KINGDOM OF BELGIUM

FIRST REPORT IN THE FRAME OF ART 9 OF THE EUROPEAN DIRECTIVE 2009/71/EURATOM

NATIONAL REPORT

July 2014
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I. Introduction

I.A. Content of the Present Report

This Belgian national report is the first report submitted in the frame of art. 9 of the Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations, hereafter referred to as "the Directive". Due account was taken of the ENSREG guidelines given in the document HLG_p(2012-21)_108. This report consists of three sections: The first section is an introduction that starts by identifying which civilian nuclear installation, as defined in article 3(1) of the Directive, are operated in Belgium under a license, as defined in Article 3(4) of the Directive.

The second section is intended to give a summary on matters that have been developed since the enactment of the Directive in June 2009, focusing on significant changes in national laws, regulations, administrative arrangements and practices related to the national safety.

Finally, the third and last section will give information and some examples on how the different articles of the Directive are addressed in Belgium.

According to the Belgian regulations, the nuclear installations covered by the Directive (i.e. Nuclear Power Plants, Research Reactors, Fuel Cycle Facilities and some waste facilities) are categorized as "Class I" facilities. Licensing processes, safety and assessment processes, inspections and enforcement processes are similar for the facilities belonging to this class. Consequently, the descriptions (legal framework, regulatory processes, licensee obligations, ...) given hereafter in the report are valid for all of these nuclear installations.

I.B. List of Belgian Nuclear Installations

Seven commercial nuclear reactors of the PWR type are in operation in Belgium, on two sites: Tihange and Doel, leading to a total installed capacity of 6224 MWe. The characteristics of these power plants and their commissioning date are given in the tables below.

All power plants are operated by Electrabel, a member of the GDF-Suez group that was created after the merging in 2008 of 2 groups "Gaz de France" and "Suez". The share of the company in electricity generating capacity in Belgium amounts to 64% in 2010.

I.B.1. The Doel Site

The Doel nuclear power plant is located close to the harbour of Antwerp, on the left bank of the Scheldt river, at 15 km northwest of Antwerp (Flanders) and at only 3 km from the border between Belgium and the Netherlands.

The site houses the following facilities:

<table>
<thead>
<tr>
<th>Units/Facility</th>
<th>Type</th>
<th>Thermal power (MWh)</th>
<th>Date of first criticality</th>
<th>Containment building characteristics</th>
<th>Fuel storage pool capacity</th>
<th>Designer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doel 1 NPP</td>
<td>PWR</td>
<td>1 312</td>
<td>1974</td>
<td>Double containment (steel and concrete)</td>
<td>664 positions</td>
<td>Westinghouse</td>
</tr>
<tr>
<td>Doel 2 NPP</td>
<td>PWR</td>
<td>1 312</td>
<td>1975</td>
<td>Double containment (steel and concrete)</td>
<td></td>
<td>Westinghouse</td>
</tr>
<tr>
<td>Doel 3 NPP</td>
<td>PWR</td>
<td>3 064</td>
<td>1982</td>
<td>Double containment with inner metallic liner</td>
<td>672 positions</td>
<td>Framatome</td>
</tr>
<tr>
<td>Doel 4 NPP</td>
<td>PWR</td>
<td>3 000</td>
<td>1985</td>
<td>Double containment with inner metallic liner</td>
<td>628 positions</td>
<td>Westinghouse</td>
</tr>
<tr>
<td>SCG building</td>
<td>Spent fuel dry storage</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>165 spent fuel containers of ~24 fuel ass. each</td>
<td>Tractebel Engineering</td>
</tr>
</tbody>
</table>
These facilities are shown in figure 1: “A” are the Doel 1&2 NPPs, “B” is the Doel 3 NPP, “C” is the Doel 4 NPP and “D” is the SCG building.

Figure 1 - Facilities at Doel site

I.B.2. The Tihange Site

The site is located on the territory of the former municipality of Tihange along the right bank of the Meuse river. Tihange is now part of the city of Huy at a distance of 25 km from Liege.

The site houses the following facilities:

<table>
<thead>
<tr>
<th>Units/Facility</th>
<th>Type</th>
<th>Thermal power (MWe)</th>
<th>Date of first criticality</th>
<th>Containment building characteristics</th>
<th>Fuel storage pool capacity</th>
<th>Designer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tihange 1</td>
<td>PWR  (3 loops)</td>
<td>2 873</td>
<td>1975</td>
<td>Double containment with inner metallic liner</td>
<td>324 positions + 49 removable positions</td>
<td>Framatome / Westinghouse</td>
</tr>
<tr>
<td>Tihange 2</td>
<td>PWR  (3 loops)</td>
<td>3 054</td>
<td>1982</td>
<td>Double containment with inner metallic liner</td>
<td>700 positions</td>
<td>Framatome</td>
</tr>
<tr>
<td>Tihange 3</td>
<td>PWR  (3 loops)</td>
<td>2 988</td>
<td>1985</td>
<td>Double containment with inner metallic liner</td>
<td>820 positions</td>
<td>Westinghouse</td>
</tr>
<tr>
<td>DE building</td>
<td>Spent fuel wet storage</td>
<td>-</td>
<td>-</td>
<td>Bunkered building</td>
<td>3 720 positions + 30 temporary positions</td>
<td>Tractebel Engineering</td>
</tr>
</tbody>
</table>

These facilities are shown in figure 2: “A” is the Tihange 1 NPP, “B” is the Tihange 2 NPP, “C” is the Tihange 3 NPP and “D” is the DE building.
I.B.3. Other Nuclear Installations

Besides the NPP sites, the Mol-Dessel site hosts the "Centre d'Etude de l'Energie Nucleaire" (SCK•CEN) in Mol (i.e. the Nuclear Research Centre), which is a public interest organisation since 1957. Research reactors were built in Mol and became operational between 1956 and 1963. These are the BR1, a uranium/graphite air cooled reactor, the materials testing reactor BR2 (fuel assemblies with highly enriched uranium placed in a beryllium matrix shaped as an hyperbolic paraboloid), and the 11.5 MWe BR3 which was the first Westinghouse-type pressurised water reactor built in Europe. This reactor, which became critical in 1963, served to develop the technology (e.g. reactivity control by boron dissolved in the water of the primary circuit, introduction of MOX and gadolinium fuel rods as early as 1963) and to train the first operators of the Belgian nuclear power reactors. The BR3 is currently nearly totally dismantled. Finally, there is VENUS, a zero power critical facility that was used to study the optimal nuclear fuel configuration for various reactors. It has recently been modified for the Guinevere experiment, which will play an essential role in research for accelerator driven systems (ADS).
a) **BR1 Research Reactor**

The BR1 (Figure 3) is a natural uranium graphite reactor, comparable to the reactors ORNL X-10 (USA) and BEPO (Harwell, UK). The reactor went critical for the first time in 1956. The core is composed of a pile of graphite blocks thus forming a cube with ribs of 7 meter. The reactor is air cooled. The fuel is metallic natural uranium with an aluminium cladding. Its design thermal power is 4 MW. However, since the start of BR2 this high power was no longer needed and since 1963 the BR1 is operated at a maximum thermal power of 1 MW using only the auxiliary ventilation system for its cooling. Due to its very well thermalized neutron spectrum, the reactor is mainly used for neutron studies, such as neutron activation analysis and instrument calibration. Neutronography is also one of the features.

No significant modifications have been made to the reactor. The fuel is still the original fuel. The burn up is still low and the fuel can be used far beyond the lifetime of the reactor. In 1963, the fuel was unloaded and the graphite matrix was heated in order to release the Wigner energy. In the actual operating regime, using only the auxiliary ventilation, the graphite temperature is relatively high compared to the fast neutron dose, such that the Wigner energy is still decreasing.

**b) BR2 Research Reactor**

The BR2 is a heterogeneous thermal high flux test reactor, designed in 1957 for SCK•CEN by NDA [Nuclear Development Corporation of America - White Plains (NY - USA)]. It has been built on the site of the SCK•CEN in Mol. Its first criticality dates from 1961 and operation of the reactor started in January 1963.

The reactor is cooled and moderated by pressurised water in a compact core of highly enriched uranium positioned in and reflected by a beryllium matrix. The maximum thermal flux approaches $10^{15}$ neutrons / (cm$^2$.s) and the ultimate cooling capacity, initially foreseen for 50 MW, has been increased in 1971 to 125 MW by replacement of the primary heat exchangers.
The reactor was originally designed for material and fuel testing. A test loop for irradiation under PWR conditions is available. This is still an important activity. However, during the last years isotope production (Mo-99, Ir-192 and others) have become important. Besides this, two irradiation facilities for silicon doping are available.

c) **Other Facilities (in decommissioning)**

- Also located at the Mol-Dessel Site, the Belgonucleaire facility manufactured the first commercial MOX fuel (Mixed Oxides fuel) batch for the French PWR power station Chooz A in 1986. After having produced more than 660 tons of MOX fuel for commercial nuclear power reactors, for both PWR and BWR reactors, Belgonucleaire definitively stopped its activities in mid-2006. The dismantling of the MOX fuel fabrication plant has started in 2009 and is currently almost completed. During the period 2010-2013, the main decommissioning activities focussed on the dismantling of the about 170 glove boxes. In 2013 a radiological survey measurements programme was started for the building H, in order to reach its unconditional release. The main use of this building during the operational phase was related to non-destructive testing, storage and transport of finished leak tight MOX fuel rods. The current planning for the remaining decommissioning activities is:
  - 2014: finalize the dismantling of the glove boxes (about 10 glove boxes remain to be dismantled).
  - 2014-2015: activities related to the infrastructure and the unconditional clearance of the buildings and the site.

The objective of the project is to reach the unconditional release of the buildings and of the site by the end of 2015.

- On the same site, the FBFC ("Franco-Belge de Fabrication de Combustible"), a subsidiary of the AREVA group, produced fuel elements for nuclear power plants mostly of PWR type with an enrichment of up to 5% U-235 but also of MOX type for BWRs. The annual fabrication capacity of the facility was approximately 400 t hm of U02 fuel and the facility has both installations containing fissile uranium (with or without gadolinium) and installations that produces MOX fuel assemblies. The MOX fuel is only present in encapsulated form (i.e fuel rods).

  On December 8th 2011, FBFC notified its intention to phase out the activities on the site of Dessel. The UO2, gadolinium and R & D activities were discontinued during the first half of 2012. The production of components for fuel assemblies stopped end of 2012, while the production of MOX fuel assemblies will continue at a rate averaging 2 production campaigns per year until 2015, for a period of 3 to 4 months per year. The dismantling of all FBFC installations should be completed by the end of 2015.

- The Ghent University had operated since 1967, the Thetis research reactor. This research reactor, a "pool type reactor" with a maximum power of 250 kWth, was located on the site of the "Institute of Nuclear Sciences" (site INW) in Ghent. In December 2003 this reactor was permanently shut down and all the necessary measures to bring the reactor in a safe standby awaiting the fuel evacuation and the subsequent decommissioning have been taken. The spent fuel of the Thetis reactor has been unloaded in 2010 and shipped to Belgoprocess where it has been conditioned as radioactive waste. After the required removal of the operational waste, the actual decommissioning works started in 2013 and are expected to be completed by the end of 2014.
### Summary Table

<table>
<thead>
<tr>
<th>Site</th>
<th>Nuclear Installation</th>
<th>Licensee</th>
<th>Type/ Characteristics</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moi-Dessel</td>
<td>BR1</td>
<td>SCK•CEN</td>
<td>Research Reactor, 4Mw th</td>
<td>In operation</td>
</tr>
<tr>
<td></td>
<td>BR2</td>
<td></td>
<td>Research Reactor, 120Mw th</td>
<td>In operation</td>
</tr>
<tr>
<td></td>
<td>Guinevere</td>
<td></td>
<td>Zero power critical assembly</td>
<td>In operation</td>
</tr>
<tr>
<td></td>
<td>FBFC</td>
<td>Areva</td>
<td>UO2 fuel fabrication</td>
<td>In dismantling phase</td>
</tr>
<tr>
<td></td>
<td>Belgonucleaire</td>
<td>Belgonucleaire</td>
<td>MOX fuel fabrication</td>
<td>In dismantling phase</td>
</tr>
<tr>
<td></td>
<td>(Belgoprocess)</td>
<td>(Belgoprocess)</td>
<td>(Waste treatment and storage)</td>
<td>(In operation)</td>
</tr>
<tr>
<td>Ghent</td>
<td>Thetis</td>
<td>University Ghent</td>
<td>Research Reactor, 4Mw th</td>
<td>In dismantling phase</td>
</tr>
</tbody>
</table>

1 Belgoprocess is a separate waste treatment and storage facility, which is not covered by the scope of the European Directive 2009/71/Euratom.
II. Significant Developments between 2010 and 2014

II.A. The Belgian "stress tests" process as a consequence of the Fukushima Daiichi accident.

