European Nuclear Safety Regulators Group
ENSREG

2nd Topical Peer Review – 'Fire Protection'

Country Review Report

Switzerland

January 2025

CONTENTS

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	3	Beznau I & II (KKB) Gösgen (KKG) Leibstadt (KKL)
Research reactor		-
Fuel reprocessing facility		-
Fuel fabrication facility		-
Fuel enrichment facility		-
Dedicated spent fuel storage	2 (dry) 1 (wet)	Zwilag (dry type) including radioactive waste storage facility Zwibez (dry type) Interim storage facility at Gösgen NPP
Installations under decommissioning		Mühleberg NPP (KKM)
On-site radioactive waste storage		-
Total		

2. Regulatory framework

The NAR mentions that "T*he structural, technical and organisational requirements for fire protection in Switzerland are laid down in the standard and the associated guidelines of the Association of Cantonal Fire Insurers (VKF). These legal requirements must also be implemented in nuclear facilities, as far as reasonably applicable. Due to the specific requirements in nuclear legislation, additional fire protection requirements in the supervisory area of ENSI are required in addition to the VKF and cantonal fire protection requirements*."

The NAR indicates that "*The requirements for fire protection in Swiss nuclear facilities are currently still defined in guideline HSK-R-50, that came into force in 2003 and will be replaced in 2024 by the new guideline ENSI-G18. […*This new guideline*] contains more comprehensive and detailed fire protection requirements and is harmonised with the corresponding international requirements of the IAEA and WENRA* [and as well specifies] *general fire protection requirements for interim storage facilities and also specific criteria for when radioactive waste can be neglected as a fire hazard".* This new guide includes subsections related to*: "Basic fire protection requirements, structural fire protection, technical fire protection, organisational fire protection, review and changes to fire protection measures*.

The NAR does not clearly state if the WENRA SRLs SV are binding. In response to the question of the TPR Team[1], Switzerland's reply was "*Switzerland signed the WENRA Terms of Reference and is a full*

[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

member of WENRA. Switzerland therefore has committed to implementing WENRA SRL and RR into national regulations. The new ENSI-G18 guideline (planned to get in force 2024) contains more comprehensive and detailed fire protection requirements and is harmonised with the corresponding international requirements of the IAEA and WENRA."

The NAR mentions "*the guidelines ENSI-A01 and ENSI-A05, in which, among other things, the requirements for the deterministic and probabilistic fire analyses are specified, cover the superordinate requirements from the IAEA Safety Requirements SSR-2/1 and SSR-2/2"*.

The NAR indicates that *"ENSI came to the conclusion that the overriding requirements of the new Issue SV "Internal Hazards" are covered in particular by the legal requirements in Switzerland and the guidelines ENSI-A01 and ENSI-A05. The additional, specific requirements for fire protection (SRL SV6) are covered with the publication of the new guideline ENSI-G18".*

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

Nuclear power plants

BEZNAU I & II (KKB)

The following **strengths** related to fire protection were reported in the NAR for **BEZNAU NPP I & II units**:

- Preventive fire protection is taken into account appropriately during plant modifications and upgrades.
- Systematic consideration of fire risk analysis of all rooms, taking into account the respective safety significance for the facility leads to an overall view of the fire risks present in the facility.
- Systematic investigation of the effects of fires in the safety-relevant plant areas.
- The effects of fires in all safety-relevant buildings have been analysed and the extent of damage of the individual fire scenarios has been determined in a largely comprehensible manner.
- The fire analysis takes into account the fire detection and firefighting options available at the KKB.
- Analysis of the effects of earthquake-induced fires as part of the new earthquake verification.
- The employees of the KKB are trained in fire protection and are familiar with the existing fire protection concept. The important position of fire protection officer is filled by an experienced person who has sound fire protection training and knows the plant very well.

The following **weaknesses** related to fire protection were reported in the NAR for **BEZNAU NPP I & II units**:

- Challenges to keep the fire protection requirements and their implementation state of the art as far as the facility was built more than 50 years ago. Some of the fire compartments in the original plant areas no longer correspond to the current state of the art.
- As part of the evaluation of the basic elements of the fire protection concept, the following need for improvements were identified:
    - The existing fire protection concept and, in particular, the associated plan bases are to be revised in accordance with the requirements laid down in the Association's of Cantonal Fire Insurances (VKF) fire protection regulations;

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..)?

