

# Topical Peer Review II on Fire Protection

National Action Plan of Denmark

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## 1. Introduction

In accordance with the provisions of the Council Directive 2009/71/EURATOM of 25 June 2009 establishing a community framework for the nuclear safety of nuclear installations as amended by Council Directive 2014/87/Euratom of 8 July 2014, article 8e 3., Denmark has undertaken a national assessment of Fire Protection at nuclear installations specified topics (Topical Peer Reviews – TPR II).

The assessment process was conducted in four phases, running from 2020, and consisting of a preparatory phase – defining the framework for the evaluation, including criteria for selecting representative sites for evaluation, followed by a national evaluation of selected sites, a phase of joint European assessment, and a final phase of development of a national action plan (NacP) based on the conclusions of the assessment.

During the assessment process, four Areas For Improvement (AFI), were identified for the Danish nuclear installations. This report presents the NacP for Denmark addressing the four AFIs identified for Denmark as well as general findings of the assessment with relevance to the Danish context.

All nuclear installations in Denmark are located at one site, the Risø site, where installations were in operation from the late 1950s until 2002. All installations have since been in “safe care and maintenance” or under decommissioning. Hence, the installations represented in the TPR II review were selected from the list of waste storage facilities and installations under decommissioning. Details of installations and features relevant to fire safety are presented in the Danish National Assessment Report ([NAR](#)).

In line with the Danish national policy for radioactive waste management, a new storage facility for all Danish radioactive waste is to be established at the Risø site. The facility, which has an anticipated operational lifetime of up to 50 years, is still in the planning stage, and therefore out of scope of the TPR II review process. Nevertheless, the experience feedback from the review is to be taken into account as the planning of the new storage facility progresses. An initial assessment of the applicability of the review process and the findings of the review has been conducted and the main conclusions of this assessment are included in an annex to this report (see Annex B).

The NacP was compiled by the nuclear regulatory authorities (Danish Health Authority (DHA) and Danish Emergency Management Agency (DEMA)), with contributions from Danish Decommissioning (DD) as the responsible licensee for the nuclear installations in Denmark.

**This report is submitted to the European Commission 31 August 2026.**

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

This section addresses the four AFIs that were identified for Denmark during the review process. For each finding, the Danish position is presented, summarizing actions that have been identified to address the specific AFI along with the anticipated timeline for their implementation.

In each subsection, the specific AFI is stated, followed by information on identified actions and implementation plans for the candidate installations. In addition, the applicability of the specific AFI to the represented installations is addressed in a separate section.

### **2.1 AFI (1): Hot Cell Facility:**

***Since there are no dampers installed in the ventilation system, the fire in the building can spread through the duct system.***

#### **2.1.1 Identified action(s) and implementation progress**

The Hot Cell Facility at Danish Decommissioning was in operation from 1964 to 1989. The original Hot Cell Facility consists of 6 interconnected concrete block cells (see more details in the NAR section II-3.1.1). Building no. 227 in which the Hot Cell Facility is located, is now vacant. Prior to 2022 the building also included facilities (laboratories and offices) used by the Danish Technical University. The building is continuously being modified to accommodate the decommissioning operation of the Hot Cell Facility.

Danish Decommissioning recognises that there is no fire dampers installed in the Hot Cell Facility ventilation. However, there are two separate ventilation systems in the building, one ventilation system for the areas containing the Hot Cells, and one for the remaining building. The separation of the systems minimizes the risk of fire spreading between the ventilation systems, from one area of the building to another.

As part of the ongoing decommissioning work, sections of the facility are being modified to support the decommissioning process, including adaptations of the ventilation systems. Danish Decommissioning will in accordance with the Operational Limits and Conditions involve certified fire safety expertise in planning and implementing changes to the Hot Cell Facility. These renovated areas will comply with current building regulations, and will include the installation of fire dampers where required. These renovations are expected to start early 2027 and be completed within two years.

#### **2.1.2 Applicability to represented installations**

Represented installations are nuclear facilities under decommissioning at the Risø site, which include DR 3 (Danish Reactor 3) and supporting waste management facilities – primarily the Waste Management Plant.