After the Fukushima-Daiichi accident, the European Nuclear Safety Regulators Group (ENSREG) was appointed by the European Council to review the safety of all EU nuclear plants on the basis of a comprehensive and transparent risk and safety assessment.

Belgium participated in the "Stress Tests" programme initiated by the European Commission after the Fukushima-Daiichi accident. The main milestones of the "Stress Tests" programme developed by ENSREG are listed below:

- Technical definition of the "stress tests" by WENRA: May 2011
- Stress test report by the Licensee: October 2011
- National stress test report: December 2011
- Peer review organized by ENSREG of the stress tests report: April 2012
- ENSREG action plan: August 2012
- Publication of the National action plans: December 2012
- European peer review organized by ENSREG of the national action plans: April 2013

The various reports that have been issued by or for Belgium are available on the following ENSREG website: http://www.ensreg.eu/EU-Stress-Tests/Country-Specific-Reports/EU-Member-States/Belgium (in English) and on the FANC website: http://www.fanc.fgov.be/fr/page/stress-tests-nucleaires/1411.aspx (in Dutch and French).

As a result of the stress tests, the ENSREG action plan and the peer review and findings of the extraordinary meeting of the contracting parties to the Convention on Nuclear Safety in 2012, a Belgian national action plan was issued in December 2012. Nearly 300 individual actions have been identified, and are currently being implemented.

This Belgian National action plan is available on the ENSREG web page: http://www.ensreg.eu/node/694 (in English). The follow-up of this action plan is closely monitored by the Regulatory Body.

II.B. Incorporation of the WENRA Reactor Harmonization Working Group (RHWG) Reference Levels into the Belgian legal framework

The "Royal Decree on the Safety Requirements for Nuclear Installations" (referred to as SRNI-2011 in this report) has been signed by the King on the 30th of November 2011 and has been published in the official journal of the 21st of December, 2012. This Royal Decree incorporates all the WENRA RHWG reference levels into the Belgian regulations. This Royal decree does not limit its scope to NPPs, since many reference levels were found applicable to other nuclear facilities (for example, the obligation to proceed to periodic safety reviews, to maintain a Safety Analysis Report, to set up an integrated Management system, ...). This Royal decree is currently being completed with specific safety requirements for waste disposal facilities, for waste storage facilities, for decommissioning of nuclear installations as well as for research reactors.

II.B.1. Peer reviews : IAEA OSART and IRRS missions

a) The OSART Mission at Doel

During the first three weeks of March 2010, the OSART-team from the International Atomic Energy Agency (IAEA) carried out an in-depth audit at units 1 and 2 of the Doel nuclear power plant, operated by Electrabel, GDF-Suez Group.

The 15 international experts noted 14 'good practices', i.e. areas where Doel sets an example for other nuclear power plants. These include: the existence of individual training programmes for all emergency plan personnel, thorough training in the correct use of special protective clothing in the controlled areas and training and coaching for contractors, focusing on activities during outages.

The experts also formulated a number of recommendations (5) and suggestions (10) that will help the power plant to continue to develop in line with the world's best practices (i.e. the OSART reference framework).
The recommendations and suggestions cover several areas, including: formalising the existing cooperative arrangement with the local fire brigade, further development and active use of a theoretical model for planning and carrying out activities, and formalising the use of protective equipment in the control rooms. The power plant is also encouraged to more quickly share its experiences with other nuclear power plants, to continue developing its workplace accident prevention plan and to pay even more attention to small anomalies at the facilities.

In March 2012, an IAEA team carried out a follow-up mission to the Doel NPP to examine how the operator has taken into account the recommendations and suggestions made in the 2010 OSART mission. According to the IAEA, the Doel NPP has since then performed good work to comply with the recommendations and suggestions made. Ten of the 15 recommendations or suggestions have been implemented. Those 10 items are prevention in industrial safety, on-the-job-training support reinforcement, reinforcement of control room inhabitability in case of emergency, effective use of PSA, reducing backlogs, limiting safety review duration, rapid sharing of operational experience feedback, formal agreements with public fire brigade, selection of adequate coatings and surface with regard to decontamination in restricted areas and on-shift emergency personnel. The five remaining follow-up items are in progress, but not yet completed. Those items are cable trays loading, local identification of chemicals, material condition and safety report update. No recommendations/suggestions were found to have made insufficient progress.

The IAEA has also considered as a good practice the decision of the licensee not to limit the OSART action plan to only the Doel 1 & 2 units, but to implement the improvements also on the Doel 3 and 4 units.

b) The OSART Follow-Up Mission at Tihange

At the request of the Belgian Government, an OSART team visited the site of Tihange Nuclear Power Plant in May 2007, focusing on unit 1. The team issued 10 recommendations and 12 suggestions to further improve the operational safety at the plant.

During the whole year 2008, the licensee developed an action plan in order to address the issues identified by the OSART team.

Solutions and results were presented by the licensee during the follow-up inspection in January 2009. The team was satisfied with the set of corrective actions taken to resolve the findings of the original mission. 73% of recommendations and suggestions were resolved and 27% were progressing satisfactorily. No recommendations/suggestions were found to have made insufficient progress.

The final report has been published. In agreement with the messages delivered by the team, the process of “continuous improvement” is ongoing.

c) IRRS Mission in Belgium and Self-Assessment Action Plan


The Belgian Regulatory Body realised a self-assessment between June 2011 and September 2012, that led to an action plan comprising some 60 actions. The implementation of this action plan started in September 2012 and is currently on going. The IRRS mission itself took place in December 2013. This mission was a "full scope" IRRS, covering all regulatory activities of the FANC and Bel V.

The final report of the mission has been received in April 2014. This reports has been made publically available and has been published on the FANC web site. According to the Directive, this report has also been sent to the European Commission.

II.B.2. Flaw indications in reactor pressure vessels of Doel 3 and Tihange 2 (2012)

In June 2012, during an ultrasonic in-service inspection intended to detect under-clad defects and conducted for the first time in Belgium, several thousands of flaw indications were detected in the base metal of the Doel 3 reactor pressure vessel, located mainly in the upper and lower core shells. As a precaution, similar inspections were conducted in September 2012 on the Tihange 2 unit, whose reactor pressure vessel is of identical design and construction. Flaw indications were detected as well, but to a lesser extent.
Figure 5 displays a typical example of data recorded in the lower core shell of Doel 3. Left: an axial section, with indications appearing as colour spots. Right: the indications, all detected in a 20° sector of the shell, are cumulated on the figure plane (333 sections).

The pressure vessel is a key-component in a reactor unit, and its failure is not covered by safety studies. As a result, the licensee decided to keep both units in cold shutdown state, core unloaded, until in-depth analyses have been achieved and submitted to the Federal Agency for Nuclear Control in view of a possible restart.

With the support of internal and external experts, the licensee started an investigation of the precise nature and origin of these indications, and built its own analysis to determine whether or not the reactor units in question could safely resume operation in spite of the detected flaws. The most likely origin of the indications identified in the Doel 3 and Tihange 2 reactor pressure vessels is hydrogen flaking due to the manufacturing process. This assumption is supported by the number of flaws, their shape, orientation, and location in zones of suspected macro-segregation.

The safety demonstration of the licensee was recorded in two safety case reports (submitted to the FANC in December 2012) and backed by a number of technical documents, leading the licensee to conclude that both Doel 3 and Tihange 2 were eligible for immediate restart. In parallel, the licensee also proposed several additional measures intended to further increase the safe operation of the units, to monitor the pressure vessels state along time or to extend its initial material testing programme.

Meanwhile, the FANC set up a dedicated organisation and commissioned several national and international expert groups to seek scientific and technical advice in order to elaborate an independent, founded and balanced judgement about the issue.

Along the assessment process, the expert groups raised a number of questions that were discussed with the licensee and its technical supports. From those discussions, a number of open issues were raised about the manufacturing of the reactor pressure vessels, the suitability of the in-service inspection technique, the possible evolution of the flaws during future operation, the characterization of the material properties, and the structural integrity of the reactor pressure vessels under penalizing loadings.

Taking into account the advice of the different expert groups, the FANC issued in January 2013 its provisional evaluation report on the issue, which stated that in the current state of knowledge and given the available data, the identified open issues did not represent conditions that require a definitive shutdown of Doel 3 and Tihange 2. However, these open issues lead to some uncertainties
that might reduce the conservatism of the licensee's safety demonstration and hence impair the level of confidence in the safe operability of the units in question. As a consequence, the Federal Agency for Nuclear Control considered that, in the current state, Doel 3 and Tihange 2 may only restart after the requirements listed in its provisional evaluation report are met by the licensee. These requirements include for example further validation of the ultrasonic inspection methods, completing the proposed material testing program (including large scale specimen tests) and the performance of a load-test on both reactor pressure vessels.

In response, the licensee elaborated an action plan to meet those requirements, including a methodology and associated acceptance criteria where applicable. This action plan was implemented in the first semester of 2013.

Once the licensee implemented its action plan, the FANC, together with Bel V and AIB-Vinçotte, evaluated whether all the safety concerns at the origin of the requirements are solved and whether the related reservations can be lifted. On this basis, on May 17th, 2013, the FANC considered that Doel 3 and Tihange 2 could be restarted safely. Consequently Doel 3 and Tihange 2 resumed operation in June 2013.

Linked to this authorization for restart in May 2013, some conditions/actions were imposed to the licensee by the FANC. A part of these actions had already been completed before the restart, whereas the rest had to be completed after one complete reactor cycle, by June 2014.

One of these medium term actions was the conduct of experimental research into the impact of radiation on the materials properties of sample pieces with hydrogen flakes ("action 11").

To this end, a research programme was drawn up by the licensee and executed in consultation with the Belgian Nuclear Research Centre SCK•CEN.

On 25 March 2014, Electrabel transmitted the first preliminary results of the materials tests on the irradiated hydrogen-flaked specimens to the Belgian nuclear safety authorities (FANC, Bel V en AIB Vinçotte).

The results of these tests indicated that the mechanical properties of the material are more strongly influenced by irradiation than experts had expected.

As a precautionary measure, on 25 March 2014, Electrabel informed FANC of its decision to advance the planned outage of its nuclear reactors Doel 3 and Tihange 2.

Further research and additional testing are now in progress to interpret and assess these unexpected results.

All files related to the flanks indication issue, including the final evaluation report are available on the FANC web site (in English):


II.B.3. The Government decision on the confirmation of shutdown of Doel 1 & 2 and on lifetime extension of the Tihange 1 nuclear power plant (2013)

According to article 4 of the law of 31 January 2003 on nuclear phase out, the lifetime of the Belgian NPPs is limited to 40 years. In the short term, the NPPs concerned are Doel 1 & 2 and Tihange 1 which have been commissioned in 1975.

Article 9 of this law in its original publication, is an exception clause. In case of force majeure, the federal government may take exceptional measures to guarantee the supply of electricity. In case of force majeure the King, after deliberation of the Council of Ministers and on advice of the Commission of Electricity and Gas Regulation (CREG), can take the necessary measures, including a modification of the nuclear phase-out, to ensure the electricity supply.

On the 4th of July 2012, the government decided to confirm the shutdown of the Doel 1 & 2 NPPs in 2015 while allowing a lifetime extension of 10 year for the Tihange 1 NPP, which should be shut down in 2025. The government also decided to propose the deletion of article 9 of the phase out law, prohibiting thereby any exception on the phase out law decided by the federal government in the future.
III. General Provisions

III.A. Article 4

III.A.1. Article 4.1 - Legislative, Regulatory and Organisational Framework

4.1. Member States shall establish and maintain a national legislative, regulatory and organisational framework (hereinafter referred to as the 'national framework') for nuclear safety of nuclear installations that allocates responsibilities and provides for coordination between relevant state bodies.

The law that sets out the framework for the management of safety is the law of 15 April 1994 on the protection of the public and the environment against the dangers of ionising radiation and on the Belgian Federal Agency for Nuclear Control. The scope of the law is very broad and forms the basis for specific regulations dealing with specific topics, such as:

- general regulation for radiological protection (workers, patients, general public);
- requirements for the safety of nuclear installations;
- requirements for medical and pharmaceutical applications;
- regulation of import, transit and export of radioactive substances;
- requirements for the safe management of radioactive waste;
- requirements for the safe transport of radioactive substances;
- requirements for the security of nuclear installations;
- monitoring the environment for possible radioactive pollution;
- requirements in case of emergencies.

The mission of the FANC is the protection of the public, workers and the environment against the hazards of ionizing radiation.

According to the Law of 15 April 1994 the FANC has the right and the obligation to make proposals for laws, royal decrees and ministerial decrees. The general manager of the FANC can only promulgate regulations (and guides) with a specific technical nature in case the laws or the royal decree foresees it.

