

Brussels, 29.9.2026
SWD(2026) 286 final

COMMISSION STAFF WORKING DOCUMENT

Progress of implementation of Council Directive 2011/70 EURATOM

Accompanying the document

**REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN
PARLIAMENT**

**on progress of implementation of Council Directive 2011/70 EURATOM and an
inventory of radioactive waste and spent fuel present in the Community's territory and
the future prospects - FOURTH REPORT**

{COM(2026) 512 final} - {SWD(2026) 285 final}

Contents

1. Introduction.....	3
2. National policies and frameworks for the safe and responsible management of radioactive waste and spent fuel.....	4
2.1. National policies	4
2.1.1. General considerations.....	4
2.1.2. Import of radioactive waste and joint approaches towards radioactive waste disposal 6	
2.1.3. National policy developments.....	8
2.2. National programmes.....	8
2.3. National legal and organisational frameworks	13
2.4. Regulatory framework and competent regulatory authorities	13
2.5. Licence holders	19
3. Implementation of national programmes	23
3.1. Progress monitoring and key performance indicators (KPIs).....	23
3.2. Implementation status	24
3.3. Self-assessments and international peer reviews	33
4. Cost assessments, financing mechanisms and available resources.....	37
5. Expertise, skills and R&D.....	51
5.1. Expertise and skills	51
5.2. Research and development	51
6. Transparency and public participation.....	53

List of abbreviations and acronyms

ARTEMIS	Integrated review service for radioactive waste and spent fuel management, decommissioning and remediation programmes
DGR	Deep geological repository
DSRS	Disused sealed radioactive source
ENSREG	European Nuclear Safety Regulators Group
EU	European Union
KPI	Key performance indicators
HLW	High-level waste
IAEA	International Atomic Energy Agency
ILW	Intermediate-level waste
IRRS	International Regulatory Review Service
LILW	Low- and intermediate-level waste
LLW	Low-level waste
NORM	Naturally occurring radioactive material
NPP	Nuclear power plant
RAW	Radioactive waste
SF	Spent fuel
VLLW	Very low-level waste

1. Introduction

This staff working document presents the Commission's assessment of the European Union (EU) Member States' notifications on the implementation of Council Directive 2011/70/Euratom on the responsible and safe management of spent fuel and radioactive waste (the 'Directive')¹. The assessment is based on information derived from the national programmes for the management of spent fuel and radioactive waste² and national reports on the implementation of the Directive³.

This document provides background information on the main findings, progress, challenges, and trends presented in the Fourth Commission Report COM(2026) 512 to the Council and the European Parliament on the progress of implementation of Council Directive 2011/70/Euratom and an inventory of radioactive waste and spent fuel present in the Community's territory and future prospects.

All Member States had submitted their fourth national reports to the Commission by November 2024⁴. For the first time, the deadlines for reporting under the Joint Convention⁵ and submitting national reports on the implementation of the Directive to the Commission were the same (23 August 2024). Two Member States took advantage of this opportunity and compiled a single report to fulfil both reporting obligations. During the reporting period (2021-2024), 11 Member States notified the Commission of their updated national programmes.

¹ 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 (OJ L 199, 2.8.2011, p. 48, ELI: <http://data.europa.eu/eli/dir/2011/70/oj>).

² Article 13(1) and Article 15(4) of the Directive.

³ Article 14(1) of the Directive.

⁴ As per the Directive, the deadline for submission of national report was 23 August 2024.

⁵ The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. [Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management | IAEA](#)

2. National policies and frameworks for the safe and responsible management of radioactive waste and spent fuel

The Directive's overarching objective is to ensure the responsible and safe management of radioactive waste and spent fuel to 'avoid imposing undue burdens on future generations'⁶. To achieve this, Member States are required to put in place and maintain national policies for the long-term responsible and safe management of radioactive waste and spent fuel. Member States must also put in place and maintain a national legislative, regulatory and organisational framework for radioactive waste and spent fuel management. The framework must include the adoption of a national programme for the implementation of national radioactive waste and spent fuel management policies⁷.

2.1. National policies

2.1.1. General considerations

Each Member State bears ultimate responsibility for the management of the radioactive waste and spent fuel it generates. It is up to the Member States to set the optimal policies based on national circumstances and needs (e.g. whether to reprocess or dispose of spent fuel, or whether to build a single disposal facility for all radioactive waste or several facilities for different waste types).

All Member States have enshrined the principles set out in Article 4(3) of the Directive in their legislation to serve as the basis of their national policies. These principles are:

- keeping the generation of radioactive waste to a minimum;
- ensuring that the interdependencies between all steps in radioactive waste and spent fuel management are taken into account;
- ensuring the safe management of radioactive waste and spent fuel and passive safety features for long-term safety;
- applying a graded approach to the implementation of measures for radioactive waste and spent fuel management;
- ensuring that the costs of managing radioactive waste and spent fuel are borne by those who generated those materials;
- applying evidence-based and documented decision-making processes at all stages of radioactive waste and spent fuel management.

⁶ Article 1(1) of the Directive.

⁷ Article 5(1)(a) of the Directive.

All Member States have set out in their laws and regulations that the prime responsibility for managing radioactive waste and spent fuel generated within their territory lies with the licence holder. In cases where this is not feasible, such as when the licence holder has disappeared or gone bankrupt, the Member State assumes ultimate responsibility. The practical implementation of this principle is reflected in the obligations of licensees, including bearing the costs of that management or setting up national waste management organisations.

Comprehensive national policies for the management of radioactive waste and spent fuel have been put in place in most Member States. During this reporting cycle, no Member State reported any changes its policies.

- *Management of spent fuel from nuclear power plants*

Nuclear fuel that has been removed from the reactor following irradiation and is no longer usable in its present form is considered to be spent. This spent fuel requires safe management. This typically involves initial cooling in a spent fuel pool to reduce heat and radiation levels, followed by storage and either direct disposal or reprocessing.

Most Member States managing spent fuel have opted for a direct disposal policy, and only a few Member States currently continue with the spent fuel reprocessing policy. Historically, more Member States opted for reprocessing spent fuel; nevertheless, in recent years, the trend has shifted towards direct disposal. However, despite this shift, a few Member States have declared that they have not necessarily discarded reprocessing as an option for the future.

