THE CZECH REPUBLIC

NATIONAL ACTION PLAN

on

FIRE PROTECTION AT NUCLEAR INSTALLATIONS

TOPICAL PEER REVIEW II
Pursuant to the article 8e of Nuclear Safety Directive 2014/87/EURATOM

Státní úřad pro jadernou bezpečnost

National Action Plan of the Czech Republic for the Purposes of Topical Peer-Review “Fire protection” under the Nuclear Safety Directive 2014/87/EURATOM

Issued by: State Office for Nuclear Safety, Prague, August 2026
Publication without language editing
Ref.No. SÚJB/OKHJB/28844/2026

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1. Introduction

The National Assessment Report has been prepared for the purpose of the second Topical Peer-Review ("TPR"), which is required by the European Union ´s Nuclear Safety Directive (“NSD”) 2014/87/EURATOM. The objectives of the assessment were mutual peer review of the established fire protection practices, to identify strengths and weaknesses in established provisions and identify findings for potential improvement, to share operating experience and also to provide a transparent and open framework for developing and implementing appropriate follow-up actions to address areas for improvement. In addition to listing the legal framework, the report focuses on the fire safety analyses performed for assessed nuclear installations, fire prevention, active fire protection and passive fire protection.

In accordance with Article 8e (2) of NSD 2014/87/EURATOM, the TPR II scope should cover all nuclear installations licensed by the national regulatory body that are in operation or under construction on 30th June 2022. Since the scope of the TPR II is wide, ENSREG TPR II Board agreed to focus the TPR on a reduced scope of nuclear installations covered by the report, taking into account the radiation risk to the environment and the population.

The peer review identified both good practices and challenges at the EU level, which are detailed in the Summary Report, along with national areas of good performance and areas for improvement outlined in the Country Review Reports. National and ENSREG action plans are developed to address the identified areas for improvement and challenges.

The National Action Plan (NAcP) address the results of the self-assessment and respond to the country specific findings outlined in the Country Review Report (CRR). Furthermore, National Action Plan of participating countries consider how the insights from the TPR, in particular their country specific findings, are transferable to the “represented installations” and to examine all findings from this peer review - regardless of their categorisation (good practice, area of good performance, area for improvement) - and assess their applicability to enhance fire protection.

The peer review identified challenges where European-level action could enhance fire protection and support consistency of approaches. The Board recommends that ENSREG develop an action plan to address these challenges.

The Czech NAcP consists of 5 sections as follows:

Section 2 describes findings from the peer review – area of improvement, action aimed at improving the described condition and applicability to other installations;

Section 3 - solutions of the findings from the self-assessment, which are summarized in the CRR, and explanations of the acceptability at represented installations;

Section 4 discuss consideration of other findings (good practises) assessed as EU level, other countries good performance and applicability of improvements recommended;

Section 5 overall conclusions on addressing the identified findings and challenges in the Czech Republic.

1.1. Nuclear installations included in the NAR

From the candidate nuclear installations, the SÚJB selected those with the potential for significant radiological risks to the environment and the population caused or affected by fire, to enable a meaningful comparison of the level of fire protection provision and the feasibility and quality of the assessment.

Type	Name of the facility	Operator
NPP	Temelin NPP (2xVVER-1000 V-320)	ČEZ, Plc.
NPP	Dukovany NPP (4xVVER-440 V-213)	ČEZ, Plc.
RR	Research reactor LVR 15	Research Centre Řež
SFS	Spent fuel storage Temelín (Intermediate and Spent fuel Storages Dukovany)	ČEZ, Plc.

1.2. Installations excluded due the minimal radiological risk to the population and the environment

Name of the facility	Type	Technology / main characteristics	State of operation	Operator
CV Řež LR0	RR	Zero-power reactor, natural cooling	operation	Research Centre Řež
Training reactor VR1	RR	Zero-power reactor, natural cooling	operation	Czech Technical University in Prague
VR2	RR	Subcritical assesmbly, natural cooling	operation	Czech Technical University in Prague
ÚRAO Dukovany Richard Bratrství	RW	Radioactive Waste Repositories	operation	Radioactive Waste Repository Authority

2. Follow-up of findings from the peer review – national areas for improvement

2.1. AFI (1) – Dukovany NPP

The water fire extinguishing system which protects the cable compartments is obsolete

2.1.1. Identified action(s) and implementation progress

The water extinguishing and sprinkler water pipes are made of carbon steel and, due to the chosen material and age, an increased number of defects in the system has occurred. Therefore, the scope of replacement of parts of this pipeline has been significantly increased since 2024 and further replacements will continue in the following years.

Furthermore, the possibility of replacing firefighting systems in cable compartments is being analysed. A feasibility study of selected firefighting sections is currently underway. The first outputs are expected in 2026.

2.1.2. Applicability to represented installations

Temelín NPP

The stable water-extinguishing system in the cable areas of the Temelín NPP is fully functional, the system is regularly inspected by experts and no operational deficiencies have been recorded.

Research reactors, spent fuel storages and waste repositories

Not applicable.

3. Follow-up of other findings resulting from the self-assessment

3.1. Nuclear Power Plants

3.1.1. Fire Safety Analysis

Weaknesses identified in the self-assessment "The number of fire safety relevant changes to the buildings are improperly reflected in the relevant documents "

Dukovany NPP

The Fire Safety Solution (FSS) passports of actual building documentation (merging of the original FSS and subsequent changes into one document) and the development of a single fire safety document for individual buildings is currently underway (in 2026 there is

processed 40% of the objects). The documents of main reactor buildings will be complete in 2028, full completion of this process is planned by 2031.

Temelín NPP

The Fire Safety Solution passports of actual building documentation (merging of the original FSS and subsequent changes into one document) and the development of a single fire safety document for individual buildings is finished.

The resulting document is, both in electronic and written form, saved in the archive, at the building administrators offices and at Fire Rescue Services Units (FRSU) of NPPs.

Research Reactors in Řež

New revision of fire documents has been ordered with a specification of fire-relevant components and their localization, including a specification of the type (secured power supply – UPS, DG, etc.).

