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

MISSION

TO

PORTUGAL

Lisbon, Portugal

14-22 May 2023

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY
DEPARTMENT OF NUCLEAR ENERGY

IAEA

Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation

ARTEMIS

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REPORT OF THE

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REPORT OF THE

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

TO

PORTUGAL

Mission dates: *14-22 May 2023*
Location: *Lisbon, Portugal*
Organized by: *IAEA*

ARTEMIS REVIEW TEAM	
Mr Christophe Depaus	ARTEMIS Team Leader (Belgium)
Mr Fabrizio Trenta	Reviewer (Italy)
Mr Vidas Paulikas	Reviewer (Lithuania)
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Mr Andrey Guskov	IAEA Team Coordinator
Mr Christoph Gastl	IAEA Deputy Team Coordinator
Ms Kristina Nussbaum	IAEA Admin. Assistant

IAEA-2023

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 8 March 2021, the Portuguese Environment Agency (APA), requested the International Atomic Energy Agency (IAEA) to organize and carry out an Integrated Review Service for Radioactive Waste and Spent Fuel, Decommissioning and Remediation (ARTEMIS) review, after the implementation of the IAEA Integrated Regulatory Review Service (IRRS) in Portugal.

The objective of the ARTEMIS Peer Review Service was to provide independent, international evaluation of Portuguese national framework for safe management of radioactive waste, and the competent regulatory authority, national programme and its implementation in this field, based on the relevant IAEA Safety Standards and proven international practice and experiences, following the guidelines of the ARTEMIS review service, requested in line with the 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*.

The review was organized by the Department of Nuclear Safety and Security and the Department of Nuclear Energy, and 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 assistance.

The preparatory meeting was held in November 2022. Review of the Advanced Reference Material (ARM) was carried out in March 2023. The ARTEMIS review mission was conducted from 15 to 22 May 2023.

The application of the legal regime to the Autonomous Regions of Azores and Madeira was excluded from the review.

Portugal has no nuclear power plants, no nuclear power programme and commits not to pursue the production of energy by nuclear means, but radioactive waste is generated from medical, industrial and research applications of radioactive materials in the form of sealed and unsealed sources. There are around 10.000 authorized facilities that use radiation sources. Significant quantities of NORM waste arising from past and present activities and facilities exist and have become more of a concern in recent years.

There is, however, a 1MW research reactor, the Reactor Português de Investigação (RPI) which is in a permanent shutdown state since 2016, in transition to decommissioning. The fuel used in the RPI was returned to USA in 2019.

During the ARTEMIS mission the team comprised of senior international experts in the field of radioactive waste management and decommissioning from Belgium, Italy, Lithuania and United Kingdom held fruitful in-person discussions with the representatives of:

APA: Portuguese Environment Agency (*Agência Portuguesa do Ambiente*),

IGAMAOT: General Inspection for Agriculture, Sea, Environment and Spatial Planning (*Inspeção-Geral da Agricultura, do Mar, do Ambiente e do Ordenamento do Território*),

ASAE: Economic and Food Safety Authority (*Autoridade de Segurança Alimentar e Económica*),

ACT: Authority for Working Conditions (*Autoridade para as Condições do Trabalho*),

IST: Instituto Superior Tecnico (i.e., Faculty of Engineering in the University of Lisbon).

Representatives from University of Porto and University of Coimbra took part virtually in the discussions on capacity building.

The ARTEMIS Review Team very much appreciated additional documentation presented by the Portuguese counterparts to address the expert's questions during the mission, the continuous and open manner of discussions and the intention to use comments from the Team as input for the process of continuous improvement of waste management in Portugal.

Based on these exchanges, covering subjects of radioactive waste management such as the Portugal national policy, framework, strategy, inventory, concepts, plans and technical solutions, safety case and safety assessment of activities and facilities, cost estimates and financing, capacity building, the ARTEMIS Review Team noted that Portugal has developed and implemented a well-functioning system to ensure the safe and effective management of radioactive waste.

However, the ARTEMIS Review Team prepared recommendations (R) and suggestions (S) into a draft report which was handed over at the official exit meeting. These are aimed at enhancing the national policy, regulatory framework and implementation of the National Programme for radioactive waste in Portugal. The ARTEMIS Review Team would draw attention to the following key findings:

- a comprehensive national policy that sets out the preferred options for radioactive waste management should be developed,
- specific provisions in the national strategy should be included to deal with all anticipated radioactive waste,
- the national radioactive waste inventory should be updated to include anticipated wastes associated with decommissioning and NORM,
- financial liability estimates for all aspects of radioactive waste management should be updated to ensure that long term budgets include sufficient provision, particularly for disposal.

In summary, the ARTEMIS Review Team considers that Portugal demonstrates the commitment and ability to enhance the safety of radioactive waste management and noted that a well-functioning system is in place.

The ARTEMIS Review Team is of the opinion that the benefits of carrying out an ARTEMIS follow-up mission could be taken into consideration on completion of the measures identified in the current National Programme.

I. INTRODUCTION

On 8 March 2021, the Portuguese Environment Agency (APA), requested the International Atomic Energy Agency (IAEA) to organize and carry out an Integrated Review Service for Radioactive Waste and Spent Fuel, Decommissioning and Remediation (ARTEMIS) review, after the implementation of the IAEA Integrated Regulatory Review Service (IRRS) in Portugal.

Portugal's request for the ARTEMIS review is to satisfy 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 (hereinafter the *EU 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. Following a preparatory meeting in November 2022, and the receipt and review of Advanced Reference Material in March 2023, in May 2023 the ARTEMIS Review Team evaluated the Portuguese national framework, competent regulatory authority, national programme and its implementation for safe management of radioactive waste.

II. OBJECTIVE AND SCOPE

The ARTEMIS review provided an independent international evaluation of the Portuguese national framework for safe management of radioactive waste, and the competent regulatory authority, national programme and its implementation in this field.

The ARTEMIS review, organized by the Department of Nuclear Safety and Security and the Department of Nuclear Energy of the IAEA, was based on 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 *EU Waste Directive*, the overall strategy for the management of all types of radioactive waste in Portugal.

The application of the legal regime to the Autonomous Regions of Azores and Madeira was excluded from the review.

III. BASIS FOR THE REVIEW

A) PREPARATORY WORK AND IAEA REVIEW TEAM

At the request of the Government of Portugal, a preparatory meeting for the ARTEMIS Review mission, was conducted on the 28th of November 2022 online. The preparatory meeting was carried out by the appointed Team Leader Mr Christophe Depaus, the IAEA coordinator and deputy coordinator Mr Andrey Guskov and Mr Christoph Gastl, and the team of National Counterparts led by Mr João Oliveira Martins from the Department of Emergencies and Radiation Protection of the Portuguese Environment Agency, with participation of representatives of the General Inspection for Agriculture, Sea, Environment and Spatial Planning.

The ARTEMIS mission preparatory team had discussions regarding:

- the Terms of Reference for the ARTEMIS review of the Portuguese strategy to fulfil obligations from article 14(3) of the EU 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 Portugal in May 2023.

Mr Pedro Rosário was appointed as the National Counterpart liaison officer for the ARTEMIS mission and designated IAEA point of contact.

Portugal provided IAEA with the ARM for the review on 14 March 2023.

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 Sunday, 14 May 2023 in Lisbon, directed by the ARTEMIS Team Leader Mr Christophe Depaus, the ARTEMIS Team Coordinator Mr Andrey Guskov and the Deputy Team Coordinator, Mr Christoph Gastl.

The ARTEMIS entrance meeting was held on Monday, 15 May 2023, with the participation of the Portuguese Environment Agency (APA), the General Inspection for Agriculture, Sea, Environment and Spatial Planning (IGAMAOT), the Portuguese Authority for Working Conditions (ACT), the Economic and Food Safety Authority (ASAE) and the Instituto Superior Técnico (IST) senior management and staff. Opening remarks were made by Ms Ana Teresa Perez (Member of the Executive Board, APA), and Mr Christophe Depaus, ARTEMIS Team Leader.

During the ARTEMIS mission, a review was conducted for all review topics within the agreed scope with the objective of providing Portuguese 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 Monday, 22 May 2023. Opening remarks were made by Mr Nuno Lacasta, President of the Management Executive Board, APA, Mr Rogério Colaço, President of IST, Mr Marco Candeias, Inspector Director of IGAMAOT, Ms Margarida Araújo, Head of Division of ACT, Ms Cristina Caldeira, Head of Department of ASAE. A presentation of the results of the Review Mission was given by the ARTEMIS Team Leader Mr Christophe Depaus. Closing remarks were made by Ms Hildegarde Vandenhove, Director of the Division of Radiation, Transport and Waste Safety, 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

Portugal's position

Portugal does not have a nuclear power programme and, according to its National Energy and Climate Plan 2030 (approved in 2020), Portugal commits not to pursue the production of energy by nuclear means. It does, however, have a single 1MW research reactor, the Reactor Português de Investigação (RPI) which is in a permanent shutdown state since 2016, in transition to decommissioning. The fuel used in the RPI was returned to USA in 2019. The Instituto Superior Técnico (IST) is the license owner of the RPI.

Radioactive waste is managed by IST under the regulatory oversight of Agência Portuguesa do Ambiente (APA) and Inspeção-Geral da Agricultura, do Mar, do Ambiente e do Ordenamento do Território (IGAMAOT) and is currently stored in the Pavilhão de Resíduos Radioativos (PRR) facility, which was licensed in 2016 and had its license renewed by APA in 2021.

According to the Advance Reference Material (ARM), elements of Portuguese policy on spent fuel and radioactive waste management have been codified in Portuguese Decree-Laws (DLs), (Ministry) orders and resolutions (of the Council of Ministers). The DLs transpose *inter alia* Council Directives.

Those are the following:

- DL 156/2013 on the legal and regulatory framework for the responsible and safe management of SF and RW management and which, inter alia, establishes the functions of the regulatory body and transposes the Council Directive 2011/70/Euratom;
- DL 108/2018 corrected by the Declaration 4/2019 and amended by DL 81/2022 on the legal framework for radiological protection and which, inter alia, establishes the functions of the regulatory body and transposes the Council Directive 2013/59/Euratom;
- DL 30/2012 amended by DL 135/2017 which establishes the framework for nuclear safety and regulated the functioning of the regulatory body and which, inter alia, transposes the Council Directive 2009/71/Euratom;
- Ministry Order 138/2019 which establishes exemption and clearance criteria;
- Resolutions of the Council of Ministers 122/2017 and 129/2022 which establish and update the national spent fuel and radioactive waste management programme (PNGCIRR).

Through the aforementioned DLs, orders and resolutions the following concepts are, *inter alia,* addressed via the framework for radioactive waste management:

- Assignment of primary responsibility for the safety of radioactive waste management to the licensee (DL 156/2013, art. 3(r), 8, 10, DL 262/2012 art. 5; DL 30/2012, art. 12);
- Assignment of ultimate responsibility for the management of radioactive waste management to the State (DL 156/2013, art. 4(2));
- Avoidance of burdens on future generations (DL 156/2013, art. 4 (1)(d));
- Minimization of waste, both in terms of volume and activity levels (DL 156/2013 art. 4(1)(a));

- Recognition of interdependencies among the different steps in radioactive waste management (DL 156/2013 art. 4 (1)(b));
- Responsibility of those who generated for spent fuel and radioactive waste for the costs for their management, including transport (PNGCIRR, section 2.1(l) and DL 156/2013, art. 11(4)).

The National Programme defines the terms of execution of the national policy with respect to the responsible and safe management of spent fuel and radioactive waste, covering all stages of its management above exclusion levels, from production to disposal.

The ARM states the implementation of a graded approach in the implementation of the National Programme, including the allocation of resources, the adoption of general safety measures and the inspection of the radioactive waste management facility.

Significant amounts of NORM arising from past and present activities and facilities exist and have been identified as potentially requiring management as radioactive waste. However, according to ARM, the capacity of the current PRR is not sufficient to store these potential amounts of waste.