    - In plant areas that were formerly free of fire loads, additional fire loads are stored that must be added to both the fire load management and the fire protection concept;
    - The use of more battery-powered lifting and cleaning equipment must be added to the fire protection concept.

- Over the years of operation, the needs of the employees and the operator have changed, among other things, which has led to the installation of equipment in some areas of the KKB that Swiss Federal Nuclear Safety Inspectorate (ENSI) considers to be a potential fire hazard. For example, there are additional fire loads in escape and rescue routes (automatic machines, charging stations for electrical equipment, battery-powered lifting equipment and cleaning equipment) that also pose a risk of ignition.

The following **lessons learned** related to fire protection were reported in the NAR for **BEZNAU NPP I & II units**:

- Fire incidents and near misses are recorded and analysed. Based on the events of the first 10 years of operation, numerous operational regulations on fire-safe behaviour, e.g. during hot work, or in the handling of bearings, have been developed.
- Lessons were also learned from the experience of other plants and, among other things, the equipment of the company fire brigade was adapted and some technical extinguishing equipment was retrofitted.
- From ENSI's point of view, the increasing age of Swiss nuclear power plants, in conjunction with the original design, means that the challenges with regard to fire protection are becoming ever greater:
    - The last fire protection inspection by ENSI clearly showed that deficiencies had arisen in the formation of fire compartments in non-safety-relevant areas in connection with the increased heat loads over the years, which have to be dissipated through ventilation;
    - The old age of the original components has led to higher oil consumption in some cases. To ensure smooth operation, more fire loads (hydraulic oil) are therefore brought into the fire compartments.
- In the area of organisational fire protection, new risk-based instruments were implemented, which regulate the handling of fire loads in a safety-oriented manner in the form of room specific specifications and regular rounds.

The following **improvements** related to fire protection were reported in the NAR for **BEZNAU I & II**:

- In the safety building (Reactor Building), cable penetrations were separated from each other with fire stops.
- As a result of PSR 2017:
    - The implementation of improvement measures in the live steam blow-off station to protect against internal fires (under implementation);
    - The specification of organisational measures in the administrative directives of the KKB to reduce mobile fire loads in the emergency buildings (completed);
    - Potential for improvement in the review of the last PSR with regard to the probabilistic fire analysis will be implemented by the end of 2023.
- As a targeted measure to reduce fire loads, existing combustible cables are replaced by qualified cables. This measure is implemented on an ongoing basis when existing cables are replaced.
- The fire alarm control system was completely renewed. In the process, the positions and settings of the on-site detectors were also checked and adapted to the new findings.

- As part of a fire protection upgrade of the containment, the existing filters of the ventilation system were replaced by flame-retardant filters.
- When planning or retrofitting oil-carrying components and electrotechnical equipment, attention was paid both to avoiding the sources of ignition and to reducing the fire loads.
- As part of a renovation project of the fire protection measures, the existing fire dampers were replaced and additional fire dampers were installed over the years.
- In the area of organisational fire protection, new risk-based instruments were implemented, which regulate the handling of fire loads in a safety-oriented manner in the form of room specific specifications and regular rounds.

GÖSGEN NPP (KKG)

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

- During construction of the plant, care was taken to ensure that only non-combustible or hardly combustible materials were used.
- The strengths of structural fire protection in the KKG include the most far-reaching consistent separation of redundancies, the use of extinguishing systems for higher fire loads and the formation of fire compartments for higher fire loads.
- The targeted use of suitable extinguishing agents and automatically triggered extinguishing systems results in a safety gain.
- The internal work release procedure for dealing with open ignition sources has proven itself, especially since the temporary deactivation of fire detectors is released by fire protection. The fire load list was supplemented with the room areas to enable a determination of the fire load level according to the VKF specifications.
- There is a fire load register in which the existing immobile fire loads are listed. For the mobile fire loads, the principle exists that no additional mobile fire loads may be introduced in safety relevant areas of the facility. There is an internal directive for the recurring inspections/round rounds. In accordance with the national regulations, the room areas were also included in the fire loads. In ENSI's view, this provides a better overview of the existing fire loads in relation to the fire compartment area.
- The handling of ignition sources (hot work) is regulated by means of a work permit.
- All hazardous materials brought into the facility are assessed independently of fire protection.
- Flammable liquids are stored in buildings that are not critical for the operation of the facility.
- Care is taken to use flammable liquids (oils) with a high flash point.
- Despite the complexity of a nuclear power plant with around 35 different buildings and various requirements, the overarching fire protection concept provides a good overall view of the plant-specific fire protection measures.
- The deterministic fire analyses carried out confirm the basic system design of the KKG that cross-redundancy effects on the emergency and safety systems in the event of fire are largely avoided by the structural separation of the individual safety redundancies.
- Analysis of the effects of earthquake-induced fires as part of the new earthquake verification.
- The KKG-internal database was provided with various functional extensions as part of the update. The database contains all data required for fire modelling such as reliability values of fire protection equipment, fire compartments, inventory for all rooms incl. fire loads, cables and routes. In addition, three-dimensional data is available for all relevant buildings, created from extensive 3D laser scans.
- The employees of the KKG are trained in fire protection and are familiar with the existing fire protection concept. The important position of fire protection officer is filled by an experienced person who has sound fire protection training and knows the plant very well.

