Belgium

(based on JC national report and OECD/NEA, NEWMDB country profiles)

a) National framework for management of spent fuel and radioactive waste

About 70% of the radioactive waste produced today in Belgium derives from the nuclear power generation activities. Nuclear industry waste is generated during nuclear power plant operations, the reprocessing of spent fuel as carried out by Areva (formerly Cogema) in France, uranium and MOX fuel fabrication, and decommissioning. The remaining 30% of Belgian radioactive waste is generated by nuclear research, production of radioisotopes by the National Institute for Radioisotopes (IRE), the use of such isotopes in medicine, industry and in private laboratories, and the European Joint Research Centre's Institute for Reference Materials and Measurements (IRMM).

Policy related to the nuclear sector, the nuclear fuel cycle and nuclear R&D is the responsibility of the Belgian federal government. The FPS for Economy, SMEs, SelfEmployed and Energy is responsible for nuclear policy within the Belgian government.

Radioactive wastes are classified in three categories:

- Category A: Low- and medium-level short-lived waste. This waste contains small amounts of mainly beta and gamma emitters with half-lives shorter than 30 years and traces of longer-lived emitters. It arises mainly from the operation of nuclear power plants, but also from reprocessing, research, production of radioisotopes and their use in nuclear medicine and industry. Seventy-four per cent of the estimated total volume of category A waste will be produced by the decommissioning of nuclear facilities. The estimated total volume of conditioned waste of this category is 69,900 m³.
- Category B: Low- and medium-level long-lived waste. This waste contains mainly alpha emitters with half-lives exceeding 30 years, together, in some cases, with intermediate amounts of beta and gamma emitters. It is derived mostly from the fabrication of nuclear fuels, from nuclear research and the reprocessing of spent nuclear fuel. Twenty-two percent of the estimated total volume of category B waste will be produced by the decommissioning of nuclear facilities. The estimated total volume of conditioned waste of this category is 10,430 m³ in the non-reprocessing scenario and 11,100 m³ in the full reprocessing scenario.
- Category C: Long-lived high-level waste. This waste contains substantial amounts of beta and gamma emitters with short and medium half-lives, together with longer-lived alpha emitters. One of its major characteristics is the considerable heat emission. It derives mostly from the reprocessing of spent nuclear fuel and from research. The estimated total volume of conditioned waste of this category is 600 m³ (full reprocessing scenario) or 4,500 m³ in the non-reprocessing scenario.

The projected total volumes of waste in each of these three categories are estimated on the basis of assumptions about the continuing operation of nuclear power plants (shut down after 40 years of operation), reprocessing of all spent fuel, and nuclear facility decommissioning by 2050.

The foundation of the 'Organisme national des déchets radioactifs et des matières fissiles / Nationale instelling voor radioactief afval en splijtstoffen' or ONDRAF/NIRAS (Belgian National Agency for Radioactive Waste and Fissile Materials) by law on 8 August 1980 is the result of a decision of the Belgian authorities to entrust the management of radioactive waste to one single institution under public control. This was done in order to ensure that the public interest would play a crucial part in all decisions on the subject. This law was modified by the law of 11 January 1991, which also slightly changed the name of the institution towards 'Belgian National Agency for Radioactive Waste and Enriched Fissile Materials'. For all radioactive waste from nuclear activities and facilities (nuclear fuel cycle, and nuclear applications in medicine, industry and research), ONDRAF/NIRAS has a policy of centralised waste management, making use of processing facilities and interim storage facilities centralised on the sites of Belgoprocess in Dessel (site 1) and Mol (site 2). Some waste producers have their own processing facilities and they transfer conditioned waste to Belgoprocess site for interim storage and the ownership and related responsibilities to ONDRAF/NIRAS.

