

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

MISSION

TO

ROMANIA

Bucharest, Romania

13-22 March 2022

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY
DEPARTMENT OF NUCLEAR ENERGY



IAEA

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

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

Mission dates: *13-22 March 2022*
Location: *Bucharest, Romania*
Organized by: *IAEA*

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IAEA-2022

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

At the request of the Government of Romania, specifically the Nuclear Agency for Radioactive Waste (ANDR), an IAEA Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) mission to Romania was undertaken from 13–22 March 2022. The objective of the ARTEMIS mission was to provide an independent international evaluation of Romania's National Programme for the responsible and safe management of spent fuel and radioactive waste (National Strategy).

The mission was requested by the Agenția Nucleară și pentru Deșeuri Radioactive, ANDR (Nuclear Agency for Radioactive Waste), with the participation of the Comisia Nationala pentru Controlul Activitatilor Nucleare, CNCAN (National Commission for Nuclear Activities and Control), SN Nuclearelectrica SA, SNN, (the nuclear power utility), Regia Autonomă Tehnologii pentru Energia Nucleară, RATEN (Technologies for Nuclear Energy State Owned Company) and Institutul National de Cercetare-Dezvoltare pentru Fizica și Inginerie Nucleara Horia Hulubei, IFIN-HH (Horia Hulubei National Institute for Research and Development in Physics and Nuclear Engineering).

ARTEMIS reviews are based on the IAEA Safety Standards and technical guidance, as well as international good practices. Romania requested this ARTEMIS review to fulfil its obligations under Article 14.3 of the Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community Framework for the Responsible and Safe Management of Spent Fuel and Radioactive Waste.

The review was performed by a team of six senior experts in the field of radioactive waste and spent fuel management from six IAEA Member States, with IAEA staff providing coordination and administrative support.

Romania currently operates two CANDU nuclear power reactors and one research reactor. The country plans to expand its commercial nuclear power operations by the introduction of two further CANDU units at Cernavoda nuclear power plant. There is a TRIGA research reactor in operation at the Institute for Nuclear Research (ICN) and one research reactor VVR-S type decommissioned and released from CNCAN regulated control through certificate no. IFIN-HH / R-06/2020 issued on 23 July 2020.

Radioactive waste disposal has been or will be undertaken at three sites. The disposal facility Depozitul National de Deseuri Radioactive, DNDR (National Repository Radioactive Waste), at Băița Bihor, is currently utilized for the disposal of institutional radioactive waste. The Depozitul Final de Deșeuri de Slabă și Medie Activitate, DFDSMA (Final Repository for Low and Intermediate Radioactive Waste), in the vicinity of the Cernavoda NPP site, is planned to commence operations in 2028. A disposal facility for high level waste will be developed at a site to be determined. The disposal facility for high level waste is to be commissioned around 2055.

Romania is committed to further develop and implement safe and sustainable radioactive waste management, whilst continually seeking to minimize waste generation.

Romania is also well aware of the steps to be addressed for ensuring safe management of its radioactive waste and is committed to acquire the appropriate expertise.

The ARTEMIS Review Team noted opportunities for improvement in relation to (i) policy and strategy for radioactive waste management, (ii) the development of the planned disposal

facilities, and (iii) the human, financial resources and capacity building required for implementing its radioactive waste management programme.

The ARTEMIS Review Team identified 10 Recommendations and 4 suggestions including:

1. ANDR should address and improve in the implemented strategy the interdependences among all steps in the predisposal steps, as well as the impact of anticipated disposal option.
2. ANDR should consider clarifying the national strategy to state the potential benefits of waste treatment to reduce volumes and diversion for appropriate wastes.
3. ANDR should finalize the plans for engagement with interested parties, and in particular, potential host communities as soon as possible to ensure they are properly engaged in the site selection process for the deep geological disposal.
4. ANDR should justify the high level roadmaps in the strategy with detailed programmes and schedules for the disposal programmes. The programmes and schedules should include the licensing process as well as corresponding R&D programmes.
5. ANDR should ensure the Waste Acceptance Criteria for DFDSMA are finalised as soon as possible to facilitate timely conditioning and disposal of waste into new facility.
6. ANDR should reconsider the foreseen timeline of the different steps in the development of the DFDSMA and its safety case, to allow the development of the safety case progressively with the evolving project, so as to be able to guide the site licensing and design activities, to allow ANDR to review and endorse the draft safety case(s) as they are proposed by the contractor(s) and to allow if needed the regulatory body to require an update of, or revision to, the safety case before given steps can be taken.
7. ANDR should consider starting to develop the safety case for the geological disposal facility, as soon as possible, in order to guide the activities, especially in R&D, that will lead to the selection of a reference concept, host rock selection and site selection process.
8. The Government should adopt adequate measures to regularly review and adjust, if necessary, the fees to the dedicated funds for radioactive waste management, in accordance with last available cost estimations, to guarantee the adequacy and sufficiency of the funds for the implementation of the National Programme.
9. The Government should ensure that sufficient human and financial resources are available for CNCAN to acquire appropriate expertise and build capacities to be able to perform its regulatory functions during the implementation of radioactive waste strategy; for ANDR and other licensees to have appropriate capabilities to undertake their roles as waste management organizations responsible for safety; and for research institutions to develop and implement appropriate R&D to support the implementation of radioactive waste management strategy.

In summary, the ARTEMIS Review Team considered that Romania is in a good position to continue meeting high standards of safe and responsible management of radioactive waste and spent fuel, and identified recommendations and suggestions for further improvements. The ARTEMIS Review Team commended the Romanian authorities and organizations involved in the design and implementation of the National Programme, as demonstrated by the deliberate actions taken, the professionalism displayed by all, and the commitment to safety in all its efforts.

I. INTRODUCTION

On 9 November 2018, the Nuclear Agency and for Radioactive Waste (ANDR) requested the IAEA to organize and carry out, in 2019, the Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) peer review mission in Romania, as required of all EU Member States by Article 14.3 of the European Council Directive 2011/70/EURATOM of 19 July 2011, establishing a Community Framework for the Responsible and Safe Management of Spent Fuel and Radioactive Waste. On 16 July 2019, the ANDR proposed to move the mission to 2020. Due to the impact of the COVID-19 international situation, specifically travel restrictions, the mission was postponed to 2022.

The review was performed by a team of six 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 virtual preparatory meeting in June 2020, and the receipt and review of Advanced Reference Material in September of 2021, in March 2022 the ARTEMIS Review Team evaluated the Romanian national programme and the national framework for executing country's obligations for safe and sustainable radioactive waste and spent fuel management.

II. OBJECTIVE AND SCOPE

The ARTEMIS review provided an independent international evaluation of Romania's radioactive waste and spent fuel management programme.

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

III. BASIS FOR THE REVIEW

A) PREPARATORY WORK AND IAEA REVIEW TEAM

At the request of the Government of Romania, a virtual preparatory meeting for the ARTEMIS Review mission, was conducted on 17 of June 2020. The preparatory meeting was carried out by the appointed Team Leader at that time Ms Sylvie Voinis, the IAEA coordinator and deputy coordinator Mr Gerard Bruno and Ms Laura McManniman respectively, and the team of National Counterparts led by Ms Ramona Popescu from the Nuclear and Radioactive Waste Agency with participation of representatives of the Agency.

The ARTEMIS mission preparatory team had discussions regarding:

- the Terms of Reference for the ARTEMIS review of the Romanian radioactive waste management programme; 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 Romania in March 2022.

Ms Ramona Popescu from the Nuclear Agency and for Radioactive Waste (ANDR) was appointed as the National Counterpart for the ARTEMIS mission and designated IAEA point of contact.

Romania provided IAEA with the Advance Reference Material (ARM) for the review in September 2021.

In February 2022 Mr Richard Cummings replaced Ms Sylvie Voinis (who had to withdraw due to postponement of the mission) as the Team Leader.

B) REFERENCES FOR THE REVIEW

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

C) CONDUCT OF THE REVIEW

The initial Review Team meeting took place on Sunday, 13 March 2022 in Bucharest, directed by the ARTEMIS Team Leader Mr Richard Cummings, supported by the ARTEMIS Team Coordinator Mr Gerard Bruno and the Deputy Team Coordinator, Ms Laura McManniman.

The ARTEMIS entrance meeting was held on Monday, 14 March 2022, with the participation of the Mr Dan Dragan, State Secretary within the Ministry of Energy, Mr Mihaita Gaina President of ANDR and the representatives of the Nuclear Agency and for Radioactive Waste, Ministry of Energy, SN Nuclearelectrica (SA – SNN), with Cernavoda Nuclear Power Plant (CNE), and Energonuclear SA, National Commission for Nuclear Activities Control (CNCAN), Institute of Physics and Nuclear Engineering Horia Hulubei (IFIN-HH), Technologies for Nuclear Energy State Owned Company (RATEN) with Institute for Nuclear Research (ICN), Center of Technology and Engineering for Nuclear Projects (CITON) senior management and staff. Opening remarks were successively made by Mr Dragan, Mr Gaina, Mr Richard

Cummings, and Mr Bruno. Ms Alice Dima, Director ANDR gave an overview of the Romanian Radioactive waste management context.

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

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

The ARTEMIS Exit Meeting was held on Tuesday, 22 March 2022. Opening remarks were made by Mr Dan Dragan, State Secretary from the Ministry of Energy, Mr Mihaita Gaina President of ANDR and Mr Cantemir Ciurea-Ercau, the President of CNCAN. A presentation of the results of the Review Mission was given by the ARTEMIS Team Leader Mr Richard Cummings. Closing remarks were made on behalf of the IAEA by Ms Anna Clark, Section Head, Waste and Environmental Safety Section, 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

Romanian position

Romanian national policy for management of radioactive waste and spent nuclear fuel is defined by the National Strategy on Medium and Long-term on the Safe Management of Spent Nuclear Fuel and Radioactive Waste (the National Strategy). The National Strategy was approved by the Government through the decision no. 102/2022.

The National Strategy, in accordance with the Government Ordinance no. 11/2003 (The Ordinance), consists of two sections:

- a) the National Policy on the safe management of spent nuclear fuel and radioactive waste (the National Policy),
- b) the National Program on the safe management of spent fuel and radioactive waste. More information on the National Programme is given in chapter 2.

The National Strategy is periodically reviewed (every 5 years) and updated taking into account the evolution of the national nuclear field in those years and the technical and scientific progress made worldwide.

The National Policy sets out the basic principles on ethical, security and environmental issues, the applicable national legal and regulatory framework, as well as the responsibilities of national organizations involved in the safe management of spent nuclear fuel and radioactive waste.

The National Policy sets out general principles related to radioactive waste (RW) and spent nuclear fuel (SNF) management i.e.:

- a) the “polluter pays” principle,
- b) responsibility of safety assigned to the waste generator,
- c) the application of the best existing techniques and technologies, without incurring unjustified costs for future generations and taking into account possible cross-border effects,
- d) waste minimization,
- e) the principle of a graded approach,
- f) public participation issues.

