BELGIUM

(Updated 2014)

1. GENERAL INFORMATION

1.1. Country overview

1.1.1. Governmental System

The political system of Belgium is based on a federal parliamentary democracy under a constitutional monarchy, with King Philippe as head of state since 21 July 2013.

Six constitutional revisions between 1970 and 2013 dissolved administrative and legal powers between the federal, regional and linguistic levels. Each of the three Belgian regions (Flanders, Wallonia and Brussels Capital Region) and each of the three linguistic communities (Dutch, French and German) has its own executive and legislative bodies, with no hierarchical relationship with the federal parliament and government whatsoever. The Brussels Capital Region is bilingual (Dutch and French).

The competencies for economic and energy policy are distributed between the federal state and the regions. The communities are primarily responsible for cultural and linguistic affairs and education, which includes R&D.

However, policy related to the nuclear sector, the nuclear fuel cycle and R&D in both nuclear fusion and fission remains the exclusive competency of the federal government.

1.1.2. Geography and Climate

Belgium is situated in north-western Europe between 49°30' and 51°30'N latitudes and 2°30' and 6°23'E longitudes. Roughly triangular in shape, its land area is 30.528 km², its extreme length is about 280 km (NW-SE) and its greatest breadth is about 181 km (NE-SW). Its altitudinal range is from about -5 m to 694 m (Signal de Botrange), but its mean elevation does not exceed 175 m.

To the northwest, the country is bounded by the North Sea for 65,5 km, to the north and northeast by the Netherlands for 450 km, in the east by the Federal Republic of Germany for 162 km, to the southeast by Luxembourg for 148 km, in the west and southwest by France for 620 km.

Its landscape varies widely, from the flat coastal plains along the North Sea, over a central plateau and the gently rolling hills throughout the country's central portion towards the almost mountainous forest area of the Ardennes region in the southeast.

The total length of Belgium's rivers including canals is about 26.600 km, of which only 2.043 km is navigable (and 1.528 km in regular commercial use); their total area is about 24.000 ha (to which can be added 1.900 ha of artificial reservoirs). The approximate annual run-off in Belgium is 360 mm or 11.000 million m^3. In receipt of an annual discharge of

5.000 million m^3 from upstream countries, the annual river discharge leaving Belgium is 16.000 million m^3. Most of the country drains to the northeast into the Netherlands through the Escaut/Schelde and the Meuse/Maas. A few streams such as the Sûre/Sauer in the eastern Ardennes are in the Rhine drainage. A small area (Oise) drains to the Seine in France. A few minor streams flow directly into the North Sea.

Belgium has a temperate maritime climate with very mild winters and cool summers. The influence of the Gulf Stream and the Atlantic Ocean result in the climate being rainy, humid and cloudy. On average, there are 200 rainy days each year. The maritime influence on the climate decreases further inland and becomes almost continental in the Ardennes.

1.1.3. Population

With a population of just over 11 million people living on 30.528 km² of land surface, Belgium is among the most densely populated countries in the OECD.

TABLE 1. POPULATION INFORMATION

								Average annual growth rate (%)
Year	1970	1980	1990	2000	2005	2010	2012*	2000 to 2012*
Population (thousands)	9.651	9.855	9.948	10.239	10.446	10.840	11.099	0,63
Population density (inhabitants/km²)	316	323	326	335	342	355	364	0,63
Urban Population as % of total	93,8	95,4	96,4	97,1	97,3	97,5	97,5	
Area (1000 km²)	30,5							

* Latest available official data
Source: FPS Economy – Statistics Belgium (Statbel)

1.1.4. Economic Data

Belgium has a very open economy, situated at the heart of a zone of intense economic activity. Exports of goods and services accounted for 84,8% of GDP in 2012 and imports 83,6%. The Belgian economy is currently dominated by the services sector. GDP at current prices in 2012 amounted to USD 483 billion. Like neighbouring countries, Belgium felt the impact of the euro crisis in 2012.

TABLE 2. GROSS DOMESTIC PRODUCT (GDP)

								Average annual growth rate (%)
	1970	1980	1990	2000	2005	2010	2012**	2000 to 2012
GDP (millions of	26.381	125.286	202.832	232.673	377.348	468.079	483.261	5,46

current USD)								
GDP at Constant 2005 PPP (millions of USD)	147.195	205.047	250.197	311.659	337.348	358.187	363.837	1,49
GDP per capita (constant 2005 USD/capita)	17.022	23.262	28.076	34.008	36.011	36.742	36.515	0,82
GDP per capita (PPP* USD/capita)		20.793	25.096	30.399	32.189	32.842	32.639	3,55
GDP per capita (current USD/capita)		10.223	18.678	27.650	32.189	37.793	39.751	4,77

* PPP: Purchasing Power Parity
** Latest available official data
Source: World Bank: World Development Indicators

1.2. Energy Information

For energy units, please refer to Attachment-1.

1.2.1. Estimated available energy

TABLE 3. ESTIMATED AVAILABLE ENERGY SOURCES

	Estimated available energy sources					
	Fossil Fuels			Nuclear	Renewables	
	Solid	Liquid	Gas	Uranium	Hydro	Other Renewable
Total amount in specific units*	0	0	0	0	<0,1	<0,1
Total amount in Exajoule (EJ)						

* Solid, Liquid: Million tons; Gas: Billion m3; Uranium: Metric tons; Hydro, Renewable: TW
Note: Solid and gas reserves are not economically exploitable.
Source: FPS Economy – Energy Observatory

1.2.2. Energy Statistics

TABLE 4. ENERGY STATISTICS

							Average annual growth rate (%)
	1980	1990	2000	2005	2010	2012*	2000 to 2012*
Energy consumption**							
- Total	2,04	2,07	2,46	2,48	2,53	2,36	-4%
-Solids***	0,52	0,44	0,33	0,21	0,14	0,13	-60%
- Liquids	0,90	0,67	0,91	0,98	1,02	0,92	+1%
- Gases	0,41	0,38	0,62	0,69	0,71	0,60	-3%
- Nuclear	0,14	0,47	0,53	0,52	0,52	0,44	-17%
- Hydro	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	-
- Other Renewables	0,07	0,11	0,07	0,08	0,12	0,24	+243%
Energy production							
- Total	0,30	0,45	0,57	0,57	0,63	0,66	+16%
- Solids***	0,18	0,04	0,01	<0,01	0,00	0,00	-
- Liquids	0,00	0,00	0,00	0,00	0,00	0,00	-
- Gases	<0,01	<0,01	<0,01	0,00	0,00	0,00	-
- Nuclear	0,12	0,40	0,53	0,52	0,52	0,44	-17%
- Hydro	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	-
- Other Renewables	0,00	0,01	0,04	0,05	0,11	0,22	+450%
Net import (Import - Export)							
- Total	1,81	1,71	2,13	2,26	2,29	1,96	-7%

* Latest available official data
** Energy consumption = Primary energy consumption + Net import (Import - Export) of secondary energy.
*** Solid fuels include coal, lignite
Source: FPS Economy – Energy Observatory

1.2.3. Energy policy

With no domestic oil or natural gas production, Belgium is fully dependent on imports for its energy supply, particularly since the end of the coal mining era (the last mine was shut down in 1992). Belgian energy policy is therefore guided by the concern to diversify both its sources of supply and its suppliers. Yet, due to its geographical location and infrastructure, Belgium plays an important role in Europe's oil and gas supply chain. In the case of natural gas, Belgium is a major hub of gas flows in the region, with some 80 billion cubic metres (bcm) transiting the country each year, compared to domestic consumption of 16,7 bcm per year (2011).

Concerning electricity, the transmission system operators (TSOs) of the Pentalateral Energy Forum are conducting at the request of Belgium a comprehensive investigation into capacity planning and additional 'regional' investments (to be completed by the end of 2014). The Pentalateral Energy Forum is the leading forum for discussion and cooperation between the Benelux, France and Germany which aims at the creation of a regional Northwest-European electricity market as an intermediate step towards one common European electricity market. Its main objectives are market integration and security of supply.

The development of offshore capacities, particularly in the North Sea, is just as vital to the success of Europe's energy policy. The Belgian Government has played a major role in launching and coordinating The North Seas Countries' Offshore Grid Initiative (NSCOGI). It was established by a Memorandum of Understanding on 3 December 2010 in order to form a regional platform for facilitating coordinated development of a possible offshore grid. The initiative was set up by the 10 North Seas Countries governments[1] and supported by ACER[2] , ENTSO-E[3] and national regulatory authorities as well as the European Commission. The NSCOGI countries worked together with regulators and TSOs on regulatory, technical and legal barriers and produced a grid study.

At national level, energy policy making is a competence shared by the federal and three regional governments (Flemish Region, Walloon Region and Brussels Capital Region), while the Communities (Flemish-, French- and German-speaking) are principally responsible for non-nuclear R&D.

This situation requires the establishment of several coordinating bodies. In 1992, the federal government and the three regional governments created a formal body for discussions on all energy matters, a co-operation group called Energy Consultations between the State and Regions, or CONCERE/ENOVER[4]. Its role is primarily advisory. It holds plenary monthly sessions and has several thematic working groups. The National Climate Commission (established in 2003), and the Federal Interdepartmental Commission for Sustainable Development are two other policy making forums bringing together different stakeholders from the regions and the federal level.

The Federal Government is competent in:

- Security of supply
- National prospective studies
- Nuclear fuel cycle and nuclear R&D programmes
- Large stockholding installations
- Production and transmission / transport of energy (electricity grid >70 kV), including large storage infrastructure
- Distribution and transport tariffs (Federal Regulator – CREG)
- Energy statistics and balances
- Offshore wind energy

The Federal Government has the exclusive competence in nuclear energy and is responsible for ensuring the country's security of energy supply.

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[1] Belgium, Denmark, France, Germany, Ireland, Luxemburg, the Netherlands, Sweden, Norway and the United Kingdom

[2] Agency for the Cooperation of Energy Regulators

[3] European Network of Transmission System Operators for Electricity

[4] Groupe de Concertation Etat-régions pour l'Energie (in French) / Overleggroep Staat-Gewesten voor de energie (in Dutch)

The regional competencies are:

- Promotion of the efficient use of energy
- New and renewable sources of energy (except nuclear)
- Non-nuclear energy R&D
- Market regulation for the distribution
- Distribution and transmission of electricity (electricity grid <70 kV)
- Public distribution of natural gas
- District heating equipment and networks
- Recovery of waste energy from industry or other uses
- Regional energy statistics and balances

Though renewable energy sources are in principle the exclusive competency of the Regions, the Federal Government administers the territorial waters and is therefore also competent in regulating the development of offshore wind farms.

At the federal level, energy matters are handled by the Federal Public Service (FPS) Economy, SMEs, Self-employed and Energy while environmental issues are handled by the FPS Health, Food Chain Safety and Environment and the FPS Mobility and Transport is responsible for the transportation sector[5].

The Sustainable Development Federal Public Service (PPS)[6] develops and implements policy on sustainable development. The Science Policy PPS (BELSPO) is responsible for research programmes, as well as for Belgium's participation in European and international R&D organisations and networks. The Federal Planning Bureau conducts modelling and analytical studies on economic, energy, social and environmental issues, and develops different scenarios and outlooks.

The Directorate-General for Energy, part of the Federal Public Service for Economy, SMEs, Self-employed and Energy is the key administration that develops and implements energy policy. It created an Energy Observatory which became operational in April 2009. The main objectives of the Energy Observatory are the monitoring of the energy markets and enhancing energy security through the following measures:

- collecting and disseminating data on demand and supply;
- processing information on consumer protection, market access and unfair commercial practices;
- establishing a permanent consultation forum for relevant stakeholders.

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[5] Federal Public Services form a specific feature of the Belgian institutional structure, they are equivalent to Ministries but their areas of responsibilities do not necessarily coincide with the areas covered by one specific Minister. Each FPS can report to several Ministers, and each Minister can have several FPSs under his/her authority.

[6] Alongside the Federal Public Services (FPS), Belgium has Federal Public Planning Services (PPS) which handle ad hoc matters that require coordination between several FPSs.

The federal energy policy is based on the Triple-S approach: Security of supply, Sustainability and Safety:

1. The Security of Supply Policy is based on an adequate assessment and monitoring of generation adequacy:
   - Developing interconnections to contribute to base and peak load at short and medium term
   - Integrating all possibilities of demand side management in order to deal with peak load at the short term
   - Supporting new investments through capacity mechanisms
   - Exempting of federal levy for gas fired power plants
   - Providing a framework for existing capacities in order to manage peak demand at the short term
   - Determining the timetable for the nuclear phase-out
   - Emergency Response Management (ERM)
2. Sustainable energy
   - Promotion of renewable energy: Offshore wind
   - Promotion of electro-mobility: Electric Vehicles
   - Promotion of biofuels
   - Promotion of energy efficiency
   - Promotion of a consumer friendly energy policy: Focus on Vulnerable consumers
3. Safety
   - Ensure safe management of radioactive waste
   - Ensure reliable and qualitative energy products (electric and gas appliances, monitoring of the control, certification and accreditation of the control of petroleum products)
   - Ensure reliable & safe energy infrastructure through the implementation of national, European and International legislation (gas & electricity networks, EPCIP, FIPOL)

Belgium signed (1992) and ratified (1996) the United Nations Framework Convention on Climate Change and ratified the Kyoto Protocol in 2002.

The implementation of climate change policies and measures is based on joint plans drawn up by the federal and regional governments, which set their own priorities and are free to determine their own goals within the scope of their competencies. The regional governments have major responsibilities in areas such as rational use of energy, promoting renewable energy sources, town and country planning, agriculture and waste management.

1.3. The electricity system

1.3.1. Electricity policy and decision making process

It should always be kept in mind that Belgium is a federal state and that the responsibilities for energy and hence electricity policy are distributed between the federal state and the regions. As a result, there is no single Belgian electricity market, but rather a Flemish, Walloon and Brussels market, each of these markets partly depending on the legal framework at the federal level.

Belgium being a federal country, the regulatory framework for the electricity market is elaborate. The national regulator for the electricity and gas markets is the Commission for the Regulation of Electricity and Gas[7] (CREG). This Commission is allocated with the responsibility to advise public authorities regarding the functioning of the electricity market and with the responsibility to monitor in general the application of related laws and regulations. It regulates and licenses electricity transmission above 70 kV, approves both transmission and distribution tariffs and monitors the market. The working costs of the CREG are covered by licensing fees and levies on electricity and natural gas.

Each region has its own regulatory institution for the electricity and gas markets: the Flemish Regulation Entity for Electricity and Gas[8] (VREG) in Flanders, Walloon Commission for Energy[9] (CWaPE) in Wallonia and the Commission for Energy Regulation in the Brussels-Capital Region[10] (Brugel) in Brussels-Capital. The three regional regulators are responsible for the licensing and the regulation of distribution of natural gas and electricity (below 70 kV); technical regulations for the management and extension of natural gas networks; monitoring the regional electricity and gas markets and the green certificate schemes; arbitrating grid access disputes; and advising the regional government.

The four Belgian regulators for electricity and gas have launched a structural consultative process in the framework of the Belgian Forum for the Regulatory Bodies (FORBEG). It is a voluntary platform for discussion with a plenary session and several working groups focusing on the following issues: technical questions; information; complaints; green power; tariffs; and strategy.

However, the management of the Belgian electricity transmission system is observed by a single transmission system operator (TSO)[11], ELIA System Operator SA[12]. ELIA is sole

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7 http://www.creg.be/nl/output-en.html/

8 http://www.vreg.be/en/

9 http://www.cwape.be/

10 http://www.brugel.be/

11 According to Article 8 of the law of 29 April 1999 on the organization of the electricity market

12 ELIA System Operator S.A. has been listed on Eurolist by Euronext, the regulated market of Euronext Brussels, since June 2005. Its core shareholder is the municipal holding company Publi-T, founded in 2001, when ELIA was established. Publipart, which also represents the interests of the Belgian municipalities, holds a 2,53% stake in the company. 52.26% of ELIA shares are traded freely on the stock exchange (these shares are also known as the 'public float'). http://www.ELIA.be/en/about-ELIA/

responsible for operating, maintaining and developing the high-voltage transmission system, including interconnections to other grids, in order to ensure continuity of supply according to the model of "full ownership unbundling"[13]. Since it has a legal monopoly, it is subject to a special legal framework and to the authority of regulators responsible for checking and approving the way in which it operates (for instance, with respect to tariffs)[14].

ELIA employs more than 1.100 professionals and owns and operates over 8.000 km of high voltage lines and underground cables throughout Belgium. ELIA also supplies power directly to major companies connected to the grid.

ELIA is investing in the future of the Belgian high-voltage grid, to safeguard security of supply, to integrate renewable energy and to enhance market development.

Investment projects are submitted for the approval of the federal or regional authorities via various investment plans. As a system operator, ELIA has to draw up four different investment plans for the development of its power grids:

- the transmission system development plan, which covers the whole of Belgium for all voltage levels from 150 kV to 380 kV at federal level;
- the investment and adaptation plans in the Flemish, Brussels Capital and Walloon regions, which cover the other voltage levels where ELIA operates.

The capital expenditure for 2013 set out in these plans forms part of the 2012-2015 tariff proposal approved by the regulator and then reflected in the ELIA grid access tariffs applying during that period.

ELIA launched the "Stevin project" to integrate the meshed offshore grid (also under development) into its onshore grid. The Stevin project[15] addresses four major needs:

- It enables offshore wind power to be brought on land and transmitted to the domestic market.
- It is necessary in order to create a further interconnection with the Belgian grid via a subsea connection to the United Kingdom (Nemo project link).
- This expansion of the 380 kV grid will significantly improve the electricity supply for the West Flanders region and make further economic development possible in the strategically important growth area in and around the port of Zeebrugge.
- It enables the connection of additional decentralised electricity generation (wind, solar and other forms of sustainable energy) in the coastal region.

The Brabo project, upgrading the existing 150-kV line between Zandvliet and Doel to a 380-kV line and installing an additional phase-shifting transformer in Zandvliet on the

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[13] By decision of 6 December 2012 of the federal Commission for the Regulation of Electricity and Gas (CREG, see below: 3.1. Regulatory framework), this license is valid for 20 years and can be renewed.

[14] See below: 3.1. Regulatory framework

[15] http://www.elia.be/en/projects/grid-projects/stevin/

border with the Netherlands, will shore up the high-voltage grid and will consolidate security of supply for both the port of Antwerp and Belgium as a whole[16].

The high-voltage electricity systems around the German city of Aachen in Germany and Liège in Belgium are relatively well developed and close to each other but they are not directly connected. Therefore, ELIA and Amprion (the TSO in this area in Germany) have decided to establish the first direct electricity interconnection between Belgium and Germany. The whole route for this link, which will be known as ALEGrO (standing for the Aachen-Liège Electric Grid Overlay)[17] and will use direct-current technology, will be laid underground. The works are expected to start in mid-2016 and the commissioning of the interconnection is anticipated in the beginning of 2019.

