



INTEGRATED REVIEW SERVICE FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT, DECOMMISSIONING AND REMEDICATION (ARTEMIS)

MISSION

TO

LATVIA

RIGA, LATVIA

3-10 December 2019

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY
DEPARTMENT OF NUCLEAR ENERGY





**REPORT OF THE
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REMEDICATION (ARTEMIS) MISSION
TO
LATVIA**

Mission *3-10 December 2019*
Location: *Riga, Latvia*
Organized *IAEA*

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IAEA-2019

The number of recommendations, suggestions and good practices is in no way a measure of the status of the national infrastructure for nuclear and radiation safety. Comparisons of such numbers between ARTEMIS reports from different countries should not be attempted.

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EXECUTIVE SUMMARY

On 17 July 2017, the Director of the Radiation Safety Centre of the State Environmental Service of Latvia sent a letter to the International Atomic Energy Agency inviting the IAEA to conduct an Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) Mission in the volume that is correspondent to the national context, together with the Integrated Regulatory Review Service (IRRS), in order to fulfil the obligation for peer review on all EU Member States in Article 14.3 of the European 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. Later it was agreed to divide the ARTEMIS and the IRRS Missions. The ARTEMIS Mission took place from 3rd to 10th December 2019 in Riga in the premises of the Radiation Safety Centre of the State Environmental Service.

The purpose of the ARTEMIS review mission was to provide an independent international evaluation of the National Programme for Radioactive Waste Management in Latvia (hereinafter referred to as the strategy), requested in line with the obligations of the Waste Directive. The ARTEMIS review assessed, as requested by the Waste Directive, the overall strategy for the management of all types of radioactive waste in Latvia against the relevant IAEA Safety Standards and proven international practice and experiences.

The ARTEMIS Review Team comprised four senior international experts in the field of radioactive waste management and decommissioning from Denmark, Cyprus, Hungary and Portugal, as well as three IAEA staff members.

The method of work included review of all documentation submitted by National Counterpart for the considered scope of the review, including clarifications presented in presentations and discussions during the mission, with a focus on the strategy, as well as the results of self-assessment, based on the provided questionnaire.

Advance reference material included the following main acts and documents: Law on Radiation Safety and Nuclear Safety, Environmental Policy Framework (Guidelines) for 2014-2020 (hereinafter - Environmental Policy Framework), Cabinet Regulation No 129 “Requirements for Operations with Radioactive Waste and Materials Related Thereto”, Radioactive Waste Storage Concept, Concept for the Decommissioning and Dismantling of Salaspils Nuclear Research Reactor, Law on Environmental Impact Assessment, Cabinet Regulation No 149 “Regulations for Protection against Ionising Radiation”, Republic of Latvia National Report on the implementation of 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 (2018), Republic of Latvia National Report on the implementation of the obligations under the Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management 6th Review Meeting of the Contracting Parties (2017), Republic of Latvia National Report on the implementation of the obligations under the Convention on Nuclear Safety for the 8th Review Meeting of the Contracting Parties (2019), and the Report of the IRRS Mission to Latvia (2019). The full list of the documentation is presented in the Section III.

During the mission representatives held discussions with the Ministry of Environmental Protection and Regional Development, Radiation Safety Centre of the State Environmental Service and the Latvian Environment, Geology and Meteorology Centre.

The ARTEMIS Review Team acknowledged the particular challenges associated with the waste

inventory from past activities in Latvia and with the decommissioning of the Salaspils Research Reactor. They commended the strong commitment of all involved Latvian organizations to ensure safe management of radioactive waste. They also were particularly encouraged by the very open and constructive manner, in which the counterparts engaged throughout.

The ARTEMIS Review Team concluded that many aspects relevant to the safe management of radioactive waste in Latvia are in place. However, they noted some important aspects, which should be evaluated and strengthened. They made a number of recommendations and suggestions, of which the most significant were to ensure that:

- Clear statements are included in the national policy, detailing the preferred management option for intermediate level waste, providing a basis for decision regarding its long term management;
- The strategy reflects the preferred long term options for management of radioactive waste stated in the policy, including interim targets and end states;
- The strategy takes into account the interdependencies between related actions and their associated risks, considering uncertainties in knowledge;
- Existing provisions to ensure timely implementation of the strategy, including effective means of preventing and mitigating omissions, deviations, failures, and delays are evaluated.

The ARTEMIS Review Team considers that by adequately implementing the outcomes of the present review Latvia will be in a good position to meet high standards of safety for radioactive waste management in the country.

In this regard, the ARTEMIS Review Team suggests that a follow-up mission in around 3 years from now could bring value to Latvia's efforts to improve its waste management.

I. INTRODUCTION

At the request of Latvian authorities, specifically the Radiation Safety Centre of the State Environmental Service of the Republic of Latvia, the International Atomic Energy Agency organized an ARTEMIS review of the Latvian Policy on Spent Fuel and Radioactive Waste Management. The objective of the ARTEMIS Peer Review Service is to provide independent expert opinion and advice on radioactive waste and spent nuclear fuel management, decommissioning and remediation, based upon the IAEA safety standards and technical guidance, as well as international good practice. Latvia requested this review to fulfil its obligations under Article 14.3 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* (“Waste Directive”).

The review was performed by a team of four senior international experts in the field of decommissioning and radioactive waste and spent fuel management, from multiple IAEA Member States, with IAEA staff providing coordination and administrative support. Subsequent to a preparatory meeting in May 2019, and the receipt and review of Advanced Reference Material in September of 2019, in December 2019 the ARTEMIS Review Team evaluated the overall Latvian strategy for the management of all types of radioactive waste and spent fuel, including aspects of decommissioning.

II. OBJECTIVE AND SCOPE

The ARTEMIS review provided an independent international evaluation of the Radioactive Waste and Spent Fuel Management Strategy of Latvia, requested in line with the obligations of the *Waste Directive*.

The ARTEMIS review, organized by the Department of Nuclear Safety and Security and the Department of Nuclear Energy of the IAEA, performed against the relevant IAEA Safety Standards and proven international practice and experiences with the combined expertise of the international peer review team selected by the IAEA.

The ARTEMIS review assessed, as requested by the *Waste Directive*, the overall strategy for the management of all types of radioactive waste in Latvia.

III. BASIS FOR THE REVIEW

A) PREPARATORY WORK AND IAEA REVIEW TEAM

At the request of the Government of Latvia, a preparatory meeting for the ARTEMIS Review mission, was conducted from 23 to 24 May 2019. The preparatory meeting was carried out by the appointed Team Leader Mr David Ulfbeck, the IAEA coordinator and deputy coordinator Mr Vladan Ljubenov and Ms Merle Lust, and the team of National Counterparts led by Ms Dace Šatrovska from the Radiation Safety Centre of the State Environmental Service, with participation of representatives of the Latvian Ministry of Environmental Protection and Regional Development and the Latvian Environmental, Geology and Meteorology Centre.

The ARTEMIS mission preparatory team had discussions regarding:

- the Terms of Reference for the ARTEMIS review of the Latvian strategy to fulfil obligations from article 14(3) of the Waste Directive; and
- the relevant detailed aspects for organization and conduct of the review.

IAEA staff presented the ARTEMIS principles, process and methodology. This was followed by a discussion on the work plan for the implementation of the ARTEMIS review in Latvia in December 2019.

Ms Dace Šatrovska was appointed as the National Counterparts for the ARTEMIS mission and designated IAEA point of contact.

Latvia provided IAEA with the Advance Reference Material (ARM) for the review at the end of September 2019.

B) REFERENCES FOR THE REVIEW

The articles of the *Waste Directive*, the draft guidelines for the ARTEMIS review service and the responses to the self-assessment questionnaire were used as the basis for the review together with the ARM and materials presented during the mission and associated discussions. The complete list of IAEA publications used as the basis for this review is provided in Appendix E.

C) CONDUCT OF THE REVIEW

The initial Review Team meeting took place on Monday, 2 December 2019 in Riga, directed by the ARTEMIS Team Leader Mr David Ulfbeck, the ARTEMIS Team Coordinator Mr Vladan Ljubenov and the Deputy Team Coordinator, Ms Merle Lust.

The National Counterparts Ms Dace Šatrovska and Mr Andris Romans were present at the initial Review Team meeting, in accordance with the ARTEMIS guidelines, and presented logistical arrangements planned for the mission.

The ARTEMIS entrance meeting was held on Tuesday, 3 December 2019, with the participation of the Ministry of Environmental Protection and Regional Development, Latvian Environment, Geology and Meteorology Centre and Radiation Safety Centre of State Environment Service senior management and staff. Opening remarks were made by Ms Elita Baklāne - Ansberga, Director - General of the State Environmental Service of the Republic of Latvia, Ms Silvija Nora Kalniņš, Deputy Director of the Department of Environment Protection, Ministry of Environmental Protection and Regional Development, Ms Dace Šatrovska, Director of the Radiation Safety Centre of State Environmental Service, and Mr David Ulfbeck, ARTEMIS Team Leader. Ms Silvija Nora Kalniņš, Ms Dace Šatrovska and Mr Vladislavs Beļskis gave an overview of the Latvian context.

