LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de la Santé

Direction de la santé

National Report to the Joint Convention - Seventh review meeting

National Report on the Measures Taken by Luxembourg to Fulfil the Obligations Laid Down in the:

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

Seventh review meeting of the contracting parties in 2021

This report was produced by the Department of Radiation Protection (DRP) on behalf of the Government of Luxembourg

List of Acronyms and Abbreviations

ADR	European Agreement Concerning the International Carriage of Dangerous Goods by Roads
ANDRA	French National Agency for Radioactive Waste (ANDRA)
ALARA	As low as reasonably achievable
CBRN	Chemical, Biological, Radiological and Nuclear
CGDIS	Grand-ducal fire and rescue corps
D-RadW	Council Directive 2011/70/EURATOM of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste.
DRP	Department of Radiation Protection
DS	Directorate of Health
EU	European Union
EU-BSS	Council Directive 2013/59/EURATOM of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom.
IAEA	International Atomic Energy Agency
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICSD	Ionizing chamber smoke detector
ISO	International Organization for Standardization
ITM	Labour inspectorate
LCDR	Collection point for radioactive waste (Local de collecte de déchets radioactifs)
LNS	National laboratory of Health
MS	Ministry of Health
NORM	Naturally Occurring Radioactive Materials
ONDRAF	Belgian Waste Management Agency (ONDRAF/NIRAS)
RID	Regulation Concerning the International Carriage of Dangerous Goods by Rail
U-RAD	Radiological Protection Unit of the CGDIS

Table of Contents

LIST OF ACRONYMS AND ABBREVIATIONS 4

TABLE OF CONTENTS 5

SECTION A: INTRODUCTION 7

SECTION B: POLICIES AND PRACTICES (ARTICLE 32.1) 9

Radioactive waste management policy 9

Radioactive waste management practices 10

Management of wastes from unsealed sources 11

Management of activated materials 11

Management of orphan sources 12

Management of disused consumer goods containing small amounts of radioactive substances 12

SECTION C: SCOPE OF APPLICATION (ARTICLE 3) 13

SECTION D: INVENTORIES AND LISTS (ARTICLE 32.2) 13

SECTION E: LEGISLATIVE AND REGULATORY SYSTEM 13

Article 18: Implementing measures 13

Article 19: Legislative and regulatory framework 14

Radiation Protection and general provisions 14

The system of licensing and prohibition 14

Special provisions concerning radioactive waste 15

Control, enforcement and responsibilities 16

Article 20: Regulatory body 17

Overview – Status, Missions, responsibilities and organizational structure 17

Human and financial resources 18

Transparency and information of the public 19

SECTION F: OTHER GENERAL SAFETY PROVISIONS 19

Article 21: Responsibilities of the license holder 19

Article 22: Human and financial resources 20

Article 23: Quality assurance 20

Article 24: Operational radiation protection 20

Article 25: Emergency preparedness **20**

Article 26: Decommissioning **21**

SECTION H: SAFETY OF RADIOACTIVE WASTE MANAGEMENT **21**

Article 11: General safety requirements **21**

Article 12: Existing facilities and past practices **22**

Articles 13, 14 and 15: Siting, design, construction and assessment **22**

Article 16: Operation of facilities **23**

Article 17: Institutional measures after closure **23**

SECTION I: TRANSBOUNDARY MOVEMENT (ARTICLE 27) **23**

SECTION J: DISUSED SEALED SOURCES **24**

Management of disused sealed sources **24**

Use of sealed sources in education 25

Orphan sources 25

Safety and security of sealed sources 26

SECTION K: PLANNED ACTIVITIES TO IMPROVE SAFETY **26**

ANNEX I - INVENTORY **29**

ANNEX II - LEGISLATIVE FRAMEWORK **31**

Section A: Introduction

Luxembourg has signed the Joint Convention on 1st October 1997 and is a party thereof since 19th November 2001. The Convention entered into force on 21st June 2001.

Luxembourg has no nuclear power plant, no other fuel cycle facility, no research reactor and no other facility generating radioactive substances. Thus, many requirements of the Joint Convention do not apply to Luxembourg. It further has no spent nuclear fuel and no high-level radioactive waste on its territory.

There are other reasons which explain, why the actual total amount of radioactive waste, mainly in form of disused sealed sources of low activity, is marginal:

- small size of the country with only a few users of radioactive substances;
- import and utilization license for a radioactive sealed source is only granted by the competent authority under the condition that the foreign supplier certifies taking back the disused radioactive source;
- import and installation of radioactive smoke detectors and of radioactive lightning conductors has been forbidden for many years;

In Luxembourg radioactive wastes are mainly arising from historical sources, mostly from old smoke detectors and some other legacy waste. Other origins of waste include the use of radioactive sources in industry, medicine and to a small extent from the use in education and research. The proportion of that waste is however very low.

For this reason, the Luxembourg Government takes the position that the option of a national management facility and of a final disposal facility would be unrealistic, because it would not at all be commensurate with the radioactive waste activity and volume, which are very low. Therefore, all disused sealed sources have to be returned to the country of origin and if this turns out to be impossible, to a foreign waste management facility.

Since 1963, Luxembourg has legislation and regulation on radiation protection, which cover all relevant nuclear and radiological safety issues. Luxembourg has updated its legal framework with regard to radiation protection, nuclear safety and radioactive waste management. The new law of 28th May 2019 on radiation protection enters into force on 1st August 2019. It is the result of the transposition of the EU-BSS directive. It repeals and replaces the former legal framework on those matters. The new law pursues transposition of the European Council Directive 2011/70/EURATOM of 19th July 2011, establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste, hereafter referred to as “D-RadW”.

The department of radiation protection (DRP) is responsible for the content of the present report. The aim of this report is to demonstrate that Luxembourg meets its obligations of the Joint Convention. This demonstration is mainly based on the Luxembourgish legislation and policy framework concerning the management, the

control and the inspection of radioactive sources and radioactive waste held in the country.

The report is structured in conformity with the latest draft version of the “Guidelines regarding the form and structure of national reports” (INFCIRC/604/Rev.3). The section concerning the safety of spent fuel management covering articles 4-10 of the Joint Convention is not applicable to Luxembourg.

The present report clearly presents the follow-up of the challenges identified (see overview in section K). It further aims at focusing on the topics identified within the conclusions of the summary report of the 6th review meeting.