The law under which ONDRAF/NIRAS was created requires the costs associated with radioactive waste management to be paid by those who produce it. This law also stipulates that the costs of all ONDRAF/NIRAS activities, including applied research and investment, be estimated at cost price and financed by the radioactive waste producers in proportion to their share of the overall volume of radioactive waste generated. Longterm operations, mainly those associated with future radioactive waste disposal, is financed by way of a special fund, the long-term fund (LTF), to which waste producers contribute annually according to the volume and type of radioactive waste they produce.

b) National legal and regulatory framework

All nuclear activities in Belgium are subject to the general regulations for the protection of the public, workers, and the environment against the hazards of the ionizing radiation. Licensing, control, and surveillance under these regulations is the responsibility of the Federal Agency for Nuclear Control (FANC), which was created in 1994 and is supervised by the federal Minister of the Interior. Since 1 September 2001 the supervision of nuclear activities is within the responsibility of the Federal Agency for Nuclear Control (FANC).

The Royal Decree of 25 April 2014 amends the "Royal Decree of 30 March 1981 determining the missions and setting out the operating modes of the public agency for the management of radioactive waste and fissile materials" and determines the guiding principles that are the basis for establishing the fees for contributing to the long-term fund.

The Belgian legal framework for safety consists mainly of:

- The General Regulations regarding the protection of the public, the workers and the environment against the hazards of ionising radiation (GRR-2001) set the licensing system for the different facilities and activities involving ionising radiation.
- The "Royal Decree on the Safety Requirements for Nuclear Installations", which incorporates all the WENRA RHWG reference levels into the Belgian regulations. This Royal Decree has a wider scope than the NPPs, as some generic reference levels were found applicable to other nuclear facilities (for example, the obligation to proceed to periodic safety reviews, to have a Safety Analysis Report, to have an integrated Management system, …) including waste management and disposal facilities.

c) Radioactive waste management, decommissioning and spent fuel strategy

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 (North-East of Belgium). The Dessel site also accommodates central facilities for interim storage of all conditioned Belgian waste, of all categories, awaiting disposal. The associated operations are carried out by Belgoprocess, the industrial auxiliary company of ONDRAF/NIRAS, which manages these central processing and interim storage facilities.

On 23 June 2006, the Belgian federal Government selected the municipality of Dessel for the location of a surface repository for low- and medium-level short-lived radioactive waste. The Government also allowed ONDRAF/NIRAS to pass from a pre-project disposal phase to the proper project phase and instructed the agency to continue the development of the technical integrated disposal project in Dessel, to carry on the local partnership participation process, to develop a legal and regulatory framework to guarantee the project's safety and financing, and to provide for the financing of the associated socio-economic aspects. A document titled Master Plan, published in March 2010, describes all the components of the integrated disposal project in Dessel. It expresses the vision shared by ONDRAF/NIRAS and the local partnerships of the project's content and execution. Since end of January 2013, ONDRAF/NIRAS has entered the licensing phase as the safety case for the surface disposal was submitted to the Federal Agency on Nuclear Control (FANC).

Programmes regarding the decommissioning of nuclear facilities have been ongoing in Belgium since 1987. They started with R&D and small pilot projects on dismantling and decontamination, with the aim of defining and developing suitable techniques and providing information on their performances and costs.

Seven commercial nuclear reactors of the PWR type are operated in Belgium, leading to a total installed capacity of 5926,8 MWe and to approximately 5 000 tHM spent fuel to be unloaded during 40 years of operation. Until the mid-nineties the Belgian strategy for the management of

the back end of the fuel cycle was the reprocessing of spent fuel from all commercial nuclear power reactors. This policy led to the reprocessing of 672 tHM of the spent uranium-oxide fuel type by COGEMA (now AREVA) at La Hague: the last Belgian fuel elements sent to La Hague have been reprocessed in late 2001.

In 1998 the Council of Ministers specified in its session of 4 December 1998 that the data available at that time and presented in the above-mentioned report were not sufficient to make a global evaluation of the benefits of both options. Therefore they decided to suspend the conclusion of any new reprocessing contract until new data were available and reported to them, allowing them to make this global evaluation.

They also urged SYNATOM to cancel a reprocessing contract concluded in 1991. The global evaluation has not been finalised up to now.

The Council of Ministers decided on 23 June 2006 of on the disposal of low and intermediate level short-lived radioactive waste should be carried out in a surface disposal facility to be developed in the municipality of Dessel in close collaboration with the local stakeholders (codesign).

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 2424 spent fuel elements were stored, while the wet storage building in Tihange contained 2267 such elements.