3.1.2. Fire Prevention

The impact of the human factors, in particular violations of fire regulations when using electrical appliances, failure to comply with the obligations and conditions of the permit when working with open flames (welding) or handling flammable materials.

As the influence of the human factor cannot be excluded in any human activity, to eliminate such a risk in the mentioned weakness, there are announced safety topics on which training and following inspections is focused. In NPP stringent conditions for the use of electrical appliances, limit the number of places where electrical appliances are allowed (especially heating appliances) is established.

The hot works NPP established requirement for starting this activity in the presence of a member of the FRSU, as well as for their termination and subsequent supervision at the workplace after the end of hot works.

3.1.3. Passive Fire Protection

The difficulty to modify some fire systems due to design features of construction

Dukovany NPP

This finding relates to the fire dampers located in compartments where inspection of fire dampers that are colliding with other equipment obstruct operability checks.

Specified modification is currently addressing this issue, which will result in the elimination of the colliding.

Temelín NPP, RR CV Řež

There was no such a problem recorded.

3.1.4. Active Fire Protection

A large modernisation of fire detection system has been carried out with the use of new generation, multi-criteria detectors.

Temelín NPP

Modernisation of fire detection system mentioned in CRR as AGP.

Dukovany NPP

The modernisation of fire detection system with the use of new generation – multi-criteria detectors is prepared. The Tender Round 2 – submission of final bids is currently underway. The design is planned to be completed in early 2027, followed by installation with a completion date of the end of 2030.

RR CV Řež

Modernization of the sensor system and related technical means is a point for improvement. Current activities are aimed at upgrading the required documentation and management procedures. Addition of points for investments in significant renovation will be considered.

3.2. Research Reactors

3.2.1. Fire Safety Analysis

The original design of the equipment does not have the exact qualification requirements or their certificates documented.

The implementation of the first periodic safety review for LVR-15 reactor continues, which in the design area also includes an assessment of the resistance of components to external influences - the final result of the PSR will be in 6/2027 and an action plan for corrections will be determined.

For newly installed equipment, the determination of external conditions, including fire protection standards, is already part of the purchasing process and assessment of supplies.

3.2.2. Fire Prevention

Constraints given by the original building design limit the application of selected physical separation practices to prevent CCF events (typically fire) particularly in relation to cable lines. In these cases, further analyses are required to justify the application of a graded approach (typically the evaluation of the expected impact on the safety function when the entire system is lost).

The fire safety design of the building is being revised to specify the boundaries of fire sections and thus their separation, including determining the entrances for further conditions of building reconstructions (for example, for cable routes).

3.2.3. Passive Fire Protection

No weaknesses were identified in the self-assessment.

3.2.4. Active Fire Protection

The limitation of the use of some automated halotron-based extinguishing agents.

The technical design of the rooms does not allow for the direct application of such systems - it is necessary to first ensure the limitation of entry, control of hermeticity and ventilation. This approach has not yet been applied.

New revision of fire documents has been ordered with a specification of fire-relevant components and their localization, including a specification of the type (secured power supply – UPS, DG, etc.).

Training of responders (local fire department) and subsequent cooperation exercises with fire departments and from the external environment to verify procedures have been carried out - according to them, another revision is underway

Evacuation masks were provided for the operating personnel in the operator's room and the possibility of using procedures for moving in a smoky environment was tested as part of an exercise with the fire department.

4. Consideration of the other findings from the peer review to enhance fire protection

4.1. Applicability of good practices identified in the peer review at EU level

GP1 Implementing learning from experience feedback from fire events in non-nuclear settings

Information about events from other NPPs is analysed within the fire protection department and when found that a similar event could occur at the NPP, the company implements measures to prevent the occurrence of a similar event in the fire protection documentation.

Fire protection specialists obtain information on the latest trends in the field of fire safety. The information can be used to comment on new actions, or specialists recommend the implementation of these innovations at installation.

Fire fighters regularly participate in professional seminars and conferences, where they can gain knowledge about new procedures and gradually implement them into the training of units.

The training plan for company Fire Rescue Units (NPP, LVR-15) is organised each year and includes new knowledge.

GP2 Extensive series of tests carried out to assess the effects of fire on elements (electrical equipment, fire doors, cables, seals, etc.) credited in the fire safety analyses to confirm their assumed resistance to the fire-induced phenomena

Fire resistance testing of equipment and building elements verifies the ability of structures to resist fire, heat flows and smoke for a specified period of time (classes R, E, I). It is carried out in accredited laboratories using vertical or horizontal furnaces according to Technical Standards series ČSN EN. The tests simulate a real fire (temperature curve) to ensure safety, property protection and timely intervention. Testing focuses on building elements, fire barriers, special technical equipment, technical insulation and cable systems.

Equipment intended to prevent the spread of fire are classified as fire safety equipment by the legislation and shall be tested in an accredited laboratory to ensure that they meet the requirements.

GP3 A dynamic system to manage storage area for transient fire loads and other non-combustible materials

The storage space management system for temporary fire loads in NPP is applied using a software tool for controlling the amount of flammable material in a given space (non-flammable material is not recorded). It serves for recording and as support for other requirements for storing flammable material, so that is possible to regulate the amount of flammable material. The use of flammable substances and materials is restricted and regulated by technical measures, the permitted maximum fire load per square meter is defined.

GP4 Thermographic cameras installed on worksites, or in case of the failure of a detector, with different detection zones and alarms

NPP

Mobile thermal cameras are now used by the NPP FRSU, especially during interventions and when inspecting workplaces where work with open fire is carried out. The locations (activities) that will be monitored by permanent thermal cameras have been identified.

Currently in 2026, there has been a change in strategy and instead of thermal cameras, new generation multi-criteria detectors that monitor the increase in environmental temperature is to be installed. (Thermal cameras have not proven to be effective in this case.) See part 3.1.4.