Where reprocessing occurs in another country and in line with Article 4(2) of Council Directive 2011/70/Euratom, the country of origin of the spent fuel remains responsible for the safe and responsible disposal of the spent fuel and any resulting radioactive waste.

- *Management of spent fuel from research reactors*

The most common policy for the management of spent fuel from research reactors is to send it back to the supplier, especially in the case of highly enriched uranium fuel. When this is not possible, spent fuel from research reactors is managed in the same way as spent fuel from nuclear power plants.

- *Management of radioactive waste*

In line with international standards and practices and depending on the nature of the radioactive waste and national circumstances, national policies for safe radioactive waste management are centred on safe storage and disposal.

A number of countries have been exploring the possibility of putting in place joint solutions with other countries for radioactive waste management. In 2023, the European Parliament adopted a pilot project called a ‘Proposal for a Joint European Approach towards Radioactive Waste’. The aim was to enable policymakers to assess, on the basis

of data, whether pooling European resources to deal with radioactive waste would make sense. The Commission (Directorate-General for Energy) responded to the European Parliament's initiative by launching two parallel projects in 2024: (i) a compendium of knowledge; and (ii) a consultation on a joint European approach towards radioactive waste.

- *Management of disused sealed radioactive sources*

The usual policy for managing disused sealed radioactive sources is to send them back to the supplier. When that is not possible, they are stored until suitable disposal facilities are available or alternative management solutions are found.

Although progress is being made, there are still a few Member States that have not fully put in place their policy to manage all their radioactive waste and spent fuel in the long term. In general, most of those Member States have in any case taken some fundamental decisions so that the absence of policies for some waste classes does not jeopardise the progress on their national programmes. About half the Member States are considering the construction of new large-scale nuclear power reactors (> 1 GWe/reactor). Notably, all countries planning to install large-scale nuclear power reactors are also interested in small modular reactors. These planned changes in energy policy are expected to be followed up with updates to the national programmes.

2.1.2. Import of radioactive waste and joint approaches towards radioactive waste disposal

Although the Directive mandates that radioactive waste be disposed of in the Member State where it was generated, Article 4(4) of the Directive provides for exceptions under certain conditions, which allows for disposal in another Member State or a non-EU country.

Most Member States prioritise disposing of their radioactive waste and/or spent fuel within their own territory. However, exporting radioactive waste for disposal⁸ to another Member State or a third country is an option considered by several Member States, particularly those without a nuclear power programme or those with research reactors and relatively small quantities of radioactive waste (RAW) and/or disused radioactive sources. While many Member States are exploring regional or shared disposal facilities as a complementary option to developing their own disposal solutions, approximately two thirds of Member States prohibit the import of radioactive waste or spent fuel for disposal.

⁸ Disposal is defined in Article 3(3) of the Directive as 'the emplacement of spent fuel or radioactive waste in a facility without the intention of retrieval'.

Table 1 provides a broad classification of national policies on the import of radioactive waste for disposal and the search for joint approaches to dispose of waste. These policies have remained unchanged since the previous reporting cycle.

Table 1: Policies for radioactive waste import and joint approach towards RAW disposal

	Import for disposal ^(*)	Joint approach towards RAW disposal ^(**)
AT	Not permitted	Option
BE	In use ¹⁰	Not considered / discarded
BG	Prohibited	Option
HR	Prohibited	Option
CY	Prohibited	Option
CZ	Prohibited	Option
DK	Not permitted	Option
EE	Prohibited	Option
FI	Prohibited	Prohibited
FR	Prohibited ¹¹	Not indicated
DE	Not indicated	Prohibited
EL	Prohibited	Option
HU	Not indicated	Option
IE	Prohibited	Prohibited
IT	Not indicated	Option
LV	Prohibited	Option
LT	Prohibited	Option
LU	Prohibited	In use ¹⁰
MT	Prohibited	Option
NL	Not permitted	Not considered / discarded
PL	Prohibited	Option
PT	Prohibited	Not indicated
RO	Prohibited	Option
SK	Prohibited	Option
SI	Not permitted	Option
ES	Not indicated	Not indicated
SE	Prohibited	Prohibited

⁹ Member States' (MS) abbreviations in this report are as follows: Austria (AT), Belgium (BE), Bulgaria (BG), Croatia (HR), Cyprus (CY), Czechia (CZ), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (EL), Hungary (HU), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), The Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Slovakia (SK), Slovenia (SI), Spain (ES) and Sweden (SE).

¹⁰ Agreement between Luxembourg and Belgium.

¹¹ French law prohibits the disposal of foreign radioactive waste on French territory, except for waste from the Principality of Monaco.

(*) Prohibited – import for disposal explicitly prohibited by law; **Not permitted** – there is no explicit prohibition, but import is still not allowed due to other regulatory or practical constraints.

() Option** – Member State explores possibilities for joint approaches for disposal; **Not considered / discarded** – Member State does not consider or discarded joint approaches for disposal.

2.1.3. National policy developments

National reports typically provide updates on the development of national policies, but approximately one third of the reports lack detailed information on the practical implementation of these policy principles. Furthermore, the current reporting period did not reveal any significant changes in national policies, as indicated in the national reports.

2.2. National programmes

Member States are required to put in place national programmes for the management of radioactive waste and spent fuel. These programmes should outline the measures, time frames and milestones for the practical implementation of national policies. Currently, all Member States have these national programmes.

In line with Article 11(2) of the Directive, Member States are required to regularly review and update their national programmes. To comply with this requirement, all Member States have set out a clear legal framework that outlines the responsibilities for reviewing, updating, and implementing their national programmes, including specific arrangements, deadlines, and conditions for these processes. Table 2 provides an overview of: (i) the organisations responsible for developing national programmes in each Member State; (ii) the organisations responsible for approving them; and (iii) the requirements for how often they need to be reviewed and updated. However, in some cases, the same organisation is responsible for both developing and approving the programme. This is not considered to be good practice as it may compromise the independence and objectivity of the review process.

Approximately two thirds of Member States have incorporated a regular review cycle into their national frameworks, specifying the time frame in which a review or update of their national programmes should be conducted. However, despite this, some Member States have already encountered difficulties in meeting these deadlines, primarily due to protracted or delayed approval and adoption procedures. As of mid-2025, four Member States had failed to review and update their national programmes within the prescribed time frame outlined in their national legislation, highlighting the challenges in complying with prescribed schedules.

