

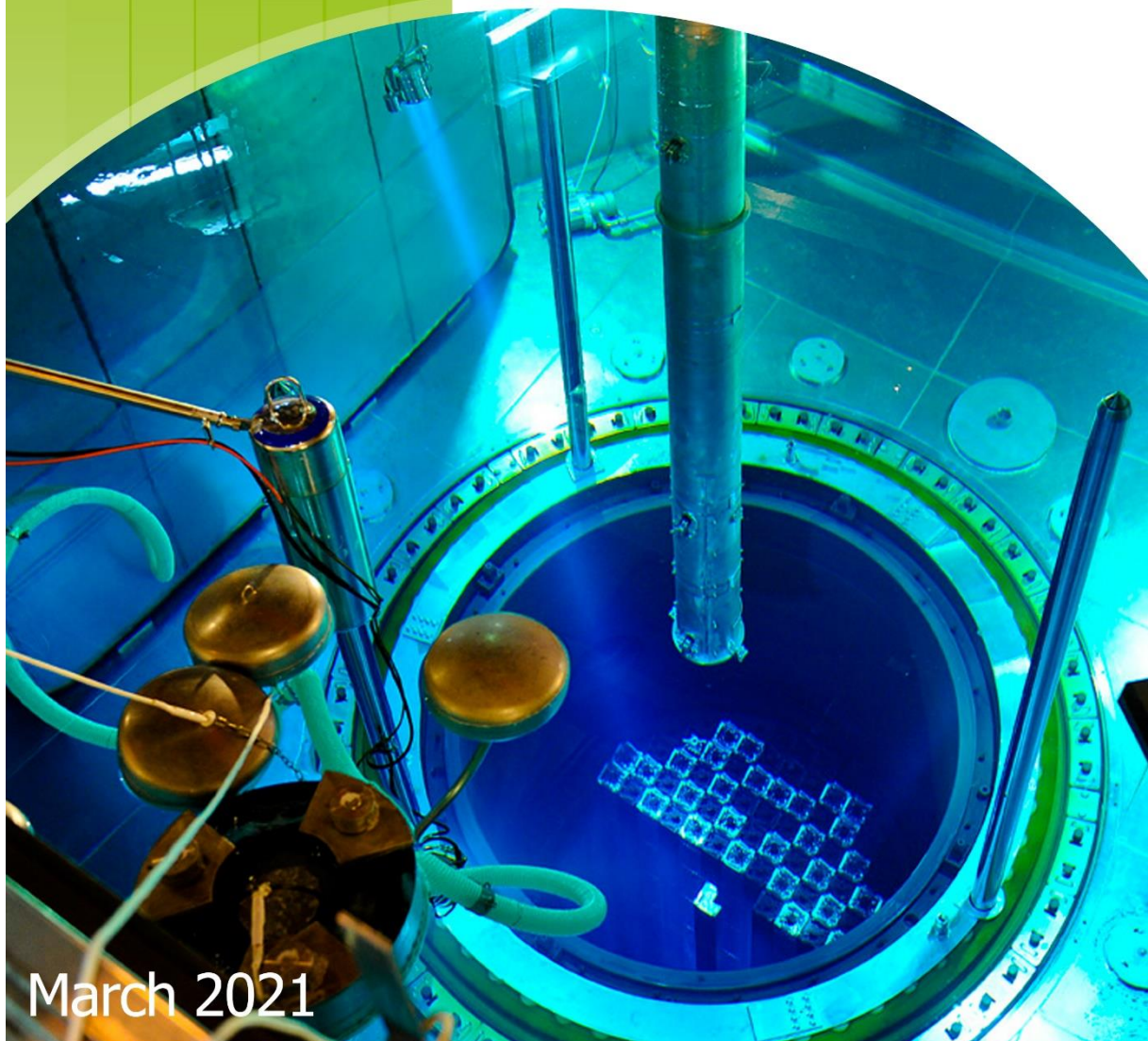
ENSREG
TOPICAL
PEER
REVIEW
2021

FANC 

federal agency for nuclear control

Ageing Management

Belgian Action Plan



March 2021

EU Topical Peer Review

Ageing Management of
nuclear power plants and research reactors

Belgian National Action Plan

Federal Agency for Nuclear Control
2021

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1. INTRODUCTION

Context

In 2014, the European Union (EU) Council adopted directive 2014/87/EURATOM amending the 2009 Nuclear Safety Directive to incorporate lessons learned following the accident at the Fukushima Daiichi nuclear power plant in 2011. Recognising the importance of peer review in delivering continuous improvement to nuclear safety, the revised Nuclear Safety Directive introduces a European system of topical peer review which will commence in 2017 and will be repeated every six years thereafter. The purpose is to provide a mechanism for EU Member States to examine topics of strategic importance to nuclear safety, to exchange experience and to identify opportunities to strengthen nuclear safety. The member states, acting through the European Nuclear Safety Regulators Group (ENSREG), have decided that the topic for the first topical peer review is **Ageing Management**.

