

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

MISSION

TO

GREECE

Athens, Greece

10-18 September 2023

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY
DEPARTMENT OF NUCLEAR ENERGY



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

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REMEDIATION (ARTEMIS) MISSION
TO
GREECE**

Mission dates: *10-18 September 2023*

Location: *Athens, Greece*

Organized by: *IAEA*

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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 9 April 2019, the Greek Atomic Energy Commission (EEAE), 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 in 2023, based upon the IAEA Safety Standards and technical guidance as well as international good practice.

The ARTEMIS review mission was requested in order to provide an independent evaluation of the Greek national policy and corresponding national programme for the management of spent fuel and radioactive waste (hereinafter referred to as the National Programme). By requesting the review Greece also meets the obligations under Article 14.3 of Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community Framework for the Responsible and Safe Management of Spent Fuel and Radioactive Waste (hereinafter the EU Waste Directive).

The review was performed by a team of senior international experts in the field of decommissioning, radioactive waste and spent fuel management, from Denmark, France, Portugal, and Sweden, with three IAEA staff providing coordination and administrative support.

The scope of the ARTEMIS mission corresponded to the review domain “national policy, framework and strategy” as per para 6.2.1 of ARTEMIS guidelines (v. 2.0.0 December 2018). Results from the IAEA Integrated Regulatory Review Service (IRRS) Follow-up mission to Greece conducted in 2017 were also taken into account, where relevant and appropriate to avoid unnecessary duplication.

A virtual preparatory meeting was organized with the representatives of Greek organizations, IAEA representatives and the designated team leader for the ARTEMIS mission on 7 February 2023 to discuss the organizational elements of the mission and to detail expectations for the review.

The Advanced Reference Material (ARM) were provided on 5 July 2023 and complemented on 23 August 2023. The ARM included a self-assessment by Greece, applicable legal acts, and other supporting documents. The ARTEMIS Review Team examined the ARM and sent a list of questions to the Greek counterparts for additional information and clarifications on 25 August 2023.

The mission took place at the headquarters of EEAE in Attiki, Greece, from 10 to 18 September 2023.

Greece has no nuclear power plants and the 5 MW research reactor (GRR-1) located at the National Centre of Scientific Research "Demokritos" (NCSR “D”) is currently licensed for extended shutdown. Spent and irradiated fuel from GRR-1 was returned to the country of origin in 2019, and fresh low-enriched uranium fuel elements were exported for use in another country in May 2023. Very low burn-up natural uranium from experimental assemblies are present in Greek universities. There are plans for expatriation of these materials. There is no disposal facility in Greece, only an interim waste storage at NCSR “D” site. Radioactive waste is also generated from medical, research and industrial applications in Greece and stored at licensees’ sites.

The ARTEMIS Review Team performed the review according to the mission programme given in Appendix B. Representatives from senior management and professional staff from EEAE and NCSR “D” participated in the meetings throughout the mission.

The ARTEMIS Review Team received presentations from the Greek counterpart and engaged in a series of exchanges to evaluate the Greek national policy and programme for executing the country’s obligations for safe and sustainable radioactive waste management, with the objective of providing Greece with recommendations and suggestions for improvement.

The ARTEMIS Review Team was also offered a site visit to the reactor building of Greek research reactor GRR-1 and the interim waste storage facility at NCSR “D”, which was organized on 12 September 2023.

The team leader and IAEA staff also had the opportunity to discuss overarching issues and perspectives for the NCSR “D” with the Director and Chairman of the Board of the National Centre for Scientific Research “Demokritos”.

The ARTEMIS Review Team commends the strong commitment of all involved parties in Greece to maintain and enhance the safety of radioactive waste management, and considers that Greece has established a good basis for these efforts. The ARTEMIS Review Team is of the opinion that the recommendations and suggestions may assist Greece in this regard. Findings and related considerations supporting outcomes of the review are summarized in this report.

The ARTEMIS Review Team is in the opinion that by adequately considering the outcomes of the present review, Greece will be in a good position to continue meeting high standards of safety for radioactive waste management in the country. In this regard, the ARTEMIS Review Team considers that requesting a follow-up mission within the next 5 years could be of benefit to Greece.

A press release was issued by the IAEA at the end of the review mission.

I. INTRODUCTION

On 9 April 2019, the Greek Atomic Energy Commission (EEAE), 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 in 2023.

Greece 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 was performed by a team of four senior international experts in the field of decommissioning and radioactive waste and spent fuel management, from multiple IAEA Member States, with IAEA staff providing coordination and administrative support. Subsequent to a preparatory meeting in February 2023, and the receipt and review of Advanced Reference Material in July 2023, in September 2023 the ARTEMIS Review Team evaluated the Greek national policy, framework, and strategy (national programme) for fulfilling the country's obligations for safe and sustainable management of radioactive waste.

II. OBJECTIVE AND SCOPE

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

The ARTEMIS review was performed against the relevant IAEA Safety Standards and proven international practice and experiences with the combined expertise of the international peer review team selected by the IAEA.

The ARTEMIS review considered the management of all types of radioactive waste in Greece.

In addition, results from the IAEA Integrated Regulatory Review Service (IRRS) Follow-up mission to Greece, conducted in 2017, were taken into account, where relevant and appropriate to avoid unnecessary duplication.

III. BASIS FOR THE REVIEW

A) PREPARATORY WORK AND IAEA REVIEW TEAM

A preparatory meeting for the ARTEMIS Review, was conducted on the 7th of February 2023 online. The preparatory meeting was carried out by the appointed Team Leader Mr David Ulfbeck, the IAEA coordinator and deputy coordinator Ms Nelli Aghajanyan and Ms Kim Baines respectively, and the team of National Counterparts led by Ms Eleftheria Carinou from the Greek Atomic Energy Commission (EEAE), with participation of representatives of the National Centre for Scientific Research "Demokritos".

The meeting participants had discussions regarding:

- the Terms of Reference for the ARTEMIS review; 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 Greece in September 2023.

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

Greece provided IAEA with the Advance Reference Material (ARM) for the review on 5 July 2023.

B) REFERENCES FOR THE REVIEW

The review was made in accordance with Version 2.0 of the guidelines for the ARTEMIS review service. The Greek responses to the ARTEMIS self-assessment questionnaire were used as a key basis for the review, together with the rest of the ARM and materials presented during the review mission and the associated discussions. In accordance with the Statute of the IAEA, the ARTEMIS review was made against the IAEA Safety Standards. Other IAEA publications were considered where relevant. The complete list of IAEA publications for this review is provided in Appendix E.

C) CONDUCT OF THE REVIEW

The initial Review Team meeting took place on Sunday, 10 September 2023 in Athens, directed by the ARTEMIS Team Leader Mr David Ulfbeck, the ARTEMIS Team Coordinator Ms Nelli Aghajanyan and the Deputy Team Coordinator, Ms Kim Baines.

The ARTEMIS entrance meeting was held on Monday, 11 September 2023, with the participation of Greek Atomic Energy Commission and the National Centre for Scientific Research “Demokritos” (NCSR “D”) senior management and staff. Opening remarks were made by Mr Christos Housiadas (EEAE Chairman), and Mr David Ulfbeck, ARTEMIS Team Leader and Ms Nelli Aghajanyan, IAEA Team Coordinator.

During the ARTEMIS mission, a review was conducted for all review topics within the agreed scope with the objective of providing Greek 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, 18 September 2023. Opening remarks were made by Mr Christos Housiadas (EEAE Chairman). A presentation of the results of the Review Mission was given by the ARTEMIS Team Leader Mr David Ulfbeck. Closing remarks were made by Ms Hildegard 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

Greek position

The Greek national policy on the management of spent fuel and radioactive waste (national policy) is presented in the article 4 in the Joint Ministerial Decision No 35225/21.04.2023 (B' 2638) "Legislative, regulatory and organizational framework for the responsible and safe management of spent fuel and radioactive waste - Adoption of Greek legislation to 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 (EE L 199/02.08.2011) - National programme for the management of spent fuel and radioactive waste."