RR CV Řež

Implementation of thermal camera on particular worksite providing an alarm in the main control room in order to be alerted of a fire outbreak - especially to place that is not typically accessible/accessible during operation (primary circuit pumps room, etc.) is considered as an upgrade to the current state where a classic visual camera is installed.

4.2. Applicability of national areas of good performance in other countries

4.2.1. ALL/MULTIPLE INSTALLATIONS

UK AGP1 There is an independent verification of hot work in addition to the assessment by the 'Hot Work Selected Person' and review by the 'Hot Work Controller' for enhanced control of work areas.

The random inspections of these works in order to improve the work of "fire inspectors" is used.

UK-AGP-2 The nuclear sector-wide review of combustible cladding risks instigated by the nuclear regulator, to identify and implement any transferable learning from the Grenfell fire.

In the Czech standards, there is established obligation to reduce combustible material. Limiting combustible material is one of priorities not only in relation to combustible cladding. Generally, it is established limitations on the use of combustible materials on the exterior surfaces of buildings depending on the height of the building in the Czech technical standard.

NL-AGP-1 Full-scope fire PSA in all operational states for Level 1 to 3 PSA.

NPP

The PSA at the Dukovany and Temelín power plants is processed, in accordance with the requirements of Czech and international legislation, for levels L1 and L2. The PSA of NPPs are not carried out to level L3. The PSA includes all operating states of the units, both power and shutdown, and for all these states also internal and external threats, including fire risk assessments. Technical changes made to technological equipment, including changes with an impact on fire risk, are assessed in the project design phase to see if they have an impact on the PSA models and processes. In the event of an impact of such a change on the PSA, its impacts are implemented into the PSA models after the change is implemented. The implementation of the impacts takes place within the framework of the so-called Living PSA in update periods according to the requirements of Decree No. 162/2017 Coll. The PSA input data (e.g. frequency of initiation events, reliability data, etc.) are regularly updated based on events from the operation of the power plant.

RR CV Řež

Upgrade fire PSA in all operational states is performed periodically according to the requirements of Decree No. 162/2017 Coll.

4.2.2. Nuclear Power Plants

BE-AGP-1 A solid process is in place to manage the authorisations to have fire doors opened: the wedge to block the fire door can be collected at the Main Control Room after approval.

In the case of reactor in operation, all doors/shuts must be closed, otherwise the leakage test of the hermetic zone would not be successful, that means fire doors as well. In other areas, there is no monitoring. Permission to open fire doors is issued only by the company Fire Rescue Service Unit.

Closing fire doors is one of the obligations that is directly stated on these fire doors. Every fire door is marked and there is an obligation to close it after departure- CLOSE THE FIRE DOOR. This obligation is checked by responsible person during afterwork inspection. Further expansion is not planned.

BE-AGP-2 The existence of first-intervention teams (composed of operators) and second- intervention teams (composed of professional fire fighters) with proper equipment and, in the case of Tihange NPP-external firefighters quartered opposite the site, ensures an appropriate response to any fire event.

In the Czech Republic the Act on Fire Protection obliges anyone who notices a fire to start firefighting. All employees are trained in how to proceed, how to use fire extinguishers, hydrants, etc. Such persons are not count as the first response teams.

The first response teams include fire patrols, e.g. when working with an open fire, this activity is carried out by supervising members of the Fire Rescue Service Unit. Extinguishing the fire before the arrival of FRS Unit is not an isolated matter.

In the event of a fire at the site, the event is reported to the regional operations centre of the Czech Fire Rescue Service and the operations officer sends forces and resources (dedicated units) to the scene of the event according to the regional fire alarm plan. Cooperation, tactical and verification exercises are carried out between fire protection units, both at the NPP site and outside the site.

BE-AGP-3 Use of a mobile scanner device with an intuitive IT tool and barcode on items to easily identify equipment or material allowed to be stored.

There is currently implemented portable fire extinguishers description using a QR codes and hydrants. If this system proves successful, it will be further expanded.

BE-AGP-4 Implementation of a software tool to easily assess the adequacy of the fire protection measures.

The adequacy of fire protection measures is determined in the construction phase of a new building; currently, there is no other tool in the Czech Republic for assessing the adequacy of fire protection measures.

CH-AGP-2 Robustness of the fire detection system against single failure.

In areas important from a safety perspective double and triple systems are installed.

ES-AGP-1 Implementation of effective flooding protection of critical equipment from the harmful effects of firefighting water extinguishing system.

Currently the water drainage is in place from areas protected by a stable water system. Within areas under rooms protected by a water system, protection against water ingress into electrical equipment has been created.

ES-AGP-2 Detailed arrangements for the management of hot works are provided (covering e.g. scope of works, supervision, necessary firefighting equipment).

Detailed measures are set out in the permit for working with open flames in areas with a risk of explosion.

ES-AGP-3 New fire-fighting procedures and training have been implemented as a result of the lessons learnt from conventional industry.

The training plan compilation for Fire Rescue Service Units in the given year includes regularly new knowledge. Company fire fighters regularly participate in professional seminars and conferences, where they gain knowledge about new procedures and gradually implement them into the training of Units.

FI-AGP-1 Use of a battery for powering fire valves and smoke removal valves for a period of at least 10 minutes as a compensatory measure.

For heat and smoke removal devices, requirements are set for power supply from at least two independent sources, so that functionality is ensured for at least 15 minutes.

FI-AGP-2 Gas detectors are installed in premises where diesel generators are located which signal the leakage of combustible gases from fuel tanks.

In the premises where the diesel units are located, there are flammable liquids with a higher boiling point (diesel 170 - 250°C, oil 300 - 400°C) in closed containers. Under normal conditions, vapor (gas) of these flammable liquids does not occur, and therefore there is not installed detection. The rooms are equipped with an electric fire alarm.

FR-AGP-1 Implementation of door-open alarms for the ones representing a safety risk (PSA based).

The door opening alarms are installed in safety important areas. Permission to open fire doors is issued only by the company Fire Rescue Service Unit.

FR-AGP-3 Measures to be taken by the operators in the control room are pre-defined in written instructions (FAIOp).

