Luxembourg

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"

Fifth review meeting of the contracting parties in 2015

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
ALARA	As low as reasonably achievable
ASS	Rescue Services Agency
CHL	Hospital Centre Luxembourg
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
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.
GPR	Radiological Protection Unit of the ASS
HCPN	High Commission of National Protection
HERCA	Heads of the European Radiological protection Competent Authorities
IAEA	International Atomic Energy Agency
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICSD	Ionizing chamber smoke detector
IRRS	Integrated Regulatory Review Service
ITM	Labor inspectorate
LNS	National laboratory of Health
NISF	National Interim Storage Facility for radioactive waste
NORM	Naturally Occurring Radioactive Materials
NPP	Nuclear Power Plant
ONDRAF	Belgian Waste Management Agency (ONDRAF/NIRAS)
RID	Regulation Concerning the International Carriage of Dangerous Goods by Rail
RPO	Radiation Protection Officer
SIP	Public relations office of the government

Table of Contents

LIST OF ACRONYMS AND ABBREVIATIONS **2**
TABLE OF CONTENTS **3**
SECTION A : INTRODUCTION **4**
SECTION B: POLICIES AND PRACTICES (ARTICLE 32.1) **6**
RADIOACTIVE WASTE MANAGEMENT POLICY 6
RADIOACTIVE WASTE MANAGEMENT PRACTICES 6
Management of wastes from unsealed sources *7*
Management of activated materials *7*
Management of orphan sources *8*
Management of disused consumer goods containing small amounts of radioactive substances *9*
SECTION C: SCOPE OF APPLICATION (ARTICLE 3) **9**
SECTION D: INVENTORIES AND LISTS (ARTICLE 32.2) **9**
SECTION E: LEGISLATIVE AND REGULATORY SYSTEM **10**
ARTICLE 18: IMPLEMENTING MEASURES 10
ARTICLE 19: LEGISLATIVE AND REGULATORY FRAMEWORK 12
Radiation Protection *12*
The system of licensing and prohibition *12*
Control, enforcement and responsibilities *13*
ARTICLE 20: REGULATORY BODY 13
SECTION F: OTHER GENERAL SAFETY PROVISIONS **15**
ARTICLE 21: RESPONSIBILITIES OF THE LICENSE HOLDER 15
ARTICLE 22: HUMAN AND FINANCIAL RESOURCES 15
ARTICLE 23: QUALITY ASSURANCE 16
ARTICLE 24: OPERATIONAL RADIATION PROTECTION 16
ARTICLE 25: EMERGENCY PREPAREDNESS 16
New national emergency response plan *17*
Nuclear Exercises *18*
ARTICLE 26: DECOMMISSIONING 19
SECTION H: SAFETY OF RADIOACTIVE WASTE MANAGEMENT **19**
ARTICLE 11: GENERAL SAFETY REQUIREMENTS 19
ARTICLE 12: EXISTING FACILITIES AND PAST PRACTICES 20
ARTICLES 13, 14 AND 15: SITING, DESIGN, CONSTRUCTION AND ASSESSMENT 20
ARTICLE 16: OPERATION OF FACILITIES 21
ARTICLE 17: INSTITUTIONAL MEASURES AFTER CLOSURE 21
SECTION I: TRANSBOUNDARY MOVEMENT (ARTICLE 27) **21**
SECTION J: DISUSED SEALED SOURCES **22**
Management of disused sealed sources *22*
Use of sealed sources in maritime environment *23*
Use of sealed sources in education *23*
Orphan sources *23*
Safety and security of sealed sources *23*
SECTION K: PLANNED ACTIVITIES TO IMPROVE SAFETY **24**
ANNEX I - INVENTORY **26**
ANNEX II - LEGISLATIVE **27**

Section A : Introduction

Luxembourg has signed the Joint Convention on 1 October 1997 and is a party thereof since 19 November 2001. The Convention entered into force on 21 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;
- most of the old "historical" radioactive sealed sources have been returned to the country of origin or to a foreign waste management facility.

In Luxembourg radioactive wastes are mainly arising from the use of radioactive sources in industry, medicine and to a small extent from the use in education and research. 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. The regulatory decrees are revised periodically in order to be in conformity with the provisions of the Directives of the European Union of which Luxembourg is a Member State. The last amendment of the relevant decrees was put into force on 30 July 2013 with the transposition of the 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, 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 Luxembourg 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 Draft 3). The section concerning the safety of spent fuel management covering articles 4-10 of the Joint Convention is not applicable to Luxembourg.