The National Policy includes the preferred option for RW management (Figure 1.):

- near surface repository for low and intermediate level waste short-lived (LILW-SL),
- deep geological repository (DGR) for low and intermediate level waste long-lived (LILW-LL) and SNF.

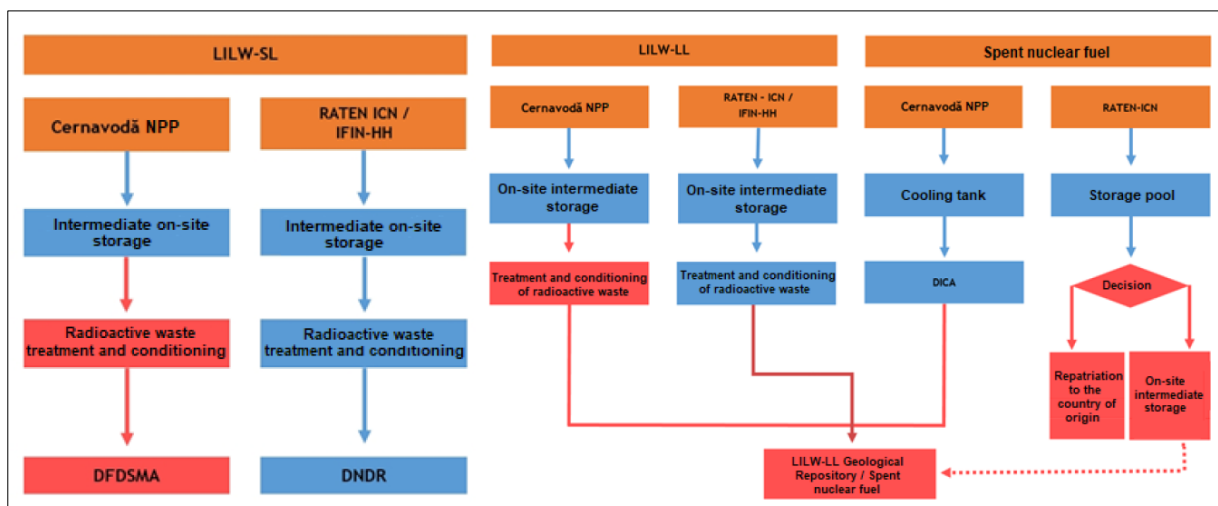


Figure 1. The long term management of RW and SNF

ARTEMIS observation

The ARTEMIS Review Team noted that the National Policy for the management of radioactive waste and spent nuclear fuel (as part of National Strategy) is in place in Romania. It takes into consideration all radioactive waste and spent nuclear fuel streams. The disposal is identified as the end point of radioactive waste management, including spent nuclear fuel.

Such National Policy was prepared first time in 2004. A draft of the updated version was prepared in 2017. The process was led by the ANDR. The new National Policy included in National Strategy was approved by the Government of Romania in January 2022 after 5 years of consultation with these interested parties: Ministry of Environment, Waters and Forests, National Administration “Romanian Waters”, Ministry of Economy, Ministry of Health, Ministry of Public Works, Development and Administration, Ministry of Agriculture and Rural Development, Ministry of Transport, The National Commission for Nuclear Activities Control (CNCAN), Technologies for Nuclear Energy State Owned Company (RATEN), National Society Nuclearelectrica SA (SNN), Cernavoda Nuclear Power Plant (Cernavoda NPP), Horia Hulubei National Institute for Research and Development in Physics and Nuclear Engineering (IFIN-HH). As part of the consultation process, the national public debate and the transboundary consultations were held in 2020-2021.

The ARTEMIS Review Team observed that the definition and scope of the National Policy and Strategy currently being used in Romania do not match with the definition recognized internationally and provided by IAEA’s Safety Standards. This could create misunderstandings during meetings with international community (expert missions, Review Meetings of Joint Convention). According to the IAEA Safety Standards, policy is the highest document approved by the Government to set out the goals for the safety management of RW and SNF, whereas strategy is the means for achieving the goals set out in the national policy.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *The Romanian national strategy for radioactive waste management consists of a policy and implementation programme. International practice, in line with IAEA Standards, is for government to set policy before strategies and plans are developed. Strategies and plans usually require review and revision more frequently than government policy. Following international practice in the presentation of Romania’s policy, strategies and plans may aid communication in international fora.*

(1)	<p>BASIS: GSR Part 1 (Rev. 1) Requirement 1 states that <i>“The government shall establish a national policy and strategy for safety, the implementation of which shall be subject to a graded approach in accordance with national circumstances and with the radiation risks associated with facilities and activities, to achieve the fundamental safety objective and to apply the fundamental safety principles established in the Safety Fundamentals.</i></p> <p><i>2.3. National policy and strategy for safety shall express a long term commitment to safety. The national policy shall be promulgated as a statement of the government’s intent. The strategy shall set out the mechanisms for implementing the national policy.”</i></p>
(2)	<p>BASIS: GSR Part 5 Requirement 2 states that <i>“To ensure the effective management and control of radioactive waste, the government shall ensure that a national policy and a strategy for radioactive waste management are established. The policy and strategy shall be appropriate for the nature and the amount of the radioactive waste in the State, shall indicate the regulatory control required, and shall consider relevant societal factors. The policy and strategy shall be compatible with the fundamental safety principles and with international instruments, conventions and codes that have been ratified by the State. The national policy and strategy shall form the basis for decision making with respect to the management of radioactive waste.”</i></p>
(3)	<p>BASIS: SSR - 5 Requirement 3 states that <i>“The operator of a disposal facility for radioactive waste shall be responsible for its safety. The operator shall carry out safety assessment and develop and maintain a safety case, and shall carry out all the necessary activities for site selection and evaluation, design, construction, operation, closure and, if necessary, surveillance after closure, in accordance with national strategy, in compliance with the regulatory requirements and within the legal and regulatory infrastructure.”</i></p>
(4)	<p>IAEA NE series NW-G-1.1 states that <i>“A well defined policy and associated strategies are useful in promoting consistency of emphasis and direction within all of the sectors involved in spent fuel and radioactive waste management.”</i></p>
S1	<p>Suggestion: The Government and ANDR should consider aligning the presentation of its policy, strategies and plans for radioactive waste management with IAEA Safety Standards and international practice.</p>

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

Romanian position

Legal and regulatory framework for radioactive waste and spent fuel management are defined in the following acts:

- a) Government Ordinance no. 11/2003 on the safe management of spent fuel and radioactive waste (amended by Law no. 378/2013 and Law 54/2021),
- b) Law no. 111/1996 on the safe deployment, regulation, licensing and control of nuclear activities, with subsequent additions and amendments
- c) Government Emergency Ordinance 195 /2005 on environmental protection, with subsequent additions and amendments
- d) Government Decision no. 1080/2007 regarding the constitution and management of financial resources necessary for the safe management of waste.

The international conventions and European directives are also part of the National legal framework, namely:

- a) Law no. 105 of 1999, ratification of Joint Convention on safe management of spent fuel and on safe management of radioactive waste, adopted in Vienna on September 5, 1997
- b) Law no. 43 of 1995, ratification of the Convention on Nuclear Safety, adopted in Vienna on June 17, 1994
- c) Law no. 378/2013, transposition of the EC Directive 2011/70/EURATOM

The Ordinance no. 11/2003, with subsequent additions and amendments, establishes the national legal framework for the responsible and safe management of spent fuel and radioactive waste. The Ordinance establishes:

- a) the responsibilities of the organizations involved in all stages of spent fuel and radioactive waste management, including for decommissioning of nuclear facilities, and disposal of radioactive wastes,
- b) the funding arrangements for the development of predisposal and disposal activities,
- c) the public engagement process in relation to radioactive waste management decision making.

Law no. 111/1996 on the safe deployment, regulation, authorization and control of nuclear activities, as subsequently amended and supplemented, establishes the primary legislative framework governing the safety of nuclear installations, including those intended for the safe management of spent nuclear fuel and radioactive waste. Specifically, this law provides/establishes:

- a) the competent national authority in the nuclear field;
- b) a system for the safe management of spent fuel and radioactive waste;
- c) a system that prohibits the operation of installations without authorization or without complying with the limits and conditions of the authorization;
- d) a system for enforcing control, regulatory body inspections, documentation and reporting;
- e) responsibilities and obligations of authorization holders generating spent nuclear fuel and radioactive waste and for decommissioning activities.

CNCAN, established in 1996, is the regulatory authority in the nuclear field. Its role is to issue regulations and guidelines, develop the strategy and policy for regulations and to issue licenses for all nuclear and radiological activities and facilities in Romania.

ANDR established in 2004 is responsible for disposal of radioactive waste and spent nuclear fuel. It also ensures, at national level, the coordination of the decommissioning of nuclear and radiological installations.

ARTEMIS observation

The ARTEMIS Review Team observed that the legal and regulatory framework for the safe management of radioactive waste are in place. According to the legal provisions of law, licensees have the responsibilities for the safe management of RW and SNF arising from operation and decommissioning of the facilities.

There is clear allocation of responsibilities of all interested parties. The independence between the ANDR and the CNCAN is set out. The implementer is under the responsibility of Ministry of Energy, Economy and Business Environment. The CNCAN is under General Secretariat of Government (see figure 2).

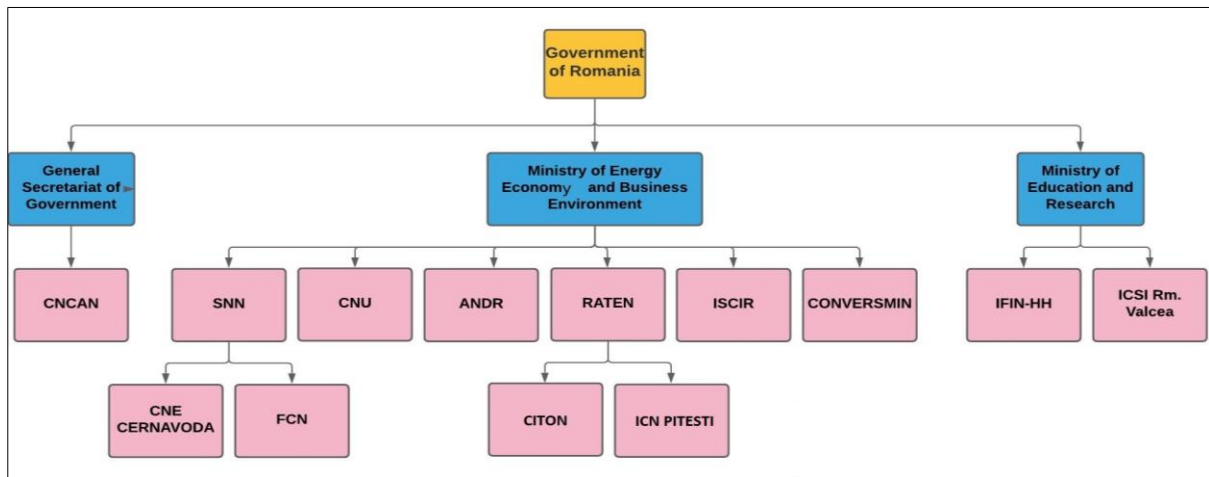


Figure 2. The independence between the ANDR and the CNCAN

This topic does not bring any recommendation or suggestion.

2. NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT

2.1. SCOPE

Romanian position

According to ANDR, the objective of the national strategy is the continuous improvement of the process of responsible and safe management of spent nuclear fuel and radioactive waste, without unjustified transfer of responsibility to future generations. To achieve this aim, the strategy sets out that disposal is the end point for the waste management strategy. Therefore, ANDR plans to implement one surface repository for low and intermediate level, short lived waste (DFDSMA) and one Deep Geological Repository (DGR) for long lived radioactive waste and spent nuclear fuel.

The waste and spent fuel taken into consideration in this strategy are produced by the operation and decommissioning of nuclear power plants (NPPs) (Cernavoda), research facilities (IFIN-HH, RATEN) and radiological facilities owned by small licence holders. Currently, institutional low and intermediate level wastes are disposed of in a dedicated facility operated by IFIN-HH (DNDR Băița-Bihor) until its capacity is filled.

In the strategy, the spent fuel and waste management routes are described (Figure 1.).

Spent fuel from the operating research reactor is planned to be sent back to the country of origin if such an agreement will be signed or it will be disposed of in a deep geological repository and spent fuel from the Cernavoda NPP is planned to be disposed of in a deep geological repository. Until disposal is available, spent fuel is being placed in dedicated storage. According to the Romanian waste classification and the strategy, LILW-SL will be disposed of in DFDSMA and LILW-LL in DGR.

In the predisposal steps, for the RW generated by Cernavoda NPP characterisation and pre-treatment like in-drum low-force compaction or incineration of the waste are currently carried out before storing the waste in dedicated facilities. No further conditioning operations have been undertaken. It was also mentioned during discussions that some metallic wastes have been sent abroad for melting.

ARTEMIS observation

During the ARTEMIS mission, the involvement of ANDR in the pre-disposal steps was a significant point of discussion. It was noticed that predisposal steps like characterisation or treatment are carried out with limited involvement of ANDR, who is responsible for developing the disposal facilities' safety cases. As an example, the ARTEMIS Review Team took note of the fact that, on one hand, according to the preliminary WAC, some non radiological hazardous materials in the waste are already limited, and in other hand that no specific characterisation of such materials is done now on NPP site in relation with disposal. Furthermore, as some wastes are treated by low-force compaction, it will require additional steps to carry out chemical or radiological characterization. The ARTEMIS Review Team highlighted presence of the the risk of non-compliance certain the packages with the future developed WAC if ANDR is not part of the choices made for treatment and conditioning steps undertaken in the pre-disposal steps. The interdependencies among all the steps in the predisposal steps as well as the disposal steps should be addressed in the strategy and implemented.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *In the strategy, the principle of the interdependences between the different steps to manage waste is not addressed. The ARTEMIS Review Team noted that predisposal steps like characterisation or treatment are carried out with limited involvement of ANDR, which is responsible for developing the safety case of the disposal. This could complicate the next steps to put in place and finally the compliance of the packages with the disposal WAC. The ARTEMIS Review Team highlights that all the waste management steps have to be taken into account in order to develop the disposal routes.*

(1)	BASIS: GSR Part 5 Requirement 7 states that <i>“Interdependences among all steps in the predisposal management of radioactive waste, as well as the impact of the anticipated disposal option, shall be appropriately taken into account”.</i>
(2)	BASIS: GSR Part 1 (Rev. 1), Requirement 10, para. 2.30 states that <i>“Radioactive waste generated in facilities and activities shall be managed in an integrated, systematic manner up to its disposal. The interdependences of the steps in the entire management process for radioactive waste [...] shall be recognized”</i>
(3)	BASIS: SSG-41 Para 6.52 states that <i>“Waste packages produced by conditioning should satisfy the respective acceptance criteria. Therefore, the regulatory body and organizations operating or planning to operate transport services, storage facilities and disposal facilities should be consulted in deciding which types of pretreatment, treatment and conditioning will be necessary.”</i>
R1	Recommendation: ANDR should address and improve in the implemented strategy the interdependences among all steps in the predisposal steps, as well as the impact of the anticipated disposal options.

Romanian position

CNE Cernavoda compacts and incinerates wastes when it is possible in order to reduce the volume of waste before storing. In the policy, the principle of waste volume reduction is specified as one of the general principles coming from the Ordinance n° 11/2003 as well as CNCAN regulations establishing radiological safety requirements for predisposal of radioactive waste.

ARTEMIS observation

The ARTEMIS Review Team noted that the principle of volume reduction is not developed in the strategy. Moreover, ANDR stated an intention to assess the potential for developing a very low level waste (VLLW) disposal facility providing appropriate levels of environmental protection for such wastes. The ARTEMIS Review Team highlighted that the waste volume reduction and using appropriate routes regarding the activity level of the waste can save surface disposal capacity and increase the lifetime of this disposal route. In consequence, the ARTEMIS Review Team suggests that ANDR clarifies the national strategy to state the potential benefits of waste treatment to reduce volumes and diversion for appropriate wastes.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *CNE Cernavoda stated that use was being made of low-force compaction and incineration of wastes. ANDR stated an intention to assess the potential for developing a VLLW disposal facility providing appropriate levels of environmental protection for such wastes. International experience suggests that waste treatment and diversion to appropriate disposal facilities can greatly reduce the volumes of wastes requiring disposal in facilities such as the proposed DFDSMA. The national strategy is not clear on the requirements for waste treatment and diversion.*

(1)	BASIS: GSR Part 5 Requirement 8 states that “Radioactive waste generation and control - All radioactive waste shall be identified and controlled. Radioactive waste arisings shall be kept to the minimum practicable”.
(2)	BASIS: GSR Part 5 Requirement 10 states that “ Processing of radioactive waste - “Radioactive material for which no further use is foreseen and with characteristics that make it unsuitable for authorized discharge, authorized use or clearance from regulatory control shall be processed as radioactive waste. The processing of radioactive waste shall be based on appropriate consideration of the characteristics of the waste and of the demands imposed by the different steps in its management (pretreatment, treatment, conditioning, transport, storage and disposal). Waste packages shall be designed and produced so that the radioactive material is appropriately contained both during normal operation and in accident conditions that could occur in the handling, storage, transport and disposal of waste.”
S2	Suggestion: ANDR should consider clarifying the national strategy to state the potential benefits of: <ul style="list-style-type: none"> • waste treatment to reduce volumes; • and diversion for appropriate wastes.

Romanian position

ANDR is starting a process to develop a DGR programme. The strategy stated that “*the communities and stakeholders involvement is foreseen in all stages of the implementation of the geological disposal program*”.

ARTEMIS observation

During discussion, the ARTEMIS Review Team noted that the procedure for interested parties involvement is not yet developed. Considering that the strategy for site selection is planned in 2023/2024 according to the schedule in the strategy, the ARTEMIS Review Team considers that plans for engagement with interested parties, and in particular, potential host communities, should be developed and finalized as soon as possible to ensure they are properly engaged in the site selection process for the deep geological disposal.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *Plans for engagement with potential host communities during selection of the site for the proposed deep disposal facility are not yet developed.*

(1)	<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, and the provision of independent regulatory functions. Protection shall also be provided beyond national borders as appropriate and necessary for neighbouring States that may be affected.</i></p> <p><i>Para 3.4. Matters that have to be considered by the government include:</i></p> <p>...</p> <p>— <i>Defining and putting in place the overall process for the development, operation and closure or decommissioning of facilities, including the legal requirements at each step, the decision making process and the process for the involvement of interested parties;</i></p> <p>...”</p>
(2)	<p>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. The regulatory body shall review and assess the safety case and the environmental impact assessment for radioactive waste management facilities and activities, as prepared by the operator both prior to authorization and periodically during operation. The regulatory body shall provide for the issuing, amending, suspension or revoking of licences, subject to any necessary conditions. The regulatory body shall carry out activities to verify that the operator meets these conditions. Enforcement actions shall be taken as necessary by the regulatory body in the event of deviations from, or non-compliance with, requirements and conditions</i></p> <p><i>Para 3.8. To facilitate compliance with regulatory requirements, the regulatory body has to do the following:</i></p> <p>...</p> <p>— <i>Encourage dialogue between and participate in dialogues with the operator and other interested parties;</i></p> <p>...”.</p>
(3)	<p>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></p> <p><i>Para 4.3 Confidence has to be developed and refined by means of iterative design and safety studies as the project progresses [19]. The process has to provide for:</i></p>

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	<i>the collection, analysis and interpretation of the relevant scientific and technical data; the development of designs and operational plans; and the development of the safety case for safety in the operational stage and after closure. The step by step process provides access for all interested parties to the safety basis for the disposal facility. This facilitates the relevant decision making processes that enable the operator to proceed to the next significant step in the development of the facility, and on to its operation and, finally, its closure”</i>
(4)	BASIS: SSG-23 Para 4.91. states that <i>“Early involvement of interested parties should be ensured as part of the process of building confidence in the safety of the disposal facility. [A range of different models for interested party involvement has been applied in different States, and extensive research has been conducted on the methods of engaging interested parties in both national and international research programmes.] A key consideration is that interested party involvement should take place within an open and transparent framework for consultation, with clearly defined rules of procedure. The process for involvement of interested parties should be set out in the safety case.”</i>
R2	Recommendation: ANDR should finalize the plans for engagement with interested parties, and in particular, potential host communities as soon as possible to ensure they are properly engaged in the site selection process for the deep geological disposal.

2.2. MILESTONES AND TIMEFRAMES

Romanian position

During the meeting, ANDR described the timelines for the development of the disposal programmes, identifying the different phases:

- DFDSMA
 - o 2023 – application for site licence,
 - o 2024 – site licence granted and application for construction licence,
 - o 2026 – construction,
 - o 2028 – commissioning,
- DGR
 - o 2023 – reference concept selected,
 - o 2025 – site selection process,
 - o 2030 – URL construction,
 - o 2045 – DGR construction,
 - o 2055 – repository commissioning,
 - o 2150 – DGR closure phase.

The strategy also identifies some R&D is needed to develop the disposal programmes. In the case of DFDSMA, the main R&D activities identified in the national strategy are related to the behaviour of the engineered barrier including the cap. Concerning DGR, the national strategy states that the R&D programme will take into account the requirements of Article 12 of EC Directive 2011/70/Euratom, which recommends the R&D activities necessary for the

implementation of national policies. In the strategy, the steps for developing this programme are presented.

ARTEMIS observation

The ARTEMIS Review Team noted that whilst a timeline exists for the development of each disposal programme, DFDSMA and DGR, there is no detailed schedule with associated milestones in the strategy. Moreover, the ARTEMIS Review Team emphasizes that the time needed for the licensing process at each step of the programme (siting, design, construction, commissioning...) has to be taken into account in the time frame of the development of the programmes. Such a roadmap should anticipate possible delays of the disposal programmes and therefore their impact on the capacities of the waste and spent fuel storages.