In addition to the legal requirements, infringement procedures or recommendations from ARTEMIS peer review missions often serve as catalysts for reviewing and updating national programmes. These review and update mechanisms play a crucial role in driving the continuous improvement of national programmes and frameworks.

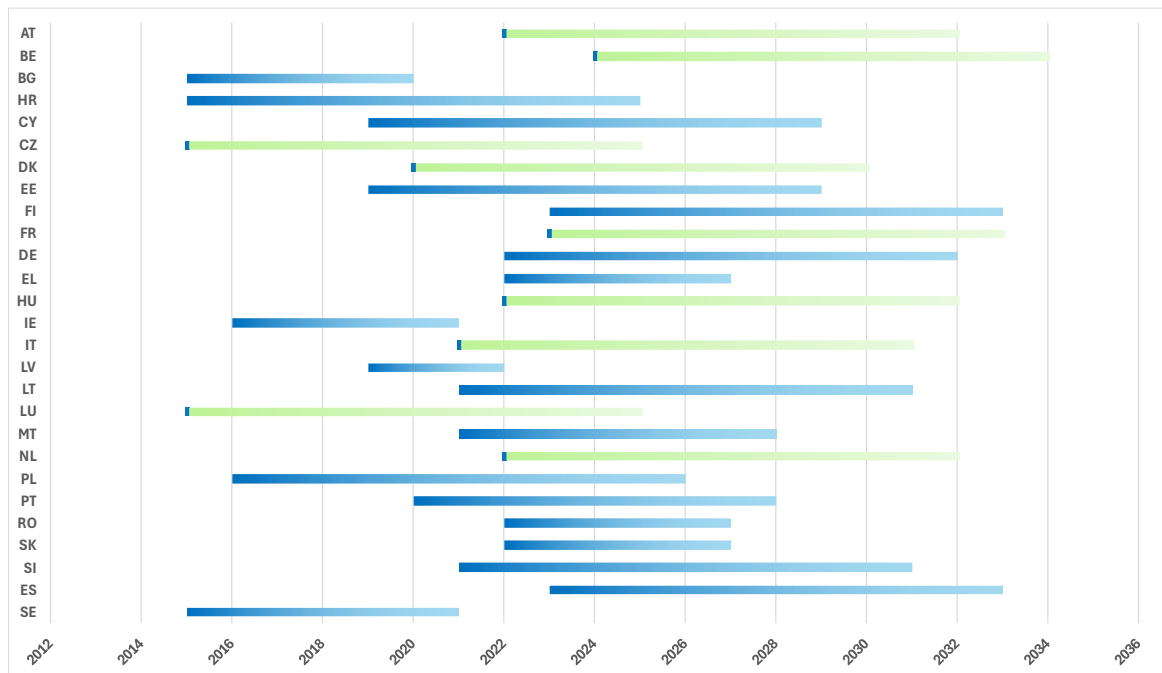
As regular reviews and updates of national programmes are mandatory, the Commission expects Member States to submit their updated programmes in line with Article 13(1) of Directive. Since 2022, 11 Member States have notified their updated national programmes (see Figure 1), which in some cases involved changes to the overall strategy and timelines for activities. However, in most instances, the updates resulted in the postponement of implementation milestones by several years, largely reflecting the current delays in the implementation of national programmes.

Some national programmes only outline activities for a specific period, typically spanning 5-10 years. At the end of this period, Member States are expected to prepare and legally approve an updated national programme for the subsequent period. To prevent similar issues to those mentioned above, Member States are encouraged to optimise their planning and adoption processes, thereby guaranteeing the continuity of their national programmes.

In general, nearly all national programmes cover all types of radioactive waste and spent fuel generated within the Member States' territories. Nevertheless, only about one third of the programmes include comprehensive plans for all waste streams, from generation to disposal. Some Member States with nuclear power plants in operation have yet to make a final decision on the long-term management of spent fuel and continue to keep several options open, such as shared disposal, reprocessing and direct disposal. Despite this, the default strategy for most Member States is to proceed with the direct disposal of spent fuel.

As noted in the previous report, Member States with nuclear power programmes tend to focus on the management of radioactive waste and spent fuel generated by the nuclear industry but provide limited or no information on the management of institutional radioactive waste. Unfortunately, this situation remains unchanged since the previous report, highlighting the need for more attention to this aspect of radioactive waste management.

Figure 1: Timeline of releases of the latest national programmes and their expected next reviews



Timeline in blue: as set by Member State.

Timeline in green: no period set by Member State

Table 2: Member State national programmes under Directive 2011/70/Euratom – Reference date: June 2023.

	Organisation responsible for developing the programme	Approving organisation	Latest release	Review and update
AT	Federal Ministry for Agriculture and Forestry, Climate and Environmental Protection, Regions and Water Management (BMLUK)	Federal government	2022	No period set
BE	Committee of the National Programme (*)	Federal Council of Ministers	2024	No period set
BG	Ministry of Energy	Council of Ministers	2015	Every 5 years
HR	Ministry of Interior	Government	2022	No period set
CY	Minister of Labour and Social Insurance (MLSI)	Ministry of Industry and Trade	2015	Every 10 years
CZ	Ministry of Trade and Industry	Government	2019	Every 10 years
DK	Danish Health Authority	Ministry of the Interior and Health	2020	No period set
EE	Ministry of Climate	Ministry of Climate	2019	Every 10 years
FI	The Ministry of Economic Affairs and Employment and the Ministry of Social Affairs and Health	Ministry of Economic Affairs and Employment	2022	Every 10 years
FR	Working group (GT PNGMDR) (***)	Ministry of Ecological Transition	2022	Every 5 years
DE	Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection	Federal Cabinet	2015	No period set
EL	Greek Atomic Energy Commission (EEAE)	Minister of Development and Investments	2023	At least every 10 years
HU	Ministry of Energy	Government	2016	Every 5 years
IE	Department of Environment, Climate and Communication	Government	2021	No period set
IT	Ministry of the Ecological Transition	Government	2019	Every 3 years
LV	Ministry of Environmental Protection and Regional Development	Council of Ministers	2021	Every 7 years
LT	Ministry of Energy	Government	2021	Every 10 years
LU	Minister of Health and Social Security	Minister of Health and Social Security	2015	No period set
MT	Radiation Protection Commission	Radiation Protection Commission	2022	No period set
NL	Ministry of Infrastructure and Water Management	Parliament	2016	Every 10 years