ARTEMIS observation

- According to ARM, there is no unified policy regarding the safe management of radioactive waste although elements thereof are embedded in the regulatory framework. Therefore, some elements of policy are missing and impede the development of an overall national strategy for the management of radioactive waste.
- DL 156/2013, art. 4(i), sets forth "*Radioactive waste for disposal in the national territory are placed close to the surface*". This legal provision, which is an element of policy, limits the long-term management of radioactive waste to the sole option of a near surface disposal facility, although this management option might be not appropriate if some existing or future waste is subsequently classified as Intermediate Level Waste (ILW) according to the IAEA classification. Therefore, the ARTEMIS Review Team would suggest a more generic formulation in the planned revision of the DL 156/2013 such as "appropriate disposal" and to carefully reconsider the national classification of waste according to the PNGCIRR.
- According to the PNGCIRR, it is acknowledged that the change of the legal status of the PRR as an interim storage facility into a disposal facility does not change its underlying technical features. Consequently, '*APA, I.P. should promote the carrying out of a feasibility study for long-term ILW-type RR*[1] *storage and /or disposal solutions that constitute an alternative to RRP*[2] *'* (PNGCIRR, p. 5). The ARTEMIS Review Team is of the opinion that this dual track approach (storage/disposal) creates an ambiguity regarding the intent to adopt disposal as the final management solution for radioactive waste.
- Moreover, Measure III in the PNGCIRR sets forth that a *'feasibility study of solutions for long-term storage and/or disposal of other radioactive waste, including ILW'* is carried out. The ARTEMIS Review Team is of the opinion that these studies should cover all types of radioactive waste in order to provide a final passively safe solution.

[1] Residuos radioactivos (RR means radioactive waste)
[2] PRR

- From the discussion with the Portuguese Counterparts, the ARTEMIS Review Team understands that an exclusion process of (some) NORM waste is in place. According to the PNGCIRR, APA may authorize, under specific conditions and when safety is demonstrated, mixing NORM excluded from the scope of regulatory control with non-radioactive materials for use in construction or other activities. However, this possibility described in the National Programme is not encompassed at a policy level. Excluding NORM waste that come from past or present mining activities (which are beyond the scope of the current ARTEMIS mission), the ARTEMIS Review Team would suggest considering the issue of NORM arising from past and present industrial activities in the policy of radioactive waste management.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Although elements of general policies and commitment to safe radioactive waste management are embedded in the regulatory framework, there is no comprehensive national policy .*	
(1)	**BASIS: GSR Part 5 Requirement 2 states that** *"To ensure the effective management and control of radioactive waste, the government shall ensure that a national policy and a strategy for radioactive waste management are established. The policy and strategy shall be appropriate for the nature and the amount of the radioactive waste in the State, shall indicate the regulatory control required, and shall consider relevant societal factors. The policy and strategy shall be compatible with the fundamental safety principles and with international instruments, conventions and codes that have been ratified by the State. The national policy and strategy shall form the basis for decision making with respect to the management of radioactive waste.* *3.5. The national policy on radioactive waste management has to set out the preferred options for radioactive waste management. It has to reflect national priorities and available resources and has to be based on knowledge of the waste to be managed (e.g. knowledge of the inventory and of the waste streams) now and in the future. It has to assign responsibilities for various aspects of radioactive waste management including regulatory overview."*
R1	**Recommendation: The Government should further develop a comprehensive national policy that sets out the preferred options for radioactive waste management.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Notwithstanding that provisions in the law include statements of the government's intent, and the principle of avoiding undue burdens on future generations (DL 156/2013, art. 4(1)(d)), they do not address the implementation of a disposal facility. There is currently no definitive commitment to dispose of all radioactive waste (existing and future) in the long term.*	
(1)	**BASIS: GSR Part 1 (Rev. 1) Requirement 10 states that** *"The government shall make provision for the safe decommissioning of facilities, the safe management and disposal of radioactive waste arising from facilities and activities […]."*
(2)	**BASIS: SSR-5 Requirement 1 states that** *"The government is required to establish and maintain an appropriate governmental, legal and regulatory framework for safety within which responsibilities shall be clearly allocated for disposal facilities for radioactive waste to be sited, designed, constructed, operated and closed. This shall include: confirmation at a national level of the need for disposal facilities of different types; specification of the steps in development and licensing of facilities of different types; and clear allocation of responsibilities, securing of financial and other resources, and provision of independent regulatory functions relating to a planned disposal facility."*
R2	**Recommendation: The Government should make a commitment to radioactive waste disposal as a safe long-term solution for the management of all radioactive waste to avoid undue burden on future generations.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Despite significant amounts of NORM arising from past and present activities and facilities being identified as potentially requiring management as radioactive waste, there is no policy or elements thereof, regarding its management as such.*	
(1)	**BASIS: GSR Part 5 Requirement 2 states that** *"To ensure the effective management and control of radioactive waste, the government shall ensure that a national policy and a strategy for radioactive waste management are established. The policy and strategy shall be appropriate for the nature and the amount of the radioactive waste in the State, shall indicate the regulatory control required, and shall consider relevant societal factors. The policy and strategy shall be compatible with the fundamental safety principles and with international instruments, conventions and codes that have been ratified by the State. The national policy and strategy shall form the basis for decision making with respect to the management of radioactive waste."*
(2)	**BASIS: SSG-60 para. 3.4 states that** *"The policy and strategy for the management of NORM residues should also take into account the national policies and strategies for safety, for management of non-radioactive waste and for radioactive waste management. States may choose to integrate key elements of the strategy for NORM residue management into their national policy, legal framework and regulatory instruments. In such cases, a separate national strategy for NORM residue management might not be necessary."*

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
S1	**Suggestion: The Government should consider including provisions in the national policy regarding the management of NORM as radioactive waste.**

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

Portugal's position

1.2.1. Responsibilities

The Decree-Laws 156/2013 and 108/2018 (as corrected by Declaration 4/2019 and amended by DL 81/2022) define the responsibilities for the safe management of spent fuel and radioactive waste.

The competent authority is the Portuguese Environment Agency (APA), which is a public institute under indirect administration by the State, but with administrative and financial autonomy. APA has assumed the mission, assignments and competences of the Regulatory Commission for the Safety of Nuclear Installations (COMRSIN) and is responsible for ensuring a high level of radiological protection and of nuclear safety, as well as the safe management of spent fuel and radioactive waste, under the tutelage of the Ministry of Environment and Climate Action. APA is responsible for, namely:

- proposing legislation and regulations,
- classifying radioactive waste,
- applying exclusion and clearance levels,
- authorising spent fuel and radioactive waste management facilities and the transport of spent fuel and radioactive waste within the national territory of Portugal,
- reviewing and approving safety assessment carried out by the applicants for spent fuel and radioactive waste management facilities and approving the management systems for these facilities prepared by the operator,
- establishing and maintaining a national inventory of spent fuel and radioactive waste,
- collaborating in the development of national plans for radiological emergencies and assuming all the obligations arising from them,
- promoting cooperation with foreign counterpart institutions and international institutions, and
- preparing and submitting periodic reports to the European Commission on the implementation of Directive 2011/70/Euratom.

APA is not, however, responsible for inspections and enforcement duties. These are carried out by General-Inspection of Agriculture, Sea, Environment and Territorial Planning (IGAMAOT).

IGAMAOT is a central service of the direct administration of the State, endowed with administrative autonomy, with direction exercised jointly by Minister of the Economy and Maritime Affairs, Minister of Environment and Climate Action, Minister of Territorial Cohesion and the Minister of Agriculture and Food. Although under the direct administration of the State, it has administrative autonomy. It is responsible for inspections of spent fuel and radioactive waste facilities and associated management activities, as well as for safe transport of spent fuel and radioactive waste within Portuguese territory.

These two entities, APA and IGAMAOT, together provide a regulatory body which is independent and functionally separated from entities promoting or operating radiological facilities or activities.

Other entities with relevant responsibilities are:

- General Inspection of Health Activities (IGAS),
- Authority for Working Conditions (ACT),
- Economic and Food Safety Authority (ASAE), and
- National Authority for Emergency and Civil Protection (ANEPC).

IGAS, ACT and ASAE were added in DL 81/2022 (in its amendment of DL 108/2018) as entities with responsibility for the supervision of compliance with the obligations of DL 108/2018 in the areas of healthcare, labour relations and economic activity, respectively.

ANEPC is the main responsible body for emergency preparedness and response for all hazards. The National Commission for Radiological Emergencies (CNER) advises and supports ANEPC in coordinating the responses to radiological emergencies and in promoting training. To fulfil these responsibilities, CNER is presided by ANEPC, and includes representatives of APA, the National Health Authority, the Directorate-General for Energy and Geology, the Office of Planning, Policies and General Administration of the Ministry of Agriculture, the National Institute of Medical Emergency, the Portuguese Institute for Sea and Atmosphere and the IST.

As previously mentioned in section 1.1, radioactive waste is managed by IST under the regulatory oversight of APA and IGAMAOT and is currently stored in the PRR facility, that has been in use for over 50 years and was first licensed in 2016 and which had its license renewed by APA in 2021. PRR is designed as an interim storage facility and not as a passive long-term facility (disposal). IST is responsible for the management of radioactive waste after its reception at the PRR facility (under article 14 of DL 156/2013). However, since the publication of DL 156/2013, the PRR has legally acquired the status of a disposal facility. As acknowledged in PNGCIRR, this change of a legal nature does not modify the underlying technical conditions and is identified for correction in the revision of DL 156/2013 foreseen in Measure VII.

1.2.2. Legal framework

The legal framework for spent fuel and radioactive waste management refers to international conventions and European directives, namely:

- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.
- Council Directive 2011/70/Euratom establishing a community framework for the responsible and safe management of spent fuel and radioactive waste.
- Council Directive 2013/59/Euratom laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation.
- Council Directive 2006/21/EC on the management of waste from extractive industries.
- Council Directives 2006/90/EC, 2008/68/EC and 2012/45/EC on the inland transport of dangerous goods.

At the Portuguese national level, these international legal acts are reported as the following:

- The provisions in the articles of the Joint Convention are enacted in Portuguese law through Decree n°12/2009 and pursuant regulations.
- Portugal reported transposition of the requirements under Council Directive 2011/70/EURATOM through DL 156/2013 on the legal and regulatory framework for the responsible and safe management of spent fuel and radioactive waste management

and of the requirements under the Council Directive 2013/59/Euratom through DL 108/2018 corrected by the Declaration 4/2019 and amended by DL 81/2022 on the legal framework for radiological protection and disused sealed sources. The requirements of the Council Directive 2006/21/EC on the management of the waste (including radioactive waste) from mining industries are reported in DL 10/2010 revised by DL 31/2013. The requirements of the Council Directives 2006/90/EC, 2008/68/EC and 2012/45/EC on the inland transport of dangerous goods are reported in DL 41-A/2010, and its amendments.

Legal national instruments complete the regulatory framework on the management of radioactive waste (and spent fuel) as follows:

- DL 29/2012 (financial resources for decommissioning of RPI provided by the Government); DL 30/2012 and its amendment (establishing the Regulatory Body); DL 198/2009 (transfer of spent fuel and radioactive waste); DL 56/2012, and its amendments (regulating the functioning and competencies of APA); DL 262/2012, and its amendment (completing the regulations of operators of nuclear facilities).
- Ministry Order 138/2019 (establishing exemption and clearance criteria); Resolutions of the Council of Ministers 122/2017 and 129/2022 (establishment and update of the national programme).
- Ministerial Order 293/2019 (setting the fees payable for services provided by APA) and Order 891/2015 (setting the fees for services provided by APA and IST)

Other relevant laws and regulations, although not dedicated to radioactive waste management, belong to its framework:

- Law 102/2009 and its amendments (which includes provisions on radiation protection of workers);
- DL 426/83 (on uranium mining and related radiological protection), DL 375/90 (on the physical protection of nuclear materials); DL 145/2009 (radiological protection in medical devices).
- DL 227/2008 (professional qualification in radiation protection)
- DL 106/2004 (transportation by sea)
- Ministerial order 136/2019 (which sets the minimum elements to be included in the Central Dose Register) and 137/2019 (which sets the values of the tissue and radiation weighting factors).

Moreover, the relevant environmental legislation is provided by:

- Law 19/2014 defining the fundamental basis of environmental policy (radioactive environmental contamination)
- DL 151-B/2013 and its amendment (environmental impact assessment including for nuclear facilities).

Finally, APA provides guidelines for the safe management of radioactive waste for surface storage.

The current regulation and legal framework on Safety of Radioactive Waste Management contain provisions regarding:

- Classification of radioactive waste according to IAEA GSG-1.
- The National Programme.
- Licensing radioactive waste management activities and facilities.
- Prohibition of the operation of a spent fuel or radioactive waste management facility without a license.

