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The impact of the disaster that occurred in March 2011 at the Fukushima-Daiichi nuclear power plant continued to affect the programmes and activities of both national and international organisations in 2012. In the wake of this tragic event, Bel V deployed considerable resources to review the action plans drawn up by the operators and to monitor their implementation, both at Belgian level as well as through European initiatives.

2012 was also marked by the detection of flaw indications in the steel material of the reactor pressure vessels at Doel 3 and Tihange 2. According to current assessments, these flaws are highly likely to have been manufacturing defects, and would have no impact on the reliability of the vessels. However, acting on the precautionary principle, the two units concerned were shut down while awaiting the go-ahead for their continued operation from the safety perspective. The justification file was submitted by the operator at the end of the year and was still under review in early 2013.

Bel V’s mission of monitoring the safety of Belgian nuclear facilities is part of the overall inspection and control strategy developed in close collaboration with the Federal Agency for Nuclear Control (FANC). In 2012, in addition to the events listed above, special attention was paid to the way the operators develop their safety culture and manage sub-contracting. The annual safety evaluation of the various facilities was carried out according to the standards of our quality system. This evaluation is presented by Bel V to each operator and discussed with its management in the presence of the FANC. The results of the annual evaluation are used for drawing up the control program for the following year.

Bel V is ISO 9001 certified. Continuous improvement of the quality of our service remains one of our key priorities. In 2012, specific actions were undertaken to significantly improve the integration of operating experience feedback and to implement a new set of performance indicators.

At the request of Belgium an IAEA Integrated Regulatory Review Service (IRSS) has been scheduled for late 2013. In order to prepare for this IRSS, the FANC and Bel V carried out a self-assessment exercise in 2012, based on the IAEA questionnaire. This exercise resulted in the development of an action plan, which will continue to be implemented in 2013.

Finally, I would like to thank and congratulate the management and the entire workforce for their day-to-day commitment to the performance of their duties, which they carry out with great dedication.

Michel JURISSE, Ir
Chairman of the Board of Directors
Bel V, an incorporated foundation, was founded on 7 September 2007 by the Federal Agency for Nuclear Control (FANC).

It is governed by the Belgian Act of 27 June 1921 on non-profit associations, international non-profit associations and foundations, and by its own Articles of Association as filed at the registry of the Brussels Court of First Instance.

Not intended for any pursuit of profit, it aims to contribute technically and scientifically to the protection of the population and the environment against the dangers of ionizing radiation.

In 2012, the Board of Directors was composed of:

**Ir M. Jurisse,**
former Chairman of the Board of the FANC

**Ph. De Sadeleer,**
current Chairman of the Board of the FANC

**Ir W. De Roovere,**
General Manager of the FANC

**P. Roose,**
member of the Board of the FANC

**Ir J. Vereecken,**
doctor in applied sciences, professor at the VUB
The effect of the Fukushima accident continued to impact the nuclear industry throughout 2012. For nuclear power plants, Bel V participated in the peer review organised by the European Commission and followed up on the operators’ action plans. For nuclear facilities other than nuclear power plants, Bel V evaluated the reports drawn up by the operators in accordance with the specifications of the FANC, and submitted its findings to the FANC.

For several years now, Bel V has been evaluating the justification file on the continued operation of Doel 1/2 and Tihange 1 beyond 40 years. In July 2012, the Belgian government decided to authorise operation of Tihange 1 for another 10-year period (i.e. until 2025) and to close Doel 1/2 permanently. This resulted in preparations for the end of operation and future dismantling of the latter two units.

Several dismantling projects are under way or in the preparatory phase. The dismantling of BR3 at SCK•CEN and of the Belgonucléaire factory are being monitored in the context of the inspection of these facilities. There are plans to begin dismantling the Thetis reactor of Ghent University and the FBFC fuel factory at Dessel in the near future. Monitoring these projects provides Bel V with the opportunity to acquire knowledge and expertise that will be useful for preparing the supervision of the dismantling of Doel 1/2.

The pre-licensing phase concerning the future facility for the disposal of radioactive waste in Dessel, for which ONDRAF/NIRAS will be the licensee, came to an end in late 2012. Bel V cooperated very closely with the FANC in both the development of the requirements and verifying how these requirements will be met. It is expected that the official licence application will be submitted by ONDRAF/NIRAS in early 2013. The evaluation of the safety analysis report on the facility will then begin in accordance with the principles laid down in the pre-licensing phase.

Another project in pre-licensing phase is the MYRRHA project of SCK•CEN. Bel V is working closely with the FANC to establish a set of requirements that must be met. The innovative nature of this project led to the identification of a set of focus points that may present difficulties in assessing safety. Bel V is analysing how SCK•CEN intends to these resolve these focus points.
In 2012, Bel V became a member of the European economic interest grouping ENSTTI (European Nuclear Safety Training and Tutoring Institute). This institute is an initiative of the European Technical Safety Organisations Network (ETSON), of which Bel V is a member. It provides high-level training courses in nuclear safety. The participation of Bel V in this organisation is intended both to strengthen its staff training programs and to enhance its visibility at international level.

2012 saw a significant increase in research and development at Bel V. Bel V’s main investment areas are:

1. Fire protection, and in particular fire modelling, with a view to improved control of the fire prevention and fire-fighting measures implemented at nuclear facilities.

2. Modelling of severe accidents, through the acquisition of the US MELCOR code. Severe accidents are those that lead to a melt-down of the reactor core, as in Fukushima. Profound insight into the phenomena involved in such accidents is key to limiting their impact.

3. Radioactive waste management. The extent of the waste management issue and the advancement of the project for a long-term disposal facility in Dessel led us to significantly scale up our activities in this field. This involves, in particular, joint actions with our French counterpart IRSN, which operates the Tournemire underground research facility on disposal in a clay formation, as well as the funding by Bel V of doctorates at Belgian universities.

Benoît DE BOECK, Ir
General Manager
Regulatory activities in Belgium
1 Regulatory activities in Belgium

1.1 General assessment of nuclear facilities

1.1.1 Nuclear power plants

A follow-up Operational Safety Review Team (OSART) inspection was conducted at the Doel nuclear power plant in March, in order to evaluate the results of the action plan that had been drawn up based on the results of the OSART mission conducted at the Doel nuclear power plant in March 2010. Results were considered as very good. The process of ‘continuous improvement’ is still ongoing after this mission.

An ‘article 35’ inspection was conducted by the European Commission at the Doel nuclear power plant in June. This inspection is focused on the measurement and declaration of radioactive releases. Results were considered as very good.

The Long-Term Operation (LTO) project is ongoing, in spite of the political uncertainty regarding the decision to authorise operation of Doel 1/2 and Tihange 1 for another 10-year period, i.e. until 2025. A governmental decision was taken in July 2012 to close Doel 1/2 in 2015 and to allow Tihange 1 to operate until 2025, but this decision has yet to be confirmed by an amendment to the law. An action plan has been drawn up for the improvement of Tihange 1, based on the safety evaluation report established by Electrabel and reviewed by the Federal Agency for Nuclear Control (FANC) and Bel V (see section 2.3). Specific inspections were carried out in the context of the follow-up of this action plan. Electrabel has to develop an action plan for the end of operation of Doel 1/2 and the future dismantling. Discussions about this subject have been initiated between Electrabel and the FANC / Bel V.

In the wake of the Fukushima accident, operators were asked to conduct stress tests (see section 2.4). Safety evaluation reports for the 2 sites have been established by Electrabel and reviewed by the FANC / Bel V and external experts. Action plans have been developed. Various modifications were made to the facilities or are in the process of implementation. Specific inspections were carried out at Doel and Tihange to monitor the implementation of these modifications.

Flaws were detected in the reactor pressure vessels of Doel 3 (in June) and Tihange 2 (in September) during outage. Both units remain shut down until cleared for start-up.

1.1.2 Other nuclear facilities

Following the Fukushima accident, all Class I nuclear facilities in operation conducted stress tests. Safety evaluation reports have been drawn up by the operators and are under review by the FANC / Bel V.

Tests and conformity checks were carried out throughout 2012 for Guinevere, the new facility at the Nuclear Research Centre (SCK•CEN). Coupling of the accelerator to the reactor core occurred in September 2011 and tests were done in 2012 for commissioning. Guinevere is a test installation, a step in the development of the MYRRHA project, for which study is ongoing (see section 2.6).

A number of different projects are still under study at BR2 with a view to continuing operation after 2016: conversion of HEU-LEU (utilisation of low enriched uranium instead of high enriched uranium), replacement of the beryllium matrix, etc.
Dismantling activities are ongoing at Belgonucléaire, without any significant contamination incident.

A Fast Limited Inspection with Thematic Scope (FLITS) was conducted by the FANC / Bel V at Belgoprocess in January, focusing on safety and safety culture, waste treatment and housekeeping.

Examination by Belgoprocess of the management of the liquid effluents coming from the National Institute for Radioelements (IRE) continued in 2012, in particular concerning the chemical compatibility of effluents from different origins.

The challenges for the management of the IRE remain numerous. Improvement of the safety culture is ongoing. Various action plans are being implemented, including for the disposal of historic waste.

A number of different projects are under study: conversion of HEU-LEU for the targets, reprocessing of uranium for recycling, design study of a new facility, increase in production (higher number of targets per week), etc.

Efforts are continuing to improve the safety culture at other facilities of the Fleurus site, Best Medical Belgium (previously MDS-Nordion) and Sterigenics.

