

**European Nuclear Safety Regulators Group
ENSREG**

2nd Topical Peer Review – ‘Fire Protection’

Country Review Report

Belgium

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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	1	Tihange 3
Research reactor	1	BR 2
Fuel reprocessing facility		
Fuel fabrication facility		
Fuel enrichment facility		
Dedicated spent fuel storage	1 dry	SCG Doel (dry)
Installations under decommissioning	1	KCD3, Doel site
On-site radioactive waste storage		
Total	4	

2. Regulatory framework

The NAR states that “*Within the Belgian national regulatory framework for nuclear safety and radiation protection, the Royal Decree of 30/11/2011 with Safety Requirements for Nuclear Installations (SRNI) transposes the WENRA Safety Reference Levels, including those related to fire prevention and protection. This Royal Decree consists of several sections: the generic section of SRNI applies to all Class I facilities, which includes nuclear power plants, research reactors and spent fuel storage facilities.*” Specific articles deal with protection against internal fires, including fire protection strategy, design principles, fire hazard analysis, fire protection systems, inspections and maintenance and the fire-fighting organisation.

The Royal Decree transposes the WENRA SRLs; therefore, the WENRA SRLs are binding.

The NAR indicates the key regulatory requirements related to nuclear safety.

In addition to the regulatory framework for nuclear safety and radiation protection, national regulations relevant to general fire protection, also apply to nuclear installations.

The NAR indicates that “*the international standards and guidelines that are or were used [...] include IAEA Safety Requirements and Guides, US NRC regulatory guides and standard review plans, Eurocodes, ASME codes, NUREG reports, EPRI reports and other sources*”.

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

Nuclear power plant

TIHANGE 3 (CNT3)

The following **strengths** related to fire protection were reported in the NAR for **TIHANGE 3 (CNT3)**:

- The creation of a unique storage database gives the organization a clear overview on the allowed fire load in the unit.
- In the maintenance department, a team has been dedicated to organize the management of the storage of the mobile fire load. They can rapidly react to correct deviations or to remove unauthorized fire load.
- A solid process is in place to manage the consignment of fire doors (blocked open). After approval, the wedge to block the fire door can be collected at the Main Control Room. This allows the operators to have a clear view on authorized blocked open fire doors at any time. The process allows people in the field to verify if it is allowed to block open the fire door.
- An intervention team is present on site at all times and this is reinforced by the provision of a second intervention team.
 - The existence of first-intervention teams (composed of operator teams) and second-intervention teams (composed of professional fire fighters) with proper equipment and training at hand, ensures that an appropriate response to any fire event can be provided;
 - The second-intervention team fosters close cooperation with the public fire brigades. The second-intervention team performs inspection campaigns that a steady improvement of the housekeeping and the reduction of the mobile fire loads.
- The licensee checks that the requirements from the insurer are not in conflict with fire safety requirements.

The following **weaknesses** related to fire protection were reported in the NAR for **TIHANGE 3 (CNT3)**:

- A verification and inspection process of the status of the seals in fire resistant concrete dals/slabs is implemented but not yet integrated in all the maintenance procedures.
- The number of notifications by the licensee related to issues concerning fire-rated penetrations was found to be elevated. The penetrations reported upon, were either unavailable either because they remained open after works on the penetration itself, or because of external damages that were not declared and repaired in due time. In response, an inspection campaign was developed by the regulatory body to ensure that the related procedures were still appropriate and applied.

The following **lessons learned** related to fire protection were reported in the NAR for **TIHANGE 3 (CNT3)**:

- Up-to-date FHA database. This was not the case in the past. Procedures have been updated or created to ensure that the data is kept up to date.
- Participation in international conferences and exchanges shows that having a Fire PSA model specific to each unit is an added value.
- WANO Technical Support Mission in Blayais (France) with a focus on fire load led to the development of a new fire load strategy and management. This mission led to the new fire load storage management process.
- The European stress test project after the Fukushima-accident resulted in the purchase of a fire truck that is able to spray water on top of the reactor building.
- After a car fire in the parking in Tihange, an assessment took place on the available documentation that is provided for the public fire brigade. As a result, additional documents to share with the external emergency services were developed. This improves the safe and efficient intervention on site (outside of the buildings).

- Following information from an international event, a dedicated training on a transformer fire has been organised for the relevant personnel.