ELIA has an emergency plan setting out the roles and responsibilities of the various players in the event of a major problem in the electricity transmission system. Despite all the preventive measures taken, extreme situations resulting from a substantial shortage of power generation remain a possibility. In such cases, Access Responsible Parties (suppliers) are no longer able to supply a large number of their customers, to such an extent that the system operator cannot offset the imbalance in its control area. Since the winter of 2012-13, coordination with FPS Economy and the government crisis centre (CGCCR) continued and made it possible to finalise the procedures to implement with the parties in question in the event of a power shortage.

There are seven reactor units in commercial operation in Belgium, four at Doel and three at Tihange[18]. Together, they can generate about 55 per cent of the country's electricity needs. In the summer of 2012, inspections of the reactor vessels of Doel 3 and Tihange 2 nuclear power stations revealed the presence of hydrogen flakes that required in-depth analyses. In a context of uncertainty regarding the future availability of the Doel 3 and/or Tihange 2 nuclear plants, ELIA performed calculations and simulations regarding security of supply for winter 2012-2013 and subsequent winters, based on various new assumptions concerning the availability of generating facilities. These figures and simulations were passed on to the Minister for Energy, who is responsible for Belgium's security of supply. Although the ELIA grid allows up to 3.500 MW of power to be imported, ELIA nonetheless stresses the role of Belgian market players whose responsibility it is to find the counterparties needed to supply their customers with electricity – outside Belgium, if necessary.

In 2003 the federal government decided the progressive phase out of the production of electricity using nuclear fission energy by limiting the operating lives of existing ones to 40 years and prohibited the construction of new nuclear power plants and. In July 2012, the government confirmed this intention but modified by law [19] in 2013 the initial timetable for

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[16] http://www.elia.be/en/projects/grid-projects/brabo/

[17] http://www.elia.be/en/projects/grid-projects/alegro/alegro-content/

[18] GDF SUEZ operates all seven units through its ELECTRABEL subsidiary. ELECTRABEL owns three of the units outright as well as 89,8% of another three (the remaining 10,2% being held by EDF LUMINUS). ELECTRABEL jointly owns the remaining unit with France's EDF.

[19] Law of 18 December 2013 amending the law of 31 January 2003 on the gradual phasing out of nuclear energy for the industrial production of electricity

the nuclear power phase-out.[20]. Doel 1 and 2 are to close in 2015 after 40 years of operation. However, Tihange 1[21], which will also celebrate its 40th anniversary in 2015, is to be permitted to operate till 2025 to avoid the risk of blackouts. It also eliminated the possibility to invoke force majeure and change the timetable by Royal Decree if Belgium's security of supply is threatened. The other four Belgian reactors will reach 40 years of operation in 2022 and 2025. The nuclear phase out will be completed in 2025. The share of nuclear energy in the total domestic electricity production will consequently decline from 52,1 % in 2010 to 43,9% in 2015 and 33,5% in 2020. The short term future of Doel 3 and Tihange 2, however, remains unsure because of the aforementioned technical reasons.

In July 2013 the government approved a holistic energy adequacy plan, aimed at guaranteeing security of supply and at the same time ensuring competitiveness of industry in the context of the nuclear phase-out.

It will subsidise gas-fired generation and offshore wind capacity with taxes from nuclear power. The legislative framework has been put in place to launch a limited call for tender (800MW) in line with Article 8 of the EU Directive 2009/72/EC, to ensure the construction of a portion of the generation capacity needed to cope with the phasing out of nuclear capacity (6.000MW). The decommissioned nuclear plants should mostly be replaced by new CCGT-power plants. The support scheme for the offshore wind parks was adapted to make it more flexible, by taking the real revenues and costs into account, and minimising the cost for consumers. Finally, the Belgian Marine Spatial Plan foresees a new hydroelectric pumping storage capacity, to be built in the sea as two artificial ring islands or atolls with a generation capacity of 300 to 650 MW each. Both the energy atolls and the future offshore wind parks will be connected to the “plug socket at sea”[22].

Regional support schemes in favour of renewable energy have also recently been adapted to take into account the increasing share of renewables in the energy mix and their decreasing costs.

The liberalisation of the Belgian energy market began in April 1999 with the transposition of the first EU Directive on Electricity and Gas Markets. The law of 1 June 2005 fully implemented the EU Directive 2003/54/EC on the common rules for the internal electricity market. Liberalisation has been carried out in gradual steps. The electricity market was legally fully opened on 1 June 2003 in Flanders. Wallonia and Brussels Capital Region followed in 2004 and 2007. From 1 January 2007, supplier choice has been granted to all consumers in all regions.

The Third Energy Package[23] was transposed into Belgian law by the law of 8 January 2012 amending the law of 29 April 1999 on the organization of the electricity market (and the law of 12 April 1965 on the transport of gaseous and other products by pipeline).

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[20] See Table 7. Status and performance of nuclear power plants

[21] Installed capacity of 962 MW

[22] Commissioned by ELIA, the consortium Plug at Sea is building a small island with a single “plug” for seven offshore wind farms.

[23] Directive 2009/72/EC and Regulation (EC) no. 714/2009 of 13 July 2009

The opening up of the European electricity markets has led to the introduction of a power exchange in Belgium: BELPEX[24] , the short term, physical power exchange for the delivery and off-take of electricity on the Belgian hub was established in Brussels in 2006. BELPEX facilitates anonymous, cleared trading in two different market segments, namely a day-ahead market segment (DAM) and a continuous intraday market segment (CIM). BELPEX' day-ahead market segment is coupled with APX in the Netherlands and UK, EPEX Spot in France and Germany and Nord Pool Spot in the Nordic region. The intraday market segment is coupled with APX in the Netherlands and Nord Pool Spot in the Nordic region. As of 13 October 2010, APX became the 100% owner of the shares of BELPEX.

[24] http://www.belpex.be, http://www.apxgroup.nl/

1.3.2. Structure of the electric power sector

By the end of 2012, some 20.769 MW of electricity generating capacity was installed in Belgium, including 2.581 MW of photovoltaic, 1.365 MW of wind (986 MW onshore and 379 MW offshore) and 5.927 MW nuclear.[25]

GDF SUEZ S.A., formed on 22 July 2008 by the merger of Gaz de France and SUEZ, has the dominant position on the Belgian market through its 100% subsidiary ELECTRABEL[26], the former incumbent electricity supplier. Despite the sale of GDF's share in SPE[27], Belgium's second largest electricity operator, most of the segments of the market remain highly concentrated in the hands of the merged company GDF SUEZ. Out of a total of some 110 generation plants connected to the ELIA grid[28] at the end of 2013, ELECTRABEL owns 75, thus controlling over 74% of electricity generating capacity (11449,5 MW)[29], coming down from 89% in 2002. EDF LUMINUS follows with 17 plants or almost 9% of generating capacity (1338,7 MW). The Tihange and Doel nuclear power plants are all operated by ELECTRABEL, though EDF owns 50% of Tihange 1 and EDF LUMINUS has a stake of 10,2% in four nuclear units (Tihange 2 and 3 and Doel 3 and 4).

Meanwhile, many power plants are no longer economically viable. In 2012, ELECTRABEL closed three plants (two biomass- and one natural gas-fired), while EDF LUMINUS closed one diesel power plant. Altogether 368,7 MW of generation capacity was lost. In 2013, ELECTRABEL closed three natural gas-fired plants (631 MW) and one biomass-fired plant (290 MW), while EDF LUMINUS put off a hydroelectric power plant (2.305 MW). Smaller producers closed three more gas-fired plans (162,5 MW).

On the other in 2012 hand Duferco Diversification[30] completed the construction of a new 420 MW CCGT power plant. C-Power brought 30 offshore wind turbines into service in 2012, and another 18 in 2013, each with a capacity of 6,15 MW, totalling 295 MW, while Northwind's 72 offshore turbines became operational at the end 2013, adding another 216 MW. As a result, the total installed capacity in offshore wind turbines accounted for 571 MW at the end of 2013.

The legal separation between companies involved in production, transmission and distribution of electricity was completed in 2007 and both the Transmission System Operator (TSO) ELIA and the regional Distribution System Operators (DSOs) are fully legally unbundled from supply/production companies.

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25 Source: FPS Economy – Energy Observatory

26 http://www.electrabel.com/

27 "Société coopérative de Production d'Electricité" (SPE) was established as a municipalities' joint utility in 1978. Centrica acquired a majority stake in July 2008 which it sold to EDF in 2009. SPE LUMINUS took over the sales activities of EDF Belgium in September 2010 and was renamed EDF LUMINUS in November 2011. EDF holds 63,5% of the shares, the other 36,5% being held by the historical Flemish and Walloon inter-municipal shareholders of SPE: PUBLILEC, PUBLILUM, SOCOFE, VEH, ETHIAS AND TECTEO.

28 http://www.elia.be/en/grid-data/data-download/

29 Only the generation plants connected to the ELIA grid (voltage of 30 kV or more) are taken into account.

30 In association with ENEL, through the special purpose company Marcinelle Energie

The Distribution system operators (DSOs) in Belgium are:

- ORES, TECTEO (RESA), Régie de Wavre, AIESH and AIEG in Wallonia,
- SIBELGA in the Brussels-Capital Region and
- EANDIS and INFRAX in Flanders.

The different DSOs have a monopoly over the territory in which they operate. They have municipal shareholders and have a legal requirement to be 100% local government-owned by 2018. With regard to the Brussels-Capital Region, ELECTRABEL has already withdrawn from the capital of SIBELGA. As a result, the municipalities have had 100% ownership of SIBELGA's capital since 31 December 2012.

INTER-RÉGIES[31] is the umbrella association of the pure public sector-owned electricity, natural gas and cable distribution system operators who have only municipal and provincial shareholders[32], while INTERMIXT[33] represents the municipal shareholders of the mixed inter-municipal distribution system operators.

FEBEG is the 25-member-association of Belgian electricity and gas companies, i.e. electricity generators, traders and shippers of electricity and gas, electricity and gas suppliers and suppliers of energy services.

FEBELIEC, the "Federation of Belgian Industrial Energy Consumers" represents the industrial energy consumers in Belgium in issues about energy and climate politics on Belgian and European level[34].

1.3.3. Main indicators

CREG, the federal regulator of the electricity and gas market in Belgium[35], estimates the total electricity generation[36] in 2013 at 70,6 TWh, compared to 71,7 TWh in 2012 and 80,1 TWh in 2011. This is a decrease of 1.5% compared to 2012 and of 11.9% compared to 2011. ELECTRABEL's market share of energy produced decreased from 86,1% in 2007 to 69,6% in 2012 and 69,3% in 2013.

Despite the decrease, the generation market is still very highly concentrated. ELECTRABEL delivered 66,4% of electricity consumed in 2011, EDF LUMINUS 17,5%, NUON 5,1%, E.ON 3,6% and ESSENT 2,1%[37]. The remaining 5,3% was delivered by smaller players (<2%).

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[31] Created 22 October 1955 in Brussels, initially under the name "Interpublic"

[32] http://www.inter-regies.be/

[33] http://www.intermixt.be/

[34] http://www.febeliec.be/

[35] http://www.creg.info/pdf/Studies/F1319EN.pdf

[36] Only the generation plants connected to the ELIA grid (voltage of 30 kV or more) are taken into account.

[37] Source: FPS Economy – Energy Observatory

Since 13 September 2012, every citizen in Belgium can switch energy supplier for free with a notice period of one month and in September 2012 the FPS Economy has run a campaign “Dare to compare” to convince consumers switching electricity retailers is easy, aiming to encourage stronger competition between suppliers. This campaign will be repeated in November 2014.

TABLE 5. ELECTRICITY PRODUCTION, CONSUMPTION AND CAPACITY

							Average annual growth rate (%)
	1980	1990	2000	2005	2010	2012*	2000 to 2012*
Capacity of electrical plants (GWe) (1)							
- Thermal	8,21	7,24	8,55	8,71	9,15	9,47	+11 %
- Hydro	1,13	1,40	1,41	1,41	1,43	1,43	+1%
- Nuclear	1,67	5,50	5,71	5,80	5,93	5,93	+4%
- Wind	0,00	<0,01	0,01	0,17	0,91	1,37	-
- Geothermal	0,00	0,00	0,00	0,00	0,00	0,00	-
- other renewable	0,00	0,00	0,00	<0,01	0,90	2,58	-
- Total	11,01	14,14	15,69	16,10	18,32	20,77	+32%
Electricity production (TWh) (2)							
- Thermal	40,26	27,30	34,14	37,33	43,40	35,80	+5%
- Hydro	0,83	0,90	1,70	1,60	1,67	1,66	-2%
- Nuclear	12,55	42,72	48,16	47,60	47,94	40,30	-16%
- Wind	0,00	< 0,01	< 0,01	0,23	1,29	2,75	-
- Geothermal	0,00	0,00	0,00	0,00	0,00	0,00	-
- other renewable	0,00	0,00	0,00	0,27	0,82	2,38	-
- Total (3)	53,64	70,92	84,01	87,03	95,12	82,87	-1%
Total Electricity consumption (TWh) (4)	51,02	67,56	77,77	80,87	85,27	83,81	+8%

(1) Net Maximum Electrical Capacity
(2) Gross Production
(3) Electricity transmission losses are not deducted.
(4) Final consumption (observed)
* Latest available official data

Source: FPS Economy – Statistics Belgium (Statbel)

Nuclear plants produced 40,9 TWh in 2013, an increase of 2,2 TWh over 2012. However, the figures for these two years are not comparable to previous years because two nuclear power plants, Doel 3[38] and Tihange 2[39], accounting together for just over 2000 MW, were unavailable for nearly a year in 2012 and 2013. Despite this special situation, the share of nuclear power generation[40] was 57,9% due to the decrease in overall generation in Belgium. Total gas plant generation was 17,6 TWh in 2013, a decrease of 3,7 TWh compared to 2012 whereas coal plants generated 4,3 TWh in 2013, also down (-0,8 TWh) compared to 2012. Gas and coal plant generation reached their lowest level of the 2007-2013 period. Other types of fuel contributed to a little less than 11,1% of electricity generation. In 2013, all offshore wind farms combined injected 1,5 TWh into the transmission grid, an increase of 75,5% compared to 2012. If onshore generation is added to offshore generation, total wind generation in 2013 was 1,8 TWh, an increase of 61,0 % over 2012.

The demand for electrical power, that is, net consumption plus pumping power and grid losses, amounted to 90,2 TWh in 2010, 87,5 TWh in 2011 and 86,8 TWh in 2012, i.e. a decrease of 0,9% between 2011 and 2012. In 2013, total electricity off-take in the ELIA control area was 80,6 TWh, a decrease of 1,4% compared to 2012. The maximum off-take was 13.446 MW, which is a little more than in 2012 but less than in 2007 (14.033 MW).

Belgium has in general been a net power importer since the beginning of the 1990s. In 2008, imports accounted for more than 13% of electricity demand. More recently, electricity imports have increased considerably. The complete unavailability of 2000 MW of nuclear capacity from August 2012 through June 2013 had a significant impact on the commercial use of import interconnections. The CREG estimates that, on average, 75% of unavailable nuclear capacity is compensated for by greater imports[41]. In 2013, net commercial imports to the ELIA control area were 1.124 MW on average and 9,8 TWh in total (that is 11% of the total electricity off-take).

The average Belgian commercial import capacity in 2013 was 3.932 MW and the average commercial export capacity was 2.821 MW. These figures confirm that Belgium is a highly interconnected country. The average import capacity was a little over 40% of the average consumption and a little less than 30% of the peak consumption in the ELIA control area.

TABLE 6. ENERGY RELATED RATIOS

	1970	1980	1990	2000	2005	2010	2012*

[38] Stoppage from 01/06/2012 until 05/06/2013.

[39] Stoppage from 17/08/2012 until 07/06/2013.

[40] Only the generation plants connected to the ELIA grid (voltage of 30 kV or more) are taken into account.

[41] http://www.creg.info/pdf/Studies/F1319EN.pdf.

Energy consumption per capita (GJ/capita)		206,8	206,2	240,4	237,7	236,55	213,85
Electricity consumption per capita (kW.h/capita)		5.448,8	7.109,1	8.205,1	8.330,9	7.866,3	7.554,0
Electricity production/Energy production (%)		64,37	56,74	53,06	54,97	54,35	45,20
Nuclear/Total electricity (%)		23,40	60,24	57,33	54,47	50,40	48,63
Ratio of external dependency (%) (1)		88,73	82,61	86,59	91,13	90,51	83,05

(1) Net import / Total energy consumption.
* Latest available official data
Source: FPS Economy – Statistics Belgium (Statbel)

Primary energy intensity has declined on the whole in Belgium since 1990, reflecting the uncoupling of economic growth and primary energy consumption. Buildings constitute the leading end consumer of primary energy (33.7%), followed by industry (30.9%) and transport (20.7%). Total final energy consumption decreased at a yearly rate of 0.06% between 2000 and 2011. Alongside petroleum, which remains the dominant energy source (45.3% in 2011) at end-consumer level, the country has considerably expanded the use of natural gas (28.3%), electricity (15.6%) and, more recently, the use of renewable sources of energy (7.5%). Petroleum covers primarily the needs of the transport and residential sectors as well as non-energy uses (feedstocks); middle distillates represent 44% of the oil products consumed in the country. Electricity and natural gas, on the other hand, play a major role in industry and the residential sector, heat (1.7%) is used in industry while the use of solid fuels (1.7%) is mainly confined to the iron and steel industry.

2. NUCLEAR POWER SITUATION

2.1. Historical development and current organizational structure

2.1.1. Overview

Nuclear power development in Belgium began after World War II, when Belgium started uranium production in its mines in the Belgian Congo and signed a nuclear technical co-operation agreement with the US. Belgium was a groundbreaker in adopting nuclear technology for peaceful purposes in the early 1960s. For many years the Belgian nuclear industry covered almost all activities in the nuclear fuel cycle. After the commissioning of the pilot PWR reactor BR3 at SCK•CEN in 1962 and an early 305 MW PWR design by Westinghouse in cooperation with France (Chooz A) in 1966, commercial utilisation of nuclear power development took off in Belgium with the decision to build the Doel (in Flanders) and Tihange (in Wallonia) NPPs. Doel 1 and 2 were ordered in 1968, and Tihange 1 was ordered in 1969). Commercial development was accelerated by the 1970's oil crisis witch lead to the construction of four more nuclear reactors in 1974. By 1985, 7 nuclear power units – all pressurised water reactors – had been connected to the electricity grid, with a total net generating capacity of 5 824.5 MW.

On 16 January 2003, the Belgian federal parliament voted a law that promulgates the gradual phase-out of nuclear fission energy for commercial electricity production. The law prohibits the construction of new nuclear power plants and sets a 40-year limit on the operational period of existing plants.