The situation with regard to the obligations of the Convention has practically not changed since the previous review meeting. For this reason and with the objective to produce a stand-alone document many paragraphs have remained unchanged. All new or changed elements, the addressing of challenges from the last review meeting and other planned actions are clearly assigned throughout the document by underlining the first words of a paragraph.

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 4th review meeting. However, from the four topics identified, only the management of disused sealed sources is applicable to Luxembourg. Therefore Section J of the present report provides more detailed information on that topic compared to the previous national reports.

Section B: Policies and practices (Article 32.1)

Radioactive waste management policy

The Luxembourg radioactive waste management policy is dictated 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 Luxembourg 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;

Concerning the small quantities of radioactive waste arising in Luxembourg, the Belgian Government has exceptionally, and due to the small quantities, accepted to treat the waste coming from the Grand Duchy of Luxembourg, in Belgium.

The interim storage of radioactive wastes has to be guaranteed by the licensee. The small national interim storage facility (NSIF) only holds waste for which no license holder exists, such as consumer goods or orphan sources.

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) • Interim storage (either at the licensee or in the NISF)	• New location and new operator for the NISF.
Disused Sealed Sources	• Return to supplier • Export to Belgium	• Licensee • State budget	• Interim storage (either at the licensee or in the NISF) • Return to supplier • Export to Belgium	• New location and new operator for the NISF.

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 will be further strengthened with the elaboration of a national programme for the management of spent fuel and radioactive waste, following the D-RadW.

Facilities using radioactive substances exceeding the exemption levels (Euratom Council Directive 96/29 – Table A) 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.

Radioactive waste is classified 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 Grand-Ducal regulation of 14 December 2000 concerning the protection of the population against the dangers arising from ionizing radiation further defines clearance levels for unconditional release. Any licensee may release waste to the environment without additional license if the specific activity of the waste is below the clearance levels and does not exceed one ton per year. Clearance of very low activity wastes above these levels has to be licensed by the competent authority. The defined clearance levels are taken from the document "Clearance of Materials, Buildings and Sites with Negligible Radioactivity from Practices subject to Reporting or Authorisation", published by the German "Strahlenschutzkommission" (Commission on Radiological Protection) in 1998.

Management practices of the different types of wastes 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 or until the activity of the waste decreased below the clearance levels. Wastes containing small specific activities below clearance level and not exceeding a total weight of 1000 kg 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 specific activities. Thus the resulting liquid wastes and contaminated solid wastes remain below the clearance levels.

Management of activated materials

The national radiotherapy centre operates the only 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 will need to be treated as radioactive waste.

In late 2012, a company situated in Luxembourg, started with the development and production of electric neutron generators. Testing of those generators results in a short-lived activation of the air within the testing facility. This air is released into the environment. The generators being operated with Tritium, in particular the process of loading the generators results in a release of Tritium into the environment. When confronted with the license application, the DRP took a precautious attitude. The operator was requested to introduce assessments of the activation and its radiological consequences for the workers and the population. For the first period, only a license for a limited amount of operations and also a reduced neutron flux was issued with a permission to release the activated air. This allowed the DRP inspectors to verify by their own measurements the radiological effects of the activation and to stepwise enlarge the licensing conditions. It has to be noted that any exposure of the population due to this activity remains clearly below 10 MicroSieverts per year. Furthermore, the licensing procedure was public.

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. Agreements exist with Belgium and with France concerning the return of the truck or the train 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 in Luxembourg 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 orphan 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.

Since the last review meeting, only a couple alerts have been reported to the DRP. It above concerned mostly false alarms. In April 2012 a small strongly damaged A-Type container with approximately 25 MBq Radium-226 has been detected and separated from the metal scrap. The shipment came form a scrap yard in another EU country, who remains responsible for the radioactive material. In order to organize the return according to COUNCIL DIRECTIVE 2006/117/EURATOM of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel, the container was first transferred to the storage of the operator. Then the procedure for the shipment back to the country of origin was engaged. The transfer was authorised 2013. It has however not yet taken place.

In August 2011 a steel plant reported a radiation alert on a slag sample from the electric arc furnace. Analyses showed that an Am-241 source of an approximate activity of 1,1 GBq, present in the scrap metals introduced to the furnace, lead to 1600 tons of highly heterogeneous contaminated slag This event had already been reported to the 4th RM and a challenge was identified for Luxembourg concerning the regulatory review of a proposed licensee strategy to condition and dispose of contaminated (Am-241) slag.