During the ARTEMIS mission, a review was conducted for all review topics within the agreed scope with the objective of providing Latvian authorities with recommendations and suggestions for improvement and, where appropriate, identifying good practice.

The ARTEMIS Review Team performed its review according to the mission programme given in Appendix B.

The ARTEMIS Exit Meeting was held on Tuesday, 10 December 2019. Opening remarks were made by Ms Rudite Vesere, Director of Environmental Protection Department of the Ministry of Environmental Protection and Regional Development. A presentation of the results of the Review Mission was given by the ARTEMIS Team Leader Mr David Ulfbeck. Closing remarks were made on behalf of the IAEA by Ms Joanne Brown, Unit Head, Assessment and Management of Environmental Releases Unit, the Division of Radiation, Transport and Waste Safety, IAEA Department of Nuclear Safety and Security.

An IAEA press release was issued.

1. NATIONAL POLICY AND FRAMEWORK FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT

1.1. NATIONAL POLICY

Latvian position

The Latvian policy for management of radioactive waste is primarily set out in the Law on Radiation Safety and Nuclear Safety, the Regulations No 129 “Requirements for Operations with Radioactive Waste and Materials Related Thereto”, and in the Environmental Policy Framework for 2014-2020. In addition, the policy is presented with reference to the principles underpinning the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management and 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.

The Environmental Policy Framework for 2014-2020 (Cabinet Order No 130, March 26, 2014) presents the general policy goal in Latvia with respect to environmental protection, including the overarching aim to establish a radioactive management system which is safe for the environment and population of Latvia.

Annex No 5 of the Environmental Policy Framework describes the *Radioactive Waste Management Programme* (the strategy). The strategy also states the general purposes and principles of the policy for radioactive waste management, including the principles of avoiding to place undue burdens on future generations, waste minimization, interdependencies in waste management, reliance on safety in long term depending on passive features, application of the graded approach in management of radioactive waste and ascertaining the responsibility of the licence holder as well as the ultimate responsibility of the state. Several of these elements are also embedded in the Law on Radiation Safety and Nuclear Safety, including the provision for state supervision of the national disposal site “Radons” after closure.

The policy includes no specific provision of a framework for identifying and meeting needs in the area of research and development in order to achieve the policy goals. The Latvian approach has in practice been governed by contracting of services or through international cooperation in response to needs as they are identified, and when capacities are not internally available. Similar arrangements are practiced for assurance of human resources.

Financial resources for the achievement of the policy goals are secured for 7-year periods corresponding to the planning periods of the Environmental Policy Framework.

ARTEMIS observation

The overarching, long term goals of the stated policy refer to the basic principles referenced above, but does not provide a statement on long term goals for safe management of existing and future radioactive waste, in particular intermediate level waste (ILW), which is not suited for disposal in the near surface disposal facilities currently in operation. However, Regulation No 129 does specify general criteria for disposal in near surface as well as geological disposal facilities. ILW is currently foreseen to be stored for up to 50 years pending a decision on

management. The aspect of defining long term goals for such waste streams was addressed in recommendation R3 of the IRRS mission report from 2019 for Latvia.

It was conveyed to the ARTEMIS Review Team, that the options for including further statements regarding long term goals for waste management, extending the 7-year planning periods of the Environmental Policy Framework will be taken into consideration for the next planning period from 2021-2027.

In this context, inclusion of clear statements regarding the preferred management options until achievement of the policy goal, including a basis for how to select such options, for all types of waste not suited for near surface disposal, would strengthen the overall framework for radioactive waste management in Latvia. This is in particular the case for ILW.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
<p>Observation: <i>Radioactive waste, in particular ILW, which is not suited for disposal in the near surface disposal facilities currently in operation, is foreseen to be stored for up to 50 years pending a decision on further management.</i></p>	
(1)	<p>BASIS: GSR Part 5 Requirement 2, states that “...The national policy and strategy shall form the basis for decision making with respect to radioactive waste management”</p>
(2)	<p>BASIS: GSR Part 5 Requirement 2, para 3.5 states that “The national policy on radioactive waste management has to set out the preferred options for radioactive waste management....”</p>
S1	<p>Suggestion: The government should consider including clear statements in the policy, detailing the preferred management option for ILW, providing a basis for decision regarding the long term management of ILW ultimately leading to the policy goal. These statements should be reflected in the strategy.</p>

1.2. LEGAL, REGULATORY AND ORGANISATIONAL FRAMEWORK (PARTLY REFERRING TO IRRS)

Latvian position

The Cabinet of Ministers holds responsibility for defining the policy for radioactive waste management, following the procedures set in the Cabinet Structure Law and in the Administration Structure Law. These arrangements specify that the relevant ministry draft laws for approval by the Parliament (Saeima) and regulations and policy planning documents for approval by the Cabinet of Ministers.

The Ministry of Environmental Protection and Regional Development (MEPRD) is the responsible entity for legislative measures and policies related to the safety of radioactive waste management.

As such, the MEPRD is responsible for the development of the Environmental Policy Framework containing the strategy for management of radioactive waste defined in accordance with the policy goals. The MEPRD also holds responsibility for providing the necessary funding for the implementation of the strategy. The strategy operates on a 7 year basis, following a formal assessment and hearing process and final approval in the Cabinet of Ministers. MEPRD holds responsibility for monitoring overall progress in the implementation of the strategy.

In the context of radioactive waste management at the national level, the “Latvian Environment, Geology and Meteorology Centre” (LEGMC) has the delegated responsibility for all disposal and long term storage activities at the national storage and disposal facility, as well as decommissioning of the Salaspils research reactor and management of the resulting waste. The regulatory authority, the Radiation Safety Centre of the state administrative institution State Environmental Service (RSC SES) is the sole regulatory body overseeing decommissioning activities, radioactive waste management, storage and disposal.

The LEGMC and the RSC SES contribute to the process of developing, reviewing and updating the strategy. The RSC SES and LEGMC are institutions subordinate to the Ministry of Environmental Protection and Regional Development.. The IRRS mission to Latvia 2019 concluded that the RSC SES operates effectively independent.

The legal and regulatory framework for radioactive waste management in Latvia is centered around the provisions in the Law on Radiation Safety and Nuclear Safety, cabinet regulations, in particular the Regulations No 129 “Requirements for Operations with Radioactive Waste and Materials Related Thereto” and further cabinet regulations and laws, such as the Law on Environmental Impact Assessment.

The legal framework also refers to international instruments such as the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, and EU legislation, in particular 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.

The Law on Radiation Safety and Nuclear Safety defines a prohibition against import of radioactive waste into Latvia, except in cases where radioactive waste has been exported from Latvia for processing purposes. The law further sets requirements to be fulfilled for export of

radioactive waste from Latvia with the purpose of disposal, in accordance with the provisions in Council Directive 2011/70/Euratom.

The Law on Radiation Safety and Nuclear Safety sets the operators responsibilities with respect to ensuring minimization of waste, arrangements for return of disused sealed radioactive sources to the manufacturer, and to cover costs associated with waste management up to the stage of either long term storage for ILW or disposal for low level waste (LLW). The costs associated with long term storage and disposal are covered by the Latvian State through financial allocations to ensure operation and maintenance of the national disposal and storage site.

Regulation No 129 further specifies the requirements for waste characterization, record keeping, waste acceptance criteria (WAC) for storage and disposal and requirements for safety assessment. The need for setting legal framework provisions for safe planning and conduct of decommissioning was addressed in the recommendation R4 of the IRRS mission report from 2019 for Latvia.

ARTEMIS observation

The Latvian arrangements provide clear mechanisms for drafting, assessing and adopting legislative measures and policies related to radioactive waste management. Similar procedures for adoption of a strategy for radioactive waste management in reflection of national policy goals are in place. Designation of tasks and mandates related to these mechanisms appear well established. The legal and regulatory framework for management of radioactive waste covers the stages from waste generation up to storage or disposal as designated in the strategy.

As such and taking into account the outcomes of the IRRS mission in 2019, the foundations for a continued strengthening of a robust infrastructure for the safe management of radioactive waste in Latvia are well established.

2. NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT

2.1. SCOPE

Latvian position

The strategy, along with the legislation, reflects the national policy on the safe management of radioactive waste, as addressed in Chapter 1. The strategy includes an action plan, which covers the actions to be carried out to reach the goals set in the policy. The strategy has been evaluated by the environmental authorities and public through a Strategic Environmental Assessment. Chapter 4 and Table 7 of the strategy set out arrangements for implementing the strategy and define the entities responsible for completion of designated tasks.

Three main waste streams have been identified to be managed within the framework of the strategy:

- Waste stored or disposed of at the “Radons” facility;
- Institutional waste from current practices (approximately 1-2 m³ annually; cemented; mainly consist of radiation sources not governed by ‘return-back’ agreements, orphan sources, and metal scrap contaminated with radioactive substances;
- Decommissioning waste from the Salaspils research reactor (foreseen when decommissioning of the reactor starts; about 1,200 m³ of LLW and ILW for disposal or long term storage at the “Radons” facility).

