Luxembourg

National Report on the measures taken by Luxembourg to fulfill the obligations laid down in the:

"CONVENTION ON NUCLEAR SAFETY"

to the

8th and 9th review meeting of the contracting parties in 2023

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

List of Acronyms and Abbreviations

AFCN	Belgian Nuclear Safety Authority
ARTEMIS	Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation
CC	Crisis Centre
CGDIS	Grand Ducal Fire and Rescue Corps
CIC	Communication and Information Cell
CNS	Convention on Nuclear Safety
CONVEX	Convention Exercises (Emergency drills and exercises in the frame of the Convention on Early Notification of a Nuclear Accident)
CORDIRPA	French working group on the management of a post accidental phase
CSPN	High Level Council of National Protection
DRP	Division of Radiation Protection within the Directorate of Health (Regulatory Body)
ENSREG	European Nuclear Safety Regulators Group
ENSTTI	European Nuclear Safety Training and Tutoring Institute
EPR	Emergency Preparedness and Response
EPRIMS	Emergency Preparedness and Response Information Management System
EPZ	Emergency Planning Zone
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.
EU-NSD	COUNCIL DIRECTIVE 2014/87/EURATOM of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations.
HCPN	High Commission of National Protection
HERCA	Heads of the European Radiological protection Competent Authorities
HWA	HERCA-WENRA Approach
IAEA	International Atomic Energy Agency
INEX	International Nuclear Emergency Exercises
IRRS	Integrated Regulatory Review Service
IRSN	Institute for Radiation Protection and Nuclear Safety in France
JINEX	Joined International Nuclear Emergency Exercises
NEA	Nuclear Energy Agency

MFA	Ministry of Foreign Affairs
NPP	Nuclear Power Plant
OECD	Organization for Economic Co-operation and Development
PCA	Advanced Command Post
PCO-C	Common Operational Command Post
RB	Regulatory Body (also referred to as DRP)
REC	Radiological Evaluation Cell
RPO	Radiation Protection Officer
SELCA	System of Exchanges and Liaison between Cattenom and the public Authorities
VDNS	Vienna Declaration on Nuclear Safety
WENRA	Western European Nuclear Regulators Association

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A – Introduction

Luxembourg signed the Convention on Nuclear Safety (CNS) on 20 September 1994. It entered into force on 6 July 1997 by ratification. Luxembourg actively participated in all previous review meetings of the contracting parties.

No nuclear power plant, no other fuel-cycle facility, no research reactor and no other nuclear facility is operated or planned in Luxembourg. In its immediate vicinity, at only 8.5 km south from the national border EDF operates the French NPP "Cattenom" comprising four 1300-MWe reactors. A second French site, Chooz with two times 1450 MWe output is located at around 70 km west from Luxembourg and the three reactors (3 x 930 MWe) at Tihange in Belgium have a distance of 65 km north-west from the closest border point. Other operating NPPs, like Doel (Belgium), Fessenheim and Nogent-sur-Seine (France), Borsele (Netherlands) and Neckarwestheim (Germany) are at distances between 150 and 250 km.

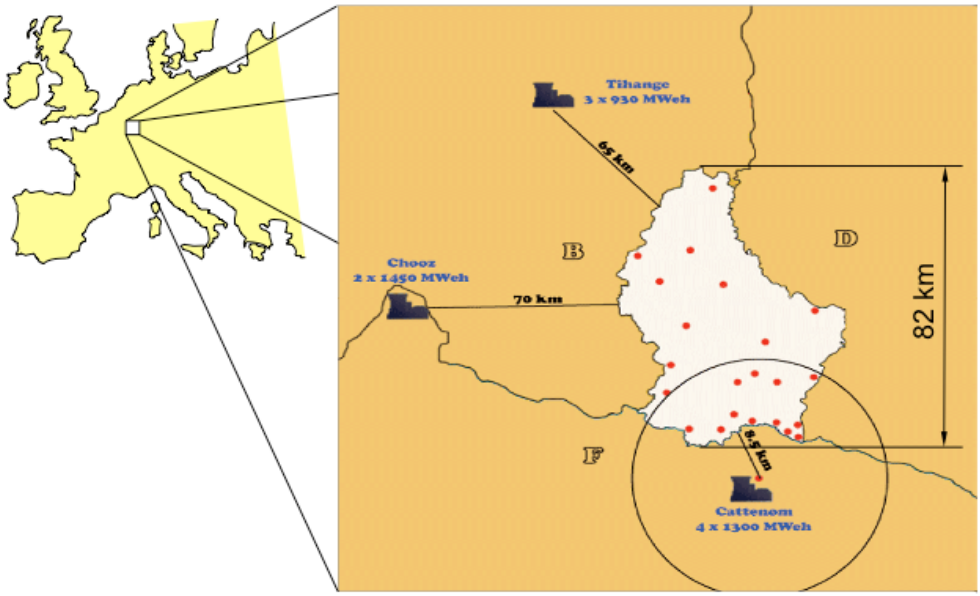

Figure 1: *Situation of Luxembourg. The image indicates the location of the 3 closest NPP's in France and Belgium, respectively. The red dots on the map show locations where radiation monitoring stations are installed.*

Since the late 70s, the public perception of nuclear power has been very critical. All succeeding governments have declared their critical attitude towards nuclear energy. The accident in Fukushima Dai-ichi in 2011 has initiated a more intensive debate at political level. The present government has clearly positioned itself against the use nuclear power.

The division of radiation protection (DRP) represents Luxembourg at the review meetings. Luxembourg considers the CNS pair review as a highly valuable exercise. It allows for a small country with limited nuclear expertise to gain insight to relevant safety issues in other countries. Being reviewed, having frank and open discussions with qualified experts while profiting from constructive "nearly cost-free" advice is also extremely useful.

The present National Reports has been produced by the DRP as a process of self-assessment of the implementation of the obligations under the Convention with focus on the challenges to be addressed and the follow-up action taken since the last Review Meeting. The report is a stand-alone document, structured in conformity with the "Guidelines regarding National

Reports under the Convention on Nuclear Safety" (INFCIRC/572/Rev.6). **Updates (9):** Taking into account the fact that the present report shall encompass the 8th and 9th Review Meeting and following the recommendations of the Presidency's letter of 23 June 2021, updated information is highlighted as follows.

- Information newly introduced at the 8th National Report is preceded be the terms "**Update (8)**";
- Information newly introduced at the present National Report is preceded be the terms "**Update (9)**";

Update (8): The President of the 7th Review recommended to look at 9 Major Common Issues Arising from the Country Groups Discussion. The following 3 issues are relevant to Luxembourg and will be taken into account throughout the present report:

- International Peer Reviews (Summary)
- Legal Framework (Article 7);
- Emergency Preparedness (Article 16).

Luxembourg further welcomes the letter circulated by the President of the 8th Review Meeting giving guidance for reporting on the Vienna Declaration on Nuclear Safety (VDNS). In line with this guidance, the present report reflects the VDNS principles with regard to the Emergency Preparedness.

The management of radioactive waste is addressed in the national report to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. From Article 19 (viii) of the CNS results no obligation for Luxembourg.

Since there is no nuclear installation planned or in operation in Luxembourg, only Articles 7, 8 and 16 are applicable. As part of the commitment to the principles of the CNS, the present report will also present information on activities covered by Articles 9, 10 and 15.

The present report along with the questions and comments received during the review process will be published on the webpage of the DRP "www.radioprotection.lu" before the Review Meeting will start.

Update (9): The present report will further address new issues that have arisen since the previous report and address safety issues identified throughout the 8th review cycle, including progress made related to suggestions and challenges. The report will also include experience with response to the Covid-19 pandemic (Summary).