Section B: Policies and practices (Article 32.1)

Radioactive waste management policy

The Luxembourgish radioactive waste management policy is shaped by the practical needs of the country. The low activity and volume of radioactive waste produced in the country are not justifying the implementation of a final waste repository on national territory.

The Luxembourgish policy is based on the aim to avoid the production of radioactive waste, through the following provisions:

- return of disused sealed sources to the foreign supplier;
- replacement of radioactive sources by non-radioactive alternatives if available;
- minimization of the production of waste by the user;
- storage of transition radioactive waste on the user's premises until decay;

However, as it is never possible to obtain a zero-waste status, some radioactive waste will still remain and needs to be taken care of. As these are very small quantities, an agreement between Belgium and Luxembourg existed since 1990, in which the Belgian Government accepted to treat the waste coming from the Grand Duchy of Luxembourg, in Belgium.

In order to fully comply with the D-RadW, the Governments of both countries retained a bilateral agreement, which was signed on 4th July 2016. This new agreement foresees not only the treatment of the Luxembourgish waste in Belgium, but also conditioning, interim storage and final disposal of the waste. The bilateral agreement has been ratified in both countries and entered into force on 1st April 2019. Currently negotiations are taking place between the Belgian radioactive waste Agency (ONDRAF) and the DRP concerning the practical modalities.

The only facility in Luxembourg considered as “radioactive waste management facility” according to the D-RadW definition, i.e. a facility or installation the primary purpose of which is radioactive waste management, is the LCDR (Local de collecte de déchets radioactifs). This facility is a collection point for orphan sources, for which the government has a legal obligation to take care of. At this location, the radioactive materials are collected and packed for transportation to a dedicated facility in Belgium.

The following table gives an overview over the national radioactive waste management policy according to the matrix used at the previous review meetings.

Type of Liability	Long-term management policy	Funding of Liabilities	Current practice / facilities	Planned facilities
Non-power wastes	• Export to Belgium	• Licensee • State budget	• Decay (interim storage and retention of short-lived wastes) • Packed for transport and awaiting transfer to Belgium (either at the licensee or in the LCDR in case of orphan sources)	
Disused Sealed Sources	• Return to supplier • Export to Belgium	• Licensee	• Packed for transport and awaiting transfer to Belgium • Return to supplier	

Table 1 - National waste management policy

Radioactive waste management practices

The radioactive waste management policy is implemented via the legal framework and an active encouragement by the DRP to avoid the production of radioactive waste. The implementation of the policy is formalized in the national programme for the management of spent fuel and radioactive waste, following the D-RadW.

Facilities using radioactive substances exceeding the exemption levels (corresponding to those of the EU-BSS) need to be licensed by the competent authority, according to the licensing system as reported under Article 19. These facilities are fully responsible for the safety and the security of the radioactive sources they use and for the management of the radioactive waste resulting from this use. If production of radioactive waste is planned by implementation of a practice, solutions to dispose of the waste need to be provided during the licensing process.

Radioactive waste is categorized by the half-life of the corresponding nuclides and whether the disused sources are sealed or unsealed. A classification system as recommended by the European Commission (Commission Recommendation 1999/669/EC, Euratom) is not used, as it constitutes no practical advantage for Luxembourg. The classification of the radioactive waste rests within the Belgian

authorities, according to the Belgian classification systems, when treating and conditioning the waste.

The law of 28th May 2019 on radiation protection further defines clearance levels for unconditional release. Any licensee may release radioactive substances to the environment without additional license if the specific activity of the waste is below the clearance levels. Clearance of wastes above these levels has to be licensed by the competent authority.

The licensing takes place in respect of a graded approach. For clearance of radioactive material whose specific activity exceeds clearance levels but whose total activity does not exceed the exemption level, a license has to be granted by the Directorate of Health. Once the material's specific activity exceeds clearance levels and the total activity exceeds the exemption level, studies must be carried out in order to respect the 10 µSv criteria. License has to be granted by the Minister of Health.

Management practices of the different types of waste are separately reported on in the following paragraphs. The management of disused sealed sources is reported on in section J.

Management of wastes from unsealed sources

Unsealed sources are only used in nuclear medicine, radiotherapy or in biomedical laboratories, e.g. Ga-67, Sr-89, Y-90, Tc-99m, I-125, I-131, Gd-153, etc. Several research laboratories, mainly in the field of biomedical research, also use small quantities of H-3, C-14, P-32, S-35 and I-125. The license, authorizing these practices, specifies the procedures for adequately handling, controlling and minimizing the releases of these radioactive substances.

Wastes resulting from these practices and containing short-lived radionuclides are stored on the user's premises until decay i.e. until the activity of the waste has decreased below the clearance levels. Wastes containing small specific activities below clearance level may be treated the same way as conventional hospital waste.

With the objective of minimizing releases, the DRP instructed all hospitals engaged in iodine-131 therapy to install a special retention system for all wastewaters from these departments.

Concerning liquid radioactive substances with longer half-lives, such as C-14 and H-3, most licensees work with almost marginal quantities. Thus, the resulting liquid wastes and contaminated solid wastes remain below the clearance levels.

Management of activated materials

The national radiotherapy centre operates an irradiator able to activate material. According to the radioactive waste policies of the producer's country, the material that has been activated during its use in Luxembourg may not be returned to the country of origin. Those parts are now stored for decay. Most of the parts decay within a ten years' storage time below clearance levels. Some smaller items may need to be treated as radioactive waste. The waste is currently monitored and further decisions or partial clearance will be considered in 2023.

Management of orphan sources

All metal recycling plants and national waste recycling plants have installed fixed portal monitoring systems to detect radioactive materials at the entrance of their sites. In all cases these portal monitors consist of two large plastic scintillation detectors. At the only harbour in Luxembourg a commercially available crane monitoring system is used for the unloading of scrap from ships.

All operators of detection gates have worked out clear procedures together with the DRP in order to react adequately when radioactive substances are detected. If the detection signal is very small, agreements exist with France concerning the return of the truck or the carriage under certain conditions and following defined procedures. In all other cases, the load has to be separated in Luxembourg. The radioactive sources are then either returned immediately or stored until a safe return to the country of origin can be organized.