- Reporting obligations for radioactive waste and spent fuel management activities and facilities and regulatory inspections.
- Enforcement of applicable regulations and of the license (expiration, revocation) by the Regulatory Body.
- Allocation of responsibilities between the licensee (primary responsibility), public authorities and the State (ultimate responsibility).
- Establishment of an independent Regulatory Body with sufficient human and financial resources to fulfil its regulatory and control missions.
- Public information and participation (through strategic environmental impact assessment).
- Financing schemes for radioactive waste management.
- Implementation of a graded approach.

ARTEMIS observation

- From the discussions with the Portuguese Counterparts, the ARTEMIS Review Team understands that the coordination between all the entities sharing a regulatory function is foreseen in the national primary law (Constitution). In practice, the coordination between APA and IGAMAOT is well established, and the drafting of a Memorandum of Understanding (MoU) is ongoing. Whilst in practice, the coordination with the other entities ACT, ASAE and IGAS does not seem to have raised major issues so far, no formal procedures or MoU are established yet. The ARTEMIS Review Team is of the opinion that such procedures/MoU would ensure a more sustainable coordination between all the regulatory entities and would avoid potential overlaps.
- From the discussions with the Portuguese Counterparts, the ARTEMIS Review Team understands that a revision of the DL 156/2013 (Measure VII of the National Programme) is planned and that the legal status of the PRR will be clarified to take into account its technical specifications. The ARTEMIS Review Team is of the opinion that this clarification is needed to avoid considering the PRR as the final solution for the management radioactive waste and creating confusion in the existing and future set of legal instruments.
- From the discussions with the Portuguese Counterparts, the ARTEMIS Review Team understands that APA takes on the responsibility, *inter alia*, of the classification of materials as radioactive waste at the request of the licensee, the preparation of the National Programme and its update, the establishment of a national inventory of radioactive waste (and its evolution), the anticipated costs of the national programme and the promotion of feasibility studies regarding potential long-term management options such as disposal facilities. In some other country programmes, these duties are typically tasks assigned to the waste management organization. In line with the graded approach, such an organization is not immediately necessary today in Portugal. However, on completion of the feasibility studies, it would be expected that the government will develop a strategic approach, according to which an existing or a new actor/entity, not belonging to the regulatory body, will take on the responsibility of the implementation of the disposal facility, including the siting process. In due time, APA will set out the procedures that this new actor is expected to follow in demonstrating compliance with the conditions for the development of a disposal facility. Such an approach would support maintenance of APA's regulatory independence.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *The allocation of responsibilities, as well as the coordination between APA and IGAMAOT as the two main branches of the Regulatory Body, seem well established in practice. However, the approval of a formal memorandum of understanding (MoU) is still pending. With the introduction, in January 2023, of supervisory roles of IGAS, ACT and ASAE, it is even more important to ensure coordination between all parties*.	
(1)	**GSR Part 1 (Rev. 1) Requirement 7, para 2.18 states that** *"[…] This coordination and liaison can be achieved by means of memoranda of understanding, appropriate communication and regular meetings. Such coordination assists in achieving consistency and in enable authorities to benefit from each other's experience."*
(2)	**GSR Part 1 (Rev. 1) Requirement 7, para 2.19 states that** *"If responsibilities and functions do overlap, this could create conflicts between different authorities and lead to conflicting requirements being placed on authorized parties or on applicants. This, in turn, could undermine the authority of the regulatory body and cause confusion on the part of the authorized party or the applicant."*
S2	**Suggestion: APA and IGAMAOT should consider finalising their MoU. APA, IGAMAOT, IGAS, ACT and ASAE should consider establishing MoU(s) to enable effective coordination and avoid possible overlaps.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Although there is no immediate issue with regulatory independence, APA is delivering various responsibilities that would not typically be assigned to a regulator, such as the classification of waste, the preparation of the National Programme including lifetime cost estimates, and identifying national waste management solutions. On the completion of the preliminary feasibility studies regarding the long-term management options for radioactive waste including disposal, it is assumed that the government will develop a strategic approach according to which an existing or a new actor/entity not belonging to the Regulatory Body will take on the responsibility for implementation of the disposal facility including the siting process in order to maintain regulatory independence in the future.*	
(1)	**BASIS: SSR-5 Requirement 1 states that** *"The government is required to establish and maintain an appropriate governmental, legal and regulatory framework for safety within which responsibilities shall be clearly allocated for disposal facilities for radioactive waste to be sited, designed, constructed, operated and closed. This shall include: confirmation at a national level of the need for disposal facilities of different types; specification of the steps in development and licensing of facilities of different types; and clear allocation of responsibilities, securing of financial and other resources, and provision of independent regulatory functions relating to a planned disposal facility."*
(2)	**BASIS: GSR Part 1 (Rev. 1) Requirement 4 states that** *"The government shall ensure that the regulatory body is effectively independent in its safety related decision making and that it has functional separation from entities having*

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
	responsibilities or interests that could unduly influence its decision making."
S3	**Suggestion: The Government should consider strengthening the regulatory body's independence by establishing a waste management organization or similar entity not belonging to the Regulatory Body to ensure functional separation of responsibility for regulatory oversight of safety from co-ordination, financial oversight and implementation of the National Programme for radioactive waste management, including the development of disposal solutions.**

2. NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT

2.1. SCOPE

Portugal's position

The national strategy for spent fuel and radioactive waste management is currently embedded in several regulations:

- Decree-Law 156/2013, which establishes the legal and regulatory framework for the responsible and safe management of spent fuel and radioactive waste and transposes into national law the provisions of Directive No. 2011/70/Euratom, of the Council, of 19 July 2011;
- Decree-Law 108/2018, as corrected by Declaration 4/2019, and amended by Decree-Law 81/2022,
- Decree-Law 30/2012, amended by Decree-Law 135/2017,
- Ministerial Order 138/2019,

and in the National Programme for management of spent fuel and radioactive waste, established in the Resolution from the Council of Ministers 122/2017 and updated in the Resolution from the Council of Ministers 129/2022.

In relation to spent fuel management, all fuel from the RPI, which is the only activity in Portugal where fuel was used, was returned to the USA in 2019. Portugal, as specified in the National Programme, has no intention to use nuclear power for electricity production, nor to restart the RPI, and therefore, it is not expected that there will be any need for the management of nuclear fuel in the future.

The RPI, which ceased operation in 2016, is in transition from operation to decommissioning: the operator is preparing the decommissioning plan to be submitted to APA for authorization.

Regarding radioactive waste management, the overall strategy established in the National Programme is aligned with the principles of prevention of production, minimization, reuse, recycling and storage. Portugal implements these principles as follows:

- prevention of production: transfer of radioactive sources back to the manufacturer/supplier once their use is no longer foreseen;
- minimization: preferential use of radioactive isotopes with short half-lives; implementation of a system for characterization and segregation to facilitate decontamination of materials;
- reuse and recycling: requires APA authorization;
- storage: when all previous options have been excluded, waste is placed in dedicated storage facilities.

Based on the classification system established in Portugal, the national strategy includes the following approach for storage of radioactive waste:

- for ILW:
  - actual 16m^3 of conditioned waste, predominantly sealed radioactive sources, are stored at PRR;

- future ILW, mainly coming from the decommissioning of RPI, will be stored at PRR;
- for future radioactive sources, the preferred option is return to the supplier/producer, with an option for storage at PRR if this is not possible;

- for LLW and VLLW:
  - storage at PRR;

- for VSLW:
  - managed and stored at the producer until it has decayed below clearance levels or managed through authorized discharge;

Moreover, in relation to the significant quantity of NORM currently stored on site where they were produced, the National Programme foresees the possibility to manage NORM excluded from the scope of regulatory control, by mixing them with non-radioactive materials, for the purposes of reuse or recycling.

Regarding disposal of radioactive waste, Decree-Law 156/2013, establishes the status of the PRR to be a radioactive waste disposal facility and considers that near surface disposal is the final solution for management of radioactive waste. However, it has to be highlighted that in the National Programme, regarding PRR, it is reported: *"Since the publication of Decree-Law 156/2013, of November 5, the Pavilion has acquired the status of a RR disposal facility, and IST has abandoned the previous designation of the facility - "Interim Radioactive Waste Storage Pavilion". However, it is important to recognize that this change of legal nature, even if accompanied by technical and structural updates imposed on the conditions of the license granted to the PRR, does not change the underlying technical conditions, so that the facility in question should be considered as a long-term storage facility and not as a disposal facility, in the strictly technical sense of the term*".

For this reason, Portugal has launched, under the remit of APA, a feasibility study of solutions for long-term storage and/or disposal for radioactive waste, which is due to complete by 2025. These options will be assessed against technical feasibility, cost of implementation, volumes of waste to be managed and risks associated with the category of waste (both current and forecast future arising).

Moreover, due to the actual limitation of useful storage capacity for radioactive waste at PRR, Portugal has launched a study to determine the volume of *'historical waste'* stored that could be released from regulatory control, based on the ongoing waste characterization, with the aim of increasing the available storage capacity at PRR and to give inputs to identify a possible long-term waste management strategy.

The legislation establishes surface disposal as the final solution for radioactive waste. Nevertheless, the National Programme establishes a measure to conduct a feasibility study of solutions for long-term storage and/or disposal of radioactive waste, alternative to the PRR, considering potential ILW streams.

ARTEMIS observation

The ARTEMIS Review Team notes that radioactive waste management activities and the related strategy are reported in the national legislation and particularly in the National Programme.

However, the strategy for the safe management of the waste, including disposal, has not been clearly outlined. In this regard, the ARTEMIS Review Team notes that Measure VII of the National Programme foresees the establishment of the national radioactive waste policy and strategy.

In addition, DL 156/2013 has designated PRR as the disposal facility for all radioactive waste produced in the country and the national policy, establishes surface disposal as the final solution for waste. Nevertheless, the Resolution of the Council of Ministers 129/2022 establishes the action plan for the implementation of the National Programme with two measures related to long term-storage and disposal, namely:

- Measure VII foresees the preparation of a proposal to update Decree Law n. 156/2013 reviewing the PRR's classification as a long-term storage facility,
- Measure III foresees the launch of a feasibility study of solutions for long term-storage and/or disposal of radioactive waste, including ILW.

Although the PRR is more than 90% full, notwithstanding that National Programme Measure IX has been identified to recover useful storage volumes to guarantee storage capacity waiting for the final disposal, no solution has been identified to establish a clear disposal strategy based on the conceptual design of a surface disposal facility. The ARTEMIS Review Team observed that the current strategy for disposal identified in the National Programme is not in line with actual inventory that includes ILW.

During the discussion, with regard to the RPI, the ARTEMIS Review Team observed that the research reactor is in the transition period between operation and decommissioning and a national strategy for decommissioning of nuclear facilities has not been established by the Government. Consequently, a strategy for RPI decommissioning and associated radioactive waste management has not yet been established by the licensee. Moreover, the ARTEMIS Review Team also noted that safety requirements for decommissioning activities including requirements for management of the resulting radioactive waste and associated regulations and guides have not been established by APA.

Regarding management of NORM, the production from past and present activities and the future estimations of NORM represent an issue for the management of significant volumes of waste. The current legislation allows mixing for those NORM excluded from the scope of regulatory control with non-radioactive materials, for the purposes of reuse or recycling. Nevertheless, the ARTEMIS Review Team noted that whilst criteria have been identified to establish when NORM have to be considered radioactive waste or not, the characterization of those significant quantities of NORM, mostly stored at the site where they were produced, has only been performed at a number of sites, leaving the determination of the inventory of radioactive waste as an open issue.

