

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

## **MISSION TO THE NETHERLANDS**

*the Hague, the Netherlands*

*19-28 November 2023*

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY  
DEPARTMENT OF NUCLEAR ENERGY



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

**ARTEMIS**



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**REPORT OF THE  
INTEGRATED REVIEW SERVICE FOR RADIOACTIVE WASTE AND  
SPENT FUEL MANAGEMENT, DECOMMISSIONING AND  
REMEDICATION (ARTEMIS) MISSION  
TO  
THE NETHERLANDS**

**Mission dates:** *19-28 November 2023*  
**Location:** *the Hague, the Netherlands*  
**Organized by:** *IAEA*

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IAEA-2023

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

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## EXECUTIVE SUMMARY

The Ministry for Infrastructure and Water Management requested the IAEA on 6 February 2019 to organize a back-to-back IRRS ARTEMIS mission to the Netherlands.

The objective of the ARTEMIS Peer Review Service was to provide independent expert opinion and advice on the radioactive waste and spent nuclear fuel management programme in the Netherlands, in line with the obligations under Article 14.3 of the Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community Framework for the Responsible and Safe Management of Spent Fuel and Radioactive Waste. The review was based on the relevant IAEA Safety Standards, following the guidelines of the ARTEMIS review service.

This ARTEMIS mission is organized back-to-back to an IRRS mission conducted from 5 to 16 June 2023. The conduct of the ARTEMIS mission and the preparation of the associated mission report have been carried out in due consideration of the IRRS mission. The ARTEMIS review was focused on the evaluation of the current Dutch national programme (2016) and national framework for executing the country's obligations for safe and sustainable radioactive waste and spent fuel management. In developing the ARTEMIS mission report, the outcomes from the 2023 IRRS mission to the Netherlands were taken into account. This ARTEMIS report takes advantage of the IRRS findings on the legal and regulatory oversight of activities, facilities and exposure situations in the field of radioactive waste and spent fuel management.

The review was organized by the IAEA Department of Nuclear Safety and Security and the Department of Nuclear Energy and performed by a team of six senior international experts in the field of management of spent fuel and radioactive waste, supported by IAEA staff providing coordination and administrative assistance.

The preparatory online meeting was held on 17 May 2023 and the Advanced Reference Material was submitted by the counterpart on 19 September 2023 for the experts' review. Subsequent to this, the ARTEMIS review mission was conducted from 19 to 28 November 2023.

During the ARTEMIS review mission, the team held discussions with the Ministry of Infrastructure and Water Management, regulatory body (ANVS), waste management organization (COVRA), Ministry of Finance, Ministry of Economic Affairs and Climate, representatives for the safe management of wastes at landfills and representatives from the National Institute for Public Health and the Environment (RIVM).

In the Netherlands the nuclear sector consists of one operational Nuclear Power Plant at Borssele, two research reactors, URENCO enrichment facility and the COVRA Central Organization for Radioactive Waste. COVRA is the only organization in the Netherlands that has been authorised for the collection, processing and storage of radioactive waste and spent fuel. The waste generator transfers ownership for the waste to COVRA at the moment that the waste is collected by COVRA. The NPP of Dodewaard is shut down in 1997 and is currently in safe enclosure. This facility will be decommissioned around 2045.

According to the agreement with France concerning the spent fuel, spent fuel originating from the NPP Borssele is being reprocessed in France. Vitrified waste and reprocessing residuals (compacted metallic waste) are returned to the Netherlands. The research reactors as well as the molybdenum production facility in the Netherlands produce spent fuel and other high level waste. The spent fuel of the research reactors are stored at COVRA without reprocessing. The design of the concrete structure of the storage facility for high level waste and spent fuel (HABOG) was based on a service life of at least 100 years. The facility has recently been extended to have place for additional high level waste. The capacity of the facility is sufficient



for the current fleet of reactors; however, several new facilities are envisioned with the potential new nuclear ambitions of the country. These include PALLAS medical radioisotope reactor and may include two new NPPs, and another medical isotope facility SHINE. The ARTEMIS Review Team suggests that the government should consider, in the national policy and strategy, the situation if the reprocessing of spent fuel of the NPP(s) abroad would not be an option.

Most of the Low and Intermediate Level Waste at COVRA is super compacted and cemented on-site. The expected lifetime of these packages is at least 100 years.

COVRA is in the process of constructing additional storage capacity for LILW waste by realizing a new waste storage building, the so-called multifunctional storage building (MOG). The new building is meant to be operational in 2025. The building is designed to accommodate different waste streams, including LILW legacy waste from the Research Reactor located in Petten, as well as the expected future decommissioning waste from the current nuclear installations. The project is in the construction phase.

To receive waste at the radioactive waste management facilities, COVRA currently uses waste specifications based on transport limits and the properties of the storage buildings. To advance the existing waste specifications the ARTEMIS Review Team recommends that the waste acceptance criteria are to be derived from facility specific safety case and supporting safety assessment, in line with IAEA safety standards. In addition, the regulatory framework should be enhanced by establishing regulatory requirements and guidance for the characterization of waste for predisposal and disposal activities.

COVRA is responsible for obtaining required fees for waste management based on the ‘polluter pays’ principle. The fees established by COVRA cover the costs of research, collection, processing, storage and disposal. The aim is to cover all anticipated costs. However, the team noted that the costs of the siting and the post-closure step are not included in the disposal cost estimates.

NORM waste with activity concentration of up to 10 times general clearance level or waste under specific clearance are disposed at designated landfills. The ARTEMIS Review Team suggested that the Government should consider setting the requirements for a programme that includes radiological monitoring, in accordance with the graded approach, at the landfill sites authorized to receive designated radioactive material.

The regulatory framework for decommissioning is established and stipulates requirements, however, the National Programme does not establish the decommissioning aspects, such as decommissioning strategies (e.g. immediate and/or deferred dismantling) and end states, that may impact waste management. The ARTEMIS team encourages the government to include in the National Policy the decommissioning aspects that may have an impact on waste management.

The ARTEMIS Review Team noted that the Netherlands has in place a waste management system that provides for the safe management of radioactive waste based on the current activities. The definitive decision for the final disposal option will not take place until 2100. The step-by-step planning, development, and decision making of legislative and regulatory framework for disposal will take place over an extended period of time. To ensure the timely realization of the disposal facility, the ARTEMIS Review Team encourages the government to enhance the national policy and strategy to further specify the steps in planning, development and authorization of disposal facilities and clearly allocate responsibilities.

In addition, the ARTEMIS Review Team provided the Government and COVRA with the following suggestions:



- The Government should consider enhancing its policy and strategy to formalize the roles and responsibilities for research and development in relation to decommissioning and waste management, including disposal.
- The Government should consider further developing a national strategy for waste management that sets out the mechanisms for implementing the National Policy, that includes appropriate interim targets, measurable progress indicators and end states.
- The Government should consider expanding the national inventory to include radioactive waste to be disposed at landfills.
- COVRA should consider enhancing its research and development programme to include predisposal research and development needs derived from the periodic safety review, the safety case and supporting safety assessment, in line with the IAEA safety standards.

In summary, the ARTEMIS Review Team considers that the Dutch programme for the management of spent fuel and radioactive waste is established and effective for the current needs. The Government, ANVS and COVRA are committed to safety, innovation and openness. The Netherlands is committed to continuous improvement for the safe management of radioactive waste and spent fuel.

## I. INTRODUCTION

On 6 February 2019, the State Secretary at the Ministry of Infrastructure and Water Management in the Netherlands requested the IAEA to organize an Integrated Review Service for Radioactive Waste and Spent Nuclear Fuel Management, Decommissioning and Remediation Programmes (ARTEMIS), with an option to combine the ARTEMIS mission with an Integrated Regulatory Review Service (IRRS), or to have two subsequent missions in 2023. In February 2021, it was decided to organize back-to-back IRRS and ARTEMIS missions, with the IRRS mission in the first half of 2023 and the ARTEMIS mission in second half of 2023.

The Netherlands's request for the ARTEMIS review is to satisfy its obligations under 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 (hereinafter the *EU Waste Directive*).

The ARTEMIS review mission was carried out between 19-28 November 2023 following the IRRS mission which took place from 5-16 June 2023. The ARTEMIS review was led by the IAEA by the Department of Nuclear Safety and Security supported by the Department of Nuclear Energy.

The review was performed by a team of six senior international experts in the field of radioactive waste and spent fuel management, from multiple IAEA Member States, with IAEA staff providing coordination and administrative support. Subsequent to a preparatory meeting in May 2023, and the receipt and review of Advanced Reference Material in September 2023, in November 2023 the ARTEMIS Review Team evaluated the Netherland's radioactive waste and spent fuel management programme.

## **II. OBJECTIVE AND SCOPE**

The ARTEMIS review evaluated the Dutch national programme and the national framework for executing country's obligations for safe and sustainable radioactive waste and spent fuel management. The Netherlands has indicated the wish not to exclude any type of waste and related waste management activities from the discussion and perform the evaluation without a particular accent.

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

The outcomes from the 2023 IRRS mission to the Netherlands were taken into account as appropriate to avoid unnecessary duplication in line with the Supplementary Guidelines on the Preparation and Conduct of IRRS-ARTEMIS back-to-back Missions, applicable for situations when an IRRS mission is conducted before an ARTEMIS mission. These Supplementary Guidelines were not a substitute for the ARTEMIS Guidelines but supplement them with the specific provisions that need to be taken into account while conducting IRRS-ARTEMIS back-to-back missions.

### **III. BASIS FOR THE REVIEW**

#### **A) PREPARATORY WORK AND IAEA REVIEW TEAM**

A preparatory meeting for the ARTEMIS Review, was conducted on the 17th of May 2023 online. The preparatory meeting was carried out by the appointed Team Leader Mr Janez Perko, the IAEA coordination officer Ms Mathilde Prevost, deputy coordinator Ms Amparo Gonzalez Espartero, and the team of National Counterparts led by Ms Marie-Noëlle Martin from the Ministry of Infrastructure and Water Management, with participation of representatives of the Authority for Nuclear Safety and Radiation Protection (ANVS) and the Central Organization for Radioactive Waste (COVRA).