DR 3 was put into operation in 1960, and remained in operation until the year 2000, where it was shut down, initially due to suspicion of a

leak in the reactor tank, but the shutdown ended up being permanent. DR 3 was a heavy water reactor with a thermal power of 10 MW. The reactor was primarily used for basic neutron physics research, material research and production of isotopes e.g. for medical and industrial applications.

DR 3 is under decommissioning, and the decommissioning has progressed as far as to the lower part of the reactor tank. DR 3 was designed with a building seal function in case of an emergency. The ventilation system is thus designed to allow part of the ventilation ducts to be filled with water, creating a water trap. It is still possible to activate the system in case of fire as a means of mitigating the spread of fire.

The Waste Management Plant (building no. 211) housed laboratories until 2020, as well as a laundry facility. The plant also houses a bitumen facility previously used for solidification; however, it is not in operation today. The Waste Management Plant is no longer in operation, and only trained personnel have access to the building when undertaking decommissioning tasks. The amount and extent of potential contamination in the building is much lower than the contamination levels documented for the Hot Cell Facility.

Danish Decommissioning will follow the same practice as for the Hot Cell Facility. If needed for the decommissioning the ventilation system will be modified to support decommissioning activities and in compliance with current building regulations. This may include the installation of fire dampers where required. A certified fire safety expert will be involved in the planning and implementing of changes to the Waste Management Plant.

In general, there are no dampers installed in the remaining buildings at Danish Decommissioning. The buildings have been built in compliance with building regulations at the time of construction. When modifying buildings, including ventilation systems, Danish Decommissioning always ensure compliance with current building regulations, and in consultation with certified fire safety experts.

Even though the buildings have been built in compliance with building regulations at the time of construction, in light of the TPR II findings, Danish Decommissioning will request a walk-through assessment by an external fire-protection expert in late 2026. Danish Decommissioning will evaluate any recommendations for further improvements to fire safety, including fire dampers in ventilation, and implement necessary improvements in 2027.

### ***Action AFI (1):***

Danish Decommissioning will involve certified fire safety expertise in planning and implementing changes to the Hot Cell Facility during decommissioning. Renovated areas will comply with current building regulations, and will include the installation of fire dampers where required. These renovations are expected to start early 2027 and be completed within two years.

## 2.2 AFI (2): Hot Cell Facility and Drum Storage Facility:

***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.***

### 2.2.1 Identified action(s) and implementation progress

Danish Decommissioning recognises the finding that fire-preventive measures at the Hot Cell Facility and Drum Storage Facility rely to a significant degree on adherence to operational procedures rather than structural features of the buildings.

As the Risø site is at the final stage of decommissioning, many of the buildings are no longer in operation. This affects the balance between investing in large-scale structural fire-protection upgrades and applying enhanced operational controls. For buildings and facilities approaching end-of-life, extensive renovations to introduce new passive fire-protection features may not represent a proportionate or feasible measure, particularly when their remaining period of use is limited and personnel access is tightly controlled. However, when renovation and modification of buildings is required to facilitate the safe decommissioning, Danish Decommissioning will ensure compliance with current building regulations, by engaging certified fire safety experts.

Operational fire safety is a key focus area at Danish Decommissioning. All workers receive training in fire prevention, active fire protection as well as basic firefighting. Annual fire drills are conducted to maintain competence and preparedness. Danish Decommissioning also performs a yearly assessment of fire loads and ignition sources and the condition of fire-protection equipment. These assessments are carried out in collaboration with a designated external fire-protection expert and participation from Roskilde Fire Brigade and the nuclear regulatory authorities.

Fire detection in both the Hot Cell Facility and the Drum Storage Facility is ensured through smoke detectors and temperature alarms connected to the automatic alarm system, which immediately alerts directly to the fire emergency services (Roskilde Fire Brigade). Only a few facilities have been excluded from the automatic alarm system due to very low fire loads and a correspondingly low risk of fire, namely building 244, the Low Level Waste Storage, and building 231 the Centralvej Storage.