Moreover, the ARTEMIS Review Team was informed that Portuguese companies that could be involved in possible reuse of NORM (e.g. construction) are reluctant to apply this practice. All these aspects introduce uncertainties in the definition of a national strategy for the management of radioactive waste for their interim/long-term storage and disposal.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Elements of the national strategy for radioactive waste management are currently embedded in the regulatory framework, including the National Programme, established in 2017 and updated and published in 2022. Nevertheless, a comprehensive strategy for the safe management of waste, particularly disposal, has not yet been established in Portugal.*	
(1)	**BASIS: GSR Part 5 Requirement 2 states that** *"To ensure the effective management and control of radioactive waste, the government shall ensure that a national policy and a strategy for radioactive waste management are established. The policy and strategy shall be appropriate for the nature and the amount of the radioactive waste in the State, shall indicate the regulatory control required, and shall consider relevant societal factors. The policy and strategy shall be compatible with the fundamental safety principles and with international instruments, conventions and codes that have been ratified by the State. The national policy and strategy shall form the basis for decision making with respect to the management of radioactive waste.[…]* *3.6. The national strategy for radioactive waste management has to outline arrangements for ensuring the implementation of the national policy. It has to provide for the coordination of responsibilities. It has to be compatible with other related strategies such as strategies for nuclear safety and for radiation protection."*
(2)	**BASIS: GSR Part 1 (Rev. 1) Requirement 10, para. 2.28 states that** *"[…] The strategy shall include appropriate interim targets and end states. Radioactive waste generated in facilities and activities necessitates special consideration because of the various organizations concerned and the long timescales that may be involved. The government shall enforce continuity of responsibility between successive authorized parties."*
(3)	**BASIS: GSR Part 1 (Rev.1) Requirement 10, para. 2.32 states that** *"The government shall make provision for appropriate research and development programmes in relation to the disposal of radioactive waste, in particular programmes for verifying safety in the long term."*
R3	**Recommendation: The Government should establish a comprehensive strategy for safe radioactive waste management, particularly disposal.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Notwithstanding provisions in the National Programme regarding the PRR, there are other facilities in Portugal that will require decommissioning. Therefore, a clear strategy for decommissioning and associated radioactive waste management is required.*	
(1)	**BASIS: GSR Part 6 Requirement 4 states that** *"The government shall establish and maintain a governmental, legal and regulatory framework within which all aspects of decommissioning, including management of the resulting radioactive waste, can be planned and carried out safely. This framework shall include a clear allocation of responsibilities, provision of independent regulatory functions, and requirements in respect of financial assurance for decommissioning."*
(2)	**BASIS: GSR Part 6 Requirement 8 states that** *"The licensee shall select a decommissioning strategy that will form the basis for the planning for decommissioning. The strategy shall be consistent with the national policy on the management of radioactive waste."*
R4	**Recommendation: The Government should include specific provisions in the national strategy for radioactive waste management to deal with the waste associated with the decommissioning of all facilities.**
S4	**Suggestion: The licensees should consider selecting a decommissioning strategy for all facilities consistent with the national radioactive waste management strategy.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Although several facilities will require decommissioning, APA has not yet established the safety requirements for decommissioning, including requirements for management of the resulting radioactive waste, and associated regulations and guides.*	
(1)	**BASIS: GSR Part 6 Requirement 5 states that** *"The regulatory body shall regulate all aspects of decommissioning throughout all stages of the facility's lifetime, from initial planning for decommissioning during the siting and design of the facility, to the completion of decommissioning actions and the termination of authorization for decommissioning. The regulatory body shall establish the safety requirements for decommissioning, including requirements for management of the resulting radioactive waste, and shall adopt associated regulations and guides. The regulatory body shall also take actions to ensure that the regulatory requirements are met."*
R5	**Recommendation: APA should establish safety requirements for decommissioning activities including requirements for management of the resulting radioactive waste and associated regulations and guides, before the submission of the decommissioning plans by the licensees.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *The current legal framework and National Programme consider that near surface disposal is the final solution for management of radioactive waste. Considering the current classification system established in the National Programme, the ILW currently stored at PRR and future ILW is not suitable for near surface disposal.*	
(1)	**BASIS: GSR Part 5 Requirement 9 states that** *"At various steps in the predisposal management of radioactive waste, the radioactive waste shall be characterized and classified in accordance with requirements established or approved by the regulatory body.[…]* *4.12 Radioactive waste may be classified for different purposes, and different classification schemes may be used in the successive steps in waste management. The most common classification is that made from the perspective of its future disposal."*
S5	**Suggestion: The Government should consider solving the potential contradiction between the current classification of waste and the disposal solution confirmed in the National Programme.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Portugal has significant quantities of NORM coming from past activities and they are mostly at the site where they were produced. Although the legislative framework exists, in practice significant quantities of NORM have not yet been classified. This poses uncertainties in the definition of a national strategy for the management of radioactive waste for its storage and disposal.*	
(1)	**BASIS: GSR Part 5 Requirement 2 states that** *"To ensure the effective management and control of radioactive waste, the government shall ensure that a national policy and a strategy for radioactive waste management are established. The policy and strategy shall be appropriate for the nature and the amount of the radioactive waste in the State, shall indicate the regulatory control required, and shall consider relevant societal factors. The policy and strategy shall be compatible with the fundamental safety principles and with international instruments, conventions and codes that have been ratified by the State. The national policy and strategy shall form the basis for decision making with respect to the management of radioactive waste."*
(2)	**BASIS: SSG 60 para. 3.4 states that** *"The policy and strategy for the management of NORM residues should also take into account the national policies and strategies for safety, for management of non-radioactive waste and for radioactive waste management. States may choose to integrate key elements of the strategy for NORM residue management into their national policy, legal framework and regulatory instruments. In such cases, a separate national strategy for NORM residue management might not be necessary."*
S6	**Suggestion: The Government should consider including suitable provisions in**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
	the national strategy to align it with a future national policy decision on the management of NORM as radioactive waste.

2.2. MILESTONES AND TIMEFRAMES

Portugal's position

The updated National Programme published in 2022 contains the list of milestones already achieved, regarding the implementation of the online database containing information on the type and volume of radioactive waste estimated to be produced annually by each licensee and by each producer, as well as their destination (2015) and the implementation of procedures for the management of NORM with activity concentration values slightly higher than the exclusion levels, but which do not present a hazard, pending the legal framework (2019).

Also, measures to address radioactive waste management issues and the decommissioning of facilities are targeted as follows:

- completion of the characterization of the *'historical radioactive waste'* stored in the PRR (2023) and determination of the actual storage capacity available at the facility (2022);
- identification of the best technical options for the management of radioactive waste, notably involving significant quantities of NORM and organic radioactive waste (2023);
- feasibility study of solutions for long-term storage and/or disposal of other radioactive waste, including ILW (2025);
- development of Waste Acceptance Criteria for the PRR (2022);
- promotion of research activities in the area of radioactive waste (2025);
- development of the PRR decommissioning plan (2025);
- revision of the legal framework on the safe management of spent fuel and radioactive waste (2023);
- updating transfer and ownership procedures for sealed radioactive sources to encourage their return to the original supplier or manufacturer (2022);
- recovery of useful PRR storage volume through radioactive waste release (2024).

ARTEMIS observation

The ARTEMIS Review Team finds that the National Programme contains milestones/measures and timeframes regarding the management of radioactive waste, as well as information regarding some milestones/measures on a storage and disposal strategy. For each milestone/measure the target, timeframe and the responsible entity for its implementation have been addressed.

Moreover, the ARTEMIS Review Team observes that the responsibility to monitor the implementation status of the National Programme is clearly addressed to APA.

However, milestones/measures identified in the National Programme do not cover all the necessary steps to ensure the management of radioactive waste from cradle to grave: in particular, there are no milestones associated with the implementation of the results of the feasibility studies of solutions for long-term storage and/or disposal, no milestones associated with RPI decommissioning implementation and resulting waste management and no milestones referring to treatment and conditioning of radioactive waste stored at PRR. These aspects have been taken into account by the ARTEMIS Review Team in the recommendations and suggestions associated with the national strategy for radioactive waste management and decommissioning (see section 2.1).

2.3. PROGRESS INDICATORS

Portugal's position

Portugal has identified in the National Programme those key performance indicators suitable to evaluate achievement of the targets; where applicable, performance indicators have been identified to evaluate progress. Progress made towards achievement of the targets will be monitored annually.

APA is required to publish an evaluation report on the implementation status of the targets in advance of each review cycle of the National Programme, which is scheduled 5 years after entry into force and then every 10 years.

ARTEMIS observation

The ARTEMIS Review Team noted that performance indicators, timeframes and responsibility have been set up to evaluate the status of implementation of the measures identified. Overall measures are generally on track, however the ARTEMIS Review Team noted during discussions that some actions such as completion of characterization for historical waste stored at PRR could be behind schedule.

3. INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE

Portugal's position

Spent Fuel

The only nuclear reactor in Portugal is a 1MW pool type research reactor, the RPI, which was commissioned in the early 1960s and was operated by the Instituto Superior Técnico (IST) until shut-down in 2016. The reactor was defueled and the spent fuel returned to the United States of America in 2019 under a bilateral agreement with the US Department of Energy. There is therefore no spent fuel remaining in Portugal and there are no plans to reinstate any future nuclear power capability.

The reactor remains under a regime of Care and Maintenance and a high-level preliminary assessment of waste volumes and types has been made, based mainly on a comparison with the Austrian ASTRA reactor decommissioned in 2006, to inform future waste management requirements.

Radioactive Waste

There is one centralized waste storage facility in Portugal, the Pavilhão de Resíduos Radioativos (PRR), operated by the IST. The facility has been in use for over 50 years and contains a variety of solid and liquid wastes arising from medical, industrial and research applications of radioactive materials. Some wastes arising from past activities stored at PRR are not fully characterized.

Work has been initiated by IST under PNGCIRR Measure I to complete characterization of the wastes stored at PRR that will lead to a better understanding of the current inventory and support the development of complementary solutions to waste storage capacity constraints.

At summary level, wastes currently stored at PRR include, inter alia:

- 800 drums of nominal 220-litre capacity containing unidentified wastes from past activities;
- 135 drums of nominal 220-litre capacity containing sources conditioned in a cement matrix; in most cases there is no information available about the origin of the sources; the practice of encapsulation ceased around the year 2000;
- A number of sealed sources held within their original shielded containers;
- Approximately 47 m^3 of liquid radioactive wastes stored in various packages, placed in 1m^3 vats/bunds.

Work has been completed by APA to encourage the return of disused sealed radioactive sources (DSRS) to the original supplier, in accordance with PNGCIRR Measure VIII, the intent of this being to minimize the inventory of DSRSs in the country.

Furthermore, work is ongoing by IST under PNGCIRR Measure IX to recover useful storage capacity in PRR through the release and clearance of radioactive waste following completion of characterization activities. The intent of this is to reduce the national waste inventory arising from past activities and maximize storage capacity at PRR. In addition, the results of the PNGCIRR Measure III are likely to lead to additional waste storage capacity being created.

A waste classification system was implemented in accordance with the National Programme, approved by the Resolution from the Council of Ministers nº 122/2017, and maintained in its

update on RCM 129/2022. The classification of radioactive waste is generally based on IAEA GSG-1 as follows:

- Very Short Lived Waste (VSLW);
- Very Low Level Waste (VLLW);
- Low Level Waste (LLW);
- Intermediate Level Waste (ILW);
- High Level Waste (HLW) – no such waste exists in the country.

Since 2016, all waste submitted to PRR for storage have been characterized in accordance with the following characteristics: isotope, activity, estimated volume and weight, dose rates at 1m, package types, and according to 7 main material types:

1. Disused sealed radioactive sources not returned to the supplier;
2. Brachytherapy I-125 "seeds" left-over from implant procedures;
3. Medical Isotope Generators (Mo-Tc);
4. Radioactive lightning rods;
5. Ionic smoke detectors;
6. Uranium and thorium salts;
7. Other materials to be classified as radioactive waste.

In addition to the inventory stored at PRR, individual operators are licensed to store very short-lived waste for a period of up to 30 days to enable decay and authorized discharge or to support subsequent transfer to PRR for interim storage. Operators can also be licensed to store radioactive waste for short periods of time but in excess of 30 days. There are currently 56 of these licenses in place, with operators submitting inventory information for these facilities to APA on an annual basis.

Information on the national inventory, including waste arising from past activities, is published in the National Programme and updated in each revision. Furthermore, APA includes information on radioactive waste inventories in each annual Environment Status Report.

The national inventory includes information on the following characteristics:

- Unique application identifier;
- Type of radioactive waste;
- Radionuclide;
- Quantity / nr. of items;
- Activity / date;
- Mass;
- Volume;
- Dose rate at contact and at 1 meter, if applicable;
- Other characteristics, if applicable;
- Location.

Future arisings

Article 6 of Decree Law 156/2013 requires that the National Programme includes "an inventory of all spent fuel and all radioactive waste and estimates for future quantities, especially resulting from the decommissioning of facilities, clearly indicating the location and quantity of radioactive waste and spent fuel, in accordance with the classification framework."

There is a high-level assessment of the waste volumes and types that are expected to arise from decommissioning of the RPI, at circa 500m^3, by comparison to the Austrian ASTRA reactor.

By comparison, preliminary estimates indicate that only 2% of the materials will be radioactive waste (LLW/ILW) that requires management, with the rest being suitable for exclusion/clearance. Work is underway to develop a decommissioning plan for RPI, which will include an update to the anticipated waste inventory arising from its decommissioning.

Work has also been initiated by IST under National Programme Measure VI to develop a decommissioning plan for PRR that will better inform the estimate of the future inventory.

