European Nuclear Safety Regulators Group
ENSREG

2nd Topical Peer Review – 'Fire Protection'

Country Review Report

United Kingdom

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	Heysham 2 Sizewell B Hinkley Point C
Research reactor		-
Fuel reprocessing facility	1	Magnox reprocessing plant-Sellafield Ltd.
Fuel fabrication facility	1	Springfields Fuels Ltd
Fuel enrichment facility	1	Urenco UK Limited (Urenco's Capenhurst site)
Dedicated spent fuel storage	1 (dry) 1 (wet)	Sizewell B dry store Spent fuel ponds at the candidate installations (Sizewell B, Hunterston B and Heysham 2)
Installations under decommissioning	3	Hunterston B NPP Dounreay Prototype Fast Reactor Pile 1 - Sellafield Ltd
On-site radioactive waste storage	3	Sellafield High Level Waste Plant /Waste Vitrification Plant/ or Encapsulation (HLW) Sellafield Box Encapsulation Plant Product Store – Direct Import Facility (BEPPS-DIF (ILW – interim storage) Sellafield Product and Residues Store (interim storage)
Total	**14**	

2. Regulatory framework

The NAR specifies that "*the principal primary legislation for ensuring the safety of nuclear installations consists of the following Acts of Parliament":*

• *Energy Act 2013* (sets out the provisions which set up the regulatory body as a statutory body (ONR), establishing its purpose, its powers and functions);

• *Health and Safety at Work etc. Act 1974* (a general duty is placed on all employers and the self-employed to conduct their undertaking in such a way as to ensure the health and safety at work of their employees and those affected by their work activities, so far as is reasonably practicable (SFAIRP) and underpinned by the concept of relevant good practice (RGP));

• *Nuclear Installations Act 1965* (no site can be used for the purpose of installing or operating a nuclear installation unless a nuclear site licence granted by ONR is currently in force; it requires and permits ONR to attach such conditions to a site licence as it sees appropriate in the interests of safety or radioactive waste management).

The NAR describes that a "*suite of secondary legislation (Fire Safety Order 2005 and Fire Scotland Act 2005) sets the regulatory requirements to protect people from fire and specifically covers fire precautions and other fire safety duties [*that are*] relevant to fire safety in nuclear installations. In addition, several complementary sets of regulations (e.g. Dangerous Substances & Explosive Atmospheres Regulations) overlap with nuclear and life fire safety requirements.*

The NAR indicates that "*The technical principles ONR uses to judge safety cases are set out in its safety assessment principles (SAPs). The SAPs are supported by more detailed guidance in a suite of technical assessment guides (TAGs), which provide detailed guidance to ONR inspectors on the interpretation and application of ONR's SAPs when assessing the adequacy of licensees' safety cases and other safety documentation within the nuclear safety regulatory process*. […] *The full suite of SAPs is applied holistically by internal hazards and fire safety inspectors when making judgements on duty holders' consideration of fire safety in nuclear installations"*.

The NAR indicates that "*The SAPs and Internal Hazards TAG incorporate the IAEA safety standards and other relevant international and national standards. More specifically, ONR ensures the implementation of WENRA Safety Reference Levels (SRL) through incorporation in ONR guidance, including referencing them explicitly in the TAGs*."

The NAR does not clearly state if the WENRA SRLs SV are binding. In response to the question of the TPR Team[1], United Kingdom's answer was "*RLs have been formally adopted as national requirements, TAG-005 as the principal regulatory tool/ vehicle and ONR can pursue legal sanctions to enforce compliance by licensees where appropriate and in line with the enforcement management model*".

The NAR mentions that "*international standards are implemented within the GB regulatory framework including through incorporation into and alignment of ONR SAPs, TIGs (technical inspection guides) and TAGs*".

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

Nuclear power plants

HEYSHAM 2 AND SIZEWELL B

The following **strengths** related to fire protection were reported in the NAR for **HEYSHAM 2 and SIZEWELL B:**

- Proactively changes in fire modelling tools, practice and experimental data, checking the ongoing validity of its safety cases, identifying gaps and addressing them.
- Hot work control arrangements had been recognised as industry best practice both within the UK and within the World Association of Nuclear Operator Fire Safety Peer Groups.
- Four safety trains at Heysham 2 well segregated for fire protection purposes. Redundant equipment that contain significant quantities of oil are separated in the four reactor quadrants and segregated by fire barriers.

