

Convention on Nuclear Safety
 Questions Posted To Belgium in 2011

Q.No	Article	Ref. in National Report
1	General	I.C.a

Question/ Comment Related to the 10% power increase at Doell, after steam generator replacement: Was a new complete Accident Analysis (Chapter 15) required for the re-license of the Unit? Was the same methodology for accident analysis used?

Answer A new complete accident analysis has been carried out, with use of new methodologies compared to the one used for the initial licensing. An example of new methodology is the use of RELAP/PANTHER/COBRA coupled codes for specific accidents

Q.No	Article	Ref. in National Report
2	General	I.C.k

Question/ Comment Related to the transfer of AVN to Bel V: Was there a loss of personnel during the transition? What happened to the people from AVN that was not transferred to Bel V?

Answer A few high level experts remained with AVN who started consultancy services in Belgium and abroad. Bel V was not able to use their services, in order to preserve Bel Vs independency. This fact did however not constitute a major handicap.

Q.No	Article	Ref. in National Report
3	General	P31

Question/ Comment LV expresses satisfaction, that Belgium as good practice includes also information about research reactors.

Could you explain the plans for treatment and final processing of Be blocks?

Answer The beryllium matrix of BR2 has been replaced two times. The first matrix, which was replaced around 1979, was stored under water until the replacement of the second matrix around 1996. At that time the first matrix was conditioned for dry storage at the waste treatment plant of Belgoprocess. In order to reduce the volume and the activity of the material to be stored as much as possible of the stainless steel connection parts was removed. Then the beryllium blocks are loaded in canisters which were filled up with quartz sand and closed. These canisters are placed in a bigger canister. The void between these canisters is filled with cement. A carbon filter is welded on the cover of the outer canister. These canisters are stored until a final disposal is decided.

A more detailed description of the management of beryllium blocks in Belgium was published in IAEA TRS 441: "Management of problematic waste and material arising from decommissioning of nuclear facilities". This report also provides other examples of management and can be downloaded from the IAEA site.

Q.No	Article	Ref. in National Report
4	General	P39

Question/ Comment Could you briefly provide experiences/changes for in particular – from AVN to FANC and FANC v.s. Ministry of Home Affairs?

Answer Before 2001, the safety authority was composed of services of the Ministry of Labour for the technical aspects and from ministry of Health for the radioprotection aspects. All civil servants of these administration were transferred (on a voluntary basis) to the FANC at his creation in 2001. This provided a more functional, integrated and efficient structure for the nuclear safety regulation.

The personnel of AVN, the former Authorized inspection Organisation has been transferred in 2008 to Bel V, the (new) subsidiary body of the FANC created for this purpose. The large majority of the AVN experts joined Bel V and as a consequence, gained in stability and in long term perspectives. Practically, the functioning of Bel V (AVN) does not differ significantly from the previous situation: the FANC delegates exclusively to Bel V the controls of NPPs as well as safety reviews of files submitted by the licensee. Regarding the general supervision of the FANC on Bel V, 2/3 of the members of Bel Vs Board are appointed by the Board of the FANC. In addition, the General Manager of the FANC is also member of Bel Vs Board

The minister of Home affairs supervises the FANC. Practically, a government commissioner attends to the meetings of the FANC board and the minister of Home affairs signs the authorisation licenses with the King. Regulatory proposals from the FANC are also submitted to the Minister of Home affairs.

Q.No	Article	Ref. in National Report
5	General	P119

Question/ Comment Why Agreement with Luxembourg was signed only 2004? What were arrangements before that?

Answer A bilateral agreement has been signed with Luxemburg in 2004 in order to cope with the exchange of specific information in case of nuclear or radiological accident affecting either Belgium, Luxemburg or both countries. This agreement further detailed existing conventions and cooperation agreements

Q.No	Article	Ref. in National Report
6	General	I.C.a, page 15

Question/ Comment In The NL some discussion raised on the question if the organization for storage of radiological waste should be qualified and assigned for handling of combinations of radiating and asbestos waste, either if companies specialized in asbestos removal should get the lead in dismantling and storage of such materials. Up till now the first option have been selected.

Could some comments be given on the assignment and qualification of companies involved in dismantling of radiologically contaminated or radiating materials combined with asbestos ?

Answer Please consult the 2009 National Report for the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management for information concerning the management of spent fuel and radioactive waste

Q.No	Article	Ref. in National Report
7	General	I.C.b, page 16

Question/ Comment Which parameters have been changed to extend the cycle length ?

Answer The loading pattern has been adapted to account for the new in-core fuel management. Therefore, some studies of the Final Safety Analysis Report were re-analysed or, if applicable, justifications of non-re-analysis were issued. The extension of the cycle length results to the modification of some parameters such as the shutdown margin and the LASP signal (Low Advanced Steam Pressure).

Q.No	Article	Ref. in National Report
8	General	I.C.c, page 16

Question/ Comment NPP Borssele modified the filters in the sump, based on the results of international research on sump clogging. However, since the international research proceeds,

there are still doubts about the adequacy of such solutions.

Some informal discussion started on designing sump recirculation pumps separate from existing decay heat removal and low pressure inundation pumps. Such pumps should be suitable for dirty water pumping providing an opportunity for reflushable filters at the pump pressure side. By such a configuration clogging of suction may be avoided and normal heat removal pumps could be saved.

How is the general view in Belgium on on- going future developments solving the problem of sump clogging?

Answer We are following the US NRC recommendations, in particular RG1.82. Filter sizes have been or will be increased. Also, a conservative analysis is being performed in order to estimate the nature and the quantity of debris that could be generated during an accident, and be transported to the sump. These informations will then be used as input for experiments, which will help to determine the most appropriate mesh size, to check a clogging possibility, and to study the debris quantity that could go through the filters and induce downstream effects.

Q.No	Article	Ref. in National Report
9	General	I.C.f, page 17

Question/ Comment Can you provide a diagram showing a relation between the INES levels and any plant emergency states (or notification levels according II.L.2.a) ? Do plant emergency states correspond with defined release thresholds?

Answer The INES-community explicitly stresses to avoid such relationship. In that context, please note that, during the last technical meeting of the INES national officers, held in Vienna last October, it was again repeated INES-rating should not be compared or linked with emergency notification levels. The project of conclusions & recommendations as discussed during this meeting mentions the following: "The TM of INES National Officers re-confirmed that the recommendations of the 2004 INES TM, which were subsequently incorporated in the IAEA Safety Guide GS-G-2.1 "Arrangements for Preparedness for a nuclear or radiological emergency: the emergency response classification system should not be confused with the International Nuclear Event Scale (INES). The INES is used for communicating to the public the severity or estimated severity of an event and cannot be used as a basis for emergency response actions still apply. The TM of INES National Officers endorsed the recommendation of the INES Advisory Committee that efforts to link emergency classifications to INES ratings should be avoided. The INES rating should be based on the criteria in the INES Users Manual (2008) and not linked to emergency classifications."

Q.No	Article	Ref. in National Report
10	General	I.C.f, page 17

Question/ Comment Is there a specific reason for a rising trend in the numbers of INES level 1 events (14 INES 1 events in 2009).

Answer There are two reasons that can explain the variation of the number of events that have been rated at level 1 of the INES-scale. First, the FANC has strongly been promoting during the past years a more systematic use of the INES-scale for communicating to the public the importance of events in the nuclear facilities. The introduction of the new INES-manual (2008-Edition) in 2009, which gives more guidance on low-level events and safety culture aspects, has lowered somewhat the threshold for reporting events and FANC strongly encouraged this. A second

reason for the variation in the numbers of events from one year to another is the periodicity of the outages :in general many events are reported during or just after an outage. Since the outage period is for many of the reactors now 18 months, it can occur that in one year there are significantly less outages than in another year. We would like also to point out that INES is not considered as the appropriate tool for assessing the safety level of NPPs and that statistics based on the number of events rated on the INES-scale should be interpreted with caution.

Q.No	Article	Ref. in National Report
11	General	I.C.i.2, page 20

Question/ Comment Does the self-assessment according WENRA result into any change of the regulatory body's capacity or the thresholds for regulatory involvement ?

Answer The WENRA benchmarking revealed that the majority (85%) of the WENRA reference levels was already implemented in Belgium. The reference levels are specified in the Safety Analysis Reports of the NPP units. As the licence requires the conformity to the SAR, the SAR is considered as a licence condition, which has to be complied with as any other licence condition and is subject to the same regulatory control. Therefore, no change of the regulatory bodys capacity or threshold for regulatory involvement occurred. Two action plans, one on the operator side addressing the C rated reference levels (non conformity) and one on the regulator side, to transpose the Reference Levels into the Belgian regulation are still in the implementation phase.

Q.No	Article	Ref. in National Report
12	General	I.C.k, page 22, due to WG3

Question/ Comment The Netherlands regulatory body tried to express its performance in indicators like numbers of assessment reports and inspections, number of findings and action points, time span for assessment. Next to monitoring of output also outcome should be an important topic.

`WG3 was in charge of defining performance indicators for controls and inspections.` Which figures or aspects are monitored for presenting the regulatory performance?