MDS-Nordion was taken over by Best Medical Belgium (BMB) in 2011, but the latter was declared bankrupt in 2012, and part of the facilities are now operated by the Belgian Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS) and part by NTP. Some undeclared radioactive sources were discovered. Radioactive waste accumulated on site has to be eliminated.

There is still no solution for the evacuation of old degraded sources of Sterigenics which are stored in the pool.

The licence for the dismantling of the Thetis research reactor has been issued (Royal Decree of 15/05/2012).

1.1.3 Integrated control strategy

The integrated strategy for inspection (by the FANC) and control (by Bel V) was applied in 2012.

The control program for 2012 was sent to the facilities at the beginning of the year. Performance indicators are used to monitor the execution of the program.

The annual safety evaluation of the various installations has been completed. The evaluation was presented to each operator and discussed during meetings between the FANC, Bel V and the head of each facility at the end of the year.

More attention is devoted to human factors and human performance, safety management and the development of a safety culture. In particular, the use of ‘safety culture observation sheets’ (drawn up in 2010) was continued and improved in 2012.

A computer tool has been developed in order to enable better follow-up of the actions required of the licensee after inspections conducted by Bel V experts at the various facilities.
1.2 Overview of inspections at nuclear power plants

The regulations require permanent inspections during operation of the 7 Belgian nuclear units. The aim of these inspections is to verify compliance with the licence, and to assess the licensee’s safety management and safety culture. About 440 inspections were performed at the 7 Belgian nuclear units in 2012.

An overview of the main inspection activities performed by Bel V inspectors is given hereafter for each unit. 11 events were rated as level 1 (anomaly) on the INES scale in 2012.

1.2.1 Doel 1/2

The annual refuelling outage at Doel 1 took place between 16/11/2012 and 11/12/2012.

Doel 2 was shut down for refuelling between 13/04/2012 and 31/05/2012.

The common annual outage for safety injection and diesel sequences tests took place from 27/04/2012 until 6/05/2012. During this common outage, 3 new safety diesel generators were installed.

Doel 1 had no reactor trips.

Doel 2 had 1 reactor shutdown on 22/06/2012 followed by a switch to cold shutdown in order to repair a leak in the unloading pipe. On 25/06/2012 the unit was restored to full capacity.

One event was rated as level 1 (anomaly) on the INES scale: the exceeding of the TS criterion during leakage tests on a number of containment penetration valves at Doel 2.

Since the government announced its decision concerning the definitive closure of Doel 1/2, Bel V has been closely involved in the ‘definitive shutdown’ project in preparation for the decommissioning and dismantling of the units. We would like to emphasise that during the various phases of the shutdown, the same standards for nuclear safety and radiation protection will be adhered to as during operation.

1.2.2 Doel 3

The unit operated at nominal power during the period from 1/01/2012 to 31/05/2012. On 1/06/2012 the annual refuelling outage started.

During the in-service inspections of the reactor pressure vessel in June and July, a large number of indications were found. After review, it was concluded that these defects date back to the original manufacturing of the vessel. While the justification of the mechanical integrity of the reactor pressure vessel is being assessed, the unit is kept in cold shutdown. The core is unloaded to the spent fuel pools, and the systems are maintained in an appropriate conservation state.
Three events were rated as level 1 (anomaly) on the INES scale:
- confirmation of INES 1 level after a re-evaluation (based on more complete data) of the observation in 2011 of an inaccurate setpoint of an electrical protection of certain classified equipment;
- the presence of a large number of defects in the reactor pressure vessel (preliminary INES evaluation);
- partial inoperability during 1 cycle of the automatic flow regulating system in the auxiliary feedwater system.

1.2.3 Doel 4

The unit operated at full capacity throughout the year, except for:
- a planned outage on 18/02/2012 in order to repair the casing around the star point of the alternator (vibration damage) and to lower the vibration level of the alternator axis;
- a planned outage from 23/03/2012 to 30/03/2012 in order to repair a steam leak in the feedwater pump and to repair an internal leak in a moisture separator-reheater of the turbine group;
- an unplanned outage between 19/04/2012 and 23/04/2012 in order to repair a main steam isolation valve as a result of a reactor trip on 19/04/2012 due to a faulty connection on an electrical board;
- a planned outage from 29/09/2012 to 2/11/2012 for 18-monthly maintenance and refuelling;
- a reactor trip upon start-up after maintenance, during a planned test of the turbine speed control system on 2/11/2012; the unit was back to full capacity as from 5/11/2012.

1.2.4 WAB/GSG/SCG

The yearly GOW maintenance (Groot Onderhoud WAB) took place in January 2012.

No events were rated on the INES scale for WAB, GSG or SCG.

1.2.5 Doel site

The Bel V control program at the site was implemented as follows:
- Meetings were held with the managers of various departments (Maintenance, Operations, Care, Engineering) and services in order to evaluate their organisation and the management of various processes relating to nuclear safety or radiation protection.
- More attention was paid to human factors and human performance, housekeeping, resolving minor deficiencies, etc., in the light of the importance of continuous improvement.
Bel V provided support to the FANC within the framework of its inspections, especially the inspection relating to management.

Bel V was also closely involved in the BEST (BElgian Stress Tests) project, which resulted in various changes to facilities and procedures.

1.2.6 Tihange 1

The unit operated at nominal power, except for the following periods:

- from 2/02/2012 to 10/06/2012, when the unit operated at 50% of nominal power, running on only the South turbine-generator group, as a result of the inoperability of the North turbine-generator group due to an electrical failure in the alternator stator;
- from 10/06/2012 (after the repair of the North turbine-generator group) until 26/08/2012 (return to nominal power), when the unit operated at 85% of nominal power in order to allow for reconditioning of the nuclear fuel elements.

Two events were rated as level 1 (anomaly) on the INES scale:

- the inoperability, for a period of 7 days, of one of the 2 safety diesel generators following a cooling circuit valve lockout error;
- the inoperability of a group of fixed heaters of the pressurizer as a result of the improper and undocumented lockout of an electrical command-and-control cell of this group.

1.2.7 Tihange 2

The unit operated at nominal power throughout the year, except for:

- a reactor trip on 17/04/2012, due to an alignment error on an electrical board during a test;
- from the beginning of the outage that occurred on 16/08/2012.

Four events were rated as level 1 (anomaly) on the INES scale:

- the failure to verify the threshold delay of a protection system for the diesel generator groups;
- the failure to perform a complete qualification of a battery pack, although this was required;
- the low phreatic level;
- the presence of indications in the thickness of the vessel.
1.2.8 Tihange 3

The unit operated at nominal power throughout the year, except for:

- a refuelling outage from 1/03/2012 to 11/04/2012; mention should be made of:
  - the confirmation of a leaking fuel assembly, which was not used for the next cycle;
  - the spurious discharge of the safety accumulators in the primary circuit;
  - the shift from cold shutdown to intermediate shutdown state while the sprinkling pumps in the reactor building were still locked;
  - a head injury sustained by an agent in a controlled zone; the agent was taken to the CHU in Liège, where it was confirmed that he had not been contaminated;
- a reactor trip on 12/04/2012, due to a high level in a steam generator;
- a shutdown on 12/10/2012 in order to top up the oil in the primary pumps.

Two events were rated as level 1 (anomaly) on the INES scale:

- the spurious discharge of three safety injection accumulators in the primary circuit;
- the shift from cold shutdown to intermediate shutdown state while the sprinkling pumps in the reactor building were still locked.

1.2.9 Tihange site

The Bel V control program at the site was implemented as follows:

- Meetings were held with the managers of various departments (Maintenance, Operations, Care, Engineering) and services in order to evaluate their organisation and the management of various processes relating to nuclear safety or radiation protection.
- Attention was paid to human factors and human performance, housekeeping, resolving minor deficiencies, etc., in the light of the importance of continuous improvement.

Bel V provided support to the FANC within the framework of its inspections, especially the inspection relating to management.

Bel V was also closely involved in the BEST project, which resulted in changes to facilities and procedures and the construction of new buildings.

Finally, mention should be made of the follow-up on the action plans resulting from the ten-year review which ended in 2011 and also resulted in changes to facilities, procedures and the safety analysis report.
1.3 Overview of inspections at other nuclear facilities

1.3.1 Nuclear Research Centre (SCK•CEN)

The working regime of BR2 during 2012 consisted of 3 cycles of 3 weeks and 2 cycles of 4 weeks.

The commissioning tests for the Guinevere experiment at the VENUS reactor continued in 2012.

Concerning the audit of the safety culture that was initiated in 2007, the action plan resulting from the audit was finalised.

No events were rated above level 0 on the INES scale in 2012.

In the wake of the Fukushima accident, SCK•CEN performed a stress test of its facilities in accordance with the specifications of the FANC.

1.3.2 Belgoprocess

In 2012, Bel V and the FANC continued to supervise the follow-up of the nuclear safety audit initiated by the FANC in 2010. The implementation of the action plan is still progressing, but at a slightly slower pace than foreseen. As a reaction to this slow progress, among other things, the FANC, with the support of Bel V, carried out an unannounced inspection at Belgoprocess. The results of this unannounced inspection have given birth to an action plan that was continuously checked by Bel V and the FANC during 2012.

Belgoprocess has been putting further effort into updating their safety analysis reports. Moreover, the safety analysis report of the installation for the production of monoliths (IPM – ‘Installatie Productie Monolieten’) was further analysed by Bel V, updated by Belgoprocess and finally submitted to the Scientific Council of the FANC for a first session in September 2012.