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

- EDF NGL tracks fire safety metrics for fire safety system health across all sites. The metrics track defects relating to detection, suppression, fire barriers, fire doors, fire dampers etc. to identify at a glance whether the stations are meeting the requirements to maintain safe systems under fire safety.
- There are fire safety action teams at all the stations. Actions and implementation of the actions are managed by the Fleet Fire Safety Manager and deputy Fleet Fire Safety Manager. EDF NGL has two Fire Safety Engineers in EDF NGL's Engineering Function, who also provide hazards advice to the Design Authority.
- Fire and rescue service provision on the sites: while fire service intervention is not credited in the fire hazard analyses, demonstration of robust arrangements for onsite firefighting and coordination with local fire and rescue services provides defence in depth.

The following **weakness** related to fire protection was reported in the NAR for **HEYSHAM 2 and SIZEWELL B:**

- EDF NGL recognised that the fire containment approach had been challenged in some areas by poor quality of the original build such as linear gap seals not installed correctly originally, or through time-based degradation of flexible barrier materials. EDF NGL manages the potential impairments of the containment approach by regular inspections of the plant and subsequent repairs.

The following **lessons learned** related to fire protection were reported in the NAR for **HEYSHAM 2 and SIZEWELL B:**

- The identification of an increasing trend in hot work-related fires led to the introduction of hot work independent verification as an additional step to ensure work sites are prepared in accordance with the hot work permits before permission to start work is granted.
- The trend in events related to electrical component and equipment failures resulted in a fleet-wide review of Electricity at Work Regulations compliance and electrical motor maintenance arrangements.
- In the categorisation of fire event, creation of the smouldering fire category to give greater visibility of events that had not reached the flaming stage but left unaddressed could escalate to a flaming fire.
- All major and minor fire events are shared across the sites as well as with the regulator. Outcome of regulator fire safety inspections are shared across sites for learning and proactive action to address any similar shortfalls elsewhere in the EDF NGL fleet.

The following **improvement** related to fire protection were reported in the NAR for:

- HEYSHAM 2: to confirm the validity of the safety case, EDF NGL is currently undertaking Consolidated Model of Fire and Smoke Transport (CFAST) and Fire Dynamics Simulator (FDS) fire modelling for certain critical areas. The intent is to predict time-temperature profiles and hot gas layer descent primarily using CFAST with secondary comparative work also being carried using FDS. This work will bring the HY2 fire references up to date using modern standards.
- SIZEWELL B: fire modelling was carried out for the increased fuel load following the upgrade of the Battery Charging Diesel Generators.

HINKLEY POINT C

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

- Fire prevention measures have been developed from modern standards.

- The fire safety analysis has been developed using standards that are more recent than those that were in place during the design and construction of other stations within the UK fleet, and close collaborative working between the UK and France has allowed benefits to be shared. The analysis has also had the benefit of development of modelling techniques and use of 3D computer models of the buildings and structures that were not available during the design of other stations in the UK fleet.
- Fire Detection System (JDT) is a dedicated I&C system that monitors detection, transmits the location of the source of any detected fire and any smoke-filled zones, to a central operator station and actuates fire protection actions.
- The Fire Alarm Repeater Panels (FARP) is located in the MCR, in the Remote Shutdown Station (RSS). It displays the state of all detectors (such as fire alarms, malfunction alarms, etc.), the control of the fire dampers and the automatic firefighting equipment. In addition, a Graphical User Interface (GUI) is installed to show plan view drawings identifying the location of the fire and state of detectors. FARPs are Class 3.