In application of the law, several royal decrees have been promulgated:

- the royal decree of 30 July 2001 laying down the general regulations for the protection of the public, workers and the environment against the hazards of ionizing radiation (hereafter referred to as "GRR-2001");
- the royal decree of 18 December 2002 on the compositions and competences of the Scientific Council of the FANC;
- the royal decree of 17 October 2003 setting out the Nuclear and Radiological emergency plan on the Belgian territory;
- the royal decree of 20 December 2007 on administrative fines;
- the royal decree of 24 March 2009 on the Import, Transit, Export of radioactive materials;
- the royal decree of 14 October 2011 on Orphan Sources;
- the royal decrees of 10 October 2011 related to security: physical protection, security zones, habilitations, documents;
- the royal decree of 30 November 2011 on the Safety requirements for nuclear installations ("SRNI-2011").

The full legal and regulatory framework is available on the FANC web site: http://www.jurion.fanc.fgov.be. This website provides a comprehensive overview of all applicable regulation, from European directives, national laws, decrees, etc. in French and in Dutch. A more complete set of national, European and international legal instruments, actually in force or of historical interest, is available.

Finally, it is also worth mentioning that Belgium has ratified the major international conventions:

- the Convention on Nuclear Safety;
- the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency;
• the Paris Convention on Nuclear Third Party Liability and the Brussels Supplementary Convention, and its amendments;
• the Convention on Early Notification of a Nuclear Accident;
• the European ECURIE system;
• the Convention on Physical Protection of Nuclear Material;
• the OSPAR Convention for the protection of the marine environment of the North East Atlantic;
• the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972) and the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of wastes and Other Matter;
• the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo-convention);
• the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR).

a) Article 4.1.a - Safety Requirements

The national framework shall establish responsibilities for:

4.1 (a) the adoption of national nuclear safety requirements. The determination on how they are adopted and through which instrument they are applied rests with the competence of the Member States.

The "Royal Decree on the Safety Requirements for Nuclear Installations" (SRNI-2011 in this report) that has been signed by the King on the 30th of November 2011 and published in the official journal of the 21st of December, 2012 is the main legal text setting up safety requirements for nuclear installations.

Before the publication of SRNI-2011 (see section II.B), all safety requirements were written down in the safety analysis reports (SAR) of the nuclear facility, but not in national laws and regulations.

The conformity of the installations, its associated practices, procedures, ... with the SAR has been imposed, at the time of initial licensing of the nuclear facilities, as a license condition, and is currently written in article 14 of the SRNI-2011.

In any case the SAR has to be kept up to date. The Regulatory Body has a copy of the SAR of nuclear installations and any modification to the descriptions of the SAR has to be approved first by the Licensee’s Health Physics Department (HPD) and by the Regulatory Body (Bel V) after a thorough review and assessment, and according to the modification management process in place (see e.g. section III.B.5 and III.C.2).

b) Article 4.1.b Licensing

The national framework shall establish responsibilities for:

4.1 (b) the provision of a system of licensing and prohibition of operation of nuclear installations without a licence.

(1) Licensing for Construction and Operation

Construction and operation of a nuclear facility without a valid license is strictly forbidden (Law of 15 April 1994, art. 16; GRR-2001, art 5.1). In addition, the licensee has to take the necessary measures to fulfill the conditions of the license (GRR-2001, art 5.2).

Since 2001, the licensing process for nuclear facilities, as described in the GRR-2001, comprises two phases, each one ending with a Royal Decree.

The license application consists of three parts:

• The first part consists mainly of administrative information, defining amongst others responsibilities, names and legal status of the applicant, ...
• The second part consists of a preliminary safety analysis report containing amongst others:
  o the safety principles that will be applied for the construction, the operation and the design basis accidents,
  o the already available probabilistic safety analysis,
  o the qualification of the mechanical and electrical equipment,
  o the principles that will be applied for quality assurance,
the expected quantities of waste and their management, including those related to the dismantling,

- The third part of the application consists of an environmental impact assessment report, including as a minimum the general data referred to in the recommendations of the European Commission on the application of Art. 37 of the Euratom Treaty (99/829/Euratom); this report must also comply with the European directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment (as amended).

The licence application is examined by the FANC and then presented for advice to the Scientific Council of the FANC. A mandatory international consultation (application of Article 37 of the Euratom Treaty on the trans-boundary impact) and/or a voluntary consultation of the European Commission may take place. Following the advice of the Scientific Council, the file is submitted to a public enquiry and to the municipal authorities concerned for advice, and then to the executive of the provinces concerned. The completed file is then sent to the Scientific Council for final advice. A positive advice of the Scientific Council is necessary for a positive decision. The Scientific council can also propose particular conditions to be attached to the license, related to the commissioning of the installations or in view of ensuring the safety of the future installation. This construction and operating licence allows the applicant to build the installations in conformity with the licence.

The second phase aims at confirmation of the construction and operation licence. The Federal Agency for Nuclear Control (FANC) or Bel V acting on behalf of the FANC proceeds to the delivery of the installations before the start up and the introduction of radioactive substances. A fully favourable acceptance report leads to the confirmation decree allowing the operation of the facility.

Partial confirmation decrees are possible, each based on a fully favourable delivery report. The confirmation decree can also modify or complete the conditions attached to the initial license.

The licensing scheme for nuclear installations is illustrated in the figure 6.

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**Figure 6 : Licensing Scheme for Class I facilities**

- **License Application:**
  - (a) General information
  - (b) Preliminary Safety Report
  - (c) Environmental Impact Assessment Report

- **Preliminary Advice from the Scientific Council (Art. 6.3.1)**

- **Municipal authority advice incl. public enquiry (Art. 6.4)**
- **International consultations (Art. 37 Euratom)**

- **Provincial Executive advice (Art. 6.5)**

- **Final Advice from the Scientific Council (Art. 6.6)** (final content of the SAR)

- **Royal Decree (Art. 6.7)** → **Construction**

- **Delivery of the installations: 2nd Royal Decree (Art. 6.9)** → **Operation**
Licensing of Decommissioning Activities

If the licensee of a nuclear facility decides to terminate (some of) their activities, the provisions of article 17 of GRR-2001 are applicable. This implies that he must notify the FANC, ONDRAF/NIRAS (the national waste management agency) and other relevant government departments. This notification must, amongst others, state the future destination of all the radioactive materials present in the facility.

In addition, the FANC demands that for nuclear facilities this notification of cessation of operation also includes the following information: the measures taken to bring the facility to a safe condition in anticipation of the dismantling, including any clean-up and decontamination activities, a description of the changes that the operator intends to make to the facility before issuing the decommissioning license, the maintenance and inspection programme applied, changes in staffing, the schedule for the decommissioning and associated license application and eventually the impact on remaining installations.

In awaiting the dismantling of the facility, the FANC may (pursuant to article 13 of the GRR-2001) propose additional conditions or to change the conditions of the existing license in order to take into account the changed condition of the facility after the cessation of operations, in awaiting the dismantling activities.

Nuclear facilities and some other high risk facilities (such as particle accelerators) must have a decommissioning license before starting the dismantling works.

Regarding nuclear facilities, the procedure for obtaining a decommissioning license is similar to that for obtaining the construction and operating license (articles 6.3 to 6.8 of the GRR-2001).

The decommissioning license application is submitted to the FANC and shall include a description of the safety aspects of the dismantling (a dismantling safety report), an environmental impact assessment and an advice from ONDRAF/NIRAS – The Belgian National Waste Management Agency - on the aspects that fall under its competence. This advice ensures that the information included in the application for decommissioning (submitted to the FANC) is in line with the final decommissioning plan which has been submitted to the ONDRAF/NIRAS.

The decommissioning license will then be issued by royal decree and communicated to all the parties involved in the procedure. This license will replace any construction and operation license for the facility which will also be repealed by royal decree.

The Belgian regulatory body that is in charge of the supervision of nuclear safety in nuclear facilities is composed of the Federal Agency of Nuclear Control (the FANC) and of its subsidiary body, called Bel V. For a description of the regulatory body, we refer to the next section related to article 5 of the Directive.

c) Article 4.1.c - Safety Supervision

The national framework shall establish responsibilities for:

4.1 (c) the provision of a system of nuclear safety supervision

The FANC established a "General Inspection and Control Policy". The aim of this inspection and control policy is to check that the activities conducted by the operator are carried out safely.

The license application and the commissioning of the installation constitute the first phase the regulatory supervision of a facility. The first phase of the supervision takes place before starting or modifying the activities of a nuclear installation. Once the construction and operating license is granted, the commissioning of the facility must be approved before starting operation. During this stage, FANC and Bel V check whether the operator complies with the general regulations and with the license conditions. Similarly, the cessation of activities and the dismantling of a nuclear facility requires a formal notification and/or a specific license.

During the operational period of a facility, a supervision scheme with 3 levels is in place: The first level of supervision is carried out by the licensee’s HPD, set up according to article 23 of GRR-2001, which has to ensure the availability and the effectiveness of the necessary measures to guarantee the nuclear safety and the radiological protection of the workers, the public and the environment.

The second level of supervision is provided by Bel V to which FANC has delegated number of inspection and regulatory tasks. The missions of Bel V are, among others, to verify the well-
functioning of the HPD, to commission new or modified installations, to approve some of the HPD's decisions related to safety or radiological protection as defined in article 23 of GRR-2001, etc... To perform these missions in an effective way, Bel V dedicates one specific expert (i.e. controller or inspector) to each nuclear site or one to each reactor for the NPP-sites, who is in charge of the operational supervision of that specific site or reactor. This expert is assisted by a back office of several specialized experts with thorough knowledge and expertise in various domains such as safety analysis, criticality, emergency planning, fire protection, systems and components, ...), that performs review and assessment.

The third level of supervision is performed by the FANC, that also verifies the well-functioning of Bel V. The prerogatives of the FANC inspectors are larger than those of the Bel V inspectors/experts: the FANC nuclear inspectors have legal competencies to take the necessary and urgent measures for the protection of the workers, the public and the environment.

This supervision structure is illustrated in the figure 7:

Figure 7 : Supervision Scheme for the Nuclear Facilities

(1) Integrated Inspection & Control Strategy

The term "control" refers to the activities performed by Bel V, whereas "inspections" refers to inspections performed by the FANC. The FANC and Bel V have developed an integrated Inspection and Control strategy for inspection and supervision of nuclear facilities. This strategy is established for a period of 3 years and aims at:

- optimizing the inspection and control programmes during those three years;
- ensuring the effective implementation of the programmes with respect to the roles of both organizations;
- maximizing the synergies between the FANC and Bel V;
- avoiding that Bel V and the FANC carry out similar inspections without transfer of information.

In addition to these global objectives, specific subjects can be selected based on their importance for maintaining a high level of safety in the facilities. This is the reason why the strategy 2012-2014 focuses on:

- the human performance: this theme consists in the analysis of the operator's organization dedicated to knowledge and competence management, use of contractors, ... 
- the safety culture: a systematic process for the analysis of the safety culture in the Class I facilities was initiated in the previous integrated strategy 2009-2011. In the meantime this process has been further developed by Bel V.

The integrated strategy refers to generic themes such as nuclear safety, radiological protection, fire protection, waste management, decommissioning, use of contractors, ... The strategy can also refer to specific themes such as Fukushima feedback experience or long term operation depending on their importance for nuclear safety.

This strategy is then translated into annual inspection and control programmes:

- a control programme (CP) with a control planning for Bel V;
- an inspection programme (IP) with an inspection planning for the FANC.
The FANC inspection programme and the Bel V control programme are defined each year. The FANC approves the Bel V control programme. Both programmes are communicated to the operators. Both programmes are based on the strategy mentioned above and integrate the feedback from experience of the controls and inspections of the previous year(s).

The control and inspection programmes are specific to each type of installation as the associated risk level is taken into consideration, which is in accordance with a graded approach. The following elements are taken into account to establish the programmes:

- the complexity and the specific risk of the installation;
- the legal requirements related to the overview of safety management;
- any specific project that is foreseen in an installation;
- the international practices;
- and finally, the available staff to carry out inspections and controls.

The Bel V control programme includes:

a) Systematic controls: these controls are periodically carried out by Bel V and are based on, among others:

- the discussions with the operators (HPD, other departments involved in safety, workers on the field);
- the analysis of documents;
- the oversight of the installations.

These systematic controls are performance based and are conducted to determine whether the operator meets the requirements of the regulations and license conditions. Such controls allow also to monitor the implementation of corrective actions (defined on the basis of previous findings, results of events, ...). Walkdowns in the facilities form an integral part of these controls. To ensure that findings and observations during these controls are truly representative, a part of the routine inspections of Bel V is unannounced or is carried out outside normal working hours (during the shift change or during the night work for example). The overall objective is to perform in a class I facility at least 10% of unannounced controls and at least 5% of controls outside of normal working hours of the operator.

b) Thematic controls: these controls are planned and announced to the operator to perform a thorough analysis of a specific, selected theme. The thematic controls are process based and aim to verify that the operator’s processes are adequate, known by the staff and implemented in the field. The deviations between the administrative processes and their implementation have to be corrected.

c) Specific controls: these controls are carried out when needed (in case of an incident, feedback experience, ...).