Answer The major objective of the performance indicator program is to verify that

- Controls and inspections are carried out according to the defined program
- Safety deficiencies are recorded and corrected
- Licensee events are recorded and analyzed

Typical performance indicators that are monitored in this way are :

- Proportion of controls and inspections performed to minima specified in control and inspection program
- Timeliness of publication of inspection report
- Number of actions/requests to correct safety deficiencies
- Proportion actions/requests which are resolved within defined delay
- Number of analyzed domestic events
- Average analysis delay for licensee events

Q.No	Article	Ref. in National Report
13	General	Para 22.J.2.a, page 97

Question/ Comment How do Belgian NPPs respond to introduction of new safety requirements?

Answer New safety requirements are typically identified within the scope of the Periodic Safety Reviews. When a new safety requirement (for instance identified through

new requirements in the USNRC regulatory system) is introduced, an analysis is made to investigate whether the NPPs comply with that requirement, and if not, to investigate whether specific measures are needed to ensure compliance. This process follows then the normal process of investigations foreseen in the PSR. The position taken regarding those rules of relevance published during the successive 10-year periods (Reference rules) is documented in chapter 3.A of the FSAR, which contains also an analysis of the original "Applicable" rules, i.e those that were mandatory during the Licensing.

Q.No	Article	Ref. in National Report
14	General	Page 22 Section I.C.1

Question/ Comment The report says that "...Belgium has not yet officially requested an IRRS mission..." giving the reason that "...for the nuclear installations falling under the scope of the Convention, the situation is not yet fixed for the control of lower risk installations."

Does Belgium plan to have an IRRS mission in the near future? The UK considers that this would be of considerable benefit, even if its scope was initially limited to the higher risk installations.

Answer The FANC plans to start shortly a self-assessment, using the same methodology and tool (SAT) that is used in an IRRS mission. The organisation, every 10 years, of an international peer review mission of the relevant national regulatory framework is now mandatory according the European directive 2009/71/Euratom. Belgium intends to benefit of a full scope IRRS mission around 2013 and has communicated this planning to the ENSREG (European Nuclear Safety Regulators Group) working group on nuclear safety, in charge of planning and coordinating IRRS missions in EU countries.

Q.No	Article	Ref. in National Report
15	Article 6	II.B.1, page 29

Question/ Comment Several NPPs got a power increase. Is that only at the secondary side? If also a primary side got a power increase, how does this match with the safety margins of the core ?

Answer Power increase is not restricted to the secondary side. Primary side power increase resulted from an optimization of the nominal operating conditions of pressurized water reactors. This methodology has proven to be practical and cost effective in case of SG replacement of the Belgian plants, with reactor thermal power uprate up to 10%. The nominal operating conditions in pressurized water reactors (PWR) have originally been fixed to keep important margins with regard to the plant limitations (turbine limit) and to limiting phenomena (DNB, centre pellet fusion, ...). All replacement steam generators have much larger primary to secondary heat exchange area, allowing to maintain core outlet temperature at uprated power. Also, improved methodologies were used.

Q.No	Article	Ref. in National Report
16	Article 6	II.B.2.a, page 31

Question/ Comment Is there a view of the life time of the graphite and its critical aspects for continued operation ?

Answer There is no predefined life time criterion for the graphite core of BR1. The Wigner energy must be limited to 60 calorie per gramme (250 J/gr). The Wigner energy is measured after every 5000 MWh of operation. The actual value is around 43 calorie per gramme and decreasing. The decrease is caused by the operation of the reactor

at low power level (maximum 700 kWth) using only the auxiliary ventilators. Due to the lower air speed, the graphite temperature is higher (maximum 104 °C) in this operation regime. This, combined with the low neutron fluxes, is the reason for decreasing Wigner energy. In the early years of operation, BR1 was used at full power (4 MWth). In this regime, there is an accumulation of Wigner energy and the core was annealed in 1962. After the start of BR2 in 1963, BR1 has always been used at low power and annealing has since then not been necessary. For the future, no operation at high power is foreseen, such that no problems with the Wigner energy are expected

Q.No 17	Article Article 6	Ref. in National Report II.B.2.b, page 31
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Question/ Comment What was the reason to replace the old cadmium control rods in BR2 by hafnium ?

Answer The cadmium rods were end of life due the burn up of the main absorbing isotope of cadmium (Cd113). The antireactivity of the rods became too low, reaching the minimum specified value. The old absorbing parts of the rods were made of aluminium clad cadmium tubes. These were fabricated by coextrusion of cadmium and aluminium. The fabrication tools are no longer available. In order to make new control rods with cadmium absorber, a new fabrication process had to be developed and qualified. A possibility would have been the use of hot isostatic pressing. Since this would mean a major cost, the possibility of using other absorbing materials was investigated and hafnium was one of the most obvious choices. It has two advantages compared to cadmium. The first is that during the irradiation, the antireactivity value of the hafnium decreases very slowly, due to the fact that the absorption of thermal neutrons is not dominated by one isotope as is the case with cadmium. A second advantage is the fact that hafnium can be used in the primary water without cladding. Furthermore, hafnium is used in many research and test reactors as an absorbing material. None of these installations reports about problems with hafnium. A minor difference between cadmium and hafnium can be noted. While cadmium is a pure thermal neutron absorber, hafnium is rather a resonance absorber. This makes the neutron spectrum around the control rods a bit softer

Q.No 18	Article Article 6	Ref. in National Report Para 22.1, page 28
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Question/ Comment How do you replicate the measures, developed in the follow-up to investigation of deviations from operation at a given power unit or good operational practices, at other power units?

Answer The analysis of the internal OE is coordinated by an OEF-site committee. For each internal OE, an applicability analysis is carried out for each unit, and when deemed applicable, appropriate measures are implemented. Also, OE organisations of different sites belong to the same organisation, with systematic exchange of internal OE. External OE is pre-screened on applicability, and when screened in, the external event under consideration is considered as an internal event, and it is handled accordingly.
The process of OEF at Electrabel is also described in more detail in paragraph II.O.1.h.

Q.No 19	Article Article 6	Ref. in National Report Para IIB1, page 28
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Question/ Have you implemented the “Leak-before-break” concept (LBB) at the Belgian RIs?
Comment

Answer The Leak-before-break concept (LBB) is implemented at on the Belgian NPPs. The LBB is applicable to primary piping in so far as it can be demonstrated that there is not risk of water hammer, erosion/corrosion, intergranular stress corrosion, important fatigue and/or creep.

For what concerns the Research Reactors :

The BR1-reactor is an open air cooled reactor. As such the leak before break concept is not applicable.

The BR2-reactor is water cooled. The primary temperature is about 50 Â°C at a pressure of 1.2 MPa such that high energy pipe breaks can not occur. The whole primary circuit is constructed of aluminum, which is a ductile material. Both aspects indicate that the BR2 could fulfill the leak before break criterium, although this is not formally proven. Periodic inspections of both the reactor vessel and primary circuit are conducted.

Q.No 20	Article Article 7.2.4	Ref. in National Report page 50
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Question/ It is stated that FANC has taken over the tasks aiming at the enforcement of the
Comment Law of 15 April 1994. We understand from chapter “II.D.2. Powers and Attributions of the Regulatory Body” that FANC is enabled in certain circumstances to suspend or withdraw a license and to introduce additional conditions to the license. Are there other enforcement measures available to the FANC?

Answer In terms of enforcement the AFCN can make use of either administrative or legal actions. You are quoting two administrative measures that are covered by the regulation: removing authorizations and imposing additional operating conditions. Other measures of the same level can also be used, such as imposing an action plan that meets a given deadline, posing administrative seals in case of danger or writing administrative fines. In dealing with legal matters, the AFCN employs nuclear inspectors with judiciary powers. These inspectors can report any observed facts to the judiciary representatives. Prosecution may then be initiated.

Q.No 21	Article Article 8.1	Ref. in National Report page 55
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Question/ Please indicate the development of human resources of the FANC and Bel V over
Comment the past 3 years? Concerning the maintenance of human resources within FANC and Bel V, are special arrangements in place to prepare for the replacement of senior staff leaving for retirement?

Answer The total number of FANC staff has increased from 110 to 140,(from which 60% are university graduated). This new staffing was determined as a result of the new FANC organisation put in place end 2007.
Since 14 April 2008, Bel V has increased its technical staff up till 56,8 full time equivalent and 9 FTE administrative and IT support.
For the knowledge transfer of senior staff who is retiring, an on the job recovery period is foreseen with the retiring person and his follower to allow enough training. Some retired senior staff also continues part of their activities as part-time extern consultant.

Q.No 22	Article Article 8.1	Ref. in National Report II.D.8, page 62/ 63
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Question/ Comment Is there a view on the required capacity of the regulatory body given number, size and complexity of the nuclear facilities in the country ? Are there financial contributions from licensees to the regulatory activities?
How far do these cover the operational costs ?
Are financial contributions, if any related to the number of regulatory products like assessment reports and inspections?

Answer Please see in the report section II.D.3.a page 55 for the financial resources of the FANC, section II.D.3.b page 58 for the financial resources of Bel V and section II.C.3.3 for the legal framework.