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

- Fires outside buildings: the assessment methodology can be applied rigorously to fires initiated within a building or structure. It does not cover fire or smoke spread through external openings, fire from an outside source such as stored materials or vehicle fire, or a large fire on the site. A gap analysis has been carried out and specific assessments are being carried out as required from the regulator.
- Reactor building: the assessment techniques used for most of the fire HSVs were found not to be directly applicable to the reactor building because the large volumes were beyond the range of applicability of the models used for other buildings. A separate assessment methodology was therefore developed for the reactor building.
- NNB GenCo considers that cable tray wrapping has some implementation challenges in practice. Wrapping adds to the cost and complexity of installation and would need to be locally removed and reinstated if wrapped components need to be accessed for maintenance or repairs during the operational life of the plant.

The following **lessons learned** related to fire protection were reported in the NAR for **HINKLEY POINT C:**

- The main actions that NNB GenCo is carrying forward for HPC include:
  - Development of a specific methodology for the reactor building where the volumes of rooms and enclosures are too large for EPRESSI methodology to be valid;
  - Use of non-fibrous materials where cable tray wrapping is required in the reactor building.
- Feedback from the French nuclear fleet reported in the HPC Fire Strategy document suggested that the fire risk posed by electrical cables is low. Self-ignition events outside gallery spaces all involved high voltage cables and some form of installation error, and only a very small number of fires have been reported within cable galleries.
- The firefighting water system has been redesigned taking into account experience from the EPR Flamanville 3 design. The main design modifications concerning the fire safety functions are as follows:
  - A dedicated building (HOJ) is being provided for HPC to house the entire Firefighting Water Supply System (JAC);
  - Total separation of the firefighting safety functions from other safety functions that the JAC system contributes to;

- Changes in routing of the piping in the galleries and in interface with the Safeguard Auxiliary Building, within the framework of functional optimisation.

The following **improvements** related to fire protection were reported in the NAR for **HINKLEY POINT C:**

- Various modifications have been provided to align with British Standards and in response to ONR comments, including:
  - Addition of secondary power supplies to firefighting shaft lighting;
  - Addition of fixed firefighting to areas with significant risk;
  - Changes to fire sectorisation and openings for personnel evacuation;
  - Upgrade Safeguard Building lifts to firefighting lifts;
  - Additional dry riser outlet in radwaste building to improve coverage;
  - Additional fire compartmentation to Nuclear Island buildings following discussions with NNB, ONR meetings, and development of Fire Strategy documents;
  - Addition of fire dampers for redundancy and after re-routing of a HVAC duct;
  - 40 mm thickness was assumed in the 3D model during early stages of the design where 1-hour fire resistance, but no commercially available product was found with the required fire resistance, so model was modified to assume 80mm thickness.
- Improvements to fire safety analysis on the HPC site would be beneficial concerning identification of the potential effects of combined hazards on the types, main characteristics and performance expectations for active fire protective systems, the potential for combined hazards to affect the capacity for firefighting and how the firefighting system may contribute to combined hazards.

Fuel Reprocessing Facility

MAGNOX REPROCESSING PLANT-SELLAFIELD

The following **strengths** related to fire protection were reported in the NAR for **MAGNOX REPROCESSING PLANT-SELLAFIELD:**

- Plant walk downs by suitably qualified third-party certified designers identify suitable locations for point optical smoke or heat detectors and this is reviewed during the Fire Risk Assessments. If the nature or use of a building or room changes, the smoke detection is reviewed to ensure it is still adequate and if it needs any additional detection. For example, if a meeting room is turned into a kitchen, the detection may be changed from smoke detection to heat detection.
- All fire detection and alarm systems in nuclear facilities to be designated as Safety Related Equipment (SRE) as a minimum for life safety, property protection and any other claims required as part of the nuclear fire safety assessment. Fire detection and alarm systems is captured on Computerised Maintenance Management System (CMMS), as part of its Examination, Maintenance, Inspection and Testing (EMIT) routines.
- Modern professional fire service permanently based on site with an overall operational staffing level of 86 personnel.