After feasibility studies that were required from the DRP, the following solution was retained: The entire slag dump was progressively dragged and the radioactivity values were monitored. The dragged lot contained Am-241 in a concentration below 1 Bq/g, as it was unavoidably homogenized through the progressive dragging process. According to the German SSK reference limits, these were then conditionally liberated to a dump for problematic slags. The remaining slags contained an Am-241 activity of less than 0,05 Bq/g and were cleared as non-radioactive material. The measurements of the activity of the slags were done in accordance with the DIN 25482 norm in a mobile laboratory installed on site. Random samples were taken by the DRP and verified in the LNS laboratory. This event was closed in November 2013, with the final liberation measurements on the remaining slag.

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.
- On 23 September 2011, the last radioactive lightning conductor in use has been dismantled and transferred to the NISF.
- 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 waste arising from these products is either returned to the supplier or collected at the national interim waste storage for being shipped to a foreign waste management facility.

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, Luxembourg operates only a small interim storage for radioactive waste and disused sources for which no license holder exists. Following discussions at the 2nd review meeting, Luxembourg has decided to declare this national radioactive waste interim storage facility (NISF) as waste management facility. It is located at the following address: "CHL, 4 rue Barblé, Luxembourg". More details on the facility are given in section H, article 12.

The inventories of the radioactive wastes and disused sources stored on 1 September 2014 at the NISF and on the user's premises are listed in Annex I.

Section E: Legislative and regulatory system

Article 18: Implementing measures

In 1963, a framework law was enacted on the "Protection of the Public against the Hazards of Ionizing Radiation", which established general principles regarding radiation protection, management of radioactive substances and nuclear safety, defined competences for ad-hoc decisions in a radiological or nuclear emergency situation, set the frame for enforcement and attributed the competence to the Minister of Health. This framework law was last amended in 1995.

The law of 21 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, as well as nuclear safety.

These principles formed the basis for executive regulations (decrees), which were regularly amended in conformity with the EU directives on radiation protection and govern the various aspects of nuclear safety. The current regulation implements Council Directive 96/29/Euratom of 13 May 1996 laying down basic standards for the health protection of the general public and workers against the dangers of ionizing radiation.

The current regulations apply 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.

The last amendment of the regulatory framework was put into force on 30 July 2013 with the transposition of the 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. Changes concern in particular:

- 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.
- 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 has been prohibited.

Other important principles of the D-RadW, such as the general obligation to keep the production of radioactive waste to a minimum, the definition of a competent regulatory authority and the availability of necessary competence, as well as human and financial resources were already in place prior to the adoption of the directive. It is further worth mentioning that article 15 of the D-RadW exempts Luxembourg from the obligation to transpose the provisions related to spent fuel.

It also needs to be mentioned that the obligation to functionally separate the competent regulatory authority from any other body concerned with the management of radioactive waste has not yet been fully implemented in practice. The progress achieved so far is illustrated in more detail under article 20 of the present report.

Concerning the national programme for the management of radioactive waste, the DRP has started to draft a national programme following the framework given by the D-RadW. At present, no major obstacles have been identified that may jeopardize the timely finalization of that programme. The deadline given by the D-RadW for submitting the first national programme to the Commission is the 23 August 2015. The national programme will be made public.

At present, the DRP has started with the transposition and implementation of the EU-BSS, the amended nuclear safety directive (2014/87/EURATOM) and the drinking water directive (2013/51/EURATOM). Following an initial assessment, the intention of the DRP concluded that both the framework law of 1963 and the regulatory decree (act of 14 December 2000) need a complete review. The DRP has consequently started work on the provisions for the new legislative and regulatory framework.

Concerning the drinking water directive no major difficulties were identified. A first draft for the transposition has been elaborated in cooperation between the Administration for the Management of Water (competent for the safety of drinking water) and the DRP.

Concerning the EU-BSS, work is on-going at DRP level and in cooperation with the legal department of the Ministry of Health. The transposition is very challenging, partially because of the size and high number of articles of the directive. Furthermore, quite a number of

articles oblige member states to define certain aspects without giving concrete guidance. Being a small country with very limited resources, Luxembourg is very strongly in favor for sharing forces in Europe when developing further guidance. Some initiatives have already been taken, such as the HERCA initiative concerning an action plan for the transposition and implementation of the EU-BSS. Those initiatives are very welcomed by Luxembourg.

Concerning the new amended nuclear safety directive, work has not yet started.

The transposition and implementation of these important directives can certainly be considered as a challenge for Luxembourg, in particular related to the workload.

Article 19: Legislative and regulatory framework

Radiation Protection

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 limit of the annual effective dose for exposed workers (including women of childbearing age, apprentices and adult students) is fixed to 10 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 3 mSv. For members of the public and for apprentices and students below the age of 16 years, the maximum annual effective dose is fixed to 1 mSv.