The issue of liquid waste has been further discussed between Bel V and Belgoprocess. Bel V has continued its in-depth analysis of the safety case made by Belgoprocess and has asked Belgoprocess to take a number of additional measures.

Belgoprocess submitted three new modification files to Bel V regarding the servicing of UF6 containers on site 1 of Belgoprocess. The first two modifications have been approved by Bel V and the third one is still being discussed between Belgoprocess and Bel V.

No events were rated as level 1 (anomaly) or higher on the INES scale in 2012. Four events rated as level 0 on the INES scale occurred in 2012. No criticality risk was involved, nor was there any contamination of the environment or of workers.
1.3.3 Belgonucléaire

As in the last two years, in 2012 the dismantling activities were focused on further emptying glove boxes and consequently dismantling them, in order to evacuate them in drums to Belgoprocess as A3X waste.

There are no contamination or overexposure incidents to report for the past year. The return of old waste from Belgoprocess to Belgonucléaire was started up. A first glove box was successfully shipped in October. Dismantling will be carried out in accordance with the customary dismantling techniques of Belgonucléaire.

1.3.4 National Institute for Radioelements (IRE)

During its inspections in 2012, Bel V has found that:
- the securing of the Fleurus site is continuing,
- the safety culture among the staff is improving,
- the management teams continue to be strengthened.

The facilities were originally designed in the 1970s. The ten-year review shows that their design could be partly reinforced. The IRE has committed itself to improving the design of a series of systems that are required for the safe operation of the facility.

A new system was delivered for measuring the release of noble gases and for triggering an alarm after an accidental release.

The IRE had launched a program to eliminate historic waste that has been accumulating on the Fleurus site, in some cases for more than twenty years. The deadlines set out in that program were often missed, however. The IRE therefore decided to restructure the said elimination program in order to render it more efficient.

No events were rated as level 1 on the INES scale in 2012.
1.3.5 Thetis

In 2012, four systematic controls and one specific control were carried out.

As a consequence of a water leak, the roof of the reactor building was completely replaced.

In the first quarter, only one significant incident was reported to Bel V: "unauthorised access by persons to the reactor building" (INES level 1). Various measures were taken in order to prevent a similar incident in the future.

On 15 May 2012, a Royal Decree was published in which Ghent University was authorised to dismantle the Thetis research reactor (see reference FANC 9834/AD-2353-A).

In September, Belgoprocess was officially designated the contractor that would carry out the dismantling.

Dismantling of the reactor is due to begin in March 2013.

1.3.6 Other (Class II and III) facilities

The waste gases of these facilities have recently been reported to the FANC.

For several years, Bel V has been noting an accumulation of radioactive waste at several facilities. The example of Best Medical Belgium is known, but other facilities are also affected. These facilities are run by public/university or private institutions. Several cyclotrons that have been shut down since several years (in some cases for more than 10 years) have not been dismantled and Bel V has not been able to assess any dismantling policy.

The accumulation of stocks of radioactive waste is in itself a safety problem that Bel V monitors and for which Bel V has in full transparency transferred its observations to its supervisory authority. The elimination of this waste also raises financial problems that do not fall within the remit of Bel V but hinder the development of a rapid and safe disposal solution.
1.4 Emergency preparedness and response

1.4.1 Emergency response exercises

In 2012, six emergency preparedness and response exercises were organised under the supervision of the Directorate-General Crisis Centre of the Federal Public Service (FPS) Interior (DG Crisis Centre):

- In March for the Doel nuclear power plant: partial exercise limited to the interaction between the emergency crisis cell of the licensee (on-site) and the evaluation cell CELEVAL (off-site);
- In May for the Belgonucléaire nuclear facility: partial exercise limited to the interaction between the emergency crisis cell of the licensee (on-site) and the evaluation cell CELEVAL (off-site);
- In June for the IRE nuclear facility: partial exercise limited to the interaction between the emergency crisis cell of the licensee (on-site) and the evaluation cell CELEVAL (off-site);
- In June and in December: exercises organised by the ‘grande Région’ with focus on cross-border interactions between the Belgian, Luxembourg, French & German organisations involved. Unfortunately, due to the scope and characteristics of the exercise, both exercises were very limited for Belgium;
- In November for the Tihange nuclear power plant: large-scale exercise over a period of 36 hours with participation of most of the response organisations (at federal, provincial and local levels) and deployment of field intervention teams. A support team assisted the participating bodies at all stages of this large-scale exercise (development, preparation, execution and evaluation). This exercise also included a large-scale simulation of media and population pressure performed by college students (IHECS).

All these exercises were prepared, conducted and evaluated according to a new Belgian methodology for the preparation, execution and evaluation of emergency preparedness and response exercises. Bel V was heavily involved in these exercises, as an involved organisation but also as ‘controller’ and ‘evaluator’, especially for the large-scale exercises for the Tihange nuclear power plant (a Bel V representative was appointed as ‘local exercise coordinator’ and member of the exercise management team).

1.4.2 Other related activities

Within the framework of the preparation for the large-scale exercise, Bel V played a significant role, together with other organisations (the FANC, Directorate-General Crisis Centre of the FPS Interior, etc.), in a number of working groups. In particular, basic principles and associated tools for the protection of first responders in case of a field intervention during a nuclear or radiological emergency response were developed, as part of the exercise objectives and outcomes.

Bel V was also involved in the various information and training sessions organised as part of the large-scale exercise.

Bel V participated in the continuation of projects that had been initiated in previous years (such as the implementation, within the various Emergency Planning Zones concerned, of the principles and guidelines as defined in 2009-2010).
1.4.3 Improvement of Bel V’s role

In order to improve the Belgian emergency preparedness and response in case of a nuclear emergency and especially the role of Bel V herein:

- Bel V staff participated in the Belgian emergency preparedness and response exercises, which, besides the response activities, required a lot of preparation, observation and evaluation of the response by the Bel V crisis team, by the licensee and by other parties involved (evaluation cell of the DG Crisis Centre);
- a Bel V representative participated in a technical meeting of the International Atomic Energy Agency (IAEA) for reviewing the Draft Safety Requirements in Emergency Preparedness and Response (revision of the GS-R.2 Safety Standards) (Vienna, November 2012);
- a Bel V representative attended an IAEA workshop on Protective Actions for Severe Reactor Accidents (Vienna, March 2012);
- Bel V participated in R&D activities in the domain of emergency preparedness and response:
  - involvement in a research program with the Vrije Universiteit Brussel (VUB) in view of developing cognitive radio for nuclear power plants (4-year program connected with a Doctorate);
  - involvement in the evaluation of the JRODOS evaluation computer code;
  - evaluation of the possibility of participating in an international benchmarking project on fast-running software tools used to model fission product releases during accidents at nuclear power plants, to be organised by the OECD/NEA. This project will start in 2013.

1.4.4 International collaboration

Bel V took part, partly in support of the Belgian competent authorities (nuclear safety authorities, TSOs), in the following working groups:

- Task Group on Accident Management of the OECD/NEA-CNRA;
- WG Emergencies of HERCA (Heads of the European Radiological protection Competent Authorities);
- Subgroup on Mutual Assistance of the Western European Nuclear Regulators Association (WENRA);
- Joint Group HERCA-WGE / WENRA-MA.
Safety assessments and national projects
2 Safety assessments and national projects

2.1 Probabilistic Safety Assessment (PSA)

Under the previous Periodic Safety Review (PSR) and the Belgian Action Plan for the WENRA Reference Levels (see section 3.2), several plant-specific PSA studies for Belgian nuclear power plants covering internal events for all operating states were updated by Tractebel Engineering on behalf of Electrabel. Some PSA updates were finalised in early 2012, after a first regulatory review by Bel V the year before: these are the PSA Level 1 for each Belgian nuclear power plant and a PSA Level 2 representative for Doel 3 and Doel 4. Another PSA Level 2 was finalised for Doel 1/2 and sent to Bel V in June 2012. For the Tihange units, a PSA Level 2 is planned in 2013-2015.

In parallel, the findings and recommendations of the Doel 3 PSA peer review, which was performed in 2011, were used by Electrabel to establish an action list for future PSA updates.

In the course of 2012, Bel V performed an evaluation of the finalised PSAs and of the results of the Doel 3 PSA peer review in order to develop its own proposals for future PSA updates.

An extension of the scope of the PSAs in order to include internal fire and internal flooding hazards was also continued in 2012. Electrabel and Tractebel Engineering continued the Fire Hazard Analysis (FHA), while preparing the Fire PSA (FPSA), and also developed a methodology for the Flooding PSA. In 2012, there were several meetings to discuss the progress of these internal hazard PSAs and Bel V’s analysis of methodologies and supporting studies that have already been carried out.

For Bel V’s R&D activities on PSA methodology and PSA applications, see section 4.4 on Research and Development.

2.2 Periodic Safety Reviews (PSR)

A Periodic Safety Review consists in an evaluation by the licensee of 14 ‘safety factors’ as defined in the IAEA Safety Guide NS-G-2.10, the use of which is required by the FANC.

Scope and methodology documents according to the guidelines of the FANC have been issued for all the units.

All assessment reports for Doel 3 (one per safety factor and one for the overall safety evaluation) were submitted to Bel V at the end of August. A review of these started during the autumn of 2012 and will extend into 2013.

Presentations of the work to be performed by the licensee for most safety factors for the Tihange 2 unit in order to perform the PSR evaluation took place during the second part of the year and will be continued in 2013.