B – Summary

Update (8):

International peer review services

Luxembourg's first IRRS mission has taken place in June 2018. The 10 member IRRS-team reviewed during 10 days models 1 to 10, as well as the areas of occupational radiation protection, patient protection, transport and security. The policy discussions were held on the "Relation between Regulatory Body and Licensee" and the "Graded approach in the context of a small country". The review gave rise to 24 recommendations, 7 suggestions and 3 Good Practices.

The main recommendations and suggestions for improvements concern the following aspects:

- establishment of a national policy and strategy for safety;
- definition of functions and responsibilities of the regulatory body within the legal framework and the establishment of mechanisms to ensure its effective independence;
- authority of the RB to issue technical requirements and guidance for implementation of regulations;
- building and maintaining the competence and for the recognition of qualification for safety.
- integrated management system, including a policy document, human resources plan, technical guides, processes and procedures;
- formalizing interactions with authorized parties in carrying out its regulatory functions and responsibilities;
- implementation of an inspection program for all facilities and activities.

Additionally an ARTEMIS mission has taken place in September 2018. The final reports and the action plan for the Implementation of the IRRS and ARTEMIS Recommendations and Suggestions have been published on the website of the DRP.

The DRP has shared its IRRS experiences in the regional lessons learned workshops (November 2018) and has accepted to delegate a team leader for the ARTEMIS mission to Germany in 2019 and for the IRRS mission to Denmark in 2020.

Legal framework

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 entered 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, namely the Act from 1963. The present report will illustrate the legislative procedure and the main changes of this new legal framework under Article 7.

Achieve harmonized emergency plans and response measures.

For Luxembourg a harmonized response in case of a nuclear accident in an NPP close to its border remains to be an important goal. Therefor the DRP has contributed very actively to the development of the HERCA-WENRA Approach (HWA). During the reporting period, Luxembourg took the initiative to involve also the regional authorities responsible for crisis management in the implementation of the HWA. Good progress between France and Luxembourg can be reported from an exercise held in October 2017.

For the reporting period, Luxembourg has also reviewed its nuclear emergency plan, taking onto account GSR part 7. The new version has been adopted on 15th May 2019.

Early 2019, Luxembourg has self-assessed its emergency preparedness and response arrangements with regard to nuclear and radiological emergencies and to shared information on the results through the EPRIMS database.

More details on EPR are reported under article 16.

Challenges form the 7th Review Meeting

At the 7th review meeting, the Country review report identified the following challenges for Luxembourg:

Challenge 1: Finalizing the update of the legal framework in connection with EU Directives and replacing the Act from 1963.

Challenge 2: Preparation for the first IRRS mission in June 2018.

Challenge 3: Further development of arrangements for emergency (implementation of GSR part 7 and HWA) and post-accident situations.

As indicated above, Luxembourg has addressed challenge 1, challenge 2 and partially challenge 3. However, no notable progress has been made on post-accident situations, which remains a challenging subject.

Update (9):

Implementation of the new legal framework on radiation protection.

Following the adoption of the law of 28 May 2019 and its executive regulation, the DRP has set up as early as June 2019 an internal action plan to ensure implementation of the new legal framework in a structured manner. The action plan comprised 18 actions of higher importance, 20 actions of medium importance and 9 actions of low importance. From those actions, respectively 18, 14 and 2 have been closed (see also under article 7).

Reorganization affecting the regulatory body

The DRP is a division within the Directorate of Health. In 2021, the General Management of the Directorate of Health has started a process of internal reorganization. The main changes concern the pooling of the 14 divisions and units into 3 pools. At an organizational level, this change became effective in April 2022 with nominations for the position “head of pool”. The DRP has been placed in a pool called “infections and environment” together with the Sanitary Inspectorate Division, the Health of Immigrants Unit and the Food Safety Division. It is worth mentioning that the law of 21 November 1980 concerning the organization of the Directorate of Health on, establishing the DRP as regulatory body, has not yet been modified.

Experience with response to the Covid-19 pandemic

There are no nuclear installations in Luxembourg. Regulatory activities concerning other facilities have been maintained during the pandemic. However, non-essential inspections have been postponed and the regulatory body has worked with reduced staff (1/3 of the staff is involved in the crisis management – see next paragraph). Also, the renewal of licenses had been interrupted during the first 3 months of the pandemic. A specific regulation has been issued to extend the concerned licenses up to the end of the "state of crisis", extended by two months for allowing an adequate licensing process. In the medical area, however all regulatory functions have been maintained. The same applies for the continuous monitoring of the level of radioactivity in the air, water and soil. The laboratory staff alternated between acual office and home office in order to reduce the risk of infection.

Some of the staff of the DPR has been involved in the crisis management. 3 staff members assisted temporarily in the national hotline and in the Covid Tracing Centre. Above 5 staff members joined the logistics cell responsible for purchasing and distributing of protective equipment, medical devices and pharmaceutical products, as well as for others organizational issues of the pandemic. The assignment of those 5 staff members has been permanent during the first 3 months of the pandemic and then stepwise been reduced. At present the logistics cell is still activated but meets only very occasionally. The DRP staff involved consisted of those agents involved in EPR and in the regulatory control of the non-medical applications. While this had a negative effect on routine missions, the close involvement in the crisis management enabled the DRP to draw valuable lessons learned for EPR, particularly on post accidental aspects. While the pandemic is still ongoing and no official lessons learned assessment has yet been concluded, it is worth mentioning that the decision-taking process established during the pandemic is particularly relevant for a transition and post accidental phase, where, unlike in the immediate emergency phase, decisions do not need to be taken very quickly.

Challenges form the 8th Review Meeting

The Country Review Report for Luxembourg of the 8th Review Meeting confirmed the self-identified challenges as follows:

- Training of the members of the radiological evaluation cell to take into account the up-dated nuclear emergency plan;
- Implementation in cooperation with neighboring states of the HERCA-WENRA Approach;
- Elaboration of a strategy for the management of a post-accidental situation.

No significant progress has been made in relation to the 3 above challenges (see also under Article 16.2). However, in order to assess EPR more comprehensively, a fact-finding mission has been organized from 27 to 29 October 2021 by an external expert. 41 detailed observations have been issued as part of that mission, including issues such as insufficient training of the members of the radiological evaluation cell. Based on those results, the expert continues advising the DRP.

The main reason why progress on EPR matters has been unsatisfactory for the last few years is a lack of sufficient personnel. Since, in the second half of the year 2022, an additional nuclear safety engineer will start working for the DRP on nuclear safety and EPR matters, it is expected that tangible improvements can be reported at the Review Meeting.

Planned/ongoing activities

In the area of nuclear safety, the main planned and ongoing activities concern:

- Finalizing the implementation of the IRRS and ARTEMIS action plan;
- Defining the role and competences of the regulatory body in the reorganization process of the Directorate of Health;
- Continue actively contributing to international activities to strengthen nuclear safety and radiation protection;

New challenges

The following areas are new or remaining challenges:

- Reorganize the radiological evaluation cell, including updates of its missions, procedures and tools, as well as ensuring regular trainings and drills;
- Implementation of cross-border cooperation on emergency response in line with the HERCA-WENRA Approach;
- Elaboration of a strategy for the management of a post-accidental situation.

C - Reporting Article by Article

Article 7. Legislative and regulatory framework

ARTICLE 7. LEGISLATIVE AND REGULATORY FRAMEWORK

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.
2. The legislative and regulatory framework shall provide for:
   - i. the establishment of applicable national safety requirements and regulations;
   - ii. a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence:
   - iii. a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;
   - iv. the enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.

Art 7 (1): Establishing and maintaining a legislative and regulatory framework

Overview of the primary legislative framework

Update (8): 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 entered into force on 1st August 2019. It is the result of the transposition of the EU-BSS directive (directive 2013/59/EURATOM). It repeals and replaces the former legal framework on those matters, namely the act from 1963.