The FANC inspection programme includes:

a) proactive inspections. These announced inspections are carried out on thematic subjects in order to:

- Verify the compliance with the legal requirements (performance based) for which the FANC has the competency of making findings;
- Analyse the processes and seek the continuous improvement of these processes (process based);
- Ensure that the operator identifies early enough the first signs of possible degradation of the level of safety and/or radiological protection.

b) Furthermore, the FANC carries out reactive inspections in case of:

- An incident or an accident requiring urgent actions;
- A complaint related to the nuclear safety and/or radiological protection;
- A request by a third party (prosecutors, citizens, ...);
- A request by Bel V (for example, if the operator repeatedly does not respect deadlines for the implementation of actions).

Those reactive inspections cannot be planned and are not included in the inspection program. They can however be announced or unannounced.
c) Other types of inspection can be organized in accordance with the graded approach on the scope that the regulatory body wants to evaluate:

- **Fast Limited Inspection with Thematic Scope (FLITS) inspection**: unannounced inspection during which a team of experts conducts a thematic inspection to collect in a minimum of time as much information as possible on one or more selected topics, evaluates and communicates the findings to the licensee of a nuclear installation. These inspections can be organized in any nuclear facility. The inspection team can be complemented with experts specialized in different topics related to safety (e.g., security experts). The FLITS inspections are in general unannounced or can be announced one day before the inspection to ensure sufficient availability of the licensee's staff.

- **Audits**: if a safety degradation is suspected, (repeated notified events, complaints of workers, ...), the FANC and Bel V can decide to carry out an audit of the licensee's processes. A team of national (and possibly international) experts conducts a thorough thematic inspection and evaluates the different processes in relation to one or more topics. These audits can be organized in any nuclear facility and can take several days. By their nature these assessments are announced.

(2) Integrated Safety Assessment

The inspections and the controls are elements used by both the FANC and Bel V to provide an integrated safety assessment of the operator’s activities.

![Diagram of Integrated Safety Assessment](image)

Figure 8: Integrated Safety Assessment

As shown in figure 8, the other process-inputs of an integrated safety assessment are:

- **Event notification and management**: The event notification to the regulatory body is an obligation for each operator of a facility. An operational condition related to this obligation is included in the license.

- **Safety Review and Assessment**: 
- **Experience Feedback**: at Bel V, an Operating Experience Feedback process (REX) has been developed to ensure that no event significant to safety or any safety related operating experience, that concern or could concern the Belgian nuclear facilities, remains undetected and that licensees take all necessary actions to prevent the recurrence of safety related events by improving the design and/or the operation of their installations.

- **Periodic Safety Reviews**.

- **Modifications management**: according to the GRR-2001, the licensee has to notify every intended modification of his installations to the regulatory body who performs appropriate safety assessment of the proposed modification.

- **Commissioning process**: related to licensing of new installations.

- **Safety culture observations**: The FANC and Bel V have jointly developed and implemented a Safety Culture observations process. Observations are made by an inspector or a safety analyst during any contact with a licensee. These observations are recorded in an observation sheet aimed at describing factual and context issues. These observations are linked to Safety culture attributes based on IAEA standards. On a monthly basis the “Safety Culture coordinator” within Bel V analyses observations (with a perspective of quality of description and classification) and provides feedback to the inspector who recorded the observation. In case of an important Safety Culture issue, a direct reporting to the licensee is considered. On a quarterly basis, the “Safety Culture coordinator” provides a summary report. The goal of this report is to identify early signs of (potential) safety problems.

- **Management inspection**: each year and for each nuclear facility, the FANC and Bel V write a common assessment report on nuclear safety and radiological protection. This assessment report is sent to the management of the licensee as an input for the annual management inspection. This inspection is conducted by a FANC and a Bel V manager, supported by the FANC and the Bel V inspectors of the site. This management inspection is integrated in the annual inspection programme and gives the opportunity:
  - to the FANC and Bel V to deliver important messages related to nuclear safety and radiological protection on the basis of their assessment;
  - to the operator to confront his own safety assessment with the assessment of the regulatory body and to present his action plan to ensure a continuous improvement of the processes related to safety. Any long-term projects of the operator are also discussed.

**d) Article 4.1.d - Enforcement**

The national framework shall establish responsibilities for:

4.1 (d) enforcement actions, including suspension of operation and modification or revocation of a licence

(1) **Legal Powers**

The procedures used in the enforcement of regulatory requirements are based on the mandate of the FANC given in the legislation. The enforcement tools and measures are provided in the following legal documents:

- the Law of 15 April 1994;
- the royal decree of July 20, 2001 related to the inspection services by the FANC nuclear inspectors and the tools that they can use;
- the GRR-2001 and the SRNI-2011;
- the royal decrees of December 20, 2007 related to administrative fines.

These regulations are enforceable, regardless of the type of the concerned installation and for all FANC legal competencies, by a FANC inspector who has the statute of “nuclear inspector”. The nuclear inspectors are nominated by the King. A nominative list of all nuclear inspectors is published on a regular base by the Minister of Home Affairs. The experts of Bel V do not have this statute and hence cannot apply enforcement measures.

The choice of the enforcement measures is based primarily on the safety significance of the infraction or situation where corrective measure are required, applying the principle of graded approach. The enforcement policy is presented in the governance document GD010-08 of the FANC’s management system.
Administrative enforcement measures are possible and supported by the legal documents mentioned above. The nuclear inspectors have to take any necessary and urgent measures to avoid or eliminate a potential danger. Examples of those measures are:

- Impose an administrative modification (as far as procedures, instructions or operating modes are concerned) or an organisational modification (obligation of additional personnel in relation to security and/or radiological protection);
- Impose technical modifications to the installation (additional shielding, installation of additional detection device);
- Proceed to the seizure or evacuation of radioactive sources, contaminated material or devices that present ionising radiation;
- Seal a room or an installation to prevent any access or utilisation.

In extreme cases, if a practice causes an obvious detriment to health or a specific danger, the nuclear inspector has the power to interrupt the activity.

In situations which have minor significance, the application of the enforcement policy implies an oral notice and a request for action in the inspection report. For every inspection, a report is written that mentions all corrective actions that the operator has to implement within a given time period. The written inspection report and its actions constitute the enforcement power that is used in a majority of cases. The FANC ensures that the licensee effectively implements the remedial actions raised from the enforcement actions either through the reporting by the operator or other inspection activities (announced or unannounced).

Coercive measures are used to reinforce FANC's orders. Two types of sanctions are foreseen in the Law of 15 April 1994 (articles 50 to 64): legal penalties (requiring a legal procedure by the Court) or administrative fines (nevertheless requiring an information to and a decision by the Prosecutor for the standard procedure). The amount of the fine is also set following the principle of graded approach, and depends on the safety significance of the infraction. Two specific legal documents are related to the administrative fines:

- royal decree of December 20, 2007 for the use of the simplified procedure;
- royal decree of December 20, 2007 for the use of the standard procedure.

The practices in case of administrative fines are defined in specific procedures and instructions.

Finally the FANC can also wholly or partly cancel/suspend a licence that FANC has granted, or determine additional conditions in the license. The FANC Nuclear inspectors can also call upon the assistance of the Federal Police to assist them when using their enforcement powers. This possibility is established in a formal way

(2) Enforcement Actions

Within the possibilities of enforcement powers of the inspectors, a graded approach is applied, as described below (from lowest level of enforcement to the highest level):

- notifications/remarks by FANC, Bel V or by an Authorized Inspection Organization to the licensee, as result of routine inspections, either orally or in inspection report. The licensee should respond to these remarks within a specific time frame.
- an official letter of the FANC, if the licensee does not respond in due time to the FANC or Bel V requests. The follow-up of these remarks is part of the daily work of the FANC-inspectors.
- the FANC inspector can issue a warning with a fixed delay (of maximum 6 months) to comply with. The follow-up of these remarks is part of the daily work of the FANC-inspectors.
- the FANC inspectors can take any immediate measures that they deem necessary to reduce or eliminate hazards for workers, the public and the environment. These measures can include warnings, requests for corrective actions with a delay not exceeding 6 months (article 9 of the Law of 15 April 1994), seizure of radiation sources, up to the suspension of the license and the closure of the facility.
- if relevant, administrative fines can be imposed by the FANC inspectors (Art 53 to 64 of the Law of April 1994 and the royal decree of 20 December 2007).
- if the licensee does not respond, the FANC can modify the license conditions.
- for infractions to the laws or regulations, the FANC inspector can send a report to the public prosecutor for penal actions (art 49 to 52 of the Law of April 1994).
III.A.2. **Article 4.2 - Maintain and Improve National Framework**

4.2. Member States shall ensure that the national framework is maintained and improved when appropriate, taking into account operating experience, insights gained from safety analyses for operating nuclear installations, development of technology and results of safety research, when available and relevant.

The development of regulation and guides is one of the FANC's core processes. The FANC has developed a main policy document in its management system regarding the development of regulations and guides.

The associated procedure for developing regulation describes the following steps:

- trigger, evaluation and decision of the need for new regulation or modification, extension to existing regulation;
- drafting of a regulation proposal;
- stakeholder consultation;
- adaptation of 1st draft;
- consultation of official advisory bodies;
- final draft;
- submission for enacting to the Minister of Home Affairs;
- publication in the Belgian official journal.

Non-binding guides with generic application are elaborated in relation to the general mission of the Regulatory Body. Several specific guides are being developed in the frame of a prelicensing process. This process, initiated on request of a future license applicant, aims to establish the maturity of a potential licensing process and to identify and remove potential licensing issues early on. Examples of this process are: the disposal of radioactive waste facility (cAt) and a subcritical Lead Bismuth Eutectic cooled research reactor (MHYRA).

Other guides usually result from regulatory feedback or feedback from experience (inspection) or on specific request of parties concerned. Practical examples are gammagraphy, reporting of incidents/accidents, and conduct of periodic safety reviews.

**a) Review and revision of regulations and guides**

An overview of possible “triggers” enabling development of new regulation as well as the review and amendment of the existing ones, is given in the above mentioned procedure. Such possible triggers are:

- European Directives;
- new international standards (e.g. from R&D);
- feedback from experience (inspections, incidents, accidents, etc.);
- European harmonization activities (WENRA, HERCA, ..);
- specific demands from authorities, licensees and other stakeholders.

Belgium is a member state of the European Union. Therefore most of the Belgian regulations are based on (are transpositions of) European Directives, which are revised and updated regularly (e.g. the Basic Safety Standards, Nuclear Safety Directive and Radioactive Waste Directive). European Directives are to be transposed in the national legal framework within a fixed period.

The large involvement of the Belgian Regulatory Body in international activities and cooperation allows consideration of relevant international safety and technical standards and experience gained. The FANC department responsible for the development of the regulations is also the department in charge of international affairs. In this way, this department receives all the feedback needed to develop the regulations, comprising feedback from the NEA working groups, review meetings of IAEA conventions, IAEA safety standards committees, WENRA, HERCA, and ENSREG regulators groups, and also from bilateral agreements.

Finally, it is worth mentioning that the FANC early committed itself in the WENRA harmonization Initiative to improve the regulations at the European level.
III.B. Article 5

III.B.1. Article 5.1 Competent Regulatory Authority

5.1. Member States shall establish and maintain a competent regulatory authority in the field of nuclear safety of nuclear installations.

Since September 1st 2001 the supervision of nuclear activities is within the responsibility of the Federal Agency for Nuclear Control (FANC), which constitutes the Safety Authority. This mission has been given to the FANC by the Law of 15 April 1994. According to articles 14bis and 28 of this law (as amended), the FANC may call upon the assistance of recognised bodies for health physics control, or on legal entities especially created to assist it in the execution of its missions. The FANC has made use of this provision and, for the nuclear installations covered by this National Report, created Bel V in September 2007, a subsidiary with the statute of a so-called 'foundation' as defined in Belgian law. The staff of Bel V is composed of experts from the former recognized body (Authorized Inspection Organisation) AVN and is carrying out all the regulatory activities since April 2008, including the surveillance activities, previously performed by AVN. Bel V is given a mandate to perform regulatory missions that can be legally delegated by the FANC, without consulting the public market. The FANC delegates different tasks to Bel V, a.o. on site routine inspections in nuclear facilities.

It is through the association of the FANC on one side, and Bel V on the other that the function of regulatory authority as stipulated in article 5, is ensured.

a) Structure of the Regulatory Body

(1) FANC

The missions attributed to the FANC by the Law of 15 April 1994 and its associated royal decrees are allocated to different departments and sections inside the Regulatory Body.