No **weaknesses** related to fire protection were reported in the NAR for **MAGNOX REPROCESSING PLANT-SELLAFIELD.**

No **lessons learned** related to fire protection were reported in the NAR for **MAGNOX REPROCESSING PLANT-SELLAFIELD.**

No **improvements** related to fire protection were reported in the NAR for **MAGNOX REPROCESSING PLANT-SELLAFIELD facility.**

Fuel fabrication facility

SPRINGFIELDS FUELS LTD

The following **strengths** related to fire protection were reported in the NAR for **SPRINGFIELDS FUELS LTD:**

- Wide range of fire prevention measures including initiatives focussing on processes and site-specific risks. These included hot work fire risk assessments, processes requiring building owners to carryout housekeeping inspections, assigning a fire nominated person on a building-by-building basis, use of local protective measures to prevent damage to equipment, inerting of zircaloy swarf, etc.
- Proactive upgrades to passive fire protection measures. These include reviews of fire compartment data, enhancement of fire compartmentation where identified, upgrades to glazing to meet the resistance standard of the barrier within which it is housed and implementation of fire resisting shutters.

The following **weakness** related to fire protection was reported in the NAR for **SPRINGFIELDS FUELS LTD:**

- The consideration of combined or consequential hazards assessment as part of the current site safety case is not systematic; combined hazards such as fire combined with flooding or fire post seismic event are considered as part of the safety case process. ONR raised a recommendation that Springfields Fuels Ltd reviews and makes any necessary improvements to its treatment of combined hazards, for example, by formalising a suitable methodology for assessment of combined hazards including fire proportionate to the site's hazards and risks. The NAR has indicated a closure date of March 2025.

The following **lessons learned** related to fire protection were reported in the NAR for **SPRINGFIELDS FUELS LTD**:

- Issues identified in ONR inspections related to housekeeping of combustibles, implementation of suitable fire alarm and detection for life safety purposes and fire safety management with respect to Fire Risk Analysis findings.
- Following the Grenfell tower fire in 2017 and in response to a letter from ONR, Springfields Fuels Ltd reviewed all cladding systems on site irrespective of building height or location. Two buildings constructed over twenty years ago storing or processing radiological materials were found to have cladding with combustible insulation. Panels comprise an aluminium outer skin with a steel inner liner and polyurethane insulation approximately 25 mm depth. As a result, controls have been introduced to reduce the potential for ignition of the cladding. Besides, Springfields Fuels Ltd reports that a complete review of the fire detection system was undertaken and a system meeting minimally an L2 level of coverage (but achieving L1/P1 in the majority of areas) was installed and completed in 2020.

The following **improvements** related to fire protection were reported in the NAR for **Springfields Fuels Ltd:**

- Fire compartmentation scheme reviewed in 2020; due to uncertainties over the fire resistance of the partitions used throughout the building, all partitions were designated a notional 30-minute fire resistance and fire drawings were updated.
- Full fire damper survey of Oxide Fuels Complex (OFC) justifying which fusible link operated dampers could be retained, which dampers could be safely declared redundant and

permanently left in an open position and which required to be operated by smoke detection and alarm systems.
- A full ratification of the fire compartment scheme for OFC and production of amended fire compartment drawings.
- Replacement of all dampers and a full upgrade of the fire detection and alarm system in the laboratory building.

Fuel enrichment facility

URENCO ENRICHMENT

The following **strengths** related to fire protection were reported in the NAR for **URENCO ENRICHMENT**:

- Fire-resistant building construction materials conforming to a facility specific Fire Strategy Robust programme of production of Fire Strategies as part of new build and refurbishment activities supporting FRA's (Golden Thread).
- Safe operations, including management of fire loading, location of nuclear inventory, and ignition sources such as control of hot work, etc.
- Providing education on fire risks and safety.
- Training and testing of mitigating systems, including fire detection/suppression and automatic shutdown systems.
- A fire damper upgrade project improving the original design and referencing appropriate guidance (BS15650 Ventilation for buildings).

The following **weaknesses** related to fire protection were reported in the NAR for **URENCO ENRICHMENT**

- Underutilisation of the site risk register to promote visibility and priority of areas of identified weakness; Transfer of Actions to Projects, but then deferred/cancelled with no impact assessment undertaken. Recognised improvement opportunity with remedial work underway.
- Delay in progressive development of an established team of internal SQEP resources to support fire risk assessment programme to support significant increase in demand.
- Not all role holders with accountability for fire prevention and safety have completed formal training to demonstrate SQEP resulting in greater demand on process owner.
- High turnover in Incident Response Service personnel and recruitment shortfall in required skillset resulting in loss of corporate knowledge and capability shortfalls.