The main aspects from the previous framework have been maintained and strengthened. It should also be noted that the previous framework has been in conformity with the new directive on nuclear safety (2014/87/EURATOM). Even though, the new framework contains some additional provisions from that directive in order to further strengthening compliance. The new law mainly ensures to:

- Modernize the national legislative framework for the control and monitoring of practices that use radiation sources, for example in nuclear medicine departments. The level of control takes into account a graduated approach.
- Simplify the administrative procedures for low-risk equipment, such as baggage screening scanners. For all these practices, the law establishes a system of authorization, inspections and sanctions by the regulatory body.
- Define conditions relating, in particular, to the training and continuing education necessary for the exercise of a practice, the compulsory consultation of experts, the individual protection of workers and the information of workers on the potential risks. Concerning the experts, the law creates the new professions of expert in medical physics and expert in radioprotection.
- Specify the responsibilities of the requesting physician and the medical director in the field of medical exposures so as to ensure for the protection of patients the optimization and justification of any act of nuclear medicine and radiology.
- Broaden the scope of the law to include exposure from natural sources of radiation, including the protection of aircrews from cosmic radiation, radon exposure in

dwellings and workplaces, exposure from building materials and protection of workers from naturally radioactive materials.
- Clarify the responsibilities and criteria for the protection of the population in order to cope with the possibility of a nuclear or radiological accident. In this area, it strengthens the implementation of the emergency response plan.
- Establish closer collaboration between Member States and to ensure participation in international peer reviews concerning nuclear safety.
- Forbid some practices, such as the construction and operation of nuclear installation.

More details about some of those provisions are reported following the INFCIRC/572 guidance under the applicable articles.

The law of 21 November 1980 concerning the organization of the Directorate of Health establishes the regulatory body (RB) by attributing the competences concerning the protection against hazards of ionizing and non-ionizing radiation, as well as nuclear safety and the safety of radioactive waste management to the division of radiation protection (DRP).

In some areas, such as 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.

Update (9)

Following the adoption of the above law of 28 May 2019, the DRP has set up as early as June 2019 an internal action plan to ensure the implementation of the new legal framework in a structured manner. The action plan comprised 18 actions of higher importance, 20 actions of medium importance and 9 actions of low importance. From those actions, respectively 18, 14 and 2 have been closed. Actions that have been implemented concern issues such as the establishment and publication of a list of justified practices, the update of licensing procedures and licensing related documents and guides, as well as the promotion of formation and training of various professionals. Actions that remain open concern several aspects related to emergency preparedness, the finalization of some guidance documents (e.g. on quality insurance for radiation detectors) and information campaigns on NORM material. More details on EPR are reported under article 16.

International Conventions and bilateral agreements

Luxembourg ratified all international conventions relevant to nuclear safety and concluded several bilateral agreements. Those ratifying acts are listed in the appendix. Though not directly linked to the CNS, it is worth mentioning that the conventions on nuclear liability were never ratified by Luxembourg.

The most relevant bilateral agreement has been signed on 11 April 1983 with France, concerning the exchange of information in case of an incident or accident susceptible of having radiological consequences. This agreement consists of the following main clauses:

- Mutual information without time delay about incidents or accidents happening in one of the state territories which might have radiological consequences susceptible of affecting the territory of the other state;
- Creation of an appropriate information system that works 24/24 hours;
- Definition of a set of key information that will be exchanged;

- Modalities for the exchange of a liaison officer in case of executing the intervention plan.

In order to handle all the bilateral questions concerning nuclear safety, a Franco-Luxembourgish Commission has been created in 1994. Regular meetings of these groups are organized. **Update (9):** The 20th meeting of the Franco-Luxembourgish Commission took place on 13th June 2022 in Luxembourg.

The government of the Grand Duchy of Luxembourg and the government of the Kingdom of Belgium concluded 28 April 2004 an agreement concerning the information exchange in case of an incident or accident, which might have radiological consequences. This agreement was ratified in Luxembourg on 27 April 2006 by law.

On 14th May 2013, the Belgian Minister of Interior and the Luxembourgish Minister of Health signed, in the name their respective Governments, a cooperation agreement on nuclear safety and radiation protection. It established a Belgo-Luxembourgish Commission of nuclear safety and radiation protection that shall meet once per year for discussing issues of common interest. **Update (9):** The 8th meeting of the Belgo-Luxembourgish Commission has taken place on the 4th May 2022 in Brussels.

Art 7 (2) (i): National safety requirements and regulations

Overview of the secondary legislation for nuclear safety

Update (8): Regulatory acts (règlements grand-ducaux) and ministerial decrees (arrêtés ministériels) can be considered secondary legislation. The relation between primary and secondary legislation has changed in the recent years. Back in 1963, it has been sufficient to adopt a high-level framework law with a more detailed by regulatory act. Due to a revision of the constitution in 2007, principal provisions need a far mor detailed legal basis and only further details of those provisions can be prescribed by regulatory acts.

In the process of the establishment of a new legal framework as described under 7 (1a) also the main regulatory acts have been repealed and replace by a single regulatory act on radiation protection. The new regulatory act on radiation protection entered into force on 1st August 2019.

Ministerial decrees are essentially used for individual ministerial decision, such as a license that includes licensing conditions. Administrative decrees do not exist.

A list of all relevant acts and official agreements is given in the appendix.

Guides issued by the regulatory body

The only guides that have been issued by the DRP refer to the regulatory supervision in the non-nuclear sector (see also article 10).

Overview of the process of establishing and revising regulatory requirements

The initiative for any legislative act or its amendment lies either within the parliament or at the competent Minister. It is worth to mention that the parliament has used its right for initiative only in few cases. It never did so in the area of nuclear safety or radiation protection. Over the last 20 years, the incentive for changing the national framework concerning nuclear safety and radiation protection came in all cases from a EU council directive with the obligation to be transposed into national law.

In practice, the DRP is at the technical level in charge with the preparation of draft text for those laws and regulatory acts. These drafts are then submitted to the department of legal affairs

of the Ministry of Health for legal revision and the coordination of the legislative procedure. In case of a regulatory act, the draft is as a first formal step submitted to different institutions, such as the Chamber of Commerce and other relevant Ministries for opinion. Taking those opinions into consideration, the text of the proposed regulatory act goes through approbation by the Council of the Government and subsequently to the Council of State (Conseil d'Etat) for opinion. In case of a positive opinion, the responsible Ministers and the Grand Duke may adopt it by signature. It enters into force after publication or on a specific date specified within the regulation. The Ministers who signed the regulation are responsible, everyone within his field of competence, for execution.

Laws are discussed after the opinion of the Council of State in the parliament. The adoption comprises a first and second vote. Ministerial decrees are just signed by the competent Minister.

Update (8): For the adoption of the law of 28th May 2019 on radiation protection, the main steps of the process were as follows:

- 14th December 2016: Adoption of the draft law by the council of government;
- 16th January 2017: Start of consultation with relevant stakeholders, the Council of State and the European Commission;
- 24th August 2017: Submission of the draft law and the stakeholders opinions to the parliament;
- 30th March 2018: Opinion of the Council of State;
- 8th May 2018-26th June 2018: Examination of the texts by the parliamentarian committee for health during 6 sessions;
- 4th July 2018: Adoption of a series of amendments by the by the parliamentarian committee;
- 9th October 2018: Complementary Opinion of the Council of State;
- 16th January 2019: The parliamentarian committee for health presents new amendments following its session of January 15th.
- 15th February 2019: Second Complementary Opinion of the Council of State;
- 4th March 2019: Adoption of the amended draft law by the parliamentarian committee for health;
- 26th March 2019: Unanimous vote for the law by the Parliament;
- 5th April 2019: The Council of State granted dispensation from the second constitutional vote;
- 6th June 2019: Publication of the law;
- 1st August 2019: The law enters into force.

Art 7 (2) (ii): System of licensing (Update 8)

Overview of the licensing system including types of licensed activity and the procedure for relicensing

In 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 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 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.