Furthermore, Danish Decommissioning uses a Computerized Maintenance Management System (CMMS) to manage tasks of relevance to fire safety, which ranges from simple tasks like removing a misplaced pallet, to more complex ones including keeping track of fire sections. The use of a CMMS ensures that tasks are properly registered and flagged when urgent. The CMMS also functions as a log, registering the actions from the creation of the task to its completion, and ensuring that all tasks are acted upon (a CMMS system will also be implemented in the Upgraded Storage Facility, NOL).

Danish Decommissioning considers this combination of targeted operational controls and CMMS to be an effective and proportionate approach for storage facilities as well as the nuclear facilities under decommissioning. The organisation will continue to evaluate whether further measures are justified as decommissioning progresses.

#### 2.2.2 Applicability to represented installations

The fact that fire preventive measures rely on a higher degree on adherence to operational procedures rather than on the structural and layout features of the buildings are considered generally applicable to all the nuclear facilities at the Risø site.

#### **Action AFI (2):**

Renovation and modification of buildings required to facilitate the safe decommissioning, will be conducted in compliance with current building regulations, by engaging certified fire safety experts.

Targeted operational fire safety measures to be maintained.

Control of fire loads through CMMS.

### **2.3 AFI (3): Drum Storage Facility:**

***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 different activities.***

#### 2.3.1 Identified action(s) and implementation progress

The part of the building (no. 212) where the walls do not reach from floor to ceiling and there is no door is designed as a labyrinth structure to facilitate the operation of a crane used for transport of waste packages from the reception area to and from the Drum Storage area. The labyrinth ensures radiological shielding of the areas where operation of the crane takes place as well as areas in other parts of the building where waste management activities are conducted.

Danish Decommissioning acknowledges that waste management activities should ideally be located separately from the storage area. Given that buildings and facilities at the site are approaching end-of-life, or have already been taken out of operation, extensive renovations to introduce new passive fire-protection features may not represent a proportionate or feasible measure, particularly when their remaining period of use is limited and personnel access is controlled. Relying instead on active safety measures, provisions have been put in place to ensure that waste management is limited as much as possible. The activities carried out in the waste management area, is further restricted to only conducting control procedures for acceptance of sealed radioactive sources and radioactive waste. Waste treatment, such as volume reduction or similar activities introducing increased fire risks are not performed.

In order to mitigate the risk of fire arising from the waste management activity in the adjacent areas of the building, the use of the area adjacent to the labyrinth has been restricted, and rules concerning the work flow for management of waste packages ensure the transfer of waste packages to a storage facility within a certain time limit. Received waste items are packaged and transported to another storage facility, usually on the same day and no later than the next day, and must be removed before a weekend. This aims to optimise the radiation protection as well as to reduce the fire load as the radioactive waste items received may partly include combustible packaging (placed on wood pallets, cardboard boxes etc.).

Today the Drum Storage area is bounded by two outer walls and a third wall that is shared with an empty room that holds an outer wall to the south. Danish Decommissioning will in accordance with the finding AFI (3) improve the compartmentalization by introducing two fire doors, thereby ensuring a full compartmentalization between the front room to the Drum Storage area and the room for management of waste items, which currently hosts a glovebox and a PC for record-keeping. The doors will be installed in 2027.