The meeting participants had discussions regarding:

- the Terms of Reference for the ARTEMIS review; and
- the relevant detailed aspects for organization and conduct of the review.

IAEA staff presented the ARTEMIS principles, process and methodology. This was followed by a discussion on the work plan for the implementation of the ARTEMIS review in the Netherlands in November 2023.

Ms Marie-Noëlle Martin, and Mr Louk Bracco Gartner were appointed as the National Counterparts for the ARTEMIS mission and designated IAEA points of contact. In July 2023 Mr Mark van Bourgondiën replaced Mr Louk Bracco Gartner as the National Counterpart. The Netherlands provided the IAEA with the Advance Reference Material (ARM) for the review on 19 September 2023.

#### **B) REFERENCES FOR THE REVIEW**

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

#### **C) CONDUCT OF THE REVIEW**

The initial ARTEMIS review team meeting took place on Sunday, 19 November 2023 in The Hague, directed by the ARTEMIS Team Leader Mr Janez Perko, the ARTEMIS Team Coordinator Mr Andrey Guskov and the Deputy Team Coordinator, Ms Amparo Gonzalez Espartero.

The ARTEMIS entrance meeting was held on Monday, 20 November 2023, with the participation of the Ministry of Infrastructure and Water Management (I&W), Authority for Nuclear Safety and Radiation Protection (ANVS), Central Organization for Radioactive Waste (COVRA). Welcome addresses were made by Ms Afke van Rijn, Director-General of DG Environment and International Affairs, I&W; Ms Annemiek van Bolhuis, chair of the board, ANVS; Mr Ewoud Verhoef, Deputy Director of COVRA. Opening remarks were made by Mr Andrey Guskov, IAEA ARTEMIS Team Coordinator and Mr Janez Perko, ARTEMIS Team Leader.

During the ARTEMIS mission, a review was conducted for all topics within the agreed scope with the objective of providing Dutch authorities with recommendations and suggestions for improvement. To demonstrate current practice in spent fuel and radioactive waste management

and address questions from the ARTEMIS Review Team, the technical visit to the site and facilities of the only waste management organization in the Netherlands (COVRA) was arranged.

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

The ARTEMIS Exit Meeting was held on Tuesday, 28 November 2023. Opening remarks were made by Mr Joris van der Voet, Deputy Director Environmental Risks and Safety Directorate, Ministry of Infrastructure and Water Management. The results of the Review Mission were presented by the ARTEMIS Team Leader Mr Janez Perko. The Final draft Report was accepted by Ms Afke van Rijn, Director-General of DG Environment and International Affairs, I&W, who also spoke. Mr. Marco Brugmans, deputy Chair of the Board of the ANVS, made the closing remarks on behalf of the regulatory body, and Mr Jan Boelen, director of COVRA, provided the closing remarks on behalf of the waste management organization. Closing remarks were made by Ms Hildegard Vandenhove, Director of the Division of Radiation, Transport and Waste Safety, IAEA Department of Nuclear Safety and Security.

An IAEA press release was issued.

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

## 1.1. NATIONAL POLICY

### **Dutch position**

The Netherlands Policy for radioactive waste management is expressed in the National Programme for the Management of Radioactive Waste and Spent Fuel National (Programme). The Policy establishes the national fundamental principles relating to radioactive waste management, these are:

- minimisation of the generation of radioactive waste
- safe management of radioactive waste now and in the future
- no unreasonable burdens to future generations
- the generators of the radioactive waste are responsible for the costs of its management.

The Policy expresses due account for the graded approach and continuous improvement.

In accordance with the Policy, a single specially established organization, the Central Organization for Radioactive Waste (COVRA), has been entrusted with the management of radioactive waste and spent fuel for the Netherlands. Radioactive waste must be transferred to COVRA as soon as reasonably achievable. Once the radioactive waste is collected by COVRA, the radioactive waste generators transfer all responsibilities for the wastes to COVRA, who becomes the owner of the radioactive waste.

The National Programme outlines the origins, types, and volumes of radioactive waste. The classification system for radioactive waste includes high level waste (HLW), low and intermediate level waste (LILW) and NORM waste. For all categories of radioactive waste, the National Programme also provides an overview of the planned routes up to disposal.

The National Programme also includes the current waste management practices as well as a general overview for the long-term management of the radioactive waste. It provides that radioactive waste is to be stored until 2130, after which disposal in a deep geological repository (DGR) is envisioned. The Policy reflects a ‘dual-track approach’ that considers provisions for both national and international disposal. The definitive decision on the disposal pathway is planned to be taken around 2100.

The revision of the National Programme is to be developed iteratively with several steps for public consultation. A public consultation step was done in 2023 for the Memorandum of Scope and Level of Detail (Memorandum) for the strategic environmental assessment (SEA). The next step for consultation is envisioned in early 2024 for which a stakeholder workshops are planned on the SEA. The results of these workshops will inform the draft National Programme that will be published later in 2024 for public consultation. This consultation is planned to inform the finalized National Programme. The revised National Programme, including the Policy, is expected to be published in 2025.

### **ARTEMIS observation**

The next revision of the National Programme is currently being prepared. The Policy and principles that currently underpin the National Programme are not planned to be changed. As in the current National Programme, waste estimates (volumes and activity), and projected waste estimates will be included.

The waste management practices are also planned to remain unchanged, that is long term storage of radioactive waste at COVRA until a DGR is operational in 2130.

The ARTEMIS Review Team was informed that the rationale for the timeframe until disposal is attributed to the physical (amount of waste reduced due to decay), financial and economic (time to acquire necessary funds), and societal (society may choose different options in the future) reasons. While the team was informed of the advantages for long term storage, the team recognized that a risk informed decision includes the evaluation of both advantages and risks. The team found no evidence if the governmental decision making for the long term storage included this evaluation.

The ARTEMIS Review Team was informed that the 2025 National Programme will include a roadmap for long term storage and disposal. The National Programme will describe the ‘dual-track approach’ (a national DGR in the Netherlands or international cooperation with other countries to develop a regional DGR). This roadmap is intended to include the necessary steps for public participation, research and development, financial, decision-making processes, development of legislative and regulatory framework, and knowledge management. The Ministry of Infrastructure and Water Management (Ministry of I&W), in this case the State-Secretary of I&W, who is responsible for the National Programme, has contracted the Rathenau Institute to provide advice on how to design a participatory process. Their advice will be published in 2024. The Ministry of I&W will use this advice for the development of a participation process which will be included in the roadmap for the National Programme. There will be a public consultation process for the 2025 National Programme.

The ARTEMIS Review Team noted that the definitive decision for disposal will not take place until 2100. The planning, development, and decision making of legislative and regulatory framework for disposal takes place over an extensive period of time. To progress the decision for disposal, a step-by-step approach would enable accumulation and assessment of necessary information, evaluation of data, development of concepts, technical and regulatory review, public consultation, and decision, and thereby would aid in the realization of the disposal facility in a timely manner.



## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *The current National Programme for the Management of Radioactive Waste and Spent Fuel includes a general overview for the future. However, the National Programme does not specify in detail the steps for planning, development and decision making for long term waste management including disposal. The next revision of the National Programme is intended to include a roadmap for disposal that encompasses these components. This roadmap is currently under development.*

<b>(1)</b>	<b>BASIS: GSR Part 5 Requirement 2 states that:</b> “[...] <i>The national policy and strategy shall form the basis for decision making with respect to the management of radioactive waste.</i> ”
<b>(2)</b>	<b>BASIS: SSR-5 Requirement 1: states that</b> “ <i>The government is required to establish and maintain an appropriate governmental, legal and regulatory framework for safety within which responsibilities shall be clearly allocated for disposal facilities for radioactive waste to be sited, designed, constructed, operated and closed. This shall include: confirmation at a national level of the need for disposal facilities of different types; specification of the steps in development and licensing of facilities of different types; and clear allocation of responsibilities, securing of financial and other resources, and provision of independent regulatory functions relating to a planned disposal facility.</i> ”
<b>R1</b>	<b>Recommendation:</b> <b>The Government should enhance the National Policy and Strategy to further specify the steps in planning, development and authorization of disposal facilities and clearly allocate responsibilities.</b>

The National Programme establishes the basis for coordinated research and development (R&D) in the Netherlands. Responsibilities are distributed as follows:

- The Ministry of I&W is primarily responsible for and performs R&D in the area related to policy development and decision making. For example, the research conducted by Rathenau Institute on the participation process for disposal.
- The ANVS is responsible for research in support of its tasks (among which is the issuing of licenses, inspections, enforcing compliance and advising). For example, research in the area of clearance and exemption as well as in decay storage.
- COVRA is responsible for the development and implementation of the waste management strategy and the technical solutions in line with the National Policy and thus also for the plans and time schedules for R&D. In accordance with the Nuclear Energy Act, the fees collected by COVRA from the waste generators cover ongoing and future costs associated with waste management, including R&D.

The ARTEMIS Review Team was informed that the roadmap to be included in the 2025 National Program will reflect R&D activities for a DGR, such as research for site selection; process knowledge about safe and efficient transport; and collection of best practices for national disposal. While the National Programme sets the basis for the allocation of roles and responsibilities and appropriateness for R&D, currently this is not formalized. The foreseen roadmap is planned to indicate the priorities for each R&D activity as well as whom to involve.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *The National Programme sets the framework for research in the Netherlands, however at the moment it does not include a formalized structure to coordinate research and development.*

<b>(1)</b>	<b>BASIS: GSR Part 1 (Rev.1) para 2.32 states that:</b> <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>
<b>S1</b>	<b>Suggestion:</b> <b>The Government should consider enhancing its National Policy and Strategy to formalize the roles and responsibilities for research and development in relation to decommissioning and waste management, including disposal.</b>

The legislative and regulatory framework includes provisions and financial assurances for the decommissioning of nuclear facilities and installations. The regulations provide that decommissioning starts immediately after the final shutdown of a nuclear facility with no transitional period. In accordance with the regulations, deferred dismantling is applicable only for Dodewaard NPP, as it was shutdown before the current regulation came into force.