Operators have defined instructions on how to proceed in case of emergencies. Instructions for measures in the event of a fire are defined in the regulation for managing abnormal conditions (stored in the unit control room). This is followed by the emergency preparedness documentation, which defines the duties of operational personnel in the event of an emergency (including fire protection events). In the event of a unit being shut down by emergency protection due to a fire, the managing operational personnel proceed as a priority according to the regulation for liquidating emergency conditions.

FR-AGP-4 High-level modelling of the effects of fire (soot, pressure effects…) to confirm the fire resistance of compartmentation elements and Structures, Systems, Components (SSCs) performance.

The Fire Safety Solution contains the requirements given by legal regulations in the field of fire protection. The requirements for individual spaces are based on the standard requirements in the area of the fire protection standards code. Modelling is included in these requirements and is based on a standard fire curve that conservatively assesses the possible effects of a fire. The Fire Safety Solution can be developed by an authorized person in fire protection, approved by the FRS CR and building authorities.

SE-AGP-1 The design approach of the fire detection and alarm system is robust regarding the separation of redundant trains.

The fire detection and alarm system the requirements for seismic resistance, functionality in the event of a fire, or doubling of lines so that they do not lead through only one fire section is applied.

SE-AGP-2 Measures to be taken by the operators in the control room are pre-defined in written instructions for every single fire compartment depending on the area affected. For complex spaces, intervention layouts (rooms, detectors and so on) and fire compartment layouts are complemented with specially developed intervention plans.

No defined rules for each individual fire section are in use; defined rules are currently used for areas important from a nuclear safety perspective and for other sections only in general.

Instructions for measures in the event of a fire are defined in the regulation for managing abnormal conditions. This is followed by emergency preparedness documentation, which defines the duties of operational personnel in the event of an emergency (including fire protection events), and is stored in the block control room. It is accessible in electronic form to all employees of the power plant.

UA-AGP-1 An extensive and targeted modernisation programme of fire protection equipment and systems has been undertaken at the NPPs.

An aging program for individual equipment that ensures modernization is carried out according to the condition of individual equipment.

UK-AGP-3 Fire doors and hatches which form part of the nuclear fire compartment have position monitoring that initiate an alarm in the MCR if the door is left open.

In the case of reactor operation, all doors/shuts must be closed, otherwise the leak test would not be successful, that means fire doors as well. In other areas, there is no monitoring. Closing fire doors is one of the obligations that is directly stated on these fire doors (every fire door is marked and there is an obligation to close it - CLOSE THE FIRE DOOR). We do not plan any further expansion.

4.2.3. RESEARCH REACTORS

FR-AGP-6 Modernisation of the facility with significant improvements (both on passive and active components) including the ones in the frame of the PSR.

PSR of LVR-15 is currently underway. The results are to be reported to regulatory body in 2027.

HU-AGP-2 A significant number of the staff and reactor operator personnel are certified fire safety engineers.

The periodical training in fire prevention of personnel is annually prepared based on the role of person. Firefighters are professional persons.

NL-AGP-2 A systematic approach for combination of hazards is applied.

The PSA is required by legislation.

PL-AGP-1 Implementation of new and modern provisions, in particular to meet the current fire protection regulations.

The requirements of fire law are fully implemented and modernisation is integral part of annual modification planning. Modification of the relevant documentation review system - regular verification and updating, is in place.

TR-AGP-2 Formalised arrangements between the reactor facility and the city fire brigade contributes to an effective response in case of a fire.

Fire Rescue Service Unit is available directly in the site of research reactors in Řež. Fire Rescue Service Unit, located close to faculty building, is available for school reactors based on Crisis management plan of the Capitol Praha. The FRSU departure time is 2 minutes after alarm, arrival time 1 minute.

4.2.4. SPENT FUEL STORAGE

CH-AGP-1 Fires resulting from military aircraft crash were considered at the design stage of the spent fuel storage facility and also the radioactive waste storage buildings.

Fires caused by military aircraft crashes into spent fuel storage were not the design basis for the design of the storage. However, we consider that military aircraft crash into SFS is covered by the design of the package and its resistance to the crash of a commercial aircraft.

SI-AGP-1 Fire resulting from large commercial aircraft crash are considered in the design basis in the deterministic studies for storage casks for spent fuel.

A fuel fire associated with a large commercial aircraft crash was the design basis for the spent fuel storage building. Additionally, a fuel fire associated with a large commercial aircraft crash is considered in the deterministic analysis demonstrating the resilience of the transport packages.

4.2.5. WASTE REPOSITORIES

IT-AGP-1 Fires resulting from a military aircraft crash onto waste buildings are considered at the design stage and compliance of the consequential impact with established radiological objectives verified.

REPOSITORIES IN NPP SITES

The NPP radioactive waste repository in Dukovany, which is intended also to store waste from Temelín NPP, is made up of concrete chambers constructed on the surface. The full chamber is closed and filled with concrete.

OTHER REPOSITORY

The institutional waste repository is located in one section of the underground complex of the former limestone mine where the packages in filled cave section are finally cast in concrete.

4.3. Applicability of national areas of improvement in other countries

ES-AFI-1 Licensees to make a better use of fire operational experience database, such as 'FIRE'.

OECD NEA FIRE (Fire Incidents Records Exchange) project is not used by NPP operators due to restriction of “data owner” OECD WGRISK.

At present SÚJB apply its competence to get access in order to assess the its usability in the field of fire protection of the Czech nuclear facilities. FIRE database is not generally shared on website with remote access.

FI-AFI-1 A need to complete replacement of old CO2-gas extinguishing systems, whose design basis does not comply with today’s industrial standards.

The CO2 extinguishing systems are used in compliance with valid Czech fire legislation.

Replacing CO2 installed in the turbine hall, in the switchboard room, in the central electrical control building with another less hazardous medium is subject of analyses.

FI-AFI-2 FSA should consider seismically induced fire.

NPP

Analyses "Assessment of the impacts of multiple, seismically induced fire events on the safety of NPP operation" have been prepared at both NPP sites.