The objective of the the Greek national policy is to provide for the management of spent fuel and radioactive waste from generation to disposal. The policy states the general principles for management of radioactive waste and spent fuel:

- Safety is the highest priority of the national policy for spent fuel and radioactive waste management;
- The import of spent fuel and radioactive waste in Greece for any purpose is prohibited;
- The spent fuel and radioactive waste generator or license holder has the prime responsibility for the management of the spent fuel and radioactive waste concerned;
- The principle of polluter pays;
- The disposal of radioactive waste is only permitted for radioactive waste that is produced within the Greek territory;
- The application of graded approach;
- The interdependencies between all stages of production and management of radioactive waste are taken into account;
- For radioactive sources, repatriation or export for recycling are the preferred management options.

In line with these principles, the Greek national policy sets out the preferred options for radioactive waste management as a reflection of national priorities. In Greece, the radioactive waste consists of mainly:

- Radioactive waste from past activities and operation of the GRR-1 research reactor in NCSR "D",
- Radioactive industrial application and consumer products such as lightning rods, fire detectors, devices with fluorescent materials,
- Radioactive waste originating from nuclear medicine laboratories.

Disused sealed radioactive sources or orphan sources are not considered radioactive waste but are included in the national programme so as not to become radioactive waste. Future arisings will include radioactive waste from the decommissioning of the GRR-1, waste management facilities and other facilities such as cyclotron or accelerator installations.

The interested parties involved in the radioactive waste management in Greece are:

- The Ministry of Finance, the Ministry of Development and Investment (MDI), and the Ministry of Environment and Energy (MEE) who are jointly responsible for the national policy on management of spent fuel and radioactive waste. The MDI is the sponsoring government ministry for the competent regulatory body.
- the Greek Atomic Energy Commission (EEAE) as the competent regulatory body in the field of safety for spent fuel and radioactive waste management,
- the NCSR “D”, which has two roles: operator of the interim storage of radioactive waste facility, and waste generator from the decommissioning of the GRR-1,
- the others radioactive waste generators,
- the National Radioactive Waste Management Committee (EEDRA): a collective body with an advisory role to the Minister responsible for the implementation of the practical aspects of the national programme for Spent Fuel and Radioactive Waste (national programme). EEDRA comprises of representatives from MDI, MEE, EEAE, NCSR “D” and a technical expert in the field of nuclear technology or nuclear sciences or waste management.

Article 11 of the Joint Ministerial Decision No 35225/21.04.2023 states that the national programme is drafted by EEAE and should take into account in particular the data and plans, submitted under the responsibility of the NCSR “D”. It is specified that EEDRA regularly reviews the national programme and provides an opinion to the respective MDI regarding necessary adjustments to the national programme for the management of spent fuel and radioactive waste.

Article 11 of the Joint Ministerial Decision No 35225/21.04.2023 states, that the national programme covers all types, streams and stages of spent fuel and radioactive waste management that fall under the jurisdiction of the Greek state, from production to disposal.

ARTEMIS observation

The ARTEMIS Review Team noted that the Greek approach to radioactive waste management in the national policy considers disposal as final destination of all radioactive waste and the repatriation or export for recycling of the sealed radioactive sources as a preferred solution. This approach in terms of the objective of the national policy is consistent with the recommendations of IAEA Safety Standards.

The ARTEMIS Review Team noted that radioactive waste generators other than NCSR “D”, such as licensees generating objects and materials contaminated with naturally occurring radionuclides, industrial, research and medical applications which currently store radioactive waste, cyclotron or other facilities, which in future will generate radioactive waste from decommissioning, are not involved to the same extent as NCSR “D” in the development and implementation of the national programme.

As stated in the policy (Article 9 of the Joint Ministerial Decision No 35225/21.04.2023), the generator is responsible for the management of spent fuel or radioactive waste until radioactive decay enables statutory release or transfer occurs to authorized waste management or disposal facility. The waste generator is also responsible for ensuring the financial resources to manage the spent fuel or radioactive waste.

Furthermore, regarding the interdependences between the different stages on radioactive waste management from predisposal to disposal, the ARTEMIS Review Team noted the potential

risks to the implementation of the national programme where extensive dialogue only takes place with a limited number of waste generators.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: <i>Radioactive waste generators other than NCSR “D” with a legitimate interest in the national programme are not involved to the same extent as NCSR “D” in its development and implementation.</i>	
(1)	BASIS: GSR Part 1 (Rev. 1) Requirement 10, para. 2.28 states that <i>“The Radioactive waste generated in facilities and activities necessitates special consideration because of the various organizations concerned and the long timescales that may be involved.”</i>
(2)	BASIS: GSR Part 1 (Rev. 1) Requirement 4, para. 2.7 states that <i>“The government has the ultimate responsibility for involving those with legitimate and recognized interests in its decision making.”</i>
R1	Recommendation: The Government should assess the means of involving all radioactive waste generators in development and implementation of the national programme.

The ARTEMIS Review Team noted that NORM waste is not considered as radioactive waste in Greece but that “objects contaminated with NORM” are included in the National Inventory, although these objects are not explicitly addressed in the national programme. Other radioactive waste streams such as radioactive waste arising from decommissioning of cyclotron facilities and radioactive waste management facilities are also not addressed in the national programme.

The ARTEMIS Review Team considers that implementation of the national programme is strongly dependent on the degree to which current and foreseen radioactive waste streams have been taken into account.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: <i>Some radioactive waste streams such as radioactive waste arising from decommissioning of cyclotron facilities and radioactive waste management facilities are not addressed in the national programme.</i>	
(1)	BASIS: GSR Part 5 Requirement 2 states that <i>“The policy and strategy shall be appropriate for the nature and the amount of the radioactive waste in the State, [...]”</i> para. 3.5 states that: <i>“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</i>

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
	<i>the waste to be managed (e.g. knowledge of the inventory and of waste streams) now and in the future.”</i>
(2)	BASIS: GSR Part 1 Requirement 10, para. 2.29 states that: <i>“In strategies for radioactive waste management, account shall be taken of the diversity between types of radioactive waste and the radiological characteristics of radioactive waste.”</i>
R2	Recommendation: The Government should ensure that waste streams such as radioactive waste arising from decommissioning of cyclotron facilities and radioactive waste management facilities that are not currently included are addressed in the national programme.

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

Greek position

The Joint Ministerial Decision No 35225/21.04.2023 is a legally binding document containing policy and strategy, part of the legal framework. According to the Joint Ministerial Decision No 35225/21.04.2023, the national framework provides the following :

- a) National programme for the implementation of the policy for the management of spent fuel and radioactive waste,
- b) Issuance of new or supplementary regulations, guidelines and recommendations,
- c) System for the licensing of spent fuel and radioactive waste management activities, and / or facilities,
- d) Management system, system of appropriate controls, regulatory inspections, documentation and reporting for activities and / or facilities for the management of spent fuel and radioactive waste, including appropriate measures for the periods following the closure of the disposal facilities,
- e) Enforcement measures, including the suspension of operation and the modification, termination or revocation of a license, accompanied by requirements,
- f) Allocation of responsibilities to the entities involved in the various stages of spent fuel and radioactive waste management. The prime responsibility for spent fuel and radioactive waste lies with their generators or license holders who have been assigned this responsibility by the competent authority.

In particular, Articles 13 and 14 of the Joint Ministerial Decision No 35225/21.04.2023 present respectively the safety requirements in radioactive waste management facilities and special safety requirements for the disposal of radioactive waste.

In Article 3 of the MD 35225/2023, a definition of radioactive waste is presented: *“radioactive materials in gaseous, liquid or solid form, the further use of which is not foreseen or considered by the Greek State or by a legal or natural person, whose decision is accepted by the Greek*

State, and which are controlled as radioactive waste from EEAE, based on the legislative and regulatory framework of the Greek State.”

ARTEMIS observation

The legal, regulatory and organizational framework in Greece for management of radioactive waste and spent fuel is comprehensive and appropriately provides for assignment of responsibilities to licensees.