The strategy also identifies a number of R&D activities but does not specify the plans to ensure that the required R&D is undertaken in the required timeframe and that the necessary resources (both human and financial) will be available. The ARTEMIS Review Team considers that a programme with prioritization of tasks in connection with the objectives to be achieved and a schedule for implementation of the disposal would facilitate the timely execution of R&D needs.

A need has been identified for a framework that enables ANDR to ensure technical feasibility, technical programme quality and confidence in safety. Therefore, a detailed schedule including programme development phases, licensing process steps, R&D needs would support meeting this need. Such a detailed schedule can be used also to plan what resources would be required and when.

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Observation: *The ARTEMIS Review Team noted that there is no detailed timeframe with associated milestones for each disposal programme, DSFMA and DGR in the strategy. Even if a list of R&D topics is presented in the case of DGR, there's no R&D roadmap associated to the programmes with milestones online with the time frame of the development of the programme. Moreover, the time needed for the licensing process at each step of the programme (siting, design, construction, commission...) has to be taken into account in the time frame of the development of the programmes. The consolidated timeframe with milestones is also necessary in order to anticipate potential delays of the programmes and therefore the impact on the capacity of the waste and spent fuel storage. Such detailed plan/roadmap can be used also to plan what resources would be required and when.*

(1)	<p>BASIS: SSR-5 Requirement 11 states that “Step by step development and evaluation of disposal facilities. 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.”</p>
(2)	<p>BASIS: SSR-5 Requirement 12 states that “Preparation, approval and use of the safety case and safety assessment for a disposal facility. A safety case and supporting safety assessment shall be prepared and updated by the operator; as necessary, at each step in the development of a disposal facility, in operation and after closure. The safety case and supporting safety assessment shall be submitted to the regulatory body for approval. The safety case and supporting safety assessment shall be sufficiently detailed and comprehensive to provide the necessary technical input for informing the regulatory body and for informing the decisions necessary at each step.”</p>
(3)	<p>BASIS: GSR Part 2 Requirement 9 states that “Provision of resources. Senior management shall determine the competences and resources necessary to carry out the activities of the organization safely and shall provide them.”</p>
(4)	<p>BASIS: SSR-5 Requirement 11, para 4.2 state that “A step by step approach to the development of a disposal facility for radioactive waste refers to the steps that are imposed by the regulatory body and by political decision making processes [...]. For the operator, it provides a framework in which sufficient confidence in the technical feasibility and safety of the disposal facility can be built at each step in its development.”</p>
R3	<p>Recommendation: ANDR should justify the high level roadmaps in the strategy with detailed programmes and schedules for the disposal programmes. The programmes and schedules should include the licensing process as well as corresponding R&D programmes.</p>

3. INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE

Romanian position

The National Strategy includes construction of a new engineered near surface repository for LILW-SL (the so called DFDSMA).

The decommissioning of the CANDU reactors from Cernavoda NPP will be done in accordance with the decommissioning plans endorsed by ANDR and approved by CNCAN. Radioactive waste will be generated from the decommissioning process, most of it will be solid LILW-SL radioactive waste, consisting of concrete, steel, soil, etc. LILW-LL radioactive waste will also be generated, most of which will be metallic radioactive waste, such as activated reactor components and contaminated pipework.

The strategy for managing the radioactive waste resulting from the decommissioning of the units from Cernavoda NPP is presented in the decommissioning plans. LILW-SL radioactive waste resulting from decommissioning is planned to be disposed of at DFDSMA, after proper treatment and conditioning. The LILW-LL waste will be stored on the Cernavoda NPP site, until the deep geological repository becomes operational.

ARTEMIS observation

In the upstream management of radioactive waste, decisions must be made even if the acceptance criteria for disposal are unknown. The first construction phase of DFDSMA is scheduled to be completed in 2028 and the radioactive waste to be delivered to this repository must meet the waste acceptance criteria. For this purpose, the radioactive waste must be conditioned accordingly and subjected to a product control in order to check compliance with the waste acceptance criteria for disposal.

In addition, compliance with the waste acceptance criteria is essential for the safe handling and storage of waste packages and unpackaged waste in normal operation, for safety in the event of possible accidents and for the long-term safety of the subsequent disposal. However, since the waste has not yet been conditioned due to the lack of the waste acceptance criteria, it is important to determine these criteria as soon as possible. Otherwise there is a risk of not being able to keep the time scales for disposal.

The LILW-LL radioactive waste generated from the refurbishment of the nuclear units at Cernavoda NPP will be packaged and stored in sealed containers at the Cernavoda NPP site. Therefore, an additional interim storage capacity is required on the site of the Cernavoda NPP, for the interim storage of LILW-LL radioactive waste resulting from the refurbishment process. All radioactive waste resulting from the operation of the Cernavoda NPP units are managed in the Services Building, where they are mainly inspected, sorted monitored, and directed to storage. By the procedures of the radioactive waste management program, LILW-LL radioactive waste is separated from LILW-SL radioactive waste.

Conditioning for disposal does not take place due to the above-mentioned problem of the lack of disposal waste acceptance criteria. In addition, the design of the disposal containers has been initiated by ANDR, but a final decision/approval or production of them has not yet been implemented. Due to the timing this process needs to be accelerated in order to be able to ensure on time delivery of the corresponding containers.

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Observation: *Adherence to the waste acceptance criteria is essential for the safe handling and disposal of waste packages and unpackaged waste during normal operation, for safety during possible accident conditions and for the long term safety of the subsequent disposal of the waste. For this reason, an early WAC is indispensable for further planning.*

(1)	BASIS: GSR Part 5 Requirement 6 states that “ <i>The Interdependences among all steps in the predisposal management of radioactive waste, as well as the impact of the anticipated disposal option, shall be appropriately taken into account.</i> ”
(2)	BASIS: GSR Part 5 Requirement 6 states that “ <i>Management systems shall be applied for all steps and elements of the predisposal management of radioactive waste.</i> ” para 3.24 states that „ <i>To ensure the safety of predisposal radioactive waste management facilities and the fulfilment of waste acceptance criteria...</i> ”
(3)	BASIS: GSR Part 5 Requirement 12 para 4.24 states that „ <i>Waste acceptance criteria have to be developed that specify the radiological, mechanical, physical, chemical and biological characteristics of waste packages...</i> ”
(4)	BASIS: GSR Part 5 Requirement 4 para 3.11 states that “ <i>Depending on the complexity of the operations and the magnitude of the hazards associated with the facility or the activities concerned, the operator has to ensure an adequate level of protection and safety by various means, including:</i> [...] — <i>Derivation of operational limits, conditions and controls, including waste acceptance criteria, to assist with ensuring that the predisposal radioactive waste management facility is operated in accordance with the safety case; [...].</i> ”
R4	Recommendation: ANDR should ensure the Waste Acceptance Criteria for DFDSMA are finalised as soon as possible to facilitate timely conditioning and disposal of waste into the new facility.

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Observation: *The radioactive waste to be delivered to the repository must meet the repository's waste acceptance criteria. The product control includes, among other things, examinations of the radiological and material composition, the type approval of waste containers, random samples of waste packages and the qualification of conditioning measures.*

Waste products are usually produced during conditioning, stored in drums (as inner containers for later disposal containers) or directly in disposal containers intended for the repository. For this reason, it is important to finalize the design for the disposal containers in order to quickly obtain approval for subsequent production.

(1)	BASIS: GSR Part 5, Requirement 10 states that “ <i>Processing of radioactive waste “Radioactive material for which no further use is foreseen and with characteristics that make it unsuitable for authorized discharge, authorized use or clearance from regulatory control shall be processed as radioactive waste. The</i>
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	<p><i>processing of radioactive waste shall be based on appropriate consideration of the characteristics of the waste and of the demands imposed by the different steps in its management (pretreatment, treatment, conditioning, transport, storage and disposal). Waste packages shall be designed and produced so that the radioactive material is appropriately contained both during normal operation and in accident conditions that could occur in the handling, storage, transport and disposal of waste.”</i></p>
<p>(2)</p>	<p>BASIS: GSR Part 5 Requirement 6 states that <i>“The main purpose of processing radioactive waste is to enhance safety by producing a waste form, packaged or unpackaged, that fulfils the acceptance criteria for safe processing, transport, storage and disposal of the waste. Waste has to be rendered into a safe and passive form for storage or disposal as soon as possible. The processing of radioactive waste can yield effluent that is suitable for authorized discharge or material that is suitable for authorized use or clearance from regulatory control.”</i></p>
<p>(3)</p>	<p>BASIS: GSR Part 5, Requirement 10, para. 4.13 states that <i>“The main purpose of processing radioactive waste is to enhance safety by producing a waste form, packaged or unpackaged, that fulfils the acceptance criteria for safe processing, transport, storage and disposal of the waste. Waste has to be rendered into a safe and passive form for storage or disposal as soon as possible. The processing of radioactive waste can yield effluent that is suitable for authorized discharge or material that is suitable for authorized use or clearance from regulatory control.”</i></p>
<p>R5</p>	<p>Recommendation: ANDR should expedite the design, licensing and manufacturing of appropriate containers to enable timely disposal to DFDSMA.</p>

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

Romanian position

ANDR described the strategy for the routing of wastes for disposal. It is proposed that LILW-SL arising from the nuclear fuel cycle will be disposed of to DFDSMA, if it meets the WAC of the facility. LILW-SL arising from outside the nuclear fuel cycle will continue to be disposed of to DNDR at Băița Bihor until that facility reaches its capacity, expected to be in around 2040. LILW-SL arising from outside the nuclear fuel cycle will then be routed to DFDSMA.

DFDSMA is planned to be a surface disposal facility constructed at the Saligny site.

A high-level programme for the licensing, construction and operation of DFDSMA was described, with the facility being ready to receive wastes in 2028. The construction of the disposal cells at DFDSMA will be phased.

The disposal concept for DFDSMA is for drummed wastes to be placed in reinforced concrete ‘modules’, which will then be grouted and placed in disposal cells.

ANDR stated that they would consider revisions to this disposal concept after the first phase of development.

ARTEMIS observation

Disposal in drums may not be the optimal approach to managing and disposing of all LILW-SL to be disposed at DFDSMA.

Experience from other countries suggests use of larger waste containers than drums, or even direct disposal of large items of waste in cells, can be beneficial. Use of larger waste containers or direct disposal can reduce the handling of waste necessary for their size reduction to fit into drums. This can result in reduced doses to operators, as well as reduced financial costs. Removing the need for size reduction can be particularly beneficial for some decommissioning wastes but larger items of waste can also arise during operations.

Given the potential improvements to safety through reduced radiological doses to workers, as well as other benefits, optimising the design of DFDSMA to allow potentially for disposal of larger items of waste, and provision of advice to waste producers on options for disposal, at the earliest possible stage will facilitate optimal management of wastes.