RR CV Řež

Such an FSA is made based on Methodology (listed in NAR).

Generally, seismically induced fires are included in hazard evaluation.

AT-AFI-1 Absence of fire extinguishing blankets that could prevent fires from developing and causing damage to the infrastructure.

NPP

Fire blankets FOGA will be deployed in buildings across the Dukovany and Temelín sites by the end of 2026. In the buildings, the blankets will be placed in special cabinets that will emit a sound and light signal when opened. The positions in the buildings where the fire blankets will be placed will be determined by the fire department (the number is approximately 150-200 pieces).

Another 20 pieces are located in the tool distribution areas at both locations, for the possibility of loans.

Research Reactors

RR prepare the introduction of fire extinguishing blankets to enhance the protection of selected equipment in places where it is appropriate and effective (as recommended by regulator).

5. Overall conclusions

The National Action Plan address all findings described in the Czech Country Review Report. Findings marked as national areas of good performance, national areas for improvement and any weaknesses were taken in account to develop appropriate follow-up measures and prepare suitable solutions.

The examination of all other findings from peer review - regardless of their categorisation (good practice, area of good performance, area for improvement) - and assessment of their applicability to enhance fire protection was prepared by regulatory body and discussed with relevant operator´s management.

As a result of whole process of TPR II findings assessment, recommendation and solutions is described in dedicated chapters. The actions to be adopted are listed in table form in appendix A. For comparison the appendices B, C and D are attached.

The peer review identified challenges where European-level action could enhance fire protection and support consistency of approaches.

A need for a unique repository for sharing information on fire safety-related events for all types of nuclear installation, based on defined criteria for categorisation and reporting has been identified as a TPR II Challenge. We also recommend such a database and we welcome the opportunity to participate in its preparation. We expect this project to be open to all EU members and allow for remote management and input of information.

Annex A - Summary table of the actions planned/implemented (for completion)

Section of NAcP	**Reference no of the finding**	**Installation type/name** (as relevant)	**Thematic**	**Finding**	**Action** (specify if planned/underway/completed)	**Deadline**	**Regulatory authority's comment on progress**
2.1.	CZ-AFI-1	NPP Dukovany	Active fire protection	The water SE (stable extinguishers), which protects the cable compartments, is obsolete.	A feasibility study of selected firefighting sections Replacement of parts of this pipeline	2026 2030	In progress Subject of regulatory inspection
3.1.4	CZ-AGP-2 AGP 4	NPP Dukovany	Active fire protection	A large modernisation of fire detection system has been carried out with the use of new generation, multi-criteria detectors.	The modernisation of fire detection system with the use of new generation – multi-criteria detectors is in prepared.	2027 to 2030	Acceptable
3.1.4	CZ-AGP-2	RR CV Řež	Active fire protection	A large modernisation of fire detection system has been carried out with the use of new generation, multi-criteria detectors.	Modernization of the sensor system and related technical means	2030	Acceptable
3.1.1	NAR-section 2.1.B.6.1	NPP Dukovany	Fire prevention	The number of fire safety relevant changes to the buildings are improperly reflected in the relevant documents.	The original documentation and subsequent changes are now being incorporated into one document	2031	Acceptable
3.1.1	NAR-section 2.2.5.2	RR CV Řež	Fire prevention	Fire management documentation	New revision of fire documents	2028	Acceptable
3.1.2	NAR-section 3.1.B.3.1	NPP Dukovany	Fire prevention	The impact of the human factors, in particular violations of fire regulations when using electrical appliances, failure to comply with the obligations and conditions of the permit when working with open flames (welding) or handling flammable materials.	Actualized conditions for the use of electrical appliances, limit the number of places where electrical appliances are allowed. Training and following inspections are focused continuously	2026	Acceptable Subject of regulatory inspection

3.1.3	NAR-section 3.1.B.3.1	NPP Dukovany	Fire prevention	The difficulty to modify some fire systems due to design features of construction	Specified modification is currently addressing this issue, which will result in the elimination of the colliding.	2030	Acceptable
4.1.4	AGP-4	RR CV Řež	Active fire protection	Thermographic cameras installed on worksites, or in case of the failure of a detector, with different detection zones and alarms'	Implementation of thermal camera on particular worksite providing an alarm in the main control or equivalent solution	2030	Acceptable
3.2.1	NAR section 2.2.6.1	RR CV Řež	Passive and active	The original design of the equipment does not have the exact qualification requirements or their certificates documented	Assessment of the resistance of components to external events - the final result of the PSR	2028	Acceptable
3.2.2	NAR section 3.1	RR CV Řež	Fire prevention	Constraints given by the original building design limit the application of selected physical separation practices to prevent CCF events.	The fire safety design of the building is being revised	2028	Acceptable
4.2.2	SE-AGP-2	RR CV Řež	Active fire protection	Measures to be taken by the operators in the control room are pre-defined in written instructions	A suitable upgrade of current emergency regulations	2028	Acceptable
4.2.3	FR-AGP-6	RR CV Řež	Passive and active	Modernisation of the facility with significant improvements (on passive and active components) in the frame of the PSR	After the completion of the PSR	2028	Acceptable
4.3	AT-AFI-1	RR CV Řež	Active fire protection	Absence of fire extinguishing blankets that could prevent fires from developing and causing damage to the infrastructure.	Purchase of fire extinguishing blankets for places with increased fire risk (UPS locations, batteries, etc.)	2028	Recommended
4.3	AT-AFI-1	RR school reactors	Active fire protection	Absence of fire extinguishing blankets that could prevent fires from developing and causing damage to the infrastructure.	Purchase of fire extinguishing blankets for places with increased fire risk (UPS locations, batteries, etc.)	2028	Recommended
		RR school reactors	Fire prevention	Fire management documentation	New revision of fire documents	2028	Recommended

Annex B - Summary of Good Practices (for information)