The National Programme provides for the safe management of radioactive waste from decommissioning, however the National Policy does not contain the overall objectives of decommissioning, including the preferred decommissioning strategy (i.e. immediate dismantling) and end-state.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *The regulatory framework stipulates requirements for decommissioning, however, the National Programme does not establish the decommissioning aspects, such as decommissioning strategies (e.g., immediate and/or deferred dismantling) and end-states, that may impact waste management.*

(1)	<b>BASIS: GSR Part 1 (Rev. 1) Requirement 10 para 2.28 states that:</b> <i>“Decommissioning of facilities and the safe management and disposal of radioactive waste shall constitute essential elements of governmental policy and the corresponding strategy over the lifetime of facilities and the duration of activities....”</i>
(2)	<b>BASIS: SSG-47 para 3.2 states that:</b> <i>“In preparing and implementing the national framework for decommissioning, the government should establish the overall objectives of decommissioning as part of its obligation to establish and maintain a governmental, legal and regulatory framework for all aspects of decommissioning, including management of the resulting radioactive waste. The policy should be developed by the government in cooperation with relevant organizations, including the licensee, and in consultation with the public.”</i>
(3)	<b>BASIS: SSG-47 para 5.19 states that:</b> <i>“The national policy on management of radioactive waste, which should include decommissioning aspects, may influence the choice of possible decommissioning strategies or combinations of options....”</i>
R2	<b>Recommendation:</b> <b>The Government should include in the National Policy decommissioning aspects that may impact waste management, such as decommissioning strategies (immediate and/or deferred dismantling) and end states.</b>

The project timeline for the revision of the National Programme includes moments for public consultations. The ARTEMIS Review Team noted the Government’s aims to actively engage with interested members of the public and incorporate feedback in the finalizing of the National Programme. The ARTEMIS Review Team encourages the Government to continue with their efforts for engagement and openness in the development of the National Programme.

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

### **Dutch position**

In the Netherlands requirements for the safe management of radioactive waste are expressed through the legislative and regulatory framework, namely the:

- Nuclear Energy Act (NEA);
- Nuclear Installations, Fissionable Materials and Ores Decree (Bkse);
- Basic Safety Standards for Radiation Protection Decree (Bbs);
- Fissile Materials, Ores and Radioactive Materials Transport Decree (Bvser); and
- Radioactive Waste and Fissile Materials Decree (Import, Export and Transit) (Biudrabs).

These regulations specify the requirements for the safe management of radioactive waste upon which regulatory decisions are based.

The Netherlands includes public input on draft legislation and regulations through an online platform. The ANVS has a licensing process (including revision or amendments to incorporate new regulations and guides) for nuclear installations, including for the COVRA waste management facility. It allows for public input on licence applications, amendments or revision.

There are several governmental bodies and organizations whose responsibilities for the safe management of radioactive wastes are stated in the legislative framework:

- Ministry of I&W having the primary responsibility for the development of legislation and policy in the area of nuclear safety, security and radiation protection, including radioactive waste management and geological disposal.
- The Ministry of Finance is sole shareholder of COVRA and is responsible for the investment mandate for the funding for waste management including disposal, and for approval, together with the Ministry of I&W, for the financial assurances for decommissioning.
- The regulatory body, ANVS, is the authority designated by the government for having legal authority for regulating radiation protection, nuclear safety, security, and safeguards, including all radioactive waste management.
- Landfills operate with a license under the Environmental Management Act. For activities with radioactive materials, authorization by the ANVS is needed. Both the Province and the ANVS have a responsibility in the oversight of landfills.
- COVRA is the national waste management organization with the mandate of managing the Dutch radioactive waste, now and in the future.

The Netherlands is taking part as a Party in a series of international treaties, conventions, and agreements, undertaking commitments in line with such instruments to ensure the safety of the management of radioactive waste and spent fuel.

### **ARTEMIS observation**

The 2023 IRRS mission reviewed the regulatory framework and found that the Government of the Netherlands established a regulatory framework for nuclear and radiation safety, and have an established system of stakeholder and public participation in regulatory processes. The IRRS review team identified some areas for improvement to enhance safety, including that the ANVS should further develop regulations and guides to be consistent with current IAEA safety

standards as well as, that the Government should establish regulatory requirements well before a DGR is established.

The ARTEMIS Review Team found the National Policy principles for radioactive waste management are established in the legislative and regulatory framework. The Netherlands legislative and regulatory framework assigns key roles and responsibilities to the relevant ministries, regulators, and waste management organization to ensure the safe management of radioactive waste.

The ARTEMIS Review Team noted that important steps are needed in the development of the legal and regulatory framework as it relates to disposal of radioactive waste. The ARTEMIS Review Team was informed that a roadmap for disposal, to be part of the 2025 National Programme, will include the necessary steps for the development of the regulatory framework. Complementary to this, the ARTEMIS Review Team considered that timely regulatory requirements and guidance are necessary for the applicant and stakeholders to have a good understanding of criteria that are relevant in the decision making. This issue is reflected in recommendation R1.

The generic regulatory requirements regarding nuclear facilities (e.g. the Nuclear Energy Act and Nuclear Installation, Fissile Material and Ores Decree) apply to waste management facilities. The ARTEMIS Review Team was informed that given there is only one centralized waste management facility, the ANVS has only stipulated detailed requirements for radioactive waste predisposal activities through facility specific licence conditions.

The Basic Safety Standards for Radiation Protection Decree and the Nuclear Installations, Fissionable Materials and Ores Decree and Shutdown and Decommissioning Regulation include requirements on decommissioning and financial assurances for the decommissioning of nuclear installations. The ANVS authorizes decommissioning and ensures compliance with regulatory requirements during its execution.

## 2. NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT

### 2.1. SCOPE

#### **Dutch position**

According to the ARM, the routes for managing radioactive waste in the Netherlands are:

- NORM waste with activity concentration up to 10 times general clearance levels or waste under specific clearance may be disposed of at designated landfills;
- All other radioactive waste and the spent fuel from research reactors must be brought to COVRA as soon as possible and stored there until disposal is available;
- Legacy waste that was stored at the Nuclear Research Group (NRG) in Petten is to be transferred to COVRA.

The nuclear programme of the Netherlands is relatively small, but diverse with a modest inventory of waste.

To meet the first principle of radioactive waste management in the Netherlands, waste minimization, various approaches are considered. These include: prevention and justification; reuse; radioactive decay; incineration, and recycling. In this respect, for example the spent fuel from NPP(s) is reprocessed to recycle the fissile material.

To meet the second principle, the safe management of radioactive waste now and in the future, all radioactive waste is stored at the COVRA centralized facility, with the exception of specific waste streams authorised for disposal in designated landfills. Following the storage period at COVRA site, geological disposal is envisioned for all radioactive waste.

To achieve radioactive waste disposal, a 'dual-track approach' which considers provisions for both a national and international disposal facility is being explored. In this 'dual-track approach', the Netherlands is pursuing a national DGR while exploring potential opportunities for international collaboration for a regional DGR.

The third principle in the Policy is 'no unreasonable burden on future generations. As presented during the ARTEMIS mission, this is achieved through collecting financial resources and continuously updating technical knowledge during the period of long term storage of radioactive waste, enabling future generations to execute disposal.

The fourth principle in the Policy is 'polluters-pay'. For this, COVRA is responsible for collecting fees from the waste generators to cover waste management costs including R&D activities. Part of the fees are invested so they will be able to grow during the storage period with the aim to cover the total cost including the DGR.

#### **ARTEMIS observation**

The ARTEMIS Review Team noted that elements of a waste management strategy are present in the National Programme. In accordance with the IAEA Safety Standards, a strategy must set out the mechanisms for implementing the national policy.

The ARTEMIS Review Team found that the National Programme outlines methods for waste minimization. For example, the reprocessing of SF from NPP(s) for recycling of the fissile material.

For the management of radioactive waste, the ARTEMIS Review Team found that radioactive waste is stored in aboveground facilities at COVRA site. In addition, part of the legacy waste that was stored at NRG on the Petten site has already been transferred to COVRA facilities. The 2025 National Programme will include a roadmap providing the necessary steps for implementing a disposal facility. This is addressed in recommendation R1.

NORM waste with activity concentration of up to 10 times general clearance level or when specific clearance is applicable can be disposed at designated landfills. The aspects on the monitoring of landfills are mentioned in suggestion S6.

The ARTEMIS Review Team noted that the definitive decision for disposal will not take place until 2100. To ensure ‘no undue burden on future generations’, a strategic assessment is needed to adequately evaluate advantages and risks of long-term storage.

## **2.2 MILESTONES AND TIMEFRAMES**

### **Dutch position**

According to the National Programme, action points are established relating to the Policy and the National Programme. These are presented in the National Programme.

Action points from Policy on radioactive waste include:

- The transfer of legacy waste from NRG on the Petten site to COVRA site;
- Clearance limits for materials, buildings, and sites;
- Guide and licensing regulations for dismantling non-nuclear applications;
- Decay storage;
- Imposing rules on import and export, storage, and disposal of radioactive waste from abroad;
- Financial aspects in the termination plan of a facility;
- Investigating the consequences of new European Basic Safety Standards on the volume of radioactive waste.

Action points in the progress of the National Programme include:

- Environmental impact assessment;
- Reporting on the implementation of the National Programme;
- Updating the National Programme;
- Drawing up a waste inventory;
- Appointing a consultancy group;
- Analysis of online debate.