Licensing process and involvement of the public and interested parties within the Contracting Party;

The application for a license has to be addressed to the Minister of Health (class I and II) or the Directorate of Health (class III). The DRP is charged with the follow up of the licensing procedure and the assessment of the application (article 52). The DRP may submit the application for opinion to experts and/or other stakeholders if it considered useful or necessary

Provision for the involvement of the public and for their input to decision-making is foreseen in the licensing procedure for the class I facilities (higher risk) as prescribed in article 48. This public consultation process is organized in the municipalities, where the facility is planned.

The decision is taken following the opinion of the DRP.

Legal provisions to prevent the operation of a nuclear installation without a valid licence.

A major change in this new law is the general exclusion of nuclear installations. In order to avoid the elaboration of a complete legislative framework for an industrial sector that does not exist and is not foreseen in the future, the construction and operation of nuclear installation (enrichment plant, nuclear fuel manufacturing plant, nuclear power plant, research reactor, installation for processing, warehousing or storage of spent nuclear fuel) have been prohibited (Article 35).

Art 7 (2) (iii): System of regulatory inspection and assessment (Update 8)

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.

An inspection program including guidelines supports the inspection process has been put in place. The program includes guidelines, procedures and checklists to ensure that all inspections follow the same standards. The program also defines the different inspection types and its current version was based on IAEA TECDOC-1526 in order to ensure compliance with international standards:

- Standard inspections cover mainly the control of radiation sources, respect of license conditions, operational safety and occupational protections in place.

- Thematic inspections include different specific areas for which a more in depth analysis takes place. For thematic inspections, question sets and inspection check lists have been developed.
- Primary inspections are defined for new practices and final inspections can take place in the event of a definitive cessation of activities.
- Inspections can be announced or not.

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 (see following chapter below)

In cooperation with HERCA, the DRP has performed inspections during 2016 on the process of justification in medical imaging. In that context, cross inspections took place together with France and Belgium. As a result, the inspected hospitals set up actions plan to address the identified shortcomings.

Art 7 (2) (iv): Enforcement of applicable regulations and terms of the licenses (Update 8)

With the introduction of the law of 28th May 2019, enforcement powers of the regulatory body are notably strengthened and a more graduated approach is introduced.

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 works under the authority of the prosecutor and must not be influenced, neither by any other body nor by his internal hierarchy.

The DRP has not a lot of experience to report on enforcement actions. In nearly all cases, licensees responded adequately to the inspection findings, by remediating any non-conformity in the prescribed time frame. Over the last 10 years, there has only been one case reported to the prosecutor. It resulted in a court case and the conviction of the accused.

Article 8. Regulatory body

ARTICLE 8. REGULATORY BODY

1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.
2. Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy

Art 8 (1): Establishment of the 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 21 November 1980 concerning the organization of the Directorate of Health defines a division of radiation protection (DRP) and allocates particular missions. Similar to a number of other small countries, the DRP centralizes as a single division all competence of radiation and nuclear safety, both the regulatory and the technical expertise aspects. For instance the national laboratory for radiation physics is part of the DRP. The organization chart and the missions of each unit are given figure 2.

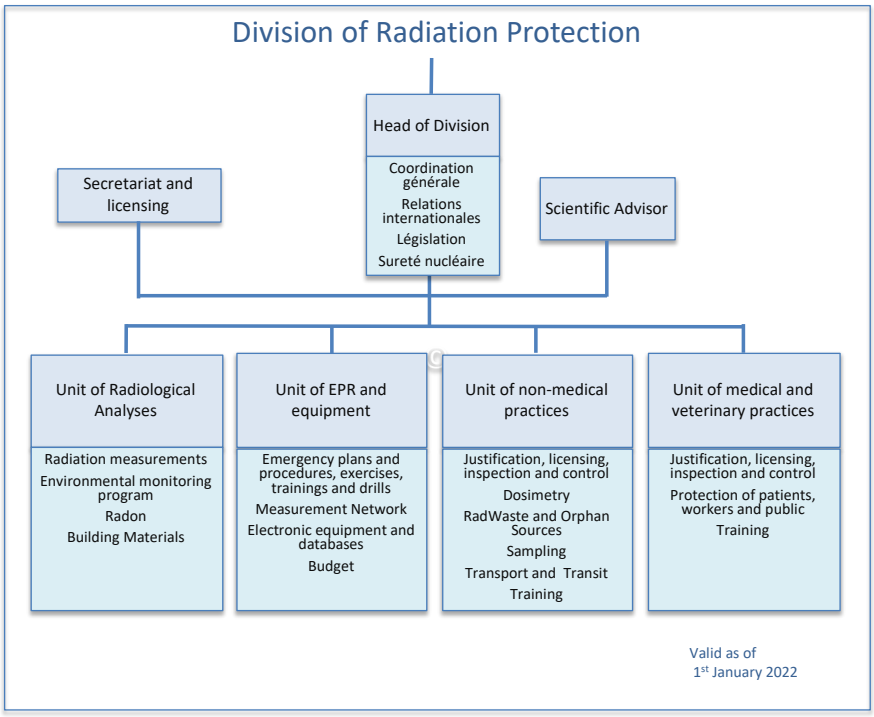

Figure 2: *Organization chart and missions of the DRP* ***(Up-dated (9))***

Human 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, 4 technicians, and a secretary.

Update (9): For the second half of 2022, the DRP was granted one additional position of an administrative coordinator. With the implementation of the law on radiation protection the administrative workload, mainly, but not only related to the licensing procedures has significantly increased. The additional person will assist in streamlining those processes.

Additionally, as reported under Article 8 (2), the nomination of the head of pool has the following direct effect on the DRP. The head of the radiation protection division has been nominated head of pool. While the future structure of the new pool has still not been defined, the head of pool continues as head of division at least during a transition phase. However, the additional duties do not further allow to follow in detail all issues related to nuclear safety and international relations. Therefore, an additional position of a nuclear engineer has been granted to the DRP. At present the selection process of candidates is ongoing. The new person will most likely start before the end of the year.

Maintaining competence

The DRP uses the training offers provided by the national institute of public administration to all public administrations in Luxembourg. Their offer includes standard training (such as management) and specific trainings on demand, such as specific training on laboratory accreditation and the ISO Norm 17025. All agents of the DRP are encouraged to set up an own multiannual training program and to schedule 1 to 2 weeks per year either training, participation in seminars or exchanges with homologue organizations. DRP agents have participated in international training sessions, such as the Basic Training Program for Analyst in Nuclear & Radiation Safety of ENSTTI and on International Law offered by the NEA.

Another important factor of maintaining competence in the nuclear safety domain is the active involvement in international activities. The professional exchange in meetings, such as the CNS-review meetings, ENSREG, WENRA and HERCA is highly beneficial for a small RB like the DRP.

Update (8): Article 137 of the law of 28th May 2019 is dedicated to competence maintenance in the area for nuclear safety. Accordingly, the DRP is obliged among others to follow-up international developments, to contribute to the international safety regime and to take steps for the training of its own staff. The principle of active international cooperation is also included in article 116 concerning EPR.

Financial resources

All activities and projects of the DRP are financed via state budget, allocating predefined credits on a yearly basis. Some of these credits are non-limited to allow covering non-predicable costs. This applies for example to expenses resulting from accidents and incidents. In the past the budget of the DRP has over the last years been increased at a yearly rate between 2 and 4% in conjunction with the economic growth.

The DRP has responsibility in the implementation of the allocated budget.

Adequacy of resources

Update (9): Over the last years, the attributed financial and human resources have allowed the DRP to fulfill its obligations in an appropriate way. However, the deviation of workforce during the recent pandemic and the fact that the implementation of the radiation protection law is very work intensive, the actual human resources situation is challenging related to periods with increased workload. The new staff should help to increase the resilience of the DRP. Above, the DRP will also need to assess the efficiency of some of its regulatory work, such as reducing regulatory control of low-risk practices.