Either the operator of the monitoring systems or the responsible supplier of the material has to cover the costs for the safe management of these sources. If this turns out to be impossible or in case of bankruptcy and abandonment of the site holding radioactive sources, a specially labelled credit of the state budget covers all associated costs and the waste is considered as orphan source. This unlikely event has however never occurred to date.

Management of disused consumer goods containing small amounts of radioactive substances

To minimize radioactive waste produced in Luxembourg, the use and installation of the below listed goods containing radioactive substances has consequently been prohibited over the years:

- The installation of new ionizing chamber smoke detectors (ICSD) has been prohibited in 1994.
- The installation of lightning conductors has also been prohibited since 1994. An extensive programme was conducted in order to locate and dismount all installed lightning conductors containing radioactive substances in Luxembourg. However, it cannot be excluded that in the future isolated lightning conductors may appear. The last known remaining lightning conductor was found in June 2017.
- The production and import of thorium incandescent gas mantles are forbidden, since gas mantles without any radioactive substances are available with similar properties.
- Consumer goods such as watches, compasses, fishing floats, etc. containing radio-luminescent paintings or other consumer goods containing radioactive substances, such as technical porcelain, optical glasses etc. are collected by the DRP.

The above-mentioned products have not been subject to regulatory control when installed or bought. Hence, they have to be considered as orphan source according to the EU-BSS definition. If a return to a supplier should be possible, this option is still preferred, however in practice almost all of these sources are to be considered

as legacy waste and collected at the LCDR awaiting its treatment abroad via the bilateral agreement.

Section C: Scope of application (Article 3)

The present report applies to the safety of the management of radioactive waste resulting from civilian applications and containing artificial radionuclide exceeding the regulatory clearance levels for the unconditional release.

The present report also applies to waste that contains naturally occurring substances exceeding the regulatory clearance levels for the unconditional release. It does not apply to waste that contains naturally occurring substances that, at the time of production, were not considered by law as radioactive waste.

As Luxembourg has no nuclear fuel cycle, the present report does not apply to the safety of spent fuel management.

Section D: Inventories and lists (Article 32.2)

In Luxembourg there exists no facility whose primary purpose is the handling, pre-treatment, treatment, conditioning, long-term storage, or disposal of radioactive waste. As described in Section B, the only facility or installation the primary purpose of which is radioactive waste management, is the LCDR (Local de collecte de déchets radioactifs). This facility is a collection point for orphan sources, for which the government has a legal obligation to take care of. At this location, the radioactive materials are collected and packed for transportation to a dedicated facility in Belgium.

The inventories of the radioactive wastes and disused sources stored on 1st October 2020 at the LCDR and on the user's premises are listed in Annex I.

Section E: Legislative and regulatory system

Article 18: Implementing measures

In 2019, a new framework law on radiation protection was enacted. This law establishes general principles regarding radiation protection, management of radioactive substances and nuclear safety, defines competences for ad-hoc decisions in a radiological or nuclear emergency situation and sets the framework for enforcement. The law attributes regulatory competences to the Minister of Health and the Directorate of Health.

The law of 21st November 1980 concerning the organization of the Directorate of Health (DS) defines a department of radiation protection (DRP), charged with questions concerning the protection against hazards of ionizing and non-ionizing radiation, nuclear safety as well as safe management of radioactive waste.

The national framework has regularly been amended in conformity with the EU directives on radiation protection and nuclear safety. The current legislation implements European Council Directive 2013/59/EURATOM of 5th December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation as well as European Council Directive 2011/70/EURATOM of 19th July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste.

By entering into force of the law of 28th May 2019 on radiation protection, all currently pending EU directives have been transposed, and hence the challenge from the 6th review meeting of the Joint Convention stating "Finalizing the update of the national legislation to comply with EU legislation" has been addressed.

The current legislation applies to the production, manufacture, possession, sale, transit, transport, import, export, use for commercial, industrial, medical, scientific or other purposes, recycling and re-use of equipment or substances capable of emitting ionizing radiation. They also apply to the treatment, handling, storage, elimination and disposal of radioactive substances or waste and to any other activity involving a risk arising from ionizing radiation.

In some areas such as, for example, maximum permitted levels of radioactive contamination of foodstuffs, specific EU-Council regulations are directly applicable in all EU member states. Those acts are not listed in the present report.

The various laws and regulations, building a solid legal framework, are listed in Annex II.

Article 19: Legislative and regulatory framework

Radiation Protection and general provisions

The provisions relating to dose limits for the public and workers take into consideration the ALARA principle (As Low As Reasonably Achievable). Thus, the exposure of the public and workers to ionizing radiation and the number of persons and workers exposed to radiation must be kept as low as reasonably possible.

The current legislation describes the operational rules to protect workers, outside workers, apprentices and students exposed to radiation. In particular, working areas are divided into "controlled areas" and "supervised areas" and workers are categorized. The regulations further impose a certain number of obligations, including the implementation of radiological monitoring of workers and workplaces, as well as medical supervision, procedures regulating access to different areas, appropriate information of workers and training in the field of radiation protection.

The system of licensing and prohibition

In the law of 28th May 2019 on radiation protection, articles 40 to 43 classify the types of facilities according to a graded approach. Article 44 defines the licensing regime for types of facilities. Article 45 defines the licensing conditions.

The types of classes are as follows:

- Class I facilities comprise facilities operating accelerators, X-ray generators used for sterilization, radioactive sources of IAEA category I, producers of radioactive sources, radioactive waste treatment facilities and radiotherapy facilities;
- Class II is dedicated to facilities using or holding radioactive substances exceeding by a factor of thousand the exemption limits as fixed by the European Council Directive 2013/59/EURATOM, facilities engaged in industrial radiography or interim storage of radioactive waste or involving medical exposures, with the exception of dental X-ray equipment that does not have a three-dimensional imaging technique;
- Class III is dedicated to facilities using or holding radioactive substances exceeding the exemption limits as fixed by the European Council Directive 2013/59/EURATOM, facilities operating x-ray machines or other electron-accelerating apparatus above 30 kilovolts, facilities where natural radioactive substances are used or held if the concentration of activity is greater than or equal to 100 Bq per gram.

Licenses are issued for a timespan ranging between 1 and 10 years and then need to be subject of a renewal procedure. Any project modifying the object or conditions of the license must be submitted for licensing following the procedure established for the class to which the establishment would belong after modification.