### **ARTEMIS observation**

The ARTEMIS Review Team noted that within the National Programme, action points relating to the Policy and National Programme are focused on the near-term and do not include action points related to radioactive waste disposal.

Furthermore, the only milestone that exists for radioactive waste disposal is a decision to be taken in 2100 and the starting of operation in 2130. There is no elaborated schedule with associated milestones in the National Programme. The ARTEMIS Review Team emphasized



the need for the timely establishment of the necessary strategic steps for the development of a disposal solution.

## **2.3 PROGRESS INDICATORS**

### **Dutch position**

The National Programme defines performance indicators for monitoring the progress of the National Programme. They include financing, status on action points, and COVRA capacity. All performance indicators are defined in consultation with the involvement of stakeholders. These performance indicators are reported to government, parliament and the European Commission to illustrate the progress of the National Programme.

### **ARTEMIS observation**

The ARTEMIS Review Team noted that the performance indicators in the National Programme reflect the milestones rather than monitor their progress. The ARTEMIS Review Team was informed that for the 2025 National Programme, it is envisaged to define a monitoring programme which should include, where possible, relevant milestones, performance indicators, and clear deadlines for the achievement of these milestones.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *Elements of a national strategy are present in the National Programme. The National Programme provides provisional action points for the long-term timeframe, but it does not detail interim targets and measurable progress indicators to monitor the status of actions and reporting of progress.*

(1)	<b>BASIS: GSR Part 1 (Rev. 1) Requirement 10, para 2.28 states that:</b> “... The strategy shall include appropriate interim targets and end states. Radioactive waste generated in facilities and activities necessitates special consideration because of the various organizations concerned and the long timescales that may be involved. The government shall ensure continuity of responsibility between successive authorized parties.”
(2)	<b>BASIS: GSR Part 1 (Rev. 1) Requirement 10, para 2.32 states that:</b> “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.”
(3)	<b>BASIS: GSR Part 5 Requirement 2, para. 3.6 states that:</b> “The national strategy for radioactive waste management has to outline arrangements for ensuring the implementation of the national policy. It has to provide for the coordination of responsibilities. It has to be compatible with other related strategies such as strategies for nuclear safety and for radiation protection.”
S2	<b>Suggestion:</b> The Government should consider further developing a national strategy for waste management that sets out the mechanisms for implementing the National Policy, that includes appropriate interim targets, measurable progress indicators and end states.

### 3. INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE

#### **Dutch position**

According to Dutch regulation, radioactive materials are designated as radioactive waste when no further use is foreseen for the radioactive substance and/or the substance is considered radioactive waste by the government or the producer. Elements of a waste classification system are found in various decrees that distinguish several categories of radioactive waste, these are: waste containing fissile material or ore, radioactive waste (including sources and NORM waste with activity concentration above 10 times the general clearance levels), waste for which specific clearance is applicable, short lived waste (with a half-life of less than 100 days) and exempt waste.

#### *Classification*

The waste classification system is outlined in the National Programme. This classification system is based on criteria derived from the need to limit exposures during the long term storage period. Wastes are divided into four categories based on activity and half-life, these are: exempt waste, short lived waste, low and intermediate level waste (LILW) and high level waste (HLW). The distinction between LILW and HLW is based on the content of fissile materials and on the requirements regarding radiation protection needed for transport, processing, and storage of the (packaged) waste. The LILW category includes NORM waste with activity concentration above 10 times the general clearance levels.

#### *National Inventory*

In the context of reporting to the European Commission and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention), the inventory at COVRA, is reported as National Inventory every three years. The inventory at COVRA distinguishes between three types of waste: HLW, LILW, NORM -waste with activity concentration above 10 times the general clearance levels. The total volume of radioactive waste currently stored at COVRA site is about 38 000 m<sup>3</sup>.

The following wastes are not included in the inventory at COVRA: radioactive waste that has been disposed of at the designated landfills (such as NORM waste with activity concentration up to 10 times the general clearance levels), radioactive waste with a half-life less than 100 days, radioactive waste originated from military or defence programmes and radioactive waste from Caribbean Netherlands.

The NORM waste with activity concentration up to ten 10 times the general clearance levels represents hundreds of thousands of cubic meters and has been disposed of in designated landfills. Although it represents the majority of the total volume of radioactive waste in the Netherlands, they are not included in the National Inventory, but only in the Inventory managed by RIVM.

The waste from spent fuel reprocessing and the SF from research reactors is classified as HLW. In addition, HLW is also generated in medical isotope production, and may be generated in decommissioning of nuclear facilities and from the management of legacy waste. The HLW category contains both heat generating and non-heat generating waste that is stored in a dedicated storage building at the COVRA site (HABOG facility) in separate compartments. The total HLW amount (about 110 m<sup>3</sup>) accounts for only 0.3% of the total volume of radioactive waste stored at COVRA site.

The rest of the waste stored at COVRA site is classified as LILW, containing long lived and short lived radionuclides. Four types of LILW have been identified:

- A-waste: waste containing alpha emitters. Alpha-containing waste is often long lived;
- B-waste: waste originating from a nuclear power plant. Much of the radioactivity of this waste decreases relatively quickly. B-waste contains mainly Co-60, with a half-life of about five years, and Cs-137 with a half-life of about 30 years;
- C waste: waste containing radionuclides with a half-life longer than fifteen years;
- D-waste: waste containing radionuclides with a half-life less than fifteen years. Most of this waste decays within a period of one hundred years.

LILW is stored in a dedicated building at the COVRA site (LOG facility). COVRA is planning to build another facility for the storage of LILW (MOG facility). About one-third (12 700m<sup>3</sup>) of the radioactive waste currently stored at COVRA is LILW.

A special category within LILW at COVRA site is NORM waste with activity concentration above 10 times the general clearance levels. There are dedicated buildings at COVRA for the storage of such NORM waste. Nearly two-thirds of the radioactive waste currently stored at COVRA (23 000m<sup>3</sup>) is NORM waste, mostly generated from the phosphate industry and the enrichment of uranium.

All categories of waste stored at COVRA are planned to be disposed of in one geological disposal facility.

#### *Forecast*

COVRA is responsible for ensuring enough capacity within the limits of its license. In the National Inventory, various alternative scenarios have been elaborated with regard to an estimate of the amount of HLW, LILW and NORM waste with activity concentration above 10 times the general clearance levels up to 2130.

The following principles have been used for these scenarios:

- In 2030, the High Flux Reactor (HFR) will be directly succeeded by the PALLAS research reactor with a lifetime of 70 years.
- Additional lifetime extension of the NPP Borssele by 10 years.
- In 2035 and 2040, two new nuclear power plants are planned to start operation, each with an assumed capacity of 1600MW and a lifetime of 80 years. The scenario assumes the current management approach in which SF is reprocessed.
- The new installation for the production of medical isotopes, SHINE, is planned to start operation in 2030 for 30 years.

The predicted quantities of LILW and NORM waste with activity concentration above 10 times the general clearance levels are calculated by extrapolating the current production up to 2130, to which expected quantities of decommissioning waste and waste stored on location are added.

#### **ARTEMIS observation**

The ARTEMIS Review Team noted that the radioactive waste classification in the National Programme is based on predisposal, particularly transport and long term storage. The team recognized that this classification fulfils its purpose for the current situation. However, this classification differs from the IAEA Safety Guide GSG-1 that suggests classification be based on disposal options. This issue has been identified in the 2023 IRRS mission to the Netherlands (S12). The ARTEMIS Review Team considered that the current Dutch waste classification could limit the flexibility of disposal routes in the future.

The ARTEMIS Review Team noted that radioactive waste that has been disposed of at the designated landfills are currently not included in the National Inventory. The team was

informed that the government is currently investigating the possibility to conditionally clear NORM waste up to 10 times the general clearance levels.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
<p><b>Observation:</b> <i>Radioactive waste disposed at landfills is excluded from the national inventory. This has been recognized in the ARTEMIS self-assessment.</i></p>	
(1)	<p><b>BASIS: GSR Part 1 (Rev. 1) Requirement 35, para. 4.63 states that:</b> “<i>The regulatory body shall make provision for establishing and maintaining the following main registers and inventories:</i></p> <ul style="list-style-type: none"> <li>- <i>[...] inventories of radioactive waste and of spent fuel.</i>”</li> </ul>
(2)	<p><b>BASIS: GSR Part 5 Requirement 2, para. 3.5 states that</b> “<i>The national policy on radioactive waste management has to [...] be based on knowledge of the waste to be managed (e.g. knowledge of the inventory and of waste streams) now and in the future...</i>”</p>
S3	<p><b>Suggestion:</b> <b>The Government should consider expanding the national inventory to include radioactive waste to be disposed at landfills.</b></p>

The limited regulatory requirements on the different steps in the predisposal management of radioactive waste, including characterization processes, were discussed in the 2023 IRRS mission to the Netherlands (R17). The ARTEMIS Review Team highlighted that NRG consistently sorted, characterized, and repacked each legacy waste drum. Subsequently, verification steps were performed by COVRA. The team was informed that ANVS performs inspections on characterization processes based on foreign benchmarks and international standards. The ANVS performed these inspections focused on characterization in advance of these regulatory requirements and guidance being codified. The team was informed about the need for improvements regarding the use of representative nuclear vectors for radionuclides difficult to measure and regarding the lack of characterization in anticipation of disposal routes (for example long lived beta-emitting radionuclides identified during the DGR safety case).