Fresh fuel and spent fuel of the Salaspils research reactor was returned to Russian Federation in 2005 and 2008, respectively, therefore there is no spent fuel to be managed.

The strategy builds on the national framework for waste management, specifying the following waste management steps and responsible parties, from generation to disposal:

- Operators are required to deliver radioactive waste for storage or disposal at the “Radons” facility or, in the case of sealed radioactive sources, to have in place agreements to return the disused sources to the manufacturer or the supplier at the country of origin. Operators are also allowed to store waste for decay, reducing the inventory to be sent to “Radons” facility for disposal;
- Transport of radioactive waste is provided by LEGMC;
- Pre-disposal activities for radioactive waste are provided by LEGMC, in accordance with the waste characterization and class (LLW or ILW);
- Disposal at the “Radons” facility is only intended for LLW;
- For ILW which cannot be disposed of at the “Radons” facility, long term storage (at least 50 years) is foreseen.

The following decommissioning and waste management activities have been outlined in the strategy:

- The decommissioning and dismantling of the Salaspils research reactor;
- The construction of a new waste vault and a long term storage facility at “Radons” site to allow for waste streams from decommissioning of the Salaspils research reactor as well as storage of already existing ILW which is not suited for disposal in “Radons” facility;

- The improvement of the radiation safety-related information made available to the public and the carry-out of training activities in the area of radiation safety;
- The programme provides that a final cover for non-operating vaults is to be constructed, as part of the contract for the construction of the new radioactive waste disposal vault and of the long term storage facility.

The final management goal or route for radioactive waste that cannot be disposed of at the “Radons” facility has not yet been defined. For such waste types, the strategy also examines the feasibility of a regional solution in cooperation with other countries or disposal in a foreign country against payment.

Table 6 under Chapter 3 of the strategy evaluates the volume of planned radioactive waste in a long term at “Radons” facility, at first until 2030, when the decommissioning activities at the Salaspils site are currently foreseen to be completed, in addition to existing radioactive waste, and it extends up to 2040, when only additional institutional LLW and ILW is foreseen.

Apart from its mandatory review and update every 7 years, the strategy provides for its periodic self-assessment and external international assessment (peer review) at least once every 10 years. Involved institutions are drafting the Environmental Policy Framework for the period 2021-2027. The next period’s strategy will be an integral part of the forthcoming policy framework, as well. The new strategy is expected to be mainly governed by the concepts of the decommissioning of the Salaspils research reactor and the storage of radioactive waste as well as addressing issues on assuring safety.

ARTEMIS observation

The strategy identifies necessary measures at the “Radons” facility to be implemented in order to ensure long term safety of storage and disposal, including the construction of a new vault for disposal, the construction of a long term storage facility, long term safety improvements of the current radioactive waste vaults, and the improvement of the radiological monitoring system. In addition, the strategy identifies yearly measures to ensure maintenance of the “Radons” facility, as well as the continued need to search for an appropriate management solution for ILW. The construction of a new vault for disposal for LLW and a new long term storage for ILW had been foreseen for 2017-2018, but was delayed and a new procurement for design and detailed cost assessment has been published on 5 December 2019. .

The strategy had foreseen the decommissioning of the Salaspils research reactor in the period 2016-2020, but the incurred delays resulted in current forecast of activities to take place in 2026-2030.

The strategy specifies the plans for implementation of measures within the 7-year framework, but does not provide an overview of how the implementation of these measures contributes to the achievement of the long term goals expressed in the policy.

The strategy identifies the sequence of measures to be implemented within the 7-year framework, but does not explicitly account for the interdependencies between these measures. In addition, the foreseen revised timeframe for decommissioning of the Salaspils research reactor extends into the upcoming 7-year frameworks, and provisions to manage the transfer of tasks in the current strategy to the following one are not reflected.

Within the current planning period, provisions to accommodate the impact of the development of a decommissioning plan for the Salaspils research reactor and the update of the associated safety assessment, on projected amounts and classes of waste generated, the timely availability of pre-disposal management capacity, as well as storage and disposal capacity have not been

elaborated in the strategy, introducing uncertainties into the planning process leading to achievement of the policy goals.

All issues related to radioactive waste management are addressed in accordance with the general framework on environmental safety and protection in the country, e.g., through strategic environmental impact assessments, and the public and other interested parties are given good opportunities to participate in the decision-making process.

2.2. MILESTONES AND TIMEFRAMES

Latvian position

The strategy outlines milestones and timeframes for the implementation of specified activities in the context of the 7-year framework.

As illustrated in Table 7 of the strategy and Table 2 of the ARTEMIS self-assessment report, milestones pertaining to completion of planned measures at the strategy level for the “Radons” facility include conduct of long term safety assessment and the construction of new storage and disposal vaults, as well as improvements to the radiological monitoring system.

Of these activities, the long term safety assessment and improvements to the radiological monitoring system have been carried out within the set timeframes. For the remaining activities, new timeframes will be defined within the next planning period.

The decommissioning of the Salaspils research reactor was envisaged within the timeframe of 2016-2020, but has been postponed for the following two framework periods in the time from 2026-2030.

Completion of initiatives, such as improvements of safety for the existing structures, improvements to the radiological monitoring system, annual maintenance tasks, continued efforts to minimise waste generation, information, training and education tasks represent annually achieved milestones.

ARTEMIS observation

The policy defines radioactive waste management goals to be achieved within one or several decades, such as completion of decommissioning of the Salaspils research reactor, disposal of the resulting waste, storage and subsequent management of ILW and tasks to be carried out over the span of several hundred years (maintaining institutional control over the “Radons” facility). No milestones or timeframes are presented in the context of such long term activities.

Regarding the “Radons” facility, the construction of a final cover for non-operating vaults 1-6 would constitute a significant milestone in achieving a long term goal of the policy.

The strategy is prepared for 7 years, which is the longest possible term in accordance with the national development planning system, however according to the information provided, the options for including milestones and timeframes beyond the 7-year planning periods of the Environment Policy Guidelines will be taken into consideration for the next planning period 2021-2027.

Whilst completion of tasks identified as essential for the strategy provides important information in defining the sequence, nature, timeframes and milestones related to subsequent

tasks, monitoring the annually achieved tasks seems to add information with only limited value to that process.

2.3. PROGRESS INDICATORS

Latvian position

The MEPRD, RSC SES and LEGMC have been charged with the responsibility for monitoring the progress of the implementation of the activities set out in the strategy each in their area, while MEPRD is responsible for monitoring the overall progress.

In 2019, to improve monitoring of progress, a supervisory body (group) was established by the MEPRD which includes representatives from the Ministry and RSC SES to monitor progress on the implementation of the strategy activities. LEGMC will regularly be invited to provide information on the project progress.

Each institution (MEPRD, LEGMC, RSC SES) also monitors progress on an annual basis.

Table 2 in the Latvian self-assessment report inter-relates the various activities and timeframes under the strategy for period 2016-2020 with the progress made under each activity. The indicators set in this way refer to achievement of the same tasks which are defined as milestones.

Since adoption of the strategy, progress in implementation has been hampered by delays, in particular due to failures of the procurement process.

Provisions for monitoring of progress have been established through informative reporting to the Cabinet of Ministers and mid-term review of the Environmental Policy Framework. On shorter time scales, this happens through reporting on progress related to the delegated agreements between the LEGMC and MEPRD, work plans of the RSC SES and meetings of the supervisory body (group). Provisions for allocating funding for contingencies also exist through Regulations No 421 and 129.

ARTEMIS observation

In the strategy, no clear distinction is made between the use of milestones and progress indicators, and progression towards achievement of goals lying beyond the 7-year framework of the Environmental Policy Framework is not addressed.

Progress indicators for implementation of the strategy within the 7-year period have been defined and are monitored through several mechanisms at different hierarchical levels and on different timescales. As such, the entities responsible for the implementation of the strategy are in a good position to follow progress in the implementation of the strategy.