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

- The challenges are to keep the fire protection requirements and their implementation state of the art as far as the facility was built about 45 years ago.

- In the annular space of the reactor building in particular, consistent fire protection redundancy separation is only possible to a limited extent.
- In a few safety-relevant areas, the structural fire compartmentation is in place, but missing fire dampers mean that there are gaps in the fire compartmentation. These gaps are currently being closed by retrofitting the missing fire dampers.
- The fire-PSA still shows some need for improvement in some areas, in particular there is a lack of studies on consequential fires caused by fires with damage to electrical safety equipment and the possible effects of this fire damage on the control of the power supply.
- The on-site signage of the bulkheads and fire protection expansion joints has not yet been completed.

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

- Fire incidents and near misses are recorded and analysed. The number of incidents is low because, among other things, internal employees are trained on the occasion of the annual safety day and external employees participate in an annual safety instruction in the area of fire protection.
- The fire protection concept and the associated fire protection plans were updated and revised in accordance with the current VKF requirements in 2022.
- The KKG-specific operational experience (including occurrence frequencies of fire events, reliability of the fire protection equipment) is systematically evaluated and taken into account as part of the periodic update of the fire PSA. The abnormalities in the closing behaviour of the fire dampers in the switchgear building identified in 2016 during functional tests had a direct influence on the calculated plant risk and were taken into account in the PSA model accordingly in a timely manner.
- Triggerings of the fire alarm system train the fire brigade in the operational routine. The very small number of false alarms contributes to the fact that the seriousness of the alarms is still very high.
- During the renewal of the fire alarm system and the replacement of the fire dampers, the control of the fire dampers and their integration into the existing control of the ventilation systems was a fundamental issue. ENSI demanded a changeover from active control of the closing function of the fire dampers to automatic closing of the fire dampers if the control is omitted.
- The bulkheads and fire protection expansion joints have been or will be signposted on site and entered into a database. It has proved particularly useful that the signage is duplicated. This way, in case of a defect or when removing the bulkhead system, one signage can be removed and handed over to the person in charge. After the bulkhead system has been repaired, it is reattached.
- After it was determined in 2016 that individual fire dampers were not closing completely and that the fire dampers used did not meet today's requirements, it was decided that all fire dampers from the time the power plant was built would be replaced and controlled via a fire damper control system.
- Activated carbon filters are installed in non-combustible housings. In the event of a fire, the activated carbon filters can be bypassed via a bypass. The ventilation systems are switched off or continue to operate according to the protection goal. By selectively controlling the fire dampers, the individual fire compartments can be isolated in a targeted manner.
- The double labelling for bulkheads and fire protection expansion joints has proven to be purposeful and practical. In the event of a defect or replacement of a component, a label can be removed and enclosed with the repair. In this way, the component is clearly marked regardless of its location and can then be repaired at the correct location.