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

Lessons learned from events/fire safety-related missions are limited to the following incidents:

- Methoklone Cleaning Tank Fire – February 2012: A degreasing bath caught light through system errors. The root cause identified the failure of third-party contractor to implement Safe System of Work (SSoW), such that the equipment was left energised despite attending to fix the equipment with a known thermostatic fault. It led to an initial change of degreasing agent to reduce risk, shortly afterwards the equipment was removed, and an alternative method was successfully trailed and implemented.
- Uninterruptible Power Supply (UPS) Fire – January 2015: The incident led to cascade failure of installed battery units due to poor maintenance and life cycle management. UUK's options for improvement included change over to new battery technology, Valve Regulated Lead Acid (VRLA); Hot Connection Indicators to provide a permanent indication method.

- Process Pump Fire – July 2015: the identified root case was an imbalanced fan element causing the bearing to overheat and eventually fail. Contributing factors included poor quality control of spares and the balancing of fans by the manufacturer and the relocation of emergency stop buttons purportedly made several years earlier.
- ONR regulatory intervention – December 2019: During a scheduled fire inspection, the ONR inspector noted several warnings/faults on the main fire alarm panel. Further investigation identified that EMIT had not been completed in accordance with BS5839 by the appointed Contractor. UUK reported remediation and subsequent improvements to fire detection faults and system warnings driven by a site-wide survey of functionality and maintenance records. The business identified significant inaccuracies of third-party assurance certification and their failure to remediate faults and warnings within a suitably adequate timeline. UUK has recognised a need to update its safety case arrangements and guidance for consideration of nuclear fire safety in light of new IAEA guides e.g. SSG-64 in so far they are transferable to fuel cycle facilities, applying a graded approach.

The following **improvements** related to fire protection were reported in the NAR for **URENCO Fuel enrichment facility**.

- A fire alarm and detection system improvement project with benefits in terms of life safety, property protection and emergency response.
- UUK reported the following as key findings of recent assessments:
    - Emergency Lighting improvements: a site-wide upgrade to emergency lighting systems and functionality is now fully installed with one asset awaiting final commissioning;
    - Fire compartmentalisation: initially specific to operating assets, then extended to all occupied assets. Review and upgrade completed;
    - Fire Detection and Fire Alarm System upgrade: scope extended to include maintenance, operational and obsolescence challenges across the site to a single standard Category L1 (Maximum Life Protection)/P1 (Maximum Property Protection) as defined in BS 5839-1:2017. All operating assets due for completion by February 2024.

Dedicated spent fuel storage

SZB DRY STORE (DRY)

No **strengths** related to fire protection were reported in the NAR for **SZB DRY STORE**.

No **weaknesses** related to fire protection were reported in the NAR for **SZB DRY STORE**.

No **lessons learned** related to fire protection were reported in the NAR for **SZB DRY STORE**.

No **improvements** related to fire protection were reported in the NAR for **SZB DRY STORE**.

AGR SPENT FUEL PONDS (WET)

No **strengths** related to fire protection were reported in the NAR for **AGR SPENT FUEL PONDS**.

No **weaknesses** related to fire protection were reported in the NAR for **AGR SPENT FUEL PONDS**.
No **lessons learned** related to fire protection were reported in the NAR for **AGR SPENT FUEL PONDS**.

No **improvements** related to fire protection were reported in the NAR for **AGR SPENT FUEL PONDS**.

Installations under decommissioning

HUNTERSTON B NPP

The following **strength** related to fire protection was reported in the NAR for **HUNTERSTON B NPP:**

- The fire and rescue service provision on the sites which ONR judges to be a strength of the EDF NGL case. While fire service intervention is not credited in the fire hazard analyses, demonstration of robust arrangements for onsite firefighting and coordination with local fire and rescue services provides defence in depth.