The scope and methodology documents of the remaining units have been reviewed, with the exception of Doel 1/2, for which a revised version will be provided at the end of April 2013 following the decision to close those units in 2015.
2.3 Long-Term Operation (LTO)

The FANC and Bel V issued a Strategy Note on Long-Term Operation, to be applied to the Tihange 1 and Doel 1/2 units. Accordingly, evaluations and results relating to ageing and design upgrade are requested 3 years before the 4th PSR deadline. LTO is to be considered as part of the 2nd common PSRs (i.e. the 4th PSR for the units concerned).

The Long-Term Operation project launched by Electrabel deals with four aspects: the development of an Ageing Management Program (AMP), re-evaluation of the design, pre-conditions and knowledge management issues. All those aspects were reviewed by Bel V. Bel V issued a safety evaluation report which summarises its conclusions and presents its recommendations.

2.4 BEST project: Belgian stress tests

2.4.1 Nuclear power plants

In the wake of the accident that occurred on 11 March 2011 at the Japanese Fukushima-Daiichi nuclear power plant, a wide-scale targeted safety reassessment program was set up among the Member States of the European Union that operate nuclear power plants on their soil. This ‘stress test’ program was designed to re-evaluate the safety margins of the European nuclear power plants when faced with extreme natural events, and to take relevant action wherever needed.

In accordance with the European Nuclear Safety Regulators Group (ENSREG) methodology, the stress tests of the Belgian nuclear power plants were continued in 2012 with the following steps:

1. The report of all national regulatory bodies was subjected to an international peer review in February 2012: these national reports are examined by other regulatory bodies representing 27 European independent national authorities responsible for nuclear safety in their country. This method increases consistency in the whole process and ensures the sharing of experience between regulatory bodies.
2. A peer review team performed a Country Visit in Belgium in March 2012.
3. ENSREG issued a summary report in April 2012, to be presented to the European Council, so as to provide an overall view of the current situation in the European power plants. Bel V was involved in steps 1 and 2.

In parallel, Electrabel set up an action plan based on its own commitments and on demands issued in the Belgian national report. This plan was discussed with the FANC and Bel V, and was accepted after inclusion of some findings from the ENSREG summary report.

Bel V is now in charge of the close follow-up of the implementation of the actions by Electrabel.
2.4.2 Other Class I facilities

In addition to the stress tests of the Belgian nuclear power plants, the Belgian Federal Parliament decided (House of Representatives, ‘Résolution relative aux modalités des stress tests et leurs conséquences sur les installations nucléaires’, 16/06/2011) to adopt the FANC specifications for all Class I nuclear facilities (“Belgian Stress Tests specifications – applicable to all nuclear plants, excluding power reactors”, 22/06/2011). The 6 Class I facilities concerned are: SCK•CEN (Mol), Belgoprocess (Mol-Dessel), the IRE (Fleurus), WAB (Doel nuclear power plant), FBFC International (Dessel) and IRMM (Geel).

In accordance with the FANC specifications, the operators published their progress reports on 15 February 2012 and their final reports on 30 June 2012. Bel V carried out an analysis of these final reports, which is due to be completed early 2013.

The publication of the FANC national report is expected on 15 April 2013.
2.5 Radioactive Waste Management

During the first half of 2012 the licensing review (which began in December 2011) of the safety case about the future installation for the production of monoliths (IPM – ‘Installatie Productie Monolieten’) continued and led to the first presentation to the Scientific Council of a Bel V report about the safety of this future installation. This presentation occurred in September 2012. The aim of the IPM facility, for which Belgoprocess will be the licensee, is to produce and store monoliths. Monoliths are grouted concrete boxes filled with radioactive waste to be disposed of later in the surface disposal facility at Dessel (see below). Prior to the second presentation to the Scientific Council some remaining safety-related issues will have to be resolved by Belgoprocess and reviewed by Bel V.

Bel V was, in collaboration with the FANC, also deeply involved in the pre-licensing discussions concerning the future facility for the disposal of low and intermediate level short-lived radioactive waste (category A waste) in Dessel, for which ONDRAF/NIRAS will be the licensee. Prior to the official licensing phase, which is expected to start in February 2013, ONDRAF/NIRAS has asked for an international peer review (led by the OECD/NEA) of some chapters of its safety case (especially those related to long-term safety). The FANC and Bel V also made their preliminary analyses of the available chapters, and the principal comments were transmitted to the future licensee. Within the framework of the long-term safety evaluations, Bel V started in February 2012 an independent safety verification (using its own modelling capacity).

In the course of control activities at nuclear facilities, the review of safety analysis reports of several nuclear facilities related to radioactive waste treatment and storage has been followed up by Bel V. Examples of these include: safety issues related to storage and treatment of liquid waste, the degradation of waste drums, etc.

Cooperation with other safety authorities in the field of radioactive waste management is described in section 3.2.
2.6 MYRRHA (SCK•CEN)

MYRRHA is an irradiation facility coupling a proton accelerator of 600 MeV with a Lead-Bismuth Eutectic cooled fast spectrum reactor of 100 MW.

In 2012 the pre-licensing phase of the MYRRHA project continued.

This pre-licensing phase should, among other things, allow for convergence towards a fixed concept of the facility that can be licensed by the authorities and therefore will at least satisfy the safety objectives that have been set. As a result, the realisation of this pre-licensing phase relies on close cooperation between the FANC and Bel V. In the framework of this cooperation, Bel V is in charge of the technical assessment.

In terms of the technical assessment, focus points have been defined in collaboration with the Scientific Council of the FANC. A focus point is a technical issue which is new or not yet mature enough, is specific to MYRRHA and has an impact on the safety of the facility.

The first answers to these focus points have been received from SCK•CEN and have been analysed by Bel V.

Several technical meetings took place to discuss focus points with SCK•CEN.
International activities and projects
3  International activities and projects

3.1 OECD and IAEA activities

Bel V participated in the activities of the following committees, working groups and meetings of the Organisation for Economic Co-operation and Development (OECD):
- the Committee on Nuclear Regulatory Activities (CNRA);
- the Committee on the Safety of Nuclear Installations (CSNI);
- the Nuclear Science Committee (NSC);
- the CNRA Working Group on Inspection Practices (WGIP);
- the CNRA Working Group on Operating Experience (WGOE);
- the CSNI Working Group on Fuel Cycle Safety (WGFC);
- the CSNI Working Group on Risk Assessment (WGRISK);
- the CSNI Working Group on Analysis and Management of Accidents (WGAMA);
- the CSNI Working Group on Integrity and Ageing of Components and Structures (IAge), and its subgroups on the integrity of metal components and structures and on the integrity and ageing of concrete structures;
- the CSNI Working Group on Human and Organizational Factors (WGOF);
- the CSNI Working Group on Fuel Safety Margins (WGFSM);
- various OECD projects (see also section 4.4 on R&D);
- the Incident Reporting System Coordinators’ activities (IRS, IRSRR, FINAS).

One of these meetings was the 4th Review Meeting for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. For this review meeting (organised every 3 years) each country has to prepare a national report to demonstrate how it is implementing the IAEA requirements of this Joint Convention. During the review meeting, the national report has to be presented and the national representatives have to answer questions arising from the international peer review.

The General Manager of Bel V participated in the 2nd Steering Committee meeting of the Technical and Scientific Support Organization Forum (TSSOF) of the IAEA.

A Bel V representative is a member of the Steering Committee on Competence of Human Resources for Regulatory Bodies, and attended the 4th meeting of this committee, including a Seminar on the Guidelines for Systematic Assessment of Regulatory Competence Needs (SARCoN).

Further, Bel V representatives participated in IAEA conferences, workshops and technical committee meetings, mainly on the following subjects:
- issues related to the Fukushima accident and the lessons learned, including emergency preparedness (6 participants);
- safety of radioactive waste disposal (5 participants);
- decommissioning safety (4 participants);
- lessons learned from precursor analysis (2 participants);
- safety of research reactors and fuel cycle facilities (2 participants).

Bel V participated in the Nuclear Safety Standards Committee (NUSSC) of the International Atomic Energy Agency (IAEA).

Bel V experts participated in several IAEA conferences, workshops and technical committee meetings (25 events in total).
3.2 Cooperation with safety authorities

3.2.1 Franco-Belgian Working Group on nuclear safety

This working group, established at the time of the construction of the Chooz B nuclear power plant, is composed of the regulatory organisations (ASN, IRSN, the FANC, Bel V). Two meetings are held each year, one in Paris and the other in Brussels (the latter chaired by Bel V). The working group covers a large range of topics on nuclear safety, such as cross-inspections, inspection practices and information exchange related to nuclear power plant operation.

In 2012, only one meeting could be held, at which the following main topics were discussed: new initiatives on regulations, status of the Chooz and Gravelines nuclear power plants, cross-inspections, feedback on emergency response exercises, activities concerning the stress tests by way of follow-up of the Fukushima accident, the status of the findings and ongoing actions related to the defect indications in the reactor pressure vessels of Doel 3 and Tihange 2, and the degradation of the concrete at the Tihange 2 reactor building.

3.2.2 Western European Nuclear Regulators Association (WENRA)

The FANC and Bel V represent Belgium in WENRA.