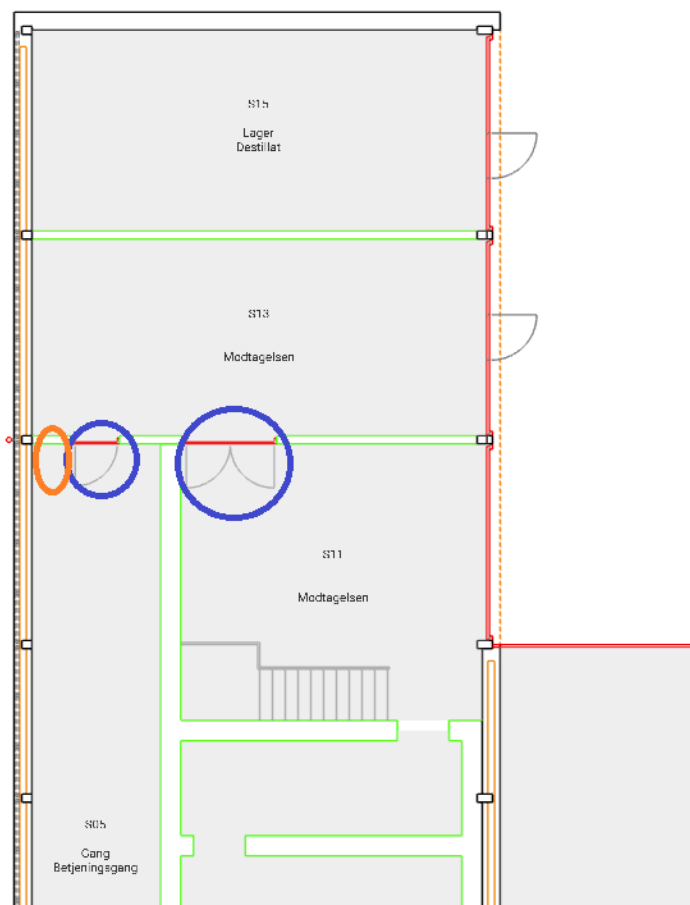


Figure 1: Building 212. The blue circles marks where doors will be installed, and the orange circle marks where a hydraulic station will be moved to the other side of the wall separating it from the drum storage section of the building.

### 2.3.2 Applicability to represented installations

Danish Decommissioning has several storage facilities for radioactive waste, out of which the applicability of AFI (3) could be relevant to assess for the Low Level Waste Storage (building 244) and Intermediate Storage (building 249). Other storage facilities are small and constitute single fire compartments or have a siloed structural layout providing a high degree of passive fire safety.

The Intermediate Storage (building 249) has recently been expanded to ensure storage capacity for future waste arising from the decommissioning, while waiting for the Upgraded Storage Facility (NOL, see more details in Annex B, C, and D) to become operational. The construction work in relation to the now completed expansion of building 249 also included an assessment of the fire safety by fire-protection experts.

The Low Level Waste Storage (Building 244) is a storage facility consisting of one large storage room/hall for storage of radioactive waste in steel drums. Based on the experiences with the expansion of building 249, the potential fire safety benefits of introducing a similar type of compartmentalization will be assessed.

#### **Action AFI (3):**

Danish Decommissioning will in accordance with the finding AFI (3) improve the compartmentalization by introducing two fire doors, thereby ensuring a full compartmentalization between the front room to the Drum Storage area and the room for management of waste items, which currently hosts a glovebox and a PC for recording keeping. The doors will be installed in 2027.

## **2.4 AFI (4): Drum Storage Facility:**

### ***There is a need to implement a system to document the inventory of fire loads (e.g. computer system).***

The activities in building no. 212 are not limited to the storage, but also include management and treatment of radioactive waste, activities that may impact the risk of and consequences of a fire. Although no specific permissible limits for permanent or temporary fire loads are defined, the authorities require that the fire load be kept as low as possible. Implementation of a means of continuous monitoring of the inventory of fire loads in the rooms of building no. 212, that are used for both storage and radioactive waste management purposes (including sorting and compaction of received radioactive waste), would help managing the risk of a fire.

#### 2.4.1 Identified action(s) and implementation progress

Danish Decommissioning carries out an annual walk-through inspection where the fire load is assessed on-site. Furthermore, Danish Decommissioning carries out safety walk-throughs of the site twice a year, and regular daily walk-throughs by a technical staff.

To meet the intent of the finding, Danish Decommissioning will implement that at least once a week during these regular walk-throughs, personnel will assess whether the fire load has increased or decreased compared with previous observations. All findings will be registered in CMMS, ensuring traceable documentation and continuous monitoring. If there is an increase the CMMS system will flag relevant personnel to ensure actions are taken. The risk stemming from the increase in fire load will then be assessed and if possible, the fire load will be decreased. All actions are registered in CMMS, making it possible to follow the progress of the task and ensuring that it is properly concluded. This procedure will be implemented late 2026 or early 2027.

Danish Decommissioning acknowledges the importance of maintaining oversight of fire loads. Danish Decommissioning assesses that a database system of fire loads would require significant resources with limited added benefit, compared to the proposed actions, particularly since no regulatory upper limit for fire loads is defined. Danish Decommissioning assesses that a more hands-on approach as proposed above will provide awareness and have a bigger impact on keeping the fire load reasonably low.