The ARTEMIS Review Team considers that, in particular for predisposal and disposal facilities general safety requirements have been defined in the Joint Ministerial Decision No 35225/21.04.2023. Article 16 of this decision provides for more specific criteria for undertaking safety assessment for disposal facilities as part of a licensing procedure. EEAE mentioned that these criteria and guidance are yet to be developed. These aspects are addressed in the Recommendations R9 and R10 in this Report.

The present definition of radioactive waste included in MD 35225/2023 states that subject to decision by EEAE, radioactive materials containing naturally occurring radionuclides can be classified (“controlled”) as radioactive waste. EEAE currently makes such decisions on a case by case basis. The ARTEMIS Review Team noted that specific criteria for decision making have not been documented. This means that currently there are no specified criteria to define which materials containing naturally occurring radionuclides are considered (and should be controlled) as radioactive waste. Such criteria could be quantitative or qualitative.

The lack of documented criteria may lead to uncertainties on the waste inventory in terms of volume and characteristics of the waste which may have adverse effects on the implementation of the national programme. The ARTEMIS Review Team considers that in specifying criteria for deciding which radioactive materials containing naturally occurring radionuclides should be controlled as radioactive waste, the feedback of experience from the currently applied case by case approach could be useful.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
<p>Observation: <i>Article 3 of the Joint Ministerial Decision No. 35225/21.04.2023 defines radioactive waste as radioactive materials with no further use and which are controlled by the EEAE as radioactive waste. EEAE decides on a case by case basis whether radioactive materials containing naturally occurring radionuclides are to be controlled as radioactive waste. However, specific criteria for decision making have not been documented.</i></p>	
(1)	<p>BASIS: GSR Part 5 Requirement 3, para. 3.8 states that “To facilitate compliance with regulatory requirements, the regulatory body has to do the following: [...]”</p> <ul style="list-style-type: none"> - Establish an appropriate definition and/or classification of radioactive waste.”
R3	<p>Recommendation: EEAE should specify criteria for radioactive materials containing naturally occurring radionuclides to be controlled as radioactive waste.</p>

2. NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT

2.1. SCOPE

Greek position

The Greek national programme for the management of spent fuel and radioactive waste is presented in an annex of the Joint Ministerial Decision No 35225/21.04.2023 (B' 2638). This represents the third revision of the national programme, which foresees actions planned for 20 years. The purpose of the national programme for the management of spent fuel and radioactive waste is to define how to implement the national policy for the responsible and safe management of spent fuel and radioactive waste.

In the national programme for the management of spent fuel and radioactive waste, the following implementing actions are defined:

- Recycling of disused sealed radioactive sources and nuclear materials.
- Characterization of historical radioactive waste of NCSR “D”.
- Upgrade of the existing radioactive waste management facility at NCSR “D” for the characterization and preparation for disposal of the NCSR “D” radioactive waste (see action B) and those that will be produced from the decommissioning of the NCSR “D” research reactor.
- Decommissioning of the GRR-1 research reactor of NCSR “D”.
- Disposal facility for the needs of the NCSR “D” radioactive waste and of those that will result from the decommissioning of the research reactor of NCSR “D”.
- Management up to disposal of radioactive waste and radioactive sources other than those of NCSR “D”.

Spent and irradiated fuel from the operation of the Greek Research Reactor (GRR-1) at NCSR “D” was repatriated to the country of origin during several campaigns in the period from 1995 to 2019. In addition, non-irradiated LEU fuel assemblies were expatriated for use at a foreign research facility in 2023. Very low burn-up natural uranium from experimental assemblies are present in Greek universities. There are plans for expatriation of these materials. Upon completion of these transfers, no spent, irradiated, or non-irradiated fuel will remain in Greece, and subsequently, no plans for future management of spent fuel are foreseen.

For the storage and disposal of the radioactive waste, the national programme currently provides management steps for the following:

- Radioactive waste stored on the NCSR “D” site and radioactive waste resulting from the operation and decommissioning of GRR-1, intended for disposal within the NCSR site.
- Radioactive waste produced by other licensees than NCSR “D” is intended for disposal on a site selected somewhere else in the country.

The action plan for the implementation of the national programme provides for the development of disposal facilities including site selection. According to the waste classification (see below), two types of disposal are considered: engineered near surface disposal facility (“disposal vault”) and borehole disposal facility.

	Classification	Management				
Radioactive Waste based on the above points (a)(d)		disposal vault *	borehole	recycling	decay	release
Historical waste (a)	VLLW LLW ILW	+	+			+
Radioactive Materials (b)	LLW	+	+			+
Radioactive Waste from GRR-1 decommissioning	VLLW LLW ILW	+	+			
Sources not in use and orphan sources				+	+	+

The MD No 35225/21.04.2023 (article 15) provides for the formation of an “Organization for the Interim Storage and Management of Radioactive Materials” (OPADRY) by joint decision of the Minister responsible for EEAE and the Minister of Finance, following the agreement of EEAE after the opinion of EEDRA.

Management of radioactive waste currently held by licensees other than NCSR “D”, is to be managed by a future “Organization for the Interim Storage and Management of Radioactive Materials” (OPADRY). The mission of OPADRY will be to operate a facility for storage and predisposal management of the above materials. OPADRY will also be responsible for disposal. Storage and disposal concepts, as well as plans for siting, construction, operation and decommissioning of the radioactive waste management and storage facility are yet to be developed.

ARTEMIS observation

The ARTEMIS Review Team noted the significant progress made in Greece in the management of the radioactive waste and spent fuel: spent fuel has been exported. In addition 40 % of the category 1 and 2 sealed radioactive sources were exported in 2022. Completion of these tasks significantly reduces the burden of implementing the national programme and demonstrates a sound approach to enhancing the safety of spent fuel and radioactive waste management in Greece.

The ARTEMIS Review Team noted that the national programme sets out the approach for developing a long-term solution for radioactive waste management which considers disposal as the final destination for all radioactive waste. This approach in terms of the scope of the national strategy is consistent with the recommendations of IAEA Safety Standards.

The ARTEMIS Review Team noticed that two tasks related to siting of disposal facilities are defined in the action plan of the national programme. According to the action plan, initial communication with the interested parties is planned for each preselected site as part of the process for issuance of feasibility license. The feasibility license provides for consultation with interested parties within a period of 20 days, to allow for participation in the decision-making process regarding a particular site. Subsequently EEAE makes a recommendation to the

responsible Minister regarding the issuance of the licenses in question. As such, the national programme allows for involvement of interested parties regarding decision making for one preselected site, but it does not provide for involvement of interested parties in decision making for the initial preselection of sites for disposal facilities.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: <i>A process for the inclusion of interested parties in decision making for the site selection of disposal facilities outside the NCSR “D” site prior to the issuance of the feasibility license has not yet been developed.</i>	
(1)	BASIS: SSR 5 para. 1.17 states that “The development (i.e. site selection and evaluation, and facility design and construction) of most types of disposal facility is likely to take place over extended periods of time. The period over which disposal facilities will be operated prior to closure will, in most cases, also extend over decades. Different activities will be conducted in this period of development, such as site selection and evaluation, and facility design and construction, with decisions being made to proceed to the next set of activities or the next step in the development of the facility.”
(2)	BASIS: SSR 5 Requirement 1, para. 3.7 states that “Matters that have to be considered include: Defining the overall process for the development, operation and closure of disposal facilities, including the legal and regulatory requirements (e.g. licence conditions) at each step, and the processes for decision making and the involvement of interested parties.”
R4	Recommendation: The Government should develop a process for inclusion of interested parties in decision making for the site selection of disposal facilities outside the NCSR “D” site prior to the issuance of the feasibility license.

The ARTEMIS Review Team acknowledges the key role that OPADRY will play in the implementation of the national programme and takes note that OPADRY has not been established yet.