The only legal requirement regarding the organisational structure of the FANC is the separation between regulation development activities and the surveillance and inspection activities.

The regulatory function "development of regulation and guides" (Article 24 of Law of 15 April 1994) is ensured by the department “Regulation, International Affairs and Development (RIAD)".

The regulatory function “licensing” (Art. 16 of Law of 15 April 1994) is ensured by the department “Facilities and Waste“ for nuclear facilities, industrial facilities and waste management facilities (including disposal facilities) and activities (including decommissioning). Security matters (Art. 17 of the Law of 15 April 1994) are also within the mission of the FANC and are entrusted to the department "Transport and Security“.

The regulatory function “review and assessment“ of facilities (Art. 15 & 16 of the Law of 15 April 1994) is performed by the departments responsible for the licensing of these facilities and by Bel V for nuclear facilities, by delegation of the FANC.

The regulatory function “inspection and enforcement“ (Art 16§3) is performed by the same departments that are responsible for licensing and by Bel V for on-site inspections in nuclear facilities, with the support of FANC nuclear inspectors when enforcement actions are needed.

Other additional functions performed by the FANC are:

- Radiological surveillance of the Belgian territory, the participation in the national nuclear emergency preparedness and response plan, which are allocated to the department "environment and health" (Art. 21 & 22 of the Law of 15 April 1994);
- Communication with the public and political authorities, allocated to the FANC Management, the Communication office and to the RIAD department (Art. 26 of 1994).

An organizational chart indicating the staffing of the FANC is given in the figure 9.
Bel V

The structure of Bel V is adapted to its missions delegated by the FANC. Its main missions are:

- On-site inspections in “high risk facilities (categorized as “Class I” and the highest risk facilities some of the “Class II” (for example: cyclotrons, ...) according to the GRR-2001);
- Safety assessment of the facilities and safety review of Class I license applications;
- Follow-up of large projects, such as the replacement of steam generators, periodic safety reviews, stress tests, ...

The relations between FANC and Bel V are formalized in a “management agreement”.

The organizational chart of Bel V is given in the figure 10.
III.B.2. Article 5.2 - Separation of Regulatory Authority from Other Bodies

5.2. Member States shall ensure that the competent regulatory authority is functionally separate from any other body or organisation concerned with the promotion, or utilisation of nuclear energy, including electricity production, in order to ensure effective independence from undue influence in its regulatory decision making.

The FANC is institutionally and financially independent. The FANC is placed under the supervision of the Minister of Home Affairs. The FANC is directed by a non-executive Board. A Government commissioner attends the meetings of the Board of Directors to verify that the FANC fulfils its legal missions. The members of the Board of Directors are appointed by royal decree, on the proposal of the Council of Ministers. The Governance charter of the Board is published on the FANC web site. The Board, which meets approximately six times per year, focuses on:

- the overall strategy at long and short term, with the approval of the mid-term and annual operational plan;
- the staffing and personnel employment conditions of the FANC;
- the financing of the FANC.

The Board approves the annual budget and the staffing of the FANC. It nominates and evaluates the senior management. The Board delegates the management of the FANC to the General Manager, who is appointed by the royal decree for a fixed term of 6 years.

The FANC, being a public body, reports to Parliament via the Minister of Home Affairs, thus ensuring a legal independence with respect to other governmental bodies and Ministries that promote the use of ionizing radiation for various purposes. The FANC has no link with the private sector dealing with the use of nuclear energy or involved in the use of radiation sources.

The Belgian Parliament has set up a permanent commission on nuclear safety, which from time to time requests the FANC to report and to be questioned. This commission also discusses the annual report of the FANC.
The Belgian public organisations dealing with questions related to the use of nuclear energy, such as the Nuclear Research Centre (SCK•CEN) in Mol, or the Belgian Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS), the Institute for Radioelements (IRE) report to the Ministry of Economic Affairs and to the State Secretary for Energy.

The Regulatory Body plays no part in nuclear energy promotion.

III. B.3. Article 5.3 - Resources of the Regulatory Authority

5.3. Member States shall ensure that the competent regulatory authority is given the legal powers and human and financial resources necessary to fulfil its obligations in connection with the national framework described in Article 4(1) with due priority to safety.

a) Human Resources of the Regulatory Body

The staffing of FANC and Bel V mainly consists of highly-educated (University level) staff for a total of approximately 220 people.

The staff number is determined based on the fulfillment of the pre-determined operational programme, mid-term and annual programme. Performance indicators of the FANC processes fulfilling regulatory responsibilities and functions are reported in quarterly reports that are submitted to the Board of Directors.

The annual report is submitted to the government and to the Parliament (or a parliamentary commission), which can also recommend additional means for staffing or resourcing of the Regulatory Body.

Performance indicators of the Bel V processes fulfilling regulatory responsibilities and functions are reported in quarterly reports that are submitted to the Board of Directors and to the FANC. Bel V is supervised by a Board of Directors appointed by the FANC (in which the majority composed of members of the FANC board), which ensures that the organization of Bel V is adequate to perform its functions.

b) Financial resources of the Regulatory Body

The budget of the FANC has to be balanced according the law of 1994 (art. 31 §5). The taxes and fees are paid directly by the licensees to the Regulatory Body and are defined by the Law of 1994 (art. 30bis) and by royal decree respectively. The taxes and fees are regularly adapted to sustain the staff evolution of the Regulatory Body.

The FANC is directly financed by the licensees by means of:

- Annual taxes for authorized parties;
- Administrative fines;
- Fixed fees paid for the delivery of administrative acts such as licenses.

For pre-licensing activities/tasks of particular large projects (like e.g. the waste repository at Dessel and the future research reactor MHYRRA), the future applicant has to pay special fees to support the additional workload of the Regulatory Body. The amount to be paid for large pre-licensing projects is fixed by article 30bis/3 § 3 of the Law of 1994 (as amended).

Bel V is directly paid by the licensees it supervises, based on a pre-determined hourly tariff.

III.B.4. Article 5.3.a & b - Require Licence Holder to Comply and Demonstrate Compliance

This includes the powers and resources to:

5.3 (a) require the licence holder to comply with national nuclear safety requirements and the terms of the relevant licence;
5.3 (b) require demonstration of this compliance, including the requirements under paragraphs 2 to 5 of Article 6;

The Belgian legal framework provides the Regulatory Body with the authority to require the license holder to comply with safety requirements:

In practice, safety requirements are imposed to each licensee of a nuclear facility through:

- The National Regulations, in particular the GRR-2001 and the SRNI-2011;
• The License. The license may contain additional requirements that are not foreseen in the Belgian regulations to ensure the safety of the facility or activity (article 6.3.1 of the GRR-2001).

At any moment, the FANC or its Scientific Council, can propose additional safety requirement through modification of the license, according to article 13 of GRR-2001.

As stated in article 5.2 of the GRR-2001, the operator has to comply with the terms of its license:

"5.2 Obligations of the operators
Operators of facilities are required to observe the conditions set out in the licences."

The GRR-2001 and the SRNI-2011 prescribe safety and radiation protection requirements to be complied with by the licensee. These royal decrees both contain enforcements measures such as:

"Article 80 : Breaches of this Decree shall be investigated, concluded and prosecuted in accordance with the provisions of the law of 15 April 1994 on the protection of the general public against the hazards arising from ionising radiation and on the Federal Agency for Nuclear Control."

In practice, the licensee has the first responsibility to ensure compliance with safety requirements. The licensee of each nuclear facility has to set up a Health Physics Department (HPD) which is in charge of the following:

• Ensuring compliance with the regulations;
• Ensuring compliance with the license and the FANC's decisions;
• Specific control tasks that are listed in article 23 of GRR-2001.

Above the HPD, a safety supervision system is in place, as described III.1.C. a) of the present report.

III.B.5. Article 5.3.c - Regulatory Assessments and Inspections

This includes the powers and resources to:

5.3 (c) verify this compliance through regulatory assessments and inspections

a) Regulatory Assessment

Review and assessment of the safety of facilities and activities during the different stages of their lifetime is a legal task of the regulatory body, as follows from the following articles of the law of 15 April 1994:

• Article 15 and 16 enable review and assessment for facilities;
• Article 16 introduces the concept of periodic safety reviews.

The main work related to activities on review and assessment for nuclear installations (NPPs, FCFs and RRs) is performed by Bel V. From the Bel V staff, mainly the members of the NRA (Nuclear safety and radiation protection Assessment) Department and the NRP (Nuclear safety and radiation protection Projects) Department are involved in review and assessment work. Over the two departments, the staff is affected to four technical branches, except for a few staff members (with mainly a project management function) depending directly from the head of the NRP Department (see also the Bel V Organisation Chart).

Besides this hierarchical structure, Bel V has a transversal structure organised in Technical Responsibility Centres (TRCs). These TRCs have been created in the nineties, with the objective to use the staff as effectively as possible. About 20 TRCs are operating. The goal is to involve all people, having expertise in a technical domain, in review and assessment work for that domain, wherever the staff member is positioned in the Bel V organisation chart. Since the creation of Bel V in 2008, also staff members of FANC can be integrated in a Bel V TRC, when it is felt that they can contribute important expertise to the TRC.

Review and assessment of the safety of facilities of nuclear facilities is performed at all stages in the lifetime of the facility by the Belgian regulatory Body.

- licensing process: a list of documents to be submitted by the applicant is defined in art. 6.2 of the GRR-2001 for class I facilities. As a part of this, the content of the Initial Safety Analysis Report is defined. The FANC verifies the acceptability and completeness of the application documents, while the technical documents (Safety Report and supporting documents) are in depth reviewed by Bel V (additional review by FANC personnel can be performed). The results of this analysis are presented to
the FANC's Scientific Council, who produce its conclusions and propose conditions to be attached to the license.

For projects with a specific/innovative character which are presently in a licensing or a pre-licensing phase, an import effort is being done to produce guidance in the frame of a pre-licensing process. Specific guides are developed for topics such as seismic hazards, accidental aircraft crashes, external flooding hazards,...

- commissioning: the initial license must be confirmed by a second royal decree (art. 6.9 of the GRR-2001). Bel V performs delivery inspections and verifies the conformity with the regulations in force and with the Safety Analysis Report.

- modifications: all modifications must be notified to FANC, according to art. 12 of GRR-2001. A categorisation of modifications for nuclear installations, according to a graded approach, is described in a FANC guidance. Major modifications require a procedure similar to the initial licensing. For less important modifications, it is required (art. 23 of GRR-2001) that an analysis, approval and verification of the delivery of the modification is performed by the Licensee's Health Physics Department and verified/approved by Bel V.

- during operation:

Major findings discovered during inspections (for instance design deficiencies in a safety system,...) are subject to specific review and assessment efforts by the department NRA of Bel V which employs more or less 25 experts in different technical areas. A main process for review and assessment is the Periodic Safety Review, required for all class I facilities by the license, with a periodicity of 10 years. Belgium has a longstanding experience in Periodic Safety Review. Even the licenses of the 3 oldest NPP (Doel 1&2 and Tihange 1) issued around 1974-1975, they already included an obligation to perform a global safety revaluation every 10 years. Since then, the process has been repeatedly applied and has been extended to all nuclear facilities, including during their decommissioning phase.

- decommissioning, dismantling: a list of documents/information to be submitted by the licensee is defined in GRR-2001 (art. 17.2) and a review and assessment similar to the one performed for the initial licensing is performed.

b) Regulatory Inspections

The FANC inspections for nuclear facilities are carried out by a section consisting of 10 members. Each nuclear facility and particularly each NPP has two single points of contact, who carry out announced inspections (which are included in the inspection program). Inspections on a specific subject (cross-subject for each facility like releases) are led by one coordinator and supported by the "Single Point of Contact" (SPOC).

The Bel V inspections are carried out by a specific department (NRI) composed of approximately 25 people. To perform these missions in an effective way, Bel V dedicates one specific expert (inspector) to each nuclear site or one to each reactor for the NPP-sites, who is in charge of the operational supervision of that specific site or reactor.

The inspection department is supported by another department responsible for studies of specific technical aspects. Specific controls are carried out by a specialised inspector in this matter, supported by the inspector of the unit or for the site.

IIII.B.6. Article 5.3.d - Enforcement Actions

This includes the powers and resources to:

5.3 (d) carry out regulatory enforcement actions, including suspending the operation of nuclear installation in accordance with conditions defined by the national framework referred to in Article 4.1;

All provisions that give the Regulatory Body sufficient authority to duly perform inspections are given in article 10 of the Law of 15 April 1994.

- have free access to all facilities/activities (including means of transport) where radiation sources are present (art 10 §2);
- can seize sources or devices not authorized or not complying with the law and the regulations based on the law, where they are manufactured, stored or used. (art 10§3);
can take any measure to render harmless sources of ionizing radiation that constitute a danger to the health of the population or the environment. (art 10§ 4);
• do the same with transport devices/containers (art 10§5).