The current regulation 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

Facilities are divided into four different categories:

- Category I defines nuclear installations, as defined by the Council Directive 2009/71/Euratom, as facilities in which fissile material in quantities exceeding 500 effective grams is customarily used or stored and as facilities for the final disposal of radioactive waste. Currently no undertaking of category I exists in Luxembourg.
- Category 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 96/29/EURATOM of 13 May 1996, or conditioning, respectively having an interim storage of radioactive waste.
- In Category III are ranged all facilities using or holding radioactive substances above the exemption limits fixed by the Council Directive 96/29/EURATOM of 13 May 1996, but not exceeding these levels by a thousand fold.

- In Category IV are classified all facilities using or holding radioactive substances staying below the exemption limits fixed by the Council Directive 96/29/EURATOM of 13 May 1996, but exceeding 1/100 of these limits.

The regulation lays down separate licensing conditions for each category of installation, notably in relation to the technical information to be supplied, public information and participation in the licensing procedure. A license, issued by the Government in Council (category I), the Minister of Health (category II) and the Directorate of Health (category III) is required for categories I-III. Declaration to the DRP is sufficient for category IV. The Minister of Health may suspend or withdraw a license when the licensee contravenes the regulation in force or the conditions of the license.

Control, enforcement and responsibilities

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". Inspections are conducted at least once per year in all nuclear medicine and radiotherapy centres, and in at least 50% of the other facilities licensed to use radioactive sources.

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.

The inspectors of the DRP are enabled to impose appropriate measures in order to avoid potential incidents or accidents with impacts on workers, the public and the environment. Some agents of the DRP are further attributed with the legal power of police officers.

Article 20: Regulatory body

The legislative and 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 department of radiation protection (DRP) and allocates particular missions to all departments within the Directorate of Health. Similarly to a number of other small countries, the DRP centralizes as a single department all competence of radiation and nuclear safety. The organizational structure and missions of the DRP are summarized in figure 1.

The DRP is at the technical level in charge with the preparation of draft text for laws, regulations and decrees. These drafts are then submitted to the department of legal affairs of the Ministry of Health for coordination of the legislative procedure. The DRP also defines the conditions for licenses. It has further issued several guides.

The DRP is composed of 9 agents with a Master degree or PhD, specialized in radiation protection (1), medical physics (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, 2 technicians, 1 laboratory assistant and a secretary.

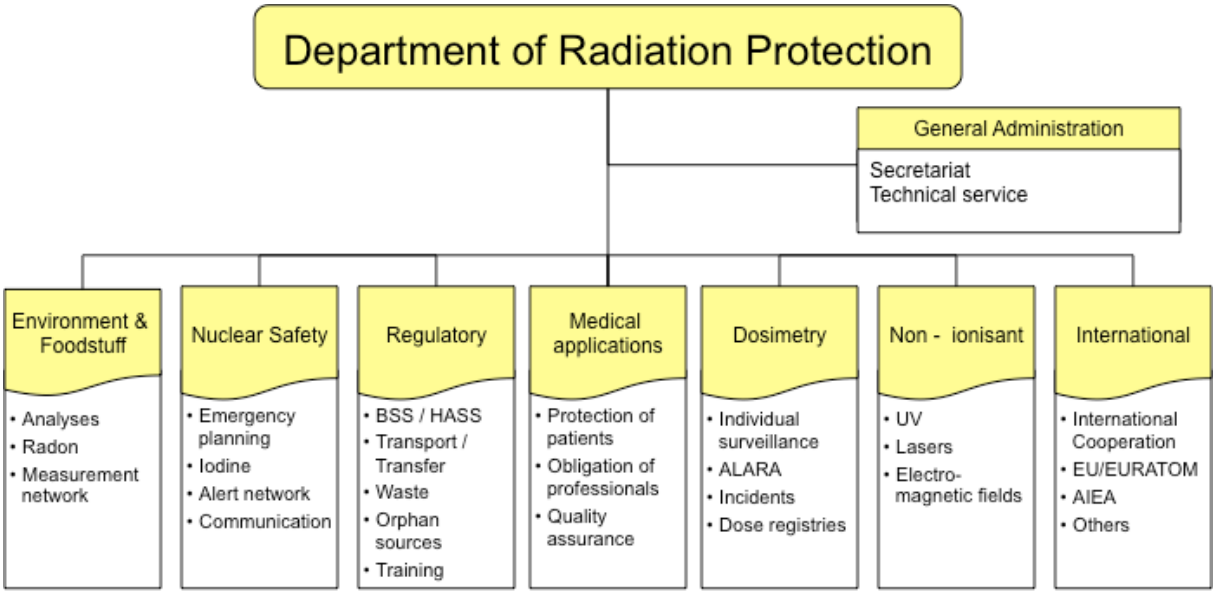

Figure 1: Organizational structure and missions of the DRP

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Compared to the previous national report, this is an increase of one person, since a candidate with expertise in nuclear physics could be engaged as of January 2012. Following the nuclear accident in Fukushima, the Government has indeed asked the DRP to increase efforts on nuclear safety and nuclear emergency preparedness. In order not to be forced to neglect its other "routine" missions, the DRP has than officially requested in June 2011 for increasing permanently its staff which in return was positively advised by the Government.