Table 1 Radioactive Waste In Storage (including spent fuel that is considered waste)

Route Waste Class	Processed (type)/Un processed	Total Current Volume (m3)	Estimated Disposal Volume (m3)	Distribution (%)							Planned Disposal Route (if known)
				RO	FFE	RP	NA	DF	DC/ RE	ND	
All Classes	No	48550	47440	0	1	3	95	0	1	0	
All Classes	Yes	22130	22130	33	1	17	34	0	14	1	
Category A	No	2755	1260	0	0	100	0	0	0	0	Surface
Category A	Yes	16250	16250	38	0	0	46	0	16	0	Surface
Category B	No	785	1180	0	33	1	6	0	60	0	Geological
Category B	Yes	5810	5810	21	2	62	4	0	8	3	Geological
Category C	Yes	70	70	0	0	94	0	0	6	0	Geological
Category R	No	45000	45000	0	0	0	100	0	0	0	TBD

NEWMDB waste origin type codes:
RO – reactor operations
FFE – fuel fabrication & enrichment
RP – fuel reprocessing
NA – nuclear applications
DF - defence
DC/RE - decommissioning & remediation
ND - Not Determined

Quantities as of 31/12/2014

* Unprocessed quantities of categories A and B are solid wastes on the BELGOPROCESS waste treatment facility. Wastes on their respective producer's sites and aqueous effluents are not taken into account.

Table 2 Radioactive Waste Disposed (as disposed volume)

Waste Class	Processed (not)	Total Volume (m3)	Distribution (%)							Disposal Route Used
			RO	FFE	RP	NA	DF	DC/RE	ND	
All Classes	Yes	15765	50	0	0	50	0	0	0	Sea
Category A	Yes	15765	50	0	0	50	0	0	0	Sea

Table 3 Spent fuel in Storage (MTHM) (not validated)

Type	Current Amount (NPP)	Current Amount (Research Reactors)
Total Spent Fuel Storage		
Wet storage (AR)		
Wet storage (AFR)		
Dry storage (AR)		
Dry storage (AFR)		
Total spent fuel held in storage for other countries (amounts also included above)		

Table 4 Spent fuel sent for reprocessing (in the country or sent to another country) (MTHM) (not validated)

Type	Current Amount (NPP)	Current Amount (Research Reactors)
Total amount Spent Fuel sent to Reprocessing (in your country)		
Total amount Spent Fuel sent to Reprocessing (in another country)		
Total amount of Spent Fuel received from another country for reprocessing and recycling		
Total amount of Spent Fuel (MTHM) or radioactive waste (cubic metres) returned to country of origin for storage/disposal		

Table 5 Example of a translation matrix (from NEWMDB) that can be used for transition from a national classification system to IAEA classification

National Waste Classification Name	LILW-SL	LILW-LL	HLW
Category A	100	0	0
Category B	0	100	0
Category C	0	0	100
Category R	-	-	-

N.B. : as the disposal route of category R waste is not yet defined, no definite correspondence can be given.

Table 6 Waste management facilities

Type	Planned	Construct.	Commiss.	In Operation	Shutdown	Decomm.	Other	Total
Spent Fuel				5				

Storage								
Spent Fuel Reprocessing and Recycling						1		
Spent Fuel Conditioning								
Spent Fuel disposal	1							
Waste processing	1			5	4			
Waste storage				11				
Waste disposal	1						SEA	

Table 7 Summary of major sources of waste

Type	Planned	Construct	Commiss.	In Operation	Shutdown	Decomm.	Other	Total
Research reactors	1	1	0	3	1	2	0	
Nuclear Power reactors		1	0	7	1	1	0	
Spent Fuel Reprocessing and Recycling	0	0	0	0	0	1	0	
Other						4		

Table 8 Future prospects

Type	Current amount	Estimated Current amount when prepared for disposal	Current Disposal Capacity	Total forecast at 2030	Disposal Capacity 2030	Total forecast at 2050	Disposal Capacity 2050
Spent Fuel Storage							
Wet storage (AR)							
Wet storage (AFR)							
Dry storage (AR)							

Dry storage (AFR)							
Total amount Spent fuel sent to Reprocessing and Recycling							
Total amount Spent fuel disposed							
Waste in storage							
Waste disposal							