Despite the monitoring and mitigating mechanisms in place, the conduct of the strategy has experienced significant delays.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *The achievement of long term goals expressed in the national policy is not clearly addressed in the strategy. The strategy does not take into consideration all the interdependencies between the main activities and the associated uncertainties in knowledge, until closure of facilities and post-closure activities.*

(1)	BASIS: GSR Part 1 (Rev. 1), Requirement 1, para. 2.3 states that “National policy and strategy for safety shall express a long term commitment to safety”. [...]
(2)	BASIS: GSR Part 5, Requirement 2, para. 3.5 states that “The national policy on radioactive waste management [...] has to be based on knowledge of the waste to be managed (e.g. knowledge of the inventory and of waste streams) now and in the future.
(3)	BASIS: SF-1, Principle 5, para. 3.22 states that “[...] Where there are interdependences between related actions or between their associated risks (e.g. for different stages of the lifetime of facilities and activities, for risks to different groups or for different steps in radioactive waste management), these must also be considered. Account also has to be taken of uncertainties in knowledge”.
(4)	BASIS: GSR Part 1 (Rev. 1), Requirement 10, para. 2.30 states that “Radioactive waste generated in facilities and activities shall be managed in an integrated, systematic manner up to its disposal. The interdependences of the steps in the entire management process for radioactive waste [...] shall be recognized”. BASIS: GSR Part 1 (Rev. 1), Requirement 10, para. 2.29 states that “In strategies for radioactive waste management, account shall be taken of the diversity between types of radioactive waste and the radiological characteristics of radioactive waste”.
(5)	BASIS: GSR Part 5, Requirement 6 states that “Interdependencies among all steps in the predisposal management of radioactive waste, as well as the impact of the anticipated disposal option, shall be appropriately taken into account”.
R1	Recommendation: The government should ensure that the strategy reflects the preferred long term management options stated in the policy, including interim targets and end states.
R2	Recommendation: The strategy should take into account the interdependencies between related actions and their associated risks, considering uncertainties in knowledge.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *The strategy includes milestones, key indicators and timeframes to enable assessment and monitoring of the actions detailed for the 7 year planning periods of the strategy. Nonetheless the conduct of the strategy has experienced significant delays despite the mechanisms in place designed to mitigate such delays.*

(1)	<p>BASIS: SF-1, Principle 3, para. 3.14 states that <i>“An important factor in a management system is the recognition of the entire range of interactions of individuals at all levels with technology and with organizations. To prevent human and organizational failures, human factors have to be taken into account and good performance and good practices have to be supported”.</i></p>
(2)	<p>BASIS: GSR Part 2, Requirement 4, para. 4.5 states that <i>“Senior management shall ensure that goals, strategies and plans are periodically reviewed against the safety objectives, and that actions are taken where necessary to address any deviations”.</i></p> <p>BASIS: GSR Part 2, Requirement 13, para. 6.3 states that <i>“The corrective actions necessary for eliminating the causes of non-conformances, and for preventing the occurrence of, or mitigating the consequences of, similar safety related events, shall be determined, and corrective actions shall be taken in a timely manner”.</i></p>
R3	<p>Recommendation: The government should evaluate existing provisions to ensure the timely implementation of the strategy, including effective means of preventing and mitigating omissions, deviations, failures, and delays.</p>

3. INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE

Latvian position

The radioactive waste to be managed in Latvia as part of the strategy is classified into two main classes, compliant with the IAEA classification, according to the planned management route:

- a. LLW – for disposal at the “Radons” facility;
- b. ILW – for long term storage at the “Radons” facility.

WAC for disposal in the “Radons” facility are set in Regulation No 129. Radioactive waste that exceeds the WAC is accepted for long term storage.

The class of Very Low Level Waste is not considered, as this class of waste is disposed together with LLW. The High Level Waste class is considered, but there is no such waste in the country. There is no spent fuel in the country, as all fuel from the Salaspils research reactor has been sent to the country of origin in 2008 and no waste from reprocessing will be returned to Latvia. The use and import of spent nuclear fuel is not allowed in the country.

The radioactive waste decay storage and clearance levels are defined in Regulation No 129. Exemption levels are also defined (Regulation No 752), but only for sources of ionizing radiation.

The LEGMC is responsible for the record keeping of the inventory of the radioactive waste, which includes the radioactive waste at the “Radons” facility (in long term storage and disposed of) and at the Salaspils research reactor (collected for pre-disposal management). The site inventories are annually submitted to RSC SES, which supervises the radioactive waste inventory and centrally manages and supervises the inventory of all the radiation sources in the country (about 40 operators use radioactive sources in Latvia, including 4 high-activity sealed radioactive sources). The total amount of existing radioactive waste at the “Radons” facility is approximately 890 m³ (out of which 6% is ILW) with about 274 TBq of calculated total activity, as of January 2019.

Estimation of future radioactive waste amounts is carried out by LEGMC in cooperation with RSC SES. The expected annual volume of institutional waste is about 1 m³, based on the received volumes over the last 6 years. It is anticipated that the decommissioning of the Salaspils research reactor will generate around 1200 m³ of the radioactive waste, which is more than the total amount of waste currently managed at the “Radons” facility. According to the data given in the Latvian self-assessment, only about 10 m³ of the waste resulting from the decommissioning of the Salaspils research reactor will need to be stored in a long term as ILW and the rest of the waste is expected to comply with the WAC for disposal.

ARTEMIS observation

Taking into account suggestion S9 of the 2019 IRRS mission regarding update of the regulation concerning classification of radioactive waste, the ARTEMIS Review Team is of the opinion that the Latvian radioactive waste classification is directly related to and serves the country’s waste management infrastructure and implementation of the strategy.

It was noted that the national radioactive waste inventory currently includes the waste at the “Radons” facility as well as includes the inventory of the radioactive waste collected from operators (institutional waste), but does not specify the inventory of existing radioactive waste from previous decommissioning activities presently stored at the Salaspils site.

LEGMC maintains an electronic radioactive waste database in accordance with internal procedures, recording amongst others the code, dates, contents (nuclides, activities, type and composition), volume, mass and the place of disposal for presently managed waste. For waste disposed in “Radons” facility’s vaults 1-6 the records were established at the time of disposal according to available information, including the passports for DSRS, on all radioactive waste and is kept in archive as well as is entered in waste inventory. The records do not include information related to potential additional contents (e.g., organic material; hazardous substances), nor specific physical and chemical properties. Such details of information are essential for conducting safety analyses.

The current WAC set out in Regulation No 129 define the maximum nuclide specific disposable activity for a 0.2 m³ package and a 100 m³ vault. It was noted that the disposable activity per vault criteria is often more restrictive than a simple sum of the maximum permissible activity of packages. However, for a number of nuclides, the maximum disposable amount of activity pr. vault appears to be several orders of magnitude higher than the sum of disposable activity pr. package. For some nuclides, no limit for disposable amount of activity pr. vault is given. No explanation for the interrelation between these criteria was provided.

Waste resulting from past activities was disposed of at the “Radons” facility since 1962 including some cemented, long-lived ILW. In total, an estimated 35 m³ ILW has been disposed of in the facility vaults 1-6. LEGMC has not verified the legacy records related to that waste. Experiences from similar facilities in other countries show that discrepancies exist between records and verified data on waste inventories and forms, so historical data should be used with caution. The safety assessment of the “Radons” facility was conducted using the unverified historical data, without considerations given to their uncertainties and to the impact of uncertainties on the assessment results. It was noted that there are no general requirements for evaluation of uncertainties and for sensitivity analysis with regard to safety assessments.

Considering the outcome of the long term safety assessment, it was deemed safer to keep the already disposed ILW in the closed vaults rather than to retrieve it for further management.

The end goal for management of about 38 m³ of ILW (18 m³ already stored, 10 m³ foreseen from the decommissioning of the Salaspils research reactor and further 10 m³ from institutional applications) that cannot be disposed of at the “Radons” facility, has not been decided.

It was noted that estimated amounts and classification of future waste resulting from the decommissioning of the Salaspils research reactor has changed as different assessments have been undertaken. The estimated amounts cover a span of about 30%. In addition, new radioactive waste streams are expected to arise during decommissioning (e.g. graphite and beryllium) and these will need special management.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *The data recorded in the radioactive waste inventory of disposal vaults 1-6 at the “Radons” facility has not been subjected to verification. That inventory data has been used in safety assessments without assumptions on uncertainties. There was no sensitivity analysis performed to evaluate impact of uncertainties of inventory data on compliance with safety criteria.*

(1)	<p>BASIS: GSR Part 4 (Rev. 1) Requirement 17 states that: <i>“Uncertainty and sensitivity analysis shall be performed and taken into account in the results of the safety analysis and the conclusions drawn from it. [...]”</i></p> <p><i>4.59. Uncertainties in the safety analysis shall be characterized with respect to their source, nature and degree, using quantitative methods, professional judgement or both. Uncertainties that may have implications for the outcome of the safety analysis and for decisions made on that basis shall be addressed in uncertainty and sensitivity analyses. [...]”</i></p>
(2)	<p>BASIS: SSG – 23, para 4.39 states that <i>“The description of the disposal system should provide information on the data supporting the safety assessments, including the following:</i></p> <p><i>[...]”</i></p> <p><i>— A description of how the radionuclide inventory has been estimated, and the uncertainties associated with the inventory; [...]”</i></p>
R4	<p>Recommendation: The government should establish requirements for management of uncertainties in order to evaluate the sensitivity of the safety and radiological analysis.</p>
S2	<p>Suggestion: The implementer should consider further analyzing the impact of uncertainty of the inventory on the results of safety and radiological analysis.</p>

4. CONCEPTS, PLANS AND TECHNICAL SOLUTIONS FOR SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT

Latvian position

The MEPRD is preparing the draft Environmental Policy Framework for the 2021-2027 period, involving all relevant institutions. This will include the strategy for radioactive waste management, containing concepts, plans and technical solutions.

There are legally binding documents concerning concepts and plans for radioactive waste management:

- Radioactive Waste Storage Concept (adopted by the Cabinet, 2003)

This Concept anticipated construction of two disposal vaults and one radioactive waste long term storage facility at the “Radons” site, as well as improvements of safety and radiation monitoring systems of the existing vaults. However, the strategy calls for constructing of only one disposal vault, on the basis of availability of funds and the reassessment of the estimated future volumes of the radioactive waste.