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *The regulatory framework does not provide comprehensive regulatory requirements and guidance on the characterization of radioactive waste.*

(1)	<b>BASIS: GSR Part 5 Requirement 9 states that:</b> <i>“At various steps in the predisposal management of radioactive waste, the radioactive waste shall be characterized and classified in accordance with requirements established or approved by the regulatory body.”</i>
(2)	<b>BASIS: GSR Part 5 Requirement 9 para. 4.11 states that:</b> <i>“...The relevant characteristics of the waste have to be recorded to facilitate its further management.”</i>
<b>R3</b>	<b>Recommendation:</b> <b>The ANVS should enhance the regulatory framework by establishing regulatory requirements and guidance for the characterization of waste for predisposal and disposal activities.</b>

In the inventory at COVRA, various alternative scenarios have been elaborated with regard to an estimate of the amount of HLW, LILW and NORM waste up to 2130. The ARTEMIS Review Team noted that no scenario for the management of spent fuel is established if the reprocessing of spent fuel of the NPP(s) abroad would no longer be an option. This point is addressed in the section Concept and Plans.

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

### **Dutch position**

Borssele NPP is the only NPP currently operating in the Netherlands. Two additional NPPs are envisaged in the future but there are no decisions made yet. The spent fuel from the NPP is sent to France for reprocessing. The HLW generated are returned to the Netherlands to be stored at COVRA. Additionally, Dodewaard NPP, is in deferred decommissioning and the dismantling is planned to start by 2045.

The Netherlands has two research reactors. Their spent fuel is not to be reprocessed and is sent directly to storage at COVRA site.

The management of LILW and NORM waste above 10 times the general clearance levels is stored at COVRA site. NORM waste containing up to 10 times the general clearance levels and radioactive waste for which specific clearance is applicable can be disposed of in designated landfills.

The Netherlands has a process to release waste from regulatory control defined in the regulations. According to the regulations, waste can be stored at the premises of the operator for decay for a maximum of two years. At the COVRA facilities, the decay storage is limited to 50 years. The Government is exploring ways to promote decay storage in order to allow more materials to be recycled and reused as part of their circular economy policy.

The LILW are partially conditioned either at the NPP site or at COVRA facilities. Most of the waste collected by COVRA is super compacted prior to storage. Additionally, COVRA has used two incinerators, which are currently taken out of operation. COVRA is planning to submit a license application for a plasma incinerator, to minimize the volume of several types of waste, to be commissioned by 2028.

The Netherlands is planning to have a single DGR to manage LILW, HLW as well as NORM waste stored at COVRA. The DGR is planned to be operational in 2130. The site selection of the DGR will be started around 2100.

### **ARTEMIS observation**

COVRA has a research programme which is divided into five year periods (currently 2020-2025). Each period produces an updated preliminary safety case for the DGR that will be used as a basis to plan for the next five year period. The ARTEMIS Review Team noted that the budget for the current period is about 3.5 M€ which can be considered low compared with other similar nuclear programmes.

Although COVRA's research programme is modest, it is connected to and active at international forums, participating in European projects such as EURAD and other international initiatives such as IGD-TP and ERDO. COVRA's research programme is supported by an international expert advisory group.

The ARTEMIS Review Team noted that while COVRA has a research and development programme on disposal, it did not encompass R&D activities for predisposal waste management.



## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *While COVRA has a research and development programme on disposal, the ARTEMIS Review Team noted that it did not encompass research and development activities for predisposal waste management.*

(1)	<p><b>BASIS: SSR-5, para 3.13 states that:</b> <i>“The operator has to conduct or commission the research and development work necessary to ensure that the planned technical operations can be practically and safely accomplished, and to demonstrate this. The operator likewise has to conduct or commission the research work necessary to investigate, to understand and to support the understanding of the processes on which the safety of the disposal facility depends. The operator also has to carry out all the necessary investigations of sites and of materials and has to assess their suitability and obtain all the data necessary for the purposes of safety assessment.”</i></p>
(2)	<p><b>BASIS: GSG-3 para 4.8 states that:</b> <i>“Development of the safety case should commence at the inception of the project and should be continued throughout all of the steps in the development and operation of the facility, through to its decommissioning. The safety case should also be used throughout all steps to guide the site selection, facility design, construction, operation of the facility and its decommissioning. It should be used to identify research and development needs, and to identify and establish limits, controls, and conditions at the various steps, and as a basis for the process of regulatory decision making and approval.”</i></p>
(3)	<p><b>BASIS: GSG-3 para 6.29 states that:</b> <i>“There may be time dependent processes and events, both internal and external to the facility or activity, that could lead to the need to modify certain assumptions, parameters, and boundary conditions. As the processes and events may be gradual or may occur at unpredictable times, the safety case for operation should be reviewed periodically in order to detect significant changes in the underlying assumptions, parameters and boundary conditions. If necessary, the safety case should be revised accordingly. This periodic review should be mandatory and should be conducted at intervals determined by the regulatory body.”</i></p>
(4)	<p><b>BASIS: GSG-3 para 3.12 states that:</b> <i>“The operator shall carry out periodic safety reviews and shall implement any safety upgrades required by the regulatory body following this review. The results of the periodic safety review shall be reflected in the updated version of the safety case for the facility”</i></p>
S4	<p><b>Suggestion:</b> <b>COVRA should consider enhancing its research and development programme to include predisposal research and development needs derived from the periodic safety review, the safety case and supporting safety assessment, in line with the IAEA Safety Standards.</b></p>

COVRA has estimated that the storage capacity of the current site is adequate for the current scenario (e.g., no new NPPs). However, COVRA has started to assess the potential impact of the anticipated expansion of the nuclear fleet on sufficiency of storage capacity.

COVRA’s ageing management plan includes the inspection of the waste packages every 20 years. Additionally, the long term maintenance of the storage facilities has been taken into account in the design. The ARTEMIS Review Team noted that ensuring fitness for service

might be a challenge considering the almost 200 years lifetime of some of the facilities. The design lifetime of the facilities assumes that the sequence of waste transferring to the DGR will be LILW first, then NORM and TENORM, and finally the HLW.

The ARTEMIS Review Team was informed that in case of situations that would make the reprocessing of spent fuel no longer available or used, COVRA will take measures for storing the spent fuel in dry conditions or alternative solutions. However, the ARTEMIS Review Team did not find evidence of plans should this situation arise.

<b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>	
<b>Observation:</b> <i>In a situation whereby spent fuel from the NPP(s) could not be reprocessed under current arrangements, no scenario for the management of spent fuel is established.</i>	
<b>(1)</b>	<p><b>BASIS: GSR Part 5, Requirement 2: National policy and strategy on radioactive waste management states that:</b> <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 national policy and strategy shall form the basis for decision making with respect to the management of radioactive waste.”</i></p>
<b>(2)</b>	<p><b>BASIS: GSR Part 1, Requirement 1: National policy and strategy for safety states that:</b> <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... In the national policy and strategy, account shall be taken of the following:</i></p> <p><i>[...]</i></p> <p><i>(c) The specification of the scope of the governmental, legal and regulatory framework for safety;</i></p> <p><i>(d) The need and provision for human and financial resources;</i></p> <p><i>(e) The provision and framework for research and development.”</i></p>
<b>S5</b>	<p><b>Suggestion:</b> <b>The Government should consider, in the national policy and strategy, the situation if the reprocessing abroad of spent fuel from the NPP(s) would not be an option.</b></p>

COVRA is planning to build a plasma furnace to process most of the LILW to replace the shutdown incineration plants and the super compactor. The license application is yet to be submitted to the ANVS for regulatory review and decision. Meanwhile the inflammable liquids are stored in a designated storage area in special containers. The ARTEMIS Review Team noted that planning for decommissioning in the initial phases of a license activity is an important step for safety, and that planning for decommissioning should be a component of the design and

operation of the COVRA plasma furnace. Moreover, the team encouraged COVRA to render all inflammable liquids into a safe and passive form as soon as possible.

The ARTEMIS Review Team was informed that in the case of a new waste stream, the waste generator needs to be in contact with COVRA to be informed of the requirements for receiving waste in order to comply with the existing specifications. As required, to accommodate new waste streams, COVRA analyses the waste information from the generator, determines potential waste routes, and establishes terms for receiving the waste.

The IRRS review team recommended that for landfills, the current Dutch legal and regulatory framework could be enhanced. The ARTEMIS Review Team was informed that NORM waste was defined in Dutch regulation in 2004. Subsequently, a decision was made to allow NORM waste up to 10 times general clearance level to be disposed of at designated landfills for hazardous waste, for which the provinces and the ANVS are responsible for overseeing. The Ministry of I&W informed that a path forward for implementing the IRRS recommendation is being investigated. Designated landfills are monitored for non-radiological releases. The ARTEMIS Review Team noted that the compliance with the radiological dose limit should be ensured. Therefore, it would be beneficial to add radiological monitoring to the current monitoring programme, taking into account graded approach.

<b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>	
<b>Observation:</b> <i>The monitoring of the landfill where radioactive waste has been disposed of, comprises only of non-radiological environmental monitoring.</i>	
<b>(1)</b>	<b>BASIS: SSR-5 Requirement 21 states that:</b> “A programme of monitoring shall be carried out prior to, and during, the construction and operation of a disposal facility and after its closure, if this is part of the safety case. This programme shall be designed to collect and update information necessary for the purposes of protection and safety. Information shall be obtained to confirm the conditions necessary for the safety of workers and members of the public and protection of the environment during the period of operation of the facility. Monitoring shall also be carried out to confirm the absence of any conditions that could affect the safety of the facility after closure.”
<b>S6</b>	<b>Suggestion:</b> The Government should consider setting requirements for a programme that includes radiological monitoring, in accordance with the graded approach, at the landfill sites authorized to receive designated radioactive material.

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

### **Dutch position**

The ANVS applies regulatory requirements for nuclear installations to waste management facilities. For the licensing of COVRA facilities, a Safety Report (SR), supporting Technical Specifications (TS) and technical documents, underlying safety analyses and assessments, and Environmental Impact Assessment (EIA), had to be submitted for regulatory review and approval. The ANVS reviews the safety based on this documentation before issuing the licence. The Safety Report is part of the formal licensing base. The ANVS stipulates detailed requirements for radioactive waste predisposal activities through facility specific licence conditions.