On 4 July 2012, the Belgian Government confirmed this decision and by the law of 18 December 2013 it provided a timetable for the nuclear power phase-out between 2015 and 2025:

- Doel 1: 15 February 2015
- Doel 2: 1 December 2015
- Doel 3: 1 October 2022
- Doel 4: 1 July 2025
- Tihange 1: 1 October 2025
- Tihange 2: 1 February 2023
- Tihange 3: 1 September 2025

At the same time, it provided for the extension by 10 years of the licence of Tihange 1. The first reactors to be shut down will be Doel 1 in February 2015 followed by Doel 2 in December 2015. No new nuclear reactors intended for the industrial production of electricity by nuclear fission are to be built in Belgium. This law does not apply to nuclear research reactors.

The main milestones are:

1949	Government of Belgium grants purchasing priority of the uranium resources in Congo to the governments of the UK and the US.
1952	The Belgian government establishes STK-CEAEN, the Research Centre for Nuclear Energy Applications [Studiecentrum voor de Toepassingen van Kernenergie - Centre d'Etudes pour les Applications de l'Energie nucléaire - The name will be changed to SCK•CEN in 1957].
1956	Commissioning of Belgian Reactor 1 (BR1) by STK-CEAEN.
1957	Belgian engineers took part in the commissioning of the first commercial nuclear plant in the USA.
1957	SCK•CEN (Studiecentrum voor Kernenergie - Centre d'Etude de l'Energie Nucléaire – Belgian Nuclear Research Centre).
1957	Foundation of BELGONUCLEAIRE (MOX production and radwaste treatment and conditioning).
1957	Foundation of EUROCHEMIC, international cooperation of thirteen European countries sharing their knowledge in recovering and reprocessing spent fuel.
1960	Franco-Belgian convention and creation of SENA (Société Nucléaire franco-belge des Ardennes): the principle was that everything from funding to studies and energy production should be shared equally.
1960	Start of the construction of the EUROCHEMIC reprocessing plant.
1960	First supply of plutonium to Belgium by the United States.
1961	Commissioning of BR2 (Belgian Reactor 2) by SCK•CEN.
1962	Commissioning of the BR3 (Belgian Reactor 3) PWR prototype plant (11 MWe) for SCK•CEN. This reactor was the first PWR built outside the United States.
1963	Researchers introduce plutonium-enriched fuel rods into BR3.
1964	Commissioning of the VENUS research reactor (Vulcan Experimental Nuclear Study).
1965	Creation of SYNATOM (Syndicate for the design of large capacity nuclear power plants).
1966	Commissioning of the Franco-Belgian Chooz A NPP, then the world's most powerful PWR (305 MW).
1966	Decision to build Doel and Tihange NPPs (Doel 1 and 2 ordered in 1968, Tihange 1 in 1969).
1966	Start-up of the installations of EUROCHEMIC.
1969	A Nuclear Safety Department (AVN) was set up within the Association Vinçotte, immediately put in charge of the regulatory control of the nuclear power plants Doel and Tihange.
1971	Creation of the Institute for Radioelements (IRE).
1972	Joint fast breeder programme with Germany and the Netherlands (Kalkar Nuclear Power Plant).
1973	Creation of FBFC (Franco-Belge de Fabrication du Combustible), nuclear fuel producing company.
1973	Oil crisis and decision to build 4 more nuclear units: Doel 3 and 4, Tihange 2 and 3 (ordered in 1974).
1974	End of the reprocessing activities of EUROCHEMIC.
1974	SCK•CEN launches a research programme on storing radioactive waste deeply underground.
1974	Commissioning of Doel 1 NPP.
1975	Commissioning of Doel 2 and Tihange 1 nuclear power units.
1976	Take-over of EUROCHEMIC by the Belgian government with the intention for it to supply for domestic needs only.
1977	SYNATOM becomes a nuclear fuel management company (Belgian company for nuclear fuel).
1980	Creation of ONDRAF/NIRAS, the National Agency for Radioactive Waste and Enriched Fissile Materials (Law of 8 August 1980, amended by the law of 11 January 1991).
1981	The Belgian Nuclear Safety Authority, made up of two services, the SSTIN and the SPRI, is created by Royal Decree.
1982	Commissioning of Doel 3 and Tihange 2 nuclear power units.
1984	Foundation of BELGOPROCESS (which at the time stood for Belgium reprocessing).
1985	Government decision to shut down EUROCHEMIC for good.
1985	Exhaustive back-fitting process for Doel 1, 2 and Tihange 1 nuclear power units. Commissioning of Doel 4 and Tihange 3 nuclear power units.
1986	Architect-engineering companies ELECTROBEL and TRACTIONEL merge to create TRACTEBEL.
1986	SCK•CEN is involved in the measurements following the Chernobyl nuclear disaster.
1986	Transfer of the BELGOPROCESS shares to ONDRAF/NIRAS.
1986	Beginning of industrial production of MOX fuel by BELGONUCLEAIRE at the Dessel plant.
1987	Start of decommissioning studies for EUROCHEMIC.
1987	The BR3 pressurised water reactor is closed down. This leads to the immediate launch of the first Western European research programme into the dismantling of this type of nuclear reactor.
1988	The construction of an 8th unit (N8) of 1400 MW (50% EDF) indefinitely postponed by Government.
1989	Start of the decommissioning of EUROCHEMIC.
1989	Construction of a centralized treatment facility to process low-level Belgian radwaste (CILVA).

1990	Construction of a storage unit for conditioned high and medium level waste (Building 136).
1990	Private electricity producers INTERCOM, EBES and UNERG merge to create ELECTRABEL.
1991	Decommissioning (by EDF) of Chooz A NPP.
1993	First steam generator replacement in Belgium at Doel 3 NPP.
1993	The first Belgian Parliament's debate on reprocessing and use of MOX fuel led to the suspension of the reprocessing contract signed between SYNATOM and COGEMA in 1991. The active reprocessing contract signed in 1978 could be further carried out, but no new reprocessing contracts could be signed. From 1993, both options for the back-end of the fuel cycle are to be considered on an equal basis and must be assessed in detail during the next five years. The authorization to use MOX in Belgian NPPs is granted in order to consume plutonium obtained from past and active reprocessing contracts for Belgian spent fuel.
1994	Royal Decree authorizing the loading of MOX fuel in Doel 3 and Tihange 2 NPPs.
1994	Promulgation of the law with respect to the Federal Agency for Nuclear Control (FANC/AFCN).
1995	First loading of MOX fuel in Tihange 2 (March) and Doel 3 (June) NPPs.
1995	Commissioning of the dry interim spent fuel storage facility on the Doel NPP's site.
1995	Creation of the co-operative company CPTE (Company for co-ordination and Transmission of Electrical Energy) by ELECTRABEL (91.5%) and SPE (8.5%).
1995	An Economic interest grouping (EIG PRACLAY, later renamed as EIG EURIDICE) is created involving SCK•CEN and ONDRAF/NIRAS to carry out feasibility studies for the disposal of high-level and/or long-lived radioactive waste in clay layers.
1996	Belgian reactor 2 (BR2) undergoes a major campaign of modernisation and refurbishment.
1997	Commissioning of the wet interim spent fuel storage facility on the Tihange NPP's site.
1997	In April, ONDRAF/NIRAS presents the various options for the final disposal of low level and short-lived waste to the authorities. A new law of 12 December 1997 defines a new mission for ONDRAF/NIRAS to establish the inventory of all nuclear facilities and sites containing radioactive waste and assess the decommissioning and site remediation costs.
1998	In January, the Belgian Government decided on a new approach for the search of disposal sites for low level and short-lived radioactive waste based on participative methods; it limits the research to existing nuclear zones or areas where the municipalities have shown interest. In December, the Belgian government ordered the cancellation of the reprocessing contract signed in 1991 between SYNATOM and COGEMA and which was suspended in 1993. It postponed the debate about spent fuel management for a year pending the results of on-going technical and economic studies. The government's decision doesn't ban further reprocessing of Belgian spent fuel, but forbids SYNATOM to conclude a new contract without its formal approval.
1998	The MYRRHA research project begins.
1999	In February, the government appointed the expert commission AMPERE (Commission d'Analyse des Modes de Production d'Électricité et de Redéploiement des Énergies) to assess the electricity demand and the options for the future of power generation in Belgium in the 21st century.
1999	Law of 29 April 1999 on the organization of the electricity market.
1999	In July, the new government announces the closure of all Belgian nuclear power plants when they reach their 40-years lifetime and introduces a moratorium on reprocessing.
1999	SCK•CEN removes the reactor vessel from Belgian Reactor 3 (BR3).
2000	In April, the first 28 containers with vitrified high-level radwaste, resulting from the reprocessing of Belgian spent fuel in La Hague (France), returned to Belgium. The second repatriation took place in November.
2000	In December, the Economic interest grouping EURIDICE (European Underground Research Infrastructure for Disposal of Nuclear Waste in Clay Environment) between ONDRAF/NIRAS and SCK•CEN was created to replace the EIG PRACLAY. The EIG EURIDICE is now responsible for the management and operation of the underground research laboratory HADES and the realisation of the PRACLAY project.
2000	In December, the Commission AMPERE published its report of more than 1000 pages, containing among its key messages, its recommendations to keep the nuclear option open. The report will be evaluated by a group of five international experts selected by the Government. .
2001	In February, repatriation of the third batch of containers with vitrified high-level radwaste resulting from the reprocessing of Belgian spent fuel in La Hague (France).
2001	In May, the group of five international experts published the conclusions of their evaluation of the report of the Commission AMPERE. The experts corroborate the standpoints of the Commission AMPERE on a large number of points, in particular the preservation of the national know-how regarding nuclear energy.
2001	During the outage of Tihange 2, that started on 9 June and ended on 11 August, the three steam generators were successfully replaced. The steam generators replacement itself was executed in

	the new time record of 17.5 days.
2001	In September, the Federal Agency for Nuclear Control (FANC/AFCN), established by the federal law of 15 April 1994, became operational, incorporating the former SSTIN and the SPRI.
2001	SCK•CEN launches the 'Master's Degree Course in Nuclear Engineering' in collaboration with five Belgian universities.
2001	In December, an agreement was obtained between the Belgian government and the electricity sector on financing the dismantling of old nuclear installations at the sites of EUROCHEMIC (BP1) and the former Waste Department of SCK•CEN (BP2), and on the management of the provisions for spent fuel disposal and dismantling of the Belgian nuclear power stations.
2002	In February and September, repatriation of the fourth and fifth batches of containers with vitrified high-level radwaste, resulting from the reprocessing of Belgian spent fuel in La Hague (France).
2002	In July, the SAFIR 2 Report (Safety Assessment and Feasibility Interim Report) on high level radwaste disposal in Belgium was presented by ONDRAF/NIRAS to the competent federal authorities. The report confirms the Boom clay as a potential host formation, as well as the technical feasibility of the construction of an underground repository in this clay. The report was peer-reviewed by the OECD/NEA.
2002	BELGONUCLEAIRE passed a cumulative production of 500 tons MOX fuel.
2003	Law of 31 January 2003 on the gradual phasing out of nuclear energy for the industrial production of electricity.
2003	ONDRAF/NIRAS submitted to the Government the first inventory report of all nuclear sites or facilities containing radioactive substances on the Belgian territory.
2003	Law of 11 April 2003, regulating the provisions for decommissioning of Belgian nuclear power plants and for the management of spent fuel from those nuclear power plants.
2003	In the same month, the general assemblies of ELECTRABEL and SPE agreed to split their joint venture CPTE with retro-active effect to 1 January 2003.
2003	In September, repatriation of the sixth batch of containers with vitrified high-level radwaste, resulting from the reprocessing of Belgian spent fuel in La Hague (France).
2005	Decision to close the MOX factory (BELGONUCLEAIRE) in Dessel.
2006	SCK•CEN undergoes a reorganisation process which leads to the creation of three scientific institutes. Each institute researches a specific field of nuclear applications. A fourth institute becomes responsible for communications, support services and administration. •The Institute for Nuclear Material Sciences conducts research into materials and fuels for current and future nuclear systems. •The Institute for Advanced Nuclear Systems develops technological knowledge on innovative nuclear reactors. •The Institute for Environment, Health and Safety safeguards the health and safety of humans and the environment for various applications of radioactivity, including the back-end of the fuel cycle.
2006	Stoppage of BELGONUCLEAIRE in August.
2007	In September 2007, the FANC/AFCN has created a subsidiary, a foundation of private law, called Bel V.
2008	On 14/04/2008, the regulatory activities of AVN, as well as the concerned staff, have been transferred to Bel V. Since that day, this subsidiary of the FANC/AFCN constitutes the Technical Safety Organisation (TSO) of the Belgian Nuclear Safety Authority.
2008	Completion of the first phase of the decommissioning of Eurochemic.
2008	The BR3 reactor chimney is demolished: an important step in the dismantling process.
2009	SCK•CEN coordinates Belgian research on fusion within "the broader approach" to nuclear fusion.
2010	Start of dismantling works of BELGONUCLEAIRE (Main contractors: TECNUBEL N.V., THV BELGOPROCESS/SCK•CEN and Studsvik GmbH. Project manager: TRACTEBEL Engineering).
2010	GUINEVERE is inaugurated at SCK•CEN; one step forward in the research on accelerator driven systems. With the European GUINEVERE project, SCK•CEN realises the world's first demonstration model of an accelerator driven system with a complete lead core. The federal government announces financial support for the MYRRHA project. Europe views MYRRHA as a priority research infrastructure for energy security and the fight against climate change.
2010	SCK•CEN celebrates 35 years of fusion research.
2011	In the aftermath of the nuclear accident in Fukushima, SCK•CEN offers support activities in areas such as analysis, measurements, technical advice etc.
2011	Stoppage of FBFC (Franco-Belge de Fabrication du Combustible).
2012	At its 60th anniversary, SCK•CEN establishes the Academy for Nuclear Science and Technology. The Academy combines all education and training activities.
2012	Doel 3 NPP: Temporary stoppage from 01/06/2012 until 05/06/2013.

	Tihange 2 NPP: Temporary stoppage from 17/08/2012 until 07/06/2013.
2012	On 4 July 2012, federal government decision on a timetable for the nuclear power phase-out between 2015 and 2025, providing for the extension by 10 years of the licence of Tihange 1 NPP.
2013	VENUS exploitation license for GUINEVERE published by Royal Decree.
2013	Law of 18 December 2013, amending the law of 31 January 2003 on the gradual phasing out of nuclear energy for the industrial production of electricity, providing a timetable for the nuclear power phase-out between 2015 and 2025.
2014	Complete transposition of EU Directive 2011/70/EURATOM establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste by the Law of 3 June 2014.

2.1.2. Current organizational chart

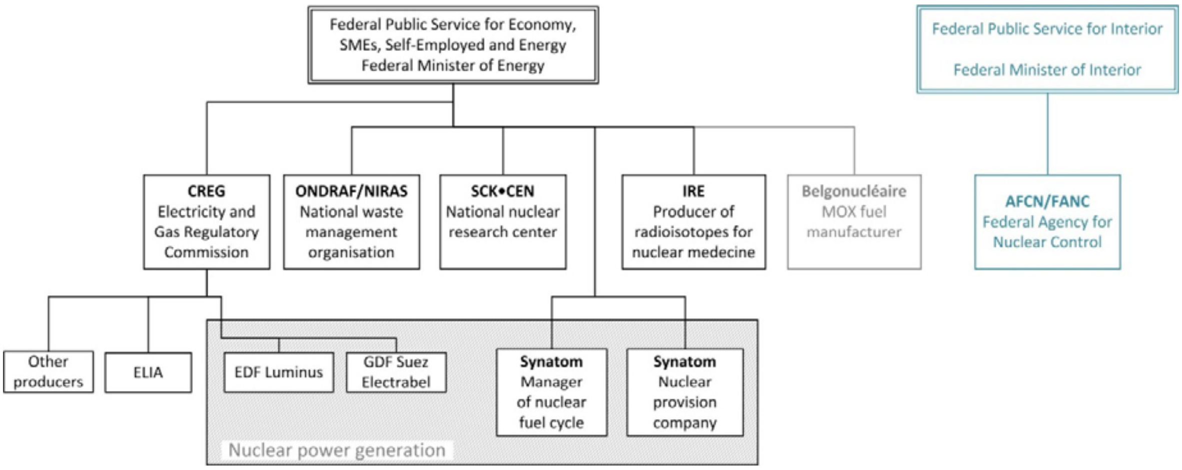

FIGURE1: Organizational chart

Policy related to the nuclear sector, the nuclear fuel cycle and nuclear R&D is the responsibility of the Federal Public Service (FPS) Economy, SMEs, Self-Employed and Energy.

Licensing, control and surveillance are the responsibility of the Federal Agency for Nuclear Control FANC/AFCN and is supervised by the Federal Minister of the Interior.

FANC/AFCN

The Federal Agency for Nuclear Control[42] (FANC/AFCN)[43] is the Belgian Nuclear Safety Authority. It was established by law in 1994[44] and became fully operational on 1 September 2001. The FANC/AFCN has legal duties in the field of radiation protection, nuclear safety and radiological surveillance.

CREG

[42] http://www.fanc.be/

[43] “Federaal Agentschap voor Nucleaire Controle” in Dutch or “Agence Fédérale de Contrôle Nucléaire” in French

[44] Law of 15 April 1994 on the protection of the public and the environment against the dangers of ionising radiation and on the Belgian Federal Agency for Nuclear Control (FANC/AFCN)

The federal Gas and Electricity Regulatory Commission (CREG) regulates and licenses electricity transmission above 70 kV, approves both transmission and distribution tariffs and monitors the market.

Its main missions are:

- to ensure that the electricity and gas market is transparent and competitive.
- to ensure that the market situation serves the public interest and fits into the overall energy policy;
- to represent essential consumer interests.

CREG also has an advisory role for the Belgian federal government and has the power[45] to perform investigations and studies on the electricity market, either on its own initiative or at the request of the Minister for Energy or a regional government.

ONDRAF/NIRAS

ONDRAF/NIRAS[46] ('Nationale Instelling voor Radioactief Afval en verrijkte Splijtstoffen' or 'Organisme National des Déchets Radioactifs et des matières Fissiles enrichies')[47] is a public agency, entrusted by the legislator with the collection and management of radioactive waste generated on Belgian territory, so that it does not constitute any danger to the population or the environment.

The National Agency for Radioactive Wastes and Fissile Materials Management[48] operates under supervision of the federal minister in charge of the Energy and the federal minister in charge of Economy. It has been entrusted by the Law of 8 August 1980 with the safe transportation, treatment, conditioning, storage and disposal of all radioactive waste produced in the country. The Royal Decree of 30 March 1981 defined these missions and duties. NIRAS' mission was extended by way of a law enacted on 11 January 1991, to include certain aspects of the management of enriched fissile materials and the decommissioning of nuclear facilities other than nuclear power plants, the procedures of which were defined in the Royal Decree of 16 October 1991. It also has the main responsibility for R&D on radioactive waste management and disposal in particular.