Furthermore, in the national programme, the site selection for facilities that OPADRY will construct and operate is planned for 2027, while OPADRY would be established after site selection.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: <i>Site selection for facilities to manage radioactive waste and sources other than those under the responsibility of NCSR “D” is planned in 2027. OPADRY which is going to be responsible for predisposal management and disposal of this radioactive waste will not be established until after site selection.</i>	
(1)	BASIS: GSR Part 5 Requirement 4 states that “Operators shall be responsible for the safety of predisposal radioactive waste management facilities or activities.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
	<i>The operator shall carry out safety assessments and shall develop a safety case, and shall ensure that the necessary activities for siting, design, construction, commissioning, operation, shutdown and decommissioning are carried out in compliance with legal and regulatory.”</i>
(2)	BASIS: GSR Part 5, para. 3.5 states that <i>“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. It has to assign responsibilities for various aspects of radioactive waste management, including regulatory overview.”</i>
(3)	BASIS: GSR Part 5, para. 3.6 states that <i>“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.”</i>
R5	Recommendation: The Government should establish OPADRY in a timeframe suitable to carry out the necessary activities for siting, design and construction of the radioactive waste management facility.

2.2. MILESTONES AND TIMEFRAMES

Greek position

The action plan for the implementation of the national programme is presented with key milestones and the associated timeframe (table below). For each task of the action plan, milestone, responsible for implementation and deadline, as well as detailed cost breakdowns are given.

Action	TITLE	START	END
A	Recycling of sealed radioactive sources and nuclear Materials	1/3/23	31/12/30
B	Characterization of historical radioactive waste of NCSR "D"	1/3/23	31/12/26
C	Upgrade of the existing RW management facility at NCSR Demokritos	1/6/25	31/12/30
D	Decommissioning of the research reactor	1/1/23	31/12/33
Ei	Disposal facility for the disposal needs of the NCSR "D" RW and of those that will result from the decommissioning of the research reactor of NCSR "D" in a location inside NCSR "D" campus	1/1/28	31/12/35
Eii	Disposal facility for the disposal needs of the NCSR "D" RW and of those that will result from the decommissioning of the research reactor of NCSR "D" in a location other than the NCSR "D" campus	30/6/29	31/12/37
F	Management up to disposal of RW and radioactive sources other than those of NCSR "D"	1/1/24	31/12/42

ARTEMIS observation

The ARTEMIS Review Team noted that the action plan for the national programme is specified for a 20-year term, although it is understood that the programme applies beyond this timeframe. The milestones within the action plan for disposal facilities only refer to the siting and construction phases. The timeframes and milestones for operation, closure and post-closure phases for the disposal facilities are not included. The national programme should outline arrangements for the implementation of all the preferred options for radioactive waste management set out in the national policy, including those that extend beyond the timeframe set in the action plan. The principles for ensuring safety of radioactive waste management including disposal are presented in Article 14 of the Joint Ministerial Decision No. 35225/21.04.2023.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *The national policy covers all stages of radioactive waste management, including operation, closure and post-closure phases for the disposal facilities. However, the national programme does not explicitly make provisions for the operation, closure and post-closure phases.*

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	BASIS: GSR Part 5 Requirement 2, para. 3.6 states that <i>“The national strategy for radioactive waste management has to outline arrangements for ensuring the implementation of the national policy.”</i>
(2)	BASIS: SSR-5 Requirement 11 states that <i>“Disposal facilities for radioactive waste shall be developed, operated and closed in a series of steps. Each of these steps shall be supported, as necessary, by iterative evaluations of the site, of the options for design, construction, operation and management, and of the performance and safety of the disposal system.”</i>
R6	Recommendation: The Government should provide for implementation of the policy in place by including operation, closure and post-closure activities related to disposal facilities in the national programme.

2.3. PROGRESS INDICATORS

Greek position

In the national programme, key performance indicators (KPIs) have been defined in order to measure progress towards the achievement of the individual tasks in the action plan. The KPIs are examined at least every 3 years, in the context of the national reports submitted on the implementation of the EU Waste Directive. In the meantime, the progress of the KPIs is systematically monitored by EEDRA, as provided in Article 15 para 1 in Joint Ministerial Decision No 35225/21.04.2023 (B' 2638). Furthermore, the appropriateness of the considered parameterization is reviewed at least every eight years by EEAE, taking into account the opinion of EEDRA.

The progress of different actions like recycling of radioactive sources is illustrating. For instance, the KPI associated to the action of recycling of radioactive sources is the number of radioactive sources for category 1, 2 and 3 that have been recycled. In June 2022, 40% of the radioactive sources for category 1 and 2 were exported for recycling.

ARTEMIS observation

The milestones and KPIs may provide information on the progress of implementation for each activity in the national programme. The ARTEMIS Review Team noted that the record of progress for one activity may not necessarily provide sufficient information to assess the progress of implementation for the entire national programme. For this purpose, a more integrated approach for assessing progress both at the scale of individual action and at the scale of the entire national programme, should be considered.

The ARTEMIS Review Team highlights that in the framework of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste management (Joint Convention), Contracting Parties recognized the value of defining realistic short- and medium-term milestones to demonstrate progress in the implementation of national policies, strategies and programmes (Summary report of the 7th Review Meeting).

3. INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE

Greek position

There is no spent fuel in Greece as all irradiated fuel from the GRR-1 was returned to its country of origin. Very low burn-up natural uranium from experimental assemblies are present in Greek universities. There are plans for expatriation of these materials.

Greece does not allow the import of spent fuel or radioactive waste from any other country.

In Greece, radioactive waste is classified according to IAEA Safety Standards Series GSG-1. However, waste originating from the operation of GRR-1 and activities performed at NCSR “D” site are classified according to origin and type. Classification of radioactive waste from other facilities and activities is also based on origin and type. The aim is that all radioactive waste, after further characterization, will be re-classified according to the provisions in GSG-1. Below is the information provided on EEAE website on the radioactive waste classification:

- VSLW: half-lives < 100 days. This category includes waste that can be released into the environment in accordance with the radiation protection regulations (appendix 7 of PD101/2018).
- VLLW: half-life <30 years and activity values twice the exemption values of appendix 7 of the PD 101/2018. Waste with isotopes with higher half-lives (e.g., Ra-226) may also be considered as VLLW, if the activity is low. Some examples are items containing Ra-226 for fluorescence, smoke detectors with Am-241, and soil contaminated with NORM (Ra-226) at low concentrations.
- LLW: half-life >30 years, activity concentration < 400 Bq/g (on average, for radioisotopes emitting α radiation) or 10 kBq/g (on average, for isotopes emitting β or γ radiation).
- ILW: waste that does not belong to the previous categories with long half-life times and high concentrations. Such waste may result from the decommissioning of the GRR-1 research reactor of NCSR “D”.

The national inventory of radioactive waste, radioactive sources and radioactive material is maintained by EEAE as part of the national radiation protection database. The database currently includes limited information, for example: facility, location, operator, persons in charge, quantities, form, activities. The responsibilities for EEAE to manage and update the national inventory are listed in Article 6 para 2d in Joint Ministerial Decision No 35225/21.04.2023 (B’ 2638).

On a yearly basis EEAE contacts all licensees to confirm the accuracy of the information in the national inventory. The national inventory is also checked during regulatory inspections. For the NCSR “D” inventory, EEAE are informed of any updates or changes as soon as they become available. General information about the national inventory is published on the EEAE website.

In the National Action Plan, EEAE will upgrade the national inventory database software to increase and improve the data that can be recorded. EEAE is considering the use of the IAEA database SRIS.

The national inventory presented in the national programme is currently containing approx. 300 m³ of radioactive waste.

NORM waste is not considered as radioactive waste in Greece. However, “objects contaminated with NORM” are included in the radioactive waste inventory. There are also some industrial activities in Greece (e.g., oil exploitation) that generate significant amounts of NORM contaminated objects, for which there are currently no management plans.