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Observation: *The disposal concept for DFDSMA described is for drummed wastes to be placed in disposal ‘modules’ before grouting and disposal in the facility cells. ANDR indicated the potential to adapt this concept over time. The disposal of all wastes in drums may not be optimal for the disposal of all wastes, and, for example, larger items of decommissioning wastes. Provision of advice to waste producers on options for disposal at the earliest possible stage will facilitate optimal management of wastes.*

(1)

BASIS: *GSR Part 3 Requirement 11 states that “The government or the regulatory body shall establish and enforce requirements for the optimization of protection and safety, and registrants and licensees shall ensure that protection and safety is optimized.”*

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(2)	<p>BASIS: GSR Part 5 Requirement 10 states that <i>“Processing of radioactive waste “Radioactive material for which no further use is foreseen and with characteristics that make it unsuitable for authorized discharge, authorized use or clearance from regulatory control shall be processed as radioactive waste. The processing of radioactive waste shall be based on appropriate consideration of the characteristics of the waste and of the demands imposed by the different steps in its management (pretreatment, treatment, conditioning, transport, storage and disposal). Waste packages shall be designed and produced so that the radioactive material is appropriately contained both during normal operation and in accident conditions that could occur in the handling, storage, transport and disposal of waste.”</i></p>
(3)	<p>BASIS: SSG-40, para. 6.31. states that <i>“Radioactive waste should be processed as close to the point of generation as practicable, with account taken of different aspects, such as safety, security, exposure and financial aspects, in order to convert it in an optimized way into a passively safe waste form and to prevent its dispersal during storage and disposal. Consideration should be given to the need for a balance between potential mobility of the waste, ALARA considerations and operational impact.”</i></p>
(4)	<p>BASIS: SSR-5 para. 2.9 states that <i>“The optimization of protection (that is, the process of determining measures for protection and safety to make exposures, and the probability and magnitude of potential exposures, “as low as reasonably achievable, economic and social factors being taken into account”) is considered in the design of the disposal facility and in the planning of all operations.”</i></p>
R6	<p>Recommendation: The ANDR should optimise the DFDSMA disposal design as soon as possible to facilitate optimal predisposal management of wastes and disposal in the facility.</p>

Romanian position

ANDR stated that the current intention is to dispose of all LILW-SL arising from the nuclear fuel cycle, and LILW-SL arising outside the nuclear fuel cycle once DNDR at Băița Bihor reaches its capacity, at DFDSMA, provided the waste meets the facility’s WAC. ANDR also stated, however, that the radioactive waste classification system allows VLLW to be disposed into a surface repository with a less complex concept than that currently assumed for DFDSMA. They envisage that they will undertake technical and economic studies to assess this option at the Saligny site at some point in the future.

ARTEMIS observation

ANDR have recognised that VLLW does not necessarily require the levels of environmental protection provided by the current disposal concept for DFDSMA and a less complex facility can provide adequate safety and environment protection.

International experience suggests diverting VLLW to a facility designed to provide adequate safety and environmental protection for such wastes can greatly reduce the volumes of wastes requiring disposal in facilities such as that planned with DFDSMA.

Given the potential benefits of a dedicated VLLW facility, it is suggested that a decision is made on whether or not to pursue this option at the earliest opportunity. Knowing whether that such a facility will become available would allow waste producers to start to segregate and manage their wastes appropriately, maximising the benefits.

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Observation: *ANDR stated an intention to assess the potential for developing a VLLW disposal facility providing appropriate levels of environmental protection for such wastes. International experience suggests that diversion to appropriate disposal facilities can greatly reduce the volumes of wastes requiring disposal in facilities such as the proposed DFDSMA.*

(1)	<p>BASIS: GSR Part 5 Requirement 10 states that <i>“Processing of radioactive waste “Radioactive material for which no further use is foreseen and with characteristics that make it unsuitable for authorized discharge, authorized use or clearance from regulatory control shall be processed as radioactive waste. The processing of radioactive waste shall be based on appropriate consideration of the characteristics of the waste and of the demands imposed by the different steps in its management (pretreatment, treatment, conditioning, transport, storage and disposal). Waste packages shall be designed and produced so that the radioactive material is appropriately contained both during normal operation and in accident conditions that could occur in the handling, storage, transport and disposal of waste.”</i></p>
(2)	<p>BASIS: SSG-40 Para 6.31 states that <i>“Radioactive waste should be processed as close to the point of generation as practicable, with account taken of different aspects, such as safety, security, exposure and financial aspects, in order to convert it in an optimized way into a passively safe waste form [12] and to prevent its dispersal during storage and disposal. Consideration should be given to the need for a balance between potential mobility of the waste, ALARA considerations and operational impact.”</i></p>
S3	<p>Suggestion: ANDR should consider assessing the potential for disposal of very low level waste in a dedicated facility at the earliest opportunity.</p>

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

Romanian position

Romania has plans to develop a surface disposal facility near Saligny for the disposal of Low and Intermediate Level short lived waste (DFDSMA).

A preliminary safety case for the surface disposal facility is currently not available. A contract of around two years will be granted in 2022 to a company that will deliver several studies and proposals that will become important elements of the safety case.

It is planned to introduce the site licence application in 2023 and the construction licence application in 2024.

The counterpart presented the following schedule (Figure 3.) for the development of the safety assessment, safety case, and licensing steps, where the time is indicated in months at the top, and the duration of each activity is indicated:

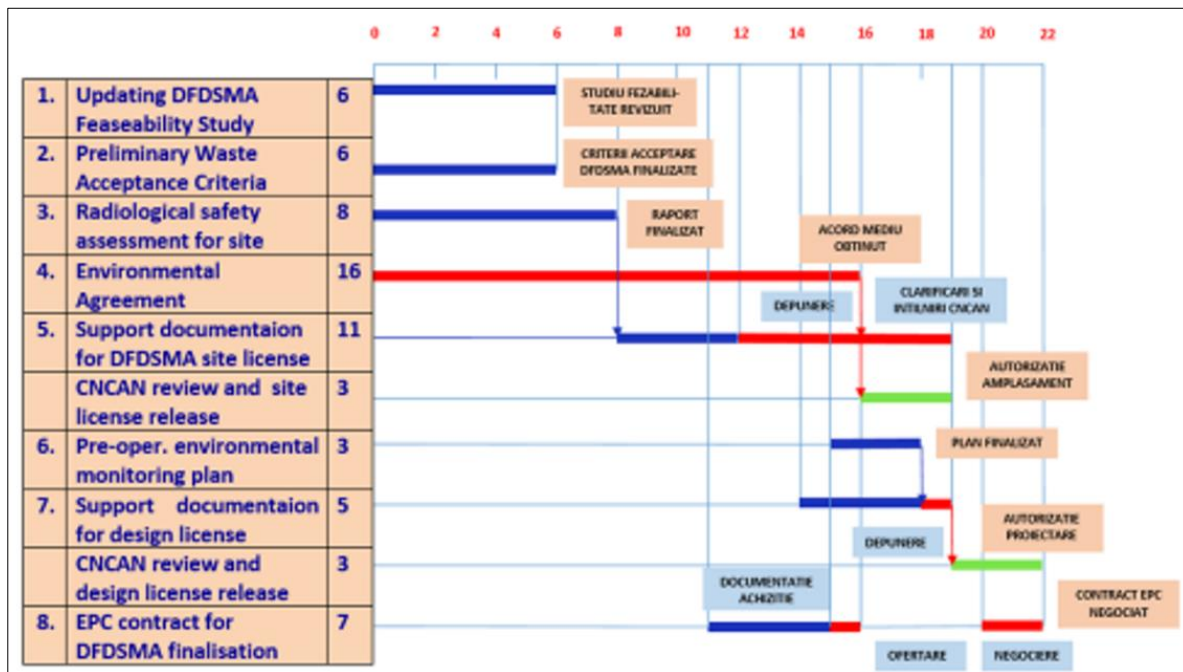


Figure 3. Schedule for the development of the safety assessment, safety case, and licensing steps

Currently, exchanges take place between the regulatory body CNCAN and ANDR for the licensing of the facility. These exchanges do for the moment not involve a preliminary safety case. In the plan, CNCAN will review the site licence application, and will also review the licence application for the design in consecutive stages. The documentation supporting the site licence application will be developed over eleven months. The documentation supporting the design licence application will be developed in seven months, according to the schedule provided. Three months are foreseen for the CNCAN review and licence release of each licence application.

ARTEMIS observation

As the safety case for the DFDSMA will only be developed a short time before the licence submissions, the ARTEMIS Review Team finds that it will be difficult for the safety case to guide the activities of site confirmation and development of the design. In many cases, iterations

are also needed in order to allow for example the design to be optimised and the waste acceptance criteria to be refined, based on the safety assessments.

In addition, ANDR should have sufficient time for the review and approval of the safety case documentation provided by the subcontractor. This means being able to review, challenge, modify and endorse before it is submitted to CNCAN for review. This is important as ANDR is responsible for the safety, including safety case and safety assessment.

The ARTEMIS Review Team noted that limited time is foreseen in the timeline for the regulator to assess the safety case, but moreover, the team noted that the proposed timescale does not seem to permit that the safety case might need update as a result of the regulatory review. The immediate following of the licence application for the siting and the licence application for design does not permit that the licence application for the design takes into account potential issues or updates on the siting application, as a result of the regulatory review.

The reassessment of the timeframe seems necessary in order to allow all parties (ANDR, CNCAN) to be able to fully discharge their duties and responsibilities in the development of the DFDSMA disposal and the review of the safety case. It will also allow the safety case to guide this development.

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Observation: *A preliminary safety case for the surface disposal facility is currently not available. ANDR foresees to introduce the site license application in 2023 and the construction license about three months later.*

As this safety case will be developed just before the license submissions, it will be difficult for the safety case to guide the activities of site confirmation and evaluation of the design.

The timescale provides no time for ANDR to review and endorse the safety case (review, challenge, make modifications and approve it) before it is submitted to the regulatory body.

The proposed timescale does not seem to permit that the safety case might potentially need update because of the regulatory review. Moreover, the immediate following of the license application for the siting with the application for the design does not permit that the license application for the design takes into account potential issues or updates on the siting application, because of the regulatory review.

(1)	<p>BASIS: SSR-5 Requirement 12 states that “A safety case and supporting safety assessment shall be prepared and updated by the operator, as necessary, at each step in the development of a disposal facility, in operation and after closure. The safety case and supporting safety assessment shall be submitted to the regulatory body for approval. The safety case and supporting safety assessment shall be sufficiently detailed and comprehensive to provide the necessary technical input for informing the regulatory body and for informing the decisions necessary at each step.”</p>
(2)	<p>BASIS: SSR-5 Requirement 12, para. 4.12 states that “A facility specific safety case has to be prepared early in the development of a disposal facility to provide a basis for licensing decisions and to guide activities in research and development, site selection and evaluation and design. The safety case has to be developed progressively and elaborated as the project proceeds. It has to be presented to the regulatory body at each step in the development of the disposal facility. The</p>

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	<i>regulatory body might require an update of, or revision to, the safety case before given steps can be taken, or such an update or revision may be necessary to gain political or public support for taking the next step in the development of the disposal facility or for its operation or closure. [...]</i>
(3)	BASIS: GSR Part 4, Requirement 3, para. 4.2 states that <i>“The responsibility for carrying out the safety assessment shall rest with the responsible legal person; that is, the person or organization responsible for the facility or activity — generally, the person or organization authorized (licensed or registered) to operate the facility or to conduct the activity. The operating organization shall be responsible for the way in which the safety assessment is carried out and for the quality of the results.[...]”</i>
(4)	BASIS: GSR Part 1, Requirement 24, para.4.35 states that <i>“Some of the stages in the lifetime of a facility or the duration of an activity (see para. 4.29) may require specific hold points at which separate authorizations are required. In such cases, the completed stages have to be subject to review and assessment, with account taken of feedback from the previous stages.”</i>
R7	<p>Recommendation: ANDR should reconsider the foreseen timeline of the different steps in the development of the DFDSMA and its safety case, to:</p> <ul style="list-style-type: none"> • allow the development of the safety case progressively with the evolving project, so as to be able to guide the site licensing and design activities. • allow ANDR to review and endorse the draft safety case(s) as they are proposed by the contractor(s). • allow if needed the regulatory body to require an update of, or revision to, the safety case before given steps can be taken.