- Concept for the Decommissioning and Dismantling of Salaspils Nuclear Research Reactor (adopted by the Cabinet, 2004)

The decommissioning concept for the Salaspils research reactor, approved in 1999, called for dismantling up to a “green field” condition. The new decommissioning concept from 2004, considers restricted release as an end state, specifying the need for maintaining institutional control for at least 60 years due to radioactive contamination of soil at the reactor site. The needs for extending institutional control will be evaluated after completion of decommissioning.

On this basis, the current strategy describes the foreseen technical solutions for each of 3 main waste streams within the country; waste from past activities disposed of at “Radons” facility; institutional waste currently produced; and future waste resulting from the decommissioning of the Salaspils research reactor. The strategy specifies the overall management steps for decommissioning, processing, storage and disposal, although without addressing the disposal of the presently stored and future arisings of ILW.

Predisposal activities

Predisposal activities for radioactive waste are provided by LEGMC in accordance with the waste characterization and classification. Processing activities are carried out at:

- the “Radons” facility (the radioactive waste volume reduction, disassembling of smoke detectors and removal of DSRS);
- the Salaspils research reactor (semi-automatic radioactive waste cementation, segmentation of metallic piping).

The existing equipment is sufficient for processing of current and future institutional radioactive waste streams. The ILW is not currently cemented for disposal, since there is no solution for its disposal yet.

The same type of containers is used for disposal and for long term storage, which allows for standardised dose rate measurements and easier handling.

After decommissioning of the Salaspils research reactor, all current waste processing activities and related infrastructure will be transferred to the “Radons” facility, but plans and schedule for that transfer are not available yet.

Decommissioning

After an unsuccessful tendering process, it is planned that the decommissioning of the Salaspils research reactor will take place in the period 2026-2030, depending on linked activities. All radioactive waste from decommissioning which meets the WAC will be disposed of in the disposal vaults of the “Radons” facility. The radioactive waste that does not comply with WAC for disposal will be placed in long term storage.

Storage and Disposal

At the beginning of 2019, about 73 m³ of LLW and ILW radioactive waste was stored and about 818 m³ of LLW and ILW, including some 26 000 disused sources, was disposed of at the “Radons” facility. The reactor hall of the Salaspils research reactor is also being used as a temporary storage of the radioactive waste waiting for processing.

LEGMC will provide long term storage (at least 50 years) for ILW waste that cannot be disposed of at “Radons” facility. Additionally, this facility does not have enough capacity for disposal of the waste that will be generated by the decommissioning of the Salaspils research reactor. For these reasons, the construction of a new disposal vault and a long term storage facility was scheduled for 2017-2018. However, this was not accomplished due to the failure of the procurement processes. As of September 2019, the preparation of new procurement for implementation of the two activities is in progress. A new procurement for design and detailed cost assessment for facility “Radons” has been published on 5 December 2019. It is also planned to construct a final cover for the non-operating vaults, together with the construction of the new vault.

The concept for the post-closure period of disposal vaults is described in Regulation No 129, Chapter X “Requirements for Radioactive Waste Management after Closure of Radioactive Waste Vault and Termination of Disposal Site Operation” (including monitoring, institutional controls and long term knowledge preservation measures). The safe disposal of radioactive waste is the responsibility of the government, as well as the post-closure period of the disposal facility. After closure of the repository, state supervision must be ensured for at least 300 years.

Regarding the final solution for disposal of the ILW waste that is not accepted for disposal at “Radons”, there is no defined management route yet. Regulation No 129 provides criteria defining that ILW should be disposed of in a geological disposal facility. Considered options include regional disposal programme or disposal in a foreign country against payment.

ARTEMIS observation

The ARTEMIS Review Team was informed about the main priorities of the Latvian strategy for the radioactive waste management namely the decommissioning of the Salaspils research reactor and the expansion of the disposal capacity of “Radons” facility, together with the construction of a new long term storage facility within the site.

Concerning the decommissioning, further to some previous concepts (and safety evaluations thereof) a new detailed decommissioning plan supported by a safety assessment is going to be elaborated by an external contractor through a new procurement process.

The conduct of the reactor decommissioning and all the related predisposal waste management activities will be outsourced as part of a second procurement process.

Since Latvia has no approved plan covering the final disposal of the present and future ILW, this type of waste is stored with minimal pre-conditioning (although there is 5 m³ of ILW that was cemented in the packages). Although the 50-year long storage concept reduces the urgency of finding a solution for disposal of the ILW, no specific activities, including R&D, are in place or planned to address the final solution for this waste.

The ARTEMIS Review Team took into account the finding of the IRRS mission that existing regulations do not contain requirements to ensure the stored waste can be inspected and monitored (Suggestion S7). It was concluded that there are no requirements nor specific set of WAC in place to ensure that the ILW will remain in such a condition after 50-year long storage period that will allow retrieval and further management. The related technical solutions and internal procedures to ensure such measures were not presented.

The counterparts informed the ARTEMIS Review Team that tritium leakage was detected at one of vaults of the “Radons” facility. To supervise this situation improved monitoring system, including groundwater monitoring wells and boreholes for dose rate measurements was introduced in 2018, also taking into account conclusion of the “Long term safety assessment for the radioactive waste disposal site “Radons”” (prepared by Consortium d'ASSistance Operationnelle aux Pays de l'Europe de l'Est (CASSIOPEE), 2001).

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *There is ILW (of which 5 m³ were cemented) stored in the “Radons” facility, awaiting further management. There are some approved conceptual documents concerning the 50-year-long storage and general provisions in regulations for long term storage. However, specific WAC, requirements and provisions for the long term storage to preserve the ILW in a condition suitable for its subsequent management are not detailed.*

(1)	<p>BASIS: GSR Part 5 Requirement 11 states that <i>“Waste shall be stored in such a manner that it can be inspected, monitored, retrieved and preserved in a condition suitable for its subsequent management. Due account shall be taken of the expected period of storage, and, to the extent possible, passive safety features shall be applied. For long term storage in particular, measures shall be taken to prevent degradation of the waste containment.”</i></p>
(2)	<p>BASIS: GSR Part 5 Requirement 4, para 3.11. states that <i>“Depending on the complexity of the operations and the magnitude of the hazards associated with the facility or the activities concerned, the operator has to ensure an adequate level of protection and safety by various means, including:</i> <i>[...]</i> <i>—Derivation of operational limits, conditions and controls, including waste acceptance criteria, to assist with ensuring that the predisposal radioactive waste management facility is operated in accordance with the safety case;</i> <i>[...]</i>”</p>
(3)	<p>BASIS: WS-G-6.1, para. 6.6 states that <i>“Waste acceptance criteria should be developed for the storage facility, with account taken of all relevant operational limits and future requirements for disposal, if the latter are known.”</i></p>
R5	<p>Recommendation: The government should establish requirements for the long term storage to ensure that waste is preserved in a condition suitable for its subsequent management.</p>
R6	<p>Recommendation: The implementer should further develop specific waste acceptance criteria for the long term storage and set out procedures to ensure that waste is preserved in a condition suitable for its subsequent management.</p>

5. SAFETY CASE AND SAFETY ASSESSMENT OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT ACTIVITIES AND FACILITIES

Latvian position

The legislation lays down requirements for the safety demonstration of radioactive waste management activities in the lifetime of a facility.

When performing a safety assessment, the operator has to comply with the requirements in Regulation No 129, as well as with IAEA standards relating to safety assessment (SSG-23, GSG-3, WS-G-2.5 and WS-G-6.1), made available at the SES website.

Regulation No 129 defines that a long term safety assessment of a radioactive waste disposal facility has to be performed as following: in the case of a new radioactive waste disposal facility, prior to the establishment of the facility; in the case of an existing facility, prior to any amendments to the licence resulting from essential safety modifications to the facility or prior to closure (for disposal facilities). In any case, a long term safety assessment has to be conducted once every 10 years, prior to submitting the application for a licence for the operation of the facility.

Regulation No 129 further specifies time periods to be considered in safety assessment for a near-surface repository (1000-year period) and for a geological repository (minimum 10 000-year period), and defines exposure pathways, as well as boundary conditions for accident scenarios to be considered in the safety assessment.

The RSC SES assesses and reviews the alignment of the (long term) safety assessment with the Regulation and the aforementioned IAEA standards as stated in RSC SES internal procedures (Quality Guidelines for Procedures).

Environmental impact assessments are referenced as documentation for safety as EIA cover aspects related to safety.

The legislation defines which facilities need to undergo an initial environmental impact assessment, depending on the complexity of the practices and related facilities. Facilities or sites for final disposal of radioactive waste require an impact assessment (Annex 1 of the Environmental Impact Assessment Law), while facilities for processing and storage of radioactive waste require an initial assessment (Annex 2 applies to all facilities where Annex 1 does not apply). In the case of an environmental impact assessment, the acceptance of planned activities is decided by the Cabinet of Ministers.