Future arisings from the decommissioning of GRR-1 are included in the radioactive waste inventory. The waste arising to achieve the end state for the GRR-1 are currently not included as the end state for the GRR-1 site has not yet been defined. Regarding the decommissioning of some other facilities that may generate radioactive waste, such as cyclotron facilities, there is currently large uncertainty, but, nevertheless, the generated radioactive waste is anticipated to be of very small amount.

ARTEMIS observation

The ARTEMIS Review Team noted that part of the inventory is classified according to GSG- 1. The team further noted that the inventory does not currently contain information regarding radiological, physical, chemical and biological properties of the waste. Characterization of other properties is planned and with some characterization project being included within the national programme. The additional characterization information will support the continued storage as well as further management of the radioactive waste, including disposal.

The ARTEMIS Review Team noted that there are still radioactive waste to be included in the national inventory. For example, the radioactive waste arising from decommissioning of GRR-1 is currently not fully accounted for as the end state is not yet defined. In addition, radioactive waste originating from the operation and decommissioning of other facilities generating radioactive waste such as a cyclotron or interim storage facilities are not currently included. The ARTEMIS Review Team notes that Recommendation R2 of this Report has bearing on the completeness of national inventory.

The ARTEMIS Review Team was informed that EEAE has compiled information related to practices using NORM from 2020-2021. The team noted further work is needed by EEAE regarding the classification of “objects contaminated with NORM” addressed in the Recommendation R3 of this Report. Without this clarification there is uncertainty about the volume of “objects contaminated with NORM” which are to be controlled as radioactive waste. This may have implications for implementation of the national programme.

The ARTEMIS Review Team considers that improvements in the data within the national inventory will support decision making, planning and financial provision to ensure continued safe management of radioactive waste in Greece.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: <i>The national inventory in Greece includes partial information about existing radioactive waste, which has not yet been fully characterized in terms of relevant radiological, physical, mechanical, chemical and biological properties to support the implementation of the national programme. A comprehensive estimate of future arisings is not fully included.</i>	
(1)	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. It has to assign responsibilities for various aspects of radioactive waste management, including regulatory overview.”
(2)	BASIS: GSR Part 5 Requirement 9 states that “At various steps in the predisposal management of radioactive waste, the radioactive waste shall be

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

	<p><i>characterized and classified in accordance with requirements established or approved by the regulatory body.</i></p> <p><i>4.10. Radioactive waste has to be characterized in terms of its physical, mechanical, chemical, radiological and biological properties. [...]</i></p> <p><i>4.11. The characterization serves to provide information relevant to process control and assurance that the waste or waste package will meet the acceptance criteria for processing, storage, transport and disposal of the waste. The relevant characteristics of the waste have to be recorded to facilitate its further management.”</i></p>
S1	<p>Suggestion: EEAE should consider strengthening the national inventory so that it covers all radioactive waste in Greece together with future arisings.</p>

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

Greek position

The Greek national programme presents an overview of envisaged concepts for disposal and describes plans for development and realisation of technical solutions necessary for the implementation of the programme.

Current situation

No plans are defined for management of spent fuel, as the irradiated fuel of GRR-1 was returned to the country of origin in 2019 and the remaining fresh LEU fuel elements were exported in 2023.

Currently there is no designated national radioactive waste management organization, no national centralised storage facility and no associated predisposal management facilities for radioactive waste in Greece. Dismantling of some systems, structures and components of GRR-1 have been undertaken. Approximately one third of the volume of radioactive waste included in the national inventory is currently held in storage at the NCSR “D”, in an interim storage facility, where operational radioactive waste from GRR-1 and other radioactive waste of historical origin is located. The storage facility consists of a small number of light structured buildings, shipping containers and a roof covered area, all located at the NCSR “D” site. Small amounts of radioactive waste are also stored in horizontal storage tubes in the basement of the GRR-1 facility. The storage tubes were originally intended as temporary shielding/storage of the neutron beam tubes during operation of the GRR-1. In addition, segregated parts of the reactor internals (e.g., grid plate) are kept in a shielded structure stored in the now dry reactor pool. Parts from cropped fuel assemblies and beryllium reflectors are stored in the pool originally used to store spent fuel.

Outside the site of NCSR “D”, some licensees, mainly hospitals, store smaller amounts (in volume) of radioactive waste for the purpose of decay and clearance. License conditions specify requirements for the safe management of these amounts of radioactive waste while stored at licensee sites. Some scrap metal facilities also store radioactive waste (primarily orphan sources or contaminated objects) detected by portal monitors when shipments are received.

According to the Memorandum of Understanding between the NCSR “D” and EEAE, NCSR “D” is tasked to receive radioactive sources (e.g. “orphan” sources) and materials that are no longer the responsibility of a licensee, or which belongs to undertakings undergoing liquidation. No other radioactive materials, including radioactive waste is accepted at NCSR “D”.

Planned predisposal activities

For predisposal management, NCSR “D” is planning to upgrade the interim storage facility in order to facilitate characterization, treatment and storage of radioactive waste currently stored by NCSR “D” as well as radioactive waste resulting from future decommissioning of GRR-1. For radioactive waste already in storage, planned activities include sorting, characterization and repackaging. The planned methodology is not specified but potential technical solutions for sorting, segregating, characterizing, packaging etc. have been listed for consideration when specific tasks have to be initiated.

For decommissioning of the GRR-1, a plan for the dismantling of the Primary Cooling System (PCS) was developed in 2010 as part of an initiative for updating the PCS and improving the reactor design and control system. The upgrade was never carried out, but the plan remains part of the overall documentation for decommissioning of the GRR-1. A final decommissioning plan, including definition of the end state as well as selection of methods for decontamination, dismantling, segregation and subsequent management of radioactive waste is yet to be completed. The final decommissioning plan must take into account, that the GRR-1 facility may in future need to serve predisposal management purposes, while at the same time supporting research activities as part of an envisaged applied radiation research center.

The plan is to develop two administratively entirely independent facilities: (a) a research lab and (b) a VLLW and LLW facility. Nevertheless, due to their close proximity it is expected that application driven collaborative scientific and technological projects in the domain of radioactive waste management can be initiated.

Planned disposal activities

For disposal of radioactive waste currently held in storage at NCSR “D” and radioactive waste which will result from decommissioning of GRR-1, the national programme specifies a preferred and an alternative option, depending on the outcome of initial radiological impact assessments. Each option includes several decision points with impacts on plans and requirements for development of technical solutions as outlined in Chapter 2.

Preferred disposal option

In the preferred option, a disposal facility within the site of NCSR “D” is foreseen. The envisaged disposal concept includes a near surface disposal facility for disposal of VLLW and LLW as well as a deeper, borehole type facility for disposal of ILW. Generic disposal concepts to be considered are presented in the national programme. The possibility to adapt a previous pump room in the basement area below the reactor to an engineered barrier, near surface type disposal facility for VLLW and LLW is under consideration. No alternative locations for disposal of VLLW and LLW on the NCSR “D” site are currently under consideration. The location of a borehole type facility has not been specified.

Alternative disposal option

In case hydrogeological radiological impact assessments conclude that safety criteria cannot be satisfied for the disposal of VLLW, LLW and ILW on the NCSR “D” site, an alternative option for selection of a new disposal site and concept is to be developed. For selection of a new disposal site and development of a corresponding disposal solution, a new Radioactive Waste Management and Disposal Organization, ODRA is to be established. In case only disposal of ILW at the NCSR “D” site is found to be in conflict with safety criteria, ILW is to be stored at the upgraded storage and radioactive waste management facilities at NCSR “D” until an alternative disposal solution for ILW is developed and operational. Actual plans for the upgraded storage facility for ILW are still to be developed. Development of a near surface disposal facility for VLLW and LLW at the NCSR “D” site will in this case proceed irrespective of the chosen management or disposal solution for ILW.

ARTEMIS observation

The ARTEMIS Review Team notes that current storage conditions for radioactive waste at the interim storage facility and at the GRR-1 provide limited opportunities for establishing technical solutions for sorting, segregation, characterization and packaging of the radioactive waste. In addition the planned upgrade to the interim storage facility will need to accommodate the management of already stored radioactive waste as well as radioactive waste generated during the upgrade as well as sorting, segregation, characterization and packaging activities.