#### 2.4.2 Applicability to represented installations

Danish Decommissioning will implement the same procedure as described above for all installations for which it might be relevant. Danish Decommissioning will initiate an investigation with the aim of identifying buildings in which a regular fire load assessment is deemed necessary.

#### ***Action AFI (4):***

Weekly assessments of fire loads (on-site walk-through inspections), including registration and management of findings in the CMMS.

### **3. Follow-up on other findings resulting from the self-assessment**

#### *Regulatory provisions for fire safety*

In chapter 4 of the NAR, the Danish nuclear regulatory authorities recognized that as decommissioning progresses and radiological constraints on fire safety become less significant, general provisions for fire safety in building regulations play an increasingly important role. In this situation, distinct delineation of responsibilities, careful coordination between regulatory authorities and clear communication to licensees become crucial for maintaining and implementing an effective fire protection concept.

It was emphasized that ensuring coordination between regulatory authorities at different hierarchical levels and with reference to different legislative requirements is challenging and presents risks of duplication of work and requirements to the licensee. In addition, risks of insufficient regulation for critical areas might arise. In this regard, clear specification of regulatory requirements regarding fire safety as well as licensee competences in the field of fire safety is a key to the effective implementation of a fire protection concept.

In order to address this issue, the nuclear regulatory authorities initiated a review of legal and regulatory provisions relevant to fire safety. In the current framework for fire safety, the local (municipal) fire authorities hold prime responsibility for the review and approval of fire safety provisions covered by the applicable building code. Subject to the provisions of Executive Order no. 278 of 27 June 1963 on Protective Measures against Accidents at Nuclear Facilities, the Danish Health Authority is tasked with setting the permissible doses to members of the public resulting from operation of nuclear facilities as well as doses resulting from accidental scenarios (including fire). In addition, the Danish Health Authority, as radiation protection authority, specifies dose limits and constraints applicable for emergency response workers, including fire fighters.

In consequence, any accident scenario, including fire, which results in anticipated doses exceeding the limits or constraints set by the Danish Health Authority, may warrant the specification of fire safety requirements by the nuclear regulatory authorities. Such requirements would need to be met in addition to the requirements derived from applicable building codes. This will be of particular importance to take into consideration for the development of the fire safety provisions for the planned new storage facility at the Risø site.

#### *Fire safety expertise at Danish Decommissioning*

Concerning the finding from the NAR about the lack of internal fire safety experts at Danish Decommissioning, who are able to carry out the necessary fire technical assessments, Danish Decommissioning acknowledges the lack of an internal accredited fire safety consultant. Consequently, Danish Decommissioning still uses an external fire protection consultant. DD believes that the use of an external fire protection consultant, is proportional to the ongoing decommissioning tasks at Danish Decommissioning. Danish Decommissioning is currently improving its competences in fire safety by educating staff in the facility management department further within the subject.

***Action Self-identified AFI:***

*Regulatory provisions for fire safety*

Based on the review of fire safety provisions, the nuclear regulatory authorities will develop specific guidance on the application procedure and regulatory approval processes related to fire safety for such facilities. The guidance is expected to be completed by the end of 2026.

*Fire safety expertise at Danish Decommissioning*

Education of staff in the facility management department in the field of fire safety. The upgrade in competences on fire safety within Danish Decommissioning, will ensure a more competent internal assessment of fire loads and fire safety more generally, but will not replace an external fire protection consultant. One member of staff has completed training as CFPA-E Fire Protection Manager. The activity concerning upgrade in competences is ongoing.

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

In this section, good practices, areas of good performance and areas for improvements identified for other countries and with relevance to the Danish national situation, are addressed. For each identified finding, it is stated in which manner the finding is applicable in a Danish context, how specific actions are expected to take the finding into account.

##### **4.1 Applicability of good practices identified in the peer review**

No good practice relevant to the Danish national situation was identified.

##### **4.2 Applicability of national areas of good performance in other countries**

###### ***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.***

Danish Decommissioning recognizes the applicability of the IT-AGP-1 finding, in which the good practice of accounting for potential fires arising from the crash of an aircraft onto waste buildings is considered at the design stage.