All activities and projects of the DRP are financed via the state budget, allocating predefined credits on a yearly basis. Some of these credits 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. In the past the budget of the DRP has usually been increased at a yearly rate of about 4% in conjunction with the economic growth. Due to the economic crisis, the budget had however been frozen in the years 2010 and 2011 and remained at the 2009 level From 2012 on, the budget has again experienced a small increase as compensation of the inflation. 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.

The laboratory of the DRP has established a quality management system in July 2010 (preparations started in 2007) within the laboratory of the DRP, with an accreditation according to ISO 17025.

In April 2009, the Ministry of Health had 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 presentation and structure. Improvements of the structure are under discussion. So far only a French version exists, although some of the documents that can be downloaded, such as the present report, may be published in other languages.

At present the DRP is confronted with a stepwise separation between its function as authority and its laboratory. The law of 7 August 2012, concerning the creation of the public agency "National laboratory of Health" (LNS), foresees the integration of the laboratory of the DRP into this new agency. The DRP will remain with its regulatory functions part of the Directorate of Health.

The separation of the laboratory from the DRP is a stepwise procedure. The law mentioned above entered into force on 1 January 2013 with the consequence that the 4 employees of the laboratory were assigned from that date on to the LNS. However, because the construction of the new building which will host the laboratory has only started late in 2014, the laboratory remains for the time being with the DRP. The staff has been temporarily detached to the Directorate of Health. The physical movement of the laboratory is tentatively scheduled for early 2018.

This legislative decision has the advantage that the LNS will also be responsible for the management of the limited amounts of radioactive waste and will thus become the operator of the NISF. The new building will also comprise a new storage for that waste. For the time being, the NISF is still operated by the DRP at its present location. As soon as the new building will be operational, the waste and the responsibilities for its management will be transferred to the LNS.

With the adoption of the above law the legislative framework exists for the functional separation of the competent regulatory authority (DRP) from any other body or organisation concerned with the management of radioactive waste. The effective implementation of that law is however still pending until the completion of the building.

Section F: Other general safety provisions

Article 21: Responsibilities of the license holder

According to the Grand-Ducal regulation of 14 December 2000 concerning the protection of the population against the dangers arising from ionizing radiation, the license holder is fully responsible for the respect of all regulatory provisions.

Article 22: Human and financial resources

By regulation, 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.

Since the transposition of the Council Directive 2003/122/Euratom in 2006, 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 Rescue Services Agency (ASS) and the laboratory 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 Germany, France and Belgium. These general agreements also cover radiological and nuclear emergencies. A bilateral agreement on mutual early information has been concluded with France and Belgium.

The Government has set up a national emergency response plan to alert and to protect the population in case of a radiological emergency. The Minister of Health and the Minister of Interior are responsible for the off-site emergency planning. The plan is activated and regularly tested by the DRP and by the ASS, 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.

New national emergency response plan

Following the nuclear accident in Fukushima, the Government has decided to review the national emergency response plan and asked the High Commissioner for national protection to coordinate the review of the existing plan. A first critical analyse of the existing plan was done by the High Commissioner. That assessment was than discussed during several meetings in 2011 within a coordination group composed of all relevant public bodies. The main conclusions drawn at that time were:

- Lack of efficient coordination between the different ministries at national level.
- Some organizational changes of key governmental organizations are not fully implemented into the plan.
- Insufficient implementation of the operational aspects (ex: preparedness of local authorities and critical infrastructures, such as hospitals).
- Post-accidental planning not included.

In June 2011, the coordination group decided to set up working groups in several subject areas, such as Evacuation, Evacuation Centers, Decontamination, Municipalities, Hospitals, Communication, Radiological Evaluation and Post Accidental Preparedness.