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

- Around 2200 fire doors are installed in the KKG. In 2013/2014, an inventory and status analysis was carried out. By 2019, 69 fire doors had been replaced, 79 fire doors converted and a further 882 upgraded.
- In 2017, the mobile smoke extraction system was established. In the event of a fire, the room area affected by the fire is exhausted with mobile fans. This system proved its worth in an incident in 2019 (short circuit in a 10kV switchgear).
- After it was determined in 2016 that individual fire dampers were not closing completely and that the fire dampers used did not meet today's requirements, it was decided that all fire dampers from the time the power plant was built would be replaced and controlled via a fire damper control system. The replacement of the fire dampers began in 2019. The replacement is expected to be completed in 2025.
- For future fire analyses, the fire simulation software PYROSIM was procured. This couples the FDS programme with a graphical user interface. For optimised use, it is planned to use 3D models for certain buildings. The building models are based on building plans supplemented by data from 3D laser scans.
- Retrofit project is currently being implemented to expand the emergency systems and thus extend the controllable spectrum of beyond-design-basis events. This project also includes an improvement of the protection against external fires by retrofitting the ventilation systems in the emergency building with an automatic building closure in case of fire detection in the outside air.
- During the revision of the overarching fire protection concept, deviations from the current VKF fire protection regulations were identified and evaluated. Based on this, improvements were made concerning, for example, the fire control of the ventilation system in the auxiliary and main cooling water buildings.

LEIBSTADT NPP (KKL)

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

- During construction of the plant, care was taken to ensure that only non-combustible or hardly combustible materials were used.
- All fire loads are recorded in a database. Regular inspections ensure that there are no deviations from the maximum possible fire load.
- All hazardous materials brought into the facility are assessed independently of fire protection.
- Flammable liquids are stored in buildings that are not critical for the operation of the facility. Care is taken to use flammable liquids (oils) with a high flash point.
- Due to the high reservoir and the associated geodesic feed, no additional pumps are needed to feed the extinguishing water. This reduces maintenance costs and increases reliability. The installed ring main system ensures the availability of the extinguishing water supply.
- For the fire analyses, current and complete data on components and cable runs from the KKL technical database were used.
- A screening analysis of the internal fire hazards was performed to identify the fire hazards requiring detailed analysis. The differences between power, low-power and outages in terms of ignition sources, fuels, scenario analysis and fire spread were identified and considered in all phases of the fire analysis.
- Systematic investigation of the effects of fires in the safety-relevant plant areas. The determined parameters and results from the deterministic and probabilistic fire analyses provide an overall picture of the possible extent of damage as well as the associated risks in the event of a fire and enable an adequate assessment of the existing fire protection measures with regard to nuclear plant safety.
- Expert panel for the treatment of fire-induced short circuits and a comprehensive set of fluid-mechanical fire propagation calculations.

- Analysis of the effects of earthquake-induced fires as part of the new earthquake verification.
- Regarding fire prevention, regular training of the operating staff in fire protection, annual special training for the operating personnel who work with fire protection systems and checklist for fire protection, which is implemented in the process flows.
- KKL increasingly carries out periodic inspections of the passive fire protection equipment. Defects are recorded in a catalogue of measures and processed according to their importance. This increases knowledge of the current condition of the fire protection facilities so that maintenance measures can be initiated at an early stage.
- KKL employees are trained in fire protection and are familiar with the existing fire protection concept. The important position of fire protection officer has been filled by a new person who now has sound fire protection training and knows the plant well.

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

- The structural fire protection in the facility was planned and executed about 45 years ago.
- There is a separate plan type for each fire protection system, which can only be "superimposed" online to obtain an overview of the fire protection-relevant information at a glance.
- Fire load management is kept in a separate database.
- Some of the fire compartments in the laundry no longer correspond to the current state of the art. The KKL is already planning plant modifications in this area.
- Combustible filters in the exhaust air systems are mounted in non-combustible housings in the KKL. In the event of a fire, the combustible filter systems can be bypassed.

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

- External events are specifically evaluated by a working group. Events that are relevant to the plant are always forwarded to the specialist departments and their comments are obtained.
- Due to the increased requirements for ensuring nuclear safety, more periodic inspections of system parts relevant to fire protection are carried out than specified by the guidelines. This results in a more in-depth and up-to-date knowledge of the system condition, including aspects of ageing, and corresponding measures can be initiated even before the actual occurrence of defects.
- The fire protection concept and the associated fire protection plans are currently being revised in accordance with the current VKF specifications. The revised document forms the overarching fire protection concept.
- ENSI's most recent fire protection inspections have shown that deficiencies have arisen in the formation of fire compartments in non-safety-relevant areas in connection with the increased heat loads over the years, which must be dissipated through ventilation. In addition, fire doors were partially locked open during the annual inspection and in some cases considerable fire loads were temporarily stored in the connecting corridors.
- An IAEA Peer Review Mission (IPSART) was organised to ensure that the KKL-PSA meets the international state of the art and quality assurance requirements. The IPSART mission highlighted the high quality of the analyses carried out. The results from the review have been incorporated into the subsequent revision of the fire analyses. The updated deterministic and probabilistic fire analyses were submitted to ENSI at the end of 2022 as part of the PSR for the long-term operation of KKL