Romanian position

Romania foresees the following steps and timeline for the development of a deep geological repository (DGR) for spent nuclear fuel and LILW-LL:

- 2023 – reference concept selected,
- 2025 – site selection process,
- 2030 – underground research laboratory (URL) construction,
- 2045 – DGR construction,
- 2055 – repository commissioning,
- 2150 – DGR closure phase.

The national strategy also mentions the selection of the host rock in 2028.

For the moment, no safety case is under development, although ANDR is currently planning to subcontract activities related to this.

ARTEMIS observation

The ARTEMIS Review Team observes from the timeline that several important steps will be taken in the next 10 years, such as selection of the reference concept and host rock selection and siting.

In order to allow a step by step development of the DGR, a safety case should be developed as early as possible. This safety case will then evolve through the different steps and can be refined and developed with each subsequent step.

The safety case will help guiding the process of developing the DGR, and specifically the research and development that will have to be undertaken in order to be able to support the decision on the next step(s) to be taken. The safety case will for example help to identify gaps from aspects that are important for safety, such as what properties from a host rock to be investigated in order to be able to confirm its suitability. Also, basic impact scenarios might be used to confirm suitability, which can later be refined as the safety case and the design evolves. The safety case will also from the beginning be able to identify the relevant uncertainties to be addressed at each step. Moreover, the safety case, even preliminary, will help in the exchanges with all interested parties.

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Observation: *The Romanian counterpart provided us with a foreseen schedule of the timeline for the development of the geological disposal facility. Important steps such as selection of the reference concept, the establishment of the siting and concept selection strategy, the site selection process and host rock selection and the start of the site characterization and URL-implementation will take place in the next ten years. No preliminary safety case is under development yet, although the ANDR foresees subcontracting in the future activities related to this.*

The ARTEMIS Review Team notices that it is expected that the safety case is prepared early in the development of a disposal facility. This is in view of guiding especially in this case the activities in research and development, site selection and evaluation and design. The safety case, even preliminary, will also help in the exchanges with all interested parties

(1)

BASIS: SSR-5, Requirement 12, para. 4.12 states that “ A facility specific safety case has to be prepared early in the development of a disposal facility to provide a basis for licensing decisions and to guide activities in research and development, site selection and evaluation and design. The safety case has to be developed progressively and elaborated as the project proceeds.”

(2)

BASIS: SSG-23, para. 4.8 states that “Development of the safety case should commence at the inception of the project and should be continued through all steps in the development and operation of the facility through to its closure and licence termination. The safety case should also be used throughout all steps to guide the site selection process, the facility design, excavation and construction activities, operation of the facility and its closure. It should be used to identify research and development needs, to identify and establish limits, controls and conditions at the various steps, and primarily to provide the basis for the licensing process. It will also be the main vehicle of communication with interested parties, in terms of explaining the safety features and how a reasonable level of safety will be ensured.”

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S4	Suggestion: ANDR should consider starting to develop the safety case for the geological disposal facility, as soon as possible, in order to guide the activities, especially in R&D, that will lead to the selection of a reference concept, host rock selection and site selection process.
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Romanian position

ANDR have established preliminary waste acceptance criteria or WAC for the DFDSMA surface disposal facility. The WAC were developed based on work in the European Phare project.

The ANDR provided the ARTEMIS Review Team with information regarding the development of these WAC. They take into account the estimated waste quantities and waste characteristics that will have to be placed in the disposal facility, as well as the experience from international disposal facilities in operation, particularly France.

Some of the radiological waste acceptance criteria have been verified by the use of some preliminary impact calculations.

Some examples of WAC are given underneath, such as provided by the Romanian counterpart:

- *“Chelatanes: fluorides, chlorides, phosphates, sulphates, EDTA, EDA, NTA, DTPA, TTHA, organic acids (or salts from these acids), ... Chelatanes may promote dispersion of radio-nuclides during post-closure period or within degraded scenarios (when water flows through the repository). Cernavoda Nuclear Power Plant shall make an inventory of chelatanes. Any significant concentration of chelatanes in the waste is to be declared to ANDRAD before acceptance of the waste, for a case by case decision. To be more precisely defined: "significant concentration of chelatanes"”.*
- *“Waste which react with water (aluminium, zinc, uranium, magnesium). The surface of aluminium accepted within one disposal module is limited to 1 m². If aluminium is isolated from the cement during curing by plastic sheets, higher surfaces may be accepted. Preliminary compaction or fusion is an alternative which may reduce the surface for a defined quantity of aluminium. Other metals (zinc, uranium, magnesium), shall be conditioned into a polymeric matrix.”*
- *“In order to define MAAL¹ so that the waste which is forecasted to be disposed of in DFDSMA will meet the WAC, we took into account activity levels from OPG inventory [7] and activity levels from ANDRAD inventory [1], [4]. We also compared these levels to French WAC for near surface repository (ANDRA specification [9]).” According to the safety assessment procedure, this definition of MAAL may be changed in the future iterations of the WAC process. Generally, the proposed MAAL are lower than ANDRA (France) value [9]. 3H and 14C values are a little bit higher, due to the high specific activities in waste to be disposed of in DFDSMA. MAAL are necessary for post-closure safety, mainly within intrusion scenarios.”*

ARTEMIS observation

The WAC are currently not derived from the safety case and safety assessment but mainly derived from international experience, and adapted to the inventory foreseen to be disposed in

¹ Maximum activity concentrations that are allowed

the facility. It is essential that the WAC are derived from the safety case and safety assessment, not only related to radiological impact but also related to the collection and presentation of scientific arguments and results from R&D that justify a chosen criterion. This development is necessary in order to assure that the WAC are sufficiently underpinned by assessments in the specific context of the DFDSMA facility, and to ensure that the safety of the facility will not be jeopardized.

The following WAC examples are cited to illustrate the recommendation (R8) and should not be seen as advice on, or review of, the WAC:

- It is stated that it has to be defined what a “significant concentration of chelatants” is. This is typically defined by use of assessments in the safety case, collecting all relevant information, studies, and R&D that will deliver the concentration at which the chelatants could become complexants influencing radionuclide migration.
- A surface of 1m² of aluminium is maximum accepted per waste disposal package. The safety case is again expected to present the arguments, scientific data, R&D, and modelling, that will demonstrate a limit which would cause no alteration of the package’s properties or retention capacities.
- The nuclide concentrations are currently not yet related to the human intrusion scenarios. These scenarios are fundamental in determining the maximum concentration limits and activities that could be allowed in the disposal facility, and generally take into account the combination of all concentration limits proposed.
- Scenarios can also help determining the nuclides that are important to be considered, as to ensure that all relevant nuclides for the disposal facility present in the waste have been identified. The completeness of the list of nuclides can be assessed with the help of basic impact scenarios.

These cases are illustrations on the importance of the safety case and subsequent safety assessment to guide the WAC developments.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
<p>Observation: <i>The ARTEMIS Review Team was informed that preliminary WAC of the DFDSMA disposal facility were established. The counterpart provided the ARTEMIS Review Team with some of the documents that explain the preliminary waste acceptance criteria’s origin.</i></p> <p><i>The ARTEMIS Review Team noticed that the criteria are mostly derived from international practices and facilities abroad and taking into account estimated waste quantities that are foreseen to be disposed into the facility.</i></p> <p><i>The provided documentation however does not show the criteria as being derived from/iterated with the safety assessment/safety case.</i></p>	
(1)	<p>BASIS: <i>SSR-5 Requirement 20 states that “Waste packages and unpackaged waste accepted for emplacement in a disposal facility shall conform to criteria that are fully consistent with, and are derived from, the safety case for the disposal facility in operation and after closure.”</i></p>
(2)	<p>BASIS: <i>SSR-5 Requirement 12, para. 4.13 states that “Safety assessment in support of the safety case has to be performed and updated throughout the development and operation of the disposal facility and as more refined site data become available. Safety assessment has to provide input to ongoing decision</i></p>

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

	<i>making by the operator. Such decision making may relate to subjects for research, development of a capability for assessment, allocation of resources and development of waste acceptance criteria.”</i>
(3)	SSG-23 Para 4.73 states that <i>“Limits and conditions of particular importance for disposal facilities are the total waste inventory acceptable and/or the acceptable concentration levels for specific radionuclides in the waste. These should be defined and/or justified on the basis of the safety assessment. Waste acceptance criteria should be established both for individual packages and for the entire facility by considering the analysis of various scenarios (e.g. for the release of radionuclides to the environment and for transfer of radionuclides along environmental pathways).”</i>
R8	Recommendation: ANDR should ensure that the Waste Acceptance Criteria for DFDSMA are derived from the safety case and safety assessment.

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

Romanian position

A National system is in place for cost estimation and financing of radioactive waste and spent fuel management and disposal and the decommissioning of nuclear installations in Romania.

Law no. 111/1996, with subsequent additions and amendments, as well as the Ordinance 11/2003 with subsequent additions and amendments and Government Decision 1080/2007, constitute the main legal basis for cost estimation, funding and financing for the safe radioactive waste and spent fuel management, as well as for decommissioning. According to these, the responsibility of covering the cost associated with the management of spent nuclear fuel and radioactive waste in Romania rests with the waste licensees – “*radioactive waste generator pays*” principle.

Responsibilities are clearly assigned by corresponding Legislation among ANDR and nuclear licensees to develop necessary cost estimates.

Cost for present and future management of RW and SNF are covered by the license holders as follows:

1. Cernavoda NPP

The costs for managing the RW and SNF from the Cernavoda NPP are paid directly from the company’s budget. This includes costs for handling and storing spent fuel and collecting and storing the radioactive waste, until it is transferred to ANDR. These costs are included in the electricity price.

2. Institutional radioactive waste

The financing of the activities of safe management and disposal of such wastes generated outside the nuclear fuel cycle, are partially supported by radioactive waste generators, partly from the state budget.

The responsibility for cost estimation for the National Programme for Radioactive Waste and Spent Fuel Management relies on ANDR. Such cost estimations are developed in the joint effort with nuclear operators.