Q.No	Article	Ref. in National Report
23	Article 8.1	Page 57 II.D.3.a. Safety Authorities

Question/ Comment The report indicates that the Department “Facilities and Waste” of the FANC must also track down any illegal activity carried out without Authorization.
Can the FANC provide some information of how this is achieved?

Answer This statement does not apply specifically to the NPP, but more to other nuclear activities. Means to track illegal activities could comprise comparison (cross-check) of different databases (for example Database from Ministry of Public Health or from Ministry of Labour and FANC Database) , complaints by citizens, etc €
Some specific campaigns are also organized (Lightning rods for example).

Q.No	Article	Ref. in National Report
24	Article 8.2	II.D.6

Question/ Comment Are members of Bel V also performing regular inspections or they are only support for FANC inspectors on thematic inspections?

Answer There is a program for inspection (by FANC) and control (by Bel V). The control program of Bel V includes systematic visits, thematic visits and specific visits, done by the Bel Vs inspectors in each installation (reports are communicated to FANC). Bel Vs inspectors are also a support for the FANCs inspectors for the realization of the inspection program of the FANC. The inspections of FANC are more transverse and general than the controls of Bel V.

Q.No	Article	Ref. in National Report
25	Article 9	II.E, page 64

Question/ Comment Daily involvement from inspectors provides a well informed view on safety aspects of the NPP, but may also provide some risk of encapsulation of the plant inspector working frequently in licensee’s organization.

What kind of measures are taken to find a good balance in the plant inspector’s involvement in the plant, preventing encapsulation?

Answer Bel Vs inspectors are not on site every day, but about one day per week, and they dont work in licensees organisation, in order to prevent encapsulation. During the other days (working at the Bel Vs offices), they may have contact by phone. Permanent discussions between inspectors affected to a site, and regular coordination between inspectors affected to different sites permit exchange of experience and limit encapsulation.
Permutation of inspectors between units on a site is also foreseen after some years. Permutation of inspectors between sites (Doel and Tihange) may occur, but are seldom due to the difference of language between these sites.

Q.No	Article	Ref. in National Report
26	Article 10	II.F.b.

Question/ Comment Related to the process of rewards and sanctions of the Performance Management process: What types of sanctions are available? Are they applicable to individuals? How often have sanctions been used?

Answer The Performance Management Process is incentive-oriented (see question n°37), and not sanction-oriented.

A sanction policy nevertheless exists and is used in case of disrespect of internal rules. 5 types of sanction can be used (in increasing importance scale) :

- 1) oral reprimand
- 2) written reprimand
- 3) downgrading
- 4) temporary suspension of contract
- 5) definitive termination of contract

Sanctions are all applicable at individual level. For one site with about 1000 employees, the sanction policy is used a few times a year.

For contractors, the company is informed. There are two types of individual sanctions:

- 1) no more access to the site : temporary
- 2) no more access to the site : permanently

Q.No 27	Article Article 10	Ref. in National Report page 65, chap. II.F.1.a
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Question/ Comment The safety policy of one Belgium operator is given.

Does the Belgium regulatory body approve this policy? If yes, please describe the references for the acceptance of this policy.

Answer The safety policy is included in the Safety Analysis Report of each nuclear unit and thereby is approved by the Belgian regulatory body. References for acceptance are international documents related to safety and safety management.. The IAEA document used in Belgium for updating the safety management system was, amongst others, the Guideline GS-G-3.5. The impact of this improvement was incorporated in the FSAR.

Q.No 28	Article Article 10	Ref. in National Report Page 74, II.F.3. Regulatory Bodies
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Question/ Comment The report states “The FANC is responsible (amongst other duties) for the supervision and control of all the activities concerning radiological protection and nuclear safety.

Inspections and controls are exercised by the FANC (inspections) and by Bel V (controls), under the responsibility of the FANC.”

Can you please provide additional information related to the scope of “inspections” carried out by FANC and the “controls” carried out by Bel V and how they complement each other in verifying compliance by the licensees to the regulatory requirements?

Answer See also answer to question 24.

FANC Inspection Program includes proactive inspections conducted in each facility belonging to the same class or group; these inspections focus on specific themes such as clearance, high-activity sealed sources, cyclotron release, etc. Moreover, the FANC also conducts reactive inspections after an incident or accident requiring immediate measures or as a result of a complaint related to

nuclear safety within a facility or on request of the federal police or the public prosecutors office. Other inspections can be carried out in support of Bel V in its relation with the operator (i.e. if the operator does not comply with the deadline imposed to implement some actions).

Bel V Control Program includes systematic, thematic or specific controls for class 1 facilities and periodical controls carried out in Class 2 facilities. The objective of the systematic controls consists in controlling the operators not only periodically, but also when they have not been warned previously and have not had the time to get prepared. The planned and announced thematic controls consist in a deep investigation of specific, previously identified domains (i.e: fire or radioactive releases).

Other specific controls are carried out by Bel V and/or the FANC in Class I & II facilities. These controls result from specific needs (incident follow-up, review on the applicability of experience feedback, etc.);

Both programs from FANC and Bel V are complementary and are implemented following an integrated inspection and control strategy (IIS). The IIS is set for a period of three years and is then translated every year into a control program (for Bel V) and an inspection program (for FANC).

Q.No 29	Article Article 10	Ref. in National Report Page 67, Section II.F.1.b
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Question/ Comment Under the text on Pillar 4, Electrabel Global Nuclear Safety action plan, there is a reference to the main objectives "...for the coming years (from 2006 to 2010)." Could Belgium please say whether these objectives have now been updated for the years beyond 2010, and indicate what themes they will cover over the next few years?

Answer Electrabel has updated the objectives in a new global plan for the period 2011-2015.

This new global plan is structured into 13 themes :

- 1) Management, Organisation and Administration
- 2) Competence and Knowledge Management
- 3) Operations
- 4) Fire Protection
- 5) Maintenance
- 6) Engineering
- 7) Configuration Management
- 8) Nuclear Fuel
- 9) Operating Experience Feedback
- 10) Radiation Protection
- 11) Emergency plans
- 12) Chemistry
- 13) Site Security and non-proliferation

Q.No 30	Article Article 10	Ref. in National Report Page 71, Section II.F.1.c
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Question/ Comment There is a brief reference in the text to an organisation not previously mentioned in this report, Synatom.

Could Belgium please say a little more about this organisation, its functions and its relationship to Electrabel's Nuclear Fuels and Liabilities department?

Answer Synatom is a 100% subsidiary of Electrabel, in charge of the management of the front end (uranium procurement, conversion and enrichment) and the back-end of the fuel cycle (including the spent fuel management from its reactor unloading up to its final conditioning for disposal). Nuclear fuel is owned by Synatom, who charges Electrabel for all costs related to the fuel (front end and backend). Uranium needs are defined by Electrabel's Nuclear Fuels and Liabilities department

Q.No	Article	Ref. in National Report
31	Article 11.1	II.G.1.c, page 78

Question/ Comment The ownership of nuclear facilities becomes more spreaded over different international production companies these days, which may lead to more reorganizations and less clear communication between licensee and regulatory body.

How is dealt with the transfer of licenses into more enlarged international companies ? What does that mean for the communication lines between licensee and regulatory body ?

What criteria or competences of the potential licensee will you assess before granting a licence to a new operator of an NPP, and why?

Answer In practice, the Belgian operator is organized in a way that there is a national structure which is in charge to fulfil the license responsibilities. In addition, most of the communication between the regulatory body and the licensee is directly done at site level.

A transfer of licenses has not recently occurred for the major class I nuclear facilities, so limited practical experience in dealing with this issue exists.

In case of transfer of the license of a class I nuclear facility, the regulations require that the FANC must give its approval to the transfer (article 5.4 of the GRR-2001).

As a minimum, a new licensee must attest that it has the necessary resources to ensure the safe operation of the NPP as defined in chapter 13 of the Safety Analysis Report of the NPPs:

- Adequate organisational structure
- Adequate Training and Qualification of Key personnel

In addition, the ability of the new licensee to comply with the other licensing or regulatory requirements for that specific nuclear facility will be assessed on a case-by-case basis

Q.No	Article	Ref. in National Report
32	Article 11.1	Page 80, II.G.1.e.4 Training programs

Question/ Comment Can we have an explanation of the process for authorization of personnel directly responsible for the operation of the reactor units and what is the role of the various organizations e.g FANC, NPP Operators etc..?

Answer In order to obtain an authorization for operating the plant, an oral examination has to be passed in the presence of a mixed jury panel. This panel is composed of members of the Operations and Safety Departments, and representatives of Bel V. After having passed this examination successfully, an on-the-job training has to be performed. The successful completion of this training is left to the appreciation of the Utility.

Q.No	Article	Ref. in National Report
33	Article 11.1	Page 80, II.G.1.e.4 Training programs

Question/ Do maintenance personnel require having some form of authorization before working on safety related plant systems? If yes please provide some information of the authorisation process.

Answer A process of formal qualification of maintenance personnel is under development for maintenance activities with impact on safety. After succeeding all the exams of this competence development program and being evaluated as competent by the hierarchy, the concerned maintenance personnel will get their own "craft passport". This system should be implemented from 2011 on, and technicians will be granted a transition period to obtain this passport, depending of their respective training program. After that transition period, it will be mandatory for technicians to possess their "craft passport" and also their "safety passport" to be authorized to work on safety related plant systems.