For new waste management facilities at COVRA or modifications outside the current licensing basis, a new licensing procedure is conducted, considering the different types of waste, allowing a graded approach. Modifications to the facility outside the licensing basis requires an update of the SR, which has to be reviewed and approved by the regulator.

For a radioactive waste management facility, a license is only granted if the applicant complies with the national requirements. The applicable parts of the IAEA Safety Standards must be included in the SR.

The license holder has to continually and systematically evaluate the nuclear safety of the facility and improve it by implementing measures from the evaluations. For all license holders of nuclear installations, a periodic safety review is mandatory every 10 years. Evaluation requirements are given in the license and regulations. License conditions for COVRA require that evaluations are periodically carried out every 5 years. Analyses of operational experiences from own and other organizations dealing with radioactive waste management have to be taken into account for this evaluation.

In addition to the COVRA centralised storage facilities, NORM waste with activity concentration up to 10 times the general clearance levels or waste under specific clearance might be disposed of in designated landfills. Three such landfills are currently operating while a fourth landfill is closed. The licensing for those landfills is regulated by the Environmental Management Act. In addition, authorization is required by the ANVS under the Nuclear Energy Act for activities with radioactive waste.

A preliminary safety case for the DGR in a generic site in Boom Clay (OPERA Programme) has been published by COVRA in 2018. To complement this safety case, a preliminary safety case for geological disposal in rock salt, has started by means of a research programme in 2020 (COPERA Programme), which results are expected to be available in 2025.

For licensing of the DGR, the licensee will have to submit the safety case for regulatory review and approval.

### **ARTEMIS observation**

The ARTEMIS Review Team noted that at this moment the preliminary safety case and supporting safety assessment for a generic DGR (OPERA and COPERA Programmes) is not meant to support the license application, as the license application will be some time in the far future, but rather to steer the research needed. However, the team noticed that there seems to be no long term strategy that identifies research needs to demonstrate safety. The team noticed

that the preliminary safety case has been used for the prioritization of short term research needs. A Roadmap including a long term research strategy for disposal is planned to be part of the next revision of the National Programme.

The team noted that the regulatory framework does not require a safety case and supporting safety assessment for a waste management facility, as per IAEA safety standards. Furthermore, the COVRA license does not require a facility specific safety case and supporting safety assessment. However, as part of the authorization for a waste management facility, COVRA is required to submit a Safety Report for nuclear installations that demonstrates safety for regulatory review and approval. The licensee must periodically evaluate the technical, organizational, human resources and administrative resources relating to safety and radiation protection.

The ARTEMIS Review Team noted that there is no regular requirement for the periodic update of the Safety Report. However, the guidelines for periodic safety reviews for nuclear installations are used and adapted for the waste management facility. The results of the periodic safety review can lead to an update of the Safety Report for the facility.

The ARTEMIS Review Team emphasizes the importance of a waste management facility safety case and supporting safety assessment and the necessary periodic updates to demonstrate safety. This is complementary to the 2023 IRRS mission findings (R17) that the ANVS should further develop recommendations and guides to be consistent with current IAEA Safety Standards.

The ARTEMIS Review Team noticed that regarding the Dodewaard NPP, currently in safe enclosure, no PSR for the deferred decommissioning is performed as required by the Dutch legislation.

The ARTEMIS Review Team noted that regulatory requirements specific to derivation, use and revision of waste acceptance criteria (WAC) need to be enhanced. Furthermore, the safety case is not identified as a source of the WAC for radioactive waste. This has already been addressed during the 2023 IRRS mission (R21). Currently, COVRA uses waste specifications for receiving waste at the radioactive waste management facilities based on transport limits, processing, and properties of the storage buildings. However, according to the IAEA safety standards, the WAC for waste management facilities should be derived from the facility specific safety case and supporting safety assessment.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *Currently, COVRA uses waste specifications for receiving waste at the radioactive waste management facilities based on transport limits, processing, and properties of the storage buildings. However, waste acceptance criteria for waste management facilities should be derived from the facility specific safety case.*

(1)	<p><b>BASIS: GSR Part 5 Requirement 12 states that:</b> <i>“Waste packages and unpackaged waste that are accepted for processing, storage and/or disposal shall conform to criteria that are consistent with the safety case.</i></p> <p><i>4.24. Waste acceptance criteria have to be developed that specify the radiological, mechanical, physical, chemical and biological characteristics of waste packages and unpackaged waste that are to be processed, stored or disposed of; for example, their radionuclide content or activity limits, their heat output and the properties of the waste form and packaging.</i></p> <p><i>4.25. Adherence to the waste acceptance criteria is essential for the safe handling and storage 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.”</i></p>
(2)	<p><b>BASIS: GSR Part 5 Requirement 4 states that:</b> <i>“Operators shall be responsible for the safety of predisposal radioactive waste management facilities or activities. The operator shall carry out safety assessments and shall develop a safety case, and shall ensure that the necessary activities for siting, design, construction, commissioning, operation, shutdown and decommissioning are carried out in compliance with legal and regulatory requirements.</i></p> <p><i>3.11. 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></p> <ul style="list-style-type: none"> <li>- <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>”</li> </ul>
R4	<p><b>Recommendation:</b> <b>COVRA should develop waste acceptance criteria for the management of radioactive waste to advance the existing waste specifications. Waste acceptance criteria are to be derived from facility specific safety case and supporting safety assessment, in line with IAEA safety standards.</b></p>



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

### Dutch position

#### *Decommissioning cost estimates and financing*

The Ministry of I&W, and the Ministry of Finance, together are the competent authorities for the approval of financial provisions related to cost of decommissioning. The Ministry of Finance is the sole shareholder of COVRA.

The polluter pays principle is applied in decommissioning and associated waste management. Reviews of financial guarantees for nuclear facilities and URENCO enrichment facility are two-fold. The ANVS reviews the technical aspects of the decommissioning plan, whereas the Ministry of I&W and the Ministry of Finance reviews the financial aspects. Reviews of financial guarantees and decommissioning plans are conducted every five years or earlier on request by the Minister of Finance and/or the Minister of I&W.

For non-nuclear facilities that are designated by ministerial regulation, a draft termination plan and a cost estimate for financial provisions must be established according to the regulations. This is to demonstrate that a licensee is able to bear the financial cost for the termination of its licensed activity. Furthermore, the licensee who holds a high activity sealed source (HASS), must provide financial security for covering the costs of its safe management and disposal.

#### *Radioactive Waste and Spent Fuel management cost estimates and financing*

According to the Nuclear Energy Act, waste generators bear the costs of radioactive waste management that arise from authorized activities. The waste generator pays fixed fees for standard waste depending on the type and volume of waste. Once the waste, and thereby the responsibility and ownership of the waste, is transferred to COVRA, COVRA is responsible for the ongoing and future costs associated with its management. That is, the fees include all costs that will be incurred during all steps in the management of waste, including disposal and research costs. For the non-standard waste, COVRA will collect payments from waste generators based on individual estimates. The ANVS is responsible to ensure the transparency, objectivity and non-discriminateness of the fees.

Generators of waste to be disposed of in a designated landfill, are required to pay a certain fee to the landfill operator. The landfill operator is required to pay the fee to cover the costs of aftercare and monitoring by the Province after closure of the landfill.

As part of the OPERA Programme, a cost estimation was drawn up based on the “Belgian model”. The disposal cost is estimated to be 2.27 billion Euros (2022 money). The Belgian cost estimate has been evaluated by an external agency. The Dutch cost estimate will be updated periodically while the planning for the DGR will continue.

COVRA has developed an investment strategy in order to meet its long-term obligations. This strategy is partly based on an asset liability management study (ALM-study), as customary for pension and guarantee funds in the Netherlands. The ALM-study concluded that the chosen strategy will enable COVRA to meet its long-term obligations. Evaluation of the ALM-study is done every five years.

Part of the fees that COVRA has received are invested in accordance with the investment statute approved by the Ministry of Finance. COVRA must generate an annual nominal average return of 4.3% (2% calculated inflation and 2.3% discount rate) in order to achieve the target capital in 2130. The investment risk lies entirely with COVRA.



## **ARTEMIS observation**

### *Decommissioning cost estimates and financing*

The financial securities required for nuclear facilities do not need to be actual money, but can also be different types of financial instruments, such as bank guarantees, funds, insurances, etc. For the planned construction of new NPPs, this means that future licensees must have an approved financial guarantee for the costs of decommissioning, before the core of a new NPP is loaded with nuclear fuel for the first time. To this end, consultations will be held with future licence holders on how the legal obligation to provide financial security will be met. It can be collected over the lifespan of the facility, including the future returns from the investment. The Ministry of Finance together with the Ministry of I&W are responsible for reviewing and accepting the financial securities.

Decommissioning costs include the costs of the management of the waste from decommissioning and dismantling, starting from the last shut down of the facility. Decommissioning cost calculations are the responsibility of the licensee. Usually, the licensee outsources the financial calculations to a specialized company. Decommissioning cost estimates for nuclear installations are updated every five years or sooner if there are significant changes in the facility. Designated non-nuclear installations have to keep their termination plans up-to-date, but it does not require the 5-yearly update.

### *Radioactive Waste and Spent Fuel management cost estimates and financing*

Disposal cost estimation is done based on the “Belgian model’ which is adapted to the Dutch inventory. The ARTEMIS Review Team noted that there are significant uncertainties in cost estimation due to differences in both programmes. In addition, the DGR cost estimation in the Netherlands does not include the siting phase. COVRA assumes that the siting process is performed by the government, and COVRA’s financial responsibility starts with the technical support of the siting process followed by the purchase of the land for the disposal facility, and ends with its closure and license termination. After the closure of the disposal facility, the government has the responsibility for the institutional control phase, that has not been included in the cost estimation.