Special provisions concerning radioactive waste

The regulatory framework fully respects the provisions of the D-RadW. The legislative system relies on the following pillars:

- Explicit obligation on license holders to keep the generation of radioactive waste to a minimum which is reasonably practicable, both in terms of activity and volume, by means of appropriate design measures and of operating and decommissioning practices, including the recycling and reuse of materials.
- Additional obligations concerning the licensing application for a radioactive waste management facility. The application needs to include:
    - A safety demonstration covering the development, operation and decommissioning of a facility as well as the post-closure phase of a disposal facility. The extent of the safety demonstration shall be commensurate with the complexity of the facility.
    - Information concerning integrated management systems, including quality assurance, which give due priority for overall management of radioactive waste to safety.
    - Demonstration of adequate financial and human resources
- Obligation on the license holder to regularly assess and to continuously improve the safety of the management of radioactive waste.
- If production of radioactive waste is planned by implementation of a practice, solutions to dispose of the waste need to be provided during the licensing process, namely the measures proposed for the management and

disposal of any radioactive waste, including that produced during the operation and dismantling of the facility, with the following information:
    - the agreement in principle of a radioactive waste management centre attesting that this centre is capable of handling the type and quantity of waste in question;
    - detailed studies demonstrating that for the practice to be implemented, the production of radioactive waste is at the lowest level that is reasonably achievable in terms of activity and volume;
    - indications relating to the different categories of waste and, for each category, indication of the maximum volume and weight of waste or products to be removed, deposited or transported per month and per year;
    - the nature and concentration of radioactive substances contained in the various categories of waste or in the products to be removed, deposited or transported, as well as their level of radioactivity, their radiotoxicity, the value of the critical mass and an estimation of the quantity of heat released during the duration of their deposition;
    - indications relating to the on-site treatment and conditioning of solid waste.
- The Minister of Health is made responsible for the elaboration and implementation of a national programme for the management of radioactive waste.
- The export of radioactive waste outside the European Union is prohibited.

Further practical provisions on the implementation of the management of radioactive waste are laid down in the national programme for the management of radioactive waste, as required by the D-RadW. The national programme has been adopted in August 2015 and is available to the public.

Control, enforcement and responsibilities

The legal basis for inspections is laid down Article 147 of the law of 28th May 2019 on radiation protection, which appoints officers of the DRP to perform inspections. The inspectors are entitled to access facilities during office hours, take samples for examination, to obtain relevant documents and to collect on the spot any necessary information.

Inspectors of the DRP follow an inspection programme for all facilities holding radioactive material or X-ray emitting devices. The questionnaires used during the inspections are derived from the IAEA-TECDOC-1526, “Inspection of Radiation Sources and Regulatory Enforcement”. The inspection programme follows a graded approach. The frequency of inspections depends on the class of the facility and hence of the risk of their activities.

These periodic inspections focus on the radiological protection of the workers and the physical protection of the radioactive substances. The licensee has to

demonstrate that internal procedures concerning the management of radioactive substances exist, are adequate and correctly applied.

According to §5 of the above article, the inspection report is send to the head of the facility and, if applicable, to the employer of the external worker. The report contains observations, records non-compliances and may give a deadline for remediation. In case of a more severe or safety significant non-compliance, enforcement actions are taken.

Article 148 introduces administrative measures that entitle the Minister of Health to suspend or revoke, partially or completely the license, respectively to suspend or stop a non-licensed activity.

Article 149 defines the penal sanctions. Officers of the DRP have the legal powers of police officers, entitling them to seize objects, documents and effects that were used to commit, or intended to commit, the offenses and to refer directly to the prosecutor. In such a case the DRP officers work under the authority of the prosecutor and must not be influenced, neither by any other body nor by his internal hierarchy.

Article 20: Regulatory body

Overview – Status, Missions, responsibilities and organizational structure

The executive competence in the field of radiological safety and radiation protection is attributed to the Minister of Health. The law of 21st November 1980 concerning the organization of the Directorate of Health defines a department of radiation protection (DRP) and allocates particular missions to all departments within the Directorate of Health.

The above-mentioned law was modified on 24th November 2015, now attributing to the DRP all competences relating to ionizing and non-ionizing radiation, nuclear safety as well as the safety of management of radioactive waste. Similarly to a number of other small countries, the DRP centralizes as a single department all competence of radiation and nuclear safety. It also includes the national laboratory for radiation physics.

The organizational structure and missions of the DRP are summarized in figure 1.