	Organisation responsible for developing the programme	Approving organisation	Latest release	Review and update
PL	Ministry of Energy	Council of Ministers	2020	Every 8 years
PT	Portuguese Environment Agency (APA)	Council of Ministers	2022	First update in 5 years, then every 10 years
RO	Nuclear and Radioactive Waste Agency (ANDR)	Government	2022	At least every 5 years
SK	National Nuclear Fund	Government	2015	Every 6 years
SI	Slovenian Nuclear Safety Administration (SNSA) (****)	National Assembly	2023	Every 10 years
ES	National radioactive waste company (ENRESA) (**)	Council of Ministers	2023	No period set
SE	Swedish Radiation Safety Authority (SSM)	Ministry of Environment	2021	Every 10 years

(*) Comprised of representatives from the Federal Public Service responsible for Energy, the Belgian Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS) and Synatom.

(**) The legal basis requires the national radioactive waste company (ENRESA) to submit a draft update of the programme to the Ministry for the Environmental Transition and the Demographic Challenge every 4 years or whenever so required by the Ministry.

(***) Led jointly by the Ministry for Energy and the French Authority for Nuclear Safety and Radiation Protection (ASNR).

(****) ARAO provides the expert basis for the revision of the programme and based on this, SNSA prepares a draft national programme that is adopted by National Assembly.

2.3. National legal and organisational frameworks

In line with Article 5(1) of the Directive, Member States are required to draw up and maintain a comprehensive national legislative, regulatory, and organisational framework (the ‘national framework’) for the management of radioactive waste and spent fuel. This framework must clearly allocate responsibilities and provide for effective coordination between the relevant competent bodies.

The Directive also required Member States to complete its transposition by 23 August 2013. In the previous report¹², it was noted that following a conformity assessment, the Commission had identified five Member States with incomplete transposition. However, all these Member States have since taken additional measures to ensure full compliance, and as a result all infringement procedures on the incorrect transposition of the Directive have been closed.

In their fourth national reports, Member States provided an overview of the legal arrangements and provisions that comprise their national framework, accompanied by a general summary of the issues addressed in the updated arrangements. While some Member States provided detailed information on the practical implementation of these legal provisions, others merely listed new or amended legal acts without elaborating on their specific impact. For instance, it was not always clear whether these changes affected the allocation of responsibilities or the coordination between relevant competent bodies. Nevertheless, the national legal and organisational frameworks in Member States with nuclear programmes are generally well-established and advanced, likely due to the fact that relevant national laws were enacted before the Directive.

Most Member States’ national frameworks incorporate provisions for updating and improving the national framework, as required by Article 5(2) of the Directive, and clearly set out the responsibilities of stakeholders. In general, the improvement of national frameworks is primarily driven by international peer reviews.

All Member States have enacted laws or regulations that mandate the consideration of operating experience, insights gained from decision-making processes, and advancements in technology and research. However, despite this legal framework, most Member States failed to provide sufficient details on how they actually integrate operating experience and research findings into the development and review of their national frameworks in practice.

2.4. Regulatory framework and competent regulatory authorities

In line with the Directive’s requirements, Member States have established and maintain a competent regulatory authority responsible for ensuring the safety of radioactive waste and spent fuel management. As shown in Table 3, all Member States have designated national

¹² Commission staff working document, Progress of implementation of Council Directive 2011/70/EURATOM, SWD(2024) 123 final.

competent authorities. While the majority of Member States have opted for a single competent authority, others have established two or more organisations with distinct powers and regulatory functions in different aspects of radioactive waste and spent fuel management. In some cases, such as in Germany, regional regulatory authorities co-exist with federal or national ones. However, the Commission has observed that the national reports lack sufficient information on local or regional competent authorities responsible for radioactive waste management, where applicable.

To improve regulatory supervision, four Member States have implemented changes to their competent regulatory authorities during the reporting period. These changes include establishing new authorities, reorganising existing ones, and consolidating functions, all aimed at strengthening regulatory oversight.

- *Functional independence*

In line with Article 6 of the Directive, the regulatory Authority must maintain functional separation from any other body or organisation involved in promoting or using nuclear energy or radioactive material, or in managing radioactive waste and spent fuel. Furthermore, the authority must possess legal powers, as well as sufficient human and financial resources to discharge its obligations effectively.

Most Member States have declared the independence of their regulatory authorities from organisations or bodies: (i) promoting or using nuclear energy; and (ii) managing radioactive waste and spent fuel. In most cases, this functional or administrative independence is enshrined in national law. The regulatory authority may be embedded in a ministry or operate as an autonomous body, reporting to the national parliament, council of ministries or government.

The majority of Member States have successfully demonstrated the functional independence of their competent regulatory authorities. Since the previous Commission report, two Member States have implemented specific measures to ensure and strengthen the functional independence of their competent regulatory authorities. In general, regulatory authorities in countries without nuclear power programmes tend to be part of the central state administration and are typically small in size, proportionate to the scale of the inventories of managed radioactive waste.

- *Technical and financial capacity*

In addition to functional and administrative independence, a regulatory authority's effective independence relies on its technical and financial capacity to fulfil its responsibilities. Most Member States' national reports provided information on the measures in place to ensure technical and financial independence, such as guaranteeing adequate human resources and funding through legislation, and charging fees to licensees. However, only six Member States have provided clear or partial information in their national reports on the actual financial resources available to their competent

regulatory authorities. To improve transparency and accountability, Member States are encouraged to provide more comprehensive reporting on the financial resources allocated to radioactive waste management in their future national reports.

- *Human resources*

The national reports of 23 Member States provided information on the human resources of the competent authority, including the actual number of staff. By contrast, the other Member States offered limited or no information, with some simply stating that resources were sufficient without providing further details. In a few cases, Member States only reported the number of positions allocated to the regulatory authority, without indicating how many were filled. Despite maintaining stable overall staff numbers since the last reporting period, a few Member States expressed concerns about the high staff turnover rate. This creates challenges in preserving knowledge, training new staff and building expertise.