COVRA manages the provision for final disposal. The investment mandate is approved by the Ministry of Finance. Until few years ago the investments were done only on the governmental bonds. However, since the interest rates of the governmental bonds have been low for many years, the investment mandate was broadened to allow investing on other communities such as shares. COVRA is a long-term investor and does not perform active trading in stock exchange.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *COVRA has developed a cost-estimate for the potential DGR, however, the existing cost estimate does not include all relevant phases of the disposal project, for example the siting, and post-closure phase.*

(1)	<p><b>BASIS: SSR-5 Requirement 1 states that:</b> <i>“The government is required to establish and maintain an appropriate governmental, legal and regulatory framework for safety within which responsibilities shall be clearly allocated for disposal facilities for radioactive waste to be sited, designed, constructed, operated and closed. This shall include: confirmation at a national level of the need for disposal facilities of different types; specification of the steps in development and licensing of facilities of different types; and clear allocation of responsibilities, securing of financial and other resources, and provision of independent regulatory functions relating to a planned disposal facility”</i></p>
(2)	<p><b>BASIS: SSR-5 Requirement 1 para 3.7b states that:</b> <i>“Setting clearly defined legal, technical and financial responsibilities for organizations that are to be involved in the development of facilities for radioactive waste management, including disposal facilities....”</i></p>
S7	<p><b>Suggestion:</b> <b>The Government should consider ensuring that all the disposal costs, including siting and post-closure phase, are incorporated in the disposal cost estimate.</b></p>

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

### Dutch position

In 2020, to assess and address the needs for maintenance and development of the necessary nuclear knowledge, an interdepartmental working group ‘*Knowledge Base Nuclear Technology and Radiation Protection*’ was established. Subsequently, this group published a report in June 2023 with the following recommendations:

- Invest in nuclear education at all levels, in order to familiarize a large group of students with nuclear technology and radiation protection;
- Increase scientific expertise by establishing professorships, including a chair in the field of radiation protection;
- Stimulate cooperation between the existing organizations that offer radiation protection courses;
- Investigate solutions to make sure a shortage of labour will not hamper the government’s nuclear ambitions.

In the report, the interdepartmental working group stressed the importance of these recommendations with the government’s ambitions to grow the nuclear sector. This led to an even larger challenge concerning the required expertise, especially considering the broader workforce needed to build new nuclear facilities in a very tight labour market.

Another development was the government’s announcement that nuclear energy will be part of the so-called *Top Sector Energy*, which will include a public-private partnership programme on nuclear energy for 2024-2030. This programme will elaborate on:

- Human Capital Agenda to strengthen nuclear education on all levels and
- Knowledge and Innovation Programme that includes radioactive waste management

The Governance Board of the Ministry of I&W has decided for all its entities, including ANVS, to develop a forward-looking *Strategic Personnel Plan* that should be updated periodically and when needed. For ANVS this plan should be linked to the strategic knowledge and competence needs of ANVS. It is used also to support the regular budget discussions with the Ministry of I&W.

### ARTEMIS observation

The ARTEMIS Review Team was informed that the interdepartmental working group ‘*Knowledge Base Nuclear Technology and Radiation Protection*’ has assessed the current state of the nuclear knowledge infrastructure in general and proposed a new strategic plan for capacity building.

The ARTEMIS Review Team emphasized the need for the government, the regulator, and COVRA, to strategically plan for the necessary resources for the current waste management activities as well as the potential nuclear ambitions.

The team was informed that the ANVS has developed a “*Tactical knowledge plan*” to predict the future work force needs. Implementation of the plan is ongoing.

The ANVS has an online platform (ANVS Academy) that provides an up-to-date overview of courses on, amongst others, radiation protection and nuclear safety. This platform is also available to the Ministry of I&W. However, the Academy does not provide specific courses on

radioactive waste management at this moment. The ANVS participate in international conferences and forums on radioactive waste management as part of their capacity building plans.

The ARTEMIS Review Team encouraged the government, the regulatory body, and COVRA to participate in international courses on radioactive waste management and decommissioning.

As a licensee, COVRA is required to submit its education and training plan to the regulatory body. The ARTEMIS Review Team was informed that most of the human resources required at COVRA are operational and that knowledge in the field of radioactive waste management and radiation protection is ensured by COVRA. COVRA has a small research group dedicated to disposal activities. Also, COVRA is involved in several international research projects. COVRA is developing a masterclass on radioactive waste management that will initially be available for the governmental organizations that work in the nuclear field.

The ARTEMIS Review Team noted the various initiatives for diversity, equality and inclusivity. The team was informed that the government, the ANVS, and COVRA are committed to promote STEM in young students. For example, COVRA tailors the visiting programme to school groups. Approximately, 2/3 of COVRA's visitors were from schools. In addition, the Government, COVRA and EPZ (operator of Borssele NPP) are currently exploring the possibility and feasibility for a visitor centre to be built in Zeeland, but no final decision has been made yet.

The ARTEMIS Review Team recognized the efforts for engagement, openness, and transparency by the government, the ANVS, and COVRA. During the site visit to COVRA, the team acknowledged the remarkable approach of incorporating art with nuclear science with the aim of meaningful engagement with society.

## APPENDIX A: TERMS OF REFERENCE

### Terms of Reference

#### 1. Introduction

On 6 February 2019, the State Secretary at the Ministry of Infrastructure and Water Management in the Netherlands requested the IAEA to organize an Integrated Review Service for Radioactive Waste and Spent Nuclear Fuel Management, Decommissioning and Remediation Programmes (ARTEMIS), with an option to combine the ARTEMIS mission with an Integrated Regulatory Review Service (IRRS), or to have two subsequent missions in 2023. In February 2021, it was decided to organise back-to-back IRRS and ARTEMIS missions, with the IRRS mission in the first half of 2023 and the ARTEMIS mission in second half of 2023.

The Netherlands's request for the ARTEMIS review is to satisfy its obligations under 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 (hereinafter the EU Waste Directive).

In line with the requests, the ARTEMIS review will be carried out from 19 – 28 November 2023 in a coordinated manner with the IRRS mission, scheduled from 4 - 16 June 2023. The ARTEMIS review will be led by the IAEA by the Department of Nuclear Safety and Security who will be supported by the Department of Nuclear Energy.

#### 2. Objective

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

The review will be conducted by an international team of experts selected by the IAEA and will be based on the relevant IAEA Safety Standards and proven international practices.

#### 3. Scope

The ARTEMIS review will evaluate the Dutch national programme and the national framework for executing country's obligations for safe and sustainable radioactive waste and spent fuel management. The Netherlands have indicated the wish not to exclude any type of waste and related waste management activities from the discussion and perform the evaluation without a particular accent.

The outcomes from the 2023 IRRS mission to the Netherlands will be taken into account as appropriate to avoid unnecessary duplication in line with the Supplementary Guidelines on the Preparation and Conduct of IRRS-ARTEMIS back-to-back Missions, applicable for situations when an IRRS mission is conducted before an ARTEMIS mission. These Supplementary Guidelines are not a substitute for the ARTEMIS Guidelines but supplement them with the specific provisions that need to be taken into account while conducting IRRS-ARTEMIS back-to-back missions.

#### 4. Reference material

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

For IRRS-ARTEMIS back-to-back missions, the National Counterpart will include in the reference material the sections of the IRRS Reference material relevant to the ARTEMIS review (e.g. parts of the IRRS self-assessment report dealing with radioactive waste and spent fuel management) as soon as they are available as well as the IRRS final draft mission report.

For IRRS-ARTEMIS back-to-back missions, identified areas of possible overlap will be addressed only by one mission, either IRRS or ARTEMIS, depending on the scope and nature of the reviews. The National Counterpart will be able to bypass in each self-assessment certain questions to avoid addressing twice the same issues. Namely, questions dealing with the General Safety Requirements (GSR) Part 1 Requirement 10 in Module 1 of eSARIS Self-assessment will be covered in the ARTEMIS mission and certain questions of topics 1, 3, 5 and 7 of ARTEMIS self-assessment questionnaire dealing with legal and regulatory framework will be covered by IRRS mission.

The provisional list of reference material is provided in **Annex 1** (this list is subject to updates and should be finalized by submission of the advance reference material).

All documents for the purpose of the ARTEMIS review will have to be submitted in English, keeping in mind that the Dutch version of all reference material is leading in the Netherlands<sup>1</sup>.

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

#### 5. Modus operandi

The working language of the review, including the review mission, will be English.

The host of the mission is the Ministry of Infrastructure and Water Management. Marie-Noelle Martin, senior advisor, is liaison officer on behalf of the Ministry of Infrastructure and Water Management. Mark van Bourgondiën, team leader, is liaison officer on behalf of the Authority for Nuclear Safety and Radiation Protection.

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

- Self-assessment: questionnaire was made available to the Netherlands as of 16 May 2022.
- Preparatory Meeting: **17 May 2023 (WebEx meeting)**.
- The reference material and the results of the self-assessment questionnaire will be provided to the IAEA as soon as they are available and not later than **19 September 2023**.
- Questions based on a preliminary analysis of the reference material and the self-assessment results will be provided to the National Counterpart from the review team by **3 November 2023**.

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<sup>1</sup> If there are any uncertainties in the meaning or correctness of the English translations during the interviews, the original Dutch text is leading and will be retranslated for the mission team if necessary.

- The review mission will be held during **19 – 28 November 2023 (10 days) in Den Haag, the Netherlands**. The mission schedule is included in annex 2.