Only the FANC nuclear inspectors have the statute of judiciary officers and can take enforcement measures or report to the public prosecutor.

The routine inspections in nuclear facilities have been delegated to Bel V which, according to art. 23 of GRR-2001 continuously supervises the good performance of the licensee's health physics department. At the request of Bel V of on their own initiative The FANC nuclear inspectors have legal competencies to take the necessary and urgent measures for the protection of the workers, the public and the environment. The FANC dedicates an inspector called "Single Point of Contact (SPOC)" to each nuclear facility, as well as a back-up.

Amongst others, the following examples demonstrated that the Regulatory Body exercises its authority irrespective of the costs to the authorized party:

• In 2006, after a radiological accident in an irradiation facility, the FANC has put a seal on the installation (effectively forbidding its further use) until it was modified in order to prevent re-occurrence of that kind of accident;
• In 2008, the Agency shut down the Institute of radioelements after an unplanned release of radioactive gaseous effluents. The regulatory Body imposed several safety improvements and corrective actions, irrespective of the costs to the authorized party;
• The issue of flaws indications in the pressure vessels of Doel 3 and Tihange 2, shut down for an extended period (~10 months) in 2012-2013.

III.C. Article 6

III.C.1. Article 6.1 - Prime Responsibility

| 6.1. Member States shall ensure that the prime responsibility for nuclear safety of a nuclear installation rests with the licence holder. This responsibility cannot be delegated |

The national legislation expresses in several statements the prime responsibility of the operator for safety.

• Article 2 of the Royal Decree of 20 July 2001 (GRR-2001) defines the "Licensee" as follows: "Any natural or legal person who is responsible of a facility or a work activity that is subject to licensing or reporting according to chapter II."
• Article 5.2 of the GRR-2001 also indicates that the licensee is responsible for complying with the conditions set in the licence. For the nuclear power plants the Royal Decree of Authorisation requires conformity with the Safety Analysis Report and with the document established in implementation of Article 37 of the Euratom Treaty.
• The licensee must organise a Health Physics Department in charge of nuclear safety and radiological protection, and must also organise the safety and health at the workplace as well as in the neighbourhood. A detailed description of the duties is given in Article 23 of the GRR-2001.
• The operator must also conclude a civil liability insurance (Article 6.2.5 of the GRR-2001); the law of 22 July 1985, which makes the conventions of Paris and Brussels and their additional protocols applicable, and the law of 13 November 2011 set the maximum amount of the operator's liability for the damage at some Euro 1.2 billion per site and per nuclear accident.
• The nuclear and radiological emergency plan for the Belgian territory, established by royal decree of 17 October 2003, has explicitly assigned the prime responsibility for the radiological protection of the workers to the operator of the nuclear installation.

However, this principle is not explicitly stated as such in the Belgian regulation. The IRRS mission that took place in Belgium end 2013 recommended to include this statement in the Belgian regulations (Recommendation n°8 of the Final IRRS Report) in the future.
III.C.2. Article 6.2 - Review and Assessment

6.2. Member States shall ensure that the national framework in place requires licence holders, under the supervision of the competent regulatory authority, to regularly assess and verify, and continuously improve, as far as reasonably achievable, the nuclear safety of their nuclear installations in a systematic and verifiable manner.

a) NPP

(1) Licensing Process

The process initially applied for licensing of the Belgian nuclear power plants is no longer the same today and since many organisations and committees that played a role in this process do not exist anymore (being replaced by other organisations and committees), it was judged no longer appropriate to describe this historic information in this report.

The current licensing process, also applicable for licensing of major modifications and dismantling of nuclear installations has been described in the section II.A of this report.

The list of documents to be submitted by the applicant is defined in art. 6.2 of the GRR-2001 for class I facilities. As a part of this, the content of the initial Safety Analysis Report is defined.

The content and format of the final SAR which will be applicable during the operation of a facility (for example a NPP) is described in article 28 of the SRNI-2001 for NPPs, in accordance with the WERNA reference levels. As part of the commissioning process, Bel V performs delivery inspections and verifies the conformity with the existing regulations and with the Safety Analysis Report.

(2) Periodic Safety Reviews

Article 14 of the SRNI-2011 (and before the publication of this decree, a license condition) requires to perform a ten-yearly periodic safety review for each nuclear facility. The general objectives of these periodic safety reviews are as follows:

- to demonstrate that the unit has at least the same level of safety as it had when the licence was granted to operate it at full power, or since its latest periodic safety review;
- to inspect the condition of the unit, devoting more particular attention to ageing and wear and to other factors which may affect its safe operation during the next ten years;
- to justify the unit's current level of safety, taking into account the most recent safety regulations and practices and, if necessary, to propose appropriate improvements.

The first of these periodic safety reviews took place in 1985 for the Doel 1 & 2 and Tihange 1 units. At the time of design of these units, i.e. in the early 1970s, the safety rules were less numerous and less detailed than they were for the later Belgian units that were started between 1980 and 1985.

These 1st periodic safety reviews were conducted very comprehensively and were an in-depth review of the safety of the nuclear power plants. This allowed to identify coherent solutions and, at that time, to simultaneously solve several problems (an example is the emergency building of Doel 1 & 2).

It also demonstrated that it is even possible to improve strongly design- and lay-out dependent systems of the nuclear power plant taking into account a higher-intensity earthquake, protection against external accidents, a new reactor protection system...

For instance, at Tihange 1, the resistance to earthquakes of several equipment and components had to be reviewed, based on feedback from experience with equipment which had undergone a real earthquake. Similarly, external accidents due to human activity were considered. Other fields included protection against high-energy line breaks, protection against primary system overpressure, improvement of fire protection, improvements of the reliability of systems, more effective training of operators (training centres with several simulators), improvements to the man-machine interface, systematic utilisation of both national and international feedback of operating experience.

A similar approach has been followed for Doel 1 & 2. In the design and during the construction of Doel 1 & 2, earthquakes had not been considered as a factor influencing the design requirements, due to the weak seismic activity of the region. However, to cope with accidents of external origin, a bunkered and seismically resistant building has been erected, containing so-called emergency safeguard systems, which allow maintaining primary water inventory, ensuring reactor sub-criticality and residual heat removal and coping with accidents like a fire in the electrical auxiliaries building (including the loss of the main control room), the total loss of electric power (external grid and the safety Diesels), the Safe Shutdown Earthquake, a high-energy line break.
The 1st periodic safety review of the most recent units (Doel 3 and 4, Tihange 2 and 3) and the 2nd periodic safety review of Doel 1 & 2 and Tihange 1 did not require reviewing the design bases, since post-TMI actions had already been taken into account and there had been no major evolution in the regulations during that period.

During these safety reviews, national and international feedback were examined; the results of probabilistic safety studies made for power operation or for shut down states were taken into account; the severe accident consequences were analysed in order to infer prevention and mitigation measures, and the field of accidents that are considered as design-basis accidents was broadened. The PSAs and the analyses of severe accidents resulted in the installation of (autocatalytic) hydrogen recombiners inside the reactor containment for all units.

The 2nd periodic safety reviews of the most recent units (Doel 3 and 4, Tihange 2 and 3), and the 3rd periodic safety review of the oldest ones (Doel 1 & 2, and Tihange 1) include two sets of topics: the first one is made of topics common to all units ("fleet approach"), the second one addresses aspects specific to one unit.

All these periodic safety reviews include two parts: one part "studies", another part "implementation" of the results of the studies.

As a summary, a large number of modifications have been made on the first Belgian units in the frame of periodic safety reviews.

(3) During Operation of the Installations

Experience feedback leads the operator to envisage modifications of the installations or launch major projects such as replacement of the steam generators or power increase. These activities are carried out in addition to those related to the periodic safety reviews.

The proposals for modifications to the installations are examined by the Health Physics Department of the operator, who discusses them with the Bel V inspector. Each proposal is classified into one of the three following categories:

- **Major modifications** that change the basic characteristics of the unit. These modifications are subject to the application for a licence under the provisions of Article 6 of the GRR-2001. A major modification requires a new license application, and follows a licensing scheme similar to that described section II.A.a. A new Royal Decree of Authorisation (license) or an amendment to the existing one is prepared by the FANC and finally signed by the Minister of Home Affairs and the King. The implementation of the modification will be authorised by the Health Physics Department. Bel V verifies the conformity with the Royal Decree of Authorisation.

- **Less important modifications** that have a potential impact on safety. In a first phase, the requesting department of the licensee, indicating the justification for the intervention, presents a proposal for modification. In a second phase, the proposal is examined on its technical merits, and later on also by a multidisciplinary team including a.o. the Health Physics Department. After approval by the departments involved, the proposal is submitted to the management of the licensee, who can decide to continue final studies for the proposed modification. In the next phase, studies are completed and approval of both the Health Physics Department and of Bel V is sought to prepare the implementation of the modifications. The proposal is thus also examined by the inspector of Bel V, and by Bel V's technical responsibility centres, which may result in amendments being requested to the modification file. Further activities then imply the implementation, and testing of the modifications. Commissioning of the completed modification is subject to a positive delivery report, issued after validation of the modification and re-qualification of the portion of the installation that was modified, plus updating the operational documents. The Health Physics Department formally approves of the modification when all the files, procedures and the Safety Analysis Report have been adequately updated and Bel V can then issue a final delivery report.

- **Modifications without impact on safety**, that usually do not imply modification of the Safety Analysis Report and which comply with all the safety rules of the installation. These modifications have to be approved only by the Health Physics Department of the unit, without
formal involvement of Bel V, except for the possible pages of the Safety Analysis Report to be updated.

(4) Certain studies relating to the modifications
Certain studies relating to modifications or initiated in the scope of the periodic safety reviews were so substantial that they had to be tackled as projects having their own specific structure:

- Severe accident analyses: ultimate strength of the containment in case of internal overpressure, installation of autocatalytic recombiners to prevent containment hydrogen build-up (installed in all the Belgian units), reactivity accidents during operation and during shut down states;
- Power increase and burn-up cycle extension studies;
- Use of mixed core (presence in the core of fuel assemblies from different suppliers) requiring detailed studies regarding mechanical, neutronic and thermal-hydraulic compatibility.
- Replacement of the steam generators, whether or not linked to a power increase;
- Replacement of technologically obsolescent systems (instrumentation and control systems) addressing software qualification issues;
- Set up of an integrated ageing management system, in order to assure that safety related structures, systems and components remain qualified within their defined service life;
- Continuous development of probabilistic safety analyses (PSAs) of L1 and L2 for the Doel and Tihange nuclear power plants (NPPs) performed by Tractebel Engineering (TE), on behalf of the utility Electabel;
- Extension of the PSA-models to include internal hazards (e.g. flooding and fire);
- Operational use of the PSA-models to complement the evaluation of modifications to the NPPs.

(5) Verification Programmes
The technical specifications (chapter 16 of the Safety Analysis Report) were examined at the time of the licensing process. Their amendment during operation falls under the prescriptions for modifications that are subject only to approval by the operator’s Health Physics Department and by Bel V. These technical specifications are reviewed in the frame of the period safety reviews. They have been completely rewritten at least once during the life of each nuclear power plant. These specifications indicate for each status of the unit the operational limits and conditions, specifying also the actions to be taken if limits are exceeded. They also list the inspections and tests to be performed and their periodicity.

Specific programmes are established, in particular for:

- examinations and tests required by the ASME Code;
- inspection and repair of the steam generator tubes;
- fire protection;
- tests of ventilation filters;
- inspection of the primary pump fly-wheels;
- examination of irradiation samples of the pressure vessel.

Each safety-related equipment has a qualification file that contains all the qualification test requirements and results. In this file are also recorded the results of ageing tests or experience feedback of similar equipment, so defining the qualified life of the equipment. The qualified life determines the frequency of replacement of that equipment, which can be re-assessed in function of the real operation conditions and location of that equipment.

An In-Service Inspection programme is permanently implemented by personnel specifically qualified for these inspections, which are carried out during power operation of the unit or in shut down states. All these tests and inspections are performed under fully detailed documented procedures.

The reactor coolant pressure boundary is treated in a specific way. It was originally designed to ensure a minimum useful life taking into account a limited number of transients during normal, incidental and accidental operation. As for the reactor vessel, it is monitored according to the transition temperature evolution (NDT) based on an irradiated samples withdrawal programme. The occurrence rate of the design transients is strictly recorded under the close supervision of Bel V.
The Stress Tests

As member of the European Union, Belgium participated in the "Stress Tests" programme initiated by the European Commission after the Fukushima-Daiichi accident. The main milestones of the "Stress Tests" programme are developed in the section II.A.1 of this report, related to the summary of significant developments during the period 2010-2014.