However, staffing requirements for carrying out regulatory functions were often not clearly specified, making it difficult to assess the adequacy of human resources on the basis of the information provided. Furthermore, most Member States reported the total number of staff in the regulatory authority without specifying the number of employees directly involved in the safety of radioactive waste and spent fuel management activities. This distinction is important, as a high overall staff number does not necessarily guarantee sufficient human resources are allocated to these specific activities.

During the reporting period, staff numbers remained stable or slightly increased in most Member States. Nevertheless, these increases do not necessarily indicate an improvement in the regulatory authority's human resources situation, as they may have followed staff cuts or recruitment freezes. Therefore, the actual impact of these changes on the authority's capacity to regulate safety effectively is unclear.

It is of note that, in several instances, the national reports submitted under the Joint Convention provided more detailed information about the competent regulatory authorities than the reports on the implementation of the Directive.

In summary, all Member States face challenges in maintaining adequate human resources in the long term, a concern that has been confirmed by recent ARTEMIS peer review missions. While progress has been made, further efforts are needed to demonstrate the technical independence of competent regulatory authorities, particularly in Member States without nuclear power programmes.

Most Member States (around three quarters) provided information on staff competence, the availability of technical support organisations or expert support, and the mechanisms in place

to maintain staff competence. However, a few Member States did not report any information on staff competence or the mechanisms for maintaining it. Additionally, some Member States provided details on the appointment and dismissal processes for regulatory authority management, aiming to demonstrate that management is shielded from undue influence in carrying out its mission.

Table 3: National competent authorities for radioactive waste and spent fuel management (*)

	Competent authority	Reporting to	Staff (year)
AT	Federal Ministry for Climate Action, the Environment, Energy, Mobility, Innovation and Technology (BMK)	Federal government	~20 (2023)
BE	Federal Agency for Nuclear Control (FANC)	Minister of Internal Affairs and Security	~150 (2024)
BG	Nuclear Regulatory Agency (BNRA)	Council of Ministers	114 (2024)
HR	Civil Protection Directorate of Ministry of Interior	Ministry of Interior	Planned 30 (2024)
CY	Radiation Inspection and Control Service of Ministry of Labour and Social Insurance	Ministry of Labour and Social Insurance	6 (2024)
CZ	State Office for Nuclear Safety (SUJB)	Prime Minister	218 (2023)
DK	Danish Health Authority	Ministry of the Interior and Health	No data
	Danish Emergency Management Agency	Ministry of Resilience and Preparedness	No data
EE	Environmental Board	Ministry of the Climate	18 (in the Radiation Safety Department, 2024)
FI	Radiation and Nuclear Safety Authority (STUK)	Ministry of Social Affairs and Health	~300 (189 related to radioactive waste and spent fuel management, 2024)
FR	French Authority for Nuclear Safety and Radiation Protection (ASNR)	Parliament	2270 (2025)
DE	Federal Office for Radiation Protection (BfS)	Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection	No data
	Federal Office for the Safety of Nuclear Waste Management (BASE)	Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection	No data
	Federal states (Länder)	Federal government	No data
EL	Greek Atomic Energy Commission (EEAE)	Minister of Development	69 (2024)
HU	Hungarian Atomic Energy Authority (HAEA)	Prime minister	211 (2024)
IE	Environmental Protection Agency (EPA)	Government	No data
IT	National Inspectorate for Nuclear Safety and Radiation Protection (ISIN)	Government and Parliament	83 (2024) [resources for 90]
LV	Radiation Safety Centre of the State Environmental Service (VVD RDC)	Ministry of Environmental Protection and Regional Development	No data
LT	State Nuclear Power Safety Inspectorate (VATESI)	Cabinet of Government and the President	54 (2024)
	Radiation Protection Centre (RPC)	Ministry of Health	60 (2024)

	Competent authority	Reporting to	Staff (year)
LU	Radiation Protection Division of Ministry of Health and Social Security (RDP)	Minister of Health and Social Security	15 (2024)
MT	Radiation Protection Commission (RPC)	Office of the Prime Minister	5 (2024) + 2 more planned
NL	Authority for Nuclear Safety and Radiation Protection (ANVS)	Ministry of Infrastructure and Water Management	159 (2024)
PL	National Atomic Energy Agency (PAA)	Minister for Climate and Environment	147 (2023) [incl. 24 inspectors]
PT	Portuguese Environment Agency (APA)	Ministry of Environment and Energy	20 (2024)
	General Inspection of Agriculture, Sea, Environment and Spatial Planning (IGAMAOT)	Direct administration exercised jointly by Minister of the Economy and Territorial Cohesion, Minister of Environment and Energy, Minister of Agriculture and Maritime Affairs	15 (2023)
RO	National Commission for Nuclear Activities Control (CNCAN)	Prime Minister	70 (2024)
SK	Nuclear Regulatory Authority (ÚJD SR)	Government and subsequently to the National Council	134 (2024)
	Public Health Authority (ÚVZ SR)	Ministry of Health	40 (2020)
SI	Slovenian Nuclear Safety Administration (URSJV)	Ministry of Natural Resources and Spatial Planning	43 (2024)
	Slovenian Radiation Protection Administration (URSVS)	Ministry of Health	No data
ES	Nuclear Safety Council (CSN)	Parliament	432/210 (2023) – [Total staff / nuclear safety and radiological protection staff]
SE	Swedish Radiation Safety Authority (SSM)	Ministry of Climate and Enterprise	295 (2024)

(*) The data does not include staff of separate technical support organisations that exist in some Member States.

2.5. Licence holders

Under Article 7 of the Directive, licence holders bear primary responsibility for ensuring the safe management of radioactive waste and spent fuel in Member States.

The national reports submitted by Member States provided limited information on the implementation of Article 7, typically consisting of a brief summary of the relevant legal requirements without any elaboration on their practical implementation, particularly during the reporting period. Only the reporting on matters related to Articles 7(2) and 7(3) of the Directive was more detailed. More than half the Member States provided information on regular safety reviews and safety improvements, as well as on safety assessments conducted during the reporting period.