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

- At HNB, the predominant means of fire protection is active which is largely linked to the age/time of build, with compartment and ventilation design based upon the standards of the time. EDF NGL recognised the shortfalls in the HNB design and added compartmentation and additional lines of protection which are physically separated from other lines such that full compartment burn out can be tolerated. In addition, HNB is now undergoing defueling, hence the nuclear risk is decreasing on the site.
- The originally installed fire-influence plant - high velocity water spray - was not adequate to control certain plausible fire scenarios. As a result, the plant was later hardened by additional fire detection and suppression equipment, leak prevention and leak ignition prevention measures, and passive fire protection of specific essential plant was provided.

No **lessons learned** related to fire safety protection were reported in the NAR for **HUNTERSTON B NPP.**

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

DOUNREAY PROTOTYPE FAST REACTOR

The following **strengths** related to fire protection were reported in the NAR for **DOUNREAY PROTOTYPE FAST REACTOR:**

- An on-site Fire Safety Advisor who is familiar with the on-site hazards and can provide advice on optioneering, modification and design. All site personnel receive mandatory fire safety training which is periodically refreshed.
- On-site fire service: Therefore, a prompt response to fire is assured: a target response time of 3 minutes is applied for fire events across site. Dounreay Fire Ambulance and Rescue Service (DFARS) are familiar with the onsite hazards and are consulted on building design and modification.
- Reviews of fire loading are undertaken through multiple different processes. These include Fire Risk Assessments for life safety purposes, safety cases for modifications, and any required DFRAs (Deterministic Fire Risk Assessment).

The following **weaknesses** related to fire protection were reported in the NAR for **DOUNREAY PROTOTYPE FAST REACTOR:**

- No explicit fire loading limits within PFR; PFR facility contains multiple sources of fire loading and there is the potential for waste to accumulate locally; The UK regulator has raised an action in the NAR for Dounreay to implement a proportionate approach to link the day-to-day management of fire loading with the assessment of fire loadings in the nuclear safety case, to aid consistency in adherence to combustible inventory controls. Closure date – December 2024.

- Dounreay does not have in-house fire engineers to complete DFRAs and is reliant upon the expertise of contracting organisations.

The following **lessons learned** related to fire protection were reported in the NAR for **DOUNREAY PROTOTYPE FAST REACTOR:**

- Dounreay reports that fires are recorded as Unusual Occurrence Reports (UNORs). Dounreay uses UNORs to record deviations from the norm, defects, situations which have or could have caused injury to people, damage to plant or equipment, harm to the environment of pose a quality non-conformance. Dounreay reports that the UNOR database is monitored to identify and analyse trends and provide reports.
- There have been two fires in the PFR facility in the last decade, one in 2014 and one in 2022:
  - A sodium fire was discovered during sodium dig out in the Sodium Tank Farm (STF) in 2014. Dounreay checked each aspect of the work and identified. procedural non compliances and behavioural practices as factors in the incident;
  - A second fire occurred in 2022 during treatment (enhanced weathering of sodium residues whereby a flow of humidified air is generated and is then passed through a tank) of sodium in the STF. Dounreay concluded that this was the result of blocked drainage.
- There are limited passive fire safety features contained within PFR. ONR attended site in July 2022 and noted that services appeared to have been passed through a compartment wall within the Sodium Tank Farm (which forms part of PFR) but fire stopping had not been reinstated. Dounreay committed to rectify this shortfall and the fire stopping was observed to have been reinstated during a follow-up inspection in February 2023.

The following **improvement** related to fire protection was reported in the NAR for **DOUNREAY PROTOTYPE FAST REACTOR.**

- Upgraded of the Fire Detection and Alarm system due to concerns about obsolescence.
- Dounreay has made a significant investment to replace the alarm and detection system at PFR which provides device level resolution to the Dounreay site fire control room.

PILE 1 - SELLAFIELD LTD

(See below under on-site radioactive waste storage).