WENRA meetings

The General Manager of Bel V participated, in support of the FANC representatives, in the spring and autumn meetings of WENRA. At these meetings, the work progress of the subgroups (see hereafter) was discussed. Interfaces with other international forums (especially ENSREG) were also discussed at these meetings. In 2012, special attention was devoted to the follow-up of the Fukushima accident and the stress tests. The European Technical Safety Organisations Network (ETSON) presented its activities to WENRA, with a view to future collaboration.

Reactor Harmonization Working Group (RHWG)

Bel V representatives participated in the three RHWG meetings held in 2012. The RHWG worked mainly on the following topics: specific safety issues for new nuclear power plants, resulting in the ‘RHWG Booklet on Safety of new NPP designs’ posted for stakeholder comments on the WENRA website; the follow-up of the national action plans concerning the WENRA Reference Levels for existing nuclear power plants; and the follow-up of the Fukushima accident. With respect to the latter, the RHWG created several new subgroups, in order to develop a revision of the WENRA Reference Levels in the light of the lessons learned from Fukushima. Bel V coordinates the subgroup ‘Containment in severe accidents’.

In 2012, several meetings were organised involving the FANC, Bel V, Electrabel and Tractebel Engineering with the aim of ensuring the follow-up of the Belgian Action
Plan for existing reactors. Some actions concerning the implementation of the WENRA Reference Levels at the nuclear power plants could be declared closed.

**Working Group on Waste and Decommissioning (WGWD)**

Bel V gave additional feedback on the proposals (developed by the FANC) for the regulatory texts concerning the implementation of the WENRA Reference Levels on decommissioning into Belgian legislation.

Furthermore, the progress made on the action plans of the Belgian licensees (Electrabel and Belgoprocess) with respect to the implementation of the WENRA Reference Levels for the facilities to store radioactive waste and spent nuclear fuel was reviewed by Bel V, in collaboration with the FANC.

### 3.2.3 International Working Groups relating to the defect indications in the reactor pressure vessels of Doel 3 and Tihange 2

In order to promote transparency and cooperation among potentially interested countries and to benefit from external insights on the case, the FANC decided to set up three international working groups to explore three distinct themes: (1) non-destructive testing techniques; (2) metallurgical origin of defect indications; (3) structural mechanics and fracture mechanics.

The participants were expert members proposed by foreign nuclear safety authorities or related organisations (IAEA, OECD/NEA, European Commission) willing to participate in the review of this issue. The chairmen of working groups (2) and (3) were provided by Bel V.

The working groups’ mission was to: (1) share information and experience among nuclear safety authorities about regulatory approaches and actions in relation to this issue; (2) take account of the lessons learned from this issue and discuss actions to be considered in other countries; (3) provide technical advice to the Belgian nuclear safety authorities (the FANC, Bel V, AIB-Vinçotte) on specific topics/questions related to the issues with the Doel 3 and Tihange 2 reactor pressure vessels.

These three expert working groups met for the first time on 16 October 2012. Their findings were discussed during a two-day plenary assembly that was held in Brussels on 8 and 9 January 2013. The conclusions of this meeting were taken into account in the final assessment report by Bel V.

### 3.2.4 Task Force on Safety Critical Software (TFSCS)

Bel V continued to take an active and prominent part in the activities of this task force, the objective of which is to harmonise licensing practices for safety critical software used in nuclear power plants.

The last edition of their report was published and dispatched in the first days of January 2013. This fifth edition, entitled ‘Licensing of safety critical software. Common position of seven European nuclear regulators and authorised technical
support organisations’, replaces the previous 2010 edition and is available on the Bel V website.

This document is the result of the work of a group of experts drawn from regulators and safety authorities. The guideline identifies a consensus and common technical positions on a set of important licensing issues raised by the design and operation of computer-based systems used in nuclear power plants for the implementation of safety functions.

Apart from Bel V, contributors are from the German Federal Office for Radiation Protection (Bfs), the Spanish Consejo de Seguridad Nuclear (CSN), the Institut für Sicherheitstechnologie (ISTec) GmbH (Munich), the British Health and Safety Executive Office for Nuclear Regulation (ONR), the Swedish Radiation Safety Authority (SSM), and the Finnish Radiation and Nuclear Safety Authority (STUK).

3.3 Cooperation with technical safety organisations

3.3.1 EUROSAFE

The EUROSAFE Programme Committee met in Brussels (February and November) and in Kaunas (June), in order, among other things, to prepare the EUROSAFE Forum that was held in Brussels in November.

This year, Bel V’s technical and support staff were especially active in co-organising (with IRSN and GRS) this Forum, that was held for the third time in Brussels. The 2012 EUROSAFE Forum was organised around the theme ‘Towards Enhanced Robustness in Nuclear Safety’. The General Manager of Bel V gave the welcoming speech and the Bel V Programme Committee member coordinated the Questions & Answers session with the invited speakers. Bel V also presented a paper at the seminars on ‘Nuclear Installation Safety Assessment’, ‘Nuclear Installation Safety Research’, ‘Waste and Decommissioning and Dismantling’, ‘Security of Nuclear Installations and Materials’ and 3 papers in the session on ‘Radiation Protection, Environment and Emergency Preparedness’.

3.3.2 European Technical Safety Organisations Network (ETSON)

ETSON contributes substantially to all activities within the framework of the EUROSAFE approach (i.e. the Forum, Tribune and the public website), as well as to the work of strengthening the scientific and technical partnership. This work area applies to general or specific issues directly linked to the convergence of scientific and technical safety practices in Europe.

The ETSON General Assembly and/or Board met in Vienna (on the occasion of the IAEA TSO Forum in January), Helsinki (June), and Brussels (November).

In 2012 the extension of the network was further explored, which resulted in the acceptance of PSI (Switzerland) as a new member and SEC NRS (Russia) as a new associate member. Other potential memberships are being examined.
ETSON created a Technical Board for Reactor Safety (TBRs) to review the technical activities of ETSON, such as the functioning of the ETSON Expert Groups and the publication of Safety Assessment Guides. A Bel V representative is chairing this TBRs.

Bel V representatives took active part in the ETSON Expert Groups, aimed at sharing views and experiences with colleagues of other technical safety organisations.

From 20 August until 24 August, Bel V hosted the fifth ETSON Summer Workshop in Leuven. The Bel V Junior Staff Programme (JSP) representatives coordinated the organisation of this Summer Workshop. The workshop was devoted to 'Radioactive waste management'. Several Bel V representatives participated by giving lectures or presentations, and by coordinating work sessions.

3.3.3 European Nuclear Safety Training and Tutoring Institute (ENSTTI)

ENSTTI is an initiative of the European Technical Safety Organisations Network (ETSON). ENSTTI provides vocational training and tutoring in methods and practices required to perform assessments in nuclear safety, nuclear security and radiation protection. ENSTTI calls on European TSO expertise to maximise the transmission of knowledge and proficiency based on practical experience and culture.

In 2012, Bel V decided to join this network and the General Manager of Bel V was appointed President of ENSTTI.

3.3.4 Collaboration with IRSN

Several activities were continued under the terms of the Cooperation Agreement between IRSN and Bel V, in particular in relation to the use of computer codes developed by IRSN, such as the Cathare code for thermal hydraulic analyses, the SYLVAR and ISIS codes for fire analyses, and the MELODIE code for analyses of the disposal of radioactive waste (see section 4.4 on R&D).

The collaboration with IRSN in the field of radioactive waste management was strengthened. Bel V representatives had the opportunity to visit (on invitation by IRSN) the Tournemire underground research facility on disposal in a clay formation. Bel V also made an agreement with IRSN and CEA to co-sponsor a PhD thesis devoted to the study of radionuclide diffusion in various media.
3.4 Assistance projects of the European Commission

Since 2007, all these projects have been financed by the Instrument for Nuclear Safety Cooperation (INSC) programme of the European Commission (EC).

3.4.1 Armenia

Bel V has cooperated with the Armenian Nuclear Regulatory Agency (ANRA) for many years through Tacis/INSC-financed projects. Bel V has provided the Technical Project Leader for the last two cooperation projects (AR/RA/04 and AR/TS/06). All the official reports (task reports and final reports) were finalised by the Bel V Technical Project Leader during the first semester of 2012.

The follow-up project AR/TS/07 (Enhancement of the safety assessment capabilities of the ANRA for licensing of Medzamor 2 safety improvements and of decommissioning activities) has been delayed due to the priority assigned to a specific project relating to the Armenian stress tests. The stress test project started at the end of 2012, and it is therefore expected that the new AR/TS/07 project will start at the beginning of 2013.

3.4.2 Russian Federation

Bel V has been participating in the most recent project of assistance to Rostechnadzor (RF/TS/54), providing support for licensing of a spent nuclear fuel dry facility by Rostechnadzor. This project which was planned to be finalised at the end of 2011 had been prolonged for a further 12 months. This extension was devoted to reviewing the documentation on the commissioning of the facility.

3.4.3 Lithuania

Bel V has continued its activities in project VAT.06.01 to support VATESI in the field of decommissioning of the Ignalina nuclear power plant. This project is not financed by the European Commission under the auspices of the INSC programme but has been directly negotiated by Riskaudit with a Lithuanian contractor (Central Project Management Agency). Bel V is involved in two tasks regarding radioactive waste treatment and storage facilities. The task concerning the review of the safety analysis report (SAR) of the buffer storage for very low-level radioactive waste (VLLW) was completed in 2012.
3.4.4 Jordan

Bel V has been participating in the first and second cooperation projects between the European Commission and Jordan. The principal objective is to provide support to the Jordan Nuclear Regulatory Commission (JNRC) in order to enhance its skills and effectiveness as a regulator.