Ref. no.	Good Practice
GP-1	'Implementing learning from experience feedback from fire events in non-nuclear settings'
GP-2	'Extensive series of tests carried out to assess the effects of fire on elements (electrical equipment, fire doors, cables, seals, etc.) credited in the fire safety analyses to confirm their assumed resistance to the fire-induced phenomena'
GP-3	'A dynamic system to manage storage area for transient fire loads and other non-combustible materials'
GP-4	'Thermographic cameras installed on worksites, or in case of the failure of a detector, with different detection zones and alarms'

Annex C - Compilation of National Areas of Good Performance (for information)

Ref. no.	Finding	Identified in the TPR for the installation
ALL/MULTIPLE INSTALLATIONS		
FR-AGP-7	Comprehensive national review after Lubrizol (chemical industry) fire accident resulting in ASN requests and consequently in concrete actions in all nuclear installations.	All installations (FR)
NL-AGP-1	Full-scope fire PSA in all operational states for Level 1 to 3 PSA.	Borssele NPP, HFR RR (NL)
UK-AGP-1	There is an independent verification of hot work in addition to the assessment by the 'Hot Work Selected Person' and review by the 'Hot Work Controller' for enhanced control of work areas.	All installations (UK)
UK-AGP-2	The nuclear sector-wide review of combustible cladding risks instigated by the nuclear regulator, to identify and implement any transferable learning from the Grenfell fire.	All installations (UK)
UK-AGP-4	Implementation of automatic fire suppression system to transporter tug engines across the site.	Sellafield (UK)
NPPs		
BE-AGP-1	A solid process is in place to manage the authorisations to have fire doors opened: the wedge to block the fire door can be collected at the Main Control Room after approval.	Tihange 3 NPP (BE)
BE-AGP-2	The existence of first-intervention teams (composed of operators) and second- intervention teams (composed of professional fire fighters) with proper equipment and, in the	Tihange 3 NPP (BE)

Ref. no.	Finding	Identified in the TPR for the installation
	case of Tihange NPP-external firefighters quartered opposite the site, ensures an appropriate response to any fire event.	
BE-AGP-3	Use of a mobile scanner device with an intuitive IT tool and barcode on items to easily identify equipment or material allowed to be stored.	Tihange 3 NPP (BE)
BE-AGP-4	Implementation of a software tool to easily assess the adequacy of the fire protection measures.	Tihange 3 NPP (BE)
CH-AGP-2	Robustness of the fire detection system against single failure.	NPPs (CH)
CZ-AGP-1	A large professional fire brigade (FRSU) ranging from 12 to 18 depending on the NPP, is deployed on a permanent basis on the NPP site providing fire prevention, firefighting and rescue services.	NPPs (CZ)
CZ-AGP-2	A large modernisation of fire detection system has been carried out with the use of new generation, multi-criteria detectors.	NPPs (CZ)
ES-AGP-1	Implementation of effective flooding protection of critical equipment from the harmful effects of firefighting water extinguishing system.	Almaraz and Cofrentes NPP (ES)
ES-AGP-2	Detailed arrangements for the management of hot works are provided (covering e.g. scope of works, supervision, necessary firefighting equipment).	Cofrentes NPP (ES)
ES-AGP-3	New fire-fighting procedures and training have been implemented as a result of the lessons learnt from conventional industry.	Vandellos 2 NPP (ES)
FI-AGP-1	Use of a battery for powering fire valves and smoke removal valves for a period of at least 10 minutes as a compensatory measure.	Olkiluoto 3 (FI)
FI-AGP-2	Gas detectors are installed in premises where diesel generators are located which signal the leakage of combustible gases from fuel tanks.	Lovisa 1, 2 NPP (FI)
FR-AGP-1	Implementation of door-open alarms for the ones representing a safety risk (PSA based).	Tricastin 900 MWe NPP (FR)
FR-AGP-2	Implementation of thermal cameras on particular worksites providing an alarm in the main control room in order to be alerted of a fire outbreak.	NPPs (FR)
FR-AGP-3	Measures to be taken by the operators in the control room are pre-defined in written instructions (FAIOp).	NPPs (FR)
FR-AGP-4	High-level modelling of the effects of fire (soot, pressure effects…) to confirm the fire resistance of compartmentation elements and Structures, Systems, Components (SSCs) performance.	NPPs (FR)

Ref. no.	Finding	Identified in the TPR for the installation
HU-AGP-1	There is a permanent presence of a well-resourced on-site fire brigade.	Paks NPP (HU)
RO-AGP-1	Since 2022, a professional unit of firefighters (15 firefighters, 3 fire trucks) is deployed on a permanent basis on the Cernavoda NPP site.	Cernavoda NPP Unit 1 (RO)
SE-AGP-1	The design approach of the fire detection and alarm system is robust regarding the separation of redundant trains.	NPPs (SE)
SE-AGP-2	Measures to be taken by the operators in the control room are pre-defined in written instructions for every single fire compartment depending on the area affected. For complex spaces, intervention layouts (rooms, detectors and so on) and fire compartment layouts are complemented with specially developed intervention plans.	Ringhals 3 NPP (SE)
SK-AGP-1	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.	Mohovce 3, 4 NPP (SK)
TR-AGP-1	The presence of a well-resourced on-site fire brigade contributes to responding to fires in a timely and robust manner.	Akkuyu NPP (TR)
UA-AGP-1	An extensive and targeted modernisation programme of fire protection equipment and systems has been undertaken at the NPPs.	NPPs (UA)
UK-AGP-3	Fire doors and hatches which form part of the nuclear fire compartment have position monitoring that initiate an alarm in the MCR if the door is left open.	Hinkley Point C, Sizewell B and 2nd generation AGRs (UK)
RESEARCH REACTORS		
FR-AGP-5	Use of a semi-quantitative fire risk assessment methodology for each of the 600 rooms of the reactor building.	RHF RR (FR)
FR-AGP-6	Modernisation of the facility with significant improvements (both on passive and active components) including the ones in the frame of the PSR.	RHF RR (FR)
HU-AGP-2	A significant number of the staff and reactor operator personnel are certified fire safety engineers.	Budapest Research Reactor (HU)
NL-AGP-2	A systematic approach for combination of hazards is applied.	HFR RR (NL)
PL-AGP-1	Implementation of new and modern provisions, in particular to meet the current fire protection regulations.	MARIA, Świerk (PL)