Safety passport is already mandatory and is provided after they succeed all exams related to the training program on Radiation Protection, nuclear safety, environment, health and safety. There are 3 levels for the safety passport :

1) Safety passport level 1 : introductory course and access granted to the plant but no authorization for work on the installation

2) Safety passport level 2 : safety training program comprising following aspects:

o Nuclear safety, operating PWR

o Electrical safety

o Radiation protection

o Industrial safety

o Human performance

o Flow loop simulator

o Environment and site security

o Fire protection

o Explosive environments

Individual are authorized to perform work on the installation after having obtained safety passport level 2.

3) Safety passport level 3 : Plant staff that supervise technical work at the plant and have responsibility over the safety of other employees must follow the level 2 training program as well as an additional training course in the areas of nuclear safety, industrial safety, human performance and environmental safety.

Q.No	Article	Ref. in National Report
34	Article 11.2	II.G.1 and 4

Question/ Regarding operator authorization: Is there a written examination by Bel V involved in the certification process?

Answer The authorization of personnel directly responsible for the operation of the reactor unit is given by a Committee, after an oral examination of the candidate. Bel V participates to this jury and is involved in the certification process.
See also answer to question 32.

Q.No	Article	Ref. in National Report
35	Article 11.2	page 80, chap. II.G.1.e1

Question/ It is stated "Doel has two full-scope simulators: these are precise replicas of Doel Unit 1 and unit 4. The full-scope simulator of Unit 4 can be used in Unit 3 mode."

Comment At which simulator the Doel 2 personnel is trained. Which restrictions does the training of the Doel 2 personnel has – compared to e.g. Doel 1 personnel – with

respect to the missing full-scope simulator. How are these deficiencies compensated?

Answer There is no missing full-scope simulator as Doel 1-2 is a twin unit with a control room common to both reactors.

Q.No	Article	Ref. in National Report
36	Article 11.2	II.G.1.e.2

Question/ Comment Are the full- scope simulators used for emergency training for site, regulatory body, emergency centre, etc.? Do the regulatory body have a data line to the simulator. If yes, which information can be derived from that data line?

Answer Yes, a full-scope simulator is used to train the NPP staff. During emergency exercises, the simulator could also be used in function of the defined scope of the exercise. At least, the simulator is used in the course of the development of the exercise scenario by the NPP staff (in Belgium, the NPP is responsible for the development of the exercises scenarios).
The Belgian RB does not dispose of any nuclear data link connected to the NPP and/or simulator. In Belgium, at the time, the installation of a Nuclear Data Link (NDL) between the NPP and the GCC or the Regulatory Body Headquarters was not found essential to assess, during an emergency, an event in an nuclear installation, as interpretation of data at distance is always difficult and as, due to the limited size of the country, an inspector could reach the site within about one hour.

Q.No	Article	Ref. in National Report
37	Article 12	Section II.F.1.b , Page 67

Question/ Comment It is stated that each year all Departments and all individual receive their specific objectives. Are there any incentives for the Departments / individuals to achieve their objectives for the improvement of safety?

Answer People performances are evaluated against their individual objectives, that are for the most of them related to the improvement of safety :

- 1) exceptional performer : high financial incentive
- 2) exceed the objectives : medium financial incentive
- 3) meet the objectives : low financial incentive
- 4) below the objectives : no incentive

The performances are also taken into account for the career development (job promotion)

Q.No	Article	Ref. in National Report
38	Article 12	Section II.H.1.b, Page 86

Question/ Comment Human performance Simulator is mentioned in section II.H.1.b . It would be desirable if nature and functioning of “Human Performance Simulator” is somewhat elaborated.

Answer The human performance simulator is used for initial training and refresher training of the own staff and the contractors. Individuals are evaluated with practical exercises on their safety behaviours by the trainers. They must succeed this exercise otherwise they do not get the safety passport. The objective of this simulator are :

- 1) put into practice the theory acquired in nuclear safety and in risk prevention within a concrete example of intervention
- 2) adopt the appropriate behaviours when confronted with conventional and radiological risks
- 3) strictly follow all the rules defined by Electrabel (wearing PPE, work permit,

waste segregation, reporting anomalies....).

Trainers have developed several scenarios of intervention and use a detailed evaluation form to assess the behaviours of the trainees.

Q.No	Article	Ref. in National Report
39	Article 13	p.89
Question/ Comment	Last two paragraphs of page 89 state that safety-related equipment, components, structures as well as safety-related activities (e.g. human performance, organizational performance, safety culture, radiological protection, etc.) are known as Quality Monitored items. Could Belgium give more information and corresponding examples on how the quality of these “Quality Monitored items” is monitored, especially for human performance, organizational performance and safety culture?	
Answer	For the safety-related systems, structures and components, a set of requirements related to quality control during fabrication and installation, traceability, controls during preventive and corrective interventions, modifications, etc. For human performance, quality monitoring is based e.g. on task observations; for organizational performance, it is based e.g. on key performance indicators, self-assessments, after action reviews, internal audits and controls; for safety culture, it is based e.g. on internal and external assessments (OSART or WANO findings).	

Q.No	Article	Ref. in National Report
40	Article 13	page 93, chap. II.I.2
Question/ Comment	It is stated “The SCK•CEN has a formal quality assurance system which includes a number of services such as the production of radioisotopes and the irradiation of silicon for which the system is certified. However the formal QA plan is introduced up to level of the operation of the reactors. From the point of view of QA, all operational procedures are considered as work instructions. This has the advantage that procedures can be updated more quickly.” The statement here (and with respect to Article 10) may imply that the research reactors have no management system according to IAEA GS-R-3. Is this observation correct? Do the research reactors or the Mol centre plan to establish a management system?	
Answer	On request of the authorities SCK•CEN made a gap analysis with respect to the IAEA GS-R-3 standard. The general conclusion is that although for reactor operation only a limited number of processes are formally certified (mainly those concerned with commercial isotope production) nearly all other processes are covered by written procedures. Most of these procedures are controlled, by the internal health physics and safety services. Other processes, such as modifications and experimental devices, are controlled by the regulatory prescriptions. SCK•CEN plans to introduce a uniform management system, taking into account the recommendations of the IAEA GS-R-3 standard.	

Q.No	Article	Ref. in National Report
41	Article 13	General Quality Assurance
Question/ Comment	This Article focuses on the Quality Assurance aspects of the operating organizations.	

A Chapter explaining the FANC and Bel V Quality Management systems and their interface would have been useful. Could you please provide some information in

that respect?

Answer The quality management system (QMS) of the FANC covers all FANC's activities necessary to fulfill its mission. It contains all process related documents, required by ISO 9001:2008 as well as the description of all core processes and supporting processes. This QMS has been approved by an accredited organization and declared to be applicable to the surveillance, adaptation and application of regulations, the awarding of licenses and permits, the performance of inspections and controls, the deliverance of advice and information, the stimulation of research as well as the management of incidents in view of protecting the population, the workers and the environment against the dangers of ionizing radiation.

The QMS of Bel V is also in conformity with ISO 9001:2008 and has been approved by an accredited organization. It is applicable to all activities that Bel V carries out in support of the FANC.

Q.No	Article	Ref. in National Report
42	Article 14.1	II.J.2.a(also Art.18, item II.N.1.d)

Question/ Comment Regarding PSA: When will the full scope level 2 PSA be completed? How the safety authorities control the fulfillment of deadlines for such type of studies required from the licensee? What happens if the study is not completed in the required time?

Answer The level 2 PSA is part of the WENRA Belgian Action Plan. As explained in the report (Section I.C i. - Implementation Issues-), the progress of the WENRA action plan is closely monitored by the WENRA consultative Committee, which meets every 2 or 3 months. It is now expected that the level 2 PSA should be completed by 2015. The proposal of the Royal decree transposing the WENRA reference levels into the Belgian legislation will foresee transitory measures for the entry into force of the provisions related to the level 2 PSA. If the level 2 PSA is not ready by 1st January 2016, the FANC may take enforcement actions (See answer to question 20 regarding this subject).

Q.No	Article	Ref. in National Report
43	Article 14.1	p.97

Question/ Comment Last paragraph of page 97 describes that “Mixed core composition (presence in the core of fuel assemblies from different suppliers) also had to be taken into account, requiring detailed studies regarding mechanical, neutronic and thermal-hydraulic compatibility”.

Do Belgium NPPs have experience in reactor cores loaded by fuel assemblies from different suppliers? If yes, please, provide some more information on the achieved operating results in comparison to the pre-operational analyses and studies performed.

Answer Belgium has a large experience of mixed cores. A mixed core is defined by the co-residence of fuel of various designs: either they come from various vendors, or they have different design (as well thermal-hydraulics as thermo-mechanical or neutronic designs) from the same vendor (e.g. MOX fuel with UO₂ fuel). Before they merged, fuel from ABB, Exxon, Siemens and Framatome have been loaded all together in the same core. Today, only 2 vendors remain on the market, but mixed core still occur in the transition cycle from one vendor to the other or from one design of one particular vendor to another design of the same vendor. The operational REX is positive. Some specific configurations lead to penalties

usually applied on FDH (they are due to flow redistributions mainly resulting from differences on the spacer grids pressure loss coefficients), but flexibilities on the loading patterns always were sufficient to accommodate to this penalty. As a result, mixed cores never induced any production losses.