Quality management system

Update (8): The directorate of Health and the DRP are in the process of establishing a management system. Towards this direction, a new top management team has been appointed in 2016 consisting of the General Director, the Deputy Director of Health for medical and technical matters and the Deputy Director of Health for administration matters and a working group consisting of the division heads and an external consultant has been formed.

The top management has made efforts to develop a common identity, including individual and institutional values and expectations. The issuing of identification badges and the drafting of clear job descriptions for each staff member are the first steps. A common mission and policy document has been approved end of 2018. It defines in more detail the missions of each division and describes projects. Projects defined for the DRP comprise subjects such as the implementation of the new law, the set up of a national dose register, the follow-up action plan of the IRRS and ARTEMIS missions. Individual work plans to define the role of each individual staff member have been drafted early 2019.

However, the elements of the management system for the directorate and the DRP do not bring together in a coherent manner all the necessary requirements for safety. Only a small part of the processes, procedures and records is documented and those have not yet been incorporated into the management system. Those issues will be addressed with the implementation the IRRS and ARTEMIS action plan.

The laboratory of the DRP has established a quality management system in July 2010 (preparations started in 2007), with an accreditation according to ISO 17025. In line with the accreditation, the laboratory participates in laboratory inter-comparison exercises (IAEA ALMERA, JRC IRMM, etc.). The accredited techniques comprise gamma measurements in liquids and gross alpha/beta measurements. During the annual audits the laboratory aims at extending to other techniques.

Transparency and information of the public

In April 2009, the Ministry of Health launched a new Internet Portal. www.radioprotection.lu gives a direct link to the DRP with 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. The homepage is up-dated and expanded at regular intervals. While the DRP is responsible for the content, a department of the ministries defines the layout. At present it exists only in French, but translation to German is foreseen. Some of the documents that can be downloaded, such as the present report, are provided in English.

The DRP also publishes on its Internet page the CNS-National Reports and the questions received with the answers immediately after their respective submittion to the CNS restricted website.

Update (8): Article 144 of the law of 28th May 2019 is dedicated to the 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 informs the public in the areas of its competence.

External technical support

The facilities that exist in Luxembourg do in the very most cases not require any competence that is not available within the DRP. Above, a specific unlimited budgetary article

allows the DRP in well-justified cases to engage external technical support. This was used in the past in the frame of specific licensing procedures, involving a TSO of a neighbouring country. It is also used to acquire an independent technical view on nuclear projects in the vicinity of Luxembourg's national borders (e.g. Stress-test or the French project for a geological repository of high level radioactive waste).

Art 8 (2): Status of the regulatory body

The DRP is a division within the Directorate of Health. The DRP reports via the Director of Health to the Minister of Health. The Ministry of Health is not involved in any energy policy activities, which fall under the competence of the Ministry of Energy. This builds an effective and functional separation between the functions of the DRP and those of any other body or organization concerned with the potential promotion or utilization of nuclear energy.

Update (9): In 2021, the General Management of the Directorate of Health has started a process of internal reorganization. The main changes concern the pooling of the 14 divisions and units into 3 pools. At an organizational level, this change became effective in April 2022 with nominations for the position "head of pool". The DRP has been placed in a pool called "infections and environment" together with the Sanitary Inspectorate Division, the Health of Immigrants Unit and the Food Safety Division. It is worth mentioning that the law of 21 November 1980 concerning the organization of the Directorate of Health on, establishing the DRP as regulatory body, has not yet been modified.

Article 9 - Responsibility of the license holder **(Update (8))**

ARTICLE 9. RESPONSIBILITY OF THE LICENSE HOLDER

Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

Article 4 of the law of 8th May 2019 defines the license holder as a moral or physical person having the legal responsibility for a radiological practice. The various provisions of the law ensure the attribution of the responsibility to the license holder concerning notably the following:

- Requesting licensing prior to installation and operation of a radiological equipment (Articles 44);
- Radiological safety of the workers (Article 61);
- Radiological safety of the patients (Article 87);
- On-site emergency preparedness arrangements (Article 110);
- Radiological Safety of the public (Article 112);
- Safe management of radioactive sources (Article 130).

Article 10 – Priority to safety **(Update (8))**

ARTICLE 10. PRIORITY TO SAFETY

Each Contracting Party shall take the appropriate steps to ensure that all organizations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety.

The law of 28th May 2019 lays down the basis for issuing requirements with regard to safety policies of the license holder. Article 45 includes a list of issues that may be added in form of license conditions. Those issues comprise performance criteria, quality insurance programs and auditing.

The law contains also the following provisions with regard to medical exposures:

- Arrangements for monitoring and self-assessment external audits and at least one internal audit per year (Article 95 and 96);
- Quality insurance programs (Article 101);
- Quality controls (Article 102);
- Performance indicators (Article 103).

Article 15 – Radiation protection **(Update (8))**

ARTICLE 15. RADIATION PROTECTION

Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

Overview of the regulatory requirements and expectations

Articles 7, 11, 13 and 14 of the law of 28th May 2019 establish the dose limits of the annual effective dose for exposed workers (including women of child-bearing age, apprentices and adult students) to 20 mSv. The working conditions for pregnant women have to guarantee that the equivalent dose to the unborn child will not exceed 1 mSv. Nursing women are not allowed to work in conditions bearing high risks of contamination. For apprentices and students aged between 16 and 18 years who are obliged to use radioactive sources, the annual effective dose is fixed to 1 mSv. For members of the public, the maximum annual effective dose is fixed to 1 mSv.

Articles 61 to 75 contain the operational requirements concerning the professional exposures, including the responsibilities of the license holder, the consultation a radiation protection expert, classification of workers and zoning, individual monitoring, radiological surveillance of the workplace, recording and reporting of results, as well as medical follow-up of exposed workers.

Article 61, §2 attributes the responsibility for the optimization following the ALARA principle of professional and medical exposures to the license holder.

Article 51 establishes the provisions applicable to clearance and release from regulatory control. Clearance levels are established below which substances can be cleared from regulatory control. Radioactive releases above those levels need to be licensed.

Implementation of radiation protection

The DRP performs the dosimetry service. Approximately 2500 workers are monitored in Luxembourg, none of which exceeded the annual dose limit. The highest annual doses are observed in interventional medical practices with annual doses up to 6 or 7 mSv. Aircrew members are typically exposed to annual doses up to below 6 mSv.

The DRP also holds ready dosimeters (TLD's) for the emergency workers. Procedures for distribution to the emergency workers in case of an emergency were set up in 2015, with the goal to insure rapid distribution of the dosimeters and adequate information to the emergency worker.

At present, there is no license holder that produces radioactive releases subject to a license. Patients undergoing a therapeutic nuclear medicine procedure have to be provided with: written instructions for keeping doses to persons in contact with or in the vicinity of the patient as low as reasonably achievable and for avoiding the spread of contamination and information on the radiation risks. The nuclear medicine departments that perform Iodine therapy need to install retention tanks with clear procedures for release.

Update (9): According to the law of 28th May 2019 on radiation protection, any dosimetry laboratory needs to have in place an accredited quality insurance program. For the dosimetry laboratory of the DRP a 5-year transition period has been defined. Following an internal

assessment, the DRP however concluded that it does not have sufficient "clients" to justify the additional investments and therefor decided to stop this activity latest in 2024. External dosimetry laboratories have in the meantime been granted a license and provide already dosimetry services to several licensees. The DRP will remain operator of the the National Dose Registry.

Environmental monitoring

The national program for the systematic monitoring and the surveillance of the radioactivity on the national territory, assures permanent control of the radioactivity in the air, water and soil on the national territory.