The reference scenario for cost estimation for the National Programme for Radioactive Waste and Spent Fuel Management considers these main assumptions:

- Open-cycle nuclear fuel option, considering spent nuclear fuel as high level waste.
- Onsite storage as the preferred option for SNF inventories until the DGR is available.
- Early planning of decommissioning starting with the initial decommissioning plan in the construction licensing step of nuclear installations is required by CNCAN specific radiological safety regulation on decommissioning of nuclear installations in Romania. The decommissioning will be initiated as soon as possible after shut down of the facilities –the immediate decommissioning strategy would be the preferred option while the deferred decommissioning strategy will be proper justified by the licensee- and the end point will be determined starting with the preliminary decommissioning plans..
- Radioactive Waste and Spent Fuel generation:
 - Existing Nuclear installations:

- Operating Cernavoda NPP 1-2 units are foreseen to shutdown by 2049 and 2059, respectively.
- RATEN/ICN TRIGA Research Reactor planned to be shutdown by 2035
- Institutional low level radioactive waste, which meets the acceptance criteria, is disposed of in DNDR IFIN-HH Băița-Bihor, which will operate until its disposal capacity is completed. Those institutional wastes above Băița-Bihor's waste acceptance criteria will be safely stored for disposal in a dedicated National repository.

-- Future Nuclear installations

- For planning and cost estimates purposes, it is foreseen that Cernavoda NPP 3-4 units will enter into operations by 2030 and 2031, respectively. It is assumed their lifecycle will be for 60 years.
- LILW-SL radioactive resulting from operation and decommissioning of NPPs will be disposed of at DFDSMA repository to enter in operation in 2028. This facility will also be the destination of any LILW-SL arising from institutional producers once Băița-Bihor is closed.
- The National DGR is foreseen to enter in operation by 2055.

The methods to estimate the National Programme for radioactive waste, spent fuel and decommissioning costs appear to be well developed following internationally applied methods (i.e. EDRAM report for DGR project and NEA/OECD International Structure for Decommissioning Costing (ISDC) methodology (Yellow book) for decommissioning waste). The estimates are subjected to the verification and approval of the corresponding Ministries of the Government.

Cost estimation for the implementation of future disposal facilities is updated by ANDR every five years.

Such Cost estimations are under the oversight and approval of the Ministry of Energy. ANDR also reported about the intention to further take into account cost uncertainties and risks. Those may be incorporated in the estimated cost by applying contingencies for each aspect of the work breakdown structure.

From a funding perspective, the Government Decision 1080/2007 on the constitution and management of financial resources necessary for the safe RWM establishes the creation of two dedicated Funds:

- the Radioactive Waste Fund
- the Decommissioning Fund

Long-term liabilities related to the radioactive waste and spent fuel management and the future decommissioning of the nuclear power plants are covered by these 2 Funds.

The Funds are made up by the contributions from Cernavoda NPP. Both funds are managed by ANDR. The Funds are conservatively deposited (accounts with the State Treasury).

Contributions (by regulated fees) to the Funds are established by corresponding Government Decisions. Current fees for both Funds were established in 2007.

ARTEMIS observation

ARTEMIS Review Team understood a National system is in place for cost estimation and

financing of radioactive waste and spent fuel management and disposal and the decommissioning of nuclear installations in Romania.

The national programme for RWM in Romania has experienced a significant development in the last fifteen years that enabled ANDR to acquire a more mature understanding of the needs and associated resources required for the successful implementation of that National Programme.

The ambitious disposal programme that is being implemented, including new disposal repositories for all wastes classes, requires a significant and demanding effort to make timely available all elements needed to guarantee the safety and success in their implementation.

Among other elements, financing is a relevant aspect. The ARTEMIS Review Team advises to carry out regular and timely reviews of cost estimates and associated funding mechanism and fees as it is internationally agreed as best practice.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: <i>The Fund for the implementation of the National RWM and SFM programme is made up regulated contributions by Cernavoda NPP. These contributions correspond to the fees established by Govern Decision 1080/2007. Those fees have not been reviewed since 2007. According internationally accepted best practises, such fees should be reviewed regularly.</i>	
(1)	BASIS: GSR Part 1 (rev 1) Requirement 1 para. 2.3(d) states that <i>“In the National policy and strategy account shall be taken of [...] the need and provision for financial resources”.</i>
(2)	BASIS: GSR Part 1 Requirement 10 para. 2.33 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, and the safe management of spent fuel.</i> <i>2.33. Appropriate financial provision shall be made for:</i> <i>(a) Decommissioning of facilities;</i> <i>(b) Management of radioactive waste, including its storage and disposal;</i> <i>(c) Management of disused radioactive sources and radiation generators;</i> <i>(d) Management of spent fuel.”</i>
(3)	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, and the provision of independent regulatory functions...”</i>
(4)	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</i>

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

*disposal facilities for radioactive waste to be sited, designed, constructed, operated and closed. This shall include:
[...]and clear allocation of responsibilities, securing of financial and other resources...”*

R9

Recommendation: The Government should adopt adequate measures to regularly review and adjust, if necessary, the fees to the dedicated Fund for radioactive waste management, in accordance with last available cost estimations, to guarantee the adequacy and sufficiency of the funds for the implementation of the National Programme.

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

Romanian position

On the national level, the academic institutions are a source of specialists for the nuclear sector. The Government is responsible for funding of basic university training. Experimental research for safety and radiation protection is performed at Bucharest University (UB), “Politehnica” University of Bucharest (UPB) and University of Pitesti (UPIT).

According to the Law no.111/1996 the licence for any facility is granted only if the applicant meets the following requirements related to the human and financial resources:

- proves the professional qualification for each position of its staff;
- has insurance or any other financial guarantee to cover his responsibility for nuclear damages;
- has financial arrangements for safe management of its own radioactive waste and for decommissioning of its installation.

Research and development (R&D) activities play an important role in achieving the objectives of the National Strategy. Knowledge development and the implementation of scientific and technical basis, for research and development is essential for:

- Promoting development for common European vision on key issues related to the responsible and safe management of spent nuclear fuel and radioactive waste, including disposal;
- Developing technologies for the management of spent nuclear fuel and radioactive waste, including those resulting from decommissioning activities of nuclear facilities;
- Optimizing and supporting the implementation of spent nuclear fuel and radioactive waste management activities, including disposal;
- Demonstrating the safety and security of disposal facilities.

In accordance with national legislation, ANDR may propose, within the sectoral plans and in the National Research and Development Plan, respectively, objectives specific to the nuclear field regarding the safe management of radioactive waste and their disposal. ANDR also proposes, endorses and receives topics and scientific papers concerning the research and development programmes in the nuclear field, financed from the state budget, regarding the safe management of radioactive waste and spent nuclear fuel, including their disposal.

The R&D plan presenting research, development and demonstration activities required for the implementation of management solutions, for the safe disposal of spent nuclear fuel and radioactive waste is developed according to the guide provided by the Implemented Geological Disposal Technology Platform (IGD-TP), which takes into account the essential planning elements in the field of research and development, as well as the necessary training of the staff. A specialized and experienced workforce, as well as the development of different skills and structures in the management field, will be ensured through professional training plans, which support the implementation of the National Strategy. Each party with responsibilities in the implementation of the National Strategy will take the necessary steps to train and improve its own staff.

The Ministry of Education and Research monitors the implementation of IFIN-HH's actions planned in the National Strategy and is responsible for ensuring the funds for the safe management and disposal of non-fuel cycle radioactive wastes from all over Romania generated from nuclear techniques and technologies application, collected by IFIN-HH.

During the discussion the counterparts (CNCAN, ANDR, RATEN, IFIN-HH) highlighted the lack of resources and difficulties in recruitment and retention of technical staff for radioactive waste management.

ARTEMIS observation

From the discussion it is clear that, in the field of radioactive waste and spent fuel, the regulatory body CNCAN does not have the sufficient capacity, both financial and human, and capability to ensure the appropriate and timely undertaking of its regulatory functions. CNCAN face difficulties in the recruitment of experienced staff to carry out the necessary regulatory reviews of safety cases associated with the licensing process of facilities and activities related to the safe management of radioactive waste and spent fuel. This is compounded by issues associated with the recruitment, training and retention of young professionals leading to difficulties in the continuity of knowledge.

ANDR has the responsibility of implementing an ambitious and demanding radioactive waste management programme. It needs to make sure that its staff are prepared to cope with such a demand in workload as the programmes increase. In particular, ANDR needs to make sure that there is sufficient capacity and capability of staff to allow for review and endorsement of the safety cases for the facilities in development, proceeding with the license application for those facilities, verifying the conformity of the waste to be disposed of, ensuring the appropriate siting, design, construction, operation and closure of the planned disposal facilities, in addition to directing the supporting R&D.

It was noted that the various institutions and the Ministry of Education and Research independently fund research waste management activities. However, it is not clear how the research funding is distributed between the institutions or whether there is sufficient funding for radioactive waste management research. The Government should therefore consider revising support for radioactive waste management programme research to ensure it can be delivered to support the ambitious radioactive waste programme timescales. Considering ANDR’s role in delivering the disposal facilities, coordination between ANDR and RATEN on research in this field is important.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *There is a concern that sufficient capacity will not be available for the main actors responsible for delivering the radioactive waste management programme.*

CNCAN is having difficulties in recruiting and retaining sufficient staff to deliver the required regulatory reviews. ANDR does not currently have the required resources available for appropriate review and endorsement of subcontracted activities.

Coordination between R&D activities and funding need to be ensured.

(1)	GSR Part 1 (Rev. 1) Requirement 10, para 2.32 states that <i>“The government shall make provision for appropriate research and development programmes in relation to the disposal of radioactive waste, in particular programmes for verifying safety in the long term.”</i>
(2)	GSR Part 1 (Rev. 1) Requirement 10, para 4.45 states that <i>“In the process of its review and assessment of the facility or activity, the regulatory body shall take into account such considerations and factors as:</i>

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

(15) Relevant research and development plans or programmes relating to the demonstration of safety;”

R10

Recommendation: The Government should ensure that sufficient human and financial resources are available:

- For CNCAN to acquire appropriate expertise and build capacities to be able to perform its regulatory functions during the implementation of radioactive waste strategy;
- For ANDR and other licensees to have appropriate capabilities to undertake their roles as waste management organizations responsible for safety;
- For research institutions to develop and implement appropriate R&D to support the implementation of radioactive waste management strategy.

APPENDIX A: TERMS OF REFERENCE

ARTEMIS Review of Romania's National Programme on Radioactive Waste and Spent Fuel Management

Terms of Reference

1. Introduction

On 9 November 2018, the Nuclear Agency and for Radioactive Waste (ANDR) requested the IAEA to organize and carry out, in 2019, the Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) peer review mission in Romania, as required of all EU Member States by Article 14.3 of the European Council Directive 2011/70/EURATOM of 19 July 2011, establishing a Community Framework for the Responsible and Safe Management of Spent Fuel and Radioactive Waste. On 16 July 2019, the ANDR proposed to move the mission to 2020. Due to the impact of the COVID-19 international situation, specifically travel restrictions, the mission was postponed to 7-16 November 2021 and later to 13-22 March 2022.