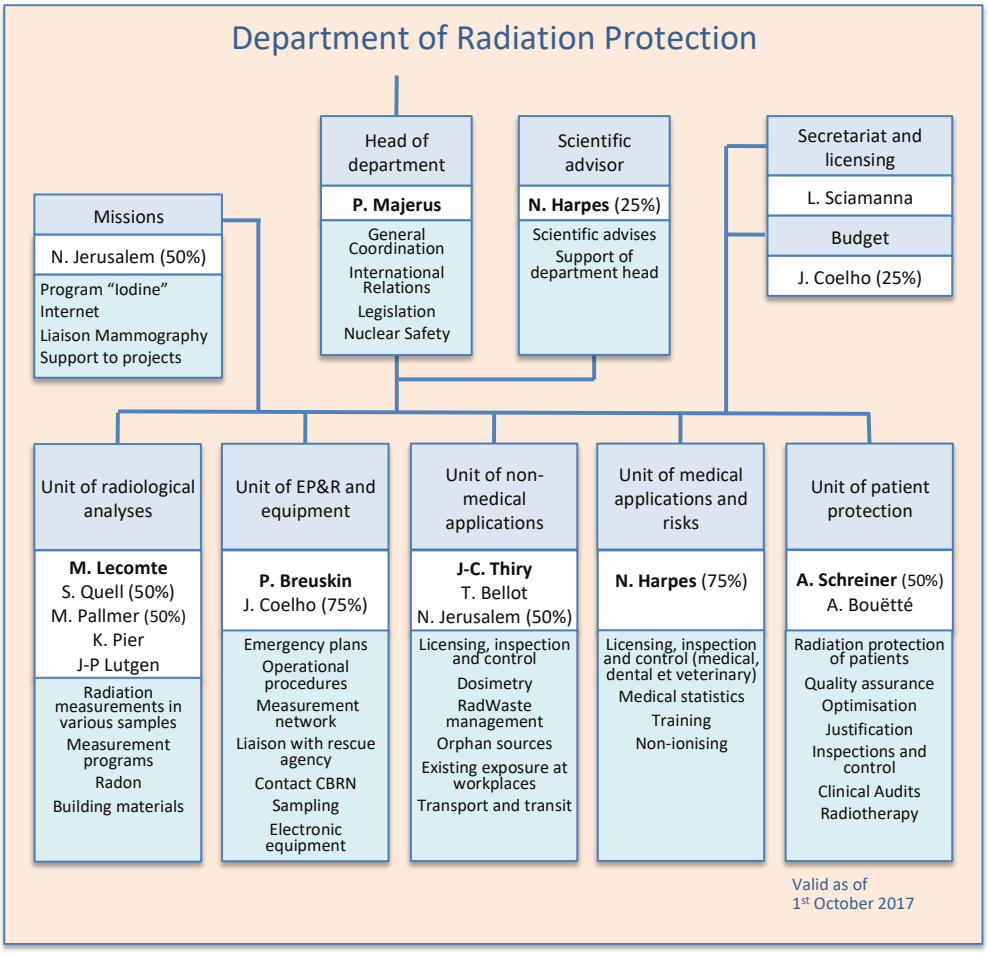

Figure 1: Organizational structure and missions of the DRP

The DRP is at the technical level in charge of supervising the use of ionizing radiation and the safety of management of radioactive waste. License requests are examined by the DRP, which defines the conditions of these licenses. Furthermore, the DRP is also in charge of control and inspections in all domains of ionizing radiation and management of radioactive waste. Besides, the DRP participates in drafting laws, regulations and decrees. It has further issued several guides.

Human and financial resources

The DRP is composed of 9 agents with master degree, including 4 with PhD, specialized in radiation protection (1), medical physics experts (2), nuclear physics and engineering (2), physics (1), geology (1), biology (1) and chemistry (1). The permanent staff of the DRP is further composed of one bachelor engineer, 3 technicians, and a secretary.

Compared to the previous national report, this is a decrease of one technician, after rearrangements of staff within the Directorate of Health. The DRP has no direct competence in the decisions for the appointment and dismissal of staff. However, the DRP is currently persuading the Directorate of Health on being granted a replacement of that technician.

All activities and projects of the DRP are financed via the state budget, allocating predefined credits on a yearly basis. As some of the credits of the state budget are non-limited to allow covering important unpredictable costs. This applies for example to expenses resulting from accidents and incidents, the management of orphan sources or the transfer of radioactive waste to Belgium. Another specific unlimited budgetary article allows the DRP in well-justified cases to engage external technical support. This is typically used in the frame of specific licensing procedures. In the past the budget of the DRP has usually been increased at a yearly rate in conjunction with the economic growth.

The financial and human resources of the DRP are not extensive, but they are felt to be adequate. They have always allowed the DRP to fulfil its obligations in an appropriate way.

Transparency and information of the public

Article 144 of the law of 28th May 2019 on radiation protection is dedicated to transparency. It states that the regulatory body shall ensure that information concerning the justification of practices and the regulation of sources of ionizing radiation and radiation protection is made available to establishments, workers, members of the public and patients exposed to medical exposure. It shall further inform the public in the areas of its competence.

Decisions taken by the DRP in its role as competent authority are transparent. This is also illustrated through the public consultation during license inquiry. According to the national legislation, licenses of class I need to undergo public consultation in the localities in the vicinity of a facility. The issued licenses for these facilities as well as the underlying conditions are also publicly disclosed.

Relevant information on all aspects related to the missions of the DRP, such as legislation, explanations and guides for RPO's, specific reports, results of the environmental survey and information for the public on emergency preparedness is publicly available through our website www.radioprotection.lu. The homepage is updated and expanded at regular intervals. So far only a French version exists, although some of the documents and brochures that can be downloaded are available in other languages as well.

Section F: Other general safety provisions

Article 21: Responsibilities of the license holder

According to the law of 28th May 2019 on radiation protection, the license holder is fully responsible for the respect of all regulatory provisions.

Article 22: Human and financial resources

By legislation, facilities using or holding radioactive sources or radioactive waste are bound to provide adequate human and financial resources to guarantee the safety and security of their sources and waste.

All licensees have to designate a qualified radiation protection officer who is responsible for implementing the obligations of the licensee. They must further contract a special insurance covering the reparation of radiological damage to third parties in case of an accident.

In line with the EU-BSS, holders of high activity sources have to conclude a contract with the supplier, where the latter agrees to take back the source after use, even when the licensee is unable to cover the associated costs.

Article 23: Quality assurance

The designated radiation protection officer is responsible to establish and implement a quality assurance program with regard to the implementation of internal procedures, such as regular verifications and calibrations of the used radiation measurement equipment.

Article 24: Operational radiation protection

The licensee is fully responsible for the implementation of internal radiation protection following the principles described under article 19 and the control of actual or potential discharges according to the national policies described under section B.

Article 25: Emergency preparedness

As facilities are fully responsible for the safety of their radioactive sources and waste, they have to take the necessary steps to cope with radiological emergencies. Depending on the quantities of radioactive substances, they have to draw up internal emergency response plans taking into account the most probable accidents. Periodic review of the plans and training of the staff by organizing regular exercises are part of the conditions set out in the license.

In case of an emergency, the license holder is obliged to notify immediately the DRP, the Grand-ducal fire and rescue corps (Corps grand-ducal d'incendie et de secours - CGDIS) and the labour inspectorate (ITM), to evaluate the possible radiological consequences for the populations at risk, to take the necessary steps to avoid or to stop the release of radioactivity in the environment in order to limit the exposure of individuals, and to respect the legal provisions in case of emergency exposures.

Most licensed users of radioactive materials have a general internal emergency plan, covering all potential accidents. The DRP insists and verifies that the radiological risk is properly reflected within that emergency plan.

Bilateral agreements on mutual assistance have been concluded with France and Belgium. These general agreements also cover radiological and nuclear emergencies. Furthermore, a bilateral agreement on mutual early information has been concluded with France and Belgium.

The Government has set up a national emergency response plan, which has been completely overhauled after the Fukushima accident, to alert and to protect the population in case of a radiological emergency. The Prime Minister, the Minister of the Interior and the Minister of Health are responsible for the off-site emergency planning. The plan is activated and regularly tested by the High Commissioner for national protection, the DRP and the CGDIS, in national, bilateral and international exercises. Emergency teams have been formed to assist in the event of a nuclear disaster, and refresher courses are held periodically.