As it regards the design stage, it will not be possible to implement the finding in the already existing waste storage facilities at Danish Decommissioning. However, the finding will be addressed in the new Danish storage facility for radioactive waste (NOL).

###### ***Action IT-AGP-1:***

Existing facilities: Potential impact has been assessed for selected existing nuclear facilities.

New storage facility in planning: The finding will be addressed as part of the safety assessment for the new Danish storage facility for radioactive waste (NOL).

##### **4.3 Applicability of national areas of improvement in other countries**

###### ***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.***

The UK-AFI-2 finding in which it is highlighted that there is no explicit fire loading limit, is also applicable in a Danish context.

Stated in Chapter 2 on the follow-up of findings from the peer review, Danish Decommissioning will implement regular on-site walk-through inspections, in order to assess the current fire load and implement changes if needed to decrease the fire load (see Section 2.4).

***Action UK-AFI-2:***

Existing facilities: implementation of assessments of fire loads via on-site walk-through inspections, including registration and management of findings in the CMMS (see Section 2.4).

New storage facility in planning: fire loading limits will be derived on the basis of safety assessment for the facility as relevant.

## **5. Overall conclusions**

With this report, the formal documentation of the phased approach to the conduct of the Topical Peer Review on fire safety (TPR II) is completed. The report documents how the Danish licensee and regulatory authorities have addressed findings specific to the Danish context as well as the applicability of findings from the TRP II process in other European member states. The timelines for implementation of identified actions have been specified taking into account the complexity of installations in question and application of a graded approach to the management of risks.

By addressing identified AFIs through actions described in this report, fire safety of existing facilities at the Risø site is expected to be enhanced. In addition, the lessons learned through the review process will contribute to the development of a new fire protection concept for the planned storage facility at the Risø site.

## Annex A - Summary table of the actions planned/implemented

| 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               | DK-AFI 1                    | Hot Cell Facility                           | DECOMMISSIONING            | Since there are no dampers installed in the ventilation system, the fire in the building can spread through the duct system.                                                                                                                                           | Danish Decommissioning will involve certified fire safety expertise in planning and implementing changes to the Hot Cell Facility during decommissioning. Renovated areas will comply with current building regulations, and will include the installation of fire dampers where required. These renovations are expected to start early 2027 and be completed within two years. | Ultimo 2028 | In progress                                             |
| 2               | DK-AFI 2                    | Hot Cell Facility and Drum Storage Facility | ALL/MULTIPLE INSTALLATIONS | 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.                                                                                                         | Renovation and modification of buildings required to facilitate the safe decommissioning, will be conducted in compliance with current building regulations, by engaging certified fire safety experts. Targeted operational fire safety measures to be maintained.<br><br>Control of fire loads through CMMS                                                                    |             | Some actions in progress, some to implemented as needed |
| 2               | DK-AFI 3                    | Drum storage facility                       | WASTE STORAGE              | 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 different activities | Danish Decommissioning will in accordance with the finding AFI(3) improve the compartmentalization by introducing two fire doors, thereby ensuring a full compartmentalization between the front room to the Drum Storage area and the room for management of waste items, which currently hosts a glovebox and a PC for recording keeping. The doors will be installed in 2027. | Early 2027  | In planning                                             |
| 2               | DK-AFI 4                    | Drum storage facility                       | WASTE STORAGE              | There is need to implement a system to document the inventory of fire loads (e.g. computer system).                                                                                                                                                                    | Weekly assessments of fire loads (on-site walk-through inspections), including registration and management of findings in the CMMS.                                                                                                                                                                                                                                              | Medio 2027  | In progress                                             |