2. Objective

The ARTEMIS review will provide an independent international evaluation of Romania's radioactive waste and spent fuel management strategy and programme.

The review, organized in the IAEA by the Department of Nuclear Safety and Security and the Department of Nuclear Energy, will be performed with the combined expertise of the international peer review team selected by the IAEA.

3. Scope

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

Results from the 2017 IRRS Follow-up mission's to Romania will be taken into account as far as possible and if appropriate

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, with a focus on the national programme, as well as the results of self-assessment, which should be based on the provided questionnaire.

The provisional list of reference material is provided in the Annex 1 (such a list is subject to updates and should be finalized by 1 August 2021).

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

6. Modus operandi

The working language of the mission will be English.

The National Counterpart is the Nuclear Agency and for Radioactive Waste (ANDR). The National Counterpart Liaison Officers for the review are Ms Ramona Popescu, Ms Alice Mariana Dima and Ms Andreea Udrescu. The timeline for the key steps of the review process is provided below:

- Self-assessment: questionnaire was made available to Romania as of March 2019.
- Preparatory Meeting: 17 June 2020 (WebEx meeting)
- The reference material (in English) and the results of the self-assessment questionnaire will be provided to the IAEA as soon as they are available and not later than 1 August 2021
- Questions based on the preliminary analysis of the reference material and the self-assessment results will be provided by the review team by 25 February 2022.
- Peer review mission: 13-22 March 2022 (9 days)
 - Sunday: arrival of experts and their meeting;
 - Monday to Friday: interviews/exchange/discussion with Counterpart(s) on the basis of preliminary analysis and drafting of recommendations and suggestions
 - Saturday-Sunday noon: drafting and delivering of the draft report (Review Team);
 - Sunday afternoon: Delivery of draft report/recommendations to the Counterparts for fact checking;
 - Monday: discussions between the Review Team and the Counterparts and finalization of draft report;
 - Tuesday: delivery of the draft mission report and closure.

7. International peer review team

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

- Six qualified and recognized international experts from government authorities, regulatory bodies, waste management organizations, and technical support organizations with experience in the safe management of radioactive waste and spent fuel;
- Two IAEA staff, to coordinate the mission. The Coordinator of the ARTEMIS review is Mr Gerard Bruno from the Waste and Environmental Safety Section of the Department of Nuclear Safety and Security. The deputy coordinator is Ms Laura MsManniman from the Waste Technology Section of the Department of Nuclear Energy.
- One IAEA staff for administrative support.
- A senior member of IAEA staff from the Department of Nuclear Safety and Security will oversee the closure of the review.

The peer review team will be led by a Team Leader, comprising from the review team as defined in the ARTEMIS draft guidelines. The Team Leader will be Mr Richard Cummings from Nuclear Waste Services, UK. The IAEA will inform the National Counterpart regarding the composition of the proposed review team prior to submission of reference material.

The review mission may include the presence of up to two observers, including the possibility of an observer from the European Commission (EU). The National Counterparts 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 Nuclear Agency and for Radioactive Waste (ANDR).

9. Funding of the peer review

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

The total cost is currently estimated to the amount of 35 000 EUR. Romania is aware that the review cost includes 7% programme support costs. Romania agrees with these Terms of Reference by accepting necessary arrangements, including release of funds from the Technical Cooperation Department of the IAEA (TC) to the responsible TC budget Officer of the IAEA.

These Terms of Reference have been agreed between the IAEA and the ANDR during the preparatory meeting 17 June 2020 and approved in June 2021. The Terms of Reference were revised in February 2022 due to postponed date for ARTEMIS review mission to 13-22 March 2022.

Annex 1: List of reference material

1. Responses to the ARTEMIS Self-assessment Questionnaire
2. Law 111/1996 on the safe deployment, regulation, authorization and control of nuclear activities, republished with subsequent completion and modification. <http://www.cncan.ro/legislatie/legi/>
3. Law 105/1999 on the ratification of Joint Convention on the safe management of nuclear fuel and on the safe management of radioactive waste.
4. Law 378/2013 for the transposition of Council Directive 2011/70/Euratom establishing a community framework for the responsible and safe management of spent fuel and radioactive waste.
5. Government Ordinance 11/2003 regarding the management of nuclear spent fuel and radioactive waste, including their disposal, with subsequent modifications and completions.
6. Government's Decision 1259/2002, regarding the approval of the National Strategy for the development of the nuclear field in Romania and of the plan of action for the implementation of this strategy.
7. Government's Decision 1080/2007 regarding the constitution and management of financial resources necessary for the safe management of waste.
8. Order 844/2004 for approving the National Strategy on medium and long-term management of spent nuclear fuel and radioactive waste, including final disposal and decommissioning of nuclear facilities.
9. The list of regulations issued by CNCAN: <http://www.cncan.ro/legislatie/norme/>

Other references

10. CNCAN (2019) Romania Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. The 7nd National Report.
11. The updated National Strategy on medium and long-term management of spent nuclear fuel and radioactive waste
12. ANDR (2021) Romania 3nd REPORT on the implementation of the Council Directive 2011/70/Euratom on the responsible and safe management of spent fuel and radioactive waste
13. The list of regulations on environmental impact assessment
14. Technical documents regarding the safe management of radioactive waste and spent nuclear fuel (studies on cost estimation, disposal programmes, waste acceptance criteria, etc)
15. The last report of IRRS mission in Romania

APPENDIX B: MISSION PROGRAMME

Time	Sun, 13 Mar	Mon, 14 Mar	Tue, 15 Mar	Wed, 16 Mar	Thurs, 17 Mar	Fri, 18 Mar	Sat, 19 Mar	Sun, 20 Mar	Mon, 21 Mar	Tue 22 Mar
9h00 – 10h00	Arrival of Team Members	Opening General presentation	Inventory	Safety case and safety assessment	Capacity building	Presentation of Suggestions and Recommendations to Counterparts	Drafting of the report	Draft report to be sent to the Counterparts by 13h00	Internal reflection of comments	Delivery of final draft report
10h00 - 12h00		National Policy and Framework								
12h00 - 13h00		Lunch	Lunch	Lunch	Lunch	Lunch		Lunch	Lunch	Departure of Team Members
13h00 – 16h00		National Strategy	Concepts, Plans and technical solutions	Cost estimates and financing	Session reserved for further discussions if required/ drafting of the report	Drafting of the report		Counterparts review the draft report	Finalising draft report	
16h30 - 17h30		Artemis team meeting	Team meeting	Team meeting	Team meeting	Finalization of Suggestions and Recommendations		Drafting of the report	Drafting of the report	Drafting of the report
	Drafting of the report		Drafting of the report	Drafting of the report						

APPENDIX C: RECOMMENDATIONS AND SUGGESTIONS

Area		R: Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
1.	NATIONAL POLICY AND FRAMEWORK FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT	S1	The government and ANDR should consider aligning the presentation of its policy, strategies and plans for radioactive waste management with IAEA Safety Standards and international practice.
2.	NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT	R1	ANDR should address and improve in the implemented strategy the interdependences among all steps in the predisposal steps, as well as the impact of the anticipated disposal options.
		S2	ANDR should consider clarifying the national strategy to state the potential benefits of: <ul style="list-style-type: none"> • waste treatment to reduce volumes; • and diversion for appropriate wastes.
		R2	ANDR should finalize the plans for engagement with interested parties, and in particular, potential host communities as soon as possible to ensure they are properly engaged in the site selection process for the deep geological disposal.

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
		R3	ANDR should justify the high level roadmaps in the strategy with detailed programmes and schedules for the disposal programmes. The programmes and schedules should include the licensing process as well as corresponding R&D programmes.
3.	INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE	R4	ANDR should ensure the Waste Acceptance Criteria for DFDSMA are finalised as soon as possible to facilitate timely conditioning and disposal of waste into the new facility.
		R5	ANDR should expedite the design, licensing and manufacturing of appropriate containers to enable timely disposal to DFDSMA.
4.	CONCEPTS, PLANS AND TECHNICAL SOLUTIONS FOR SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT	R6	The ANDR should optimise the DFDSMA disposal design as soon as possible to facilitate optimal predisposal management of wastes and disposal in the facility.
		S3	ANDR should consider assessing the potential for disposal of very low level waste in a dedicated facility at the earliest opportunity.

Area		R: Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
5.	SAFETY CASE AND SAFETY ASSESSMENT OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT ACTIVITIES AND FACILITIES	R7	<p>ANDR should reconsider the foreseen timeline of the different steps in the development of the DFDSMA and its safety case, to:</p> <ul style="list-style-type: none"> allow the development of the safety case progressively with the evolving project, so as to be able to guide the site licensing and design activities. allow ANDR to review and endorse the draft safety case(s) as they are proposed by the contractor(s). allow if needed the regulatory body to require an update of, or revision to, the safety case before given steps can be taken.
		S4	ANDR should consider starting to develop the safety case for the geological disposal facility, as soon as possible, in order to guide the activities, especially in R&D, that will lead to the selection of a reference concept, host rock selection and site selection process.
		R8	ANDR should ensure that the Waste Acceptance Criteria for DFDSMA are derived from the safety case and safety assessment.
6.	COST ESTIMATES AND FINANCING OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT	R9	The Government should adopt adequate measures to regularly review and adjust, if necessary, the fees to the dedicated funds for radioactive waste management, in accordance with last available cost estimations, to guarantee the adequacy and sufficiency of the funds for the implementation of the National Programme.

	Area	R: Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
7.	CAPACITY BUILDING FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT – EXPERTISE, TRAINING AND SKILLS	R10	<p>The Government should ensure that sufficient human and financial resources are available:</p> <ul style="list-style-type: none"> • For CNCAN to acquire appropriate expertise and build capacities to be able to perform its regulatory functions during the implementation of radioactive waste strategy; • For ANDR and other licensees to have appropriate capabilities to undertake their roles as waste management organizations responsible for safety; <p>For research institutions to develop and implement appropriate R&D to support the implementation of radioactive waste management strategy.</p>

APPENDIX D: LIST OF ACRONYMS USED IN THE TEXT

ANDR – the Nuclear Agency and for Radioactive Waste

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

CITON – Center of Technology and Engineering for Nuclear Projects

CNCAN – National Commission for Nuclear Activities and Control

CNE – Cernavoda Nuclear Power Plant

DFDSMA – Final Repository for Low and Intermediate Radioactive Waste

DGR – deep geological repository

DNDR – National Repository Radioactive Waste

IAEA – International Atomic Energy Agency

ICN – Institute for Nuclear Research

IFIN-HH – Horia Hulubei National Institute for Research and Development in Physics and Nuclear Engineering

IGD-TP – Implemented Geological Disposal Technology Platform

ILW – Intermediate Level Waste

LILW-LL – low and intermediate level waste long-lived

LILW-SL – low and intermediate level waste short-lived

IRRS – Integrated Regulatory Review Service

RATEN – Technologies for Nuclear Energy State Owned Company

R&D – Research and development

SNN – National Society Nuclearelectrica SA

VLLW – very low level waste

WAC – Waste Acceptance Criteria

APPENDIX E: IAEA REFERENCE MATERIAL USED FOR THE REVIEW

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