The following **improvements** related to fire protection were reported in the NAR for **TIHANGE 3 (CNT3)**:

- The evaluation of the impact of plant modifications on the outcomes and conclusions of the FHA has been included in the standard modification process.
- Implementation of a Fire Load Index (FLI) indicator used for the management of the mobile fire loads in facilities. In particular, it provides an overview of deviations from fire load expectations established in the reference procedure. This index makes it possible to correctly display and monitor fire load violations after which corrective measures can be taken to eliminate these as quickly as possible. The management of the Fire Load Index is described in a specific procedure that defines the roles and responsibilities in all stages (selection of premises to be assessed, periodicity, stakeholders, corrective actions and communication), leading to the completion of the fire risk assessment related to the presence of mobile fire loads.
- Based on the results of the FHA and Fire PSA for CNT3, an action plan was developed with a total of 76 actions implemented by December 2020. The main actions carried out are:
 - Improvement of the fire protection (passive or active) of the cables related to the Ventilation of the Annular Space and the spent fuel pool building;
 - Improvement of the physical separation between electrical boxes (relocation) or re-routing of cables, e.g. related to the electrical supply of the pool cooling function system pumps;
 - Add fire detectors;
 - Limitation/interdiction of transient fire loads in the rooms with high potential fire safety issue;
 - Addition of portable fire extinguishers;
 - Modification of emergency operating procedure, including the management of fire events.
- Replacement of fire doors in critical rooms with higher fire resistance.
- Replacement of the entire fire detection system by a new system to anticipate the risk of obsolescence of the CNT3 fire detection system.
- Implementation of improvements and actions to ensure long term performance of fire water supply: control of the fire water system supply, process and procedure to flush polluted parts.

Research reactor

BR 2

The following **strengths** related to fire protection were reported in the NAR for **BR 2**:

- Fire hazard assessment focused on the conventional aspects of fire protection, such as management of fire loads and ignition sources, compartmentalization and availability of firefighting equipment due to the specific in-pool design.
- The results of the FHA analysis are visualized on a building map (red, orange, green) for intervention purposes and can easily be updated when needed.
- Presence of an on-site fire brigade (during working hours) as well as the cooperation with the local public fire brigade.

No **weaknesses** related to fire protection were reported in the NAR for **BR 2**.

The following **lessons learned** related to fire protection were reported in the NAR for **BR 2**:

- Establishment of clear storage rules after the observation that the storage rules for chemicals and flammable liquids in fire-rated cabinets were not properly applied (in particular compatibility between substances).
- BR2 logs all operational events, not only incidents and accidents, in a specific system. At company level, a complementary system is available covering all events at SCK CEN related to fire safety, occupational safety, radiological safety, security, environment, etc. Both systems are used to spread knowledge and experiences within the company and to improve processes and procedures if needed.
- Improvement of the housekeeping and reduction of the fire loads.

The following **improvements** related to fire protection were reported in the NAR for **BR 2**:

- Update of the automatic fire detection system that will ease the network extension.
- Replacement of fire-rated doors in the containment.
- Plant modifications resulting from the operating experience: implementation of metallic pallets, as wooden pallets were a significant contributor to the mobile fire loads.

Dedicated spent fuel storage

SCG DOEL (dry)

The following **strengths** related to fire protection were reported in the NAR for **SCG DOEL (dry)**:

- Combustible materials in spent fuel storage facilities can be largely avoided in the facility.
- Spent fuel storage casks provide a very high level of protection against a fire.

No **weaknesses** related to fire protection were reported in the NAR for **SCG DOEL (dry)**.

No **lessons learned** related to fire protection were reported in the NAR for **SCG DOEL (dry)**.

No **improvements** related to fire protection were reported in the NAR for the **SCG DOEL (dry)**.

Installations under decommissioning

KCD3, DOEL SITE

The following **strengths** related to fire protection were reported in the NAR for **KCD3 and DOEL SITE**:

- Operational procedures (e.g. fire load management, fire permits, ...) will remain valid during the post-operational phase (POP) which contributes significantly to the reduction of fire risks;
- A specific FHA study was developed for POP.
- A risk analysis on lithium-ion batteries (electrical cars and electrical bicycles) has been made as well as on all charging points. Analysis showed that electrical bicycles cannot be allowed inside the buildings.
- A seismically constructed building to house the emergency equipment to independently cope with loss of off-site power, complete station black out, flooding, on-site and off-site radiation & contamination and a fire on the reactor building after an airplane crash on the reactor building.
- A firefighting network was set up with 4 other SEVESO companies and the public fire brigades in the port of Antwerp. This platform will enable further exchange of knowledge and information.

No **weaknesses** related to fire protection were reported in the NAR for **KCD3 and DOEL SITE**.