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

- The definition of clear criteria for leaving the main control room in the event of a fire.
- The decentralised structure of the fire alarm control centres.
- Detailed analysis of the effects of false signals in the emergency control points.
- New deterministic and probabilistic fire safety analyses as part of PSR2022.
- The existing fire protection concept is currently being revised at the KKL on the basis of a target/actual comparison, in close coordination with ENSI.

Spent fuel storage facilities

ZWILAG (dry storage)

The following **strengths** related to fire protection were reported in the NAR for **ZWILAG** spent fuel storage:

- During the construction, care was taken to ensure that only non-combustible or hardly combustible materials were used.
- Sufficient passive cooling of the casks is ensured by the parking space concept in Building H. The casks are therefore not expected to reach inadmissible building or cask temperatures.
- Zwilag employees are trained in fire protection and are familiar with the existing fire protection concept.

The following **weakness** related to fire protection was reported in the NAR for **ZWILAG** spent fuel storage:

- The existing fire protection concept from 2002 and, in particular, the associated plan bases must be revised in accordance with the requirements set out in the VKF fire protection regulations.

The following **lessons learned** related to fire protection were reported in the NAR for **ZWILAG** spent fuel storage:

- During the last walk downs, it was noticed that the fire compartmentation was impaired, especially during renovation work. ENSI arranged for these deficiencies to be rectified immediately.
- During operating history, once fire alarm was triggered by a smoke detector. It was reported, that there was no need for a further review of operations related to fire protection due to this event.

No **improvements** related to fire protection were reported in the NAR for **ZWILAG** spent fuel storage.

ZWIBEZ (dry storage)

The following **strengths** related to fire protection were reported in the NAR for **ZWIBEZ** spent fuel storage:

- During the construction of the ZWIBEZ interim storage facility, care was taken to ensure that only non-combustible or hardly combustible materials were used.
- There is a fire load register in which the existing immobile fire loads are listed.
- The ventilation in the HAW storage facility and the LAW storage facility ensures that no unacceptable ambient conditions (humidity, temperature) can arise.

The following **weakness** related to fire protection was reported in the NAR for **ZWIBEZ** spent fuel storage:

- A fundamental revision and division of the fire protection concept in accordance with the current VKF regulations into an overarching fire protection concept and detailed building-specific fire protection concepts is necessary, as well as the preparation of comprehensive fire protection plans (National area for improvement).

No **lessons learned** related to fire protection were reported in the NAR for **ZWIBEZ** spent fuel storage.

The following **improvement** related to fire protection was reported in the NAR for spent nuclear fuel storage facility **ZWIBEZ**:

- Additional fire detectors were retrofitted as part of an extended use of electrical cabinets.

Interim wet spent fuel storage facility at Gösgen NPP

The following **strengths** related to fire protection were reported in the NAR for **Interim wet spent fuel storage facility at Gösgen NPP**:

- During the construction, care was taken to ensure that only non-combustible or hardly combustible materials were used.
- The storage facility is integrated into the monitoring and alarm system of the KKG.
- The wet storage benefits from the availability of the nearby KKG fire brigade (BFW) that are familiar with the existing fire protection concept.
- In the event of a fire, the external fire brigade is automatically alerted for support.
- Fire alarm systems and parts of the fire control system were upgraded recently to state-of-the-art technology together with the fire dampers, which have been made fail-closed.

No **weaknesses**, **lessons learned** or **improvements** related to fire protection were reported in the NAR for the **Interim wet spent fuel storage facility at Gösgen NPP**.