This first cooperation project ended in April 2012 and the second is ongoing. Bel V is participating in Task 1 and Task 6 of the JO/RA/02 project:

- Task 1: Update of the Strategy Plan, the Action Plan and the Cooperation Plan in the field of capacity building for the enhancement of National Regulatory Authority including an overview of the present situation;

3.4.5 Morocco

Bel V is participating as Technical Project Leader and also in tasks 1 and 3 of the first cooperation project between the European Commission and Morocco, which started in April 2011.

The Bel V Technical Project Leader took part in the first progress meeting in Rabat in January 2012. During that meeting the decision was taken to freeze the activities due to the delay in the promulgation of the law creating the new regulatory authority.

The project could restart in 2013, keeping in mind that the ultimate date for restart is April 2013; otherwise the project will be cancelled.

3.4.6 Mexico

Bel V is participating in the first cooperation project between the European Commission and Mexico (CNSNS). The objectives of the project are to enhance and strengthen certain aspects of the regulatory regime for nuclear safety in Mexico in accordance with international obligations and internationally accepted criteria and practices. Bel V participates in Tasks 1 and 2 of the MX/RA/01 project:

- Task 1: Establishment/development of an action plan for cooperation in the field of capacity building for the enhancement of the CNSNS, including an overview of the present situation;
- Task 2: Development and implementation of quality management at CNSNS, aimed at the external certification of the regulatory authority by the end of the project.
3.4.7 Vietnam

Bel V is participating in the first cooperation project between the European Commission and Vietnam. This project was initiated in July 2012. The general purpose is to develop and strengthen the legal framework as well as the managerial and technical capabilities of the Vietnam Agency for Radiation and Nuclear Safety (VARANS) and the local Technical Support Organisation.

Bel V is involved in Task 2 of the project, i.e. the development of a quality assurance system for assessment and verification of safety and regulatory oversight (internal regulatory guides and procedures).

The activities within the framework of this task will start in mid-2013.

3.4.8 Ukraine

Bel V is participating in the INSC Project U3.01/08 – Component UK/TS/39. The overall objective is to strengthen the SNRIU’s capabilities in safety assessment, as a basis for regulatory decisions and licensing at all lifetime stages of radioactive waste management facilities to be constructed/reconstructed in the immediate future in accordance with the national strategy and radioactive waste management program. This project follows the previous TACIS project N° U3.01/04 - Component UK/TS/35.

Bel V is involved in the following subtasks:
- Task 1:
  - 1a: Guideline for the assessment of the radiological impact of the ‘vector’ site with multiple facilities for radioactive waste processing, storage, and disposal;
- Task 2:
  - 2b: Support to the licensing of the ICRSM Supporting SSE Technocentre in revising the SAR for Lot 3 - Safety assessment methodology;
  - 2c: Review of Design Terms of Reference of Storage facility for LL-ILW (Part 1) + Review of Design Terms of Reference of Storage facility for HLW (Part 2);
3.4.9 Regulatory assistance management

The European Commission (DG Devco) decided to disband the Regulatory Assistance Management Group (RAMG) at the end of 2010. Discussions continued to be held in 2012 (with the European Commission and between Member States) on the best way for the Member States to continue to give advice to the European Commission on the strategic aspects, the programming phase and the implementation phase of future EC projects. Furthermore, the regulatory authorities and their technical support organisations (TSO) were invited to discuss the new INSC instrument that should be put into place in 2014. The geographical and technical scope of the projects funded under this new instrument should be broadened. Rules of tendering could change and are under discussion.

Bel V has been very active in these issues:
- Participation in the three INSC committee meetings of 19 April, 22 June and 12 December 2012 and one INSC working group on 18 April, where the action forms of the Annual Action Programme 2012 were extensively discussed and commented on by the Member States.
- Participation in the first meeting on European support to Regulatory Authorities under the new Instrument for Nuclear Safety Cooperation (INSC) on 5 September 2012.

So far, no final decision has been taken on the way forward, but a new ENSREG working group could be created under the new instrument to play a role similar to the RAMG. As the FANC is the official Belgian representative on ENSREG, this issue was managed in consultation with the Federal Agency for Nuclear Control.
4 Expertise management

4.1 Domestic experience feedback

Each year, Bel V performs a systematic screening of events at all Belgian nuclear power plants, as well as an in-depth analysis of a number of events with emphasis on lessons learned and corrective actions.

In 2012, 80 event-reporting forms were drafted and inserted into the experience feedback database.

Corrective actions relating to these events and the licensee’s experience feedback process were evaluated during the inspections of the nuclear facilities. More detailed event analyses and the resulting identification of additional corrective actions were also performed for a number of events. These analyses resulted in three IRS reports.

2012 was also marked by the events relating to the leak in the spent fuel pool of the Tihange 1 nuclear power plant as well as by the discovery of flaws in the vessels of the Doel 3 and Tihange 2 units. These events were analysed in depth by Bel V.

4.2 Foreign operating experience feedback

4.2.1 PWRs’ Operating Experience in perspective

At the end of 2012, the 7 Belgian nuclear units reached 229.8 reactor years since their first criticality. Their average age is thus close to 33 years. This includes, however, long shutdowns of Doel 3 and Tihange 2 further to the detection of defects related to reactor pressure vessel construction.

4.2.2 ARIANE program (for nuclear power plants)

The number of records in the main events Access database – up to the end of December 2012 – has reached 1730 (8 new entries), of which 115 (5 new entries) are condensed as Recurring Events Records (RER) (the preferred method, highlighting Generic Issues).

Screening Cards are written for each incoming original document considered to merit an in-depth analysis outside the events database (5 were created in 2012). By way of comparison, 44 documents were considered worth registering in the database records (6,331 since its inception).

Spreadsheets are the preferred tools for summarising and exhaustively recording similar events when their number is too large to be described in plain text as in the Recurring Events Records. They should be a convenient source of information for PSA practitioners. Of the 9 spreadsheets, 4 were updated because of recent events: Floods inside NPPs (1 case in 2012), Station Blackout precursors (3 cases in 2011-2012), LOCA from a single valve (1 case in 2011), Configuration issues (Doel 4 in 2011).
The most significant event in 2012 (in terms of the INES scale) was the Station Blackout that occurred in a Korean reactor (09/02/2012): rated as level 2 due to the misbehaviour of management (attempt to hide the event).

A formal request for consideration has been issued further to the only NRC Bulletin in 2012: ‘Design Vulnerability in Electric Power System’.

4.3 Knowledge management

For several reasons (one of them being that in the next 5 to 10 years several experienced Bel V staff members will retire), Bel V is attaching great importance to knowledge management. Various tools are used in order to generate, capture, distribute, use and store knowledge.

The Technical Responsibility Centres (TRC) continue to play a key role in knowledge management within Bel V. There are about 20 Technical Responsibility Centres, acting as ‘Centres of Competence’ for all important fields of expertise of Bel V. In line with developments in nuclear issues, new Technical Responsibility Centres are continuously set up (i.e. concerning decommissioning issues). Moreover, TRC management and operation is fully embedded in Bel V’s Quality System.

In 2012, several new engineers were recruited. This requires an important effort on the part of the more experienced engineers to ensure an adequate transfer of knowledge. A coach is assigned to every newly recruited person, to facilitate their integration. This knowledge transfer device is combined with, among other things, on-the-job training and cross-functional team meetings. The recruitment of a high number of new people also requires customised training to suit specific needs (see section 4.5). Mention should also be made of the Bel V focus on knowledge transfer from retiring experts to younger staff.

Knowledge management is also closely linked to the R&D program aimed at generating new skills, better ideas or more efficient processes (see section 4.4).

Some Bel V staff members participate in the Centres of Competence (CoP) established at the FANC. This is especially the case for some technical fields in which the FANC has important activities, such as radiation protection, waste management and evaluation of the security of nuclear installations. Participation in these CoP also contributes to the development of the expertise of Bel V staff members.

The continuous implementation of the Bel V adapted Electronic Documentation Management software (KOLIBRI, based on Hummingbird DM) is an important step towards an efficient retrieval of information, good knowledge sharing and easier integration of new members of staff. To this end, a specific committee known as the Documentation Users Group (DOCUS) has been re-launched, focusing on user needs analysis and on improvements.
4.4 Research & development

4.4.1 Introduction

The R&D program for 2012 was developed in February 2012. This section gives a summary of the significant R&D activities that were performed in 2012. The involvement in R&D activities remains an important pillar for the continuous development and sustainability of Bel V’s expertise.

The total effort for 2012 amounted to 7,273 hours, which represents about 7.6% of the total work time for the technical staff.

4.4.2 R&D on nuclear installation safety

Thermal hydraulic phenomena
During 2012, R&D activities on thermal hydraulics were carried out in the following fields:
  - The OECD/NEA PKL2 and ROSA2 projects.
    a. As proposed by Bel V, the Natural Circulation Interruption phenomenon was included within the PKL-3 project through a series of tests that will be performed at the PKL, PACTEL and ROCOM facilities.
    b. CATHARE simulations of ROSA Test 6 were performed and the results were presented during the ROSA-2 PRG6 meeting.
    c. CATHARE calculations of the PKL-2 and ROSA-2 tests were presented in the PKL/ROSA analytical workshop.
  - Participation in the OECD/NEA/CSNI Best Estimate Plus Uncertainties Workshop (UPC, Barcelona) within the framework of the scheduled participation of Bel V in the OECD/NEA/CSNI PREMIUM project.
    - Delivery of the Bel V results for PHASE II to the PREMIUM coordinators.
    - Participation to the CIRCE course organised by CEA-Grenoble (September 2012).
    - Master thesis topics connected with Bel V’s activities were proposed during the R&D workshop organised by Bel V on 19 December.
  - Familiarisation with the use of the RELAP5-3D code has been carried out.
  - Participation in the PKL/ROSA analytical workshop, the PREMIUM project, and the EUROSAFE Forum 2012 provided opportunities to gain additional expertise and to exchange views on experimental issues as well as analytical tools for simulating such tests.