BELGOPROCESS

BELGOPROCESS, a subsidiary of NIRAS, offers integrated nuclear waste management and decommissioning services; driven by safety and backed by hands-on industrial experience. BELGOPROCESS is an expert in safely minimising the amount of radioactive waste produced and maximising release of decontaminated material while optimising operational costs.[49].

SCK•CEN

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[45] Law of 29 April 1999 on the organization of the electricity market

[46] http://www.niras.be/ (Dutch version) or http://www.ondraf.be/ (French version)

[47] National Agency for Radioactive Waste and Enriched Fissile Material

[48] http://www.nirond.be/

[49] http://www.belgoprocess.be/eng/AboutUs.htm

As a foundation of public utility, the Belgian Nuclear Research Centre SCK•CEN conducts research into the safety of nuclear installations, the management of radioactive waste and human and environmental protection against ionising radiation, safeguards of strategic materials and social implications of nuclear energy [50].

According to its statutes and besides the research activities, it also guarantees the maintenance of a Centre of Competence in the domains of nuclear energy and ionising radiation, and has a role in communication, education and training. In 2012 it created its Academy for Nuclear Sciences and Technology. It also offers services in the scope of its competences.

Besides its duties within foregoing basic missions, SCK•CEN's materials test reactor BR2 plays also a prominent role in the production of medical radioisotopes and the doping of Silicon at use in renewable energy systems.

The BR2 reactor is in service since 1963 en was subject in this period to two major refurbishments, the last one dating from 1997. The next major refurbishment period is scheduled for 2015-2016. According the Belgian licence rules for nuclear installations, the safety of the BR2 reactor, whose present 10 year licence period extends to 2016, will be subject to a periodic re-evaluation in 2016, aiming to assure the safe exploitation for the next in 10 year period 2016-2026.

[50] https://www.sckcen.be/en/

IRE

The National Institute for Radioelements (IRE)[51] is a public utility foundation whose main activity is the production of radioelements used in nuclear medicine for diagnostic and therapeutic purposes. Its R&D department contributes to research in the field of radioelement production, environmental protection and radioactive waste management.

Through its subsidiary, IRE ELiT, the Institute develops its service activities relating to the environmental protection and its new radiopharmaceutical production activities.

SYNATOM

The fuel cycle for Belgian nuclear plants is managed by SYNATOM (Société Belge des Combustibles Nucléaires)[52], a wholly-owned subsidiary of ELECTRABEL. The Belgian government holds a "golden share" and appoints two representatives in the Board of Directors.

SYNATOM is responsible for the fuel cycle front-end management, i.e., the supply with enriched uranium of the seven nuclear power units; as well as the fuel cycle back-end management, i.e., the management of all activities in connection with spent nuclear fuel. In addition, SYNATOM is entrusted by Law with the management of the provisions for dismantling the Belgian nuclear power plants and for the costs related to their spent fuel[53].

ELIA

ELIA System Operator SA[54] is Belgium's only transmission system operator (TSO) for electricity[55].

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51 http://www.ire.be/en/index_en.php

52 http://www.synatom.be/

53 Law of 11 April 2003 on the provisions made for the decommissioning of nuclear plants and the management of irradiated nuclear fuel in these plants, amended by the law of 25 April 2007

54 http://www.elia.be/en/about-elia/

55 For more information on ELIA, see above, sub 1.3.1. Electricity policy and decision making process.

2.2. Nuclear power plants: Overview

2.2.1. Status and performance of nuclear power plants

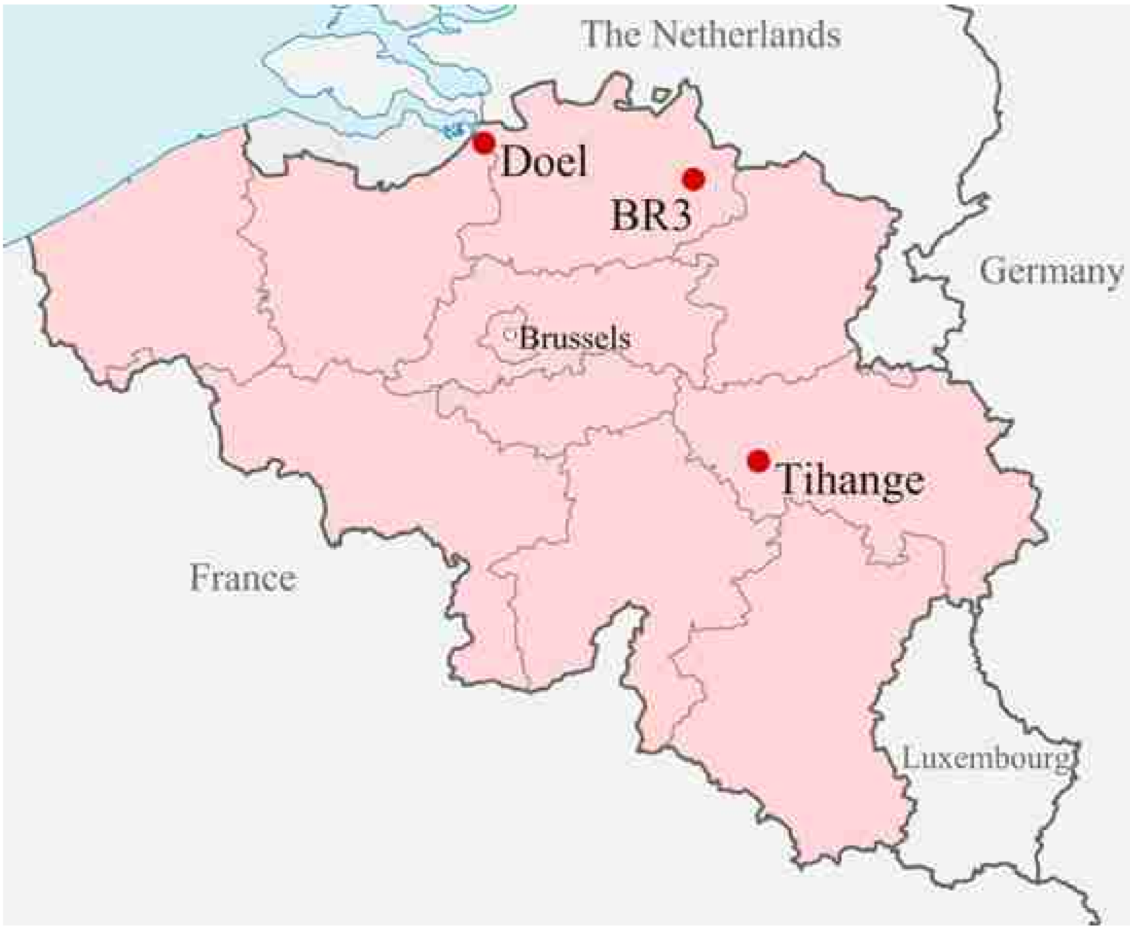

FIGURE 2: Location of nuclear power plants in Belgium)[56].

The nuclear power plants are located in Doel (in Flanders) and Tihange (in Wallonia).

The BR3 (Belgian Reactor 3), a prototype pressurised water reactor, was shut down in 1987.

[56] Licensed under Creative Commons Attribution-Share Alike 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Belgium_location_map.svg

TABLE 7. STATUS AND PERFORMANCE OF NUCLEAR POWER PLANTS

Station	Type	Net Capacity MW	Operator	Status	Reactor Supplier	Construction Date+	Grid Date++	Commercial Date	Programmed Shutdown Date[57]	UCF for year 2013*
Doel 1	PWR	433	ELECTRABEL	Operational	ACECOWEN	1974-07-18	1974-08-28	1975-02-15	2015-02-15	97,9%
Doel 2	PWR	433	ELECTRABEL	Operational	ACECOWEN	1975-08-04	1975-08-21	1975-12-01	2015-12-01	93,8%
Doel 3	PWR	1.006	ELECTRABEL	Operational	FRAMACEC	1982-06-14	1982-06-23	1982-10-01	2022-10-01	56,9%
Doel 4	PWR	1.039	ELECTRABEL	Operational	ACECOWEN	1985-03-31	1985-04-08	1985-07-01	2025-07-01	93.5%
Tihange 1	PWR	962	ELECTRABEL	Operational	ACLF	1975-02-21	1975-03-07	1975-10-01	2025-10-01	80.9%
Tihange 2	PWR	1.008	ELECTRABEL	Operational	FRAMACEC	1982-10-05	1982-10-13	1983-06-01	2023-02-01	55.8%
Tihange 3	PWR	1.046	ELECTRABEL	Operational	ACECOWEN	1985-06-05	1985-06-15	1985-09-01	2025-09-01	88.9%

* UCF (Unit Capability Factor) for the latest available year (only applicable to reactors in operation).
+ Date when first major placing of concrete, usually for the base mat of the reactor building, is done.
++ Date of the first connection to the grid.
Source: PRIS database (**Error! Hyperlink reference not valid.**/).

Table 7 is automatically updated from the PRIS database for all nuclear power plants: those in operation, under construction, suspended*, and cancelled after start of construction, permanently shut down and decommissioned.*

[57] Law of 18 December 2013 on the gradual phasing out of nuclear energy

2.2.2. Plant upgrading, plant life management and licence renewals

Licence renewals

The initial licences of the seven nuclear power plants were granted for an unlimited time.

After the licensing of the plants, the safety of the installations was continuously reviewed through different processes. The most important and systematic process is the series of periodic safety reviews (PSR) that is performed for all seven nuclear power plants.

In addition, many other projects with important modifications have been executed, amongst others steam generator replacements at all units, in some cases accompanied by power increase. Those major modifications to the nuclear power plants such as power increase, steam generators replacement, etc., are subject to license amendments following a similar process to the initial one.

As mentioned earlier, the federal government confirmed in July 2012 its intention[58] to limit the operating lives of existing nuclear power plants to 40 years and it provided (in 2013) a timetable[59] for a nuclear power phase-out between 2015 and 2025[60]. The Law of 18 December 2013, amending the law of 31 January 2003 on the gradual phasing out of nuclear energy for the industrial production of electricity, limited the operating licenses accordingly.

11 March 2011 Fukushima accident

On 24-25 March 2011 the European Council decided that the safety of all EU nuclear plants should be reviewed, on the basis of a comprehensive and transparent risk and safety assessment. Following the specification proposal such “stress tests” by the Western European Nuclear Regulator's Association (WENRA) on 21 April 2011 and by the European Nuclear Safety Regulators' Group (ENSREG) on 13 May 2011, the Federal Agency for Nuclear Control (FANC/AFCN) proposed on 17 May 2011 the specifications for “Belgian Stress tests” applicable to power reactors[61].

These specifications were adopted by Belgian Parliament on 16 June 2011[62].

In the light of the report submitted by ELECTRABEL (GDF SUEZ Group) to the Federal Agency for Nuclear Control (FANC/AFCN) on 31 October 2011, the FANC/AFCN concluded that the Doel and Tihange nuclear power plants have an adequate level of protection under extreme conditions[63].

A similar stress test evaluation was performed at SCK•CEN, BELGOPROCESS and IRE. FANC/AFCN also concluded that these installations have an adequate level of protection under extreme conditions. For all installations a follow-up plan with specific measures was implemented.

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58 Law of 31 January 2003 on the gradual phasing out of nuclear energy for the industrial production of electricity

59 Law of 18 December 2013 amending the law of 31 January 2003 on the gradual phasing out of nuclear energy for the industrial production of electricity

60 See Table 7. Status and performance of nuclear power plants

61 http://www.fanc.fgov.be/GED/00000000/2800/2847.pdf

62 http://www.dekamer.be/FLWB/PDF/53/1405/53K1405007.pdf

63 http://www.gdfsuez.com/wp-content/uploads/2012/05/stress-tests-belgian-nuclear-power-plantspdf.pdf

2.3. Future development of the Nuclear Power sector

The law on nuclear power phase-out of 31 January 2003 prohibited the building of new nuclear power plants and made provision for the gradual phase-out of the use of nuclear fission energy for the industrial production of electricity in Belgium, based on an operating period of the nuclear reactors of 40 years.

2.4. Organizations involved in construction of NPPs

TRACTEBEL Engineering

TRACTEBEL Engineering (TE)[64] is the Engineering division of the GDF SUEZ group. Its activities cover the whole lifecycle of infrastructure and energy projects, from feasibility studies to decommissioning. Headquartered in Brussels, it has offices in twenty countries and is running projects in over 80, employing around 3,300 people.

TRACTEBEL Engineering (TE) is the Architect-Engineer of the Belgian nuclear power stations (and of most of the fossil fuel fired plants). It houses the know-how of over forty years of nuclear technology, which started with the construction of the research reactors of SCK•CEN.

WESTINGHOUSE Electric Belgium

The Westinghouse Electric Belgium[65] office (in Nivelles) provides engineering support to nuclear power utilities in Europe and worldwide. Activities include structural and safety analysis; materials and fracture analysis; plant aging management and life extension; repair or replacement of major components; systems power uprating; and efficiency analysis. Ideally located, the centre supports Westinghouse Field Services efforts at European operating reactors. The Nivelles Service Centre, inaugurated in January 2010, has two fully licensed Class 2 nuclear facilities, including the 2,000-square-meter European Pump and Motor Maintenance and Repair Centre. Westinghouse Electric Belgium employs a multi-national workforce of approximately 200 employees.

2.5. Organizations involved in operation of NPPs

ELECTRABEL

The public limited company ELECTRABEL[66] was established in 1905, called 'Elektriciteitsmaatschappij der Schelde'. After a series of mergers, it developed into the biggest energy company in Belgium and the former incumbent electricity supplier. As from 1990, its name is ELECTRABEL.

ELECTRABEL is 100% owned by GDF SUEZ and it is active in the production of electricity and in the selling of electricity, natural gas and energy services to retail and business customers.

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64 http://www.tractebel-engineering-gdfsuez.com/

65 http://www.westinghousenuclear.com/

66 http://www.electrabel.com/

ELECTRABEL operates seven nuclear reactors: four in Doel and three in Tihange, with a total capacity of almost 6.000 MW. Moreover, ELECTRABEL owns 50% of Tihange 1; 89,8% of Tihange 2 and 3; 100% of Doel 1 and 2 and 89,8% of Doel 3 and 4.

EDF Belgium

EDF Belgium[67] is active in electricity generation. It owns a 63.5% stake in EDF LUMINUS, Belgium's second largest gas and electricity supplier. EDF Belgium also holds a direct 50% stake in Unit 1 of the TIHANGE NPP.

EDF LUMINUS

EDF acquired in 2009 the majority stake of Centrica in SPE LUMINUS, which was originally established in 1978 as a municipalities' joint utility called "Société coopérative de Production d'Electricité" (SPE). EDF Belgium now holds 63,5% of the shares, the other 36,5% are held by the historical Flemish and Walloon inter-municipal shareholders of SPE: PUBLILEC, PUBLILUM, SOCOFE, VEH, ETHIAS and TECTEO.

EDF Belgium merged its sales activities with SPE in September 2010 and renamed the company EDF LUMINUS on 23 of November 2011.

EDF LUMINUS has a stake of 10,2% in four nuclear power units (Tihange 2 and 3 and Doel 3 and 4).

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[67] http://belgium.edf.com/edf-in-belgium/

2.6. Organizations involved in decommissioning of NPPs

FANC/AFCN

The Federal Agency for Nuclear Control (FANC/AFCN)[68] is the regulatory body which is in charge of nuclear safety, licensing and de-licensing, under supervision of the minister for the Interior. The decommissioning of nuclear installations belonging to the Class I facilities, as well as some belonging to the Class II facilities, is subject to prior authorisation by the FANC/AFCN. For Class I installations, the decommissioning licence is granted by a Royal Decree, countersigned by the Minister responsible for nuclear safety and radiological protection, but the licence application must be submitted to the FANC/AFCN. For Class II installations, the licence is granted by the FANC/AFCN. The decommissioning strategy is specified by the licence applicant and submitted to the FANC/AFCN for approval.

ONDRAF/NIRAS

The legislator assigned by law certain responsibilities in the field of decommissioning to NIRAS. Among others, the agency has to collect and to evaluate information related to the decommissioning programmes of nuclear installations, to approve those programmes, and to execute decommissioning programmes at the demand of third parties or in the case of failure of an operator. For the purpose of standardisation of decommissioning planning, ONDRAF/NIRAS issued recommendations for the elaboration of decommissioning plans, following the IAEA-Safety Requirements and Guides in the field of decommissioning. The legislator furthermore assigned by law to ONDRAF/NIRAS the elaboration of an inventory of all nuclear installations and all sites containing radioactive substances within the country, including the verification of the existence of sufficient financial provisions for the execution of decommissioning and remediation programmes.

ONDRAF/NIRAS also sees to it that the owners/operators create the necessary provisions for the financing of the future dismantling programme.

ONDRAF/NIRAS must work at cost price and charge those using its services – radioactive waste producers – no more or less than the amounts necessary to ensure the safe management of their waste, in accordance with the "polluter pays" principle.

CREG

The law of 24 December 2002 providing for the levy of an excise tax, called federal dues, which is calculated on the basis of kWh consumed. These dues are paid to a fund earmarked to finance responsibilities resulting from the decommissioning of the sites of the former EUROCHEMIC plant (BP1) and the former Waste Department of SCK•CEN (BP2), as well as the treatment, processing, storage and evacuation of accumulated radioactive waste. The Commission for Electricity and Gas Regulation (CREG) collects the amount owed as dues and transfers it to ONDRAF/NIRAS, which is responsible for the management and clean-up.

SYNATOM

SYNATOM[69], a wholly owned subsidiary of ELECTRABEL, has been entrusted by Law with the management of all the provisions for the nuclear liabilities, the dismantling of the nuclear

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68 http://www.fanc.fgov.be/

69 http://www.synatom.be/

power plants and the management of the spent fuel[70]. SYNATOM is also the exclusive owner of the nuclear fuel from its fabrication to its transfer to NIRAS/ONDRAF when declared as radioactive waste. Hence it is the most important owner and producer of irradiated fissile materials.

The main characteristics of the applied methodology for dismantling provisions are the following:

- the provision must be accrued over the life expectancy of the nuclear power plants (as defined by the law of 31 January 2003, i.e. 40 calendar years), the current scenario is a dismantling approach based on the dismantling of each unit separately, but in series, and the decommissioning of the common facilities well after the decommissioning of the last unit on each site.
- the initial provision is equal to the net present value of all future decommissioning expenses (based on a study performed by an independent engineering company and the engineering office TRACTEBEL).

TRACTEBEL Engineering

See 2.4. Organizations involved in construction of NPPs.

SCK•CEN

SCK•CEN has accumulated almost 25 years' experience in decommissioning and decontamination of reactors, hot cells, radioactive contaminated laboratories and "exotic" installations.