Installations under decommissioning

MÜHLEBERG NPP (KKM)

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

- Since the cessation of service operations at the end of 2019, the fire protection concept has been revised several times in accordance with the applicable decommissioning phase. These revisions were each carried out by the internal specialist departments and approved by the fire protection quality assurance department.
- The existing processes of the commissioning and modification procedure with the tasks, measures and responsibilities continue to apply in the ongoing decommissioning process.
- The passive fire protection measures are shaped by the decommissioning process and are continuously evaluated and, if necessary, adapted due to the constantly changing environmental conditions. In the event of corresponding changes, the fire protection authority is involved in the decision-making process.
- During decommissioning, the proven maintenance process continues to be applied, which includes all measures to preserve and restore the target condition as well as to determine and assess the actual condition of electrical and mechanical components of the dismantling operation systems and of building structures.
- The monitoring scope of the fire alarm system, which is divided among several fire alarm centres, and the resulting high availability of these systems.
- The direct internal alarm chain and the internal emergency forces.
- In the course of the decommissioning, the applied ongoing sensitisation of staff and regular housekeeping with regard to fire safety is assessed as a strength.
- The employees of the KKM are trained in fire protection and are familiar with the current fire protection concept during the decommissioning phases. The important position of fire protection officer is filled by an experienced person who has sound training and knows the plant very well.
- The analysis carried out on earthquake-induced fires showed that other fire scenarios are either covered (earthquake-induced filter fire in the turbine building) or cannot be assumed in the event of a cask crash due to the spatial separation of the crash site and potential ignition sources.

The following **weakness** related to fire protection were reported in the NAR for **MÜHLEBERG NPP**:

- The cost-intensive and time-consuming changeability is assessed as a weakness in structural fire protection. In the course of decommissioning, the technical fire protection measures often

form interference edges to the dismantling. These interfering edges can only be adapted at great expense or with a time delay.

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

- As part of the approval of decommissioning phase 1, the KKM developed the event spectrum for decommissioning, taking into account the findings from the dismantling experience in Germany, the German guidelines and the IAEA Safety Guide "Decommissioning".
- Since the boundary conditions of the plant are constantly changing as dismantling progresses, a close monitoring is necessary in order to guarantee passive fire protection in all dismantling phases.
- The last fire safety inspections have shown that increased attention is needed with regard to the introduction of highly flammable liquids and their storage. Some fire loads had been introduced into the turbine building that had not been accounted for, and that KKM had no knowledge that an external company had introduced highly flammable liquids
- The positions of mobile extinguishers such as portable fire extinguishers were not systematically recorded during the dismantling work. As a result, some portable fire extinguishers were not properly maintained.

No **improvements** related to fire protection were reported in the NAR for **MÜHLEBERG NPP**.

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 waste storage) was addressed in the NAR.

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

The document was reader-friendly and facilitated the finding of relevant information.

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

In general, replies to the written questions allowed to clarify the identified issues.

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	
Nuclear installation: Beznau and Gösgen NPP and Zwibez spent fuel storage	
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.

Nuclear installation: Leibstadt NPP	
AFI (2)	There are two different systems to support the fire load management. It does not allow to get information efficiently.
Nuclear installation: Zwilag spent nuclear fuel storage facility	
AFI (3)	Necessary to update and supplement the fire protection concepts and associated documentation in accordance with the national fire protection regulations.

The TPR team recommends that Switzerland 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: All NPPs		
	Finding	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.
	Justification	Fire protection system is mainly based on the non-nuclear VKF guidelines that do not consider nuclear safety and radiation protection aspects. The approach for the need of fire detectors should be justified by a hazard assessment taking into account nuclear safety and radiation protection.

The TPR Board recommends that Switzerland addresses this area for improvement in the TPR national action plan.

Areas of Good performance		
Nuclear installation: Zwilag storage facility		
AGP (1)	**Finding**	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.
	Justification	Detailed analyses were carried out at the design stage for the buildings storing spent fuel and radioactive waste for an impact of a military aircraft. The analysis of a fire resulting from aircraft crash event with the combustion of the aircraft fuel is not commonly performed for radioactive waste storage facilities.
Nuclear installation: All NPPs		
AGP (2)	**Finding**	Robustness of the fire detection system against single failure.

	Justification	The Swiss regulatory framework requires that "*the fire alarm centres used to monitor the individual redundancies of safety and emergency systems must be functionally and spatially separated from each other",* (Richtlinie für die schweizerischen Kernanlagen ENSI-G18, sect. 6.1.2). This requirement ensures robustness against a single failure affecting more than one safety train.

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.