Scope

It was decided that topical peer review will cover the following types of nuclear installations:

- Nuclear power plants;
- Research reactors with a power equal to 1 MW_{th} or more;

that are still in operation on 31st December 2017 or under construction on 31st December 2016.

Ageing Management

Ageing and ageing management are defined as below in the terms of reference of the Topical Peer Review :

- **Ageing** is considered as a process by which the physical characteristics of a structure, system or component (SSC) change with time (ageing) or use (wear-out).
- **Ageing management** is understood as the engineering, operations and maintenance actions undertaken by a licensee to prevent or to control within acceptable limits ageing degradation of structures, systems and components (SSC) of its installation. With regard to safety it ensures the availability of required safety functions throughout the service life of the plant, with account taken of changes that occur with time and use and by considering all service conditions.

Topical Peer Review Process

National Assessment Report (NAR)

The first stage of the peer review process was the production of a national assessment report for each country participating in the topical peer review by December 2017.

The objectives of the National Assessment Report (NAR) were to:

- describe the overall ageing management program including:
 - Programmatic aspects;
 - Implementation of overall ageing management program;
 - Experience of the application of ageing management;
- assess the outcomes to identify main strengths and weaknesses;
- identify actions to address any significant areas of improvement;

- produce a report in sufficient detail to allow a meaningful peer review.

Full specifications for achieving the NAR were provided by ENSREG.

Peer Review

The second stage of the peer review process was the peer-review itself during which National Assessment Reports were examined by other countries in order to share operating experience, identify good practices, common issues and follow-up actions to address the challenges posed by ageing management of nuclear facilities.

Action Plan

The third phase of the peer review process is the definition of a National Action Plan for addressing the challenges and areas of improvement allocated during the peer review and to meet the identified expected level of performances. In accordance with the Council Conclusions of March 18th 2019 and the ENSREG decision of March 25th 2019, countries that participated in the 1st TPR process should deliver their National Action Plans (NACPs) for Nuclear Power Plants and Research Reactors by the end of September 2019.

A status update of the NAcP is requested by May 2021 and is the topic of this report.

A report on the implementation status is foreseen at the end of a follow-up phase, in December 2023.

Full details on the complete process for developing the Topical Peer Review are presented in the terms of reference and technical specifications by ENSREG.

A new topical peer review will take place in 2024 on Fire Protection.

Belgian national Action Plan

This document presents the Belgian National Action Plan developed to tackle the findings identified concerning the ageing management and ageing management programs for both the NPP licensee and the Research reactors licensee, in each step of the Topical Peer Review.

The Belgian situation and, so the Belgian NAcP, may differ from other countries as no specific findings were attributed from the peer review phase of the National Reports and in the final ENSREG report on ageing and ageing management, while several findings were identified by the licensee itself or by the Belgian Safety Authority during the self-assessment phase.

As a consequence of that the NPP licensee had already addressed and resolved most of the issues identified during the self-assessment phase before the redaction of the Belgian National Assessment Report. As most self-assessed findings were already resolved in the self-assessment phase and no specific finding was attributed to Belgian NPP, the Belgian NAcP for NPP is mostly limited to position Belgium in relation to the Good Practices attributed to other countries and to present the situation with respect to generic ENSREG findings on cables management.

For the Research Reactor BR2, most findings identified during the self-assessment had still to be answered at the end of the self-assessment phase and the way for their resolution is detailed in the present report.

No specific findings were attributed to any Research Reactors during the peer review phase, while BR2 meets all Good Practices identified for Research Reactors, so that no additional actions to the ones self-assessed by Belgium is considered for the BR2 research reactor.

The NAcP is intended to enable progress to be monitored against the range of findings emerging from the TPR and it will also inform future TPR follow-up activities by ENSREG.