Q.No 44	Article Article 14.1	Ref. in National Report p.98
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Question/ Comment Last bullet on page 98 explains that “Bel V is performing an “on-line” review of the development and the updating of the PSA models and discusses its findings with TE and the utility on an interactive basis. In addition, at the same page it is mentioned that “The main applications of the PSA are the evaluation of the design as a complementary tool to the deterministic safety analysis, the evaluation of the accident management and the PSA-based event analysis.
Could Belgium explain in details the scope and content of such “on-line review of the development and the updating of the PSA models”? Is the use of PSA limited to the abovementioned applications?

Answer The « on-line » review has been performed for the regulatory review of the original PSAs and is now pursued for the updates of the PSAs. It works as follows.

For the Belgian NPPs, the architect-engineering company Tractebel Engineering (TE) performs the PSA-analyses on behalf of the Licensee Electrabel. Instead of submitting a fully finalised PSA study for review to Bel V (which would lead to an off-line review), TE transmits to Bel V all kinds of technical documents of the PSA, as soon as these documents are available. These documents cover methodological aspects, data aspects, plant specific analyses (event trees for sequence analysis, system reliability analysis with corresponding fault trees, human reliability analyses, etc) and quantification results. Bel V examines these documents, transmits comments and questions to TE and Electrabel, which are then discussed with TE and Electrabel. Depending on the outcome of the discussions, the documents are then revised and the analyses and PSA models adapted correspondingly. This process leads to a quite detailed review of the PSA.

At the end of the on-line review, TE and Electrabel submit to Bel V a final version of the Synthesis Report of the PSA, and the corresponding RiskSpectrum model. Bel V writes then an Evaluation Report of the PSA, in which a global evaluation is given, together with an overview of remaining questions, comments and recommendations for the future PSA updates.

Besides the PSA applications mentioned in the national report, there are some additional (recent) applications that are under the development by the Licensee. An example is Reliability Centred Maintenance (RCM).

Q.No 45	Article Article 14.1	Ref. in National Report page 98
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Question/ Comment It is written that the utility has set up an integrated ageing management system, in order to assure that, among other, safety related structures, systems and components remain qualified within their defined service life. Main issues are maintaining the qualification and anticipation of the loss of qualified suppliers and spare parts. The utility uses a methodology which follows the recommendations of the IAEA.
Please give a concrete explanation of the integrated ageing management system.

Answer The proposed approach aims at defining a systematic process ensuring that all SSCs important to safety are the object of an appropriate management of the ageing phenomena. This process must ensure the timely detection and follow-up of ageing degradation, in order to take remedial measures when necessary, to ensure that the required safety margins in terms of structural integrity and functional capacity of the SSCs are maintained.

Hereby an example (PWSCC - Reactor Pressure Vessels Closure Heads) :

- (1) Ageing management review (primary water stress corrosion cracking)
- (2) Condition assessment (problem known from international operating experience feedback)
- (3) Development of Ageing Management Programs (periodic inspection program for detection of cracking, qualification of repair techniques)
- (4) Implementation of decisions (preventive replacement option, feasibility studies, etc.)
- (5) Improvement of AMPs

Q.No	Article	Ref. in National Report
46	Article 14.1	page 131 - 132

Question/ Comment It is mentioned that in the course of periodic safety reviews for all units a global evaluation of the safety during low-power and shutdown states is being performed. The ongoing update of all PSAs will lead to full Level 2 analyses for all plants. Is it possible to give information about the concerned topics and the results of the reviews?

Answer In the on-going periodic safety review an analysis is being conducted in which an evaluation is made whether all initiating events have been considered for all plant states, to investigate the measures available for coping with the initiating events in the different plant states, with as objective to investigate whether any additional measures have to be foreseen.

At the same time, the PSA (Level 1 and Level 2) for all plants are being updated, and these analyses will also include low-power and shutdown states.

Unfortunately, at the moment when answering this question, the results are not yet available.

Q.No	Article	Ref. in National Report
47	Article 14.1	Page 96, Section II.J.2.a

Question/ Comment The report says that for major modifications “The safety analysis performed by Bel V is presented to FANC.”

Does this mean that Bel V is performing the safety analysis instead of the licensee, or does the text simply mean that Bel V is making an assessment of the safety analysis which is submitted to it by the Licensee?

Answer The term safety analysis as used in this paragraph of our national report may indeed lead to confusion.

For all modifications it is up to the Licensee to perform the safety analyses that are needed to demonstrate that the modification is in line with the design basis of the plant and with corresponding regulations and that the modification is safety neutral or provides an improvement of safety.

It is then Bel Vs task (being part of the regulatory body) to review the analyses performed by the Licensee. As written in the national report, for major modifications (requiring a modification of the License of the installation), Bel V will report on the results of its review to FANC and its Scientific Council.

In other words, using the wording of your question, we confirm that Bel V is

making an assessment of the safety analysis which is submitted to it by the Licensee.

Q.No 48	Article Article 14.1	Ref. in National Report Page 97, Section II.J.2.b
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Question/ Comment The report says that for major modifications “A new Royal Decree of Authorisation is prepared by the FANC and finally signed by the Minister of Home Affairs and the King.”

Could Belgium please comment on the added value of this process and indicate how much extra time is typically added to the decision process by these two final steps?

Answer The GRR-2001 stipulates that the King is the competent Authority who grants the licenses for class I nuclear facilities. The King is consequently the competent authority for modifying, amending or completing the licence or the conditions attached to the licence if a major modification requests it (for example, a change of the nominal power specified in the licence). Another added value is transparency and public participation, due to the public consultations foreseen in the licensing process. The Minister of Home Affairs and the King represent in this case the Belgian Federal Government who exercises the federal executive power in Belgium. Those two levels are essential to ensure that significant modifications that impact the society are supported by adequate representative levels. Typically the signing of a Royal Decree by the Minister of Home Affairs and by the King can require a few days up to a few weeks, but longer periods are also possible.

Q.No 49	Article Article 14.2	Ref. in National Report II.J.2.b
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Question/ Comment Related to irradiated samples for evaluation of transition temperature evolution (NDT): is there enough samples available in case of life extension of the old units?

Answer The surveillance program of the reactor pressure vessels of the Belgian units was adapted in the nineties in order to provide information for fluencies corresponding to more than 60 years of operation with the existing surveillance capsules. This information is now available for most units and confirms the acceptability of the reactor vessel embrittlement in case of long term operation. For the Tihange 2 and 3 and Doel 3 and 4 units, 2 spare surveillance capsules were introduced recently in the vessel to ensure follow-up of irradiation beyond 40 years of operation and confirm the available information. Archive material is also available, should more capsules be necessary.

Q.No 50	Article Article 14.2	Ref. in National Report Section II.2.1.a, Page 96
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Question/ Comment It is mentioned that the safety level of Doel 1 & 2 was raised towards a level closer to that of most modern units. All analysis was compared to Reliability analysis of various systems. Please provide the important measures taken on the basis of this analysis. What modifications in the plant systems/procedures have been made against this analysis?

Answer The units Doel 1&2 have followed the American regulation at the construction. During the periodic safety reviews, a comparison has been imposed between the current regulation and the origin regulation. According to the conclusions of the periodic safety reviews, the safety report will include a summary table of the analyses of the safety rules. The procedures of Doel 1 & 2 were updated to be in

conformity with the procedures ERG (Emergency Response Guide). The GNS was implemented for protection against the external accident, duplication of the relief valve to the atmosphere and the installation of the new diesels have been launched.

Q.No	Article	Ref. in National Report
51	Article 15	II.K.3.c

Question/ Comment Related to radiation monitoring of environment: Who conducts the environmental monitoring program? Is there a environmental monitoring program by the licensee and another independent program by FANC?

Answer See answer to question 53

Q.No	Article	Ref. in National Report
52	Article 15	page 103, section II.K.3.a

Question/ Comment Are dose limits defined for the occupational exposure of trainees, students and pregnant women?

Answer For trainees and students (older than 18), the dose limit is 6 mSv/year, as specified in article 20.1.5 of GRR-2001 (compared to 20mSv/y for workers). Young people under 18 cannot work in an exposed area. Regarding pregnant women, article 20.1.1.3 specifies that any future child must have the same level of protection than the general member of the public, i.e. 1mSv/y. It means practically that no pregnant women can work in an environment where ionizing radiations are present.

Q.No	Article	Ref. in National Report
53	Article 15	Page 108, II.K.3.c. Radioactive Releases

Question/ Comment The report states that “radiation monitoring of the environment and assessment of public health impact is assured by a programme set up and managed by the FANC, as stipulated in Article 71 of the GRR-2001.”

Can FANC provide some additional information related to this programme and also indicate the role/responsibilities of the operating organizations in the implementation of this programme (or their own independent environmental monitoring programmes)?