Besides, the coordination group started working on the main body of a new intervention plan. The organizational structure of the crisis cells, alerts and communication channels, phases of an accident from first alert to post-accidental, planning zones and definitions of possible counter measures were reviewed and were, if necessary, up-dated. It was foreseen to present a draft of a new intervention plan by June 2012 for adoption. However, this target could not be met. One of the main difficulties was a lack of expertise on nuclear emergency preparedness principles within the coordination group. Only several experts of the DRP and the Rescue Service Agency (ASS) were familiar with those principles, including for instance standard reference documents such as the IAEA safety guide GS-G-2.1.

It was then decided by the Government to participate in the second part of the exercise "3 in 1" (see below) on the basis of the non-approved draft version of the new plan. The idea was to use the experience feedback from that exercise to finalize the work on the new plan. This was indeed the case, and a new plan was submitted in June 2013 to the Government for approval. At the time of writing of the present report, the approval of the new national nuclear emergency plan is scheduled for October 2014. The time from June 2013 on was used to prepare an information campaign for the public and to hold consultations with several stakeholders. The operational procedures were also finalized during that time.

Compared to the current plan (version 2 December 1994), the new draft plan contains main new or modified provisions in the following areas:

At a technical level

- Definition of different phases of the accident, namely the emergency phase and the post-accident phase, the first being subdivided into a threat phase and a release phase and the second into a transition phase and a long-term consequences management phase. This is now independent of the severity of an accident.
- New Emergency Planning Zones (EPZ) are proposed for evacuation, sheltering and iodine prophylaxis.
- The decision for a protective action will be based on defined reference levels while taking into account the principles of proportionality and effectiveness of each of the proposed measures. This flexibility shall mainly allow for ad-hoc

coordination of the protective actions with the neighbouring states along national borders.

- The draft emergency response plan focuses on the emergency phase, including the phase immediately after the accident, in particular the first few weeks after the release. The management of long-term consequences, including waste management, will be dealt with in a specific plan for the post-accident phase.
- National planning for crisis management in the event of a nuclear accident now also includes the development of two categories of operational emergency procedures, operational procedures per measure (OPM)[1] and operational procedures per responsible actor (OPA).

Organizational and legal aspects

- Implementation of the plan falls now under the responsibility of the Prime Minister, the Minister of the Interior and the Greater Region, and the Minister of Health.
- In the event of an imminent risk or the occurrence of a nuclear crisis potentially affecting the territory of Luxembourg, the Prime Minister activates the crisis cell. Members of the cell are alerted trough the HCPN mechanism. Under the authority of the Government, the crisis cell initiates, coordinates and monitors the implementation of all measures to cope with the crisis and its effects, respectively, promotes the return to normality, and prepares the necessary decisions. The crisis cell is composed of 12 permanent members and 9 topic-related members.
- Regarding the legal basis, the plan provides a comprehensive survey of laws and regulations that apply in the context of nuclear emergency, including Article 32, paragraph 4 of the Constitution that attributes in the case of an international crisis particular competences to the Grand-Duke.
- A commission composed of representatives of HCPN, the DRP, the ASS and the SIP shall meet at least once a year to make any adaptation of the plan, as appropriate, and include for example experience feedback from exercises or knowledge acquired during the development and updating of the respective operational procedures.
- The main responsibilities of the regulatory body (DRP) in the emergency preparedness remained mostly unchanged.

Details of the new plan will be made public after its adoption.

Nuclear Exercises

The Executives of the Greater Region, meeting at the Extraordinary Summit in Metz (France) on 20 April 2011, agreed to strengthen cooperation in the establishment and implementation of operational management plans relating to nuclear accidents. The result was the joint project entitled "Nuclear Exercises Project 3 in 1", which aims to improve national

[1] Eighteen measures are considered within the draft emergency response plan in case of a nuclear accident for which a dedicated OPM is being developed (1 Radiological Evaluation, zoning; 2 Individual Protection Measures; 3 Distribution of Potassium Iodide Tablets; 4 Sheltering; 5 Access Control to Affected Areas; 6 Evacuation; 7 Reception Centres; 8 Decontamination of People and Goods; 9 Foodstuff; 10 Agricultural Products and Feeding Stuff; 11 Internal Communication; 12 External Communication; 13 International Collaboration: Mutual Assistance; 14 Hospitals & Healthcare; 15 Social Infrastructure (e.g. nurseries, retirement homes); 16 Schools; 17 Transport Management; 18 Water Management)

and international cooperation in the Greater Region and, hence, the coordination of emergency measures in case of a nuclear accident at the French NPP Cattenom.

The first exercise organized by the participating German federal states took place during the last week of June 2012 with a simulation of the alert phase up to first releases in real time over 16 hours. The second exercise, organized by Luxembourg, was held from 5 to 6 December 2012 with a focus on the release phase. The last exercise organized in June 2013 by France permitted to simulate over 3 to 4 days several aspects of the post-accidental situation.