- *Human and financial resources*

Most Member States reported that licence holders are legally obliged to provide and maintain adequate financial and human resources to fulfil their safety obligations relating to radioactive waste and spent fuel management. However, in most cases, this information was not accompanied by details of the actual human and financial resources available to licence holders, nor was there any information on how these resources have evolved over time. Only a few Member States provided specific details on the status of human resources, such as staff numbers. In some instances, general information was provided on competence and skills management, which was often linked to Article 8, while financial data was mostly referenced in relation to Article 12(1)(k). As a result, it is difficult to determine whether Member States have effectively ensured that licence holders have sufficient human and financial resources in place to meet their safety obligations.

- *Waste management organisations*

A common feature among Member States is the presence of dedicated radioactive waste management organisations, with all nuclear power and most non-nuclear power Member States having such bodies in place. The list of radioactive waste management organisations in the EU as of mid-2025 is provided in Table 4. These organisations are typically public bodies, although there are some exceptions where they have been set up by nuclear power plant operators. In both cases, the funding of radioactive waste and spent fuel management activities is based on the ‘polluter pays’ principle, where those who generate radioactive waste and spent fuel are responsible for covering the associated costs. Some of these organisations also oversee the decommissioning of shutdown nuclear installations. In certain cases, responsibility for a disposal facility is transferred to the Member State after the facility’s closure.

The responsibilities of these waste management organisations vary across Member States. In some cases, they are responsible for both predisposal and disposal activities, ensuring a comprehensive approach to radioactive waste management. In other cases,

these organisations are only responsible for predisposal activities, such as storage and treatment, or for disposal activities, such as operating a geological repository. Limited responsibility for specific types of activities may be a result of a waste management strategy that has not yet been fully developed. For example, a lack of a disposal strategy is likely to result in responsibilities for disposal activities not clearly being assigned.

Since the publication of the third Commission report, there have been no significant changes regarding the licence holders.

Table 4: Radioactive waste management organisations in the EU

	Radioactive waste management organisation	Type	Responsibilities
AT	Nuclear Engineering Seibersdorf GmbH (NES)	Public/private	Management of radioactive waste and decommissioning.
BE	Belgian Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS)	Public	Managing radioactive waste and spent fuel when declared as radioactive waste. Responsible for establishment of long-term solution for radioactive waste.
BG	State Enterprise for Radioactive Waste (SERAW)	Public	Management of radioactive waste and spent fuel and decommissioning.
CZ	Radioactive Waste Repository Authority (SÚRAO)	Public	Management of radioactive waste and spent fuel. Operation of LLW disposal facilities. Development of deep geological disposal facility for HLW and spent fuel.
DE	Federal Company for Radioactive Waste Disposal (BGE)	Public/private (*)	Responsible for establishment of disposal solutions.
	Federal Company for Radioactive Waste Storage (BGZ)	Private (†)	Management of storage facilities of radioactive waste and spent fuel.
DK	Danish Decommissioning (DD)	Public	Management of radioactive waste and decommissioning. Responsible for establishment of long-term solution for radioactive waste and spent fuel.
EE	AS ALARA	Public	Management of radioactive waste and decommissioning. Responsible for establishment of long-term solution for radioactive waste.
ES	National radioactive waste company (ENRESA)	Public (‡)	Management of radioactive waste and spent fuel. Decommissioning nuclear plants. Disposal of VLLW and LLW. Responsible for establishment of disposal solution for ILW, HLW and spent fuel.
FI	POSIVA	Private (*)	Responsible for disposal of spent fuel generated by its owners.
FR	National agency for management of radioactive waste (ANDRA)	Public	Management of radioactive waste and spent fuel. Disposal of VLLW and LLW. Responsible for establishment of disposal solution for ILW and HLW.
HR	The Fund for the Financing of the Decommissioning and Disposal of Radioactive Waste and Spent Nuclear Fuel from Krško Nuclear Power Plant	Public	Coordination, preparation and development of the programme for decommissioning the Krško NPP and the programme for the disposal of radioactive waste from the Krško NPP.
HU	Public Limited Company for Radioactive Waste Management (PURAM)	Public	Management of radioactive waste and spent fuel. Decommissioning nuclear plants. Disposal of LLW and ILW.

	Radioactive waste management organisation	Type	Responsibilities
IT	Company for the Nuclear Installations Management (SOGIN)	Public	Management of all radioactive waste and spent fuel. Decommissioning of nuclear facilities. Responsible for establishment of the disposal solution.
LT	State Enterprise Ignalina Nuclear Power Plant (INPP)	Public	Management of all radioactive waste and spent fuel. Decommissioning of nuclear facilities. Disposal facility for VLLW. Responsible for establishment of the disposal solution.
LV	Latvian Environment, Geology and Meteorology Centre (LEGMC)	Public	Management of radioactive waste, disposal.
NL	Central Organisation for Radioactive Waste (COVRA)	Public	Management of radioactive waste and spent fuel.
PL	Radioactive Waste Management Plant (ZUOP)	Public	Management of radioactive waste, disposal of LLW.
PT	Instituto Superiore Tecnico (IST)	Public	Management of radioactive waste.
RO	Nuclear and Radioactive Waste Agency (ANDR)	Public	Coordination of the safe management of radioactive waste and spent nuclear fuel.
SE	Swedish Nuclear Fuel and Waste Management Company (SKB)	Private (§)	Management of radioactive waste and spent fuel. Disposal of LLW. Responsible for establishment of the disposal solution for ILW, HLW and spent fuel.
SI	Agency for Radwaste Management (ARAO)	Public	Collecting, transporting, treating, storing and disposing of LLW and ILW and for the disposal of HLW. Management of the closed uranium mine.
SK	Nuclear and Decommissioning Company (JAVYS)	Public	Management of radioactive waste and spent fuel. Decommissioning of the nuclear power plants.

(*) Public body with private legal personality.

(†) Private law body under the sole ownership of the federal government.

(‡) State-owned company CIEMAT (80%) and SEPI (20%).

(§) Reactors licensees.