SCK•CEN was entrusted with the decommissioning of the BR3 (Belgian Reactor 3), a prototype pressurised water reactor which was operational from 1962 to 1987. At present, the major components of the BR3 reactor have been dismantled, and concrete cleaning works have started. The major remaining tasks as such are related to the demolishing of the buildings. It will be the first complete decommissioning of a PWR in Europe.

This expertise is nowadays also being applied for the refurbishment of various laboratories on site.

The experience with the dismantling of BR3 has led to considerable expertise in the various chemical and mechanical dismantling techniques, but also the management of materials including various categories of radioactive and non-radioactive wastes and materials suitable for free release.

SCK•-CEN has also been strongly involved in the management of the dismantling of the Thetis research reactor at Ghent University and at the dismantling of the former MOX production plant BELGONUCLÉAIRE in Dessel, both projects approaching their end.

The experience with handling of materials, transportations, legal requirements etc. has also allowed Belgium to evacuate in 20134 some strategic materials to the US, under the coordination of SCK-CEN and in cooperation with US-DOE, the European Commission and various actors located on the Belgian territory.

[70] Law of 11 April 2003 on the provisions made for the decommissioning of nuclear plants and the management of irradiated nuclear fuel in these plants, amended by the law of 25 April 2007

2.7. Fuel cycle including waste management

Mining and milling

Prior to 1977 a few uranium occurrences and showings were reported and between 1979 and 1981 exploration was funded jointly by the European Commission and the (then) Belgian Ministry of Economic Affairs[71]. The results were published in 1983. Currently no exploration or mining activities are being done. Belgian regulations concerning prospecting and the export of ores contain no special provisions regarding nuclear ores.

Uranium conversion and enrichment

As stated earlier, the supply of enriched uranium for the Belgian nuclear power plants belongs to the responsibilities of SYNATOM, which used to have an 11% share in the EURODIF enrichment facility on the Tricastin site in France. This facility closed down in June 2012. SYNATOM does not participate in Georges Besse II.

In 2008, SYNATOM announced a strategic partnership with POWERTECH Uranium Corp. from Canada, for the development of POWERTECH's uranium projects in the USA. SYNATOM currently owns 18,6% of POWERTECH.

No conversion or enrichment activities take place in Belgium.

Fuel fabrication

Belgium invested MOX fuel at SCK•CEN and has experience in MOX fuel development and production dating back to 1960, though MOX has been in use in Belgian nuclear power plants since 1995 only.

BELGONUCLEAIRE has been operating a MOX-fuel manufacturing facility in Dessel from 1986 to 2006 at industrial scale. It had a yearly production capacity of 32 tonnes of MOX fuel for commercial West-European Light Water Reactors. At the end of 2005, it was decided to stop the production after the successive capacity increases of MOX plants in France and the UK. BELGONUCLEAIRE definitively ended its production activities in the Dessel MOX-plant in mid-2006[72]. Decommissioning of the plant started in 2009 and has reached a progress of 90% by the middle of 2014; it will be completed in 2015.

FBFC (Franco-Belge de Fabrication du Combustible), a subsidiary of AREVA, had a fresh fuel production capacity of 500 tonnes per year, but the facility was shut down in 2012. Its 200 tonnes per year MOX fuel fabrication building will end activities in the middle of 2015.

Interim storage of spent fuel

Currently, commercial spent fuel is separately stored in dedicated facilities on the sites of the nuclear power plants (pool storage in Tihange and dry storage in Doel). End of 2012, the dry storage building in Doel contained 82 containers in which 2.424 spent fuel elements were stored, while the wet storage building in Tihange contained 2.267 such elements.

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[71] Uranium 2011:Resources, Production and Demand, OECD/NEA and IAEA http://www.oecd-nea.org/ndd/pubs/2012/7059-uranium-2011.pdf

[72] The last fabrication campaign has been completed on 15 August 2006. The decommissioning license was granted by Royal Decree on 26 February 2008.

Reprocessing

Reprocessing of spent fuel has been carried out by AREVA (formerly COGÉMA) in France since 1978, when SYNATOM entered into a reprocessing contract with COGÉMA.

Also in 1978, the Belgian government concluded an agreement in principle about the takeover of the EUROCHEMIC reprocessing plant[73] with the intention for it to supply domestic needs only.

The EUROCHEMIC pilot plant was founded in December 1957 by an international consortium of twelve OECD countries, in partnership with the private sector.[74] It was EUROCHEMIC's mission to construct and operate an experimental reprocessing plant for the recycling of spent nuclear fuel and to conduct scientific research into new reprocessing methods, whilst offering training for the future European nuclear scientists.

EUROCHEMIC's plant was in operation from 1966 till 1974. A total of 181,5 tonnes of natural and low-enriched uranium was reprocessed. Of this material, 95,5 tonnes originated from commercial nuclear reactors. A total of 677 kg of plutonium was separated. In addition, 1.363 kilograms of high-enriched uranium was recycled from 30,6 tonnes of fuel elements from European pilot reactors. When EUROCHEMIC was commissioned in 1966, it employed 378 people of thirteen different nationalities. But it was precisely this international approach that proved its Achilles heel. Quite soon after the plant had been commissioned, the main partners France and Germany quit the partnership intent on taking industrial reprocessing of nuclear fuel into their own hands. With a maximum capacity of 60 tonnes of uranium a year, it was impossible for EUROCHEMIC to compete on an industrial scale with these large national reprocessing projects.

In 1984, the Belgian government transferred EUROCHEMIC to BELGOPROCESS (which at the time stood for Belgium reprocessing), but in 1986 the decision was made to close the factory. The demolition of the EUROCHEMIC reprocessing plant has been completed in 2014.
In December 1993, the Belgian Parliament imposed a moratorium on further reprocessing of the spent fuel. This moratorium is still in force, although it was initially established for a period of five years.

Waste management

Radioactive waste generated during routine operations of nuclear facilities in Belgium is processed and conditioned on-site by the operator of the relevant facility or by the National Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS) in central processing and conditioning facilities located mainly in Dessel and managed by BELGOPROCESS, the industrial auxiliary subsidiary of ONDRAF/NIRAS.

The interim storage facilities for conditioned waste of all categories are centralised on the Dessel site operated by BELGOPROCESS.

Low-level solid waste is either incinerated or compacted in a 57 million euro facility named CILVA, which began industrial operation in 1994 and was certified according to the ISO 9001 quality management standard of 1995. Low-level liquid waste is treated chemically by flocculation and precipitation. After processing, the waste is encapsulated in cement in 400-

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[73] http://www.eurochemic.be/eng/documents/Eurochemic-brochure.pdf

[74] The twelve partners were: Germany, France, Belgium, Italy, Sweden, the Netherlands, Switzerland, Denmark, Austria, Norway, Turkey and Portugal, to be joined by Spain in 1959.

litre drums and then stored inside a building designed specifically for the purpose. Bitumen was also used in the past, until 2004. Annually, an average of 500 m³ of waste is supercompacted and 180 tonnes of waste is incinerated in the CILVA facility. Medium-level and long-lived alpha-bearing waste as well as Pu-contaminated glove-boxes have since 2007 been encapsulated in cement in 400-litre drums in the PAMELA-installation. About 801 m³ has been treated and about 433 m³ of conditioned waste produced up to the end of 2012.

The HRA/Solarium facility (G280X), built on site 2 at BELGOPROCESS and put into operation at the end of February 2005, is intended for the processing and conditioning by compression and cementation of historical medium-level waste and certain radium-bearing waste. By the end of 2013, 133 m³ of waste had been processed in the HRA/Solarium facility.

A simplified representation of the organisation of radioactive waste management in Belgium[75] is sketched below:

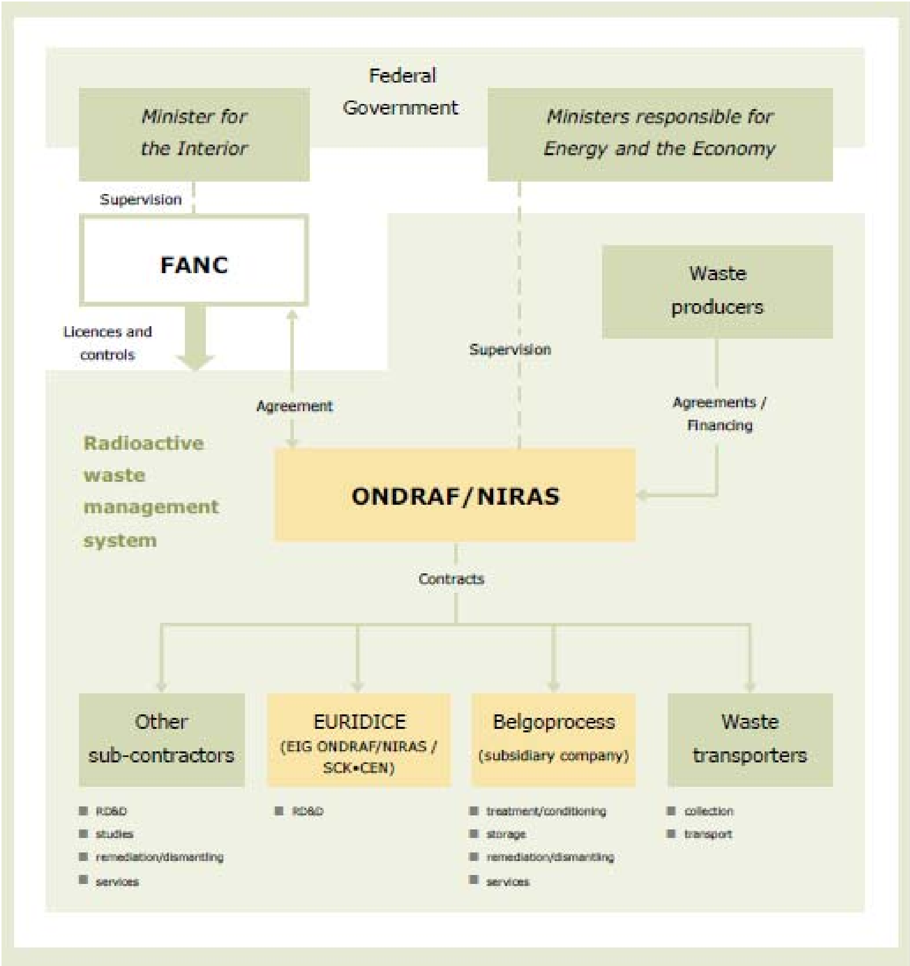

FIGURE3: Organization of radioactive waste management

Storage of low-level waste

Building 150: commissioned in 1986 after Belgium joined the international moratorium on sea disposal of conditioned low-level waste. Capable of holding 1.929 m³, it has been filled to

[75] http://www.ondraf-plandechets.be/

near capacity since the end of the eighties (it is filled with 1.914 m³ of conditioned waste, or 3.317 packages at the end of 2012).

Building 151: commissioned in 1988, this is a modular building, initially featuring two storage halls. Two more halls were added in 1993, increasing the total capacity from 6.300 m³ to 14.700 m³. The drums are stored by means of a remotely controlled roller bridge. By the end of 2012, building 151 housed 14.153 m³ of conditioned waste (35.144 packages). According to the most recent predictions, its total capacity should be enough to accommodate Belgium's conditioned low-level waste until the beginning of 2016.

Storage of medium-level waste

Building 127: commissioned in 1978, this building has undergone two phases of extension and adaptation, the last of which was in 1988. Since then, its total capacity has been 4.650 m³, split between 4 bunkers of the same size with reinforced concrete walls 80 cm thick. The drums are stored by means of a remotely controlled roller bridge. At the end of 2012, 3.863 m³ of conditioned waste (15.855 packages) were housed in building 127.

Building 155: a storage facility specially designed to store low-level radium and plutonium-bearing waste following processing/conditioning. Commissioned in 2005, it consists of two separate storage rooms each: one for housing radium-bearing waste and the other for plutonium-bearing waste. Although it would be possible to extend the storage rooms, building 155's capacity should be adequate for all the drums of radium and plutonium-bearing waste currently in existence and for those whose production is forecast. At the end of 2012, building 155 housed 1.404 m³ of conditioned waste (3.442 packages).

Building 270: a simple buffer storage on site 2 of BELGOPROCESS, used to temporarily store conditioned waste waiting for its transfer to the appropriate storage facilities on site 1 of BELGOPROCESS. At the end of 2012, 461 conditioned waste packages (198 m³) were stored.

Storage of medium-level and high-level waste

Building 129: commissioned in 1985, this building has a capacity of 250 m³, split between two shielded bunkers with reinforced concrete walls, 1,2 m thick. The containers, which are handled remotely from a shielded control room, are placed in vertical steel shafts. The building contains 195 m³ of conditioned high-level waste from the vitrification in the PAMELA facility of liquid waste derived from the reprocessing of spent fuel in the former EUROCHEMIC reprocessing plant. Since 1995, it also houses medium-level and high-level cemented waste from SCK•CEN's BR2 and BR3 reactors and from the operation and partial decommissioning of PAMELA. Ever since, building 129 has contained 215 m³ of conditioned waste (2.335 packages). Although heat emitted by waste stored in building 129 is quite low, the storage shafts are ventilated to accelerate the dissipation of whatever heat is being generated.

Building 136: the construction of building 136 started in 1990. Five years later, the building was issued its operating licence. It is designed for the storage of medium-level and high-level waste resulting from the reprocessing by the French company AREVA (former COGÉMA) of spent fuel from Belgian nuclear power plants. Medium-level waste arising from the reprocessing in Dounreay of the SCK•CEN research reactor BR2 spent fuel will also be stored in building 136. Building 136 is capable of accommodating 600 containers of high-level vitrified waste and about 1.000 m³ of medium-level cemented or compacted waste (additional modules may, if necessary, increase its capacity). The containers, which are handled remotely from a shielded control room, are placed in vertical steel shafts equipped with a constant ventilation system designed to dissipate the generated heat. This building is designed to resist extreme external disturbances such as earthquakes, explosions, or the crash of a military aircraft.

At the end of 2012, 390 containers (70,20 m^3) of high-level vitrified waste, 408 containers (73,44 m^3) of compacted medium-level waste (hulls and end fittings) repatriated from France, and 54 containers (30,24 m^3) of medium-level waste from Dounreay were stored inside this building.

The very high-level waste will remain stored in the building for at least 60 years. The amount of heat initially released by this waste is such that it has to be left to cool down sufficiently before deep final disposal can take place, this to prevent the risk of altering the properties of the surrounding geological environment.

Disposal of category A waste

In accordance with the conditions laid down in the decision of the Belgian Government of 23 June 2006 to build a surface disposal infrastructure for the waste concerned on the territory of the municipality of Dessel, ONDRAF/NIRAS is pursuing its activities and efforts to realize the project in close cooperation with the local partnerships. The disposal project is integrated into a broader project that offers added value for the region, taking into account the concerns and values of the local community.

The local partnerships STORA (the original name STOLA has been changed into STORA) in Dessel and MONA in Mol have been prolonged and participate in the further steps of the decision making process and in the development of all aspects of the integrated disposal project. This integrated project includes the disposal project itself (the Installation for the Production of Monoliths (IPM) facility for the conditioning of category A waste into concrete boxes to produce disposal packages called “monolith”, surface disposal concrete infrastructures, control and drainage systems, auxiliary buildings) and the associated socio-economic aspects (prior importance to be placed on safety, health and the environment, communication centre, local fund to achieve social, economic and cultural added value for the municipalities concerned, …). Negotiations with all the parties concerned (radioactive waste producers, the federal, regional and local authorities) with a view to financing the socio-economic aspects have led to the creation of a special dedicated fund (see further description under Financing hereafter).

A project team ONDRAF/NIRAS established in Dessel is elaborating the various constituents of the global integrated disposal project. During the detailed study phase, which covers the period 2007-2016, all the components of the disposal project will have to be elaborated upon and settled in view of the project’s implementation and realization phase scheduled to start in 2017. ONDRAF/NIRAS is preparing the necessary applications and authorizations, as the agency will act as nuclear operator of the disposal site. The plan calls for putting the disposal site into operation by the year 2020.

The safety case prepared by ONDRAF/NIRAS for the licence application successfully passed the international peer review that was organized in 2012 by the NEA. The peer review concluded that the safety strategy and methodology employed were credible and founded on solid principles and that the project has achieved the technical maturity to proceed to the next steps of construction and storage. Based on the commentaries of the said peer review, the safety file was further elaborated and the licence application prepared for submission to the Federal Agency for Nuclear Control in January 2013.

On 31 January 2013, the procedure leading to the issuance of a "building and operations permit" for the surface storage of category A waste in Dessel was initiated with FANC/AFCN, which will constitute a new nuclear Class I facility. ONDRAF/NIRAS is currently formulating answers to all the questions and remarks expressed by FANC/AFCN, according to a strict methodical and systematic process.

Long-term management of category B&C waste

In the 1970's, an inventory of potential deep geological formations for the disposal of conditioned high level and alpha-bearing waste was drawn up by SCK•CEN and the Belgian Geological Survey. One of the promising potential host rocks was the Boom Clay, also present at the SCK•CEN site at a depth of about 200 m. More detailed investigations on that site started in 1974. Geophysical investigations led to the decision to build an underground research laboratory, called the High Activity Disposal Experimental Site (HADES), in the Boom Clay layer of the Mol-Dessel area. It is located on the SCK•CEN site, at a depth of 220 m, and comprised in 1984, an access shaft and two galleries in which numerous measurements and in situ experiments have taken place.

The principal areas of research include the geology and hydrogeology of the Clay formation, the definition of the deep underground repository concept, the backfilling material, the interaction between the waste, the engineered barriers (EBS) and the host rock and, in particular, the retention of radionuclides by Clay minerals; the assessment of spent fuel disposal techniques; the improvement and definition of the various disposal scenarios; the safety and performance assessment of a potential repository in the deep Clay. Several of these experiments are conducted in co-operation with other research organisations and universities, both national and international. An important experiment, conducted in close collaboration with the French waste disposal organisation ANDRA, deals with the lining of the galleries of a future repository.

In 1999, as part of the PRACLAY project (a preliminary demonstration test of high-level radioactive waste disposal in Clay); a second access shaft to the Boom Clay was built. This was followed, in 2002, by the excavation of an 80 meter-long gallery connecting the new shaft to the HADES underground research laboratory. For the excavation, the so-called Wedge Block System was used. This is a tunnelling technique that uses a drilling machine equipped with a segment erector and enables the collecting of important data on clay convergence. It was an innovative experiment, since it was the first time anywhere that the technique had been used at a depth of 225 m in poorly indurated clay such as the Boom Clay at Mol. It proved very successful, with an excavation rate of 2 to 3 m/day.