|   |                     |                                                                      |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             |             |
|---|---------------------|----------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|
| 4 | IT-AGP-1            | Selected existing installations and new storage facility in planning | WASTE                        | 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                                                                                                                                                                                                                                                                                                                            | Existing facilities: Potential impact has been assessed for selected existing nuclear facilities.<br><i>New storage facility in planning: The finding will be addressed as part of the safety assessment for the new Danish storage facility for radioactive waste (NOL).</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | N/A         | In progress |
| 4 | UK-AFI-2            | Existing installations and new storage facility in planning          | DECOMMISSIONING              | 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.                                                                                                                                                                                                                                                                                                                                    | Existing facilities: implementation of assessments of fire loads via on-site walk-through inspections, including registration and management of findings in the CMMS. See also DK-AFI 4.<br><i>New storage facility in planning: fire loading limits will be derived on the basis of safety assessment for the facility as relevant.</i>                                                                                                                                                                                                                                                                                                                                                                                                                         | Medio 2027  | In progress |
| 3 | Self-identified AFI | Existing installations and new storage facility in planning          | Finding from self-assessment | <i>Regulatory provisions for fire safety</i><br>Coordination between regulatory authorities at different hierarchical levels and with reference to different legislative requirements is challenging and presents risks of duplication of work and requirements to the licensee. In addition, risks of insufficient regulation for critical areas might arise.<br><br><i>Fire safety expertise at Danish Decommissioning</i><br>Danish Decommissioning acknowledges the lack of an internal accredited fire safety consultant. | <i>Regulatory provisions for fire safety</i><br>Based on the review of fire safety provisions, the nuclear regulatory authorities will develop specific guidance on the application procedure and regulatory approval processes related to fire safety for such facilities. The guidance is expected to be completed by the end of 2026.<br><br><i>Fire safety expertise at Danish Decommissioning</i><br>Education of personal in the facility management department in the field of fire safety. The upgrade in competences on fire safety within Danish Decommissioning, will ensure a more competent internal assessment of fire loads and fire safety more generally, but will not replace an external fire protection consultant. The activity is ongoing. | Ultimo 2026 | In progress |

## **Annex B - Summary of report concerning ENSREG-findings and their integration into the NOL project**

The report examines whether the fire safety findings from the ENSREG 2nd Topical Peer Review – Fire Protection Country Review Report for Denmark (TPR II-DK) have been incorporated into the design of the New Upgraded Storage Facility (NOL), specifically Buildings 801 and 810 at the Risø site.

The NOL project is intended to provide modern, long-term storage for Denmark's radioactive waste until 2073. The facility includes multiple buildings designed for different storage purposes, with a central focus on safety, particularly fire protection in relation to radioactive materials.

The TPR II-DK review identified several strengths, including the use of non-combustible construction materials, clear fire compartmentation, limited personnel exposure, and reliance on independent expertise. However, it also highlighted weaknesses, such as dependence on operational procedures rather than structural measures, limited internal fire safety expertise, and risks related to fire spread through ventilation systems or insufficient compartmentation. Additional lessons learned pointed to the need for better compliance monitoring and clearer functional separation within facilities.

In response, the NOL design places strong emphasis on non-combustible materials and structural fire protection measures. Building 801 is designed with negligible fire load due to both its construction and stored materials. Building 810 incorporates fire compartmentation (typically EI60-rated elements), separation of functional areas, and protective measures such as flame barriers to limit fire spread despite necessary operational openings for crane transport.

Fire risks associated with stored radioactive materials are mitigated by encapsulating waste in steel drums surrounded by concrete and steel container overpacks, thereby minimizing combustibility. Although the ventilation system does not include fire dampers, alternative measures—such as fire insulation of ducts—are implemented to limit fire propagation, consistent with applicable standards.

Overall, the report concludes that the NOL project adequately addresses the key improvement areas identified in TPR II-DK, particularly regarding structural fire safety and compartmentation. While some deviations exist (e.g., absence of fire dampers), these are compensated by alternative design solutions that achieve an equivalent level of safety.

The full report is available (in Danish) upon request.

## **Annex C - Summary of report concerning ENSREG-findings and their integration into the NOL project**

This report assesses how international findings from the ENSREG 2nd Topical Peer Review on Fire Protection (2025) are reflected in the design of the New Upgraded Storage Facility (NOL), focusing on Buildings 801 and 810.

The NOL facility is being developed at the Risø site to ensure safe, long-term storage of Denmark's radioactive waste until 2073. The report reviews international best practices for fire safety in nuclear waste storage facilities and evaluates their relevance for the NOL project.