This National Radiological Monitoring Network comprises an automatic measuring and warning network for the environmental radioactivity as well as the systematic measurement of environmental samples and samples of the food chain. Actually the network stands for a permanent surveillance of potential radioactive emissions from nuclear facilities and an early warning of the DRP in case of a radioactive release.

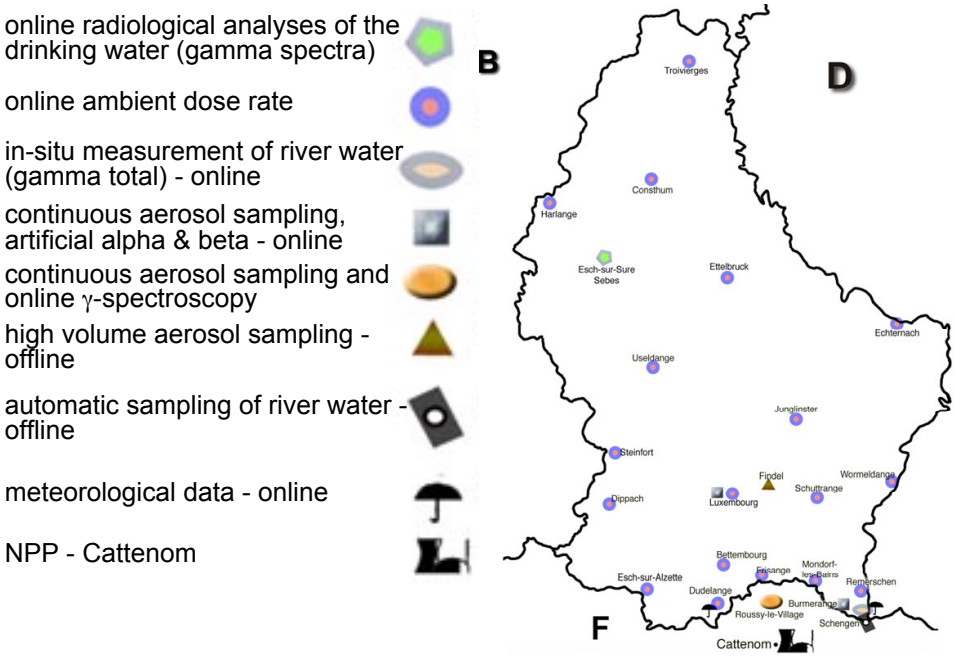

Figure 3: *National radiological monitoring network operated by the DRP*

In case of an emergency, 5 additional mobile stations can be added as necessary. The DRP is in the process to exchange and update the monitoring network. In 2016 the only station outside Luxembourg situated in France at half distance between the NPP Cattenom and the national border in Roussy-le-village has been completely renewed. Most stations have operated since the late 80's.

The public can directly consult the measurements since May 2016 on www.radioprotection.lu (link to EURDEP) focused on Luxembourg and www.gis-gr.eu/portal/themen-und-karten/umwelt/radioaktivitaet.html focused on the Greater-Region (in German and French).

Regulatory review and control activities

The DRP assesses the radiation protection programs and radiological risk assessment of the licensees for all license applications. It further preforms inspections to verify, among others, the respect of the above legal provisions applicable to radiation protection issues.

Article 16. Emergency Preparedness

ARTICLE 16. EMERGENCY PREPAREDNESS

1. Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency. For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.
2. Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for emergency planning and response.
3. Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.

Art 16 (1): Emergency plans and programs

Overview of the arrangements and regulatory requirements for off-site emergency preparedness **(Update (8))**

The law of 28th May 2019 contains the main requirements related to nuclear and radiological emergencies, as follows:

- Definition of a reference level of 100 mSv for all exposures received by members of the public due to the emergency over a period of one year from the time of the accident, applying a maximum reference level of 20 millisievert for the existing exposure situation. The reference level for other existing exposure situations is fixed to 1 mSv per year (Article 9).
- Training and information of the emergency workers (Article 32);
- Responsibility for the license holder concerning on-site emergency planning (Articles 61 and 114);
- Emergency exposures (Article 75);
- Off-site emergency planning (Article 115);
- International cooperation for the planning and response phase (Article 116);
- Information of the public (Article 117);

The above law defines in particular that the Government in Council adopts the emergency plan and that the Prime Ministers, the Minister of Interior and the Minister of Health are responsible for the elaboration and execution of the plan. It is further defined that exercises have to be organized at regular intervals and that the plan is submitted to a yearly revision.

Those new provisions better reflect the already exiting operational arrangements. Indeed, since the commissioning of the French nuclear facility in Cattenom in 1986, Luxembourg has set-up a special nuclear emergency response plan, which is focused but not limited to an accident at the Cattenom-NPP. The High Commission of National Protection (HCPN), which reports directly to Prime Minister is in charge with the coordination of crisis management during any crisis of national importance, as defined by the law of 23rd July 2016 on the establishment of the HCPN.

Following the Fukushima accident, the former emergency plan had been completely revised and the new emergency plan was adopted on 15th October 2014. More details on the adoption process were included in the national report for the 7th review meeting. The latest revision of that plan was adopted 15th May 2019. The main changes of the updated version concern:

- The structure of the chapter on crisis management bodies and their alerting has been completely revised and adapted to other emergency response plans:
  - a Common Operational Command Post (PCO-C) was created providing operational coordination and control of tactical leaders dispatched to the field;
  - the Advanced Command Post (PCA) has been integrated into the plan;
  - the composition of the Crisis Staff has been reviewed and adapted to new governmental and administrative changes;
  - the alerting of the different cells has been detailed.
- The legal bases and agreements in force have been reviewed and updated.
- Believing that international assistance and exchanges with the International Atomic Energy Agency (IAEA) and the European Union are essential in the event of a nuclear accident, an entire chapter has been devoted on international existing mechanisms concerning cooperation and notification.
- The new warning systems, namely the SMS to the population and the GouvAlert application have been included to complete other existing public information systems.
- A description of the role and duties of the function of liaison officer has been included.

Among the ten national emergency plans, there is another plan related to nuclear and radiological emergencies; "The Emergency response plan in event of chemical, biological, radiological or nuclear material attack". In addition, in the event of an accident involving chemical, biological, radiological or nuclear substances not caused by an act of terrorism, the "Mass Casualties" Plan or the Emergency Response Plan in the event of a disruption in the drinking water supply is applicable.

The above described legal and operational up-dates of the emergency plan contribute largely to the implementation of GSR part 7, respectively the conclusion that requirements are adequately met. The latter concerns in particular the emergency management system put in place by the HCPN in cooperation with other administration. The IRRS mission concluded for instance: *"The IRRS team acknowledges the strong integration of the radiological and nuclear emergency response arrangements into the national all hazards emergency management system. A single all hazard response structure is used, leveraging the expertise of the DRP effectively for nuclear emergencies."*

It should be noted that the process to implement GSR part 7 is still ongoing. For the operational declination working groups have been put in place with the participation of the Civil Protection, the Police and the DRP. Those groups work mainly on the implementation of the training requirements for first responders, as well as on operational procedures for first responders. The following aspects of GSR part 7 however still need further attention:

- Managing the medical response in a nuclear or radiological emergency;
- Managing radioactive waste in a nuclear or radiological emergency (this issue is addressed by a recommendation from the ARTEMIS mission);
- Mitigating non-radiological consequences.

Overview and implementation of main elements of national plan for emergency preparedness, including the role and responsibilities of the regulatory body and other main actors, including State organizations **(Update (8))**

The emergency intervention plan in the case of a nuclear accident applies to all nuclear and radiological emergencies resulting from accidents, with particular focus on Cattenom.

The execution of the plan falls within the competency of the Prime Minister and Minister of State, the Minister for Home Affairs and the Minister of Health. All the other ministries, agencies and departments of the State are bound to cooperate with the implementation of the plan using all the means available to them. Local authorities are considered key partners in this.