Severe accidents
The most recent results of the MCCI/MCCI-2 projects and the SERENA project have been exploited in the discussions with the licensee concerning ex-vessel corium coolability strategies in the context of the Belgian Action Plan for the WENRA reference levels.

The first steps have also been taken to acquire the MELCOR code and develop a MELCOR simulation capability at Bel V. Bel V has signed an agreement with USNRC relating to participation in CSARP.
Fission products and aerosol behaviour

The BIP/BIP2 project, coordinated by the OECD/NEA, investigates the behaviour of iodine released in a nuclear reactor containment during a severe accident. Bel V’s participation in the BIP/BIP2 project offered a good opportunity to improve its knowledge of iodine behaviour in the containment, in support of assessments of fission product releases during severe accidents.

PSA methodology and its applications

Bel V began to build up its expertise on Internal Flooding PSA (IFPSA), using the Guidelines for Performance of Internal Flooding Probabilistic Risk Assessment (EPRI 1019194, December 2009). This EPRI guide will be used by Tractebel Engineering for the IFPSA of the Belgian nuclear power plants.

In May 2012, a meeting was held to discuss potential cooperation between Bel V and ULB (Prof. P.-E. Labeau) in the field of Dynamic PSA and Reliability.

Bel V attended two meetings of the ETSON PSA expert group (Helsinki in June, Prague in November). This ETSON expert group has prepared a list of guidance documents that can be useful for PSA development or review by TSOs.

Bel V further participated in the PSAM11 / ESREL 2012 Conference (Helsinki, 25-29 June 2012), where it presented a paper on “Status and Perspectives of PSA in Belgium. The ASAMPSA_E project proposal, which focuses on PSA Level 1 and Level 2 for external hazards, was prepared by IRSN. Bel V will participate in WP1 (Relationship with End Users). The final proposal was sent to the European Commission in November 2012 and approval of the project proposal can be expected in 2013.

Fire protection

Bel V seeks to acquire proper knowledge and modelling capabilities for initiating and reviewing risk-informed fire analysis, which will be conducted by the Belgian nuclear power plant licensees. In addition, activities aimed at gaining more experience and knowledge on specific fire behaviour and its consequences in nuclear facilities other than nuclear power plants are being launched to mark this evolution for all nuclear facilities. Consequently, during 2012, Bel V went on with the development of expertise in fire safety analysis and know-how in the use of fire codes. In particular, R&D was mainly conducted on the IRSN codes (ISIS and SYLVIA).

Bel V attended the second and third OECD/NEA/CSNI PRISME 2 meetings. During the second meeting, a first calculation of the results of the first benchmarking exercise were presented by Bel V.

A paper was presented at the EUROSAFE Forum 2012, setting out the R&D activities on fire safety within Bel V.

In mid-2012, two International Master’s students in Fire Safety Engineering (Ghent University) defended their theses, research for which was conducted in collaboration with Bel V. The results of these research activities are valuable for the development of Bel V’s expertise in fire safety analysis and its know-how in the use of fire codes.

As from 1 October, a post-doctoral research project on combustion, fire and fire safety was started in collaboration with Ghent University. Research is being conducted on soot modelling and subsequent radiation in free and vitiated atmospheres. The researcher established contacts with the ISIS development team of IRSN during the PRISME 2 meeting.
4.4.3 R&D on waste and decommissioning

Waste disposal
In 2012 Bel V pursued its efforts (started in 2010) to collect information and made itself still more closely acquainted with the cAt-project (surface disposal facility at Dessel). Bel V also developed its expertise through its involvement in several IAEA technical meetings about “Practical Illustration and use of the Safety Case Concept in the Management of Near-Surface Disposal” (PRISM), “Human Intrusion in the context of Disposal of Radioactive Waste” (HIDRA), “Modelling and Data for Radiological Impact Assessments” (MODARIA) and an IAEA working group as the “International Low Level Radioactive Waste DISPosal NETwork” (DISPONET). Finally Bel V also participated in a conference regarding the long-term performance of cementitious barriers and reinforced concrete in nuclear power plants and radioactive waste storage and disposal (NUCPERF).

In the field of geological disposal facilities and within the 7th European Framework Programme, Bel V participated with other European TSOs and regulatory bodies in the “Sustainable network of Independent Technical Expertise for radioactive waste disposal” (SITEX). This two-year project is financed by the European Commission. Bel V further developed its expertise through its involvement in the “International Intercomparison and Harmonisation Project on Demonstrating the Safety of Geological Disposal” (GEOSAF II).

Finally, Bel V fostered R&D activities relating to radioactive waste disposal by financially supporting two PhD theses (a PhD thesis at a Belgian university and a PhD thesis in collaboration with the French IRSN/CEA; both theses were started in October 2012). Contacts have also been made with IRSN in order to launch a future cooperation with the ‘Station Expérimentale de Tournemire’ (research laboratory in clay formation in France).

Decommissioning and dismantling
Last year, a draft guide on decommissioning was drawn up in order to address Bel V’s future activities concerning the decommissioning of large facilities. It aims to explain the regulatory context in Belgium and the role of Bel V among the different actors. Typical decommissioning issues about regulations, licence applications and technical activities were described.

In 2012, Bel V continued to build up its knowledge in the field of decommissioning. Bel V has taken particular care to gain knowledge on experience, practices, techniques, pitfalls, etc., in countries where large decommissioning projects are under preparation or under way. Relevant information has been gathered and used to expand the decommissioning guide. It has also been pointed out that the safety supervision of a large decommissioning project requires consideration of all the aspects that could have an impact, in the short or long run, on the safety of workers, the population and the environment. Indeed, decommissioning has many aspects: not only safety (minimising hazards) but also cost, resources, waste management, planning, uncertainties, social impact, etc.
4.4.4 R&D on cross-cutting issues

Safety culture assessment
In order to reinforce Bel V’s assessment expertise in safety culture (SC), an integrated process for SC observation has been redesigned. This process is aimed at linking SC field observations with the overall oversight process of the FANC/ Bel V. A review of the literature has been conducted in order to define the different types of improvement, and a SC observation guidance has been written.

Emergency preparedness
In view of improving and enhancing the emergency preparedness and response knowledge and skills of Bel V,

4.4.5 R&D collaboration with Belgian universities

Vrije Universiteit Brussel (VUB)
A research agreement was signed in October 2012 with the VUB, which will undertake studies in the field of cognitive radio for nuclear power plants. This project will make a contribution to the emergency support plan. The objective is to improve communication links during emergencies that might promote stronger emergency management.

Université libre de Bruxelles (ULB)
Since November 2012, Bel V has been sponsoring an R&D project at the ULB, in the area of long-term safety assessment of radioactive waste disposal.

Ghent University
A research agreement was signed in August 2012 with Ghent University, which will undertake studies in the field of fires in free atmosphere, and interaction of the fire with the mechanical ventilation system in a closed room. Within the framework of this research, quantitative simulations will be performed with the use of the ISIS software.
4.5 Training

A structured training approach was adopted on the basis of the IAEA Systematic Approach to Training (SAT). Training programs were developed for all staff members, and in particular for new hires, on the basis of the job descriptions and the relevant competencies needed. Implementation of the training programmes is carried out using different methods, depending on the availability of training materials and the adequacy of external courses: self-study, internal training sessions, external courses or on-the-job training.

A key element of the initial training of newcomers is the programme of internal training sessions conducted by the Technical Training Manager with the help of experienced experts (mainly from Bel V and the FANC) as lecturers. This programme comprises 23 training modules. 4 sessions took place in 2009, 5 in 2010, 7 in 2011 and 11 in 2012:
- Regulatory control & practices - modifications
- Synthetic description of nuclear facilities other than nuclear power plants (6 sessions)
- Security and interfaces with safety
- Legal and regulatory framework in Belgium
- DBT security
- Safety culture observation

Examples of external training courses with the participation of Bel V newcomers in 2012:
- Basic training on Pressurised Water Reactors at AREVA (1 expert during 3 weeks)
- ETSON JSP Summer School in Leuven (5 people during 1 week)
- Full training course on radiation protection (120 hours) organised by the ISIB in French (1 expert during the year)

Also worth mentioning is the participation of Bel V staff members in numerous specialised or refresher training activities, and in several international working groups, seminars and conferences.