In particular to disposal at “Radons”, several safety assessments have been carried out during the past years in order to evaluate the feasibility of potential solutions and the long term impact of the “Radons” facility on safety issues, including safety after closure:

- a. An Environmental Impact Assessment for the construction of the new vault (two vaults initially) and the long term storage facility at the disposal site “Radons” was carried out in 2005 and approved in 2008. Various options were considered under this assessment in terms of economic, social, technical, safety, environmental, hydrological, air pollution, public health and land-use issues;
- b. The safety assessment for the “Radons” facility was initially carried out in 2001 and revised in 2016.

The recent assessment covered both the existing facility and the planned constructions. The report: provides details as concerns the geomorphological and other physical characteristics of the “Radons” facility area; describes the existing seven vaults (construction materials, sizes,

volumes, etc.) and the new planned disposal vault and a long term storage vault (construction materials, volumes, activities to be disposed or stored, etc.); and the activities of radionuclides disposed of or stored in the existing seven vaults, as well as the planned waste activities (mostly to be generated from decommissioning of Salaspils Research Reactor) to be disposed of there. The report also reviews the criteria for classification and acceptance of radioactive waste, as well as the security and monitoring measures, and potential safety and security emergency scenarios.

The safety assessment proposed safety upgrades to be considered at the disposal site, such as the elaboration of technical designs of multi-layer constructions of the new vaults and closure top covers (final covers) for non-operating vaults; specification of hydrogeological parameters in the area of the “Radons” facility; modification of the monitoring programme when the construction of the new vaults is completed; installation of additional monitoring wells, if necessary; and closure of non-operating vaults by constructing multi-layer top covers.

Regarding decommissioning at the Salaspils site, the need to develop the legal requirements for content of a decommissioning plan as a basis for the safety assessment for decommissioning was addressed in the 2019 IRRS report for Latvia. Nevertheless, the Salaspils research reactor decommissioning concept was approved in 1999, foreseeing the reactor to be dismantled and the site to be released from regulatory control (“green field”). Subsequent discovery that contamination on the site might require institutional control for a minimum of 60 years led to the revision of the foreseen end state after decommissioning and to an update of the accompanying safety assessment in 2003. An environmental impact assessment was performed in 2004. The intention for the safety assessment of the Salaspils research reactor is to be updated as a part of a final decommissioning plan, to be developed as part of the next Environmental Policy Framework for the period 2021-2027.

Radiological and environmental monitoring is carried out at the reactor site to ensure its safe management, and regular inspections are carried out by the regulatory body.

ARTEMIS observation

The ARTEMIS Review Team has taken note of the binding nature of application of the aforementioned IAEA standards when performing a safety assessment by the operator, as well during the review and assessment of conformity with the standards by the regulator. This procedure is considered a good approach to underpin safety.

Despite the lack of legal requirements for the content of a decommissioning plan, several assessments of safety associated with the decommissioning of the Salaspils research reactor have been conducted in the past.

The environmental impact assessment for the “Radons” disposal site integrates long term safety aspects of the facility (including the post-closure safety). The requirements for performing safety assessments either in the context of EIA or as separate assessments are detailed in Regulation No 129.

Since end of operations, the Salaspils research reactor has been under safe management and maintenance and, in addition, pre-disposal activities (segmentation and cementing of waste), including storage of radioactive waste, takes place inside the reactor hall. No evidence was presented that ongoing activities at Salaspils research reactor (care and maintenance of the facility and predisposal waste management activities), as well as the impact of one to another are covered by updated safety assessment.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *Although the main elements of regulatory and legislative framework relating to the safety assessment of facilities and activities are in place, there was no evidence presented that ongoing activities at the non-operational Salaspils research reactor (care and maintenance of the facility and predisposal waste management activities) are covered by updated safety assessment.*

(1)	BASIS: GSR Part 4 (Rev. 1) Requirement 2 states that <i>“A safety assessment shall be carried out for all applications of technology that give rise to radiation risks; that is, for all types of facilities and activities.”</i>
(2)	BASIS: GSR Part 6 Requirement 6, para. 3.4 states that <i>“The responsibilities of the licensee shall include: - Ensuring that the facility is maintained in a safe configuration during the period of transition following permanent shutdown and until the approval of the final decommissioning plan.”</i>
R7	Recommendation: The implementer should ensure that the safety of ongoing activities at Salaspils research reactor is assessed.

6. COST ESTIMATES AND FINANCING OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT

Latvian position

Law on Radiation Safety and Nuclear Safety considers the “polluter pays” principle. Nevertheless, the number of operators producing radioactive waste is small (about 40) and it is considered that these operators cannot fully cover the costs of radioactive waste management. Accordingly, the costs of long term storage and disposal are covered by the government. The government also has to ensure the necessary funding for decommissioning of the Salaspils research reactor and operation of the “Radons” facility. The 300-year institutional control period for the “Radons” facility is also a responsibility of the government, but the associated costs have not been estimated yet.

The radioactive waste management strategy is part of the Environmental Policy Framework, operating on a 7-year cycle, currently covering the 2014-2020 period. The funding required for the implementation of the strategy is reviewed along with the review of the overall policy implementation and whenever circumstances mandate.

A decommissioning concept for the Salaspils research reactor was approved by Cabinet Order No 958 in 2004. The options considered at that time required up to 11 M€ (15.8 M LVL) financing from the government for handling the spent fuel and decommissioning the facility. For the period 2015-2020 the foreseen financing was 5.7 M€ for the decommissioning of the reactor and 1.4 M€ for the construction of a new vault at “Radons” facility. However, the responses to the tendering exceeded the allocated funds and the procedures were halted.

The next tendering procedure for decommissioning of the Salaspils research reactor will be split in two parts, with the first part to be launched in 2020. The scope of the first procedure is to develop a decommissioning plan and estimate the costs associated with the implementation. After that, funding will be requested to the government and a new tendering procedure for conduct of decommissioning will be launched. As a consequence, it is now foreseen that the decommissioning of the Salaspils research reactor will take place in the period 2026-2030. A new tendering procedure for the construction of the new vault at “Radons” facility has been launched on 5 December 2019. It is foreseen in the tendering documentation for the new vault that after the re-assessment of the radioactive waste resulting from decommissioning of Salaspils research reactor is done, the planned volume of the new vault shall be specified accordingly if it differs from currently estimated volumes of the radioactive waste significantly.

It is expected that the radioactive waste management strategy for the 2021-2027 cycle will be prepared and approved in 2020. The main foreseen tasks during the period after 2020 are conducting the decommissioning of the Salaspils research reactor, as well as the maintenance of the “Radons” facility, expansion of the disposal capacity and construction a new long term storage facility. It is estimated that the maintenance expenses of the Salaspils research reactor and the “Radons” facility after 2020 will be kept at present level (up to 350 k€/year).

ARTEMIS observation

Latvia is a country with a small number of operators generating radioactive waste, but with a significant inventory of waste from past activities.

The absence of a final decommissioning plan for the Salaspils research reactor creates uncertainties on the amounts and classes of future radioactive waste that needs to be disposed

of and, consequently, on cost estimation and financing for the main waste generating activity defined in the policy for radioactive waste management.

In addition, the lack of a designated management goal for ILW precludes the possibility of estimating the overall costs associated with management of this waste stream.

Accordingly, the total costs for achieving the goals for safe management for all classes of existing and future radioactive waste have not been estimated and remain poorly constrained.

The cost estimation that was used for the recent tendering procedures for decommissioning of the Salaspils research reactor and for construction of an additional vault at the “Radons” facility appeared to be inadequate for the changing circumstances, thus contributing to a failure of the tender process and introducing significant delays in the implementation of the planned activities.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: <i>There is no estimate of the total cost for achieving the goals for safe management for all classes of existing and future radioactive waste. The cost estimation used for tendering decommissioning and radioactive waste management tasks appeared to be inadequate for the changing circumstances, thus contributing to a failure of the tender process and to significant delays in implementation of activities.</i>	
(1)	BASIS: GSR Part 1 (Rev. 1) Requirement 10, para. 2.33 states that <i>“Appropriate financial provision shall be made for:</i> <i>(a) Decommissioning of facilities;</i> <i>(b) Management of radioactive waste, including its storage and disposal;</i> <i>[...]”</i>
(2)	BASIS: GSR Part 6, Requirement 9, paras 6.1, 6.2 and 6.5 state that <i>“6.1. It shall be ensured that adequate financial resources to cover the costs associated with safe decommissioning, including management of the resulting waste, are available when necessary.</i> <i>6.2. The cost estimate for decommissioning shall be updated on the basis of the periodic update of the initial decommissioning plan or on the basis of the final decommissioning plan. The mechanism used to provide financial assurance shall be consistent with the cost estimate for the facility and shall be changed if necessary.</i> <i>6.5. If the decommissioned facility is to be released with restrictions on its future use, financial assurances shall be such that financial resources are available for monitoring, surveillance and control of the facility throughout the necessary time period.”</i>
R8	Recommendation: The government should ensure that adequate cost estimates are made timely available to facilitate appropriate financing for achieving the goals for safe management of all classes of existing and future radioactive waste.