## **6. International peer review team**

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

- 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. Among the experts, the IAEA will identify one expert with enough knowledge and experience in the regulatory field as well as in the radioactive waste and spent nuclear fuel management, decommissioning and remediation field to participate in both the IRRS and ARTEMIS missions. This Expert will cover IRRS Modules 5 to 9 on aspects for waste and spent fuel management facilities and will ensure that the ARTEMIS mission is informed on the IRRS review findings and mission.
- Two IAEA staff to coordinate the mission. The coordinator of the ARTEMIS review is Mr Andrey Guskov from the Waste and Environmental Safety Section of the Department of Nuclear Safety and Security. The deputy coordinator is Ms Amparo Gonzales Espartero from the Nuclear Fuel Cycle and Materials Section of the Department of Nuclear Energy.
- One IAEA staff for administrative support who will assist the Review Team to assemble the Review Report.
- A senior member of IAEA staff from the Department of Nuclear Safety and Security will oversee the closure of the review mission.

The peer review team will be led by a Team Leader. The Team Leader will be Mr Janez Perko, SCK CEN, Belgium.

The review mission may include the presence of up to two observers, including the possibility of an observer from the EC. The National Counterparts will be notified of any proposed observers; the presence of any observers will be agreed between the IAEA and the National Counterpart in advance of the mission.

## **7. Reporting**

The findings of the ARTEMIS review will be documented in a final ARTEMIS Review Report that will summarise the work 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 organizations or Member States, or of the IAEA.

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

## **8. Funding of the peer review**

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

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

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

**These Terms of Reference have been agreed between the IAEA and the Netherlands during the preparatory meeting held on-line on 17 May 2023.**



## **Annex 1: List of reference material**

- Responses to the ARTEMIS Self-assessment Questionnaire
- The Netherlands's third National Report on Implementation of Council Directive 2011/70/Euratom,
- 7th Joint Convention National Report
- The Netherlands IRRS ARM Summary Report
- The IRRS self-assessment report including parts dealing with radioactive waste and spent fuel management
- The IRRS Review Report
- The Nuclear Energy Act and other selected regulations and legislations
- The National Programme for the management of radioactive waste and spent fuel
- Selected policy documents, licences and other documents

## APPENDIX B: MISSION PROGRAMME

Time	Sun 19 Nov	Mon 20 Nov	Tue 21 Nov	Wed 22 Nov	Thur 23 Nov	Fri 24 Nov	Sat 25 Nov	Sun 26 Nov	Mon 27 Nov	Tue 28 Nov
	Novotel - The Hague	<b>ANVS – The Hague</b>	COVRA - Nieuwdorp	<b>ANVS – The Hague</b>	<b>ANVS – The Hague</b>	<b>ANVS – The Hague</b>	Novotel - The Hague	Novotel - The Hague	<b>ANVS – The Hague</b>	<b>I&amp;W – The Hague</b>
<b>9h00 - 10h00</b>	Arrival of Team Members	<b>Entrance meeting</b> General presentation Feedback on IRRS findings (legal and regulatory aspects of RW and SF mgt)	Transfer by bus at 7:00  Site visit to COVRA	Concepts, Plans and technical solutions - continued	Capacity building	Finalization of Recommendations and Suggestions	Report drafting	Report drafting	(8:00) Counterparts preparing combined reaction draft report	Delivery of final draft report  <b>Exit Meeting</b>
<b>10h00 - 12h00</b>		National Policy and Framework		Safety case and safety assessment					<b>Discussion with Counterparts on the draft report</b>	Departure of Team Members
<b>12h00 - 13h00</b>		Lunch	Lunch	Lunch					Lunch	
<b>13h00 - 15h00</b>	Initial team meeting (at the hotel)	National Policy and Framework - continued	Waste and Spent Fuel Inventory	Safety case and safety assessment - continued	Session reserved for further discussions if required /	<b>Presentation and discussions of draft Suggestions &amp; Recommendations</b>		<b>14:00h Delivery of draft report to Counterparts</b>	<b>Discussion with Counterparts on the draft report-continued</b>	

15h00 - 18h00		National Strategy	Concepts, Plans and technical solutions	Cost estimates and financing	drafting of recommendations and suggestions	<b>ons to/with Counterparts</b>		<b>for FACT CHECKING</b>	Finalising Report	
18h00 - 19h00		Team meeting	Team meeting (in bus back to The Hague)	Team meeting	Team meeting	<b>Social event and dinner with counterparts</b>				
19h00		Dinner and Report drafting (Novotel)	Dinner and Report drafting (Novotel)	Dinner and Report drafting (Novotel)	Dinner and Report drafting (Novotel)	<b>(Escher museum; suggested start 17:00h, will follow in detail planning)</b>				

**APPENDIX C: RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES**

<b>Area</b>		<b>R: Recommendations S: Suggestions G: Good Practices</b>	<b>Recommendations, Suggestions or Good Practices</b>
1.	<b>NATIONAL POLICY AND FRAMEWORK FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT</b>	<b>R1</b>	<b>The Government should enhance the National Policy and Strategy to further specify the steps in planning, development and authorization of disposal facilities and clearly allocate responsibilities.</b>
		<b>S1</b>	<b>The Government should consider enhancing its National Policy and Strategy to formalize the roles and responsibilities for research and development in relation to decommissioning and waste management, including disposal.</b>
		<b>R2</b>	<b>The Government should include in the National Policy decommissioning aspects that may impact waste management, such as decommissioning strategies (immediate and/or deferred dismantling) and end states.</b>
2.	<b>NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT</b>	<b>S2</b>	<b>The Government should consider further developing a national strategy for waste management that sets out the mechanisms for implementing the National Policy, that includes appropriate interim targets, measurable progress indicators and end states.</b>
3.	<b>INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE</b>	<b>S3</b>	<b>The Government should consider expanding the national inventory to include radioactive waste to be disposed at landfills.</b>
		<b>R3</b>	<b>The ANVS should enhance the regulatory framework by establishing regulatory requirements and guidance for the characterization of waste for predisposal and disposal activities.</b>

Area		R: Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
4.	CONCEPTS, PLANS AND TECHNICAL SOLUTIONS FOR SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT	S4	COVRA should consider enhancing its research and development programme to include predisposal research and development needs derived from the periodic safety review, the safety case and supporting safety assessment, in line with the IAEA Safety Standards.
		S5	The Government should consider, in the national policy and strategy, the situation if the reprocessing abroad of spent fuel from the NPP(s) would not be an option.
		S6	The Government should consider setting requirements for a programme that includes radiological monitoring, in accordance with the graded approach, at the landfill sites authorized to receive designated radioactive material.
5.	SAFETY CASE AND SAFETY ASSESSMENT OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT ACTIVITIES AND FACILITIES	R4	COVRA should develop waste acceptance criteria for the management of radioactive waste to advance the existing waste specifications. Waste acceptance criteria are to be derived from facility specific safety case and supporting safety assessment, in line with IAEA safety standards.
6.	COST ESTIMATES AND FINANCING OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT	S7	The Government should consider ensuring that all the disposal costs, including siting and post-closure phase, are incorporated in the disposal cost estimate.

## APPENDIX D: LIST OF ACRONYMS USED IN THE TEXT

ANVS – Authority for Nuclear Safety and Radiation Protection

ARM – Advance reference materials

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

Bbs – Basic Safety Standards for Radiation Protection Decree

Biudrabs – Radioactive waste and Fissile materials (Import, Export and Transit) Decree

Bkse – Nuclear Installations, Fissionable Materials and Ores Decree

Bvser – Fissile Materials, Ores, and Radioactive Materials Transport Decree

COPERA – National geological disposal research programme

COVRA – Central organization for radioactive waste

DGR – Deep Geological Repository

EC – European Commission

EIA – Environmental Impact Assessment

EPZ – Operator of Borssele NPP, (N.V. Elektriciteits-Produktiemaatschappij Zuid-Nederland)

ERDO – European Repository Development Organization

EURAD – European Joint Programme on Radioactive Waste Management

HABOG – High-level waste treatment and storage building

HASS – High Activity Sealed Source

HFR – High Flux Reactor

HLW – High Level Waste

IAEA – International Atomic Energy Agency

IGD -TP – Implementing Geological Disposal of radioactive waste Technology Platform

IRRS – Integrated Regulatory Review Service

KPI – Key Performance Indicator

LILW – Low and Intermediate Level Waste

LTO – Long Term Operation

Ministry/I&W - (Ministry of) Infrastructure and Water Management

NEA – Nuclear Energy Act

NORM - Naturally Occurring Radioactive Material

NPP – Nuclear Power Plant

NRG – Nuclear Research and consultancy Group

OPERA – National geological disposal research programme (2011-2017)

PSR – Periodic Safety Review

R&D – Research and Development

SA – Safety Assessment

SAR – Safety Assessment Report

SF – Spent Fuel

SMR – Small Modular Reactor

STEM – Science, Technology, Engineering and Maths

TENORM - Technologically Enhanced Naturally Occurring Radioactive Material

TS – Technical Specifications

WAC – Waste Acceptance Criteria

WMO – Waste Management Organization

## APPENDIX E: IAEA REFERENCE MATERIAL USED FOR THE REVIEW

- [1] INTERNATIONAL ATOMIC ENERGY AGENCY, Fundamental Safety Principles, Safety Fundamentals No. SF-1, Vienna (2006).
- [2] INTERNATIONAL ATOMIC ENERGY AGENCY, Governmental, Legal and Regulatory Framework for Safety, General Safety Requirements No. GSR Part 1 (Rev. 1), Vienna (2016).
- [3] INTERNATIONAL ATOMIC ENERGY AGENCY, Leadership and Management for Safety, General Safety Requirements No. GSR Part 2, IAEA, Vienna (2016).
- [4] INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3, IAEA, Vienna (2014).
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- [11] INTERNATIONAL ATOMIC ENERGY AGENCY, Radioactive Waste Management Objectives, Nuclear Energy Series, NW-O, Vienna (2011).
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- [16] INTERNATIONAL ATOMIC ENERGY AGENCY, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, INFCIRC/546, IAEA, Vienna (1997).
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- [18] Official Journal of the European Union No. L 199/48 from 2nd Aug 2011, Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste, Brussels (2011).