

Thematic: PASSIVE FIRE PROTECTION

Answers provide references to a section (§) or page (p) in the NAR. In some cases a generic reference to the NAR is given where a certain topic and the associated questions are treated. Where necessary further information is provided.

Please provide (additional) information, if not yet provided in the NAR on the following Topics of Common Interest (all types of installations reported):

- Compartmentation

How is the risk taken into consideration?

§1.2.1.1: compartmentation required to be based on the FHA. For details see §2.1.2.1 and §2.2.2.

Compartmentation (and fire resistance) are defined by the applicable regulations. The risk of fire propagation is verified in FHA through FCA method.

How is propagation of fire prevented/delayed/mitigated?

§1.2.1.1: Each compartment shall be equipped with appropriate fire detection and alarm systems. Adequacy of the compartment, including the resistance of barriers is assessed in the FHA. For details see §2.1.2.1.

If the analysis shows that a fire can propagate and leads to a safety issue, the action are taken to prevent this fire propagation: Limitation of the transient fire load and/or installation of fire resistance separation wall, taken into account the presence of automatic fire extinguishing system or manual intervention (within 40 minutes)...

How are ventilation systems divided among trains/ compartments?

§1.2.1.1: The ventilation systems shall be designed so that the compartmenting function can achieve its segregation purpose in the event of fire. The components of the ventilation systems belonging to a fire compartment (connection ducts, fan batteries, filters), which are located outside this compartment, shall have the same fire resistance as the compartment itself or it shall be possible to isolate them by means of fire dampers having appropriate fire resistance.

What improvements could be achieved to older existing facilities? What limitations are there to do that and what are the alternative measures to cope with that?

Question is generally too broad to answer. However, it is noted that for (older) research reactors it is more challenging to fully implement compartmentation due to their open nature. In that case alternatives are limitation of fire loads and/or increased detection and response.

How is the management concerning fire compartmentation performed as the facility is growing?

A "growing" facility, whatever that means, is likely subject to the modification process. Fire safety is an aspect to consider as part of the modification process. See §2.1.5 and §2.2.3.

For new building, the same approach than what is described above is applied. The fire compartment is defined by the applicable regulations and performing the fire hazard analysis.

How are the fire loads linked to fire compartmentation and fire rating of barriers? Fire loads are the considered in the FHA (part FCA analysis). For details see §2.1.2.1 and §2.2.2. In fact, all the fire loads present in the fire compartment are taken into account in the fire propagation assessment. The fire ignition is postulated in each room, the hot layer temperature generated by the fire is calculated and the fire propagation through the separation wall is evaluated numerically.

○ Management of fire loads

See p46. and further, p51 and further, and §3.1.2.2

Describe the types of permanent and transient fire loads in the facilities?

How is the inventory of fire loads (transitional and permanent) systematically documented (e.g. computer system) and managed (tasks and responsibilities) during operation and decommissioning (if any what is the difference)?

How is analysed whether the change on fire loads affects fire risk?

How is the existing knowledge of the inventory used during daily activities?

What are the limits and practices on permanent and transient loads, which items are excluded?

Describe the inspection programme for fire loads, roles and (independent) responsibilities and frequency. What are the lessons learned and corrective actions taken?

○ OPEX on fire events

How do you classify and report on fire related events? Are smouldering events reported?

Several criteria are available that can be used to report a fire related event, including smouldering events, depending on the severity/threat associated with the event.

These range from ALERT (for fire that may threaten the safety) to INFO (for on-site presence of fire brigade for whatever intervention).

The fire event are reported according to the management by a specific KPI.

The reported fire event is:

- A fire-event that is detected and that requires or results in an intervention

OR

- When it is detected evidence of a combustion i.e. charring/carbonisation or smoke that would have resulted in an intervention

So smouldering events can be reported if one of the two condition above is meet.

How and to what extent is information on these fire events shared and/or discussed national and international level? If applicable: what are the current fire safety related topics that are discussed on national level? Is there an exchange with conventional industry?

The NPPs are operated by the same licensee and has an internal experience sharing process. See also §3.4.1 and §2.1.6.2.

All events and any incident reports are reviewed by Bel V. The high-level lessons learned are shared with all licensees of class I facilities. For example, it was noted that the number of notifications related to fire-rated penetrations was found to be elevated and this triggered a response by the RB.

The fire event is also shared with the insurer.

Can you provide information on events related to fire at your facilities which led to (significant) improvements of fire protection within your country (causes, improvements and relevant lessons learned)? Same question for external experiences (national, international, other industries).

See §3.4.2 and pages 32 and 99.