3. Implementation of national programmes

3.1. Progress monitoring and key performance indicators (KPIs)

The content of the national programme is outlined in Article 12 of the Directive, which states that:

*The national programmes shall set out how the Member States intend to implement their national policies referred to in Article 4 for the responsible and safe management of spent fuel and radioactive waste to secure the aims of this Directive, and shall include all of the following: (a) the overall **objectives** of the Member State's national policy in respect of spent fuel and radioactive waste management; (b) the significant **milestones** and clear **timeframes** for the achievement of those milestones in light of the overarching objectives of the national programme; ... (g) the responsibility for the implementation of the national programme and the **key performance indicators** to monitor progress towards implementation.*

The vast majority of Member States have set overall objectives for their national policies for radioactive waste and spent fuel management. However, in several cases, the policies are incomplete, as noted elsewhere in this document.

On milestones and clear time frames, most Member States have incorporated them into their national programmes. Nevertheless, a few Member States have not identified any milestone, or their time frames are vague, unrealistic or only cover the short term.

KPIs, together with objectives and milestones, to which they are closely connected but from which they must be distinguished, are essential parts of the national programme. They enable monitoring progress on programme implementation, on national policy implementation and, ultimately, in achieving the Directive's overarching objective of avoiding undue burdens on future generations. Moreover, as KPIs enable monitoring of progress on national programme implementation, they are also an important tool for ensuring transparency to the general public¹³.

The Commission commissioned a study¹⁴ on KPIs and how they are applied in monitoring the implementation of the national programmes. The study described the characteristics of good KPIs, including clarity, auditability, threshold values to adopt corrective measures, and the ability to update and reassess them. In summary, effective indicators enable effective monitoring of national programme implementation progress.

¹³ Article 10 of the Directive provides that 'Member States shall ensure that necessary information on the management of spent fuel and radioactive waste be made available to workers and the general public. This obligation includes ensuring that the competent regulatory authority inform the public in the fields of its competence'.

¹⁴ European Commission, Directorate-General for Energy, Study on key performance indicators for monitoring implementation of national programmes on safe and long-term management of spent fuel and radioactive waste: final report, Publications Office of the European Union, 2022, <https://data.europa.eu/doi/10.2833/052078>.

Setting and applying KPIs has been a persistent challenge for Member States since the first report¹⁵ on the implementation of the Directive. Despite multiple reporting cycles, the development and effective use of meaningful KPIs as a monitoring tool has continued to pose a challenge, highlighting the need for further effort and improvement in this area.

The current situation shows little progress. Although a few countries have updated or recently defined KPIs in their national programmes, more than half the Member States have not defined KPIs or have defined set ones that lack the required characteristics mentioned above. In most of these countries, progress is monitored through milestones, such as the construction of waste storage or disposal facilities. A few countries use detailed multiannual plans for monitoring, while others have defined KPIs but have not reported on them.

The lack of KPIs makes reporting on national programme implementation progress more difficult and less clear. Progress is often communicated as a list of new activities, but it is unclear how far the programmes are from their final objectives. Member States are encouraged to identify suitable KPIs and use them more systematically to monitor and report on national programme implementation progress.

3.2. Implementation status

With the exception of a few countries, national reports clearly indicate the progress made since the last report. However, in some cases, information on progress is either missing or unclear.

In general, the implementation of national programmes has been delayed, ranging from a few months to a number of years. These delays have accumulated over several reporting cycles and are largely due to lengthy licencing procedures, changes in policy, or political decisions. Although these delays have not compromised the population's safety, they have hindered the timely implementation of the programmes. Several countries have not reported clear timelines or set out a long-term strategy, making it challenging to assess the progress of their programmes.

Most countries have plans for storing all types of radioactive waste and disposing of short-lived waste. However, decisions on the disposal of high-level waste and spent fuel are still pending in most cases.

Compared with initial plans, the construction of disposal facilities has been delayed in most countries. While there are no immediate concerns about the capacity for safe storage of existing radioactive waste, some concerns remain about future waste generation.

¹⁵ Report from the Commission to the Council and the European Parliament on progress of implementation of Council Directive 2011/70/Euratom and an inventory of radioactive waste and spent fuel present in the Community's territory and the future prospects, COM(2017) 236 final, [COM\(2017\)236 - Register of Commission Documents](#).

- *Storage facilities*

Most countries have put in place comprehensive strategies for the storage of all types of radioactive waste and spent fuel. In line with those strategies, the construction, modernisation, and extension of storage facilities are progressing, albeit with some delays.

A limited number of Member States are near the maximum capacity of their existing storage facilities for radioactive waste. In response, some of these Member States have opted to implement waste reduction measures, rather than construct new storage facilities or expand existing ones. These measures include the supercompaction of waste and the application of clearance levels to release stored waste that meets the relevant criteria, thereby freeing up space in existing storage facilities. While these waste reduction strategies can help to optimise the use of existing storage capacity in the short term, their effectiveness is limited in the longer term or in scenarios where significant additional storage capacity is required to accommodate larger volumes of waste. Therefore, it is essential for Member States to continue developing and implementing comprehensive and sustainable strategies for the management of radioactive waste, including the construction of new storage facilities or the expansion of existing ones

During the reporting period, two Member States shipped spent fuel to facilities abroad for reprocessing, in line with their national strategies for spent fuel management. In total, six Member States are expected to receive returned waste, including vitrified high-level waste and other by-products, from reprocessing operations (Table 5). However, three Member States are currently facing significant challenges in establishing suitable storage facilities to accommodate this returned waste, which is a concern for the responsible management of radioactive waste. Furthermore, Member States that have shipped spent fuel to the Russian Federation for reprocessing are exposed to additional risks and uncertainties, including potential disruptions to reprocessing services and returns of waste.