For GRR-1, the final decommissioning plan will need to include an itemized overview of which systems, structures and components are subject to dismantling and which may be left in place, in order to satisfy the criteria for achieving the desired end state of the facility. It should be recognized that systems, structures and components left in place now may in future become radioactive waste when decommissioning of the envisaged new radiation research centre ceases to operate.

Disposal of radioactive waste currently held in storage at NCSR “D” and radioactive waste which will result from decommissioning of GRR-1, may follow one or several of the management options described in the national programme. In this regard, special attention should be paid to the interdependencies between management steps for instance related to treatment and packaging, transport and compliance with waste acceptance criteria for specific facilities. The task of taking interdependencies into account regarding the plans for establishing a new radiation research centre and storage and disposal facilities in adjacent locations within the GRR- 1 facility appears particularly demanding.

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

Greek position

According to Joint Ministerial Decision No. 35225/21.04.2023 (B'2638), the prime responsibility for the safety of radioactive waste management rests with the licensee. For radioactive waste management and disposal facilities, license holders are required to perform safety assessments covering all stages of the lifetime of the facilities. Safety assessments must be periodically updated, taking into account the effects of ageing, operational experience, characteristics of the site and relevant research and development. The safety assessment must be verified through regulatory assessments. For facilities and activities other than radioactive waste management and disposal facilities, Joint Ministerial Decision 45872/2019 (1103 B as amended with the Joint Ministerial Decision No. 32083/04.04.2022 (B' 1552) specifies further requirements regarding the scope and contents of the safety assessment as part of licensing procedures, taking into account a graded approach. Additional guidance is provided by EEAE. For disposal facilities, the siting, design and operation of the facility must provide isolation of the radioactive waste from humans and the biosphere for over 1000 years and safety must be assured by passive means, taking into account events which may affect the safety of natural as well as engineered barriers. Further specifications regarding the scope and contents of the safety case and safety assessment for radioactive waste management facilities and disposal are expected to enter into force by the adoption of an additional ministerial decision in late 2024.

The contents and updates to safety assessments for facilities other than those on the NCSR "D" site are regularly reviewed by EEAE. The safety case and associated safety assessment for the currently operating interim storage facilities and activities at NCSR "D" has been developed in a series of iterative steps related to a licensing process initiated in 2006. Currently, a few issues remain unresolved, including updates to the safety report documenting the safety assessment, provisions for characterization and record keeping. Provisions to ensure resolution of these issues have been added in licensing conditions stipulating deadlines for corrective actions. A future upgraded radioactive waste management facility will be subject to a staged licensing procedure (feasibility, planning, operation, decommissioning etc.), each with an associated safety assessment. The safety assessment of the reactor including the storage of radioactive waste and the sources used for research activities was updated in September 2022 and again in September 2023. Decommissioning of the GRR-1 will be subject to the requirement for undertaking a safety assessment in support of a final decommissioning plan for the facility, which has not yet been prepared.

ARTEMIS observation

The legislative framework provides comprehensive requirements and guidance concerning the conduct of safety assessments for all facilities apart from radioactive waste management and disposal facilities. The requirements are implemented by licensees as verified through regulatory inspection and licensing procedures.

However, safety assessments have not been completed for decommissioning of GRR-1 and for the activities undertaken at the currently operating interim storage of radioactive waste at NCSR "D".

In the framework of the national programme, the general criteria for safety of radioactive waste management and disposal facilities are specified in a ministerial decision, while the steps for licensing with respect to siting, design and operation of these facilities remain unspecified.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *The decommissioning plan and supporting safety assessment for the Greek research reactor GRR-1 is only partially completed.*

(1)	BASIS: GSR Part 6 Requirement 10, para. 7.6 states that <i>“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.”</i>
(2)	BASIS: GSR Part 6 Requirement 3 states that <i>“Safety shall be assessed for all facilities for which decommissioning is planned and for all facilities undergoing decommissioning.</i> <i>2.6. The final decommissioning plan shall be supported by a safety assessment addressing the planned decommissioning actions and incidents, including accidents that may occur or situations that may arise during decommissioning.”</i>
R7	Recommendation: NCSR “D” should complete the decommissioning plan and supporting safety assessment without undue delay, including all reactor systems and components taking into consideration the adopted end state for the facility.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *The safety report for the currently operating interim storage of radioactive waste at NCSR “D” is not complete.*

(1)	BASIS: GSR Part 5 Requirement 13, states that <i>“The operator shall prepare a safety case and a supporting safety assessment. In the case of a step by step development, or in the event of modification of the facility or activity, the safety case and its supporting safety assessment shall be reviewed and updated as necessary.”</i>
R8	Recommendation: NCSR “D” should update the safety report for the interim storage of radioactive waste.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *While general safety criteria for radioactive waste management and disposal facilities are defined, more specific criteria for undertaking safety assessment as part of a licensing procedure are yet to be adopted. In addition, regulatory requirements and guidance are yet to be developed.*

(1)	BASIS: GSR Part 5 Requirement 1 states that <i>“The government shall provide for an appropriate national legal and regulatory framework within which radioactive waste management activities can be planned and safely carried out.”</i>
(2)	BASIS: GSR Part 5 Requirement 3 states that <i>“The regulatory body shall establish the requirements for the development of radioactive waste management facilities and activities and shall set out procedures for meeting the requirements for the various stages of the licensing process.”</i>
(3)	BASIS: SSR 5 Requirement 1 states that <i>“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: [...]; specification of the steps in development and licensing of facilities of different types; [...].”</i>
(4)	<p>BASIS: SSR 5 Requirement 2 states that <i>“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. [...]</i></p> <p><i>3.8. [...] The regulatory body has to develop regulatory requirements specific to each type of disposal facility for radioactive waste, including each type that is envisaged, on the basis of national policy and with due regard to the safety objective and criteria set out in para. 2.15. The regulatory body has to provide guidance on the interpretation of the national legislation and regulatory requirements, as necessary, and guidance on what is expected of the operator in respect of each individual disposal facility.”</i></p>
R9	Recommendation: The Government should enhance the legal and regulatory framework for safety of radioactive waste management and disposal facilities as planned by specifying the steps in development and licensing of such facilities.
R10	Recommendation: EEAE should further detail regulatory requirements and provide guidance on the interpretation of the national legislation and regulatory requirements, and on what is expected of the operator in respect of each individual facility.

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

Greek position

The national programme currently covers actions to be developed over a 20-year planning horizon, with an estimated total cost of 10.7 M€. This includes the provision of funds for the characterization of historical waste at the interim storage at NCSR “D”, the upgrade of this interim storage, the partial decommissioning of the GRR-1 research reactor at NCSR “D”, the construction of a new disposal facility at NCSR “D” or in another location to be determined, and funds for the management up to construction of a disposal facility for radioactive waste and radioactive sources other than those of NCSR “D”.

The costs of some actions in the national programme (export of sealed radioactive sources and nuclear materials; characterization of historical waste at NCSR “D”) were estimated from recent market research. The estimated cost of the upgrade of the existing interim storage at NCSR “D” results from the costs of individual items (equipment and services, mostly) that were considered necessary. The costs of the partial decommissioning of the GRR-1 were estimated using the methodology set in the 2017 IAEA publication TECDOC-1832 “Data Analysis and Collection for Costing of Research Reactor Decommissioning: Report of the DACCORD Collaborative Project”. The costs for the construction of a near surface engineered facility with a capacity of 300 m³ were estimated based on the 1999 OECD/NEA publication “Low-Level Radioactive Waste Repositories: An Analysis of Costs” where the reference unitary (per m³) cost was doubled. In general, an horizontal 30% contingency is included additionally. Funds left from actions that were concluded at a cost lower than foreseen can be used to support other actions, as necessary. Also, built-in cost overestimates for the disposal facility are provided to give confidence that other costs incurred in the future that are not explicitly included at this time can be supported.