Article 26: Decommissioning

Prior to licensing, all users of high activity sources have to introduce a safety report. This report includes precautions for avoiding accidents and provisions for the management of incidents and accidents, such as potential contaminations necessitating clean up and decommissioning. These reports are regularly updated by the licensee and submitted to all involved actors, including the DRP.

Section H: Safety of Radioactive Waste Management

Article 11: General safety requirements

As highlighted in section B only marginal amounts of radioactive wastes exist in Luxembourg and effective measures are in place to keep their amounts and the duration of their interim storage very low. Thus, many provisions of article 11 do not apply. Facilities that keep such radioactive wastes have to comply with the safety provisions of class II facilities.

The relevant legislation further attributes the responsibility to the DRP for maintaining a national database of all radioactive sources above exemption level. This includes radioactive wastes. Licensees have to notify the DRP of any modification of their inventory. The database contains information about the type, activity and registration number of the source, its localization and a reference to the corresponding license.

The DRP also issued some guides such as:

- Guide to implement general procedures on radiation safety.
- Guide to perform risk assessments.
- Guide on internal intervention planning.

Article 12: Existing facilities and past practices

There are no radioactive waste repositories in Luxembourg as radioactive waste is disposed of in Belgium under the bilateral agreement. The only facility or installation the primary purpose of which is radioactive waste management, is the LCDR (Local de collecte de déchets radioactifs). This facility is a collection point for orphan sources, for which the government has a legal obligation to take care of. At this location, the radioactive materials are collected and packed for transportation to a dedicated facility in Belgium.

The LCDR is a single facility, which is built as an annex to the National laboratory of Health and situated on the territory of the City of Dudelange. The facility has been explicitly designed to host radioactive waste by a specialized engineering office. Even though the collection centre only hosts properly packed transport barrels and disused radioactive sources, the legislative obligations for a category II facility, to which belong waste treatment and interim storage licensees have been applied.

At the LCDR the radioactive waste is grouped according to its nature, isotopic composition and physical state. Disused sealed sources, which are mainly composed of smoke detectors, are collected until a sufficient quantity is reached. They are then packed for transport. Other waste, especially open sources and contaminated objects need to be immediately packed for transport. Packing is done by an external provider approved for that purpose and in accordance with the acceptance criteria of the recipient storage centre. Steps are taken to organize cross-border transfer and transport. A detailed inventory of all the radioactive waste presently stored at the LCDR is given in annex I.

The LCDR may not accept radioactive waste or disused sealed sources that come from a licensee. The collected waste is exclusively composed of orphan sources, for which no other recycling option is possible. As the facility is required by the DRP in order to fulfil its legal obligation to take care of orphan sources and to ensure that they are disposed of in an appropriate manner, there is no strict separation between the DRP and the operator of the facility. Furthermore, waste volumes are very low and storage is for short time only, pending transfer to a foreign storage centre.

In order to ensure high safety standards, the DRP contracted an external foreign radiation protection expert to provide an independent safety assessment for the premises.

Articles 13, 14 and 15: Siting, design, construction and assessment

Siting, design, construction of a waste facility, and its assessment, is ruled by the law of 28th May 2019 on radiation protection and its decrees, laid down in section E.

According to the legislative context, waste facilities may be classified as:

- Class I: for radioactive waste treatment facilities
- Class II: for interim storage of radioactive waste.

There is no class I radioactive waste facility in Luxembourg. The LCDR has been designed and built according to the class II requirements.

Any hypothetic further projects to build radioactive waste management facilities or facilities for the final disposal of radioactive waste are subject to prior authorization according to the procedures defined in Luxembourgish laws and decrees. According to these, each applicant would have to demonstrate full compliance with articles 13, 14 and 15, which include studies on safety aspects, public consultation, suitable measures to limit possible radiological impacts, decommissioning plans and independent safety assessments.

Article 16: Operation of facilities

As stated under article 12, Luxembourg only hosts a single waste collection facility. In order to guarantee a safe storage, the DRP regularly mandates an external foreign radiation protection expert to provide an independent safety assessment.

Segregation and packing of the collected wastes, is done by an external company according to the acceptance criteria established by the Belgian Waste Management Agency (ONDRAF/NIRAS).

The inspectors of the DRP further verify radiation level within the storage room and the absence of radioactive contamination on a yearly basis.

Article 17: Institutional measures after closure

The LCDR is not very likely to be contaminated. Thus, no specific measures, except of a final contamination verification, will be needed after closure. However, in the very unlikely event of accidental contamination during the manipulation of the wastes or as a result of severe accidents like fire or flooding it is foreseen that the facility would then be set back into a contamination-free state.

Depending on the degree of contamination, decontamination may be performed by own means and by the Radiological Protection Unit (U-RAD) of the CGDIS. Luxembourg is also increasingly cooperating with specialized rescue teams from neighbour countries that could assist in case of major accidents.

The DRP further has the possibility to contract a specialized private company. To this effect, a specially labelled credit of the state budget has been introduced in order to cover such unpredictable costs and a German company is licensed by the Minister of Health to perform decontamination activities in Luxembourg.

Section I: Transboundary Movement (Article 27)

In Luxembourg, transport of radioactive material is controlled by the competent authorities. The provisions of the ADR (European Agreement Concerning the International Carriage of Dangerous Goods by Roads) and of the RID (Regulation Concerning the International Carriage of Dangerous Goods by Rail) apply. Also, the technical instructions of the ICAO and the “Dangerous Goods Regulations” of the International Air Transport Association (IATA) are applicable.

Only licensed carriers are allowed to transport radioactive materials in quantities above exemption level. The authorization is valid for a period of ten years at maximum. For the transfer of radioactive sources, the EU Council Regulation of 8th June 1993 on shipments of radioactive substances between Member States is applicable.

The transfer of radioactive waste is regulated by the Grand-Ducal regulation of 3rd March 2009 on the supervision and control of shipments of radioactive waste and spent fuel. This regulation addresses all the requirements laid down in Article 27 on the Joint Convention and is the transposition of the European Council Directive 2006/117/EURATOM of 20th November 2006 on the supervision and control of shipments of radioactive waste and spent fuel.