The following **lessons learned** related to fire protection were reported in the NAR for **KCD3 and DOEL SITE**:

- After a fire in an electrical switch board, a preventive thermographic screening will be implemented and this screening has been added to the maintenance plans.
- The firefighting equipment was evaluated after a car fire in Tihange, a large fire blanket has been bought to handle a fire of an electrical car.
- Development of a new fire load strategy and management after WANO Technical Support Mission in Blayais (France) with a focus on fire load.

The following **improvements** related to fire protection were reported in the NAR for **KCD3, DOEL SITE**:

- The replacement of several fire doors in critical rooms is started. The list of fire doors in non-critical rooms is in development.
- The project to improve the fire-resistant seals in concrete dals/slabs has started.
- The replacement of fire dampers is undergoing some delay due to asbestos that has been found in the fire dampers.
- Based on the FHA analysis, additional fire detection has been added in spent fuel building of KCD3.
- The European stress test project after the Fukushima-accident resulted in the purchase of a fire truck that is able to spray water on top of the reactor building.
- The fire trucks were updated and underwent a large maintenance work.
- Implementation of identical KPI on Fire Load index for KCD3 and CNT3.
- Implementation of regular exchanges between Doel NPP and Tihange NPP related to fire safety issues.

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) were addressed 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.

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

Adequate information was provided in reply to the written questions.

- 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: Tihange 3 NPP The verification and inspection process of the seals in fire resistant concrete dals is implemented but not yet integrated in all the maintenance procedures.
AFI (2)	Nuclear installation: Tihange 3 NPP FSA should consider seismically induced fire.

The TPR team recommends that Belgium addresses these areas for improvement in the National Action plan.

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

Areas of Good Performance		
Nuclear installation: Tihange 3 NPP		
AGP (1)	Finding	A solid process is in place to manage the authorisations to have fire doors opened: the wedge to block the fire door can be collected at the Main Control Room after approval.
	Justification	This allows the operators to have a clear view on authorised blocked open fire doors at any time. The process allows people in the field to verify if it is allowed to block open the fire door.
AGP (2)	Finding	The existence of first-intervention teams (composed of operators) and second- intervention teams (composed of professional fire fighters) with proper equipment and, in the case of Tihange NPP - external public firefighters quartered opposite the site, ensures an appropriate response to any fire event.
	Justification	<p>Each of the 3 units of the Tihange plant has a first intervention team (EPI) that is permanently available on site, 24/7, made up of at least five operations staff of whom at least two are trained in firefighting.</p> <p>The second intervention team (ESI) reinforces the first intervention team and consists of at least 2 qualified firefighters, permanently present, and a firefighter coordinator during working hours. The members also work as voluntary firefighters for an external fire brigade, which allows them to maintain a good level of knowledge and experience of firefighting.</p> <p>External public firefighters are quartered in the same street opposite the Tihange site which allows for a rapid intervention; they are systematically called upon for each fire event unless otherwise decided based on the assessment of the situation by the ESI. The external firefighting brigade ensures a permanence</p>

		of 13 agents (11 at night). The provisions exceed those detailed for installations in other NARs.
AGP (3)	Finding	Use of a mobile scanner device with an intuitive IT tool and barcode on items to easily identify equipment or material allowed to be stored.
	Justification	The plant has developed a system to manage storage area of transient fire loads and other non-combustible materials. The system is composed of mobile scanner devices (PDA) with an intuitive IT tool, stickers with bar code, docking stations to synchronize the mobile devices and a desktop interface to set up the application. The goal of the application is to easily identify any storage area, the allowed equipment/materials stored and the owner of the area and the equipment. The tool is a dynamic and interactive tool that provides a simple solution for the traceability, verification of storage area, generation of the notifications directly in the field and monitoring and trending. The tool also provides other information such as the owners of each storage area, the allowed storage materials, the maximum allowed fire load of each storage area, and the contamination level. The bar-codes are permanently present in permanent storage locations and are installed at temporary storage locations.
Nuclear installation: Tihange 3 NPP and Doel 3		
AGP (4)	Finding	Implementation of a software tool to easily assess the adequacy of the fire protection measures
	Justification	The plant has developed an integrated tool to support fire hazard analyses which includes assessments for the fire resistance of a separation barrier, calculations for fire propagation in multi-compartment configurations and an algorithm for taking extinguishing systems into account in the calculation of fire growth and propagation. The software tool 'Safety Reports' collects all data related to fire protection (e.g. fire doors, fire load, fixed and manual fire extinguishing systems) in one database. The tool allows to make an evaluation of the adequacy of the fire protection measures easily. This makes it also possible to see immediately the impact on the fire risk if a particular fire protective equipment is unavailable. The tool helps to identify the correct compensatory measures if fire protection equipment is unavailable.

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.