The ENSREG review emphasizes that fire safety in nuclear facilities must be based on comprehensive fire safety analyses, applying a defence-in-depth approach that includes prevention, detection, control, and mitigation. It highlights the importance of clearly defined safety objectives, consideration of hazard combinations, and mitigation of secondary consequences such as radioactive release.

Key fire prevention measures include minimizing fire loads, controlling ignition sources, and maintaining strict operational limits. Continuous monitoring of fire load and systematic identification of potential hazards such as mechanical failures are considered essential throughout the facility's lifetime.

Regarding passive fire protection, the report stresses the importance of durable, well-maintained fire barriers and the management of ageing in safety systems. Ventilation systems play a critical role in limiting fire and smoke spread, typically supported by fire dampers and controlled shutdown strategies.

For active fire protection, detection systems should ensure rapid identification of fires, often through advanced and redundant technologies. Fire suppression systems must be carefully selected to avoid unintended consequences, particularly in nuclear environments where water-based systems may increase risks such as contamination or equipment damage.

The report also highlights important cross-cutting issues, including fire compartmentation, the need to address changing risk conditions during decommissioning, and the importance of analysing combined hazards (e.g., fire occurring together with earthquakes or flooding).

In relation to the NOL project, the assessment finds that many preventive measures are already incorporated, including the use of non-combustible materials, separation of functions, and low inherent fire load. Detection systems are implemented, while suppression systems are limited to targeted areas to avoid risks associated with extinguishing water.

The report suggests that a dedicated fire safety analysis can be made to fully align the project with international best practices. Such an analysis would define safety objectives, evaluate the need for additional measures (e.g., fire dampers), and ensure that fire protection systems are robust under all relevant scenarios, including combined hazard events.

Overall, the report concludes that the NOL design incorporates several key safety principles and that further analytical work can be carried out to ensure full compliance with international standards and to optimise fire safety performance.

The full report is available (in Danish) upon request.

## **Annex D - Summary of report concerning the evaluation of TPR II-findings and their relevance for the NOL project**

This report provides responses to comments and questions raised in relation to the TPR II (Topical Peer Review II) assessment of Danish nuclear facilities and evaluates their relevance for the New Upgraded Storage Facility (NOL) project.

The primary purpose is to clarify whether the issues identified in TPR II for existing facilities have implications for the design and fire safety strategy of the new NOL buildings (Buildings 800, 801, and 810). The review focuses on general questions applicable to NOL, while building-specific questions concerning existing facilities are considered not directly relevant.

The report concludes that a formal Fire Safety Analysis (FSA) has not been carried out for the NOL project, as this is not required under Danish legislation (Building Regulations BR18 and the Emergency Management Act). Instead, a comprehensive fire strategy has been developed in accordance with national regulations, demonstrating that the design meets required safety and functionality standards.

Many of the TPR II questions relate specifically to methodologies, analyses, or operational aspects—such as probabilistic safety assessments, combined hazard scenarios, and radiological consequence modelling—that are typically addressed within an FSA. As such, these questions are generally answered by stating that:

- No FSA or PSA has been conducted due to the absence of regulatory requirements,
- Relevant safety aspects are instead addressed through compliance with Danish building regulations,
- Certain topics (e.g., radiological impacts or operational procedures) fall outside the scope of the building design and are handled by Danish Decommissioning (DD) in other documents (the analyses are being done, just elsewhere).

Where applicable, the report explains how fire safety is managed in the NOL design through:

- Fire compartmentation based on regulatory requirements,
- Determination of fire loads and classification according to established standards,
- Procedures for controlling ignition sources (e.g., hot work),
- Maintenance, inspection, and operational planning as required by legislation.

A significant part of the responses indicates that many TPR II comments are not directly relevant to NOL, either because:

- They concern specific existing facilities with different designs,
- They relate to operational conditions not yet applicable (as NOL is not yet in operation), or
- They go beyond the regulatory requirements governing the project.

Overall, the report concludes that the current fire strategies for the NOL project are fully compliant with Danish regulatory requirements and that the TPR II comments do not necessitate changes to the design.

The full report is available (in Danish) upon request.