It is planned that OPADRY will benefit from the state financial budget as responsible for the interim storage and management of radioactive waste and radioactive materials for which EEAE considered there is a clear and justified need.

Up to now the update of the national programme was performed on a three-year period. In the current version of the national programme there is no fixed timeline. The update follows the internal process of EEAE based on its integrated management system. These updates consider the plans and information submitted by NCSR “D” and the other licensees that are communicated to EEAE on an annual basis.

ARTEMIS observation

The ARTEMIS Review Team observed that the cost estimates for the national programme only cover actions for a time frame of 20 years. Costs and funding for human resources, competence management, research and development needs, and post-closure actions will be covered partly by regular state budget, and partly through funding secured for the implementation of the national programme.

The costs for the construction of a 300 m³ near surface engineered facility for the disposal of existing and estimated future waste were based on generic criteria with the added contingencies described above. It is not clear how the safety margin accounts for uncertainties due to effects of scaling, compound inflation, and site and facility specific requirements. Furthermore, the

costs for operating this facility were not explicitly considered, nor for closure and post-closure activities.

The ARTEMIS Review Team also observed that the cost for the decommissioning of the existing interim storage at NCSR “D” is not included, nor the cost for management of waste that cannot be disposed of in a near surface engineered facility.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
<p>Observation: <i>The national programme does not include cost estimates and financial provisions for all stages of all facilities with regard to decommissioning, radioactive waste storage and disposal, including post-closure; currently, the national programme does not include detailed cost estimates and financial provisions for the existing interim storage facility and the future radioactive waste storage and disposal facilities with regard to their decommissioning and post-closure.</i></p>	
(1)	<p>BASIS: GSR Part 1 (Rev. 1) Requirement 10 states that <i>“The government shall make provision for the safe decommissioning of facilities, the safe management and disposal of radioactive waste arising from facilities and activities[...]</i></p> <p><i>2.33. Appropriate financial provision shall be made for: (a) Decommissioning of facilities; (b) Management of radioactive waste, including its storage and disposal. [...]”</i></p>
(2)	<p>BASIS: SSR-5 Requirement 1 states that <i>“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. [...]”</i></p> <p><i>3.7. Matters that have to be considered include ... (c) Ensuring the adequacy and security of financial provisions [...]”</i></p>
(3)	<p>BASIS: GSR Part 6 Requirement 9 states that <i>“6.1. It shall be ensured that adequate financial resources to cover the costs associated with safe decommissioning, including management of the resulting waste, are available when necessary.</i></p> <p><i>6.2. The cost estimate for decommissioning shall be updated on the basis of the periodic update of the initial decommissioning plan or on the basis of the final decommissioning plan. The mechanism used to provide financial assurance shall be consistent with the cost estimate for the facility and shall be changed if necessary.”</i></p>
(4)	<p>BASIS: GSR Part 5 Requirement 1 states that <i>“The government shall provide for an appropriate national legal and regulatory framework within which radioactive waste management activities can be planned and safely carried out. This shall include the clear and unequivocal allocation of responsibilities, the securing of financial and other resources, [...]”</i></p>
R11	<p>Recommendation: The Government should assess the completeness of the</p>

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

costing information used to establish the financial provisions for implementation of the national programme and align cost estimates and funding provisions as appropriate. In particular this applies to the existing interim storage facility and the future radioactive waste storage and disposal facilities with regard to their decommissioning and post-closure.

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

Greek position

Legal provisions to ensure the establishment and maintenance of the necessary competences and skills are spread in several legislative acts. All parties with responsibilities relevant to radioactive waste management must ensure the training of their staff. EEAE identifies its training gaps through its own integrated management system (IMS). Regarding the license holders, EEAE ensures that the relevant training requirements are met during the assessment of the documentation received within the authorization procedure and verifies them through the inspection programme. EEAE and NCSR “D”, have regular meetings that facilitate the exchange of experiences, challenges, and approaches, contributing to continuous improvement. The tasks and responsibilities associated with different actions of the national programme are agreed within EEDRA meetings. Sufficient resources, including funding, personnel and equipment are expected to be allocated via the IMS of the involved parties, based on the programme’s needs and timeline.

The staff of the parties involved in the national programme are encouraged to participate actively in international conferences, workshops, and collaborations to exchange knowledge with national and international experts.

Also, one of the actions taken by EEAE for the maintenance of necessary competences in the country is the establishment of scholarships through which it is envisaged to maintain and further develop the expertise and skills needed in the national programme.

Greek legislation also includes provisions for the recognition and approval by EEAE of qualified experts in medical exposure and outside medical exposure, including the areas of veterinary, research, industry, education, management of radioactive waste and natural radioactive materials.

The NCSR “D” has experienced difficulties in attracting and retaining human resources for the tasks that are assigned to it in the national programme. The interim storage facility currently has a staff of three. This will be reduced to one within five years due to retirement and there is no defined plan for hiring staff for this facility in the next few years. The GRR-1 has currently a staff of nine members, all hired more than 10 years ago, that will be drastically reduced to two within three years, also due to retirement. There is also no defined plan for hiring in the next few years. EEAE has not experienced difficulties in attracting talent and also has more flexibility to hire staff, using own funds whenever necessary.

EEAE and NCSR “D” participate regularly in research and development projects funded by the European Commission and by the IAEA. There has not been significant national funding available for research and development to support the national programme.

The national programme foresees several actions for which external contractors will be used, due to limited human resources within the parties. External contractors are in part funded by resources available to EEAE.

ARTEMIS observation

The NCSR “D” has a key role in the programme, but the ARTEMIS Review Team observed that available human resources at the interim storage facility at NCSR “D” are limited in view of the planned activities in the national programme. Human resources will be further reduced due to retirement. Reduction in human resources may affect the ability to retain facility knowledge. The same situation applies for GRR-1, where knowledge retention is essential for supporting future decommissioning.

Regarding future actions, the ARTEMIS Review Team observed that the national programme does not contain clear provisions on the human resources required for the establishment and operation of OPADRY and ODRA that are foreseen in different steps of the implementation. The ARTEMIS Review Team notes the importance of maintaining the technical capacity to oversee the work by external contractors and to take responsibility for the implemented tasks.

Greek institutions have mainly participated in international research and development projects, which are not necessarily all specific to the needs of the national programme. Overall, the parties involved in the national programme have limited financial and human resources to implement research and development programmes. The policy does not yet include specific provision to identify and meet the needs in research and development for implementation of the national programme. The ARTEMIS Review Team notes the benefits delivered by the IAEA’s Technical Cooperation Programme to other Member States, through national projects that can be tailored to the specific country needs.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: <i>The national programme does not contain clear provisions for the human resources for OPADRY and ODRA required for implementation of the programme.</i>	
(1)	BASIS: GSR Part 1 (Rev. 1) para. 2.3 states that: “[...] In the national policy and strategy, account shall be taken of the following: (d) The need and provision for human and financial resources; [...]”
(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. It has to assign responsibilities for various aspects of radioactive waste management, including regulatory overview.”
(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

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
	<i>and other resources, [...]”</i>
R12	Recommendation: The Government should make provision for the human resource needs for OPADRY and ODRA to ensure the implementation of the national programme.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *NCSR “D” currently has a limited workforce dedicated to implementation of the national programme. Due to retirements a reduction within 3 to 5 years may have an adverse impact on retention on knowledge and information necessary for NCSR “D” to perform its responsibilities.*

(1)	BASIS: GSR Part 1 (Rev. 1) para. 2.3 states that: “[...] In the national policy and strategy, account shall be taken of the following: (d) The need and provision for human and financial resources; [...]”
(2)	BASIS: GSR Part 2 Requirement 9, para. 4.27 states that: “The knowledge and the information of the organization shall be managed as a resource.”
(3)	BASIS: GSR Part 6 Requirement 7, para. 4.4 states that: “Individuals performing decommissioning actions shall have the necessary skills, expertise and training to perform decommissioning safely. Provisions shall be made to ensure that institutional knowledge about the facility is obtained and made accessible and, as far as possible, that key staff from the facility are retained.”
R13	Recommendation: NCSR “D” should take measures to ensure retention of knowledge and information and provide human resources with sufficient expertise, training and skills to implement actions in the national programme.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *The parties involved in the national programme have limited financial and human resources to implement research and development programmes in support of the national programme.*

(1)	BASIS: GSR Part 1 (Rev. 1) Requirement 1, para. 2.3 states that “[...] The strategy shall set out the mechanisms for implementing the national policy. In the national policy and strategy, account shall be taken of the following: [...] e) The provision and framework for research and development; [...]”
(2)	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 [...].”
(3)	BASIS: GSR Part 1 (Rev. 1) Requirement 11, para. 2.35 states that “The building of competence shall be required for all parties with responsibilities for the safety of facilities and activities, including authorized parties, the regulatory body and organizations providing services or expert advice on matters relating to safety. Competence shall be built, in the context of the regulatory framework for safety, by such means as: [...]”