Answer The sampling and measurement campaigns on the ground constitute the radiological monitoring of the territory. They make it possible to refine the radiological profile of the Belgian territory and enable the levels of natural and artificial radioactivity in the environment to be precisely evaluated and radiation doses to which the population is subjected to be assessed. They therefore systematically target the main areas of the environment and the principal components of the food chain liable to be contaminated and to which the population may be exposed: the air, atmospheric dusts, rain, river, sea and drinking water, the soil, river and marine sediments, river and marine flora and fauna, milk, meat, fish, vegetables, etc. The programme for the radiological monitoring of the territory currently relies on more or less 5,300 samples annually, which are subjected to almost 32,000 alpha, beta and gamma radioactivity analyses. All the technical content of the radiological monitoring programme (type, frequencies' of samplings, nuclides controlled, etc) is defined by the Agency. The samples are taken on behalf of the Agency by specialised teams from SCK•CEN and IRE. The frequency of sampling has been defined in such a way as to be in possession of information that is as useful as possible, while taking account of technical and material constraints. The samples are then analysed in the

laboratories of these institutions in order to determine the nature and level of radioactivity contained in them in very precise terms. A public tendering procedure has been used to select these institutes

Q.No	Article	Ref. in National Report
54	Article 15	Page 107, II.K.3.c

Question/ Comment What factors/parameters considered during the re-evaluation of authorized discharge limits contributed to the increase in public dose which is on average more than a factor of 10 for the respective pathways?

Answer The GRR-2001 transposed the European Directive 96/29/Euratom into the Belgian regulation. The definition of the dose changed: Use of effective dose in place of whole body dose and new dose-activity (Sv/Bq) conversion factors were introduced. A new dose limit was also imposed: 1 mSv/y for the members of the public. The radiological impact of the existing release limits of the NPPs were re-evaluated according the new dose definition, the new conversion factors, and some improvements in the calculation methodology (consideration of additional radionuclides, review of pathways, integration of local habits, ..). The values are different for Tihange and Doel sites because exposure pathways differ significantly for the two site. As the newly calculated radiological impacts were found acceptable (well below 1mSv/y) and in line with international practices, the discharge limits (Bq of specified nuclides) were not modified. The right part of the table (radiological impact of actual releases) shows that the actual impact is significantly lower.

Q.No	Article	Ref. in National Report
55	Article 15	Page 107, II.K.3.c

Question/ Comment What is the basis for the activity discharge limits for the two plants?

Answer See also answer to question 54.
The initial release limits were determined according the US rules 10 CFR 50 appendix I (design criteria) and 40CFR190 (ALARA aspect).

Q.No	Article	Ref. in National Report
56	Article 16.1	page 116

Question/ Comment "The report states that ""the HEC should be transferred to the AFCN emergency centre in April 2010, leading to several modifications for the Celevel organization, Bel V and AFCN"".

How did you manage these changes? Will they be permanent?"

Answer As a result of the creation of Bel V as subsidiary of the FANC, working groups are installed between the 2 organizations to establish working methods. One of the WG have analysed the emergency response organizations. The conclusions issued from this WG led to the integration of the duties, tools and documentation of the former HEC to the internal FANC emergency centre and to the strengthening of the evaluation cell of the GCC. In case of an emergency situation leading to the activation of the evaluation cell of the GCC, Bel V will therefore sent 2 experts on duty, one dedicated to the technical assessment and the other to the radiological assessment. All these changes are included in the Bel V internal procedures & instructions and are presently enforced for an unspecified period.

Q.No	Article	Ref. in National Report
57	Article 16.1	§16 - general question

Question/ Could Belgium present the main lessons learnt concerning the incident of the IRE

Comment (“Institut des Radioéléments”) in terms of the emergency response aspects?

Answer The main lesson learned from this event concerns the paramount importance of an early notification of the Authorities by the Licensee and a rapid exchange of as accurate and complete as possible information between the different stakeholders: from the operator up to the population, through federal and local authorities. In particular, the proximity role of the local authorities (mayors) to convey the information to the population affected by the protective actions decided at the federal level could be stressed. In addition, even for a relatively low importance event, this real incident confirmed human and material resources able to be mobilized in case of radiological event are and will be limited. This statement implies an efficient management of the priorities and an adequate allocation of available resources are key elements of the emergency response strategy.

Q.No	Article	Ref. in National Report
58	Article 16.1	II.L.2.a, page 112

Question/ Comment In the case that an emergency is quickly developing (fast kinetics), Belgium has introduced a pre-defined reflex-zone with ‘reflex’ protective actions, which is considered to be good practice.

Up to what distance is this zone defined?

Answer The extent of the so-called "reflex-zone" is based on an assessment of the accident scenarios fitting the criteria of this reflex-phase (fast kinetics with sufficiently high potential consequences). The extent of the reflex-zone is defined for each nuclear site concerned by this issue in 2 steps: after fixing of a scientific reflex zone by the Licensee and the Regulatory Body (technical & radiological assessment of reflex-scenarios), the reflex-zone is then translated by the authorities into an operational reflex-zone. This approach led to the following scientific reflex-zones :

- NPP (Tihange, Doel, Chooz): 3.5 km
- IRE Fleurus: 1.15 km
- BN/BP/SCK&CEN: 3.8 km

Q.No	Article	Ref. in National Report
59	Article 16.1	II.L.2.c, page 117

Question/ Comment It is stated that the emergency plan of each Belgian unit has been approved at the time of the licensing.

What regulatory procedure is implemented to ensure periodic revisions?

Answer The internal emergency plan is periodically reviewed, among other to take into account lessons learned from real events or from exercises. The revised emergency plan is distributed to different stakeholders (local & federal Authorities, FANC, Bel V&C).

In the frame of the Bel V/FANC inspection & oversight program, it is expected the Emergency Preparedness & Response programme established by the Licensees to be controlled every year or 2 years (depending of the type of Licensees) using a so-called Thematic Inspection. During these thematic inspections, one of the topics discussed with the Licensee is the overview of the main modifications introduced or to be introduced in a next future to the Emergency Plan.

In addition, a global assessment of the emergency planning will be done in the framework of the periodic safety review (SF-13 of the IAEA NS-G-2.10 Emergency planning). This work will be assessed by the Safety Authorities, with the other evaluations done for the PSR.

Q.No	Article	Ref. in National Report
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60	Article 16.1	page 117
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Question/ Does the National Emergency Plan consider post accidental protective measures?
Comment

Answer The National Emergency Plan describes in Â§6.6 how the emergency situation could be lifted. It is the responsibility of the Emergency Director of the authorities (Minister of Internal Affairs) to decide when the emergency plan could be lifted. At that time, the evaluation cell should verify if a long term procedure for the supervision is needed and establish the arrangements required to restore normal life conditions (return of evacuees, food chainâ€).).

Q.No	Article	Ref. in National Report
61	Article 16.1	Page 117, II.L.2.c

Question/ How are the outcomes from emergency exercises handled to determine if the
Comment emergency arrangements are still adequate?

Answer After each emergency exercise, evaluation of the statements, identified weaknesses and strengthsâ€ are performed at different moments(just after the end of the exercise as a Hot-debriefing, about 3 to 4 weeks after the exercise) & levels (Licensee, Evaluation cell, Rescue servicesâ€) and are recorded. On yearly basis, as required by the National Emergency Plan (Â§10.5), a global evaluation report is established with identification of the lessons learned and correctives actions from the exercises.

Q.No	Article	Ref. in National Report
62	Article 16.1	Page 104, II.L.2.a

Question/ What is the radius of the reflex zone (how many kms) ?
Comment

Answer See answer to question 58

Q.No	Article	Ref. in National Report
63	Article 16.2	II.L.2.d

Question/ Regarding information to the public about the Emergency Plan: What kind of
Comment information is provided to the public before an emergency? Is there public participation in the Emergency Exercises?

Answer There are mainly 2 kinds of information channels for the population prior an emergency or an exercise: periodic general information campaigns focussed on radiological risks to be organised in accordance with the European Directive 89/618/EURATOM and specific information sessions organised for selected target groups in the frame of emergency exercises, if appropriate (depending of the scope, objectivesâ€).

For the first category, the delivered information should cover at least the following topics:

- basic information on radioactivity & effects on people and environment
- types of radiological emergencies and their consequences for people and environment
- kinds of protective measures considered

- information about the expected behaviour of the population in case of emergency

Within the second category, specific information material could be developed during the preparation phase of a specific exercise. Some examples of such developed materials: FAQ-brochure focussed on agricultural protective measures, general information brochures for a specific exercise distributed to the local populationâ€ In addition to these information material, in some emergency

exercises, information sessions dedicated to the local population could be organized.

During some exercises, some dedicated population groups (such as schools or farmers) could be invited to take part to the exercise or a part of it, but it is not systematic as it depends of the scope and objectives of the exercises.

Q.No	Article	Ref. in National Report
64	Article 17.1	page 124

Question/ The connection of the plant to the external electric grid is an important siting aspect. It may be an advantage the plant being not connected to an end of a line, but embedded in a strong external grid. The external grid should be rigid enough to withstand disconnection from the plant and start of power supply from outside to the plant.

Comment The connection of the plant to the external electric grid is an important siting aspect. How are the nuclear units ramified in the external grid ? What criteria do you use for the reliability of the external grid especially regarding possible power dips ?