On-site radioactive waste storage

PILE 1, SELLAFIELD (HLW), SELLAFIELD (ILW – INTERIM STORAGE) AND SELLAFIELD PRODUCT AND RESIDUES STORE (INTERIM STORAGE) – [FACILITIES AT SELLAFIELD]

The following **strengths** related to fire protection were reported in the NAR for the facilities at **SELLAFIELD:**

- Sellafield Ltd. identified a positive reporting culture allowing trending and learning from fire events and near misses. This has allowed Sellafield Ltd. to share learning within the nuclear industry and increase visibility of obsolescence/maintenance issues which had led to electrical fires. Identifying likely causes of fires (electrical failures) allows more targeted assurance to be carried out.
- Mandatory to use third-party accredited fire stopping products, designers, installers and maintainers to ensure that the fire barriers are built and maintained as required by the fire

analyses. A Fire Damper Asset register is maintained for all buildings where such devices are installed.
- Provision of a modern professional fire service permanently based on site.
- Low reliance placed on suppression systems to deliver nuclear safety for Pile 1.
- Utilisation of new technologies to enable rapid deployment of wireless systems to replace ageing fire alarm systems.

The following **weakness** related to fire protection was reported in the NAR for the facilities at **SELLAFIELD:**

- Holistic Fire Safety Strategies (FSSs) are not currently available for all nuclear facilities.

The following **lessons learned** related to fire protection were reported in the NAR for the facilities at **SELLAFIELD**:

- Sellafield Ltd's Building Manager inspections and Fire Risk Assessment reviews produce actions if shortfalls or fire safety deficiencies are identified. Sellafield Ltd. categorises these by cause e.g. fire alarm and detection system, ignition sources or maintenance. It then loads the actions onto the ATLAS system and tracks them to completion, holding the duty holder and competent person responsible for closing out the action to rectify the issues. Sellafield Ltd. reports that, during ONR's Licence Condition 15 Inspection in December 2015, a query was raised regarding the potential fire risk specifically the Diesel Alternator Set (DAS) housed within, poses to the structural stability of Pile 1. Following completion of the inspection, an action was raised to undertake a fire safety review of DAS. Sellafield Ltd. produced a nuclear fire assessment and fire engineering calculations in response. Whilst it recommended no physical improvements, a number of recommendations to control the further control the risk, such as preventative maintenance and combustible control requirements, were identified and implemented. Sellafield Ltd. reports that there are no physical modifications planned that would affect nuclear fire safety but, as there is a programme in place to implement revised nuclear fire safety assessments (prompted by a finding from the 2022 periodic safety case review), emergent work may arise.
- There was a fire within a breakdown cell in Waste Vitrification Plants in 2000, which occurred when sparks from grinding operations ignited some combustible waste. Sellafield Ltd. states that, following the fire, additional fire extinguishing measures were fitted in the cell and an extent of condition was carried out to ensure there was no combustible waste in any other cells in the building.
- ONR assessed the internal hazards aspects of BEPPS-DIF at the pre-inactive commissioning report stage in 2021. Some shortfalls relating to vehicle fire suppression and passive fire protection in the road bay were identified. ONR assessed the licensee's response to these shortfalls at the pre-active commissioning report stage in 2023, finding that the shortfalls had been adequately closed by providing automatic fire suppression within all transporters in use on the site.
- Combustible management and segregation from ignition sources were identified as an area for improvement by WANO, Sellafield Ltd.'s own internal regulator (Nuclear Intelligence and Independent Oversight; NI&IO) and through inspections from Fire Protection and Building Management. These were identified at Sellafield's Waste Vitrification Plants during a WANO review in 2021 and during Sellafield Ltd.'s own review of the plants' Fire Risk Assessment in 2022. Following the identification of combustible management as a concern in multiple facilities, Sellafield Ltd. is developing a Key Performance Indicator (KPI) to highlight areas of concern (e.g. where combustible waste has been stored in a facility for a significant period) at a site level. Sellafield Ltd.'s checklists for Building Managers now include a section to highlight areas holding significant combustible inventories or posing ignition risks.

- An investigation into fire damper issues reported at the Encapsulation Plants in 2022 identified that a significant number of fire dampers had not been maintained in accordance with relevant good practice. The dampers identified as failed in the initial incident do not have nuclear classification. ONR is tracking this activity via a regulatory issue.