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

	-- <i>Research and development work.</i> ”
S2	Suggestion: The Government should consider increasing resources to strengthen the research and development programmes for the implementation of the national programme.

APPENDIX A: TERMS OF REFERENCE

1. Introduction

On 9 April 2019, the Greek Atomic Energy Commission (EEAE), 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 in 2023.

Greece 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 Greek national framework for safe management of radioactive waste, and the competent regulatory body, national programme and its implementation in this field.

3. Scope

The ARTEMIS review in Greece will cover the review domain “national policy, framework and strategy” as per para 6.2.1 of ARTEMIS guidelines (v. 2.0.0 December 2018).

Results from the IAEA Integrated Regulatory Review Service (IRRS) Follow-up mission to Greece conducted in 2017 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 Greek Atomic Energy Commission (EEAE). The National Counterpart Liaison Officer for the review is Ms Eleftheria Carinou from the Greek Atomic Energy Commission (EEAE).

The ARTEMIS review mission will be conducted from **10 to 18 September 2023** in Attiki, Greece. 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 Greece as of **18 May 2021**
- Preparatory Meeting: **7 February 2023** (WebEx meeting)
- Notification by IAEA to the Counterparts on the review team composition: by **7 February 2023**
- Submission of reference material: by **10 July 2023** (including the completed self-assessment and, if desired, a preliminary national action plan)
- 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 **25 August 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 Ms Nelli Aghajanyan from the Waste and Environmental Safety Section of the Department of Nuclear Safety and Security of IAEA. The Deputy Coordinator is Ms Kim Baines from the Section on Decommissioning and Environmental Remediation 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 David Ulfbeck (SIS, Denmark). 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 EEAE .

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. Greece is aware that the review cost includes 7% programme support costs.

If the actual cost of the ARTEMIS review exceeds the estimated voluntary contribution, Greece 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 Greece through the Counterpart.

These Terms of Reference were agreed on 16 February 2023 between the IAEA and the EEAE after the preparatory meeting held on-line on 7 February 2023.

Annex 1: List of reference material

1. Responses to the ARTEMIS Self-assessment Questionnaire
2. Laws, regulations and regulatory guidelines (including waste classification, concept of clearance, radiation sources categorization)
3. Article 14 Report for Waste Directive
4. Joint Convention report for the 7th Review Meeting
5. Greece IRRS 2017 report
6. Country Group 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, 10 Sept	Mon, 11 Sept	Tue, 12 Sept	Wed, 13 Sept	Thurs, 14 Sept	Fri, 15 Sept	Sat, 16 Sept	Sun, 17 Sept	Mon, 18 Sept
8h30 – 10h00	Arrival of Team Members	9h00 Opening General presentation	Inventory	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	09h00 Internal reflection of comments 10h30 Discussions with the Counterparts on the draft report	Delivery of final draft report
10h00 - 12h00		National Policy and Framework	Concepts, Plans and technical solutions	Cost estimates and financing			Draft report to be sent to the Counterparts		EXIT MEETING
12h00 - 13h00		Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
13h00 – 16h00		National Strategy	Site Visit	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, SUGGESTIONS AND GOOD PRACTICES

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 assess the means of involving all radioactive waste generators in development and implementation of the national programme.
		R2	The Government should ensure that waste streams such as radioactive waste arising from decommissioning of cyclotron facilities and radioactive waste management facilities that are not currently included are addressed in the national programme.
		R3	EEAE should specify criteria for radioactive materials containing naturally occurring radionuclides to be controlled as radioactive waste.
2.	NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT	R4	The Government should develop a process for inclusion of interested parties in decision making for the site selection of disposal facilities outside the NCSR “D” site prior to the issuance of the feasibility license.
		R5	The Government should establish OPADRY in a timeframe suitable to carry out the necessary activities for siting, design and construction of the radioactive waste management facility.
		R6	The Government should provide for implementation of the policy in place by including operation, closure and post-closure activities related to disposal facilities in the national programme.

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
3.	INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE	S1	EEAE should consider strengthening the national inventory so that it covers all radioactive waste in Greece together with future arisings.
5.	SAFETY CASE AND SAFETY ASSESSMENT OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT ACTIVITIES AND FACILITIES	R7	NCSR “D” should complete the decommissioning plan and supporting safety assessment without undue delay, including all reactor systems and components taking into consideration the adopted end state for the facility.
		R8	NCSR “D” should update the safety report for the interim storage of radioactive waste.
		R9	The Government should enhance the legal and regulatory framework for safety of radioactive waste management and disposal facilities as planned by specifying the steps in development and licensing of such facilities.
		R10	EEAE should further detail regulatory requirements and provide guidance on the interpretation of the national legislation and regulatory requirements, and on what is expected of the operator in respect of each individual facility.
6.	COST ESTIMATES AND FINANCING OF RADIOACTIVE	R11	The Government should assess the completeness of the costing information used to establish the financial provisions for implementation of the national programme and align cost estimates and funding provisions as appropriate. In particular this applies to the existing interim storage facility and the future radioactive waste

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
	WASTE AND SPENT FUEL MANAGEMENT		storage and disposal facilities with regard to their decommissioning and post-closure.
7.	CAPACITY BUILDING FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT – EXPERTISE, TRAINING AND SKILLS	R12	The Government should make provision for the human resource needs for OPADRY and ODRA to ensure the implementation of the national programme.
		R13	NCSR “D” should take measures to ensure retention of knowledge and information and provide human resources with sufficient expertise, training and skills to implement actions in the national programme.
		S2	The Government should consider increasing resources to strengthen the research and development programmes for the implementation of the national programme.

APPENDIX D: LIST OF ACRONYMS USED IN THE TEXT

EC	European Commission
EEAE	Greek Atomic Energy Commission
EEDRA	National Radioactive Waste Management Committee
EURATOM	European Atomic Energy Community
IAEA	International Atomic Energy Agency
ILW	Intermediate Level Waste
KPI	Key Performance Indicators
LEU	Low Enriched Uranium
LLW	Low Level Waste
MD	Ministerial Decision
MDI	Ministry of Development (former Ministry of Development and Investment)
MEE	Ministry of Environment and Energy
NCSR “D”	National Centre for Scientific Research "Demokritos"
NORM	Naturally Occurring Radioactive Material
ODRA	Radioactive Waste Management and Disposal Organization
OPADRY	Organization for Temporary Storage and Management of Radioactive Materials
PD	Presidential Decree
VLLW	Very Low Level Waste
VSLW	Very Short Lived Waste

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. SSR-4, IAEA, Vienna (2017).
- [10] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Energy Basic Principles, Nuclear Energy Series, NE-BP, Vienna (2021).
- [11] INTERNATIONAL ATOMIC ENERGY AGENCY, Radioactive Waste Management 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, INFCIRC/546, IAEA, Vienna (1997).
- [17] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Safety and Security Glossary, IAEA, Vienna (2022 interim edition).
- [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).