Future arisings of NORM have not been fully quantified but could be significant and are not deemed to be suitable for storage at PRR in terms of waste type and volume. Waste management options for NORM are being developed by APA under National Programme Measure II. At this stage, although some NORM has been classified as waste and stored at PRR and some has been excluded from regulatory control through the relevant processes, most of the NORM have not yet been classified and are therefore neither treated as waste nor included in the national inventory.

Portugal does not consider orphan sources to be a significant issue for the country. A system is in place through the Environmental Fund to address the costs of the management of any orphan sources that do arise from time to time.

Roles and Responsibilities

APA is accountable for establishing and maintaining the national inventory of Spent Fuel and Radioactive Waste, in accordance with Article 13(l) of Decree-Law No. 156/2013.

IGAMAOT is responsible for inspecting compliance with all aspects of the relevant Decree Laws, which would include aspects relating to the national inventory of waste. This could include inspecting compliance with duties that other regulatory bodies have, such as APA's role in final decision making on waste classification.

All licensees are required to submit an annual inventory of radioactive waste that is held in their interim storage facilities to APA, in accordance with Article 14(3) & (4) of Decree-Law No. 156/2013, Article 1 of Decree-Law No. 319/2003 amended by Article 8(h) of Decree-Law No. 30/2012.

All licensees are also required to submit requests to APA within 10 days of concluding that materials have no further use and require their classification as radioactive waste or releasing from regulatory control.

IST is the licensee of the RPI reactor and is responsible for preparing a decommissioning plan including associated waste inventories and characterization plans.

IST is also the licensee of the PRR and is responsible for developing the decommissioning plan and associated waste inventories and characterization plans. This initial plan is due to be completed in 2025 and is on track.

Exclusions

According to Decree Law DL 156/2013, mining wastes and authorized discharges are not under the scope of the radioactive waste management regime. Management of radioactive waste arising from mining operations is governed by the general regime provided for in Decree Law 10/2010, revised by DL 31/2013. Prior licensing of such installations is mandatory, however it is noted that no such operation is currently active in Portugal.

The procedure presently in use by APA allows the exclusion of radioactive waste containing NORM, which have activity concentrations slightly higher than the clearance levels, but still lower than the exemption levels defined in Ministerial Order No. 138/2019.

There are unspecified significant quantities of NORM originating from past and present activities such as mining and fertilizer industries. It is noted that Portugal has commissioned an IAEA TC Expert Mission on options for management of NORM residues. As already mentioned in chapter 1, NORM from mining industries is beyond the scope of the ARTEMIS mission.

According to ARM, there is a quantity of yellowcake in storage at a facility owned by EDM - Empresa de Desenvolvimento Mineiro S.A., a publicly owned company that is responsible for environmental remediation of mining areas. The material is under safeguards provisions and is considered to be a strategic national asset. Therefore, it is excluded from the scope of the ARTEMIS mission.

ARTEMIS observation

The inventory of waste stored at PRR is partially understood, with a significant quantity (800 drums) only having partial characterization information and provenance. The licensee (IST) plans to undertake a campaign of intrusive characterization beginning in 2023. A further population of 135 conditioned drums, containing sources in a cement matrix, have little characterization information, which will be more difficult to investigate and quantify.

Considering the criteria used to consign materials to PRR in the past, the waste inventory at PRR likely contains items that could be released from regulatory control. This is the intent of the current plan, under PNGCIRR Measures I and IX, to create additional storage capacity at PRR for future waste arising.

There are uncertainties over the potential future national inventory, which should be clarified to enable decisions on short-term and long-term storage and disposal needs. It is anticipated that some form of additional storage capacity will be required in the future, but no decision has been made on where, when or what size. This will be developed as part of the measures defined in the National Programme.

Although the legislative framework for NORM exists, in practice significant quantities of NORM have not yet been classified and a suitable management option is not yet in place. This is recognized and is being investigated as part of PNGCIRR Measure II. Furthermore, there is no policy or strategic approach regarding its management as radioactive waste, as detailed in Chapters 1 and 2 of this report. The strategic approach will be linked to an understanding of the national inventory, which in turn should be supported by suitable characterization information. Understanding of this issue is required to be able to accurately forecast the national waste inventory and plan storage and waste disposal requirements for the future.

The ARTEMIS Review Team noted that if significant quantities of NORM material are designated as waste, it will significantly increase the national inventory and overwhelm the existing national storage capacity.

There is still no detailed characterization data for RPI nor a decommissioning plan. This is being progressed currently by IST through the development of an implementation plan for the decommissioning activities, which should include the establishment of a detailed inventory.

Similarly, there is no detailed characterization data nor decommissioning plan in place for PRR, although this is under development by IST as National Programme Measure VI. This work

should include an appropriate assessment of the future waste inventory arising from the closure of PRR.

In accordance with Article 6 of DL 156/2013, it is the responsibility of APA to collate the national waste inventory, including estimated future arisings, based on details submitted by the licensees. Whilst the National Programme approved under RCM 129/2022 contains an assessment of current waste inventories and some elements of future arisings, there is uncertainty about this future inventory due to:

a) Policy and strategy provisions that are not yet made for NORM; (noted above)

b) Lack of characterization data and decommissioning plans for both RPI and PRR, and therefore lack of accurate waste inventory estimates; (noted above);

c) Missing information on waste characterization and inventories associated with other existing facilities.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *There are no detailed waste characterization data for RPI nor PRR and no conceptual plans for their decommissioning. Without this information, it will not be possible to plan storage and waste disposal requirements for the future.*	
(1)	**BASIS: GSR Part 5 Requirement 9 states that** *"At various steps in the predisposal management of radioactive waste, the radioactive waste shall be characterized and classified in accordance with requirements established or approved by the regulatory body.* *[…]* *4.12. Radioactive waste may be classified for different purposes, and different classification schemes may be used in the successive steps in waste management. The most common classification is that made from the perspective of its future disposal."*
(2)	**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. It has to reflect national priorities and available resources and 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."*
S7	**Suggestion: The licensees should consider developing waste inventory estimates and associated waste characterization data.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *There are significant quantities of NORM that may be classified as waste in the future, which could impact significantly on existing waste storage capacity and future disposal requirements. A suitable management option is not yet in place but is being developed as part of the National Programme Measure II. Without understanding this issue, it will not be possible to plan storage and waste disposal requirements for the future.*	
(1)	**BASIS: GSR Part 5 Requirement 9 states that** *"At various steps in the predisposal management of radioactive waste, the radioactive waste shall be characterized and classified in accordance with requirements established or approved by the regulatory body.* *4.12 Radioactive waste may be classified for different purposes, and different classification schemes may be used in the successive steps in waste management. The most common classification is that made from the perspective of its future disposal."*
(2)	**BASIS: SSG-60 para. 3.8 states that** *"The government should coordinate the establishment of an appropriate national inventory of significant NORM residues arising from new and existing NORM activities. […]"*
S8	**Suggestion: The Government should consider establishing a waste inventory, based on characterization data for NORM, on completion of National Programme Measure II.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Whilst the National Programme contains an assessment of current waste inventories and some elements of future arisings, there is significant uncertainty about this future inventory.*	
(1)	**BASIS: GSR Part 5 Requirement 9 states that** *"At various steps in the predisposal management of radioactive waste, the radioactive waste shall be characterized and classified in accordance with requirements established or approved by the regulatory body.[…]* *4.12 Radioactive waste may be classified for different purposes, and different classification schemes may be used in the successive steps in waste management. The most common classification is that made from the perspective of its future disposal."*
(2)	**BASIS: GSR Part 1 (Rev. 1) Requirement 35 states that** *"The regulatory body shall make provision for establishing, maintaining and retrieving adequate records relating to the safety of facilities and activities. […]* *4.64 The regulatory body may or may not be the sole entity responsible for the maintenance of these registers and inventories, but it shall be involved in their proper retention and use. The authorized party shall be responsible for maintaining*

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
	its own records. The authorized party shall maintain all the records necessary for the safe operation of facilities and the safe conduct of activities, as specified in the authorization. This includes maintaining an inventory of radioactive sources and inventories of radioactive waste."
S9	**Suggestion: APA should consider including in the next revision of the National Programme the anticipated future waste inventory data from the ongoing studies for RPI & PRR decommissioning, NORM management plans and for any other facilities that are not currently included in the national inventory.**

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

Portugal's position

The main source of information for the ARTEMIS Review Team to assess the national approach (current or planned) to management of spent fuel and radioactive waste was presented in the ARM and the National Spent Fuel and Radioactive Waste Management Programme (PNGCIRR).

Management of spent fuel

All spent fuel from the RPI was returned to the United States of America (USA) in 2019, under a bilateral agreement established between Portugal and the US Department of Energy. There is currently no spent fuel in Portugal, or any intention of generating it again.

As the RPI is a facility that was commissioned in the early 1960s, its decommissioning was not considered at the design stage. It is the responsibility of IST, as the licensee to develop a plan for its decommissioning including technical solutions for decontamination and dismantling as well as corresponding radioactive waste management solutions and associated safety justification.

Management of radioactive waste

There is one centralized waste storage facility in Portugal, the PRR, operated by the IST. The facility has been in use for over 50 years and contains a variety of solid and liquid radioactive waste arising from medical, industrial and research applications of radioactive materials. Some waste arising from past activities is already in storage at PRR and is not fully characterized.

In relation to storage capacity at the PRR facility, IST has noted that 91% of the storage capacity of buildings 1 and 2 is utilized and 95% of the storage capacity of building 3 is utilized. Since the storage capacity at PRR is approaching its maximum, the government has recognized a need to consider the provision of additional capacity in the short term and the need to develop a long-term approach to storage and/or disposal. PNGCIRR includes actions to address this issue in two ways:

- Measure III – Feasibility study for long term storage / disposal solutions. Due to complete in 2025.
- Measure IX – Recovery of storage capacity at PRR through release of currently stored materials. Due to complete in 2024.

The main users of radioactive material or sealed radioactive sources are in the areas of medicine, industry and scientific institutions. In order to minimize the future production of radioactive waste from applications involving the use of radioactive material and sealed radioactive sources, the present PNGCIRR encourages operators to return disused radioactive sources to the manufacturer or supplier, instead of having to manage this as radioactive waste in Portugal.

Usually, VSLW are stored for decay in the authorized premises of the licence holder. Radioactive waste of other classes is treated and stored in PRR. The PRR, located in the Nuclear and Technological Campus of IST, is a facility dating from the 1960s and contains waste dating from that time. At the beginning of operation this facility was dedicated to manage radioactive

waste from activities at the campus, later becoming a centralized treatment and storage facility, which stores radioactive waste from all across Portugal.

The main processing technologies used in the facility involve segregation of radioactive waste by radionuclides and volume reduction, either by removal of non-radioactive or contaminated materials or by compaction, prior to packaging in 220 litre steel drums. After segregation, ILW was grouted in 220 litre steel drums until around the year 2000, but this practice is no longer in use. There are 800 unconditioned drums and 135 grouted drums, that are poorly characterised and stored in PRR. Disused sealed radioactive sources, which are usually LLW or ILW, whenever possible and necessary, are kept within their original shielding, thus reducing the number of operations with risk of worker exposure. Disused sealed radioactive sources have been previously grouted in 220 litre drums as well, but this practice is no longer in use.

Liquid radioactive waste that cannot be disposed of through authorized discharges is classified as radioactive waste and sent to the PRR facility, kept in its original containers, segregated by radionuclide and packed in containment packages. Subsequently, these packages are placed in $1m^3$ packaging with a system to collect any spills that may occur. If there is compatibility between the liquids (chemical or other relevant), they may be mixed in suitable packages to minimize storage volume.

NORM represent a source of radiation exposure to be taken into account in radiation protection of workers and public. APA may, when safety is demonstrated, authorize the mixing of radioactive materials with non-radioactive materials, for the purposes of reuse or recycling, under the terms of article 28 of Decree-Law 108/2018, of December 3. As mentioned above, there is an urgent need to find solutions for management and reuse of NORM otherwise Portugal needs build capacities to store NORM as radioactive waste. The challenge is recognised in PNGCIRR through *Measure II - Identification of the best technical options for the management of radioactive waste, especially involving large amounts of NORM and organic radioactive waste*.

Plans

The PRR operator's license was renewed at the end of 2021 for radioactive waste management activities, including requirements for the following measures to be implemented:

a) Completion of the characterization work of waste arising from past activities already foreseen in the previous license and development of more robust indicators for measuring storage capacity;

b) Completion of the implementation of measures to improve physical security and resilience to extreme events;

c) Continuous development and updating of the decommissioning plan.