In July 2002, the SAFIR 2 report (Safety Assessment and Feasibility Interim Report), was published. It presents the results of R&D on disposal of high-level and long-lived waste performed in the period 1989-2000. The three main objectives of the report are:

(1) to provide a structured synthesis of the technical and scientific studies carried out on the disposal of category B and C waste in a poorly indurated argillaceous formation.

(2) to promote interaction with the nuclear safety authorities in order to reach closer agreement on the outstanding requirements for R&D on the principles of safety assessment.

(3) to offer a technical and scientific base for dialogue with all stakeholders in the long-term management of radioactive waste.

The report concludes that there are no fundamental problems that put the safety and feasibility of disposal of high-level waste in the Boom Clay into question. It reinforces confidence in the concept studied and confirms that, for the waste considered, disposal in poorly indurated Clay remains a viable option. By establishing an inter-disciplinary R&D programme that incorporates aspects of social sciences, it will be possible to further enhance confidence in the concept studied. In particular, paying due attention to management alternatives, developing repository designs, allowing for non-radiological environmental effects, and attention to societal aspects will increase confidence. The SAFIR 2 report was evaluated by an NEA peer review in October 2002 and its results were published in March 2003 ("SAFIR 2: Belgian R&D Programme on the Deep Disposal of High-level and Long-lived Radioactive Waste - An International Peer Review by NEA").

The underground laboratory was extended in 2007 to include a representative-scale disposal gallery (45 m long), the so-called PRACLAY-gallery. The basic objective of the PRACLAY experience remains the study of the response of the Clay formation to heat, but the original PRACLAY experience has been redefined and reorganized into five in-situ components including the large-scale heater-test and three on-surface experiences aimed at testing the feasibility of building important elements of the EBS (buffer, overpack, plug, backfill...) and verifying and confirming the behaviour and interactions of these elements.

The underground and surface facilities of HADES and PRACLAY, and the research performed in them, are now managed by the European Underground Research Infrastructure for Disposal of Radioactive Waste in a Clay Environment (EIG EURIDICE), a European economic interest grouping of which ONDRAF/NIRAS and SCK•CEN are the founding members. EIG EURIDICE is now preparing the installation of the heater-test device. Commissioning of the heating test is planned to start in 2014.

The on-surface preliminary backfilling test of a disposal gallery within the scope of the European project ESDRED has been a success. The EIG EURIDICE, SCK•CEN and ONDRAF/NIRAS have been, and are, also involved in many other European projects and international collaborations in order to increase the scientific knowledge and allow collaboration with different experts worldwide.

The R&D team is preparing a first Safety and Feasibility Case, the SFC-1, integrating all existing scientific and technical arguments in order to increase the confidence of all stakeholders in the possibility of building, operating, and securely closing a geological disposal in Clay unit for category B and C waste that will remain safe during hundreds of thousands of years after closure. If the Waste Plan exercise (see above in Waste management policies) leads to the confirmation of the deep disposal option for the long-term management of category B&C waste, the SFC-1 report will support the decision of the Government to start the siting phase.

Whatever the Government's decision based on the Waste Plan may be, the implementation of the chosen technical solution is bound to be a lengthy drawn-out process that will probably take a few decades before the selected solution becomes operational.

Policy for ultimate high level waste disposal

ONDRAF/NIRAS is legally obliged to prepare a plan for the long-term management of the radioactive waste under its responsibility. According to the law of 13 February 2006 (which transposes into Belgian legislation EC Directives 2001/42/EC and 2003/35/EC), this plan has to be accompanied by a strategic environmental assessment (SEA) and submitted for public consultation.

Although an extensive R&D programme assessing the use of Clay formations as potential host rock for the disposal of categories B and C waste started in 1974, no general policy decision or general guidance decision relating to the long-term management of those waste categories has been taken yet. In this context, ONDRAF/NIRAS has taken the initiative to compile in an integrated document, the "Waste Plan for the long-term management of high-level and/or long-lived radioactive waste", all elements necessary to enable the Government to take, with full knowledge of the facts, a decision in principle regarding the long-term management of categories B and C waste. The Waste Plan is accompanied by a SEA (Strategic Environmental Impact Assessment) in which alternative long-term management options to disposal in Clay have been assessed. The assessment not only covers environmental impacts but also the scientific and technical bases of the various options, the economic aspects and attendant ethical and societal considerations.

The final Waste Plan, including the results of the public consultation and the accompanying documents, was adopted by the Board of Directors of ONDRAF/NIRAS on 23 September 2011.

Moreover, ONDRAF/NIRAS committed itself to:

- ensure the reversibility of the disposal facility's operations and examine such measures as are likely to facilitate the potential recuperation of the waste after complete or partial closure of the disposal unit;
- maintain control functions over the proper operations of the disposal system that will be additional to the regulatory control;
- prepare as efficiently and effectively as possible the transfer to future generations of the knowledge linked to the disposal facility and the waste contained in it.

ONDRAF/NIRAS also recommended creating an independent monitoring body to ascertain that the decision making procedure progress as scheduled.

The Waste Plan will form the basis for establishing the national policy and the national programme on the long-term management categories B and C waste, as requested by the recent Law of 3 June 2014 transposing the EU Directive 2011/70/EURATOM (see hereafter).

Whatever the option for the long-term management of categories B and C waste, the implementation of the technical solution chosen is bound to be a long, stepwise, open and participative process that will probably take a few decades before the selected solution becomes operational.

EU Directive 2011/70/EURATOM

EU Directive 2011/70/EURATOM, establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste, has been completely transposed by the Law of 3 June 2014. The national policy will be laid down by Royal Decree deliberated in the Council of Ministers, on the proposal of ONDRAF/NIRAS and after consulting FANC/AFCN. The Law provides for the creation of a National Programme Committee that will be in charge of establishing and keeping up to date the national programme, which will cover all stages of the management of radioactive waste and spent fuel. The Ministers in charge of Energy and Economy will lay down, by ministerial decree deliberated in the Council of Ministers, the national programme on the proposal of the National Programme Committee and after consulting FANC/AFCN.

2.8. Research and development

Policy related to the nuclear sector, the nuclear fuel cycle and nuclear R&D is the exclusive responsibility of the Belgian Federal Government. Although deciding to phase out the production of electricity by nuclear fission energy, the Belgian government acknowledges the importance of continuing to invest in nuclear research to support the safe operation of nuclear power plants in Belgium and in Europe, the development of sustainable solutions for the management of radioactive waste, the future decommissioning and dismantling of nuclear power plants and the research on nuclear medical applications.

Nuclear research and development in Belgium is co-ordinated by the Federal Public Service (FPS) Economy, Small and Medium Enterprises (SMEs), Self-employed and Energy.

Research and development as well as innovation in the fields of nuclear energy, nuclear safety, nuclear fuel cycle, nuclear waste management and other nuclear application, such as nuclear medicine, are carried out by SCK•CEN.

Research and development for the support of both nuclear and non-nuclear power plant operations is carried out by LABORELEC.[76]

2.8.1. R&D organizations

Most of the nuclear research in Belgium is carried out at the National Nuclear Research Centre SCK•CEN, which also provides training and other services to the nuclear industry, the medical sector and the authorities, and promotes public awareness of nuclear technology. The nuclear research by SCK•CEN is mainly aimed at reactor safety experiments, innovative fuel cycles and partitioning and transmutation, advanced nuclear systems, radioactive waste disposal, decommissioning, radiation protection, and health physics and medical and space applications.

The research areas for SCK•CEN are authorised by Royal Decree.

The first priority is to maintain the safety of the nuclear power plants. This involves research of the ageing of their main components and the safety aspects of fuel development. The research is carried out in cooperation with TRACTEBEL Engineering, the nuclear engineering company of GDF SUEZ, and to a large extend in cooperation with the international research community, and at the service of the international legislation and safety authorities and industry. Regarding the integrity of structural reactor systems, structures and components, advanced scientific sound evaluation methodologies are continuously elaborated, leading to thorough and improved surveillance practices. Regarding nuclear fuel safety, comprehensive qualification programmes are being performed, both to support and validate the proper and safe operation of the ever evolving fuel, and to assess its back-end aspects such as the ultimate source term and thermal-mechanical performance.

The second priority is to find an appropriate solution for the long-term management of the long-lived medium- and high-level radioactive wastes.

Besides its basic missions – i.e. the development , qualification and surveillance of materials and components for use in nuclear installations – SCK•CEN's high performance materials test reactor BR2, which ranks among the world top class of high neutron-flux reactors, produces 25% of world-wide demand of the dominant medical isotope ^{99m}Tc, applied commonly in

[76] http://www.laborelec.be/ENG/

oncology and cardiology. A wide range of other radioisotopes applied in various medical diagnostic and therapeutic procedures are being produced at BR2. Furthermore it produces the α- and β-radioisotopes that have recently broken through for radiotherapeutic applications. The second main industrial application of BR2 concerns the highly homogeneous doping of silicon (covering also about 25% of the global demand) at use in renewable energy systems like hybrid/electric cars and electrical energy conversion and transmission systems as essential in windmills and solar power.

The present licence of the BR2 reactor extends to 2016. To prepare the next 10 years licence period of BR2 (2016-2026), conform the strategic note of the safety authorities (FANC/AFCN) regarding the long term operation of research reactors, an analysis on the design upgrades and advanced structural/functional maintenance and ageing management measures – in order to comply with modern safety standards – has been made up and approved by the safety authorities. In parallel with the implementation of the identified periodic safety review measures, the measures resulting from the stress test conducted in 2011-2012, to improve the robustness against external hazards of the SCK•CEN installations in general and the BR2-reactor in particular will be implemented as well by 2016. Two essential points regarding the safe BR2 exploitation are the reactor vessel and the beryllium (structural support) matrix of the reactor core. The condition of the reactor vessel is predicted on basis of a surveillance program that entails an accelerated irradiation of representative material that is tested on its embrittlement resulting from the neutron-damage. The results of these tests assure the resistance of the vessel material against brittle fracture up to doses experienced by the actual vessel well beyond 2026. The present Beryllium matrix, being in service since 1998, has reached half of the maximal allowed irradiation dose in 2011. The maximum lifetime of the matrix, subject to swelling and cracking as neutron fluence is accumulated, would be reached in the second half of the 2016-2026 period. Hence, it will be replaced by a new one in 2015-2016, thus providing a safe condition of this matrix regardless of the exploitation regime that could be enhanced in the 2016-2026 period, while providing maximal operational flexibility given the poison-free condition of a new Beryllium matrix.

SCK•CEN has a statutory mission to conduct research on the protection of man and environment against the harmful effects of ionizing radiation. In the field of life sciences, SCK•CEN has dedicated laboratories for specific research in radiobiology, microbiology and radioecology. The laboratory for radiobiology studies the effects of low dose ionizing radiation on the developing mammalian organism, the induction of cancer and non-cancer diseases and the individual radiosensitivity. A new animal facility using state-of-the-art technology is operational since February 2014 to clarify the significance of short term biological responses to ionizing radiation for the human health in the long term. The laboratory for microbiology investigates bacterial adaptation under extreme conditions, such as cosmic radiation, microgravity, heavily polluted soils and the geological disposal of radioactive waste. Radioecological research is performed in the unit biosphere impact studies. Its main focus is on understanding the behaviour of radionuclides in the biosphere for the protection of man and environment in normal and accidental situations.

SCK-CEN is a major player in European Radiation Protection and Safeguards research and is founding member and member of the management board/president such as MELODI, ALLIANCE, NERIS, EURADOS, and ESARDA.

The societal aspects of nuclear technology are also investigated with emphasis on public participation in the decision process. Research is performed in the context of decision support to add to the transparency of decisions. Three major areas are investigated: nuclear waste management, nuclear risks management and energy management.

2.8.2. Development of advanced nuclear technologies

SCK•CEN is developing the multipurpose nuclear research facility MYRRHA[77], identified within the European ESFRI roadmap and within the European Sustainable Nuclear Industrial Initiative (ESNII) of the Sustainable Nuclear Energy Technology Platform (SNETP) in support of the SET-Plan. MYRRHA[78] will be a sub-critical assembly driven by a high power proton accelerator that generates the primary neutrons by means of spallation reactions in the centre of the core to trigger fission reactions in the sub-critical core. MYRRHA is designed in such a way to be able also to operate in a mode. As well as being able to produce radioisotopes and doped silicon, MYRRHA's research functions would be particularly well suited to investigating transmutation and demonstrating the efficient operation of the concept of Accelerator Driven Systel (ADS) at a pre-industrial scale. Early in 2010, the Belgian government approved its share of funding of the facility at SCK•CEN. Belgium is to contribute 40% towards the 960 million euro (of 2009) (1,3 billion USD) investment the project will require. Belgium and SCK•CEN are looking to set up an international consortium to ensure additional financing of the project. In 2009, MYRRHA itself was scheduled for operation in 2023, but a reduced power model, GUINEVERE, became operational in February 2011.

In 2010, the Belgian government has granted SCK•CEN a budget of 60 million euro for a five year period (2010-2014) for advancing the design of MYRRHA, securing its licensing and consolidation of the investment and operational cost of the facility and preparing the international consortium for investing in MYRRHA. At the end of 2014, the Belgian government will be reviewing the achievement of SCK•CEN related to the MYRRHA project before deciding on the next steps of the project.

2.8.3. International co-operation and initiatives

Belgium is active in a number of international nuclear organizations including the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency (NEA) of the Organization for Economic Co-operation and Development (OECD) as well as other bilateral and multilateral organizations such as the World Association of Nuclear Operators (WANO).

SCK•CEN is coordinator of the Belgian Support Programme to the IAEA for safeguards. It also executes most tasks of the Support Programme. Among these tasks, the most important contributions relate to development of safeguards approaches for geological repositories and the Accelerator Driven System MYRRHA, currently in design at SCK•CEN. Moreover, SCK•CEN makes available its facilities and subject matter experts for calibration of IAEA equipment and courses to IAEA safeguards inspectors, helping the IAEA to better perform the safeguards inspections in the framework of the Non-Proliferation Treaty and Additional Protocol.

SCK•CEN is a major player in European projects and has research collaborations on the peaceful use of nuclear applications with most "nuclear" countries/institutes throughout the world.

As member state of the EU’s Joint Undertaking for ITER and the Development of Fusion Energy, Belgium contributes to the development of fusion energy which aims to start producing CO_2-free electricity in 2050.

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[77] Multipurpose Hybrid Research Reactor for High-tech Applications

[78] http://myrrha.sckcen.be/

2.9. Human resources development

Thanks to its thorough experience in the field of nuclear science and technology, its innovative research and the availability of large and unique nuclear facilities, SCK•CEN is an important partner for nuclear education and training (E&T) in Belgium as well as at international level. It is the specific task of the SCK•CEN Academy to foster the transfer of nuclear knowledge, skills and attitudes towards students and professionals who are active in the nuclear field.

Within the SCK•CEN Academy, more than 60 years of nuclear expertise and experience gained from SCK•CEN's different research projects is collected and transferred. In the interests of maintaining a competent workforce in industry, healthcare, research, and policy, and of transferring nuclear knowledge to the next generations, the SCK•CEN Academy takes it as its mission to:

1. Provide guidance for young researchers

SCK•CEN experts are available to guide Bachelor and Master students, PhD candidates or any professional who wants to enrich his or her nuclear competences via an internship. Post-doc positions are also available. Research topics for these purposes can be found on the SCK•CEN Academy website; candidates from all over the world can postulate. The topics are all situated in the priority research domains of SCK•CEN. High school pupils and their teachers are welcome to visit our laboratories; several projects are available for this specific target public.

2. Organise academic courses, training for professionals and scientific events

The SCK•CEN Academy collaborates with several Belgian and foreign universities and contributes to academic learning. Examples are the BNEN master-after-master specialisation in nuclear engineering and the Radiation Protection Expert course.

BNEN, the Belgian Nuclear higher Education Network[79], is a master-after-master academic programme in nuclear engineering, organised through a consortium of six Belgian universities and SCK•CEN[80].

The BNEN consortium was one of the very first in Europe to offer a nuclear engineering programme where nationwide expertise is gathered and combined with the infrastructure and access to operating reactors. It served as a role model for the foundation of the European Nuclear Education Network (ENEN Association). BNEN catalyses networking between academia, research centres, industry and other nuclear stakeholders, and aims at developing and maintaining high-level nuclear engineering competences. The condensed programme (60 ECTS in one year, including a master thesis) allows students to acquire all necessary scientific and technical background and skills to develop a career in the field of nuclear applications. A modular approach facilitates participation of foreign students. The lectures are taught in English, at the premises of SCK•CEN in Mol, Belgium. The laboratory exercises make use of the nuclear facilities of SCK•CEN and are organised by SCK•CEN scientists. Various technical visits are organised to research and industrial nuclear facilities. Teaching blocks of

[79] http://bnen.sckcen.be/

[80] The University of Leuven (KUL), the University of Louvain (UCL), the University of Gent (RUG), Liège University (ULg) and the University of Brussels (VUB). The ULB joined the consortium in 2007.

one to three weeks for each module allow optimal time management for students and university lecturers, facilitate registration for individual modules, and allow easy access for international students through ERASMUS and ERASMUS-Mundus programmes.

The post-graduate course for Radiation protection Experts (20 ECTS) meets the requirements set in the Royal Decree of July 20, 2001 regarding the training for Radiation Protection Experts (Art. 73.2), and is therefore targeted towards those who need to be formally recognised as RPE, as well as to all professionals working in nuclear, radiology or the medical sector The course focuses on the scientific and technological basis of radiological and nuclear techniques, with specific attention to radiation protection. This course is organised in Dutch by the SCK•CEN Academy and the University of Hasselt. An equivalent French course is run by ISIB and IRE.

In addition to academic learning, the SCK•CEN Academy also provides customised training courses aiming at improving the knowledge, skills and attitudes of nuclear workers from industry, the medical sector, research organisations, and governmental institutions dealing with applications of radioactivity. These courses are modular, and tailored to the needs of the trainees in terms of content, duration, level, language (Dutch, French or English), venue, etc. The topics treated are all those topics that are subject to SCK•CEN's R&D programme, for example radiation protection, reactor technology, nuclear materials issues, nuclear safety and safety culture, emergency management, decommissioning and decontamination, waste and disposal, radiation biology, -ecology, microbiology, ethical aspects and nuclear technology assessment etc. Some courses are specifically designed to fit into the CPD programmes endorsed by the Federal Agency for Nuclear Control (FANC/AFCN).

Within the course programmes, lectures and practical sessions can be complemented with visits to several nuclear laboratories and research reactors. These technical visits enable trainees to enrich and illustrate their acquired knowledge with the practice of real-life situations. SCK•CEN facilities that can be visited include: three operating research reactors (BR1, BR2 and VENUS), one research reactor in dismantling phase (BR3), hot cells, the HADES underground laboratory for waste disposal research, the decontamination wing of the medical services, the laboratories for antropogammametry (a means of assessing radioactive internal contamination) and low-level alpha, beta and gamma measurements, the laboratories of the radiation biology, -ecology and microbiology groups, the dosimetry and nuclear calibrations laboratory, and more.