It is worth mentioning that the operator of the NPP Cattenom actively participated in the preparation and execution of the exercises. For example, the detailed scenario for the second exercise has been prepared in close cooperation between the operator and the DRP. This was very positively received, since, for the first time, Luxembourg was able to influence the type of scenario chosen for such an exercise. It was also the first time that an exercise was held during a release phase with a simulated radiological impact on the territory of the French neighbouring countries Germany and Luxembourg.

At the regional scale a very active participation of all involved actors permitted to simulate a number of operational issues that have hardly been tested before, such as, for example, the traffic management in and around the region, the setting up of reception centres and the coordination of the hospitals of the region. On the other hand, the regional character of the exercise series also signified that important national authorities in France and in Germany were not involved in all cases. Relevant information exchanges with those bodies were thus not always guaranteed. During the exercises those missing partners were simulated through a common exercise animation cell.

After each exercise “lessons learned” meetings were held, both at national level in Luxembourg and with the partners of the Greater Region. Following the last exercise from June 2013, France organized in September 2013 a common meeting for the exchange of the lessons learned of the 3rd exercise. This occasion also served to set up a list of priorities for further strengthening the cooperation in the Greater Region on nuclear emergency preparedness.

More details on these exercises and the national emergency response plan are reported under the Convention on Nuclear Safety.

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 up-dated 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 store such radioactive wastes have to comply with the safety provisions of category II facilities.

The relevant regulation 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

The radioactive wastes resulting from practices highlighted in section B and for which exist no license holder are collected by the DRP for a short interim storage at the national radioactive waste interim storage facility (NISF), operated and controlled by that department and situated at the CHL, 4, rue Barblé, Luxembourg. The NISF is located within the building of a hospital at the minus 2 level. It consists of two small rooms, used for the storage and manipulation of the sources. The location can be accessed from a public parking lot through a single door and the access is limited to agents of the DRP. Furthermore, the NISF is integrated into the more global internal emergency response plan of the hospital. A detailed inventory of all the radioactive waste presently stored at this location is given in annex I.

The storage time of the waste is not defined, neither limited, but based on practical considerations. A transfer is normally organized when sufficient waste of one type is available to reach the yearly quota. This concerns mainly smoke detectors and lightning rods of which the storage time is mostly below 5 years. Other types of wastes in very small quantities are stored longer.

At regular intervals, the Belgian Waste Management Agency (ONDRAF/NIRAS) picks up this radioactive waste in Luxembourg and transfers it to the Belgian storage facility. Before organizing a transfer, ONDRAF establishes an offer based on the quantities and involved nuclides. The last transfers took place in October 2010, December 2008 and October 2005.

Due to the DIRECTIVE 2011/70/EURATOM (D-RadW) it became necessary to attribute the operation and the control of the NISF to two bodies that are functionally separated. This separation has started step-by-step as described in Section B under Article 20 of the present report.

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

Any hypothetic project to build a radioactive waste management facility or a facility for the final disposal of radioactive waste is subject to prior authorization by the Government in council according to the procedures defined for category I facilities. Each applicant would have to demonstrate full compliance with articles 13, 14 and 15.

Article 16: Operation of facilities

As stated under article 12, Luxembourg only operates a single waste interim storage facility. In order to guarantee a safe storage, the DRP regularly asks the Belgian authorized inspection organization AV Controlatom for segregation and the packing of the collected wastes, 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 bases.

Article 17: Institutional measures after closure

The NISF is not very likely to be contaminated. Thus no specific measures, except of a final contamination verification, will be needed after closure. However, accidental contamination during the manipulation of the wastes or as a result of severe accidents like fire or flooding, may occur. It is foreseen that the storage 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 (GPR) of the ASS. Luxembourg is also increasingly cooperating with specialized rescue teams from neighbour countries that could assist in case of major accidents.

The DRP has further 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, the regulatory control of the transport of radioactive material is also a competence regulatory body DRP. 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 issued by the Minister of Health and may be limited to a single transport operation or may be valid for only a period of five years at maximum.