DL 156/2013, of 5 November, introduced clearance and exclusion criteria that can be applied to waste arising from past activities stored since the 1960s in the current PRR. To this end, the IST determined the need to perform a detailed characterization of each container (220 l drum), under regulatory control for the purposes of possible release. The application of the exclusion criteria will reduce the volume of radioactive waste by excluding from regulatory control those wastes causing unnecessary pressure on storage capacity.

Decommissioning plans

The PRR is a facility established in the 1960s for the management of radioactive waste, so its decommissioning was not foreseen in its design. However, since it is a radioactive waste management facility, according to current legislation in force, it is necessary that the operator maintains an updated general plan for its decommissioning, as well as the establishment of post closure measures. The PNGCIRR actions this through *Measure VI – Develop a decommissioning plan for PRR*.

Additionally, no firm decommissioning strategy or plan is yet in place for the RPI, although some benchmarking has been done against the Austrian 10MW ASTRA research reactor decommissioning. The operator is currently developing a decommissioning plan for RPI with support from other international bodies.

Disposal plans

There are currently no firm plans for disposal of waste. It has been clarified that, although DL 156/2013 addresses the PRR as a "disposal" facility and this fact is therefore reflected in the initial PRR license, it was designed for interim storage. This has been addressed in the updated PNGCIRR, where actions are included to develop an appropriate long-term storage and/or disposal solution for radioactive wastes through *Measure III – Feasibility study for long term storage/disposal solutions*. Due to complete in 2025.

Research and development activity regarding spent fuel and radioactive waste management

Several research activities have been carried out, in particular the monitoring and participation of Portuguese universities in the field of radioactive waste treatment technology projects PETRUS III, GEOSAF, RER9143, European Joint Programme JOPRAD Towards a joint programming on radioactive waste disposal, EURAD European Joint Programme (EJP1) on Radioactive Waste - WP9.

In Portugal, the following lines of research are being followed:

a) Developing methodologies and researching suitable sites for near-surface disposal of LLW and ILW on national territory;

b) Impact of international directives and conventions on the Portuguese regulatory framework and on the elaboration of the PNGCIRR.

In order to meet the national needs and to strengthen the approach in each phase, the lines of research to be promoted to better manage the different types of radioactive waste are:

a) Waste Acceptance Criteria;

b) Complementary solutions for long-term and/or permanent storage of radioactive waste;

c) Solutions for the reuse or recycling of radioactive waste containing NORM (E.g. phosphogypsum, RCDNORM);

d) Organic radioactive waste management solutions.

ARTEMIS observation

Decommissioning plans for RPI are still at an early stage of development. The ARTEMIS Review Team was not informed of a clear schedule for its development, of an agreed strategy for decommissioning, of technical solutions for dismantling and radioactive waste management options, or cost estimates and safety substantiations. Also, there are other facilities in Portugal for which decommissioning plans need to be developed and maintained.

During the discussion the ARTEMIS Review Team verified that, whilst provisions in the legal framework set criteria and procedures for classification of NORM as radioactive waste, significant quantities of NORM are not yet classified. Recognising that some challenges of NORM management are included in the National Programme, the National Policy and Strategy should include further provisions for NORM management as radioactive waste. Consequently, the inventory of NORM, as well as concepts and technical solutions including disposal options should be further developed (see chapters 1, 2 and 3).

Whilst radioactive waste management steps up to the point of storage in PRR are well established, the ARTEMIS Review Team recognises that there are no concepts, plans and technical solutions for disposal of radioactive waste. Therefore, inclusion of suitable provisions for disposal in the National Policy and Strategy will ensure further development in the area under question as a safe long-term solution for the management of all radioactive waste to avoid undue burden on future generations (see chapters 1 and 2).

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Although several existing facilities will require decommissioning, such as Portugal's RPI, their decommissioning and associated radioactive waste management were not considered when they were licensed for operation.*	
(1)	**BASIS: GSR Part 6 Requirement 8 states that** *"The licensee shall select a decommissioning strategy that will form the basis for the planning for decommissioning. The strategy shall be consistent with the national policy on the management of radioactive waste."*
(2)	**BASIS: GSR Part 6 Requirement 10, para. 7.6 states that** *"For existing facilities where there is no decommissioning plan, a suitable plan for decommissioning shall be prepared by the licensee as soon as possible. The plan shall be periodically reviewed and updated by the licensee.""*
R6	**Recommendation: The licensees should develop decommissioning plans for existing facilities including options for radioactive waste management consistent with the National Programme, in accordance with guidance issued by APA.**

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

Portugal's position

In accordance with provisions of DL156/2013 radioactive waste management facilities require a licence for any stage of their lifetime. In order to obtain such a licence, the applicant is required to submit a safety demonstration. The safety demonstration of a facility or activity necessary for the siting, design and construction shall cover the development and operation of the activity, the operation and decommissioning of the facility or the closure of a disposal facility, as well as the post-closure surveillance of the disposal facility. The scope of the safety demonstration shall be proportional to the complexity of the operation and the severity of the hazards associated with radioactive waste and spent fuel management and to the facility or activity that develops them. This safety demonstration is part of the safety case.

The main responsibility for the safety of the facilities and for the management of spent fuel and radioactive waste lies with the licensee and may not be delegated or transferred.

In compliance with the provisions of the legislation and regulations in force, licensees shall continuously verify and improve the safety of the facility or activity of safe and responsible management of radioactive waste in a systematic and verifiable manner, through an adequate safety assessment and its demonstration.

The basis for review of safety case are the DLs and IAEA Safety Standards. Guidance and regulations for preparation of safety cases as well as internal procedures of APA for review of safety case are being drafted by APA (as indicated by the IRRS Mission).

Research Reactor

RPI has been operated since the 1960s and is currently shut down. The core has been defueled and the fuel returned to the country of origin.

The decommissioning plan for the RPI is not yet developed.

The reactor is being maintained under the provisions of its full operating licence.

Radioactive Waste Treatment and Storage Facility (PRR)

PRR has been operating since the 1960s. The last update of the licence was carried out in 2021.

The National Programme initiates the preparation of a decommissioning plan as part of the safety case for the operational license renewal.

Disposal facility

There is no licensed disposal facility in the country. In accordance with provisions of PNGCIRR '*APA, I.P. should promote the carrying out of a feasibility study for long-term ILW-type RR*[3] *storage and /or disposal solutions that constitute an alternative to RRP*[4] *'* (PNGCIRR, p. 5).

Use of radioactive sources in medicine, industry and science

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[3] See footnote 1
[4] See footnote 2

Safe management of radioactive waste arising from use of radioactive sources (mainly storage for decay) are described in license applications for authorisation of the activity.

ARTEMIS observation

The ARTEMIS Review Team notes that the general requirements for developing a safety case are in place, and the regulatory process for review and assessing it are still under development (as indicated by the IRRS Mission). Safety cases are provided for authorisation of existing facilities and activities. The ARTEMIS Review Team observes that PNGCIRR sets out a number of measures to be implemented in the near future in the area of radioactive waste management (preparation of feasibility study for long term solutions of radioactive waste management; establishment of WAC's for storage) and future decommissioning of the storage facility (PRR), RPI and other facilities. The measures identified in PNGCIRR do not explicitly require the preparation of safety cases and performing of safety assessment in early stages of development. It is assumed that the regulator will consider this in its updated regulations and guidance. It should be recognised that safety assessment shall cover all stages of the lifetime of a facility including siting, design and operation and concluding with decommissioning or closure and post-closure surveillance for disposal facilities. The responsibility for safety assessment rests with the applicant /licensee.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *The National Programme sets out a number of measures to be implemented in the near future in the area of radioactive waste management (preparation of feasibility study for disposal solutions; establishment of WAC's for storage) and future decommissioning of nuclear installations (e.g., PRR). Currently, there is not enough regulatory guidance to support safety related decisions on these options.*	
(1)	**BASIS: SSR-5 Requirement 2 states that** *"The regulatory body shall establish regulatory Requirements for the development of different types of disposal facility for radioactive waste and shall set out the procedures for meeting the Requirements for the various stages of the licensing process. It shall also set conditions for the development, operation and closure of each individual disposal facility and shall carry out such activities as are necessary to ensure that the conditions are met."*
(2)	**BASIS: GSR Part 5 Requirement 13, para. 5.4 states that** *"It is the operator's responsibility to compile the safety assessment as part of the safety case in accordance with the requirement of the regulatory body."*
S10	**Suggestion: APA should consider developing safety requirements and recommendations to support safety related decisions and safety cases that will be required for waste management facilities and activities in the future.**

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

Portugal's position

Portugal's legal and regulatory framework supports the following key principles:

- No burdens and costs are imposed on future generations as a result of current practices that could have been avoided or mitigated.
- The costs of spent fuel and radioactive waste management, including its transport, are borne by those who produced these materials, in accordance with Article 11(4) of DL. 156/2013 and Article 4(3)(e) of Directive 2011/70/Euratom, which in some instances is the state itself.

The polluter pays principle is implemented in two main ways:

- Existing operators are responsible for the costs associated with the transport, treatment, storage/disposal and management in general of their radioactive waste. This is in the form of:
  - Fees that are paid by operators for consignment of wastes to the PRR storage facility.
  - Under article 46 of DL 108/2018, the holder of sealed radioactive sources must pay a deposit for each sealed source corresponding to 10% of the source value or 5% of the value of the equipment containing the source upon transfer of the source. Once the licensee considers that the source is no longer used for the practice for which the license has been granted, it should be either returned to the manufacturer, transferred to another authorized party, or sent to the PRR, upon which the deposit may be released or revert to cover the cost of the management of Disused Sealed Radioactive Sources as radioactive waste.
- The cost of RPI decommissioning will be borne by the Portuguese government through the relevant Ministry, in accordance with Article 4(3) of Decree Law DL 29/2012. In this instance the state is recognised as the original 'polluter'.

DL 108/2018 establishes specific provisions to address orphan sources, when its owner cannot be identified. Under these provisions, 10% of all fees collected by the regulatory body revert to the Environment Fund, a mechanism of the Ministry of Environment and Climate Action to support environmental policies. Under article 59 of DL 108/2018, the Environmental Fund covers the cost of retrieving and managing orphan sources, including remediation whenever necessary.

The PNGCIRR recognizes that there is a funding deficit between the operational costs of the PRR and the fees received from licensees. The revenue obtained through waste management fees, collected under the terms of Order No.891/2015, is less than 20% of the annual costs, and the difference is financed through the state budget and through other revenues of the operator. This shortfall is recognized as unsustainable and this is addressed in the following measure:

- Measure VII – Revision of the legal framework on the safe management of spent fuel and radioactive waste, including review of Order No. 891/2015 regarding fees due to the competent authority and radioactive waste management, taking into account the economic sustainability of the activity and socio-economic factors. Due to complete in 2023.

In addition to the routine operational costs noted above, there is a need to fund the future cost of developing national waste storage and disposal capabilities. Solutions are being developed

under the auspices of PNGCIRR and will be accompanied by proposals for their financial sustainability. The government recognizes its ultimate liability for these future capabilities, noting in the PNGCIRR (Section 5.2) that the "economic sustainability of the activity is guaranteed through the State Budget". The measures addressing this are:

- Measure II – Option assessment for radioactive waste management, particularly for NORM and organics, including appropriate cost assessments. Due to complete in 2023.
- Measure III – Feasibility study for long term storage / disposal solutions, including appropriate cost assessments. Due to complete in 2025.

Decommissioning costs for RPI have been broadly estimated at 15 million Euros (according to RCM 122/2017).

Funding of regulatory bodies, including APA and IGAMAOT, is diverse :

- APA is a public institute integrated in the indirect administration of the State, with administrative and financial autonomy. This independence is also reinforced by paragraph 3 of Article 12 of DL 108/2018. APA's funds come mostly from its own revenues, supplemented by State Budget.
- With regard to IGAMAOT, it is a central service of the direct administration of the State, endowed with administrative autonomy. According to DL 108/2018, IGAMAOT has the mission, in this matter, to verify compliance autonomously, namely through the planning and execution of ordinary or extraordinary inspection actions, order corrective actions and apply the necessary administrative offences in case of non-compliance.
- Both regulatory bodies submit annual budgets for approval by the government. Article 200 of the DL 108/2018 states that the staffing and budget of APA and IGAMAOT shall be aligned with their duties as regulatory authorities.
- The Portuguese Court of Auditors provides a level of oversight of departmental expenditure across government.