A crisis cell initiates, coordinates and monitors the execution of all the measures intended to deal with the crisis and its effects. It is composed of high-level representatives from the relevant ministries and administration, including the head of the DRP. The Crisis Cell works closely with its foreign counterparts.

The crisis cell is assisted by:

- Common Operational Command Post (PCO-C)
- Advanced Command Post (PCA)
- Communication and Information Cell (CIC)
- Radiological Evaluation Cell (REC)

The REC is presided by the DRP, and composed of members both of the DRP and the CGDIS. The main mission of the REC is to suggest appropriate protective actions to the Crisis Cell, monitoring changes to the state of the damaged reactor, the scale and changes to radioactivity in the environment and its impact on the population. The members of this cell work closely with their foreign counterparts with the aim to align recommendations.

As soon as the national contact point is informed of a nuclear accident, it alerts the Radiological Evaluation Cell, which immediately carries out an evaluation of the information available. If the accident is likely to pose a danger to the population, the High Commissioner for National Protection is informed. After consulting with the ASS and DRP, the High Commissioner for National Protection informs the Prime Minister and Minister of State who decides whether to activate the Crisis Cell (CC).

Following bilateral arrangements with France, the national contact point receives direct alerting by the operator of the Cattenom NPP. A dedicated network SELCA, (the System of exchange and liaison between Cattenom and the authorities) allows the exchange of information between the NPP, and the Prefecture in France, Rhineland-Palatinate (Germany), Saarland (Germany) and Luxembourg. The CC also immediately sends a liaison officer to the French Prefecture in Metz.

In the event of a nuclear emergency, the Crisis Cell may trigger specific alert signals via the national siren network to warn the public. The plan distinguishes a thread phase, a release phase and a post accident phase.

Concerning the planning zones, the urgent protective action planning zone (UPZ) is as follows:

- 15 km of the Cattenom NPP for evacuation;
- 25 km of the Cattenom NPP for ITB and sheltering;

The zone is divided into three alarm areas: East, Central and West. This separation enables separate alarm sirens to be triggered depending on wind direction and how urgent it is that the protective measures be implemented.

The extended planning distance (EPD) covers the rest of the country. The main towns in this zone will house the reception centers needed in the event of an evacuation. Measures are foreseen to extend ITB and sheltering into this zone.

For the post-accident phase, two separate zones are defined in line with the French CORDIRPA:

- Public Protection Zone (Zone de protection de la population, ZPP)
- Heightened Territorial Surveillance Zone (Zone de surveillance renforcée du territoire, ZST).

The emergency response plan sets out the four main protective actions (table below). It also defines restrictions and bans concerning outside activities, individual health measures, clothing, protection against incorporation and specific measures for the river Moselle.

The plan does not use intervention levels, but defines Reference Levels (RL) and also Operational Reference Levels (ORL). The use of reference levels shall give flexibility to adjust protective actions along the borders with neighboring states.

Protective Action	RLs	ORLs
Evacuation	100 mSv (eff., 7d, ext.+inh.)	
Sheltering **	10 mSv (eff., 7d, ext.+inh.)	100 microSv/h
ITB **	50 mSv (Thy., 7d, inh.)	100 microSv/h
Protection of food and livestock		1 microSv/h

** Sheltering and ITB are combined

The plan considers two types of evacuation: pre- and post-release evacuation (no evacuation under the cloud). Evacuation is combined with access control. Reception centers will be set up in the north of the country.

The maximum duration of the shelter phase is 48 hours.

Preventive distribution of potassium iodide tablets to all the residents of the country has been organized in 2014. Additionally tablets are made available to all employers who receive an adequate stockpile for his employees on simple demand. The goal of this measure is to cover commuters during their stay in Luxembourg. New arrivers to Luxembourg will get their tablets at the place they first register.

The previously established stockpiles and mechanisms are maintained:

- KI stockpiles in the municipalities situated at a distance up to 25 km from Cattenom.
- KI stockpiles in all schools, including nursery schools;
- Pre-distribution to all newborns;

The main responsibilities of the regulatory body (DRP) in the emergency response consist of:

- Participation in the CC;
- Presiding and participation in the REC;
- Participation in the internal crisis cell of the Ministry of Health;
- Advising the CIC;

- Activating and operating the laboratory in emergency mode;
- Operating the National Radiological Monitoring Network;
- Providing dosimetry for emergency workers.

Training and exercises, evaluation activities and main results of performed exercises including lessons learned

Since more than twenty years, the authorities have twice per year organized small-scale national exercises in order to train the specialized intervention teams of the CGDIS.

Given the relatively limited own resources and expertise, Luxembourg focuses its efforts on participating in international exercises. Such simulations of emergency situations have the advantage to face a higher degree of complexity and are thus more realistic. It also permits a mutual learning effect at all levels of participation.

Luxembourg also participates, together the two German federal States, Sarreland and Rhineland-Palatinate, at the national nuclear emergency exercises organized every five years by the French authorities at the Cattenom NPP. Luxembourg participates in most INEX and CONVEX exercises.

Update (8): A "Cattenom" exercise was held on 17th October 2017. It has been a French national exercise that involved the neighboring countries as participants. The scenario has not been known, but the objective was set to test alerting and cross-border coordination. For the exercise, Luxembourg has activated its CC in a reduced form, composed of the HCPN, the CIC and the REC. The other members of the CC have been alerted, but were not asked to join the CC in person, rather to be available in case of need. A liaison officer of the CC was deployed to the Operational Center in France and a staff member of the DRP participated as observer at the crisis center of the French regulatory body ASN.

Main lessons learned from that exercise were as follows:

- Terminologies used in France, Germany and Luxembourg are not always understood properly, the presence of the liaison officers proved to be highly useful in this respect;
- The exchange of information through a dedicated web-application set up by France allowed a timely information on the accident evolution, which has been highly appreciated;
- The liaison officers being generally very useful, it was nevertheless observed that the crisis managers were relying too much on that function, rather than communicating directly with their counterparts;
- A highly positive note of the exercise was the successful application of the HWA between France, Belgium and Luxembourg. This has allowed taking a decision concerning food restrictions in a coherent way, at the same moment, sending a coherent message and covering the zone of both sides of the national borders in an harmonized way.

Update (9): The last "Cattenom" exercise was held on 11th May 2022. It has been a similar exercise than the one in 2017. The lessons learned from that exercise has not yet been concluded.

Art 16 (2): Information of the public

With the adoption of the new emergency plan, the government has organized an information campaign consisting of the following main elements:

- Establishment of a crisis information website (www.infocrise.lu) to provides information on nuclear emergencies and presents all the information on radioactivity in general and the nuclear sites located close to the Grand Duchy of Luxembourg in German, French and English. While the site was launched with regards to a nuclear emergency, the site now also provides information on other potential crisis situations.
- Publication of a new brochure "What to do in the event of a nuclear alert" to inform the population, raise their awareness and prepare them for such an eventuality. The brochure exists as hard copy in German, French, Luxembourgish and English. It can additionally be downloaded in Portuguese and in a version of Easy Read German. The brochure is also available in Braille and in an audio version.
- Establishment of an office for crisis communication. This office, equipped with permanent staff is charged to update all available information and to organize communication during a crisis by making use of modern network communication platforms.

Update (8): Warnings to the public are provided via the national siren system, which is universally used for all types of emergencies. The Crisis Cell calls the ASS's Emergency Call Centre to trigger specific alarm signals, as required by the emergency. There is a specific alarm signal for nuclear emergency as well. The public is informed that in case of a siren alarm they have to listen to radio and follow the authorities' instructions.

In the event of a nuclear emergency, the main concern of the authorities is how best to protect the population. The communication strategy is a central part of the emergency response plan: it aims to ensure that the internal communication chain that links those managing the crisis functions correctly, and that there is clear and efficient communication to the media and the population.