7. CAPACITY BUILDING FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT – EXPERTISE, TRAINING AND SKILLS

Latvian position

Regulation No 129 prescribes that the operator has to provide the necessary financial, technical and human resources to ensure radiation safety. Regulation No 149 sets requirements for the operator to appoint a sufficient number of trained workers and to ensure their regular training. According to Regulation No 752, radiation safety training is assured at least every five years within the framework of a programme developed by an educational institution, as well as upon changes of duties or introduction of new equipment or procedures. Educational institutions coordinate the content of the training programmes in radiation safety with the regulatory body and with relevant professional associations.

Radiation safety experts and other involved specialists can acquire basic education and additional training at the University of Latvia (physics, chemistry), Riga Technical University (medical physics) and Riga Stradiņš University (medicine). Research and development activities on radioactive waste management are limited, but the University of Latvia is involved in the European Concerted Programme on Radiation Protection Research programme (CONCERT) and in fusion-related activities, mainly focused on issues related to tritium retention in materials.

The MEPRD draws on the comprehensive human resources policy of the Latvian state in identifying and developing human resource and capacities in order to provide solutions in proportion to the needs identified. As such, several capacity strengthening actions of environmental authorities are financed from the State budget, including efforts to ensure the increase of capacity of environmental institutions in accordance with a graded approach and to provide training and exchange of experience for the employees of institutions supervising environmental protection.

In the framework of the strategy, the need to engage in:

- international training in the area of radioactive waste;
- regular training courses in the area of radiation safety (incl. radioactive waste management);
- improvement of the educational system on radiation safety (incl. radioactive waste management).

has been identified in recognition of the difficulties to establish a special education programme in the field of radioactive waste management in Latvia, and given the limited scope of the Latvian radioactive waste management commitments. Due to the specific nature of the field and tasks, it has been deemed impossible to maintain necessary skills within the internal pool of human resources.

LEGMC operates the “Radons” facility, is responsible for the permanently shutdown Salaspils research reactor and also acts as Technical Support Organization. New employees are required to have a university degree in physics, chemistry, environmental science or related fields and must be trained by the respective site radiation protection officer according to their duties. At least once every 5 years all employees from the Salaspils and “Radons” facilities (as well from other departments, which are involved in ionizing radiation related activities) attend a qualification course organised by experts from the University of Latvia. Workers of “Radons” facility are part of a national emergency response team and their responsibilities include removal of orphan radioactive sources or contaminated materials and their transportation to the

“Radons” facility. The requirement on emergency training for workers is laid down in the quality assurance programme of “Radons” facility.

LEGMC has currently a staff of 15 employees, engaged at the “Radons” facility (4 persons), Salaspils research reactor (2 persons), environmental laboratory (2 persons), Secondary Standard Dosimetry Laboratory (3 persons) and administrative staff (4 persons). The Salaspils research reactor staff members are beyond retirement age. Difficulties in recruitment of new staff are reported. One foreseen way to mitigate these difficulties is to manage staffing and new hiring for the “Radons” and Salaspils facilities together, exploring synergies.

The strategy identifies the decommissioning of the Salaspils reactor and the increase in disposal and storage capacity at the “Radons” site as central to achieving the policy goals. In preparation of these activities, the studies: “Radioactive Waste Storage Concept” and “Concept for the Decommissioning and Dismantling of Salaspils Nuclear Research Reactor” were conducted. Both studies were carried out, drawing on the resources supplied by external contractors. The same approach will be applied for the development of the final decommissioning plan, safety assessment and the cost estimate for the Salaspils research reactor. The actual conduct of decommissioning will be undertaken by an external contractor, who will deliver manpower, equipment and technical expertise. The engineering designs for the construction of new disposal vault, the long term storage facility, as well as the top cover of the disposal vaults 1-6 are also to be outsourced.

RSC SES has currently a staff of 15 employees with a university degree in physics, chemistry, medical physics, radiology, or related fields. Information on the RSC SES staff competence development and employee evaluation is provided in the RSC SES Quality Guidelines “Quality Management System Manual No KV_Vis_Rokasgramata”. The Quality Guidelines “Training Module” are elaborated and define the principles of personnel training and the necessary training themes. The RSC SES has developed Training Plan 2018-2022 aimed at acquiring technical knowledge and professional skills of staff (according to performed functions and assigned tasks). The plan is developed for 5 years, it is reviewed annually and updated as necessary.

The Recommendation R5 of the IRRS mission performed in 2019 recommended that RSC SES prepares an assessment of the necessary number of staff including competence and skills to perform its functions and to discharge its responsibilities, and based on this analysis to develop and implement a comprehensive human resources plan including, specific training programme, which is based on assessment of the necessary staff.

ARTEMIS observation

A significant amount of work at the “Radons” facility and at the Salaspils research reactor is foreseen in short- and mid-term to be managed by LEGMC and overseen by RSC SES. The implementation of the strategy also envisages outsourcing of important tasks.

The ARTEMIS Review Team noted the actions that are underway or are planned to ensure that the required competences and skills are preserved. Also, the related organizations are making significant efforts to have in place mechanisms to adequately manage outsourced activities, involving administrative, legal and financial aspects, creating a well-organized system.

However, the ARTEMIS Review Team stresses the importance that, in situations when execution of central tasks for implementation of the strategy relies on outsourcing, it is essential to maintain capacity to exercise control over the work being done by contractors and to take responsibility for the implemented tasks, when considering technical aspects. Thus, all involved

organizations are encouraged to maintain and enhance existing mechanisms and ongoing efforts to manage outsourced activities, which are essential for successful implementation of the strategy.

APPENDIX A: TERMS OF REFERENCE

ARTEMIS Review of the Republic of Latvia's National Programme on Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation

Terms of Reference

1. Introduction

On 10 July 2017, the Radiation Safety Centre of the State Environmental Service of the Republic of Latvia requested the IAEA to organize and carry out, in 2019, an ARTEMIS Review of the national programme of the Republic of Latvia, as required by Article 14.3 of the European 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.

2. Objective

The ARTEMIS review will provide an independent international evaluation of Latvia's radioactive waste and spent fuel management programme, recognizing the elements required by the Article 14.3 of the EC Directive 2011/70/EURATOM.

The review, organized in the IAEA by the Department of Nuclear Safety and Security and the Department of Nuclear Energy, will be performed on the basis of the relevant IAEA Safety Standards and proven international practice and experiences, with the combined expertise of the international peer review team selected by the IAEA.

3. Scope

The given ARTEMIS review will evaluate the Latvian national programme and the national framework for executing country's obligations for safe and sustainable radioactive waste and spent fuel management.

Environmental remediation is out of the scope of this review, as it is not relevant for the national programme of the Republic of Latvia. Management of residues from mining and milling are out of the scope of this review, as the national regulations of the Republic of Latvia do not consider that types of material as radioactive waste. Management of NORM is out of the scope of this review, as there are no authorized practices in the country involving NORM.

Results from the 2019 IRRS mission to Latvia will be taken into account as far as possible.

4. Basis for the review

The ARTEMIS review will be based on the relevant IAEA safety standards and proven international practice and experience, following the draft guidelines of the ARTEMIS review service. The review will take into consideration the requirements laid on the EU Member States by the EC 2011/70/Directive.

5. Reference material

The review will cover all documentation submitted by the National Counterpart for the considered scope of the review, with a focus on the national programme, as well as the results of self-assessment, which should be based on the provided questionnaire.

The list of reference material is provided in the Annex 1 (that list is subject to updates and should be finalized by 1 October 2019).

All documents for the purpose of the ARTEMIS review will have to be submitted in English.

6. Modus operandi

The working language of the mission will be English. The provisional mission schedule is provided in the Annex 2. The timeline for the key steps of the review process is provided below:

- Self-assessment: questionnaire was made available to Latvia as of November 2018.
- Preparatory Meeting: 23-24 May 2019, Riga, Latvia
- The reference material (in English) and the results of the self-assessment questionnaire will be provided to the IAEA as soon as they are available and not later than 1 October 2019, except for the draft report from the IRRS mission, which will not be available before November 2019.
- Questions based on the preliminary analysis of the reference material and the self-assessment results will be provided by the review team by 15 November 2019.
- Peer review mission: 3-10 December 2019 (8 days)
 - Monday 2 December 2019: arrival of experts and their meeting;
 - Tuesday to Friday (3-6 December 2019): presentations by the Counterparts on specific topics and discussion, taking into account preliminary analysis of the reference material and the self-assessment results; drafting of recommendations and suggestions by the review team;
 - Saturday-Sunday noon: drafting of the report (Review Team);
 - Sunday afternoon: Delivery of draft report/recommendations to the Counterparts for fact checking;
 - Monday: discussions between the Review Team and the Counterparts and finalization of draft report;
 - Tuesday: delivery of the draft mission report and closure.

The National Counterpart is the Radiation Safety Centre of the State Environmental Service of the Republic of Latvia (RSC SES).