2. TABLE: SUMMARY OF THE PLANNED ACTIONS

Installation	Thematics	Finding	Planned action	Deadline	Status by March 2021	Regulator's Approach to Monitoring
NPP 1	OAMP	Extension of the new ageing management program to the ageing management program of Tihange 2&3 and Doel 3&4 based on the program installed for the LTO units, and using the most recent international standards and guidance.	Included in the upcoming PSRs of these units	Next PSR action plan	<p>As a consequence of the phase-out law of 2003, all the reactors are to be shut down by 2025.</p> <p>The upcoming PSR dates correspond to the definitive end of operation and will be focused on the SSCs with a safety function during the post-operational phase. The upgrade to the new ageing management program is thus not considered.</p> <p>The PSR action plans are due 6 months before the final shutdown of the units.</p>	The action is closed.
NPP 2	OAMP	Investigate whether and how the ageing programs need to be adapted to avoid ageing issues, inadequate ageing monitoring and inadequate remedial actions for some concrete degradations.	<p>The Belgian Safety Authority conducted several inspections in 2018-2019 in both Doel and Tihange NPPs specifically dedicated to the process and performances for In-Service Inspections (ISI) of the concrete structures and buildings of the NPPs.</p> <p>Those inspections conclude that the ageing management program for concrete buildings, and more specifically the ISI program for the concrete structures, were uncomplete and insufficient to guarantee that most concrete degradations can be identified and followed-up for years, but mainly to guarantee that the potential impact of those identified concrete degradations on the safety functions of the structure is systematically assessed. The ISI program was suitable for classic civil structures in relatively standard external conditions and was not adapted for tackling specific issues related to civil structures in unusual external conditions (temperature, humidity, steam jets...).</p> <p>The Belgian Safety Authority requested in accordance the licensee to develop a new process, based on the latest international standards, for performing In-Service Inspections on civil structures, assessing the impact of the defects identified, guarantying a follow-up of the defects and assuring an adequate AQ of the process. The Safety Authority required the licensee to perform a complete new ISI campaign of all civil structures once the new process and the underlying procedures for inspection will be approved by the Safety Authority</p> <p>The licensee presented in early 2019 an action plan for answering all the findings of the Safety Authority in a timely manner. The action plan and the associated planning were discussed and approved by the Safety Authority. The licensee started in June 2019 the new ISI program and plans to complete its application to all civil structures by 2021.</p> <p>In parallel, the systematic and specific controls on the field concerning civil structures have been intensified by the Safety Authority.</p>	Most actions were due by June or September 2019 and have been realized in due time. The few remaining actions are due for December 2019.	<p>Action plan was developed.</p> <p>The new ISI inspection procedures for civil structures have been developed.</p> <p>The inspection campaign with the new procedures has been performed. All the reports are going to be edited by March 2021.</p> <p>The major info is that all inspections are done and no severe defects were discovered.</p> <p>The inspection campaign suffered little delay as a consequence of the COVID-19 pandemic and the multiple outages of the units in 2020.</p>	<p>This topic was subject to significant follow-up by the Safety Authority.</p> <p>The Belgian Safety Authority performed new inspections by the end of 2019 in order to assess the progress brought on the ISI process.</p> <p>Additional and recurrent inspections have been carried out in 2020.</p> <p>The Safety Authority begin to be reassured about the efficiency and quality of the process. Small details still needs improvement and are followed-up by the Safety Authority.</p> <p>The action is closed.</p>