In total, more than 130 training activities took place during 2012.
Balance sheet as at 31 December 2012
(in thousand euros)

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ASSETS</strong></td>
<td>15,046</td>
<td>14,156</td>
</tr>
<tr>
<td><strong>FIXED ASSETS</strong></td>
<td>7,252</td>
<td>6,843</td>
</tr>
<tr>
<td>II. Intangible fixed assets</td>
<td>1,654</td>
<td>1,414</td>
</tr>
<tr>
<td>III. Tangible fixed assets</td>
<td>5,596</td>
<td>5,427</td>
</tr>
<tr>
<td>A. Land and buildings</td>
<td>5,439</td>
<td>5,277</td>
</tr>
<tr>
<td>B. Plant, machinery and equipment</td>
<td>48</td>
<td>45</td>
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<tr>
<td>C. Furniture and vehicles</td>
<td>109</td>
<td>105</td>
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<tr>
<td>IV. Financial fixed assets</td>
<td>2</td>
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</tr>
<tr>
<td><strong>CURRENT ASSETS</strong></td>
<td>7,794</td>
<td>7,313</td>
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<tr>
<td>VII. Amounts receivable within one year</td>
<td>2,556</td>
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<tr>
<td>A. Trade debtors</td>
<td>2,550</td>
<td>2,628</td>
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<tr>
<td>B. Other amounts receivable</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>IX. Cash at bank and in hand</td>
<td>5,091</td>
<td>4,475</td>
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<tr>
<td>X. Deferred charges and accrued income</td>
<td>147</td>
<td>194</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>2012</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------</td>
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</tr>
<tr>
<td><strong>LIABILITIES</strong></td>
<td>15,046</td>
<td>14,156</td>
</tr>
<tr>
<td><strong>EQUITY</strong></td>
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<td>8,209</td>
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<tr>
<td>I. Capital</td>
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<tr>
<td>IV. Reserves</td>
<td>2,629</td>
<td>2,629</td>
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<tr>
<td>V. Profit carried forward</td>
<td>650</td>
<td>848</td>
</tr>
<tr>
<td><strong>DEBTS</strong></td>
<td>7,035</td>
<td>5,947</td>
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<tr>
<td>VII. Payable after more than one year</td>
<td>3,000</td>
<td>2,000</td>
</tr>
<tr>
<td>IX. Amounts payable within one year</td>
<td>4,035</td>
<td>3,944</td>
</tr>
<tr>
<td>A. Current portion of amounts payable within one year</td>
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<td>1,000</td>
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<tr>
<td>C. Trade debts</td>
<td>335</td>
<td>416</td>
</tr>
<tr>
<td>D. Advances received on contracts in progress</td>
<td>1,500</td>
<td>1,500</td>
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<tr>
<td>E. Taxes, remuneration and social security</td>
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<td>1,028</td>
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<tr>
<td>F. Other amounts payable</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>X. Deferred charges and accrued income</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>
Profit and loss account as at 31 December 2012
*(in thousand euros)*

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Turnover</strong></td>
<td>9,940</td>
<td>10,056</td>
</tr>
<tr>
<td><strong>Other operating income</strong></td>
<td>24</td>
<td>78</td>
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<tr>
<td><strong>TOTAL OPERATING INCOME</strong></td>
<td>9,964</td>
<td>10,134</td>
</tr>
<tr>
<td><strong>Services and other goods</strong></td>
<td>1,224</td>
<td>1,927</td>
</tr>
<tr>
<td><strong>Wages and social security costs</strong></td>
<td>6,744</td>
<td>7,391</td>
</tr>
<tr>
<td><strong>Depreciation</strong></td>
<td>510</td>
<td>531</td>
</tr>
<tr>
<td><strong>Write-downs on trade debtor</strong></td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td><strong>Other operating charges</strong></td>
<td>100</td>
<td>101</td>
</tr>
<tr>
<td><strong>TOTAL OPERATING CHARGES</strong></td>
<td>8,578</td>
<td>9,959</td>
</tr>
<tr>
<td><strong>Operating result</strong></td>
<td>1,386</td>
<td>175</td>
</tr>
<tr>
<td><strong>Financial charges and income</strong></td>
<td>-15</td>
<td>23</td>
</tr>
<tr>
<td><strong>Profit on ordinary activities</strong></td>
<td>1,371</td>
<td>198</td>
</tr>
<tr>
<td><strong>Profit for the financial year</strong></td>
<td>1,371</td>
<td>198</td>
</tr>
</tbody>
</table>
In 2012, the activity continued apace, yielding a very slight increase in our turnover.

**Operating income**

**Turnover**

In 2012, the largest part of the turnover of Bel V (96%) was again generated by the regulatory inspections and safety assessments in Class I facilities, which are invoiced on the basis of a rate which has been agreed with the FANC and which covers the costs of our services. This year was also marked by activities linked to the stress tests and flaws in the vessels of two reactors.

A small part of the turnover (1.6%) derives from contracts with the European Commission for support to nuclear safety authorities in Eastern European and emerging countries. Regulatory inspections are also carried out in some Class II facilities (the future Class IIA).

**Other operating income**

Other operating income is not actual revenue, but reinvoicing of hotel costs relating to the organisation of Eurosafé 2012 and to contributions by staff to the provision of meal vouchers.

**Operating charges**

**Services and other goods**

In 2012, these operating charges included a considerable use of technical subcontracting for the reactor vessels, a significant increase in our expenses for Research and Development and for seminars held in Belgium (JSP Summer School and Eurosafé 2012).

**Wages and social security costs**

Staff expenditures represent 74% of our costs, including training expenditures.

**Financial charges and income**

Financial income comes from cash investments. Financial charges relating to borrowings from the FANC have fallen sharply due to the decline in interest rates.

**Operating result**

Operating result for the financial year has been allocated to retained earnings.
## List of abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANRA</td>
<td>Nuclear Safety Authority of Armenia</td>
</tr>
<tr>
<td>ARIANE</td>
<td>Automatic Retrieval of Information on Abnormal Nuclear Events</td>
</tr>
<tr>
<td>ASN</td>
<td>Autorité de Sûreté Nucléaire (France)</td>
</tr>
<tr>
<td>BEST</td>
<td>Belgian Stress Tests</td>
</tr>
<tr>
<td>CNRA</td>
<td>Committee on Nuclear Regulatory Activities (OCDE)</td>
</tr>
<tr>
<td>CSN</td>
<td>Consejo de Seguridad Nuclear (Spain)</td>
</tr>
<tr>
<td>CSNI</td>
<td>Committee on the Safety of Nuclear Installations (OCDE)</td>
</tr>
<tr>
<td>CNSNS</td>
<td>Comisión Nacional de Seguridad Nuclear y Salvaguardias (Mexico)</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
</tr>
<tr>
<td>ENSREG</td>
<td>European Nuclear Safety Regulators Group</td>
</tr>
<tr>
<td>ETSON</td>
<td>European Technical Safety Organisations Network</td>
</tr>
<tr>
<td>FANC</td>
<td>Federal Agency for Nuclear Control</td>
</tr>
<tr>
<td>GRS</td>
<td>Gesellschaft für Anlagen und Reaktor Sicherheit (Germany)</td>
</tr>
<tr>
<td>IAEA</td>
<td>International Atomic Energy Agency</td>
</tr>
<tr>
<td>INES</td>
<td>International Nuclear Event Scale</td>
</tr>
<tr>
<td>INSC</td>
<td>Instrument for Nuclear Safety Cooperation (European Commission)</td>
</tr>
<tr>
<td>IRE</td>
<td>National Institute for Radioelements</td>
</tr>
<tr>
<td>IRSN</td>
<td>Institut de Radioprotection et de Sûreté Nucléaire (France)</td>
</tr>
<tr>
<td>JNRC</td>
<td>Jordan Nuclear Regulatory Commission</td>
</tr>
<tr>
<td>LTO</td>
<td>Long-Term Operation</td>
</tr>
<tr>
<td>NEA</td>
<td>Nuclear Energy Agency (OCDE)</td>
</tr>
<tr>
<td>NRC</td>
<td>Nuclear Regulatory Commission</td>
</tr>
<tr>
<td>NUSSC</td>
<td>Nuclear Safety Standards Committee (IAEA)</td>
</tr>
<tr>
<td>OECD</td>
<td>Organization for Economic Cooperation and Development</td>
</tr>
<tr>
<td>ONDRAF/NIRAS</td>
<td>Agency for Radioactive Waste and Enriched Fissile Materials</td>
</tr>
<tr>
<td>OSART</td>
<td>Operational Safety Review Team (IAEA)</td>
</tr>
<tr>
<td>PRG</td>
<td>Programme Review Group</td>
</tr>
<tr>
<td>PSA</td>
<td>Probabilistic Safety Assessment</td>
</tr>
<tr>
<td>PSR</td>
<td>Periodic Safety Review</td>
</tr>
<tr>
<td>PWR</td>
<td>Pressurised Water Reactor</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research &amp; Development</td>
</tr>
<tr>
<td>SCK•CEN</td>
<td>Studie Centrum voor Kernenergie – Centre d’études d’Energie Nucléaire (Mol)</td>
</tr>
<tr>
<td>SNRCU</td>
<td>State Nuclear Regulatory Committee of Ukraine</td>
</tr>
<tr>
<td>TRC</td>
<td>Technical Responsibility Centre (Bel V)</td>
</tr>
<tr>
<td>TSO</td>
<td>Technical Safety Organisation</td>
</tr>
<tr>
<td>TSOF</td>
<td>Technical and Scientific Support Organization Forum (IAEA)</td>
</tr>
<tr>
<td>VARANS</td>
<td>Vietnam Agency for Radiation and Nuclear Safety</td>
</tr>
<tr>
<td>VATESI</td>
<td>Lithuanian State Nuclear Safety Inspectorate</td>
</tr>
<tr>
<td>WENRA</td>
<td>Western European Nuclear Regulators Association</td>
</tr>
</tbody>
</table>