Given the relatively small magnitude of radioactive waste management activities in the country, Portugal is adopting a graded approach in its consideration of future requirements for reuse/recycling, storage and disposal.

ARTEMIS observation

There are a variety of funding challenges associated with the national waste management programme, which are generally understood and under active management through measures identified in the PNGCIRR. These include the following issues, which currently prevent the government from fully understanding its financial liabilities and from making sufficient provision to protect future generations from undue financial burden:

- The PNGCIRR recognizes that the funding mechanism for operation of PRR is unlikely to be sustainable, with funds obtained through waste management fees being less than 20% of the annual costs. This is currently under review.
- There is no underpinned asset investment plan for the upkeep of PRR beyond routine operational costs.
- Decommissioning costs for RPI are not well understood, and even less so for PRR.
- The cost and scheduling of major infrastructure investments that may be required for long term waste storage and disposal facilities are not well understood.
- Costs for other facilities that will require some level of decommissioning and waste management are not well understood.
- Costs for the future management of NORM are not well understood.

The current cost estimate for decommissioning of RPI is based on outturn costs for the decommissioning of the ASTRA reactor in Austria. The figure of 15 million Euros was included in the RCM 122/2017 as an indication of the potential cost. Whilst important lessons can be taken from ASTRA decommissioning, it is recognized by the IST that this figure is likely to increase. The ARTEMIS Review Team considers that the following factors could have a significant impact on the likely cost:

- Compound inflation could drive the benchmark figure above 20 million Euros in current monetary values, or further depending on future inflation.
- Elements of the costs incurred and/or saved on the ASTRA reactor may not be comparable.
- Investment in waste conditioning facilities may be required, at additional cost for Portugal, which were already in place for ASTRA.
- Costs associated with the management of waste from decommissioning, in compliance with cradle to grave approach, cannot be estimated due to the lack of the overall strategy for waste management.
- It is also important to ensure that cost estimates include storage and disposal costs.

The ARTEMIS Review Team considers that it would be prudent to provide a cost estimate range for significant investments, such as decommissioning or infrastructure construction projects, due to the inherent levels of complexity and uncertainty associated with these activities.

It is the responsibility of the Ministry of Finance to ensure that all organizations submit long term investment plans to enable strategic budget planning by the government. However, the ARTEMIS Review Team notes that there is no centralized register of all government financial liabilities related to the lifetime of all radioactive waste management activities. There is no national waste management operator who is responsible for ensuring that this is fully understood. Furthermore, APA is currently responsible for informing the government of cost estimates and financial issues associated with the radioactive waste management programme. This is not a typical duty for a regulatory body, often undertaken by some other departmental or non-departmental public entities, such as a national waste management organization or other body. Whilst this is not directly required by IAEA standards, this point is noted in Chapter 1.

Like in many countries, budgets are set annually and are informed by long-term strategic budget plans maintained by the Treasury. Annual budgets can pose a risk to the progress of multi-year, multi-million Euro investments associated with decommissioning or infrastructure projects, so it is important that long term investment requirements for the waste management programme are developed, maintained and communicated to the Ministry of Finance in a timely manner.

The RPI remains under the original operating safety case and the licensee considers that transition to a simplified shut-down safety case would not lead to any significant savings due to the simplicity of the reactor. A proactive decision has been taken to maintain the same level of staff to ensure knowledge retention and expertise to support the future decommissioning operations.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *The current information on governmental cost liabilities associated with decommissioning, waste storage and waste disposal is incomplete and not informed by sufficient data and plans. Whilst this is recognised in the National Programme, a comprehensive assessment of the total lifetime liability is required for all stages of all facilities, to enable the Government to discharge its duties with respect to making suitable financial provisions.*	
(1)	**BASIS: GSR Part 1 (Rev. 1) Requirement 10 states that** *"The government shall make provision for the safe decommissioning of facilities, the safe management and disposal of radioactive waste arising from facilities and activities[...]* *2.33. Appropriate financial provision shall be made for: (a) Decommissioning of facilities; (b) Management of radioactive waste, including its storage and disposal.[…]"*
(2)	**BASIS: GSR Part 5 Requirement 20 states that** *"The operator shall develop, in the design stage, an initial plan for the shutdown and decommissioning of the predisposal radioactive waste management facility […] assurance shall be provided that sufficient funds will be available to carry out shutdown and decommissioning."*
(3)	**BASIS: SSR-5 Requirement 1 states that** *"The government is required to establish and maintain an appropriate governmental, legal and regulatory framework for safety within which responsibilities shall be clearly allocated […] This shall include: […] clear allocation of responsibilities, securing of financial and other resources, and provision of independent regulatory functions relating to a planned disposal facility.[…]* *3.7. Matters that have to be considered include … (c) Ensuring the adequacy and security of financial provisions[…]"*
R7	**Recommendation: The Government should update its financial liability estimates for all aspects of radioactive waste management and ensure that long term strategic budgets include sufficient financial provision, particularly for disposal solutions.**

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

Portugal's position

Portugal has established provisions to address responsibilities between the different public and private entities involved in the safe management of radioactive waste. In particular, the national legislation clearly allocates duties and responsibilities to the entities and establishes requirements for capacity building particularly related to expertise, competence and training of human resources.

The operator has the prime and full responsibility for the safe management of radioactive waste and related facilities and this responsibility cannot be delegated or transferred to third parties.

However, the State has the ultimate responsibility for the management of radioactive waste generated in Portugal.

To ensure the safe management of radioactive waste, Portugal has established the regulatory body comprised of APA - Portuguese Environment Agency and IGAMAOT - Inspectorate General for Agriculture, Sea, Environment and Spatial Planning, two new administrations entrusted with duties and functions previously attributed to COMRSIN, separating licensing functions from inspection functions in the field of nuclear safety and radioactive waste management. In 2023 three new entities, namely ASAE, ACT and IGAS were appointed with the functions to perform supervision, respectively, in the fields of economic, working conditions and healthcare activities, with respect to the obligations of Decree Law 108/2018.

The national legislation (Decree-Law 156/2013, Decree-Law 30/2012 and Council of Ministers Resolution no. 129/2022), establishes that any entity taking part in the management of radioactive waste must have sufficient staff with adequate qualifications and training to ensure their safe management.

To carry out their regulatory tasks, APA and IGAMAOT performed an initial assessment for staff number and competences needed: now they are in the phase of building capabilities to carry out their duties and functions by training on-the-job and participating in additional training opportunities.

APA has a staff of 20 persons, IGAMAOT of 14 persons dedicated to carrying out their regulatory functions. ACT has a total of 464 labour inspectors and 255 senior technicians.

When a member of staff leaves the regulatory body, the recruiting process associated with roles in Public Administration can be long and create gaps during the transition period.

Article 200 of the DL 108/2018 states that APA and IGAMAOT shall be supported to ensure that they can fully discharge their duties and accountabilities.

The training programme for new staff members relies mainly on in house training for understanding of the legislative framework and internal procedures of the regulatory body. Technical aspects of development are provided through on the job training and internationally recognised courses provided by the IAEA, OECD/NEA, and EC, as well as through participation in international workshops.

To access competences and resources that are not available in-house, Art. 14 and 15 of DL 108/2018 authorises the Regulatory Body to be supported by technical entities in such a way as to ensure that the independence of the Regulatory Body is maintained. These technical entities are typically selected for periods of five years, subject to renewal.

Regarding the licensees, DL 156/2013 requires that a systematic and documented human resource management plan shall be implemented to ensure current and future staff needs are in place. Training plans must be put in place and updated for all workers, to ensure they are competent to perform activities safely. Training plans must take into account relevant technical and scientific developments. Moreover, art. 26 of DL 108/2018, requires the licensees to develop a radiation protection and safety training plan for the workforce. IST actually is the main operator in Portugal in the field of radioactive waste management operating the PRR.

According to article 33 of DL 108/2018, licensees have to maintain a list of workers with the respective classification of exposed workers, professional qualification, competences, including information and training and date of the last occupational health appointment.

Article 30 of DL 156/2013 requires that licensees must periodically revise the safety of the facility, subject to the supervision by the regulatory body, which requires the existence of a methodology to collect and analyse relevant operating experience, which can allow for the assessment and the determination of the necessary corrective measures.

Within DL 227/2008 Portugal has established three levels of qualification for radiation protection experts depending on the different level of education and training performed. The courses leading up to these qualification levels must be approved by APA and can be performed by higher education institutions and public/private entities recognized by APA as training centres.

In the framework of knowledge building, Portugal also provides experts for international training and peer review missions (e.g., IRRS, EPREV, ARTEMIS) and promotes the participation of staff in relevant international events such as workshops, conferences, training and exercises.

In the PNGCIRR there are provisions to establish a programme of Research & Development activities to support existing and future capability needs and at this scope, to keep and continue to develop the necessary competences and qualifications of human resources for the implementation of the National Programme. Portugal has been and continues to be involved in EU and IAEA projects.

In this regard, to give evidence to the ARTEMIS Review Team about educational programme and competencies currently available in Portugal, presentations from University of Porto on the Master programme in nuclear and decommissioning remediation and from University of Coimbra on laboratory radio-analytical analysis were showed.

ARTEMIS observation

APA and IGAMAOT have been appointed with regulatory and inspection functions in the field or radioactive waste management. The management system, including knowledge management is under implementation.

The ARTEMIS Review Team was informed that the number of applications in all areas has increased considerably and consequently noted that, considering the activities that will have to be undertaken for the implementation of the PNGCIRR, that the number of APA staff may not be sufficient for the future. In this regard, APA should develop a resource plan to ensure there are sufficient resources to discharge all of its statutory obligations, including suitable provision to compensate for attrition.

The Team heard that the staff resources of IGAMAOT are sufficient in term of numbers.

Moreover, the ARTEMIS Review Team noted that, even if APA and IGAMAOT performed an initial assessment for the number of staff and the competence needed, a plan for maintaining the capability, dealing with resource attrition, has not been developed (in line with observation R6 from IRRS mission of 2022).

The ARTEMIS Review Team was informed that the number of IST staff is currently adequate to carry out duties and functions assigned by law and that IST has established and is implementing a system for knowledge transfer and retention.

APA staff participation in national and international projects for learning and knowledge development is in place, and a training programme for existing staff has been developed.

Similarly, IGAMAOT has established and is implementing a training programme to improve the knowledge of staff: during the discussion, the ARTEMIS Review Team was informed that IGAMAOT has undergone training activities with IST and CIEMAT (Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, from Spain) to train its staff in the fields of radiation protection and inspections.

The ARTEMIS Review Team was also informed that ASAE has an annual training plan concerning the competencies of the Authority and that concerning the competencies attributed to ASAE, with the recent entry into force of Decree Law 108/2018, their application are still under development.

The ARTEMIS Review Team was informed that ACT also has an annual training plan concerning the competencies of the Authority and that the knowledge development and training of its employees is a responsibility assumed as strategic, adapting the training offer to organizational and individual needs. Between 2019 and 2022, ACT trained nearly 200 new labour inspectors. The training of labour inspectors includes ionizing radiation risks among various occupational risk factors.

The ARTEMIS Review Team was not able to collect information from IGAS because no representative took part in the discussion.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Portugal has established the new National Programme where the implementation of some measures have been appointed to APA. Considering the current and future activities that APA will have to deliver according to the National Programme, and the need to compensate for the departure of qualified staff (according to IRRS report R6) there may be a requirement for additional staff to ensure that APA can continue to fulfil its statutory obligations.*	
(1)	**BASIS: GSR Part 1 (Rev. 1) Requirement 3 states that** *"The government, through the legal system, shall establish and maintain a regulatory body, and shall confer on it the legal authority and provide it with the competence and the resources necessary to fulfil its statutory obligation for the regulatory control of facilities and activities."*
(2)	**BASIS: GSR Part 1 (Rev. 1) Requirement 18 states that** *"The regulatory body shall employ a sufficient number of qualified and competent staff, commensurate with the nature and the number of facilities and activities to be regulated, to perform*

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
	its functions and to discharge its responsibilities.[…] *4.12 The human resources plan for the regulatory body shall cover recruitment and, where relevant, rotation of staff in order to obtain staff with appropriate competence and skills, and shall include a strategy to compensate for the departure of qualified staff."*
R8	**Recommendation: APA should develop a resource plan to ensure there are sufficient resources to discharge all of its statutory obligations, including suitable provision to compensate for attrition.**
S11	**Suggestion: The Government should consider whether APA has sufficient resources to discharge all of its statutory obligations, based on APA's planning and assessment of current and future needs.**

APPENDIX A: TERMS OF REFERENCE

1. Introduction

On 8 March 2021, the Portuguese Environment Agency (APA), requested the International Atomic Energy Agency (IAEA) to organize and carry out an Integrated Review Service for Radioactive Waste and Spent Fuel, Decommissioning and Remediation (ARTEMIS) review, after the implementation of the IAEA Integrated Regulatory Review Service (IRRS) in Portugal.