NPP 3	Electrical cables	Cables necessary for accident mitigation are tested to determine their capabilities to fulfil their functions under Design Extension Conditions and throughout their expected lifetime.	An action is ongoing within the compliance project with the WENRA 2014 RLs. The study should determine which actions should be performed the I&C cables used in DEC B conditions. The planning of the study was discussed with the Belgian Safety Authority.	Within the WENRA 2014 Action Plan	The licensee performed the survivability studies for the cables, justifying the capability to fulfil their functions based on their qualification files. All the studies have been transmitted to the Safety Authority.	The action is followed in the framework of the project aiming at establishing the compliance with the 2014 WENRA Reference Levels. The concerned studies are currently under review.
NPP 4	Electrical cables	Based on international experience, appropriate techniques are used to detect degradation of inaccessible cables.	Regarding the MV (380V) cables and I&C cable, projects have been launched in 2019 to update the inventories of the inaccessible cables.	Continuous	The licensee launched a R&D program on different diagnostic testing methods for LV and I&C cables (dielectric frequency response, insulation resistance, time domain reflectometry). The licensee has started with the first measurements on site in order to compare the lab results, for inaccessible cables and cables in adverse environment. The follow-up, testing, evaluation of test-results,... is carried out in the licensee existing CMP (Cable Management Program) that guarantees a uniform approach.	The status of the action and an update of these specific projects is part of the annual licensee report on the Ageing Management program. The action is closed.
NPP 5	Concealed pipeworks	In order to establish the integrity of new or novel materials, sections of pipework are removed after a period of operation and inspected to confirm the properties are as expected.	For future replacement in new material with low operating experience, this good practice will be evaluated on a case by case basis.	Continuous	The action is performed on a case-by case basis, requested by a procedure.	The action is closed.
NPP 6	Concrete containment structures	Complementary instrumentation is used to better predict the mechanical behaviour of the containment and to compensate for loss of sensors throughout the life of the plant.	The number of sensors on the containment are currently still sufficient for the ageing management program of the concrete containment structure of the NPPs. The adequacy of the ageing management program and an eventual need for compensating for a loss of sensors is to be reevaluated in the framework of the review of the dedicated AMP or during the forthcoming PSR. The topic should be addressed in the framework of the forthcoming PSR in Belgium.	Next PSR	Due to the final shutdown of all NPPs by 2025, complementary instrumentation is not needed, as it is demonstrated that the actual number of sensors is sufficient for the ageing management program.	The action is closed.
NPP 7	Concrete containment structures	A proactive and comprehensive methodology is implemented to inspect, monitor and assess inaccessible structures or structures with limited access	Guideline ENSI-B01 was not used by ENGIE Electrabel up to now. This document will be evaluated to check what can be applied in Belgium in the framework of the forthcoming PSR.	Next PSR	As a consequence of the final shut-down of all units in 2025, it has been decided not to perform the evaluation of the guideline due to the residual lifetime of the units.	The action is closed.
NPP 8	OAMP	Finding not retained by ENSREG: Some countries request their licensees to provide an annual summary report on Ageing and Ageing Management	Request the licensee for an annual report on Ageing and Ageing Management	January 2019	The licensee provided annual reports by 2019 and 2020.	The action is closed.

BR2 research reactor

Installation	Thematics	Finding	Planned action	Deadline	Status by March 2021	Regulator's Approach to Monitoring
RR 1	OAMP	The licensee shall extend the scope of the ageing management program to include all SSCs relevant for safety that are present within the premises of the BR2. Notably the hot cells, experimental devices and spent fuel storage system should be included. In addition, spare parts for safety related SSCs that are in stock should also be included.	The Belgian Safety Authority asked the licensee to add all those actions in the 2016PSR action plan for the BR2 reactor. All the actions are followed in this framework.	PSR action plan	<p>The indicators for the AMP have been defined. These are based on the finding that formally an AMP never ends. In order to be able to objectively assess the evolution of the project, a process was defined that gives an indication of the current state of affairs. In particular, indicators have been defined for the different phases:</p> <ul style="list-style-type: none"> • Asset Configuration Management (ACM). For this phase, the completeness (number of components included) and the correctness of the classification must be monitored. <p>O The inventory can currently be considered complete. Additional assessments can be the result of new components, changes or new insights.</p> <ul style="list-style-type: none"> • Installation Concept Management (ICM): If the component is classified as safety (ACM class A or B), a more detailed analysis must be drawn up. <p>O For every SSC that has a safety function (ACM class A or B there is an ICM file). A revision of this sheet is ongoing. Changes can be the result of test results or new information.</p> <ul style="list-style-type: none"> • Workmanship & Management Skills (WMS): This phase provides the detailed procedures for performing inspection, maintenance and replacement tasks. The procedures are drawn up when the relevant tasks must be performed. <p>For the mechanical components, 78% of the WMS should be reached by June 2021.</p> <p>A new calculation of mechanical resistance was performed for the reactor vessel, replacing the calculations dating from the 1990s. This new calculation is based on the ASME VIII, div. 2 (ed. 2019)), the UK PD5500 directive and the R6 code. This new calculation examines the fatigue resistance and determines the minimum necessary fracture toughness of the irradiated aluminium. In addition, a formal «Leak Before Break» concept is being developed.</p> <p>An inspection schedule was drawn up in 2011 for the primary pipes in accordance with the ASME XI code. Criteria were developed for the acceptance criteria based on a specific calculation. The first 10 annual period has ended and in February 2021 the first inspection campaign of the second 10 annual period has started.</p> <p>For electricity and instrumentation, an inventory is used of all components (switches, cables, batteries, contactors, transformers, ...) that are involved in the power supply or control of SSCs classified in class A or B. At present, 22 826 components included in the database. These occur for a total of 74,085 circuits. The status of implementation is currently 28%.</p> <p>Conclusion:</p> <p>A first version of the AMP is available. The inventory of the components has been carried out, including a safety assessment. It is assumed that this inventory currently provides a complete picture of the installation. At least a first version of an ICM assessment is available for all components with a safety classification.</p> <p>It is necessary to continue to evaluate this assessment and to adjust it if necessary.</p> <p>Currently, the AMP consists of a series of tables and documents. In practice this is difficult to manage. This requires a lot of manual research. In the future, action will be taken to integrate the system into SCK's general maintenance program (ULTIMO).</p>	<p>The development of the ageing management program continues in order to reach a level commensurable with international standards for NPP reactors.</p> <p>Periodic status of the action plan are required by the safety authority.</p>
RR 2	OAMP	The on-going development of the ageing management program should be focused on safety-related SSCs.				
RR 3	OAMP	The licensee shall develop procedures to review and update the ageing management program once the current implementation phase is completed and to measure its effectiveness.				