The following **improvements** related to fire protection were reported in the NAR for facilities at **SELLAFIELD:**

- Automatic fire suppression was provided within all transporters in use on the site.
- All penetrations were individually registered and assigned a unique reference code so that they can be identified and inspected for any signs of degradation over their lifetime. The same approach has been applied to the fire dampers separating different fire zones.

4. Peer-review conclusions

4.1 Attributes of the NAR and the information provided

The candidate installations are the ones which were the subject of the Board's review prior to the national self-assessment. The recommendations of the Board (consideration of on-site NPP waste storage, highlighting differences in the fire protection approach between candidate and represented installation for NPPs, justification for installations represented by Dounreay Prototype Fast Reactor) were addressed in the NAR. NPPs were reported as 'NPP in operation' (whether fuelled or undergoing defueling). The recommendation of the Board to consider a reactor under decommissioning (Magnox reactor) was not taken into account in the NAR.

The information provided in the NAR allowed a meaningful peer review in particular, for the identification of peer review findings.

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

The outcomes of the self-assessment appropriately mentioned the findings, which were well-illustrated and clearly described.

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

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

4.2 Peer review findings

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

Areas For Improvement mentioned in the NAR as weaknesses and acknowledged as such by the TPR Team	
AFI (1)	**Nuclear installation: Springfields Fuels Ltd** Lack of systematic consideration of combined or consequential hazards assessment as part of the current safety case.

AFI (2)	**Nuclear installation: Dounreay Prototype Fast Reactor** 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.
AFI (3)	**Nuclear installation: Facilities at Sellafield site** Holistic Fire Safety Strategies (FSSs) covering fire objectives: nuclear safety, life safety, property protection not currently available for all nuclear facilities.

The TPR team recommends that the United Kingdom addresses these areas for improvement in their National Action Plan.

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

Areas of Good Performance		
Nuclear installation: Sizewell B		
AGP (1)	**Finding**	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.
	Justification	The hot works control/permit by EDF includes multiple stages of development and validation and is subject to a third level (of independent) verification outside the escalation chain for higher risk areas. It outlines the responsibilities assigned to all individuals involved in the workflow, including the person responsible for the independent review. It also details the process for issuing hot work permits. The workflow indicates that independent verification is applied to those hot works with a higher fire risk and serves as an additional step in the assessment of: – risk assignment, – the conditions under which the work permit is issued, – the implementation of the required preventive measures. These are separate to the hot work assessor, selected hot work person, fire safety coordinator, Hot Work Controller, Team Leader/First Line Supervisor and Fire Watcher.
Nuclear installation: All		
AGP (2)	**Finding**	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.
	Justification	Following the Grenfell tower fire in 2017 involving combustible cladding in a residential building in London, learning for the nuclear sector was sought through a letter from the ONR to all

		licensees, to review the status of their buildings for any presence of the cladding products. The licensees provided responses which were evaluated through technical triage meetings by fire specialists in the regulatory body. The learning from two sites mainly concerns the testing and controls that were introduced to reduce fire risks including prevention of use of the materials in design.
Nuclear installation: Hinkley Point C, Sizewell B and 2nd generation AGRs		
AGP (3)	**Finding**	Fire doors and hatches which form part of the nuclear fire compartment boundaries have position monitoring that initiate an alarm in the MCR if the door is left open.
	Justification	Open fire doors and hatches initiate an alarm in the MCR, providing better assurance that such openings do not unduly compromise the compartmentation function.
Nuclear installation: Waste Facilities		
AGP (4)	**Finding**	Sellafield: Implementation of automatic fire suppression system to transporter tug engines across the site.
	Justification	Transporter tugs are used for on-site movement of waste arising from retrieval operations in legacy facilities at Sellafield site. A system using a Low-Pressure Dry Powder fire suppression agent has been installed into the transporter engine compartment, which is automatically released upon triggering of a heat sensor before a fire develops. The system also actuates a local alarm. Site nuclear and radiological risk assessments consider the burning of vehicles, and this system was identified as a reasonably practicable provision to reduce risk of transporter tug fires. Information about the methodology has been shared by the licensee with other sites through different fora.

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.