As result of the stress tests, the ENSREG action plan and the peer review and findings of the extraordinary meeting of the CNS in 2012, a Belgian national action plan was issued in December 2012. Nearly 300 individual actions have been identified for the Nuclear Power Plants, and are currently being implemented.

It is worth mentioning that, at the request of the Belgian Parliament, the FANC extended the stress test process to all nuclear facilities present on the Belgian territory and to security issues.

In a similar way as for the Nuclear Power plants, the licensees of nuclear facilities proceeded to stress tests, delivered a report and a final action plan was defined for the nuclear facilities. This national action plan has been published on the 13 April 2013 on the FANC web site and is currently on going. Updates of the action plan completion are regularly published.

b) Research Reactors

(1) Continuous and Periodical Safety Monitoring

During the operational lifetime of the installation modifications may be deemed necessary. The modifications are treated with the same process as above described for the NPPs.

Experimental devices are not considered as modification of the reactor. A dedicated stepwise approval system is developed. The experiment is at first discussed in an internal advisory committee. Based on the advice, the experiment has to be approved by the Health Physics Department and Bel V has to confirm this decision.

The installations of the SCK*CEN are also subject to periodic safety reviews. According to the initial licence for operation of the SCK*CEN installations, the reactors BR1 and BR2 have had to undergo a 5 yearly safety review. The result of this review has to be reported to the authorities. In 2009 the periodicity of the safety reviews was changed by royal decree to 10 years, as it is the practice for nuclear power plants.

(2) BR1 Research Reactor

The last safety review of BR1 included four topics:

- A programme for the modernization of the fixed radiation monitoring systems has been defined;
- A seismic qualification has been performed. The reactor can withstand an earthquake that is expected with a frequency of one every 10,000 years. The main issue was to prove that the loose staked graphite pile would remain intact and would not show displacements that could prevent the fall of a control rod;
- A few years ago an increased iodine release, still within operating limits, was observed. A number of fuel channels were unloaded and some failed fuel elements were found. An investigation programme was started in order to find the root cause of these failures. These can be attributed to the long-time slow interaction between the metallic uranium and the aluminium cladding;
- The study of the consequences of a full electrical black out. Although the reactor needs no active cooling after scram, one loses the readings of the instrumentation and it is difficult to have a good knowledge about the situation. Therefore the number of instruments connected to the battery backup system will be increased.

(3) BR2 Research Reactor

BR2 underwent from 1995 to 1997 a thorough refurbishment. The second beryllium matrix was nearing its end of life at that time and it was decided to replace it. A matrix was available from a zero power mock-up of BR2, called BR02, which was no longer in use. This BR02 matrix was fully qualified for use in BR2 and could be used for BR2 without any problem. According to the licence the matrix has to be inspected on regular intervals to follow cracking. Due to neutron irradiation gases (helium and tritium) are formed in the beryllium. This causes swelling and the initial space between the beryllium blocks are consumed and blocks make contact between each other. The cracks are caused...
by deformation and mechanical stresses. The licence specifies that the beryllium matrix must be replaced if the inspection indicates that there is a risk of losing material. At the latest, the replacement must be done if the fluence reaches $6.4 \times 10^{22}$ fast neutrons/cm$^2$ for the most irradiated channel.

In case of replacement of the matrix, an inspection of the vessel is also required by the licence. In fact, this is the only occasion when the vessel wall is accessible. For the inspection of 1996, a fracture mechanical calculation of the vessel was performed. However, the vessel is made of aluminium 5052-0 alloy, and knowledge about this material in irradiated condition is limited. Therefore it was decided to cut a number of samples out of the shroud, which is made of the same material and has received nearly the same irradiation fluence. Out of these samples, tensile and fracture toughness test pieces were made. Some samples were immediately tested. The others were loaded in irradiation baskets in the reactor and a number of them will be tested on predefined time intervals. In this way a material follow-up programme for the vessel is established. The conclusion of the latest tests performed during the last periodic safety review, was that the material of the vessel has a sufficient mechanical resistance to at least 2026.

During the lifetime of BR2 various systems have been replaced. The last important modernization was the replacement of the control rod drive mechanisms with the position indicators included and the replacement of the cadmium neutron absorbers by hafnium.

In addition, some safety improvements resulting from the "stress tests" are currently being implemented.

III.C.3. **Article 6.3 - Accident Prevention and Mitigation of Consequences**

6.3. The assessments referred to in paragraph 2 shall include verification that measures are in place for prevention of accidents and mitigation of consequences of accidents, including verification of the physical barriers and licence holder’s administrative procedures of protection that would have to fail before workers and the general public would be significantly affected by ionizing radiations.

**a) Legal Context**

The SRNI-2011 contains provisions related to this requirement:

- Art. 7 sets out requirements related to the design basis of the facility. These requirements comprise a.o. the defence in depth concept, the identification of normal operating conditions, anticipated operational occurrences as well as accidents from postulated initiating events (internal and external), the fail safe principle, ...
- Art. 16 sets the requirements related to the internal emergency plan that the licensee has to implement. It specifies the objectives, the preparation and organisational issues. It also states that adequate emergency infrastructure needs to be provided on site and that the internal emergency plan needs to be exercised at least once per year.

In application of these articles, the Safety Analysis Report (SAR) details the provisions that the licensee has put in place in order to ensure the compliance with these requirements.

In addition to the safety assessment performed within the licensing process, the regular on-site inspections performed by the FANC and Bel V verify the compliance with the regulations and in particular with these provisions of the SAR.

**b) NPP Accident Management**

A full set of incident and accident management procedures has been developed by the operator, with the help of the Architect Engineer and the designer of the Nuclear Steam Supply System. These procedures cover both power operation and shutdown modes.

These procedures are validated on a simulator and are used for operator training. Procedures are periodically reviewed and relevant experience feedback is integrated. Procedures backgrounds have been developed for some normal and incident procedures.

The Belgian NPPs, except Tihange 1, have implemented the Emergency Response Guidelines (ERG) approach developed by the Westinghouse Owners Group (WOG). These standard procedures have been adapted to the plant-specific elements and systems, especially the systems for protection against external events.
The ERG procedures are composed of 3 major elements: (1) the optimal recovery procedures (ORG: optimal recovery guidelines) which are event-based, (2) the critical safety function status trees and (3) the function restoration procedures (FRG: function restoration guidelines) which are both symptom-based, i.e. independent of the event scenario.

The ORG on one hand and the status trees and the FRG on the other hand are applied in parallel during an event: the first procedures are used by the operators crew (even-based approach) whereas the second ones are applied independently by a Shift Technical Adviser (symptom-based approach).

For Tihange 1 the Framatome approach has been followed. The accident management procedures combine event-based and symptom-based approaches, using the surveillance of key safety functions or parameters.

Severe accident management procedures, inspired by the "Severe Accident Management Guidelines" developed by the Westinghouse Owners' Group, were implemented, adapted to the specificities of each unit. The training programme of the control room operators was developed in parallel.

Specific procedures have been written to give guidance to the operators after an earthquake that could occur during normal operation or in shutdown state.

In the framework of the Belgian Stress Tests, several actions have been executed or are still on-going to take into consideration the return of experience of the Fukushima Daiichi accident.

III.C.4. Article 6.4 - Management System of License Holder

6.4. Member States shall ensure that the national framework in place requires licence holders to establish and implement management systems which give due priority to nuclear safety and are regularly verified by the competent regulatory authority.

a) National Framework

Article 5 of SRNI-2011 states that "an integrated management system giving priority to safety shall be established, implemented, assessed and improved on a continuous basis. This management system shall cover all the activities and processes which can have an impact on the nuclear safety of the facility, including the activities carried out by the subcontractors or suppliers." This article is applicable to all nuclear facilities, including NPPs, Research reactors, Fuel Cycle facilities and is based on the WENRA reference level "issue C – Management System", which is itself derived from the IAEA Safety guide GS-R-3.

b) Activities of the Regulatory Body

In 2010, FANC and Bel V asked the licensees of nuclear facilities to perform a gap analysis between their management system and the requirements of the safety guide GS-R-3. Since the SRNI-2011 became into force on the 1st March 2013, article 5 of this SRNI-2011 imposes to the licensees of nuclear facilities to set up an integrated management system.

The results were received and analysed by FANC and Bel V. End 2012, FANC and Bel V sent the results of their analysis to the licensees and asked them to take the necessary corrective actions in order to be fully in compliance with the GS-R-3 by the end of 2013.

An inspection campaign is programmed in 2014 in order to verify the implementation of the corrective actions and the compliance with GS-R-3.

III.C.5. Article 6.5 - Resources of Licence Holders

6.5. Member States shall ensure that the national framework in place requires licence holders to provide for and maintain adequate financial and human resources to fulfil their obligations with respect to nuclear safety of a nuclear installation, laid down in paragraphs 1 to 4.

a) NPP

(1) Operator's Financial and Human Resources to use the Installation throughout its Industrial Life

The Doel and Tihange power plants are operated by Electrabel, a member of the GDF-Suez group that was created after the merger in 2008 of 2 groups "Gaz de France" and "Suez". The share of the company in electricity generating capacity in Belgium amounts to 64% in 2010.

Main activities of Electrabel are the generation and commercialisation of electricity and gas in Europe. In Belgium, Electrabel is the owner of the twin units 1 and 2 (100%) and the units 3 and 4 (89.8%)
of Doel, and of the unit 1 (50%) and of the units 2 and 3 (89.8%) in Tihange. The installed power of
Belgium’s nuclear generating units accounts for some 40% of all installed power in Belgium. Nuclear
electricity accounts for some 55% of all electricity produced in Belgium (see table 1 of the
Introduction of this Report).

About 1900 people (about one hundred at corporate level and the remaining equally distributed on
the NPP sites) are devoted to nuclear power plant operation among Electrabel’s total workforce in
Belgium of around 7000. In September 2002, the company Ella System Operator was appointed by
the Belgian Government as the Manager of the electricity distribution network. This activity is now
completely separated from the activity of electricity generation. Electrabel has signed specific
connection contracts with Ella. In accordance with the legislation on deregulation of the electricity
sector in Europe, all distribution activities in the three regions of Belgium have been separated and
turned into independent companies.

The GDF-Suez group has also an Engineering division, Tractebel Engineering, which is the Architect-
Engineer of the Belgian nuclear power units (and of most of the fossil fired plants) and which houses
know-how accumulated over fifty years of nuclear technology, which started with the construction of
the first research reactors at the Mol Research Centre.

(2) Financing of Safety Improvements during Operation

Major safety improvements to the Belgian nuclear power stations emanate from the periodic safety
reviews (ten-yearly) and are financed through annual provisions (1/10th each year). Cost of specific
projects and for replacement of aged or obsolete components are amortized on the remaining lifetime
of the concerned power plant.

(3) Financial and Human Provisions for Future Decommissioning and for Management of
the Waste produced by the Installations

The existing mechanisms are described in the Belgian report for the Joint Convention on the Safety of
Spent Fuel Management and on the Safety of Radioactive Waste Management. More details can be
found in that report, available on the FANC and IAEA web sites.

b) Research Reactors

The SCK*CEN, the Belgian Nuclear Research Centre is a "Foundation of Public Utility " (FPU) with a
legal status according to private law, set up according to the law on non-profit organisations, under
the supervision of the Belgian Federal Minister in charge of Energy. From the first of January 2005
the SCK*CEN, like any other non-profit organization has to apply the principles and rules prescribed
by Belgian accounting rules. The turnover and the operating profit of the previous years are defined
in accordance to this law. The adequacy of the SCK*CEN’s financial system and internal controls is
assessed by an external auditor. According to the safety and security charter, the management
hereby is committed to provide all necessary financial means to enhance safety and to ensure all
required security measures.

The future cost for dismantling is covered by funds. With respect to these technical liabilities, the
following rules for funding apply. All dismantling costs for installations built and in operation before
1989 are covered by a special 'Technical Liabilities Fund', which is administered outside the SCK*CEN.
All new technical liabilities after January 1989 are financed by the SCK*CEN by means of setting up
the necessary provisions. The total liabilities are periodically reassessed and total amounts have to be
available at the moment of dismantling and decontamination. The necessary financial means are
funded by means of annual government grant and by revenues from contract research and services
to third parties.

III.D. Article 7 - Expertise and Skill in Nuclear Safety

7. Member States shall ensure that the national framework in place requires arrangements for
education and training to be made by all parties for their staff having responsibilities relating to
the nuclear safety of nuclear installations in order to maintain and to further develop expertise
and skills in nuclear safety.

The parties having some responsibilities for safety, whose competence is intended here are, for the
installations covered by the Directive:

- the personnel of the operators;
- the personnel of the regulatory body : the FANC and Bel V.
III.D.1. Operators

Article 25 of the Law of 15 April 1994 states that the FANC shall supervise the training obligations of the operators.