Ref. no.	Finding	Identified in the TPR for the installation
TR-AGP-2	Formalised arrangements between the reactor facility and the city fire brigade contributes to an effective response in case of a fire.	İTÜ Research Reactor (TR)
DECOMMISSIONING		
IT-AGP-2	Permanent presence on the site of the research reactor under decommissioning of a well-resourced on-site fire brigade.	ESSOR RR - Decommissioning (IT)
SPENT FUEL STORAGE		
CH-AGP-1	Fires resulting from military aircraft crash were considered at the design stage of the spent fuel storage facility and also the radioactive waste storage buildings.	Zwilag SFS (CH)
SI-AGP-1	Fire resulting from large commercial aircraft crash are considered in the design basis in the deterministic studies for storage casks for spent fuel.	Dry SFDS Krško NPP site (SI)
WASTE		
IT-AGP-1	Fires resulting from a military aircraft crash onto waste buildings are considered at the design stage and compliance of the consequential impact with established radiological objectives verified.	OPEC2 and D2 EUREX - Waste (IT)

Annex D - Compilation of National Areas for Improvement (for information

Ref. no.	Finding	Identified in the TPR for the Installation
ALL/MULTIPLE INSTALLATIONS		
DK-AFI-2	Fire preventive measures rely to a higher degree on the adherence to operational procedures than on the structural and layout features of the building itself.	Risø site (DK)
LT-AFI-3	A need for standardisation of inspections and functionality testing procedures for fire dampers. Fire dampers must be visually inspected on site for actuation condition and such a method shall be properly addressed in relevant Ignalina NPP operating and maintenance procedures.	All installations (LT)
UK-AFI-3	Holistic Fire Safety Strategies (FSSs) covering fire objectives: nuclear safety, life safety, property protection not currently available for all nuclear facilities.	Sellafield (UK)
NPPs		

Ref. no.	Finding	Identified in the TPR for the Installation
BE-AFI-1	The verification and inspection process of the seals in fire resistant concrete dals is implemented but not yet integrated in all the maintenance procedures.	Tihange 3 NPP (BE)
BE-AFI-2	FSA should consider seismically induced fire.	Tihange 3 NPP (BE)
BG-AFI-1	The need for replacement of fire detectors due to ageing management.	Kozloduy Unit 5 NPP (BG)
CH-AFI-2	There are two different systems to support the fire load management. It does not allow to get information efficiently.	Leibstadt NPP (CH)
CH-AFI-4	There is a need to reassess the detection strategy in area/rooms with harsh environment, in particular high radiation, according to the FSA, and consider the adoption of appropriate fire detection solutions where needed.	All NPPs (CH)
CZ-AFI-1	The water fire extinguishing system which protects the cable compartments is obsolete.	Dukovany NPP (CZ)
ES-AFI-1	Licensees to make a better use of fire operational experience database, such as 'FIRE'.	NPPs (ES)
FI-AFI-1	A need to complete replacement of old CO2-gas extinguishing systems, whose design basis does not comply with today's industrial standards.	Olkiluoto 1,2 NPP (FI)
FI-AFI-2	FSA should consider seismically induced fire.	Lovisa 1, 2 & Olkiluoto 1,2 NPP (FI)
HU-AFI-3	Lack of detector for an area with combustible materials temporary storage.	Paks NPP (HU)
HU-AFI-4	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.	Paks NPP (HU)
HU-AFI-5	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.	Paks NPP (HU)
NL-AFI-1	Several automatic extinguishing systems do not fully comply with the current design requirements and regulations.	Borssele NPP (NL)
NL-AFI-2	The fire detection alarms are not simulated in the control room simulator.	Borssele NPP (NL)

Ref. no.	Finding	Identified in the TPR for the Installation
NL-AFI-4	Automatic fire suppression is not guaranteed in case of SSE.	Borssele NPP (NL)
RO-AFI-1	Fire hydrants and piping not yet installed in the Reactor Building of Unit 1.	Cernavoda NPP Unit 1 (RO)
RO-AFI-3	The combination of fire and earthquake events is not systematically considered and documented in all nuclear installations, as applicable.	Cernavoda NPP Unit 1 (RO)
SI-AFI-1	Absence of multiple spurious operation (MSO) in FHA.	Krško NPP (SI)
SK-AFI-1	The intervention time of the intervention units may be delayed due to restricted access to certain rooms.	Mochovce 3,4 NPP (SK)
UA-AFI-1	A need to enhance fire hazard analysis by further development of deterministic analyses to specifically assess the potential consequences of fire events on the performance of the safety functions.	NPPs (UA)
RESEARCH REACTORS		
AT-AFI-1	Absence of fire extinguishing blankets that could prevent fires from developing and causing damage to the infrastructure.	TRIGA Mark II Vienna RR (AT)
HU-AFI-2	No inventory of the flammable materials transported into the facility (e.g. packaging materials, paints).	Budapest Training Reactor (HU)
HU-AFI-1	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.	RRs (HU)
HU-AFI-6	Insufficient physical separation between redundant safety-related components (i.e. diesel generators, ventilators).	Budapest Research Reactor (HU)
IT-AFI-1	Based on the FHA results, the fire protection system for RSV TAPIRO has to be improved, in particular with regard to the fire compartmentation and to the ventilation system.	TAPIRO Fast Neutron RR (IT)
NL-AFI-5	Inadequate management and qualification of isolation valves in the reactor building.	Hoger Onderwijs Reactor- HOR (NL)
NL-AFI-6	In the reactor building fire detectors are located only in the ventilation ducts.	Hoger Onderwijs Reactor- HOR (NL)
PL-AFI-1	Lack of automatic extinguishing systems.	MARIA, Świerk (PL)
PL-AFI-2	Lack of compartmentation or compensatory measures between redundant SSCs (UPS, diesel generators).	MARIA, Świerk (PL)