- Management of ignition sources

See p48 and further, and p58.

What types of hot works are managed in the installations? What are the roles and responsibilities and the way they are regulated and listed?

Describe the details of the approaches (as documented in procedures) to systemically permit and control hot works, including the types of additional (temporary) measures in fire prevention and firefighting. Is it different during decommissioning?

Describe in some detail the programme of (independent) inspections related to hot works including the purpose (before, during, after the work).

- Maintenance/Access/Inspection of fire dampers (not relevant for all facilities)

See pages 55 and 93. In addition, according to the Technical Specifications specific inspection program 16.5.3 on fire protection equipment, 10% of the fire dampers are inspected every 18 months. This includes a visual inspection and a closing test. If degradations are observed, an additional 10% sample in the same building is selected for further inspection. This is repeated until no defect is observed. In some circumstances higher frequencies or sampling rates are foreseen, e.g. for older dampers that could not be upgraded or replaced, due to accessibility or other technical considerations.

The preventives maintenances activities are also done on the fire damper as required by the supplier/manufacturer.

What are types and frequencies of testing/inspection of fire dampers? How is this applied to (nearly) inaccessible dampers?

What insights have been gathered and improvements of the dampers or test/inspection have been made?

- Management of the hydrogen risk (not relevant for all facilities)

See pages 45, 46 and 53.

Describe all the elements of the management of hydrogen risk (such as limiting amount, separate storage, pipe routing etc....).

Describe events and lessons learned or external experience used to modify the management of hydrogen and the related modifications.

Please provide (additional) information, if not yet provided in the NAR, on the following Installation Type Specific Topics of Interest:

○ NPP: Ageing management of fire passive and active SSC

Equipment ageing is monitored through the ageing management program, based on the applicable IAEA methodology. See §1.2.1.1 and p93. These however do not provide all the details asked for below. Further details can be provided if this topic is selected for the workshops.

The ageing management program manages the ageing effects on the intended functions of:

- The fire barriers: fire doors and hatches, fire walls, fire ceilings and floors, fire penetration seals, fire floor slabs, fire/smoke dampers, fire ducts HVAC, fire ducts for smoke exhaust, fire cable ducts, fire coating on cableways and plate under cableways,
- water distribution: Fire pumps, fire main, valves...
- Automatic fire protection systems: Deluge valves, network, nozzles, Sprinkler valves, network, heads and accessories, gaseous fire protection systems...
- Manual fire water protection: Outside and inside hydrants, Piping up to the isolating valve of the hose reels

Preventive actions are taken to minimize and control ageing degradation. visual inspections, periodical testing, system performance testing and maintenance assure the functionality of the systems and mitigate or prevent ageing degradation:

- For the fire barriers: cracking, separation from walls and components, separation of layers of material, rupture, puncture of seals, degradation of intumescent seal, loss of material, integrity of fire doors, operating of the doors, general state of the fire dampers is visually checked to assess the integrity of the blades, the absence of corrosion on the metallic moving parts, the blade fixation to its rotating axis...
- For active fire protection: test of operating pressure and flow, test of sample of sprinkler heads, corrosion and biofouling inspection, functional tests of the fire detections systems...

Throughout the SHR/CHR process, the different data of the components mentioned in the technical specification of the units (chapter 16 of the SAR) that are collected are evaluated and if it appears clearly that a degradation appears for a SSC, a trending can be performed and appropriate measures can be undertaken (replacement, more frequent evaluation, repair etc)

Describe which fire active and passive SSCs are covered by the aging management program.

Describe in general the preventive actions to minimize and control ageing degradation on fire protection.

Describe specifically how the aging management program covers/considers fire barriers, fire extinguishing system and the firewater distribution network.

Describe in general the monitoring and trending of ageing effects on FP SSC?

Which kind of deficiencies of active and passive FP SSCs in scope of aging management program were identified in last 10 years?
Describe how these deficiencies were corrected (e.g. what kind of replacement, improvement or modifications?)

- RR : ventilation management in case of fire

See §3.3.2.2

Describe the ventilation management in case of a fire ?

Explain on what criteria is the ventilation stopped and/or are the fire dampers closed? And is this manually or automatically?

- Decommissioning: fire safety strategy, with indications of development for decommissioning activities

The differences between the operating NPP (CNT3) and the NPP (KCD3) in decommissioning, including modification or preparations for decommissioning, are highlighted were relevant as part of each section in the NAR.

Describe which elements of the fire safety strategy (in the areas of prevention, passive safety and ventilation as covered by the NAR) have/had to be further developed or modified for the decommissioning phase and how?