The task of the Communication/Information Cell is to support the Crisis Cell in its efforts to coordinate communication between the authorities and the population in the event of a nuclear crisis. It keeps the media and citizens informed of the changing situation as well as the prescribed preventive and protective measures.

Several tools are used to facilitate this communication:

- Traditional press releases,
- The social network Twitter,
- The portal www.infocrise.lu, and
- The free-phone hotline.

The Communication/Information Cell is presided over by the director of the Office for crisis communication (or by its representative), who assumes the role of spokesperson for the Crisis Cell. Through its composition, the president ensures that the CCI is able to combat the crisis the country is facing effectively. When required, its members may call upon experts to provide assistance.

In the event of a nuclear emergency, the Communication/Information Cell is convened at the same time as the Crisis Cell and the Radiological Evaluation Cell.

Art 16 (3): Emergency Preparedness from the perspective of a non-nuclear state and international arrangements.

Measures for the preparation and testing of emergency plans that cover the activities to be carried out on their territory in the event of such an emergency

Given the fact that the French NPP Cattenom is with 8.5 km relatively close to the border of Luxembourg, most obligations on off-site emergency preparedness are identical for Luxembourg than for a Contracting Party with nuclear installations. For that reason the present report describes those elements under article 16.1 above.

However, a few issues are particularly related to the circumstances of having no own nuclear installation. Worth to mention are for instance:

- The national emergency response plan does not comprise action levels that would be triggered by the operator. Those "automatic" protective actions are in France based on a fast kinetic scenario with limited radiological consequences and concern only a couple of kilometers around NPP's and do not reach op to the border of Luxembourg. Implementing such type of reactions in Luxembourg would thus mean to create an inconsistency along the border with France.
- Luxembourg does not perform an own situation assessment, neither an own radiological prognosis but has concluded agreements with France for sharing their assessments. All exercises have indeed shown a high degree of uncertainty and margins of interpretation. Assessments done by 2 countries thus always result in decisions for protective actions that are inconsistent along borderlines.
- The size of Luxembourg having borders with three neighboring countries in the range of potentially affected territories of a nuclear accident explain why the DRP has always been in favor of harmonizing emergency preparedness in Europe. Therefore, the DRP and the CGDIS participated in a group of experts from France, Belgium, Germany, Switzerland and Luxembourg from early 2006 to July 2007 who developed proposals for a harmonized strategy, focused on iodine prophylaxis linked with other protective actions. Luxembourg implemented those recommendations in the following years.

The situation however remains very challenging, as emergency preparedness is not harmonized.

The DRP has chaired the HERCA working group "emergencies" from 2011 to 2014 with the goal to elaborate a new operational approach for achieving better consistency of protective actions between neighboring European Countries during a nuclear emergency in Europe or elsewhere, resulting in the adoption of the HERCA-WENRA Approach in October 2014 by HERCA and WENRA. The HERCA-WENRA Approach represents the alternative to harmonization of the preparedness arrangements. It consists basically of a coordination mechanism during the response, enabling neighboring states to act consistently.

For Luxembourg the HERCA-WENRA Approach represents the way forward for a more harmonization of emergency preparedness and response in Europe. However, the implementation of this Approach is a long journey requiring the active cooperation of all relevant authorities. At national level, arrangements are globally in line with the HWA.

Update (8): For a better implementation of the HWA, Luxembourg had organized in July 2017 a workshop between the decision-taking authorities and the nuclear safety authorities from France, Germany, Belgium, The Netherlands and Luxembourg. During the workshop several ideas were discussed, such as:

- Priority was given to strengthen bilateral exchanges between different countries rather than setting up a complex multilateral consultation process;
- To facilitate communication between crisis centers and the population, the development of a shared segmentation of planning zones should be promoted.

The discussion also revealed reluctance to proactively and informally exchange non-validated or sensitive information. More regular exchanges and meetings would be needed to strengthen trust concerning the cross-border communication. It was finally agreed to further test the HWA at the October 2017 Cattenom exercise (see above).

Update (9): In order to assess the national EPR arrangements more comprehensively, a fact-finding mission has been organized from 27 to 29 October 2021 involving an external expert. 41 detailed observations have been issued as part of that mission, including issues such as insufficient training of the members of the radiological evaluation cell (REC). Based on those results, the expert continues advising the DRP in order to continuously improve.

One of the main objectives of that ongoing process is to nominate, train and equip with updated procedures 24 persons for the REC. The DRP itself only has 15 agents whereas at least 5 would need to operate the laboratory. This means that at least 14 persons which are not member of the DRP have to join the REC, namely from other departments of the Directorate of Health and from the Corps CGDIS.

It is expected that the addressing of all observations from the fact-finding mission will take 24 months.

International arrangements, including those with neighbouring States

Bilateral agreements exist with France and Belgium, as explained under article 7. The agreement with France is complemented by operational arrangements, such as:

- On the regional scale a specific system for communication between the authorities and operator has been established. This "System of Exchanges and Liaison between Cattenom and the public Authorities (SELCA) connects the "Préfecture de la Moselle" and the Cattenom NPP to the competent authorities in Germany and Luxembourg (see also on page 25). Technically it is now a satellite fax-connection, located in Luxembourg at the "112" emergency call center and at the DRP.
- Information exchange protocol between the NPP and the Prefecture in Metz in France and the DRP and ASS in Luxembourg on the notification and information in case of incidents and accidents at the Cattenom NPP, enabling direct exchanges of the NPP with the neighboring country authorities and the exchange of liaison officers.
- Mandate and role of the liaison officer.
- Procedure of information in case of potential media interest (see informing on incidents).
- Protocol on information exchange during an emergency between ASN/IRSN, and DRP/ASS with the aim to coordinate protective actions along the border.

Update (8): The DRP has self-assessed its emergency preparedness and response arrangements with regard to nuclear and radiological emergencies and shared information on the results through the Emergency Preparedness and Response Information Management System (EPRIMS). The HERCA EPR country fact sheet, the emergency plan and the public information leaflet were also uploaded to the EPRIMS webpage.

Appendix

1) Laws, regulatory acts and degrees

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.

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 12 June 2006 concerning the creation of the rescue services agency.

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 28 July, 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.

Law of 23rd July 2016 on the establishment of the High Commission of National Protection.

Law of 28th May 2019 on radiation protection.

Regulatory act of 3 march 2009 on the supervision and control of shipments of radioactive waste and spent fuel (transposition Council Directive 2006/117/EURATOM of 20 November 2006).

Regulatory act of 6 May 2010, defining the specific missions, the composition, organization and operation of the department of civil protection of the rescue services agency.

Regulatory act of 16 December 2015 on the quality of water intended for human consumption.

Draft regulatory act on radiation protection.

Emergency intervention plan in case of a nuclear accident, adopted by the Government in Council on 15 October 2014 (revision of that plan was adopted 15th May 2019).

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.

2) Composition of the crisis cell in case of a nuclear accident

The basis composition of the crisis cell includes:

- High Commissioner for National Protection;
- Director of Health;
- Head of the DRP;
- Director of CGDIS;
- Director General of the Police;
- Army Chief of Staff;
- Director of the office for crisis communication;
- Director of State Intelligence Service;
- Director of the Customs and Excise Agency;
- Manager of the Government Communication Centre;
- A representative from the Ministry of Family Affairs, Integration and the Greater Region;
- A representative from the Ministry of Home Affairs;

These permanent members may be accompanied or represented by his/here substitute. Depending on the circumstances, the CC is enlarged with as follows:

- A representative from the Ministry of Foreign Affairs;
- A representative from the Ministry of Education;
- A representative from the Ministry of Agriculture;
- A representative from the Ministry of Transport;
- A representative from the Ministry of Economy;
- Director of the Water Administration;
- Director of the Road Administration;
- Director of Environment;
- Director of the Computer Technologies Center;