Ref. no.	Finding	Identified in the TPR for the Installation
RO-AFI-2	The fire hazard analysis performed in 2013 has not been revised and updated yet. It should be updated as part of Periodic Safety Review of the RR which is currently under development. According to the TPR Team, FHA should be revised at least every 10-years as part of the PSR.	TRIGA Research Reactor in Pitesti (RO)
TR-AFI-1	Need for review and upgrading of the fire safety-related systems in order to adapt to the design requirements in the new regulation on fire safety of nuclear facilities.	İTÜ Research Reactor (TR)
TR-AFI-2	Due to the new regulation on fire safety, the licensee will have to perform a fire safety analysis and hazard assessment. It should include justification of the acceptability of the fire protection measures including the seismic robustness of fire protection equipment.	İTÜ Research Reactor (TR)
FUEL CYCLE FACILITIES		
ES-AFI-2	Need for consideration of the radiological risks in the FHA.	Juzbado FCF (ES)
FR-AFI-1	In the event of fire extinguished with water, the extinguishing water has to be retained and collected within the building concerned or its immediate vicinity. For two buildings out of the eight harbouring uranium-bearing materials, part of the extinguishing water is liable to infiltrate the soil. Thus, these two buildings must undergo improvements in order to retain and recover fire extinguishing effluents. These improvements are taken into account as part of the installation's ongoing periodic safety review.	Framatome Romans fuel fabrication facility (FR)
FR-AFI-2	Improve the implementation of spray water extinguishers regarding the Labour Code requirements. Incompatibilities with the process or particular water-reactive substances should be assessed in order to not degrade the safety of nuclear installations.	La Hague (FR)
NL-AFI-3	No obvious connection between the diverse fire analyses performed with different requirements, guidelines and scenarios depending on the fire analyses.	FCF Urenco (NL)
UK-AFI-1	Lack of systematic consideration of combined or consequential hazards assessment as part of the current safety case.	Springfields Fuels Ltd (UK)
SPENT FUEL STORAGE		
CH-AFI-1	A need for a revision of the fire protection concept into an 'overarching fire protection concept' and detailed building-specific fire protection concepts.	Beznau and Gösgen NPP and Zwibez spent fuel storage (CH)

Ref. no.	Finding	Identified in the TPR for the Installation
CH-AFI-3	Necessary to update and supplement the fire protection concepts and associated documentation in accordance with the national fire protection regulations.	Zwilag SFS (CH)
IT-AFI-2	There is a need to strengthen the fire detection provisions in the context of the planned fuel transfer into the new dry storage facility.	ITREC plant - SFS (IT)
IT-AFI-4	There is a need to reassess the fire protection measures to decide whether to install new provisions (e.g. fire dampers, smoke detectors, ventilation ducts, ...).	ESSOR Plant-SFS (IT)
LT-AFI-1	A need to install additional equipment that would allow remote monitoring of the situation in SNFSF-1 from INPP main control room.	SNFSF-1 (LT)
SK-AFI-2	There is a need to complete the replacement of external underground fire hydrants with external over-ground fire hydrants.	Interim spent fuel (SK)
SK-AFI-3	Additional work is needed to review the components and replace the cable connections of the fire detection and protection system (FDPS).	Interim spent fuel (SK)
SK-AFI-4	There is a need to re-evaluate the use of voice alarm in the civil structure.	Interim spent fuel (SK)
SK-AFI-5	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.	Interim spent fuel (SK)
SK-AFI-6	There is a need to elaborate procedures for the repair, the operability and the identification of fire protection system components.	Interim spent fuel (SK)
DECOMMISSIONING		
DK-AFI-1	Since there are no dampers installed in the ventilation system, the fire in the building can spread through the duct system.	Hot Cell facility - Risø site - Decommissioning (DK)
IT-AFI-3	There is a need to update the fire protection provisions in compliance with technical guide n. 31, in the context of the ongoing licensing process for decommissioning.	ESSOR RR, EUREX FCF - Decommissioning (IT)
UK-AFI-2	No explicit fire loading limits: a proportionate approach is needed to implement the day-to-day management of fire loading with the assessment of fire loadings in the nuclear safety case.	Dounreay Prototype Fast Reactor - Decommissioning (UK)
WASTE STORAGE		

Ref. no.	Finding	Identified in the TPR for the Installation
DK-AFI-3	The lack of compartmentation (rooms not everywhere separated by doors and absence of floor to ceiling wall) requires complementary analysis to verify and implement, if necessary, compensatory measures to ensure that fire does not spread from between different activities.	Risø - Waste (DK)
DK-AFI-4	There is a need to implement a system to document the inventory of fire loads (e.g. computer system).	Risø -Waste (DK)
LT-AFI-2	A need to implement solutions to improve the reliability of fire detectors that are operating in hard conditions (for instance, high radiation, humidity) in Solid waste treatment and storage facilities (B3/4 project) and Solid waste storage buildings 157, 157/1.	Waste (LT)

Annex E – List of abbreviations

AFI	Area For Improvement
AGP	Area of Good Performance
CCF	Common Caused Failure
CRR	Country Review Report
ČSN EN	the Czech technical standards
EU	European Union
ENSREG	European Nuclear Safety Regulators Group
FRS CR	Fire Rescue Service of the Czech Republic
FRSU	Fire Rescue Service Unit
FSA	FIRE Safety Analysis
FSS	Fire Safety Solution
GP	Good Performance
MCR	Main Control Room
NAcP	National Action Plan
NEA	Nuclear Energy Agency
NPP	Nuclear Power Plant
OECD	Organisation for Economic Co-operation and Development
PSA	Probabilistic Safety Assessment
PSR	Periodic Safety Review
RR	Research Reactor
SE	Stable Extinguishers
SFS	Spent Fuel Storage
SSC	Systems, Structures, Components
SÚJB	State Office for Nuclear Safety of the Czech Republic
TPR	Topical Peer Review
WGRISK	Working Group “RISK”