Section J: Disused sealed sources

Management of disused sealed sources

All radioactive sealed sources are imported from other countries, mainly from other European Member States. In line with the regulation in force, each import and installation of a sealed source is submitted to a licensing procedure. Part of the licensing procedure aims at reducing the production of radioactive waste, which relies on the following principles:

1. **Reduction of the number of sealed sources in use**

   As part of the licensing procedure, the DRP verifies the justification of the use of a sealed source. The applicant must in particular demonstrate that no non-radioactive alternative is available. This also applies when a source needs to be exchanged at the end of the recommended lifetime. In several cases this policy has led to the replacement of sealed sources by X-Ray devices, such as for the control of the thickness of thin metal foils.

2. **Reduction of the number of disused sources stored in Luxembourg through the systematic return of the sealed source to the supplier**

   The applicant must have a written commitment from the foreign supplier, in which the latter agrees to take back the source once it has become disused. Several licensees still hold older disused sources where the supplier does no longer exist or never made any commitment and other solutions are needed. For recently installed sealed sources (approx. the last 20 years) the return to the supplier works in nearly all cases without delay, so that no interim storage is needed. Only in a very few instances a supplier tried to avoid the reacceptance.

3. **Maintaining necessary documents**

   In the recent past it turned out in a few cases that the shipment back to the supplier was not possible because necessary certificates of the source (e.g. special form certificate) had expired. As a consequence, the DRP now verifies

the availability of all necessary documentation during its inspections. If necessary, the licensee is also asked to renew the reacceptance certificates.

4. **Individual tracking of sealed sources by the DRP**

   The DRP holds a register with all sealed sources licensed in Luxembourg. The register contains the nuclide, the activity, the source number, the manufacturing date, the use of the source and data concerning the licensee.

If it turns out that the supplier is unable to respect his commitment of reaccepting the sealed source, e.g. in case of bankruptcy, the user or holder is obliged to take all necessary administrative steps to send his disused source to any other supplier of radioactive sources or foreign waste management facility. This also applies to older sources not yet covered by these new regulatory provisions.

Before the sources are sent back to the foreign supplier or to a foreign waste management facility, the user or holder must guarantee the safe interim storage of the disused sources on his premises. Such interim storage needs to be licensed and follow provisions to be respected for the safe storage. The expenses related to the interim storage, to the conditioning, to the transport and to the final disposal of the radioactive waste are covered by the user or holder.

Use of sealed sources in education

In early 2014, the DRP has started a national campaign to collect the unused and/or unneeded radioactive sources and substances from schools. This action plan was taken in order to evacuate ancient collections of radioactive substances, often exempt from licensing, which however present a risk without serving for educational purposes.

After an enquiry phase in form of a questionnaire sent to the different schools in March, the first on-site visits and collections of orphan sources started in 2014. During these visits, a complete inventory is established for the school and all the disused radioactive substances and sources are evacuated. The remaining sources are then subject to issuing of a new licence (if required) in order to ensure compliance with the legislative requirements.

The action plan has been completed by the end of 2019. A total of 410 sources have been collected during the campaign and awareness about the uses of radioactive substances in education has been raised.

This addresses the challenge from the 6th review meeting of the Joint Convention, stating “Completing the first step of the national campaign to collect the unused and/or unneeded radioactive sources and substances”.

Orphan sources

The DRP assumes the management of disused sealed sources for which a safe management may not be guaranteed because there is no legal owner, i.e. orphan sources. This is also the case when members of the public still hold old historic sources. Those sources are then brought to the LCDR. At regular intervals, these

sources are prepared for shipment and transferred in accordance with the bilateral agreement with Belgium to ONDRAF.

A list of all these sources is given in annex I.

Safety and security of sealed sources

The provisions of the Code of Conduct on the Safety and Security of Radioactive Sources and its Supplementary Guidance on the Import and Export of Radioactive Sources were transposed into national regulations in 2006. Luxembourg also notified its efforts on that topic to the IAEA and expressed to the Director-General its support and endorsement of the Agency's efforts to enhance the safety and security of radioactive sources.

Furthermore, on 4th February 2019, Luxembourg has notified the Director General of the IAEA of its political commitment to implement the Guidance on the Management of Disused Radioactive Sources.

Section K: Planned activities to improve safety

Given the size of the country, Luxembourg does not experience any significant modifications from one review meeting to another. However, Luxembourg considers the Joint Convention pair review as a highly valuable exercise. It allows a small country with a limited programme to gain insight into relevant issues in other countries. Besides the aspect of being reviewed, having frank and open discussions with qualified experts is extremely useful.

Luxembourg is determined to constantly consolidate, update and improve its dispositions with regard to the safety of radioactive substances. The process of self-assessment, when writing the national report every 3 years, supports such continuous improvement. Luxembourg commits itself to follow up the suggestions and challenges identified at the previous review meeting.

At the 2018 peer review meeting, 2 challenges have been identified for Luxembourg. The present report addresses those challenges in the relevant sections. The table below summarizes the challenges and the way in which they are addressed.

#	Challenge	Solution
1	Completing the first step of the national campaign to collect the unused and/or unneeded radioactive sources and substances	The campaign aiming to collect the unused and/or unneeded radioactive sources and substances from schools has been completed in 2019 *(see also section J)*
2	Finalizing the update of the national legislation to comply with EU legislation	By entering into force of the law of 28th May 2019 on radiation protection, all currently pending EU directives have been transposed,

		and hence the challenge has been fully addressed *(see also section E - Article 18)*

Table 2: Challenges from the 6th review meeting

The single issue that was presented in the previous national report as planned activity was the hosting of an IRRS as well as an ARTEMIS mission. Both missions took place in 2018. The outcome of these missions is reflected in the recommendations and suggestions of the ARTEMIS mission report. The table below represents the recommendations and suggestions as well as the proposed action in order to address the different issues.