- The National Coordinator for the given review is Ms Dace Šatrovska Director of the RSC SES;
- Deputy National Coordinator is Ms Marite Caikovska, Head of Inspection Division and Deputy Director of the RSC SES.

The other Latvian organizations involved in the review are:

- Ministry of Environmental Protection and Regional Development

- State limited liability Company «Latvian Environment, Geology and Meteorology Centre»

7. International peer review team

The IAEA will convene a team of international experts to perform the ARTEMIS review according to the agreed Terms of Reference. The team will comprise of:

- Four qualified and recognized international experts from government authorities, regulatory bodies, waste management organizations, and technical support organizations with experience in the safe management of radioactive waste and spent fuel;
- Two IAEA staff, to coordinate the mission. The Coordinator of the ARTEMIS review is Mr. Vladan Ljubenov from the Waste and Environmental Safety Section of the Department of Nuclear Safety and Security. The deputy coordinator is Ms Merle Lust from the Waste Technology Section of the Department of Nuclear Energy.
- One IAEA staff for administrative support.

The peer review team will be led by a Team Leader, assisted by a Deputy Team Leader, comprising from the review team as defined in the ARTEMIS draft guidelines. The Team Leader will be Mr David Ulfbeck from the Danish Health Authority, Radiation Protection. The IAEA will formally inform the National Counterpart regarding the composition of the proposed review team (Annex 3) by 1 September 2019.

The review mission may include presence of Observers, what has been agreed with the National Counterpart. The IAEA will provide the names of Observers by 1 September 2019.

8. Reporting

The findings of the peer review will be documented in a final report that will contain proceedings, the recommendations, suggestions and if applicable, good practices. The report will reflect the collective views of the team members and not necessarily those of their respective organization or Member State or the IAEA.

Prior to the finalization and delivery of the final draft ARTEMIS review report, it will be delivered to the National Counterpart for fact-checking, being the RSC SES.

9. Funding of the peer review

The cost estimate for the ARTEMIS review covers both preparatory meeting and the review mission, and includes travel costs, per diem of the peer review team (external experts and IAEA staff) and fees to the external experts in line with IAEA Financial Regulations and Rules.

The total cost is currently estimated to the amount of 23 000 EUR. The Republic of Latvia is aware that the review cost includes 7% programme support costs. The Republic of Latvia agrees with these Terms of Reference by accepting necessary arrangements, including release of funds from the Technical Cooperation Department of the IAEA (TC) to the responsible TC budget Officer of the IAEA.

These Terms of Reference have been agreed between the IAEA and the RSC SES during the preparatory meeting 23-24 May 2019 in Riga.

APPENDIX B: MISSION PROGRAMME

Time	Mon, 2 Dec	Tue, 3 Dec	Wed, 4 Dec	Thurs, 5 Dec	Fri, 6 Dec	Sat, 7 Dec	Sun, 8 Dec	Mon, 9 Dec	Tue, 10 Dec		
9:00–10:00	Arrival of the ARTEMIS review team members	9h00 Opening General presentations Coffee break and photo	Inventory	Cost Estimates and Financing	Finalization of Recommendations and Suggestions	Drafting of the report	Draft report to be sent to the Counterparts	Internal reflection of comments Discussions with the Counterparts on the draft report	Delivery of final draft report EXIT MEETING		
10:00–12:00		National Policy and Framework	Concepts, Plans and Technical Solutions	Capacity Building - Expertise, Training, Skills							
			10h30 Coffee break	10h30 Coffee break							
			Concepts, Plans and Technical Solutions (cont)	Capacity Building - Expertise, Training, Skills (cont)							
12:00–13:00		Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch		
13:00–16:00		National Strategy	Safety Case and Safety Assessment	Session reserved for further discussions, if required or drafting of the report	Presentation of Recommendations and Suggestions to the Counterparts and Discussions	Drafting of the report	Counterparts review the draft report	Finalizing the draft report	Departure of Team Members		
			14h30 Coffee break	14h30 Coffee break						14h30 Coffee break	14h30 Coffee break
			National Strategy (cont)	Safety Case and Safety Assessment (cont)							
16:30–17:30		16h00 ARTEMIS team meeting	ARTEMIS team meeting	ARTEMIS team meeting	ARTEMIS team meeting	18h30 Dinner	Drafting of the report	Drafting of the report	Drafting of the report		
		Drafting of the report	Drafting of the report	Drafting of the report							

APPENDIX C: RECOMMENDATIONS AND SUGGESTIONS

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
1.	NATIONAL POLICY AND FRAMEWORK FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT	S1	The government should consider including clear statements in the policy, detailing the preferred management option for ILW, providing a basis for decision regarding the long term management of ILW ultimately leading to the policy goal. These statements should be reflected in the strategy.
2.	NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT	R1	The government should ensure that the strategy reflects the preferred long term management options stated in the policy, including interim targets and end states.
		R2	The strategy should take into account the interdependencies between related actions and their associated risks, considering uncertainties in knowledge.
		R3	The government should evaluate existing provisions to ensure the timely implementation of the strategy, including effective means of preventing and mitigating omissions, deviations, failures, and delays.
3.	INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE	R4	The government should establish requirements for management of uncertainties in order to evaluate the sensitivity of the safety and radiological analysis.
		S2	The implementer should consider further analyzing the impact of uncertainty of the inventory on the results of safety and radiological analysis.
4.	CONCEPTS, PLANS AND TECHNICAL	R5	The government should establish requirements for the long term storage to ensure that waste is preserved in a condition suitable for its subsequent management.

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
	SOLUTIONS FOR SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT	R6	The implementer should further develop specific waste acceptance criteria for the long term storage and set out procedures to ensure that waste is preserved in a condition suitable for its subsequent management.
5.	SAFETY CASE AND SAFETY ASSESSMENT OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT ACTIVITIES AND FACILITIES	R7	The implementer should ensure that the safety of ongoing activities at Salaspils research reactor is assessed.
6.	COST ESTIMATES AND FINANCING OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT	R8	The government should ensure that adequate cost estimates are made timely available to facilitate appropriate financing for achieving the goals for safe management of all classes of existing and future radioactive waste.

APPENDIX D: LIST OF ACRONYMS USED IN THE TEXT

IAEA – International Atomic Energy Agency

ILW – Intermediate Level Waste

IRRS – Integrated Regulatory Review Service

LEGMC – Latvian Environment, Geology and Meteorology Centre

LLW – Low Level Waste

MEPRD – Ministry of Environmental Protection and Regional Development

NORM – Naturally Occurring Radioactive Materials

RSC SES – Radiation Safety Centre of the state administrative institution State Environmental Service

WAC – Waste Acceptance Criteria

APPENDIX E: IAEA REFERENCE MATERIAL USED FOR THE REVIEW

- [1] INTERNATIONAL ATOMIC ENERGY AGENCY, Fundamental Safety Principles, Safety Fundamentals No. SF-1, Vienna (2006).
- [2] INTERNATIONAL ATOMIC ENERGY AGENCY, Governmental, Legal and Regulatory Framework for Safety, General Safety Requirements No. GSR Part 1 (Rev. 1), Vienna (2016).
- [3] INTERNATIONAL ATOMIC ENERGY AGENCY, Leadership and Management for Safety, General Safety Requirements No. GSR Part 2, IAEA, Vienna (2016).
- [4] INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3, IAEA, Vienna (2014).
- [5] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Assessment for Facilities and Activities, IAEA Safety Standards Series No. GSR Part 4, IAEA, Vienna (2009).
- [6] INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of Radioactive Waste, IAEA Safety Standards Series No. GSR Part 5, IAEA, Vienna (2009).
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- [8] INTERNATIONAL ATOMIC ENERGY AGENCY, Disposal of Radioactive Waste, IAEA Safety Standards Series No. SSR 5, IAEA, Vienna (2011).
- [9] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Fuel Cycle Facilities, IAEA Safety Standards Series No. NS-R-5 Rev. 1, IAEA, Vienna (2014).
- [10] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Energy Basic Principles, Nuclear Energy Series, NE-BP, Vienna (2008).
- [11] INTERNATIONAL ATOMIC ENERGY AGENCY, Radioactive Waste Management and Decommissioning Objectives, Nuclear Energy Series, NW-O, Vienna (2011).
- [12] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Fuel Cycle Objectives, Nuclear Energy Series, NF-O, Vienna (2013).
- [13] INTERNATIONAL ATOMIC ENERGY AGENCY, Policies and Strategies for Radioactive Waste Management, IAEA Nuclear Energy Series No. NW-G-1.1, IAEA, Vienna (2009).
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- [15] INTERNATIONAL ATOMIC ENERGY AGENCY, Policy and Strategies for Environmental Remediation, IAEA Nuclear Energy Series No. NW-G-3.1, IAEA, Vienna (2015).
- [16] INTERNATIONAL ATOMIC ENERGY AGENCY, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, IAEA International Law Series No. 1, IAEA, Vienna (2006).
- [17] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Glossary – Terminology used in Nuclear Safety and Radiological Protection, IAEA, Vienna (2018).
- [18] Official Journal of the European Union No. L 199/48 from 2nd Aug 2011, 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, Brussels (2011).