For the transfer of radioactive sources, the EU Council Regulation of 8 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 3 March 2009 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 have to be 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. In relation to sealed sources the following provisions need to be mentioned:

1. Reduction of the amount 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 if 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 15 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) were 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 date of its first installation, 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. The licence contains provisions to be respected for the safe interim storage of waste. 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 maritime environment

The DRP has also licensed two maritime dredging companies that are registered in Luxembourg to use high activity sealed sources on the dredgers. These vessels operate mainly in international waters. The sources, mostly Co-60, never physically enter Luxembourg and are thus also not imported to Luxembourg. The competent authority in Luxembourg still grants the license to install these sources and the DRP holds all relevant registers from the installation over the use including yearly inspections performed all around the world up to the safe return to the supplier. The experience shows that it is not always possible to verify the authenticity of the source certificate and the inspection reports. An exchange of good practices with other regulatory bodies, having similar cases, would certainly be beneficial. On the other hand, the management of the disused sources is quite straightforward. Those sources are replaced every 5 years. The supplier, who installs the new sealed source, also immediately takes back the disused sealed source.

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 July 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 will be followed intensively within the next months and the collected sources will eventually be disposed of.

Orphan sources

The DRP assumes the management of disused sealed sources for which a safe management may not be guaranteed, e.g. in case of bankruptcy of the owner of the source. This is also the case when members of the public still hold old historic disused sources. Those sources are then stored in the NISF.

At regular intervals, these sources are prepared for shipment and transferred in accordance with the bilateral agreement with Belgium to ONDRAF. At present, all Lightening conductors and ICSD’s that are listed in annex I, have been prepared for transport and the licensing procedure concerning the shipment is in preparation.

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.

Section K: Planned activities to improve safety

Given the size of the country, Luxembourg does not experience any significant modifications from review meeting to review meeting. 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 while profiting from constructive "nearly cost-free" advice is extremely useful.

Luxembourg is determined to constantly consolidate, up-date 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 2012 peer review meeting, the 3 following challenges have been identified for Luxembourg:

- Transposition of Council Directive, 2011/70/EURATOM (D-RadW) by July 2013 (independency of the DRP) - (see Section E – Article 18);
- Review and update of the national emergency response plan (see Section F – Article 25);
- Regulatory review of a proposed licensee strategy to condition and dispose of contaminated (Am-241) slag detected in an electric arc furnace at a steel plant (see Section B – Practices);

The present report addresses those challenges and the relevant sections as indicated above. Provided the new national emergency response plan will be adopted as scheduled in October 2014, all 3 topics are finalized. Luxembourg has also started working on the issues that were presented in the previous national report as "planned activities". Those issues are:

- Adoption of Council Directive 2013/59/EURATOM of 5 December 2013 laying down basic safety standards for the 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, hereafter referred to as "EU-BSS" (see Section E – Article 18);
- Stepwise separation of the laboratory for radiological analyses from the regulatory body (see Section E – Article 20);
- National campaign to collect the unused and/or unneeded radioactive sources and substances from schools (see Section J);
- National programme for the management of radioactive waste (see Section E – Article 18);

Given the fact that the international and moreover European context changes rapidly, a number of issues have arisen that need to be addressed over the next five years, as outlined below.

- The elaboration of a national plan focusing on post-accidental management, based on the French CORDIRPA-doctrine. This project is scheduled to begin after the adoption of the national emergency response plan in October 2014.
- Transposition and implementation of the following EU Directives:
  - EU-BSS

  - Council Directive 2013/51/EURATOM of 22 October 2013 laying down requirements for the protection of the health of the general public with regard to radioactive substances in water intended for human consumption (Euratom Drinking Water Directive)
  - 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
- Preparation for the first IRRS mission (scheduled for 2018).

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 placed on Internet (direct link: http://www.ms.public.lu/fr/activites/radioprotection/coop-nat-internationale/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 1 June 2014 on the 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

Inventory of disused radioactive sealed sources stored on 1 June 2014 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**

Inventory of disused radioactive sealed sources stored on 1 June 2014 on the authority's premises. Items containing NORM are not included (chemicals and minerals containing NORM and some items containing Ra-226, together below 30 litres).

Source type	Radionuclide	Number of sources	Total activity (GBq)
Lightening conductors	Am-241	2	0.072
Lightening conductors	Ra-226	6	0.207
ICSD's	Am-241	667	0.301
ICSD's	Ra-226	218	0.0013
Industrial sources	Ni-63	1	0.37
Demonstration source	Ra-226/Be	1	0.111

Annex II - Legislative

- Law of 25 March 1963 concerning the protection of the population against the dangers arising from ionizing radiation.
- 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 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.
- 93/1493/EURATOM - Regulation of 8 June 1993 on shipments of radioactive substances between Member States.
- 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.
- Grand-Ducal regulation of 14 December 2000 concerning the protection of the population against the dangers arising from ionizing radiation, as modified on 21 July 2006 and on 24 July 2011.
- National emergency response plan in case of an incident or accident in the nuclear power plant of Cattenom or in case of any other radiological or nuclear event (December 1994).
- 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).