Among the SCK•CEN Academy lecturers - about 70 in total - are physicists, biologists, medical doctors, engineers, technicians and social scientists who all bring insights and ideas from their specific background into the course programmes. As SCK•CEN staff members they have a solid knowledge and experience in their field and can thus directly transfer their theoretical knowledge and practical experience into the various courses. In addition, they possess excellent didactical skills. Many of them are also appointed as part-time professors or guest professors at several Belgian and international universities.

Furthermore, scientific events like workshops and topic specific days are organised in order to deepen the knowledge in very specific nuclear themes and to contribute to innovate new research via interactive Q&A sessions and discussions. International experts are invited to contribute to the scientific programme.

3. Offer policy support related to E&T matters

The implementation of a coherent approach to E&T in nuclear science and technology becomes crucial in a world of dynamic markets and increasing workers' mobility. Through networking and participation in international programmes, the SCK•CEN Academy contributes to a better harmonisation of education, training practice and skills recognition on a national and international level.

4. Care for critical-intellectual capacities for society

Nuclear technology attracts attention and strong opinions in society. While the science itself may not be controversial, its application often is. Working with nuclear technology, either as scientist, manager or regulator, requires both technical knowledge and an insight in the societal issues. There is a growing awareness of the importance of being able to consider this wider context. The SCK•CEN Academy is unique in addressing this challenge by developing educational content and methods to raise awareness and stimulate thinking and discussion.

2.10. Stakeholder Communication

The website of ONDRAF/NIRAS contains a new sub-site dedicated to the Waste Plan (in Dutch and French, but the waste plan is available in English)[81], plus another one dealing with the category A disposal project[82]. Technical publications deal more specifically with R&D concerning long-term management of nuclear waste.

ONDRAF/NIRAS also has a radioactive waste information centre[83], called “ISOTOPOLIS”, on the BELGOPROCESS site in Dessel. This centre, recently renovated, is open to the public and intended primarily for secondary school students.

BELGOPROCESS[84] organizes visits to its processing, conditioning, and interim storage facilities for the press, professional visitors, and occasionally for the public. It also publishes an annual report and information leaflets on its activities.

EURIDICE[85] has its own, recently renovated, communication space within the demonstration hall and organizes visits to both the demonstration hall and the underground laboratory.

The Belgian Nuclear Research Centre SCK•CEN shares its expertise in an active way as an accessible and reliable source of (scientific) information for (local) authorities, the industry, the media and the general public. SCK•CEN offers information about its activities and the results of its research through a variety of publications and dedicated websites for the general public, scientists, students and young people. Every year SCK•CEN welcomes hundreds of visitors (both professionals and members of the general public) in its laboratories.

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[81] http://www.ondraf-plandechets.be/

[82] http://www.ondraf.be/node/160/

[83] http://www.isotopolis.be/

[84] http://www.belgoprocess.be/eng/AboutUs.htm

[85] http://www.euridice.be/

The Belgian nuclear industry created a federation under the name "NUCLEAR FORUM"[86]. This federation has the mission to contribute to a quality discussion on the future of nuclear industry. Its main goal is to provide factual and practical information on the nuclear industry and its many applications as well as to bring answers to the legitimate questions that are being asked.

2.11. Emergency Preparedness

Emergency preparedness and planning is a competence belonging to the Federal Minister of Home Affairs and his administrative services. The law of 15 May 2007 defines the notion of Civil Safety and describes the roles and missions of the different entities involved. The Royal Decree of 16 February 2006 organises the planning and interventions during emergency situations. The Royal Decree of 17 October 2003 defines a nuclear and radiological emergency plan for the Belgian territory as well as notification criteria from the operators to the Government.

Off-site operations are directed by the "Governmental Centre for Co-ordination and Emergencies" (CGCCR), under the authority of the Minister of Home Affairs. The implementation of the actions decided at the federal level and the management of the intervention teams are conducted by the Governor of the Province concerned. In addition to the duties defined in the Royal Decree of 17 October 2003, the Federal Agency for Nuclear Control (FANC/AFCN) is a main actor within the emergency plan. Its role is defined in articles 15, 21 and 22 of the law of 15 April 1994, creating the FANC/AFCN, and in articles 70, 71 and 72 of the GRR-2001[87]. These articles stipulate that the FANC/AFCN is responsible to survey, to control and to monitor the radioactivity on the territory and to deliver technical assistance to set up the emergency plan. It is also in charge of participating and/or organising operational cells (i.e. evaluation cell and measurements cell).

86 http://www.nuclearforum.be/

87 General Regulations regarding the protection of the public, the workers and the environment against the hazards of ionising radiation (GRR-2001), EURATOM Treaty, Article 37

3. NATIONAL LAWS AND REGULATIONS

3.1. Regulatory framework

3.1.1. Regulatory authority

The Federal Agency for Nuclear Control (FANC/AFCN)

The regulatory authority in the field of radiation protection, nuclear safety and radiological surveillance is the Federal Agency for Nuclear Control[88] (FANC/AFCN)[89], a public body with legal personality which is supervised by the minister for the Interior. It was established by law in 1994[90] to ensure that the public and the environment are effectively protected against the hazards of ionizing radiation, but became fully operational on 1 September 2001.

By the decree laying down the *General regulations for the protection of the population, workers and the environment against the dangers of ionising radiation* (GRR-2001)[91], the regulatory responsibilities for radiological protection were transferred from the specialised offices of the Ministry of Public Health and the Environment and the Ministry of Labour and Employment to this Agency. On 2 April 2003 and 30 March 2011, this law was amended to include nuclear security.

The FANC/AFCN is an independent governmental body. Its legal statute is in itself a guarantee that it can make independent regulatory judgements, within its legal competences. The FANC/AFCN can organize its internal decision-making and can recruit its staff with sufficient autonomy from the political level. The FANC/AFCN has legal personality. This means that it can defend its position before court against other interested parties when needed.

The FANC/AFCN has been given its basic missions and powers, such as review and assessment tasks, control and inspection tasks and enforcement powers for its nuclear inspectors, directly from parliament. This legal empowering guarantees that a constitutional independence with respect to the Government, because the King cannot suspend the normal execution of laws.

In 2008 Bel V was created as a subsidiary of the FANC/AFCN following a Parliamentary resolution. Bel V took over the personnel of the former Authorized Inspection Organisation (AIO) AVN. A management contract between FANC/AFCN and Bel V, delegates some tasks to Bel V, such as the controls of nuclear facilities and the review and assessment activities for these facilities. Today, the regulatory body for nuclear power plants is composed of the FANC/AFCN and Bel V.

The missions attributed to the FANC/AFCN by the Law of 15 April 1994 and its associated royal decrees are allocated to different departments and sections. The only legal requirement regarding the organisational structure of the FANC/AFCN is the separation between regulation development activities and the surveillance and inspection activities.

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88 http://www.fanc.be/

89 "Federaal Agentschap voor Nucleaire Controle" (FANC) in Dutch or "Agence Fédérale de Contrôle Nucléaire" (AFCN) in French

90 Law of 15 April 1994 on the protection of the public and the environment against the dangers of ionising radiation and on the Belgian Federal Agency for Nuclear Control (FANC/AFCN)

91 Royal decree of 20 July 2001; it must be noted that these general regulations deal with civil facilities and activities only. Military installations and activities are dealt with in Royal Decree of 11 May 1971 laying down the general military regulations for protection against the hazards of ionizing radiation.

The FANC/AFCN is currently composed of five departments, with a total of about 150 people:

- Regulation, International Affairs and Development (RIAD)
- Facilities and Waste
- Security and Transport
- Health protection and Environment
- Support

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

The regulatory function "licensing" (Art. 16 of Law of 15 April 1994) is ensured by the department "Facilities and Waste" for nuclear facilities, industrial facilities and waste management facilities (including disposal facilities) and activities (including decommissioning)

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

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

Security matters (Art. 17 of the Law of 15 April 1994) are also within the mission of the FANC/AFCN and are entrusted to the department "Security and Transport".

Other additional functions performed by the FANC/AFCN are:

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

The FANC/AFCN may propose laws and decrees to the Government and it has to implement laws and decrees to review licence applications, to propose licences or to grant licences, as applicable, to ensure compliance with the regulatory provisions and the licence conditions.

The FANC/AFCN is also a founding member of the West European Nuclear Regulators Association (WENRA). Together with Bel V, it participates actively in the Reactor Harmonization working group (RHWG) and in the Working Group on Waste and Decommissioning (WGWD) and in particular in the working group developing reference levels for waste disposal facilities.

3.1.2. Licensing Process

Licensing takes place under the authority of the Minister of Interior (Royal decree of August 7, 1995), who has the guardianship over the Federal Agency for Nuclear Control (FANC/AFCN). The Minister and the Agency are responsible for promulgating and enforcing regulations designed to protect the employees of the nuclear plants and the population against the hazards of ionising radiations. The Agency is assisted in technical matters by a Scientific Council of experts and representatives from various authorities responsible for nuclear safety. They have only an advisory role. The Council gives recommendations by absolute majority. Bel V[92], the subsidiary body of the FANC/AFCN, carries out official acceptance procedures for nuclear installations prior to commissioning and exercises supervision over nuclear installations during operation. Final authorization for nuclear plant commissioning rests with the King.

The main steps in the Belgian licensing procedure for nuclear installations (referred to as "Class I" installations in the Belgian regulations) are described in the GRR-2001 and are summarized below:

1. Filing of an application: the licence application is first sent to the Director General of the FANC/AFCN, together with the relevant information (characteristics of the installation, planned safety measures, an Environmental Impact Assessment, and a study of the premises and the demographic, geological, meteorological, etc. characteristics of the area of the installation). The application has to contain a preliminary safety report and a report describing the incidences of the environment;

2. The Scientific Council is consulted a first time. After the Council has given its preliminary advice, it is sent to the applicant. Then the European Commission is also consulted (if necessary) according to article 37 of the EURATOM Treaty, as well as all the municipalities in a radius of 5 km around the installation (who inform their population) and the Province involved. After the advice of the municipalities, of the Province and of the European Commission have been received, the file is submitted to the Scientific Council once more, which then gives its definitive advice;

3. The Minister of Interior then decides by submitting a Royal Decree to the King. This Royal Decree gives the construction and operation licence. It contains the conditions to be respected. These stipulate, among other things, the content of the safety report;

4. After the construction of the installation, and before the start of the operation, the Agency or Bel V proceeds with the acceptance of the installation. This acceptance must establish the conformity of the installation with the general regulation, the stipulations of the construction and operation licence and the safety report. If the acceptance is favourable, the Minister of Interior proposes to the King to confirm the construction and operation licence, which are granted for an unlimited period.

3.2. National laws and regulations in nuclear power

3.2.1. Main National Laws

Nuclear Law, establishing responsibilities for different areas

[92] http://www.belv.be/index.php?lang=english

- Law of 8 August 1980 on the budgetary proposals for 1979-1980, art. 179 §2 and §3 (as amended by the laws of 11 January 1991 and 12 December 1997), establishing the "National Agency for Radioactive Waste and Fissile Materials" (ONDRAF/NIRAS) and entrusting ONDRAF/NIRAS with the safe transportation, treatment, conditioning, storage and disposal of all radioactive waste produced in the country. This law was modified by the law of 11 January 1991, which also slightly changed the name of the agency towards 'Belgian National Agency for Radioactive Waste and Enriched Fissile Materials'
- Royal Decree of 30 March 1981 defining the missions and duties of ONDRAF/NIRAS, as amended by the Royal Decrees of 16 October 1991, 4 April 2003, 1 May 2006, 18 May 2006, 2 June 2006, 13 June 2007, 3 July 2012, 25 April 2014
- Law of 15 April 1994 on the protection of the public and the environment against the dangers of ionising radiation and on the Belgian Federal Agency for Nuclear Control [It constitutes the legal basis for the FANC/AFCN as regulatory body and sets out the basic elements for protecting the workers, the public and the environment against the adverse effects of ionising radiation, repealing and replacing the Law of 29 March 1958]
- Law of 31 January 2003 on the gradual phasing out of nuclear energy for the industrial production of electricity
- Law of 18 December 2013 amending the law of 31 January 2003 on the gradual phasing out of nuclear energy for the industrial production of electricity

Civil nuclear liability

- Law of 22 July 1985, as modified by the Law of 11 July 2000, on nuclear liability, which integrates the Paris Convention and the follow-up Convention of Brussels and their additional protocols. (This law sets the maximum amount of the operator's civil liability for damages caused by a nuclear accident to about 300 million euros (per accident and per site.)
- Law of 10 February 2003 on the liabilities for staff employed by public entities
- Royal Decree of 28 December 2011 laying down the maximum amount of the damage for which the operator or carrier may be held responsible in the case of transport within the meaning of Article 14 of the Law of 22 July 1985 on third party liability in the field of nuclear energy

Establishing a regulatory body

- Law of 15 April 1994 on the protection of the public and the environment against the dangers of ionising radiation and on the Belgian Federal Agency for Nuclear Control (FANC/AFCN), repealing and replacing the Law of 29 March 1958 [It constitutes the legal basis for the FANC/AFCN as regulatory body, its role being defined in articles 15, 21 and 22]

- Law of 22 December 2008 amending the Law of 15 April 1994 and allowing the FANC/AFCN to create Bel V in order to perform regulatory missions that can be legally delegated by the FANC/AFCN, without consulting the public market

Implementing IAEA safeguards

- Law of 26 November 1996 approving the Convention on Nuclear Safety of 20 September 1994
- Law of 5 June 1998 approving the Convention on Early Notification of a Nuclear Accident of 26 September 1986
- Law of 5 June 1998 approving the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency of 26 September 1986
- Law of 2 August 2002 approving the Joint Convention on the Safety of Spent Fuel Management and on the Safety of radioactive waste management of 5 September 1997

Rules for environmental protection

- Law of 13 February 2006 on the assessment of the environmental consequences of certain plans and programs and the public participation in the preparation of plans and programs in connection with the environment
- Law of 5 August 2006 on public access to environmental information

Import and export controls of nuclear material and items

- Law of 1 June 2005 on the implementation of the Additional Protocol of 22 September 1998 to the International Agreement of 5 April 1973 in implementation of Article III, Paragraphs 1 and 4 of the Convention of 1 July 1968 on the non-proliferation of nuclear weapons
- Law of 13 November 2002 approving the Additional Protocol to the Agreement in implementation of Article III, paragraphs 1 and 4 of the Treaty on the Non-proliferation of Nuclear Weapons and Annexes I, II and III of 22 September 1998
- Royal decree of 24 March 2009 on the import, transit, and export of radioactive materials, transposing directive 2006/117/EURATOM (replacing directive 1992/3/EURATOM) on the supervision and control of shipments of radioactive substances between Member States and suppressing chapter IV of GRR-2001

Security principles, including physical protection of nuclear material and facilities and protection of sensitive information

- Law of 11 December 1998 on classification and security clearances, certificates and advice
- Law of 15 July 2008 approving the Amendment to the Convention on Physical Protection of Nuclear Material (CPPNM) of 8 July 2005
- Law of 10 September 2009 approving the International Convention for the Suppression of Acts of Nuclear Terrorism of 14 September 2005

- Law of 1 July 2011 relating to the security and protection of critical infrastructures, partially transposing Council Directive 2008/114/EC of 8 December 2008 on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection
- Royal decrees of 17 October 2011 on security, addressing categorization and protection of documents, physical protection of nuclear materials, nuclear installations and transport, categorization of nuclear materials and definition of security zones in nuclear installations and nuclear transport organizations, security clearances and certificates, and regulating access to security zones, nuclear material or documents in specific circumstances

Roles of national government, local government, and stakeholders

- Special Law of 8 August 1980 on Institutional Reform, awarding federal and regional authorities joint responsibility for energy policy
- Law of 8 August 1980 on the budgetary proposals for 1979-1980, art. 179 §2 and §3 (as amended by the laws of 11 January 1991 and 12 December 1997), establishing the "National Agency for Radioactive Waste and Fissile Materials" (ONDRAF/NIRAS) and entrusting ONDRAF/NIRAS with the safe transportation, treatment, conditioning, storage and disposal of all radioactive waste produced in the country. This law was modified by the law of 11 January 1991, which also slightly changed the name of the agency towards 'Belgian National Agency for Radioactive Waste and Enriched Fissile Materials'
- Royal Decree of 30 March 1981 defining the missions and duties of ONDRAF/NIRAS, as amended by the Royal Decrees of 16 October 1991, 4 April 2003, 1 May 2006, 18 May 2006, 2 June 2006, 13 June 2007, 3 July 2012, 25 April 2014
- Law of 22 July 1985, as modified by the Law of 11 July 2000, on nuclear liability, which integrates the Paris Convention and the follow-up Convention of Brussels and their additional protocols.
- Law of 29 April 1999 on the organization of the electricity market (amended by the law of 8 January 2012)
- Programme Law of 30 December 2001, modifying art. 179 §2, on the National Agency for Radioactive Wastes and Fissile Materials Management in the law of 8 August 1980.
- Law of 1 June 2005 fully implementing EU Directive 2003/54/EC on the common rules for the internal electricity market
- Law of 8 January 2012 amending the law of 29 April 1999 on the organization of the electricity market (and the law of 12 April 1965 on the transport of gaseous and other products by pipeline)

3.2.2. Main Regulations in Nuclear Power

Provisions for authorization system, responsibilities of the operator, inspection and enforcement, radiation protection of workers, public and environment

- Law of 15 April 1994 on the protection of the public and the environment against the dangers of ionising radiation and on the Belgian Federal Agency for Nuclear Control [It constitutes the legal basis for the FANC/AFCN as regulatory body and sets out the basic elements for protecting the workers, the public and the environment against the adverse effects of ionising radiation, repealing and replacing the Law of 29 March 1958]
- Law of 4 August 1996 on the welfare of workers in the performance of their work
- Royal Decree of 20 July 2001 (amended) laying down the "General Regulations" regarding the protection of the public, the workers and the environment against the hazards of ionising radiation (GRR-2001, as amended) provides for the general principles set in the 1994 law, replacing the Royal Decree of 28 February 1963 (GRR-1963). The GRR-2001 scope is very wide and covers practically all human activities and situations which involve a risk due to the exposure to ionizing radiation.