Answer In Belgium the external electric grid is a rather meshed and dense web. The two Belgian nuclear sites of Doel and Tihange are located one in the north and the other one in the south of the country. Each sites produces respectively 2816 MWe and 2985 MWe.

The Belgian Safety Authorities do not have criteria for the reliability of the external grid regarding possible power dips.

In order to realize the primary and secondary frequency control the UCTE-rule 1998 recommended that a power reserve is able to compensate the instantaneous loss of 3000 MW (i.e. loss of two units of 1500 MW) in the UCTE grid. In order to meet these recommendations the Belgian participation to the primary frequency control has been calculated on the basis of its contribution to the European grid production (about 4 %) and has been distributed among the nuclear production and the classic production.

From 1999 the Belgian participation to the primary frequency control has been extended to all the nuclear power units. The secondary frequency control has not been installed in the Belgian nuclear power units.

In each NPP new functions have been added in the speed control of the main turbines in order to produce an extra power production (max. 2.5 % of the rated power) in a short delay (30 s) in case of severe frequency dips in the European grid (i.e. trip of big power units).

Before the operation of the primary frequency control the power of the concerned nuclear unit is brought down to 97.5% of the rated power because the power may not exceed the rated power during the regulating.

The frequency control is in operation in case of:

- o A slow frequency variation when the deviation of the frequency is higher than 85 mHz vs the rated frequency
- o A quick frequency variation when the sudden frequency dip is higher than 35 mHz

Q.No	Article	Ref. in National Report
65	Article 17.1	Pg. 126: II.M.1.b. Periodic Reassessment

Question/ Comment What additional emergency systems were installed following the 1st PSR of Doel 1 and 2?

To what standards and analysis rules were these systems designed, constructed and being maintained?

Answer The emergency systems building (2nd level of protection) were installed following the 1st PSR to cope with several concerns: protection against earthquakes, protection against external hazards (explosion, large fire, aircraft crash), some fire scenarios, some High Energy Line Break-hazards, etc.

This building accommodates the following systems: an emergency feedwater system, an emergency injection system for the primary pump seals, an emergency control room and a number of support systems (compressed air, ventilation, equipment cooling, spent fuel pool cooling, power supply from own diesel generator set and batteries, I & C equipment).

More information can be found in Section III.C.3 of the national report.

The emergency systems and the existing SSCs needed to bring the reactor to safe shutdown were designed and/or qualified against the hazards for which they are supposed to provide protection (see above). In contrast to the emergency systems for the last four units, the emergency systems for Doel 1&2 are not fully automatic (some systems start automatically; others not). It has also been accepted that these emergency systems are not fully redundant (some systems are redundant; others not).

More information on the design basis of the emergency systems can be found in Section III.C.4 of the national report

Q.No	Article	Ref. in National Report
66	Article 17.1	Pg. 124: II.M.1.a. Characteristics

Question/ Comment What return periods were considered in the determination of the site parameter envelop for the various natural phenomena such as seismic, flooding, etc. and what is the basis for the return periods?

Answer For seismic events, the studies used are based on the deterministic method. For each area seismological near to the power stations, the maximum seism was found according to the official historical data. The attenuations values were calculated between the unit and the border of the tectonic plates. The macro seismic scale of the site provides the acceleration (including a coefficient safety margin). The acceleration allows to study the spectrum according to the RG 1.60. With regard to external flooding, the ground level of the Tihange site presents sufficient margin with respect to the height of water associated with the secular flood of 1926. For the Doel site, the embankment presents sufficient margin with respect to the tide level.

Q.No	Article	Ref. in National Report
67	Article 17.2	II.M.1.b, page 126

Question/ Comment ` Also, a review of the protection of Tihange 1 against external accidents was performed: the

probability was assessed that an aircraft crash would result in unacceptable radiological consequences; taking into account the specificities of the buildings, that probability was found sufficiently low.`

Is there an indication of radiological consequences on the plant or at the plant fence ?

Answer No estimation or calculation of radiological consequences has been carried out. The acceptability is based on the value of the probability per year of an aircraft crash (including the fire risk) and a structural integrity analysis of the reactor and water and steam buildings for the design basis aircraft.

Q.No 68	Article Article 17.3	Ref. in National Report Sect. II.M.1.b
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Question/ Comment For the Tihange site the 'possible rise in temperature due to climate changes' has been considered. What was the scientific basis (i.e. data and methods) for this assessment?

Answer During the periodic safety review, the extreme climatic design parameters are examined based on historical data from the ten last years. The data come from reference meteorological stations. Trends were studied in order to make estimations for the next ten years.

Q.No 69	Article Article 17.3	Ref. in National Report p.17
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Question/ Comment Is the capacity of the Doel fire brigade sufficient to meet a fire from a big aircraft crash on the NPP or is in that case assistance from other fire brigades required ? In what time frame could be reacted ?

Answer Doel NPP owns trucks on site that deliver sufficient foam capacity to face a fire caused by a big aircraft crash on the NPP. For impact on top of the reactor building, assistance is required and foreseen from off-site fire brigades, located in Beveren and ready for on site intervention within 20 minutes.

Q.No 70	Article Article 18.1	Ref. in National Report page 131 - 132
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Question/ Comment With respect to the mentioned periodic safety reviews, what are the improvements implemented since the last report due to deterministic and probabilistic assessments?

Answer At Tihange 1, a renovation of the polar crane has been performed, based on an analysis of actual regulatory references (not available at the design stage). It includes a.o. the adjunction of emergency brakes on the main axis, of a surveillance system of the kinematic chain, of lock devices and the replacement of an overload limitation system.

Installation of new supports on some piping at Tihange 1, to replace existing fixed points with a better design; at Tihange 2.

Closure during normal exploitation of the connecting line between recirculation sumps and vessel cavity, to ensure a better cooling of the corium in case of severe accident.

Some pipe supporting structures were modified.

At Doel 3 and Tihange 1, the T1-testconsole has been partially renovated.

At Doel 4, the personal dose monitors have been replaced.

SCK:

For the BR1-reactor: the installation of an uninterruptible power source.

For the BR2-reactor: for the control rods, the old cadmium absorbers were replaced by hafnium. A second modification was the installation of a number of uninterruptible power sources for the control rooms.

Q.No	Article	Ref. in National Report
71	Article 18.1	Pg. 129: II.N.1.a. Rules

Question/ Comment A copy of the transposition of the ASME code will be useful information to the NNR as South Africa is facing similar challenges..

What was (and is) the Regulatory Authorities role with the certification of AIA's.

Answer The transposition of the ASME Code is a document developed by the Utility and its architect engineer. It therefore belongs to the Utility Electrabel " GDF Suez and can only be transmitted with their consent.

The Belgian AIAs are not certified by the nuclear authority but by the Ministry of Labour in as far as the equipment is submitted to Belgian regulations.

The Owner may entrust the AIA assignment to an independent entity only in the case of repair or replacement of class 2 or 3 equipment not covered by:

- Derogation Ministerial Decree regarding the nuclear boiler and steam components
- Royal Decrees regarding the erection and operation of the units, in which are specified requirements that apply to (i) pressure vessels and equipment (pressures higher than 1 bar having a capacity of more than 300 l) for which there are no regulatory stipulations, (ii) compressed air tanks

The nuclear regulatory authority performs general surveillance of the activities performed by the Utility, architect engineers, subcontractors, inspection results etc.

Q.No	Article	Ref. in National Report
72	Article 18.1	Pg. 129: II.N.1.a. Rules

Question/ Comment Do the bunkerised structures include the containment building itself?

If not, what is the design basis aircraft specification for containment and how is beyond design basis aircraft treated?

Answer For the units 2 and 3 of Tihange and the units 3 and 4 of Doel, the , the bunkerised systems (including the containment building) have been designed to withstand a large commercial aircraft crash. For unit 1 of Tihange and twin units 1 and 2 of Doel, the structural integrity of the containment building was verified for small civilian aircraft (up to 5,7 tons at a speed of impact of 100 m/s), with the use of conservative hypothesis, since this aircraft family contributes the most to the overall aircraft crash occurrence.

An assessment based on realistic hypothesis, has shown that for large commercial aircraft the integrity of the primary containment is preserved.

Q.No	Article	Ref. in National Report
73	Article 18.2	II.N.1.d, page 132

Question/ Comment Extension of the time frame of the PSA after the initiation of the presumed event may lead to higher calculated core damage frequencies, which later on may be decreased by further design modifications and accident management.

Which calculation time frame, starting from an initiating event is applied for the

PSA ?

Answer A time frame of 24h is considered for the PSAs in Belgium (except for the LOOP). This is the international practice. In the framework of WENRA Reference Levels, a longer time frame (72h) should be assessed in order to get insights on the possible modifications/accident management actions.

Q.No	Article	Ref. in National Report
74	Article 18.2	II.N.1.f, page 133

Question/ Contradicting action from main and emergency control rooms should be prevented.
Comment Is it possible to having completely switched off the main control room while operating/ monitoring the plant from the remote safety panel ?