RR 4	Electrical cables	The licensee shall establish a formal ageing assessment program for all safety related electrical cables. Priority should be given to neutron flux instrumentation cables and the 110V cables. The ageing management program should then be upgraded in accordance.			The neutron measurement chains are renewed. Following this action, the cables are reassessed and a new follow-up program is defined. All power cables that supply A or B components with voltage are included in the database and are followed up accordingly, both for the high-voltage cables and for the 110 V DC voltage. It should also be noted that the high voltage cables were renewed in 2016 and that the 110 V DC voltage system can withstand a single fault.	The action is closed.
RR 5	Electrical cables	The licensee shall perform walk-downs in order to confirm the absence of adverse environment (e.g. wetting or abnormal local cable's heating mechanisms) and in support of the development of the ageing assessment program for the electrical cables. Particular attention is needed for the safety related cables that were not recently replaced or that are not planned to be replaced in the future (for instance the 110V cables and instrumentation cables).			No cables were found in an aggressive environment (high temperature, chemicals, ...).	The action is closed.
RR 6	Electrical cables	The licensee shall demonstrate that the safety related cables can fulfil their safety function in all relevant accidental conditions.			To be performed (priority is given to the development of the AMP)	The Belgian Safety Authority asked the licensee to add all those actions in the 2016PSR action plan for the BR2 reactor. All the actions are followed in this framework.
RR 7	Concealed pipeworks	Additional monitoring, testing, sampling or inspection activities should be implemented for: the piping for transport of pool water from the reactor building to the storage basin under the ventilation building, the fuel transport piping for the Diesel generators and the concealed part of the feed water line for firefighting in the reactor building.			After the execution of a pending request for a modification to the installation, the part of the piping of pool water that lies underground is no longer part of the reactor building in case of reactor building isolation.	The Belgian Safety Authority asked the licensee to add all those actions in the 2016PSR action plan for the BR2 reactor. All the actions are followed in this framework.
RR 8	Concealed pipeworks	The need for a replacement of the piping for city water should, based on the projections provided by SCK•CEN, be investigated.			To be performed (priority is given to the development of the AMP)	The Belgian Safety Authority asked the licensee to add all those actions in the 2016PSR action plan for the BR2 reactor.

RR 9	Concealed pipeworks	It is suggested to consider additional monitoring, testing, sampling or inspection activities for city water and feed line for cooling water from the lagoon;				All the actions are followed in this framework.
RR 10	Concealed pipeworks	It is suggested to update or validate the ageing management program for concealed piping based on data obtained from the piping that was removed.				
RR 11 <i>(RR 12 was a doublon)</i>	Reactor Pressure Vessels	The ageing management of the RPV of BR2 should be extended by explicitly tracking the number of stops that provide the most severe loads for low cycle fatigue and compare this number with the established limit.			A new fatigue calculation has been performed. This point was a conclusion of the calculations of the early 1990s. The new calculations, assuming that 10% of the cycles end with an emergency stop, indicate that even with this very conservative assumption, the contribution of the emergency stop to the fatigue load is very limited (magnitude about 1%).	The action is closed.
RR 13	Concrete containment structures	The need for monitoring, testing, sampling and inspection activities as well as for preventive and remedial actions should be determined on the basis of a dedicated ageing assessment.			The preparation of a formal follow-up program is included in the BR2-2036 project (upcoming PSR scheduled for 2026 to justify continued operation until 2036). No degradation is observed in current buildings important in terms of safety	The action will be followed-up in the framework of the BR2-2036 project.