  The GRR-2001 includes provisions for establishing an authorization system, responsibilities of the operator, inspection and enforcement and for site selection and approval within the licensing system.
- Law of 5 August 2006 on access to environmental information by the general public, which also applies to the nuclear sector
- Law of 15 May 2007 defining the notion of Civil Safety and describing the roles and missions of the different entities involved

Safety of nuclear installations

- Law of 15 May 2007 defining the notion of Civil Safety and describing the roles and missions of the different entities involved
- Royal decrees of 17 October 2011 on security, addressing categorization and protection of documents, physical protection of nuclear materials, nuclear installations and transport, categorization of nuclear materials and definition of security zones in nuclear installations and nuclear transport organizations, security clearances and certificates, and regulating access to security zones, nuclear material or documents in specific circumstances
- Royal decree of 30 November 2011 on the Safety Requirements for Nuclear Installations (SRNI-2011). This royal decree includes all reference levels developed by the Reactor Harmonization Group (RHWG) of the Western European Nuclear Regulators Association (WENRA). It also transposes the European Directive 2009/71/EURATOM in the Belgian regulations.

Radioactive waste and spent fuel management, including storage and disposal

- Law of 8 August 1980 on the budgetary proposals for 1979-1980, art. 179 §2 and §3 (as amended by the laws of 11 January 1991 and 12 December 1997), establishing the "National Organization for Radioactive Waste and Fissile Materials" (NIRAS) and entrusting NIRAS/ONDRAF with the safe transportation, treatment, conditioning, storage and disposal of all radioactive waste produced in the country.
- Royal Decree of 30 March 1981 defining the missions and duties of NIRAS, as amended by the Royal Decrees of 16 October 1991, 4 April 2003, 1 May 2006, 18 May 2006, 2 June 2006, 13 June 2007

- Law of 11 January 1991, modifying the law of 8 August 1980, to include certain aspects of the management of enriched fissile materials and the decommissioning of nuclear facilities other than nuclear power plants in the responsibilities of NIRAS, also slightly changing the name of the institution into “Belgian National Agency for Radioactive Waste and Enriched Fissile Materials”
- Royal Decree of 16 October 1991 defining the procedures for the Law of 11 January 1991 and the responsibilities of ONDRAF/NIRAS: the qualification of installations for treatment and conditioning of radioactive waste; the establishment of acceptance criteria for conditioned and unconditioned radioactive waste based on General Rules to be approved by the safety authority
- Law of 12 December 1997 extending the mission of ONDRAF/NIRAS to establish an inventory of all nuclear facilities and sites containing radioactive waste; and its financing
- Ministerial letter of 10 February 1999 concerning General Rules for the establishment of acceptance criteria by ONDRAF/NIRAS for conditioned and non-conditioned waste
- Programme Law of 30 December 2001, modifying art. 179 §2, on the National Agency for Radioactive Wastes and Fissile Materials Management in the law of 8 August 1980.
- Royal Decree of 18 November 2002 regarding the practical implementation of the qualification of installations for the storage, treatment and conditioning of radioactive waste and installations for the radiological characterisation of radioactive waste
- Law of 13 February 2006 transposing EC Directives 2001/42/EC and 2003/35/EC into Belgian legislation, requiring that the plans for the long-term management of the radioactive waste drawn up by ONDRAF/NIRAS must be accompanied by a strategic environmental assessment (SEA) and submitted for public consultation
- Royal Decree of 26 May 2006, transposing directive (2003/122/EURATOM) on the control of sealed radioactive sources and, in particular, of “orphan sources”, amending accordingly the GRR-2001
- Law of 29 December 2010, modifying a.o. the Law of 8 August 1980, giving NIRAS/ONDRAF additional legal tasks w.r.t. activities and measures in the domain of the societal support for the integration of a disposal facility at the local level. This law entitles NIRAS/ONDRAF to create a fund to cover all of the costs related to the societal conditions for the integration of a disposal facility at the local level. The supply to this fund is by the waste producers on the basis of the total amount of the fund for a specific disposal project, and on the basis of the waste volumes to be disposed of.
- Royal decree of 14 October 2011 on orphan sources
- Law of 3 June 2014, completely transposing EC Directive 2011/70/ EURATOM, the EU framework for the responsible and safe management of spent fuel and radwaste.
- Royal Decree of 25 April 2014, amending the Royal Decree of 30 March 1981 determining the tasks and functional modalities of the public body for the management of radioactive waste regarding the providing of resources for the medium and long term funds.

Decommissioning, including funding and institutional control

- Law of 8 August 1980 on the budgetary proposals for 1979-1980, art. 179 §2 and §3 (as amended by the laws of 11 January 1991 and 12 December 1997), establishing ONDRAF/NIRAS and entrusting ONDRAF/NIRAS with the safe transportation, treatment, conditioning, storage and disposal of all radioactive waste produced in the country.
- Law of 11 January 1991, modifying the law of 8 August 1980 which also slightly changed the name of ONDRAF/NIRAS towards ‘National Agency for Radioactive Waste and Enriched Fissile Materials’
- Law of 24 December 2002 providing for the levy of an excise tax, called federal dues, which is calculated on the basis of kWh consumed. These dues are paid to a fund earmarked to finance responsibilities resulting from the decommissioning of the sites of the former EUROCHEMIC plant (BP1) and the former Waste Department of SCK•CEN (BP2), as well as the treatment, processing, storage and evacuation of accumulated radioactive waste. The Commission for Electricity and Gas Regulation (CREG) collects the amount owed as dues and transfers it to ONDRAF/NIRAS, which is responsible for the management and clean-up.
- Law of 24 March 2003 creating the legal framework for a structural financing mechanism of the dismantling activities on the BP1 and BP2 sites until their completion by a levy on the transported kWh. For each period of five years, ONDRAF/NIRAS has to present a financing plan to its supervising minister.
- Royal Decree of 24 March 2003 laying down the detailed rules on the federal contribution for the financing of certain public service obligations and the costs related to the regulation and control of the electricity market
- Royal Decree of 4 April 2003 determining that ONDRAF/NIRAS’ funds available in the medium and the long term must be invested in financial instruments issued by the Federal State. As a result, the board of ONDRAF/NIRAS has decided to invest the assets of the "Long-term fund" into Belgian governmental bonds which will be passively managed.
- Law of 11 April 2003 regarding liabilities and provisions for the decommissioning and dismantling of nuclear power plants and the management of the spent fuel from these nuclear power plants, amended by the law of 25 April 2007. This law also determines the management of funds built up by SYNATOM for the decommissioning of the nuclear power plants.
- Royal Decree of 19 December 2003 to determine the amounts allocated to the financing of the nuclear liabilities BP1 and BP2 for the period 2004 to 2008, in implementation of Article 4, § 2 of the Royal Decree of 24 March 2003 laying down the detailed rules on the federal contribution for the financing of certain public service obligations and the costs related to the regulation and control of the electricity market
- Law of 29 December 2010, modifying a.o. the law of 8 August 1980, giving ONDRAF/NIRAS additional legal tasks w.r.t. activities and measures in the domain of the societal support for the integration of a disposal facility at the local level. This law entitles ONDRAF//NIRAS to create a fund to cover all of the costs related to the societal conditions for the integration of a disposal facility at the local level. The supply to this fund is by the waste producers on the basis of the total amount of the

fund for a specific disposal project, and on the basis of the waste volumes to be disposed of.

Emergency preparedness

- Royal Decree of 17 October 2003, defining a nuclear and radiological emergency plan for the Belgian territory as well as notification criteria from the operators to the Government. Emergency planning is a competence belonging to the Federal Minister of Home Affairs and his administrative services
- Royal Decree of 24 November 2003 setting the emergency planning zones relative to the direct actions to protect the population (evacuation, sheltering, and iodine prophylaxis). These evacuation and sheltering zones vary from 0 to 10 km radius depending on the nuclear plant concerned; the stable iodine tablets pre-distribution zones extend from 10 up to 20 km around the nuclear plants.
- Royal Decree of 16 February 2006 organising the planning and interventions during emergency situations
- Law of 15 May 2007 defining the notion of Civil Safety and describing the roles and missions of the different entities involved

Transport of radioactive material

- Law of 8 August 1980 on the budgetary proposals for 1979-1980, art. 179 §2 and §3 (as amended by the laws of 11 January 1991 and 12 December 1997), establishing ONDRAF/NIRAS and entrusting ONDRAF/NIRAS with the safe transportation, treatment, conditioning, storage and disposal of all radioactive waste produced in the country. This law was modified by the law of 11 January 1991, which also slightly changed the name of the institution towards 'National Agency for Radioactive Waste and Enriched Fissile Materials'
- Royal decrees of 17 October 2011 on security, addressing categorization and protection of documents, physical protection of nuclear materials, nuclear installations and transport, categorization of nuclear materials and definition of security zones in nuclear installations and nuclear transport organizations, security clearances and certificates, and regulating access to security zones, nuclear material or documents in specific circumstances
- Royal Decree of 28 December 2011 laying down the maximum amount of the damage for which the operator or carrier may be held responsible in the case of transport within the meaning of Article 14 of the Law of 22 July 1985 on third party liability in the field of nuclear energy

BIBLIOGRAPHY

In French:

M. MARIS, A. JAUMOTTE and P. GOVAERTS, *Histoire du Nucléaire en Belgique*, 1990-2005, Brussels, P.I.E. Peter Lang, 2007.

In English:

OECD/NEA, *Radioactive Waste Management Programmes in OECD/NEA Member Countries: Belgium 2013*, https://www.oecd-nea.org/rwm/profiles/Belgium_profile_web_2013.pdf

IAEA, *Integrated Regulatory Review Service (IRRS) Mission to Belgium*, 2013, http://www.fanc.fgov.be/GED/00000000/3500/3594.pdf

OECD/NEA, *Nuclear Energy Data 2013*, Country Reports: Belgium (p. 37), http://www.oecd-nea.org/ndd/pubs/2013/7162-bb-2013.pdf

OECD/NEA and IAEA, *Uranium 2011: Resources, Production and Demand*, http://www.oecd-nea.org/ndd/pubs/2012/7059-uranium-2011.pdf

OECD/NEA, *Nuclear Legislation in OECD and NEA Countries 2010*, Regulatory and Institutional Framework for Nuclear Activities: Belgium, https://www.oecd-nea.org/law/legislation/belgium.pdf

APPENDIX 1: INTERNATIONAL, MULTILATERAL AND BILATERAL AGREEMENTS

AGREEMENTS WITH THE IAEA

Statute of the International Atomic Energy Agency	Entry into force:	29 July 1957
Agreement on privileges and immunities	Entry into force:	26 October 1965
NPT related safeguards agreement INFCIRC No. 193	Entry into force:	21 February 1977
Additional protocol to the NPT safeguards agreement	Signature:	22 September 1998
Improved procedures for designation of safeguards inspectors	Rejected by EURATOM, but agreed to alternative solution.	16 February 1989

OTHER RELEVANT INTERNATIONAL TREATIES

Non Proliferation Treaty (NPT)	Entry into force:	2 May 1975
EURATOM	Member	
Convention on the physical protection of nuclear material	Entry into force: Ratification:	6 October 1991 6 September 1991
Amendment to the convention on the physical protection of nuclear material	Ratification:	22 January 2013
Convention on early notification of a nuclear accident	Entry into force: Ratification:	4 February 1999 4 January 1999
Convention on assistance in the case of a nuclear accident or radiological emergency	Entry into force: Ratification:	4 February 1999 4 January 1999
Vienna convention on civil liability for nuclear damage		Non-party
Paris convention on nuclear third party liability	Ratification:	3 August 1966
Joint protocol relating to the application of the Vienna and the Paris conventions	Signature:	21 September 1988
Brussels convention on supplementary compensation	Ratification:	20 August 1985
Convention on nuclear safety	Entry into force: Ratification:	13 April 1997 13 January 1997
Joint convention on the safety of spent fuel management and on the safety of radioactive waste management	Entry into force: Ratification:	4 December 2002 5 September 2002
International convention for the suppression of acts of nuclear terrorism	Entry into force: Ratification:	7 July 2007 2 October 2009
Zangger Committee	Member	
Nuclear export guidelines	Adopted	
Acceptance of NUSS Codes	Summary: codes can be used as guidelines when formulating national regulations. Belgium often goes beyond code requirements.	8 November 1988
Nuclear Suppliers Group	Member	

BILATERAL AGREEMENTS

Belgium has nuclear bilateral agreements with The United States of America (1962, 1983), India (1965), France (1966, 1981, 1984, 2014), Luxembourg (1970, 2002, 2004), Romania (1974), Lithuania (1978, 1998), Korea (1981), The Netherlands (1984 and 1990), The People's Republic of China (1985) and Russia (1993).

The BELGO-LUXEMBOURG ECONOMIC UNION (BLEU) concluded bilateral agreements with Poland (1973) and The People's Republic of China (1979).

APPENDIX 2: MAIN ORGANIZATIONS, INSTITUTIONS AND

COMPANIES INVOLVED IN NUCLEAR POWER RELATED ACTIVITIES

GOVERNMENT

Federal Public Service Economy, SMEs, Self-Employed and Energy Directorate general Energy Nuclear Applications Boulevard du Albert II, 16 B-1000 Brussels	Tel: +32-2-277 89 81 or +32-2-277 71 93 Fax: +32-2-277 52 06 E-mail: nuclear@economie.fgov.be Website: http://economie.fgov.be/
Federal Public Service Foreign Affairs, Foreign Trade and Development Cooperation Rue des Petits Carmes, 15 B-1000 Brussels	Tel: +32-2-501 81 11 Website: http://diplobel.fgov.be/
Federal Public Service Interior Rue de Louvain, 1 B-1000 Brussels	Tel: +32-2-500 21 11 Fax:+32-2-500 20 39 E-mail: info@ibz.fgov.be Website: http://www.ibz.be/

NUCLEAR SAFETY AUTHORITY

Federal Agency for Nuclear Control AFCN/FANC Rue Ravenstein, 36 B-1000 Brussels	Tel: +32-2-289 21 11 Fax: +32-2-289 21 12 E-mail: info@fanc.fgov.be Website: http://www.fanc.fgov.be/

WASTE MANAGEMENT ORGANISATION

ONDRAF/NIRAS (Waste Management) Avenue des Arts, 14 B-1210 Brussels	Tel: +32-2-212 10 11 Fax: +32-2 218 51 65 E-mail: info@nirond.be Website: http:// www.nirond.be/

COMMUNICATION

ISOTOPOLIS Gravenstraat, 73 B-2480 Dessel	Tel: +32-14-33 40 31 E-mail: isotopolis@belgoprocess.be Website: http://www.isotopolis.be/

R&D

EIG EURIDICE Boerentang, 200 B-2400 Mol	Tel: +32-14-33 27 84 Fax: +32-14-32 37 09 E-mail: euridice@sckcen.be Website: http://www.euridice.be/
SCK•CEN (Nuclear Research Centre) Boeretang, 200 B-2400 Mol	Tel : +32-14-33 25 73 Fax: +32-14-33 89 36 E-mail: info@sckcen.be Website: http://www.sckcen.be/

OTHER BELGIAN NUCLEAR ORGANISATIONS

Belgian Association for Radioprotection Avenue Herrmann Debroux, 40 B-1160 Brussels	Tel: +32-02- 289 21 27 E-mail: office@bvsabr.be Website: http://www.bvsabr.be
Belgian Nuclear Society c/o SCK-CEN Avenue Herrmann Debroux, 40 B-1160 Brussels	Tel: +32-2-774 05 38 Fax: +32-2-774 05 47 E-mail: secretary@bnsorg.be Website: http://www.bns-org.be
Institut Interuniversitaire des Sciences Nucléaires	Tel: +32-2-504 92 11

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B-1000 Brussels
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Website: http://www.nuclearforum.be/

BELGIAN NUCLEAR INDUSTRY SECTOR

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Diamant Building
Bd. A. Reyers, 80
B-1030 Brussels
Website: http://www.agoria.be/

Association Vinçotte Nuclear (AVN)
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B-1070 Brussels
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Website: http://www.belgonucleaire.be/

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B-1070 Brussels
Tel: +32-2-528 02 11
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Website: http://www.belv.be/

ELECTRABEL (Utility)
Boulevard Simón Bolívar, 34
B-1000 Brussels
Tel: +32-2-518 61 11
Website: http://www.electrabel.be/

FBFC International, S.A. (AREVA) (Fuel Manufacturer)
Europalaan, 12
B-2480 Dessel
Tel: +32-14-33 12 11
Fax: +32-14-31 58 45
Website: http://areva.com/

IRE (Institute for Radio-Isotopes)
Avenue de l'Espérance, 1
B-6220 Fleurus
Tel: +32-71-82 95 56
Fax: +32-71-81 38 12
Website: http://www.ire.eu/

LABORELEC (Utility's Laboratory)
Rue de Rhode, 125
B-1630 Linkebeek
Website: http://www.laborelec.be/

SCK•CEN (Nuclear Research Centre)
Boeretang, 200
2400 Mol
Tel: +32-14-33 25 73
Fax: +32-14-33 89 36
E-mail: info@sckcen.be
Website: http://www.sckcen.be/

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Fax: +32-2-505 07 90
Website: http://www.synatom.be/

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(Architect-Engineer and Contractor)
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E-mail: http://www.tractebel-engineering-gdfsuez.com/contact/contact-us/
Website: http://www.tractebel-engineering-gdfsuez.com/

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Avenue Ariane, 4
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Tel: +32-14-34 69 11
Fax: +32-14-32 00 90
Website: http://www.tecnubel.be/

TRANSNUBEL, S.A. (Fuel Transportation)
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B-2480 Dessel

Website: http://www.transnubel.be/

TRANSRAD, S.A.
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Fax: +32-71-82 97 68
Website: http://www.transrad.be/

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Fax: +32-67-28 78 21
Website:
http://www.westinghousenuclear.com/

BELGIAN NUCLEAR RELATED COMPANIES REPRESENTED BY AGORIA GROUP B6

ABAY-TS (Contractor)
Rue de Genève 4, BTE 30
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AIB-Vinçotte Group (Safety Services)
Avenue A. Drouart, 27
B-1160 Brussels

Tel: 0032.2.674.57.11
Fax: 0032.2.674.59.59
Website: http://www.aib-vincotte.com

Asea Brown Boveri (ABB)
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B-1930 Zaventem

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Fax: +32-2-718 66 56
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Website: http://www.alstom.com

ALSTOM Belgium SA Energy-MTM
(Mechanical Equipment Supplier)
Leuvensesteenweg, 474
B-2812 Muizen

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Fax: +32-15-42 33 37
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Research Park
Pontbeeklaan, 57
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Website: http://www.canberra.com

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Website: http://www.cmi.com

ENI (Electrical Contractor)
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Website: http://www.eni.be

G.C.C.N. c/o S.B.B.M. - Six Construct
(Civil Works Contractors)
Boulevard Louis Mettewie, 74-76
B-1080 Brussels

Website: http://www.sixconstruct.com

IMOP (Mechanical Contractor)
Noorderlaan, 119
B-2030 Antwerpen

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Fax: +32-3-541 72 52
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Lepage Euronucléaire (Mechanical Contractor)
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CG Power Systems Belgium Pauwels Trafo Belgium (Transformers Supplier)
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Website: http://www.cgglobal.com/be/

SOBELCO (Thermal Construction)
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Stork MEC (Mechanical Contractor)
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