Answer Specific design dispositions have been taken to be able to allow safe shutdown by either cutting off all orders from the main control room when operating from the remote safety panel (complete switch off), or either by operating from the remote safety panel in the presence of spurious signals originating from induced failure in the case of total loss of the main control room.

Q.No	Article	Ref. in National Report
75	Article 18.3	page 133

Question/ With respect to the requirements of a reliable, stable and easily controllable
Comment operation what kind of improvements regarding the topic man-technology-organisation are being made for a reliable and appropriate plant design?

Answer Systematic consideration for human performance related aspects is ensured in the event analysis process. The modification process integrates the man-machine related aspects. Next to those already mentioned in the report, examples are plant status control monitors or alarm management systems. In addition, computerized systems allow direct monitoring of critical equipment parameters form the main control room.

Q.No	Article	Ref. in National Report
76	Article 19.1	II.O.1.h, page 140

Question/ How are failure figures for PSA collected ?
Comment Are data bases dealt with plants from equal design ?

Answer A recent OECD/WGRISK report (2010) mentions the following text, that was proposed by the NPP licensee and approved by Bel V and FANC :

For the PSA update, the following methodologies on data are used:

- Initiating event frequencies are generic, plant specific or a bayesian combination of generic and specific data when the feed back of experience is not sufficient to be used alone.
- Unavailabilities of system components or trains (programmed or non-programmed) are based on plant operating experience.
- Component failure rates are based on the Swedish T-book. Plant-specific reliability data are not used.
- The CCF-modelling is based on the Alpha factors and uses generic CCF-parameter data.
- For human reliability, as well pre- as post-initiating-event human errors are modelled, by using a methodology that is largely based on the THERP and ASEP methodologies. Test and maintenance activities are covered in the pre-initiating

event human reliability analysis. Errors of commission will be identified and included in the PSA models. Human errors caused by the change of state of the plant are also included in the PSA models.

Q.No	Article	Ref. in National Report
77	Article 19.1	II.O.1.h, page 140

Question/ Comment Is the OE- FB program also serving the PSRs ?

Answer In the current and upcoming periodic safety review, OE is considered as a safety factor as a whole, following the IAEA document NS-G-2.10 en NS-G-2.11. the OE-process has to be evaluated according to a very ambitious methodology, covering events internal and external to the organisation, as well as information originating from research programs.
In the completed periodic safety review, OE-FB was not evaluated as a process, but it was used to select candidate topics or to evaluate them.

Q.No	Article	Ref. in National Report
78	Article 19.1	II.O.2.e

Question/ Comment Are any specific problems expected in the RR control rod mechanism ? What kind of degradation mechanisms would be expected ? Is the direction of a degradation always safe ?

Answer Control rods of BR1:
BR1 has 6 safety rods (S-rods), 10 rods for coarse control (C-rods) and 2 fine regulation rods. The rods are connected with a steel cable to a winch. The cables of the S and C rods are connected to the winches by an electromagnetic clutch. In case of a SCRAM demand (manually or by instrumentation), the clutches are opened and the S and C rods drop in the core by their own weight. The C rods are released faster due to their higher weight. Normally, the reactor is stopped by the C rods because these are already partly introduced in the core. This simple system is easy to maintain and has never shown unsafe failures.

Control rods of BR2:

The BR2 control rods consist of different parts, namely:

- The absorbing part and the beryllium follower. The absorbing part is replaced when the antireactivity becomes too low. In the past the absorbing material was cadmium. In 2010 it was replaced by hafnium, which can be used for at least 1000 effective full power days.
- The scram mechanism. This is the connection between the absorber and the driving mechanism. The connection is made by a latch mechanism which is kept closed by an electromagnet. The absorbing part is spring loaded. When the current in the electromagnet is cut, the latch opens en the absorber is driven in the core by the spring and its own weight. The scram mechanism is still of the original design and has never had an unsafe failure. The magnet has been improved during the years using a better magnetic core. This improved the reliability in a significant way.
- The driving mechanism which consists of a worm drive to convert the rotation of the motor to the axial movement of the rod. The mechanism was replaced in the years 2006 and 2007. This mechanism is totally independent of the scram mechanism cannot be responsible for unsafe faults.

- The motor drives which were replaced together with the driving mechanism.
- The position indicators which are mounted on the driving mechanism. The old selsyn system was replaced on the occasion of the modernization of the dring by a double, redundant, resolver system.

The control rod system undergoes the normal wear. Due to the modular construction of the control rods it is easy to replace a component which is defect or has become unreliable. A number of spare control rods mechanisms and absorbers is available, such that a failed component can be rapidly replaced.

The control rods are loaded in guide tubes, such that the probability of blockage of a rod is reduced. These guide tubes must be replaced after a predefined fast neutron fluence according to the technical specifications.

Q.No	Article	Ref. in National Report
79	Article 19.1	General

Question/ Comment What role do the Safety Authorities (FANC and Bel V) have in the review and approval process (initial and subsequent) of operating procedures such as the Technical Specifications, Incident and Accident Management procedures, In service Inspection programmes etc..?

Answer FANC has no role in the review or approval of operating procedures; this role is delegated by FANC to Bel V.
 Technical Specifications are reviewed and approved by Bel V.
 Other operating documents are transmitted to Bel V but are not formally approved by Bel V (they may be commented if judged necessary).

Q.No	Article	Ref. in National Report
80	Article 19.1	II.O.1.h. Operational Experience Feedbac

Question/ Comment The Article describes the OEF programme of the operating organizations. Do the Safety Authorities (FANC and Bel V) have their own independent Operating Experience Feedback(OEF) programme to monitor amongst other trends of nuclear safety at operating organizations? If yes please describe the main elements of this programme.

Answer Bel V has a quality system in which a subprocess describes the experience feedback system. It consists roughly of keeping data bases of national and internationally reported incidents up to date and analyzing the applicability to Belgian nuclear installations. The results are used during the inspection of the experience feedback systems of the nuclear utilities.
 The system also provides for the preparation of INES reports.

Q.No	Article	Ref. in National Report
81	Article 19.1	Page 138, Section II.O.1.f

Question/ Comment The report refers to the Engineering Support Department, and says it also "...acts as the design authority."

Noting that the report also says Tractebel Engineering "...acts as the responsible designer", could Belgium clarify whether the Engineering Support Department is part of licensee (Electrabel), or whether it is part of licesees contractor (Tractebel)?

Answer The Engineering Support Department is part of licensee (Electrabel)

Q.No	Article	Ref. in National Report
82	Article 19.2	II.O.1.b

Question/ Comment Regarding Technical Specification: Have the "Westinghouse improved technical specification" (Revision 1 of NUREG 1431 "Standard Technical Specifications -

Westinghouse Plants”, 04/07/1995) been adopted in the Belgium plants?

Answer NUREG 1431 is not adopted as such, but is a (main) reference for the Technical Specifications of the Belgian plants.

Q.No	Article	Ref. in National Report
83	Article 19.2	Para II.O.1.h, page 140

Question/ Comment Which criteria are usually referred to in the Annual Report on Self-Assessment in Chapters on Operations and Maintenance?

Answer Inputs for self-assessments are key performance indicators, condition reports, event reports, task observations, external and internal assessment results and yearly objectives.

Q.No	Article	Ref. in National Report
84	Article 19.3	II.O.2.b

Question/ Comment Are experts from Bel V helping FANC during licensing of significant modifications, which requires a licence amendment?

Answer A major or significant modification requires a new license application, and follows a licensing scheme similar to that described section II.C.8 of the report. The safety review of the significant modification is indeed performed by experts from Bel V. The results of this review are presented to the FANCs Scientific Council. (See also section II.J.2.a page 96-97)

Q.No	Article	Ref. in National Report
85	Article 19.6	II.O.2.c

Question/ Comment What are the NPP’s obligations to the Regulatory body regarding reporting of unusual events?

Answer Nuclear power plants operators must notify to the authorities every event significant for safety occurring in their facilities. There are two different categories of events that must be notified.

- The Royal Decree of 17 October 2003 establishing the Nuclear and Radiological Emergency Plan for the Belgian Territory states that each operator must include in its internal emergency plan a list of events that could have an impact on the population, the workers or the environment. Those events are characterized by notification levels N1, N2, N3 and NR. When such an event occurs, the operator must immediately alert the Coordination and Crisis Center of the Federal Government, which is in charge of activating the national nuclear emergency plan. The safety authorities (FANC and Bel V) are then immediately informed that an event has occurred and they play an essential role in managing the crisis.

- The second category encompasses events that, at first glance, are less serious, such as anomalies on equipments or systems, non-compliance with technical specifications, etc. The safety report for each nuclear reactor indicates that this kind of events must be notified to the FANC and/or Bel V in a relatively short time, depending on the type of anomalies. That time can range from immediately to the next working day after the event.

At the end of 2010, the FANC and Bel V produced a guidance that clearly lists the safety authorities requirements for significant events occurring in Class I nuclear facilities (especially nuclear power plants) and affecting nuclear safety or radiological protection of people and the environment. This note is without effect for the first category of events, but not for the second one. The guidance lists the (sorts of) events that require notification to the safety authorities when occurring.

The guidance also describes how such events must be notified to the safety authorities and will come into force on the 1st of April 2011.