Portugal requested the ARTEMIS review to satisfy 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 (hereinafter the EU Waste Directive).

The review will be organized by the Department of Nuclear Safety and Security and the Department of Nuclear Energy of IAEA. It will be performed by an independent, international peer review team selected by the IAEA.

2. Objective

The ARTEMIS review will provide an independent, international evaluation of Portuguese national framework for safe management of radioactive waste, and the competent regulatory authority, national programme and its implementation in this field.

The review will be performed by an international peer review team selected by the IAEA.

3. Scope

The ARTEMIS review will evaluate the Portuguese national framework, competent regulatory authority, national programme and its implementation for safe management of radioactive waste.
Portugal has not indicated any interest in discussing specific topics during the review mission but reserves the right to specify topics, if necessary, to the IAEA by 14 March 2023.
It was agreed to exclude: the application of the legal regime to the Autonomous Regions of Azores and Madeira.
Results from the IAEA Integrated Regulatory Review Service (IRRS) mission to Portugal conducted in 2022 will be taken into account, where relevant and appropriate to avoid unnecessary duplication.

4. Basis for the review

The ARTEMIS review will be based on the relevant IAEA Safety Standards and proven international practice and experiences, following the guidelines of the ARTEMIS review service.

5. Reference material

The review will cover all documentation submitted by National Counterpart for the considered scope of the review, including the results of a national self-assessment, which should be based on the ARTEMIS self assessment questionnaire provided by the IAEA.

All documents for the purpose of the ARTEMIS review shall be submitted in English.

Reference material for the purpose of the ARTEMIS review shall be submitted to the ARTEMIS mission webpage on the Global Nuclear Safety and Security Network (GNSSN) of the IAEA.

6. Modus operandi

The working language of the mission will be English.

The National Counterpart is the Portuguese Environment Agency (APA). The National Counterpart Liaison Officer for the review is Mr Pedro Rosário, from the Department of Emergencies and Radiation Protection of APA.

The ARTEMIS review mission will be conducted from **14 to 22 May 2023** in Amadora/Lisboa, Portugal. The provisional schedule for the review mission is provided in **Annex 2**.

The timeline for the key steps of the review process is provided below:

- Self-assessment questionnaire: available to Portugal as of **16 April 2021**
- Preparatory Meeting: **28 November 2022** (WebEx meeting)
- Notification by IAEA to the Counterparts on the review team composition: by **28 November 2022**
- Submission of reference material: by **14 March 2023** (including the completed self-assessment and, if desired, a preliminary national action plan, and topics for discussion))
- Submission of questions from the review team to the Counterpart based on preliminary review of the reference material (and in accordance with the graded approach): by **28 April 2023.** The questions can be discussed during the Review Mission.

7. International peer review team

The IAEA will convene a team of international experts to perform the ARTEMIS review according to the ARTEMIS Guidelines and these Terms of Reference. The team will consist of:

- Four qualified and recognized international experts from government authorities, regulatory bodies, waste management organizations, or technical support organizations with experience in the safe management of radioactive waste;
- Two IAEA staff to coordinate the mission. The Coordinator of the ARTEMIS review is Mr Andrey Guskov from the Waste and Environmental Safety Section of the Department of Nuclear Safety and Security of IAEA. The Deputy Coordinator is Mr Christoph Gastl from the Section of Nuclear Fuel Cycle & Materials of the Department of Nuclear Energy of IAEA;
- One IAEA staff for administrative support.

A senior staff member from the Department of Nuclear Safety and Security of IAEA will oversee the closure of the review.

The peer review team will be led by a Team Leader from the review team, Mr Christophe Depaus (ONDRAF/NIRAS, Belgium). The IAEA will inform the National Counterpart regarding the composition of the proposed review team as defined under Section 6. Modus operandi. The review mission may include the presence of up to two observers, including an observer from the EC. The National Counterpart will be notified of any proposed observers; the presence of any observers must be agreed in advance of the mission.

8. Reporting

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

Prior to its finalization, the ARTEMIS Review Report will be delivered to the National Counterpart for fact-checking, being the APA.

9. Funding of the ARTEMIS review

The costs for the services will be limited to the travel costs and per diem of the peer review team (external experts and IAEA staff) in line with IAEA Financial Regulations and Rules.

The cost of the ARTEMIS review were paid to the IAEA as voluntary contribution before the start of the mission. Portugal is aware that the review cost includes 7% programme support costs.

If the actual cost of the ARTEMIS review exceeds the estimated voluntary contribution, Portugal agrees to cover such additional cost to the IAEA. Similarly, if the actual cost is less than the estimated voluntary contribution, any excess will be refunded to Portugal through the Counterpart.

These Terms of Reference were agreed on 28 November 2022 between the IAEA and the APA during the preparatory meeting held on-line.

Annex 1: List of reference material

- *Responses to the ARTEMIS Self-assessment Questionnaire*
- *Laws, regulations and regulatory guidelines (including waste classification, concept of clearance, radiation sources categorization)*
- *Article 14 Report for Waste Directive*
- *Joint Convention report for the 7th Review Meeting*
- *Portugal IRRS report*
- *Country Review Report from the Joint Convention (JC) on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*

APPENDIX B: MISSION PROGRAMME

Time	Sun, 14 May	Mon, 15 May	Tue, 16 May	Wed, 17 May	Thurs, 18 May	Fri, 19 May	Sat, 20 May	Sun, 21 May	Mon, 22 May
8h30 – 10h00	Arrival of Team Members	**9h00 Opening** General presentation	Inventory Concepts, Plans and technical solutions	Safety case and safety assessment	Session reserved for further discussions if required/ drafting of the report	**9h00 – 11h00** **Presentation and discussions of Recommendations and Suggestions with the Counterparts**	Drafting of the report **Draft report to be sent to the Counterparts**	**Xh00 Internal reflection of comments** **xh00 Discussions with the Counterparts on the draft report**	Delivery of final draft report **EXIT MEETING**
10h00 - 12h00		National Policy and Framework							
12h00 - 13h00		Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
13h00 – 16h00		National Strategy	Cost estimates and financing	Capacity building	**Finalization of Recommendations and Suggestions**	Drafting of the report	Counterparts review the draft report	Finalising draft report	Departure of Team Members
16h30 - 17h30		Team meeting	Team meeting	Team meeting					
	Artemis team meeting	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**	R1	The Government should further develop a comprehensive national policy that sets out the preferred options for radioactive waste management.
		R2	The Government should make a commitment to radioactive waste disposal as a safe long-term solution for the management of all radioactive waste to avoid undue burden on future generations.
		S1	The Government should consider including provisions in the national policy regarding the management of NORM as radioactive waste
		S2	APA and IGAMAOT should consider finalising their MoU. APA, IGAMAOT, IGAS, ACT and ASAE should consider establishing MoU(s) to enable effective coordination and avoid possible overlaps.
		S3	The Government should consider strengthening the regulatory body's independence by establishing a waste management organization or similar entity not belonging to the Regulatory Body to ensure functional separation of responsibility for regulatory oversight of safety from co-ordination, financial oversight and implementation of the National Programme for radioactive waste management, including the development of disposal solutions.

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
2.	**NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT**	R3	The Government should establish a comprehensive strategy for safe radioactive waste management, particularly disposal.
		R4	The Government should include specific provisions in the national strategy for radioactive waste management to deal with the waste associated with the decommissioning of all facilities.
		S4	The licensees should consider selecting a decommissioning strategy for all facilities consistent with the national radioactive waste management strategy.
		R5	APA should establish safety requirements for decommissioning activities including requirements for management of the resulting radioactive waste and associated regulations and guides, before the submission of the decommissioning plans by the licensees.
		S5	The Government should consider solving the potential contradiction between the current classification of waste and the disposal solution confirmed in the National Programme.
		S6	The Government should consider including suitable provisions in the national strategy to align it with a future national policy decision on the management of NORM as radioactive waste.

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
3.	**INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE**	S7	The licensees should consider developing waste inventory estimates and associated waste characterization data.
		S8	The Government should consider establishing a waste inventory, based on characterization data for NORM, on completion of National Programme Measure II.
		S9	APA should consider including in the next revision of the National Programme the anticipated future waste inventory data from the ongoing studies for RPI & PRR decommissioning, NORM management plans and for any other facilities that are not currently included in the national inventory.
4.	**CONCEPTS, PLANS AND TECHNICAL SOLUTIONS FOR SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT**	R6	The licensees should develop decommissioning plans for existing facilities including options for radioactive waste management consistent with the National Programme, in accordance with guidance issued by APA.

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
5.	**SAFETY CASE AND SAFETY ASSESSMENT OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT ACTIVITIES AND FACILITIES**	S10	APA should consider developing safety requirements and recommendations to support safety related decisions and safety cases that will be required for waste management facilities and activities in the future.
6.	**COST ESTIMATES AND FINANCING OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT**	R7	The Government should update its financial liability estimates for all aspects of radioactive waste management and ensure that long term strategic budgets include sufficient financial provision, particularly for disposal solutions.
7.	**CAPACITY BUILDING FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT – EXPERTISE, TRAINING AND SKILLS**	R8	APA should develop a resource plan to ensure there are sufficient resources to discharge all of its statutory obligations, including suitable provision to compensate for attrition.
		S11	The Government should consider whether APA has sufficient resources to discharge all of its statutory obligations, based on APA's planning and assessment of current and future needs.

APPENDIX D: LIST OF ACRONYMS USED IN THE TEXT

ACT: Authority for Working Conditions (*Autoridade para as Condições do Trabalho*)

ANEPC: National Authority for Emergency and Civil Protection (*Autoridade Nacional de Emergência e Proteção Civil*)

APA: Portuguese Environment Agency (*Agência Portuguesa do Ambiente*)

ASAE: Economic and Food Safety Authority (*Autoridade de Segurança Alimentar e Económica*)

COMRSIN: Regulatory Commission for the Safety of Nuclear Installations (*Comissão Reguladora para a Segurança das Instalações Nucleares*)

DEPR: Department of Emergencies and Radiation Protection (*Departamento de Emergências e Proteção Radiológica*)

DGEG: Directorate General of Energy and Geology (*Direção-Geral de Energia e Geologia*)

EDM: EDM – Mining Development Company (*EDM - Empresa de Desenvolvimento Mineiro S.A.*)

EM RAD: Multidisciplinary Team for Ionizing Radiation (*Equipa Multidisciplinar de Radiações Ionizantes*)

FCT: Foundation for Science and Technology (*Fundação para a Ciência e Tecnologia*)

IGAMAOT: General Inspection for Agriculture, Sea, Environment and Spatial Planning (*Inspeção-Geral da Agricultura, do Mar, do Ambiente e do Ordenamento do Território*)

IGAS: General Inspection of Health Activities (*Inspeção-Geral das Atividades em Saúde*)

IST: Instituto Superior Tecnico (i.e., Faculty of Engineering in the University of Lisbon)

ITN: Nuclear and Technological Institute (*Instituto Tecnológico Nuclear)*

MAAC: Ministry of Environment and Climate Action (*Ministério do Ambiente e Ação Climática*)

MCTES: Ministry of Science, Technology and Higher Education (*Ministério da Ciência, Tecnologia e Ensino Superior*)

PNGCIRR: National Programme for Management of Spent Fuel and Radioactive Waste (*Programa Nacional para a Gestão do Combustível Irradiado e dos Resíduos Radioativos*)

PRR: Radioactive Waste Pavillion (*Pavilhão de Residuos Radioativos*)

RCM: Resolution of Council of Ministers (*Resolução do Conselho de Ministros*)

REA: Environment Status Report (*Relatório do Estado do Ambiente*)

RPI: Portuguese Research Reactor (*Reator Português de Investigação*)

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).

[7] INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Facilities, IAEA Safety Standards Series No. GSR Part 6, IAEA, Vienna (2014).

[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).

[14] INTERNATIONAL ATOMIC ENERGY AGENCY, Policies and Strategies for the Decommissioning of Nuclear and Radiological Facilities, IAEA Nuclear Energy Series No. NW-G-2.1, IAEA, Vienna (2012).

[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).