Article 73 of GRR-2001 specifies the training and competence requirements for the head of the health physics department of the operator. The FANC examines the application for recognition as an expert in health physics and grants the recognition. In addition, license applications for construction and operation of authorized facilities shall describe the competence of the operating personnel (articles 6, 7 and 8 of GRR-2001 and are part of the operating license).

Article 4.3 and 6 of SRNI-2011 enumerates training, competence, qualification and authorization requirements for the operating personnel of nuclear facilities.

a) NPPs

The Safety Analysis Report (chapter 13) deals with personnel qualification, training and re-training. Qualification of the personnel is inspired from the ANS 3.1 standard, though adapted to the Belgian educational system. The Safety Analysis Report defines the level of qualification corresponding to each of the safety-related functions. It does not state the individual qualifications of each person in the organisational chart. However, proof of qualification of all the operating personnel is available to Bel V. The functions and qualifications prescribed by the US regulations are transposed in function of the educational system structure and curricula existing in Belgium.

The training programmes are defined in the Safety Analysis Report, which includes a "function-programme" correlation chart. Chapter 13 of the Safety Analysis Report lists exhaustively all posts for which an authorization is required. This authorization is based on the positive opinion expressed by an Assessment Committee, which examines the candidate's knowledge. This qualification is reviewed every two years or, if an authorized person has ceased during four months or more performing the function for which he/she was qualified. It is renewed on the condition of, among other, a favourable advice of the Assessment Committee on the basis of the individual's training and activity file.

Bel V is member of the Assessment Committee, with veto right.

A knowledge re-training programme for all authorized personnel is defined in function of the occupied position. The contents of this programme which is discussed with Bel V, is essentially operation-focused and includes, among other, a refresher course regarding the theoretical and practical knowledge (two weeks per year), training on the full-scope simulator (two weeks every two years) and, in teams, a review of the descriptions of the different systems (two weeks per year).

The SRNI-2011 requires that the Licensee identifies in a systematic and documented way, the needs with regard to the qualification and training of personnel executing safety-related activities.

The GRR-2001 requires an annual retraining of the whole personnel on the basic rules of radiological protection, including the good practices for an efficient protection and a reminder of the emergency procedures at the work site.

b) Research Reactors BRI and BR2

The minimum requirements for operating personnel are detailed in the safety analysis report both for BRI and BR2. These requirements are the necessary education and training of the personnel. The minimum number of personnel necessary for operating the reactor is also specified. For BR2 additional requirements for training are defined. Each reactor operator has to receive two weeks training every year. The initial authorisation as a reactor operator is given on advice of a committee, in which the Health Physics Department and of Bel V, are represented with veto power. Reauthorisation is necessary every three year or after a longer period of non-activity as an operator. The requirements for BR1 personnel are less formalized. The appointment of the BR1 reactor manager has to be confirmed by the health physics and safety department. The training of the operators is defined by the BR1 reactor manager case by case. This is acceptable due to the limited number of operators for BR1.

III.D.2. The Regulatory body

a) FANC

Each department determines the number of staff and the competences it requires, according to the mid-term and annual Operational Plan (POP) and other foreseeable workload (like pre-licensing projects). Resources are adapted accordingly. The recruitment process is described in the procedure.
PC003-01 of the management system. Each job description specifies the required core technical competencies. All positions are also open to internal candidates and priority is usually given to internal applicants who can apply before external applicants.

Specific assessments of the applicants are done as appropriate looking not only at technical competencies, but also at behavioural and/or managerial competencies.

Formal and regular assessment of non-technical competencies of the FANC staff has been initiated as from 2012. Training needs for newcomers are identified after assessment with respect to the required competencies. A tutorial plan is defined.

Training of staff consist of external training as well as of internal training:

- courses in universities, high schools, nuclear research centres;
- workshops, congress and conferences;
- on the job training or exchanges (inspectors) with foreign Regulatory bodies (French ASN for example). Specific training in operator’s facilities may be organized;
- An agreement between the FANC and Bel V allows sharing of the internal training courses organized by each organization.

b) Bel V

The competence needs (both number of staff and required competencies) are periodically evaluated at the level of the organization as a whole; the evaluation may lead to announcement of new positions, internal job rotations or adapted training the actual staff members.

The recruitment process is described within process A08 “Manage and develop Human resources”. If no internal expertise is available, vacancies are published through the Bel V website and selected job sites, mentioning the job description as well as the required competencies and qualifications.

The TRC (Technical Responsibilities Centres) Annual Reports, as well as the staff’s Individual Development Plans, indicate training needs in the short and long term. The Technical Training Manager is in charge of the elaboration and follow-up of an annual training programme.

Bel V proceeds to a periodic evaluation of the competence (HR) needs and opens vacancies accordingly. In addition, the Bel V HR process is being adapted (deadline end 2013) to include the IAEA methodology SARCoN in the evaluation of the competence needs.

Bel V experts involved in the control activities of nuclear facilities have to be accredited by the FANC as experts in health physics, in accordance with the criteria and procedure of article 73 of GRR-2001. Within FANC, a similar process for recognising experts as FANC nuclear inspectors has been developed.

III.D.3. Research and development of the Regulatory Body

For developing and maintaining expertise of the regulatory body, performing or participating into R&D is very important. In review and assessment, the Regulatory Body is sometimes confronted with new areas (for instance about 15 years ago, the regulatory body started at that time discussions with ONDRAF/NIRAS, on waste disposal) or with evolving technology (for instance the introduction of safety critical software in systems, especially Instrumentation and Control). Such new areas of activity or evolving technologies require that the regulatory body develops new expertise in order to be able to assess files submitted by the Licensees.

Since the creation of Bel V in 2008, the FANC and Bel V are coordinating their R&D efforts through the periodical meetings on “Transversal processes”.

For nuclear safety, the main effort on R&D is with Bel V. The R&D activities are integrated in the management system through subprocess A07.02. Within that process an R&D coordinator is appointed and the process is overviewed by the Bel V Process manager for Process A07.

According to the management system a 5-year R&D Strategy is set up, which serves as a basis for the annual R&D programme, defined at the beginning of each calendar year. At the end of each calendar year, an R&D Report is set up, which serves as input to the R&D Programme of the next year. During the year, an R&D task register is kept up to date to monitor the progress of the R&D activities.

The R&D Programme of Bel V covers various aspects of reactor safety, waste management, decommissioning and dismantling, and some transversal topics.
R&D activities are performed through several frameworks: as internal projects, by participation into international projects (Framework programmes of the EC; OECD/NEA projects, ...) and via collaboration or sponsorship of R&D activities performed by universities.

For radiological protection issues, the main effort on R&D is with the FANC. The FANC actively supports research and development by collaborating in and financing certain projects and by offering support in the dissemination of useful information to the stakeholders.

### III.E. Article 8 - Information to the Public

8. Member States shall ensure that information in relation to the regulation of nuclear safety is made available to the workers and the general public. This obligation includes ensuring that the competent regulatory authority informs the public in the fields of its competence. Information shall be made available to the public in accordance with national legislation and international obligations, provided that this does not jeopardise other interests such as, inter alia, security, recognised in national legislation or international obligations.

The FANC is in charge of disseminating objective and neutral information about radiation risks, according to article 26 of the law of 15 April 1994.

Interested parties that are informed by the FANC comprise:

- the general public and the media:
  - the FANC and Bel V have their own web sites. The FANC web site allows the general public to contact and ask questions to the FANC;
  - the media are informed by the FANC management and the FANC communication office. Important events give rise to press releases and conferences;
  - laws and regulations are published in the Belgian official journal ("Belgish Staatsblad-Moniteur Beige"), as well as notification of decisions (licensing of class I facilities, recognition of experts in health physics ...). A consolidated version of the regulations is available on the FANC web site (http://www.juron.fanc.fgov.be);
  - the general public is consulted ("public inquiry") in the frame of the licensing process of high risk facilities (Class I and some Class II), with the possibility to attend information meetings organized by the FANC;
- the supervising Minister and the Parliament through:
  - the answers proposed by the FANC to questions addressed by the Parliament's members to the minister;
  - the government commissioner who attends the meetings of the Board of Directors;
  - the annual report submitted to the parliament;
  - the follow-up by the parliamentary commission of Home Affairs;
- the licensees: several formal and informal communication mechanisms are in place;
- other interested parties: The GRR-2001 foresees that other parties are notified of the FANC decisions: For example article 6.8 prescribes notification of the granted licenses to local authorities, to some federal administrations, to the civil security, to ONDRAF/NIRAS, to the European commission and other European countries when relevant.

The government and the public are also informed by the annual report of the FANC. This report is published on the FANC web site, together with the Bel V annual report. Parliament members can also ask questions to the FANC supervising minister.

The main communication tool of the Regulatory body is its web site www.fanc.fgov.be. Several reports, information files about the radiation risk of different facilities and activities or about particular subjects are available. Flash news are also regularly published on the web site. In addition, the entire legal framework is available in a particular section of the FANC web site: http://www.juron.fanc.fgov.be/jurdb-consult/consultatie?lanQuaae=fr

The results of the measurements performed by the TELERAD network are available on the FANC web site as well. This gives the opportunity to all interested parties to have an on line overview of the measured radioactivity on the Belgian territory.

All events related to nuclear activities and radiation are rated on the INES-scale (International Nuclear and Radiological Event Scale). The Belgian regulatory body has set up a specific convention between the regulatory body and the licensees of the class I installations and the highest risk class II installations to use INES as a communication tool to the public. This convention is on a voluntary
basis, and all the concerned licensees participate to it. Events that are classified on level 1 or higher on the INES-scale are published on a dedicated web page on the web site of the FANC. This open and transparent communication of events using the INES-scale, contributes to a better understanding of the public on the safety significance of events, as well to the trust building of the regulatory body.

Finally, since 2012, the radioactive releases of all Belgian nuclear and waste facilities with their calculated radiological impact are published annually on the FANC web site: [http://www.fanc.fgov.be/fr/page/les-grandes-installations-nucleaires/1091.aspx](http://www.fanc.fgov.be/fr/page/les-grandes-installations-nucleaires/1091.aspx) (in French).
IV. Conclusion

Belgium complies with the European Directive 2009/71.

A regulatory system for safety supervision with an appropriate legal and regulatory framework is in place in Belgium for several decades and has been improved regularly. The current safety authority, the Federal Agency for Nuclear Control (the FANC) has been provided with its legal missions by the Law of 15 April 1994.

The Belgian regulatory body, for nuclear facilities, is composed of the FANC and its subsidiary body Bel V, to which the FANC delegates some regulatory activities. The current staffing of the regulatory body amounts up to more than 200 people, of which almost 2/3 has a university degree. It has the necessary independence, staffing, and resources to properly discharge its responsibilities. Processes for development of regulations and guides, authorizations, safety assessments, inspections and enforcement, are in place. The major part of safety assessments and on-site inspections related to nuclear facilities are delegated by the FANC to Bel V.

The general regulations for the protection of the public, workers and the environment against the hazards of ionizing radiation prohibits operating a nuclear facility without a license, describes the licensing and the supervision system, including inspections and enforcement in nuclear facilities. The licence holder has the prime responsibility for safety, namely through the internal Health Physics Department that each licensee has to set up within its organisation and which constitutes the first level of safety supervision.

A legal framework for safety, addressing radioprotection, safety and emergency preparedness and response issues, is in place. The FANC committed itself to transpose the WENRA reference levels into bindings regulations. The royal decree on the Safety Requirements for Nuclear Installations published end 2011 introduced the WENRA-RHWG reference levels for nuclear facilities. This royal decree requires, amongst others, the licence holders of nuclear facilities to:

- set up an integrated management system including assessment and improvement;
- ensure training, competence, and qualification of the staff performing safety related activities;
- duly assess their decisions having an impact on safety;
- conduct operation in accordance with established Operational Limits and Conditions (OLCs);
- make analyses and propose improvements for design extension conditions (DECs);
- perform periodic safety reviews;
- set up ageing management programmes;
- manage experience feedback;
- manage and assess modifications;
- set up and exercise on site emergency and response plans.

In addition, the Belgian regulatory body plays an active role in the national nuclear emergency plan, is in charge of the radiological surveillance of the territory, and has the responsibility to disseminate neutral and objective information to the public.

Finally, in application of article 9 of the European Directive 2009/71, Belgium invited an IRRS peer review mission in December 2013. This IRRS mission reviewed all regulatory activities performed by the FANC and Bel V. An action plan is currently under development in order to address the observations made by the IRRS reviewers team. The final IRRS report has been published on the FANC web site and sent to the European Commission and to ENSREG.
V. References

- Belgian national report for the sixth meeting of the contracting parties to the Convention on Nuclear Safety – September 2013.
- Belgian national report for the fifth meeting of the contracting parties to the Convention on Nuclear Safety – September 2010.
- FANC-Bel V IRRS Advance Reference Material (Self-Assessment) – September 2013
FANC

Federal Agency for Nuclear Control