#	Recommendations, Suggestions or Good Practices	Action foreseen in the action plan
R1	The Ministry of Health should enhance the regulatory framework for the safe predisposal management of radioactive waste, the decommissioning of facilities and remediation activities in accordance with relevant IAEA safety standards.	The DRP will review the corresponding license conditions.
R2	The Ministry of Health should establish a mechanism to ensure the effective independence of DRP as a regulatory authority from the operational radioactive waste management facility and activities.	The DRP will analyse possible mechanisms to be proposed to the Minister of Health for consideration
R3	DRP should strengthen provisions for the authorization of all the radioactive waste management activities that are performed in the country, including those that are implemented by qualified foreign companies.	The radiation protection law introduced the obligation for regulatory control other those who have a responsibility with regard to a practice. This includes the case mentioned by the recommendation.
S1	DRP should consider further developing the safety provisions and procedures for establishing the safety case and safety assessment for facilities and activities in the predisposal management of radioactive waste.	The DRP will prepare a guidance document

R4	The Government should establish and regularly update the national policy and strategy considering provisions for the management of radioactive waste generated by potential emergency situations or other new identified waste streams.	Preparation by the DRP of a national strategy concerning waste management in an existing exposure situation following a radiological incident.
S2	DRP should consider the need of increasing the number of staff devoted to fulfil the provided recommendations and suggestions including the radioactive waste management programme.	The DRP will request more staff.

Table 3: Recommendations and suggestions from the ARTEMIS mission in 2018

Implementation of the proposed actions is foreseen to be achieved by 2023. Due to a large workload within the Directorate of Health due to the COVID-19 pandemic however, first actions are already behind schedule.

The DRP made its national reports and other relevant documents available to the public. In particular, the national reports, the questions and comments including the written answers, and the national reports of the two previous RM's are available on the Internet (direct link: http://www.sante.public.lu/fr/espace-professionnel/radioprotection-cooperation/instruments-cooperation/joint-convention/index.html).

After each RM, the DRP also publishes a small statement on the review process, summarising in particular the suggestions and challenges that have been identified.

Annex I - Inventory

Interim storage of radioactive waste stored on 1st October 2020 on users' premises. Very short-lived radioisotopes are not taken into account:

Radionuclide	Physical state	Volume	Total activity
Activated material from irradiator	solid	200 kg	To be determined

Table 4: Interim storage of radioactive waste stored on users' premises

Inventory of disused radioactive sealed sources stored on 1st October 2020 on users' premises (3 licensees).

Radionuclide	Number of sources	Total activity (GBq)
Am-241	18	635
Kr-85	13	26.64
Co-60	1	0.05
Cs-137	4	2.24
Total:	**36**	**663,93**

Table 5: Inventory of disused sources stored on users' premises

Inventory of disused radioactive sealed sources stored on 1st October 2020 at the LCDR. Items containing NORM are not included (chemicals and minerals containing NORM and some items containing Ra-226, together below 30 litres).

Type and Nuclide	Total Qty	Total Activity (kBq)
Ionizing chamber smoke detector	2501	332 659
Am-241	1401	327 822
Ra-226	1100	4 837
Contaminated materials	8	4
Ra-226	5	4
(blank)	3	
Other materials	1	
Th-232	1	
Minerals	2	
Ra-226	2	

Lightning conductors	8	279 350
Am-241	2	72 150
Ra-226	6	207 200
Refractory	1	
Th-232	1	
Salt	29	936
Ra-226	1	20
Th-232	28	916
Radio-luminescent panels	3	481 000
H-3	3	481 000
Sources	350	563 239
Am-241	18	3 696
Ba-133	1	666
C-14	1	9 250
Co-60	10	6 475
Cs-137	9	20 635
Na-22	1	185
Ni-63	1	370 000
Ra-226	181	36 427
Ra-226/Be	1	111 000
Sn-113	1	333
Sr-90	9	1 221
Th-232	114	576
Tl-204	3	2 775
Grand Total	**2903**	**1 657 188**

Table 6: Inventory of disused sources stored at LCDR

Annex II - Legislative framework

- Law of 21 November 1980 concerning the organization of the Directorate of Health.
- Law of 28 March 1984 concerning the approbation of the agreement between the government of the Grand-Duchy of Luxembourg and the government of the French Republic concerning the information exchange in case of an incident or accident which might have radiological consequences, signed in Luxembourg on 11 April 1983.
- 93/1493/EURATOM - Regulation of 8 June 1993 on shipments of radioactive substances between Member States.
- Law of 11 April 1995 concerning the approbation of the Convention on the Physical Protection of Nuclear Material, opened for signature in Vienna and New York on 3 March 1980.
- Law of 19 March 1997 concerning the approbation of the Convention on Nuclear Safety, adopted in Vienna on 20 September 1994.
- Law of 28 July 2000 concerning the approbation of the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, adopted in Vienna on 26 September 1986.
- Law of 28 July 2000 concerning the approbation of the Convention on Early Notification of a Nuclear Accident, adopted in Vienna on 26 September 1986.
- Law of 20 June 2001 concerning the approbation of the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, adopted in Vienna on 5 September 1997.
- Law of 27 April 2006 concerning the approbation of the agreement between the government of the Grand-Duchy of Luxembourg and the government of the Kingdom of Belgium concerning the information exchange in case of an incident or accident which might have radiological consequences, signed in Eischen on 28 April 2004.
- Law of July 28, 2011, 1) approving the Amendment to the Convention on the Physical Protection of Nuclear Material, adopted at Vienna, July 8, 2005; 2) amending the amended law of 11 April 1985 approving the Convention on Physical Protection of Nuclear Material, opened for signature at Vienna and New York dated March 3, 1980.
- Grand-Ducal regulation of 11 August 1996 concerning the provision of information to the population on the applicable measures for the protection of public health and on the conduct to be adopted in the event of a radiological emergency.
- Agreement of 14 May 2013 between the Minister of Health, Luxembourg in the name of the Government of the Grand Duchy of Luxembourg and the Minister of Interior, Belgium in the name of the Government of the Kingdom of Belgium on the organization of the bilateral cooperation on nuclear safety matters and radiation protection.

- Grand-Ducal regulation of 3 March 2009 on the supervision and control of shipments of radioactive waste and spent fuel (transposition of Council Directive 2006/117/EURATOM of 20 November 2006).
- National programme for the implementation of spent fuel and radioactive waste management policy, 2015
- Law of 6th June 2018 approving the Agreement between the Grand Duchy of Luxembourg and the Kingdom of Belgium on the management and final disposal of radioactive waste from the Grand Duchy of Luxembourg on the territory of the Kingdom of Belgium
- Law of 28th May 2019 on radiation protection.
- Grand-Ducal regulation of 1st August 2019 on radiation protection