- *Disposal facilities for spent fuel and/or high-level waste*

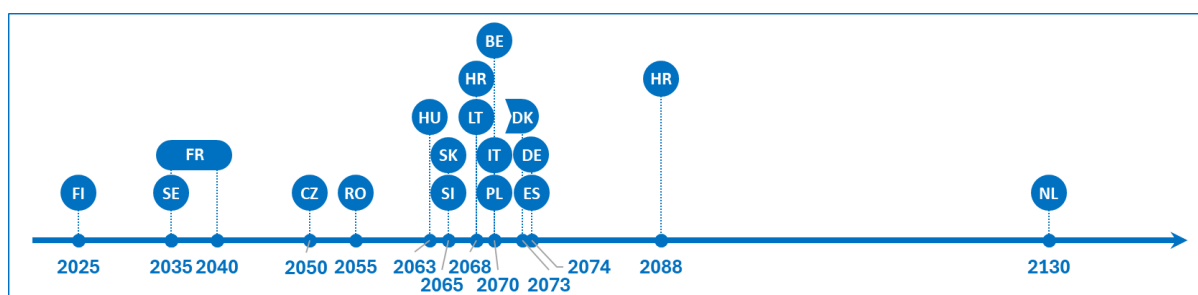
Three Member States (Finland, Sweden and France) have made significant progress in developing disposal facilities for high-level waste and/or spent fuel. Finland is on track to start disposal operations in 2025¹⁶, while Sweden is in the review phase of the construction licence (2024). France is also making notable progress on the Cigéo site. Although other countries with high-level waste or spent fuel have included deep geological repositories (DGRs) in their national programmes, only four countries (in

¹⁶ Compared with initial plans, a delay of approximately four years was recorded due to licencing procedures. Despite this, the Finnish DGR will be the first of a kind on a global scale.

addition to Finland, Sweden and France) have initiated research on siting. No concrete action has been reported by other countries on this matter (Table 6).

Many Member States have chosen to keep the possibility of joint solutions with other countries open, considering DGRs as a last resort. As a result, preparatory and siting activities have stagnated and been pushed further into the future, with the exception of Czechia, which has advanced the planned commissioning date for its DGR to 2050. The planned commissioning dates for most repositories range from 2050 to 2075 (Figure 2). Some Member States have already postponed milestones for site selection or the commissioning of their DGR, and others plan to do so. One Member State has indicated plans to construct a DGR but has not provided a time frame. The lack of concrete progress on high-level waste and spent fuel disposal is a concern, particularly for countries planning to build new reactors.

Figure 2: Planned start of operations of deep geological facilities



- *Other disposal facilities*

Progress with disposal facilities for other radioactive waste is proceeding according to plans, although with some delays in most countries (Table 7). However, not all countries have concepts and plans in place for the final disposal of radioactive waste – some only have plans at the conceptual phase. Two countries have decided to export all disused sources and radioactive waste to other countries, so there would be no need to have a disposal facility on their territory. Other countries with only a very limited amount of disused sealed sources and radioactive waste are considering similar solutions. A few countries have delayed taking decisions on final disposal solutions, including one with a nuclear power programme.

- *Decommissioning*

The decommissioning of shutdown nuclear installations is ongoing in several Member States, and plans have been reported for operating installations. Decommissioning generates large amounts of material, most of which released from regulatory control as non-radioactive and then recycled or reused. The residual material is managed as radioactive waste, primarily consisting of very-low-level and low-level waste, with

small quantities of intermediate-level waste. Progress in decommissioning is linked to the availability of disposal sites for these types of waste.

In general, implementation of the national programmes is going according to schedule, with some milestones met earlier than planned and others delayed, without jeopardising overall implementation in the longer term.

Table 5: Return of by-products from spent fuel reprocessing to Member States

	Type of material	Timeframe
BG	Return of HLW from spent fuel reprocessing in the Russian Federation	After 2025
CZ	Return of residual waste from highly enriched Uranium fuel reprocessing in the Russian Federation	First batch in 2024 Second batch in 2033
DE	The return of reprocessing waste from France was planned to be completed in 2024. The completion of the return of reprocessing waste from the UK is planned by 2026	2024 - 2026
ES	Return of HLW from spent fuel reprocessing in France	~2029
IT	Return of resulting waste from spent fuel reprocessing in France and the UK	Not indicated
NL	Return of HLW from spent fuel reprocessing in France	At the latest in 2052

Table 6: Disposal facilities for high-level waste and spent fuel in the EU.

	Status	Siting/site	Commissioning	Operation (years)	Closure	Responsible organisation	Comment
BE	Planned	Not indicated	~2070	Minimum 100	~2170	ONDRAF/NIRAS	The licence for the geological disposal facility is supposed to be granted by 2050.
BG	Planned	Dates not yet set				SERAW	
CZ	Planned	2030	2050		2176	SÚRAO	Site selection by 2030; siting licence by 2032; building permit by 2036; construction starting in 2038.
DE	Planned	By 2074	After 2094			BGE	
DK	Planned	Not specified	2073	50	2122	Danish Decommissioning	
ES	Planned	2029-2032	2074		2100	ENRESA	
FI	Construction	Eurajoki (Olkiluoto)	2025		2120	POSIVA	
FR	Licence application	Bure (Cigéo)	2035-2040	120	2155-2160	ANDRA	
HR	Planned	2050 (start of siting)	2068-2088			The Fund (•)	Agreement with Slovenia: spent fuel disposal continues as joint activity.
HU	Planned	Site selection ongoing	2063		2080s	PURAM	
LT	Planned	2047	2058-2067	2068-2074	2075-2079	Ignalina NPP	
NL	Planned		2130			COVRA	Decision to be taken around 2100.
PL	Planned		2070	2070-2120	2120-2140	ZUOP	
RO	Planned	2025-2038	2055	~100	~2150	ANDR	
SE	Construction	Forsmark	2034-2035			SKB AB	
SI	Planned	2045-2055	2065	10	2075	ARAO	
SK	Planned	Site selection by 2030	2065	40-60	2105-2115	JAVYS	

(•) Fund for Financing the Decommissioning of the Krško Nuclear Power Plant and the Disposal of Krško NPP Radioactive Waste and Spent Nuclear Fuel.

Table 7: Other disposal facilities in the EU

	Status	Site	Commissioning	Planned operation (years)	Responsible	Comment
AT	No decision on a disposal solution					
BE	Licence to construct and operate	Dessel	2029	50	ONDRAF/NIRAS	Near surface disposal facility for LLW
BG	Construction	Radiana/Kozloduy	2025	60	SERAW	Disposal of LLW from nuclear facilities and nuclear applications
HR	Planned		2060		The Fund (•)	
CY	No decision on a disposal solution					
CZ	Operation	Dukovany	1995	95	SÚRAO	Near surface disposal for radioactive waste from NPPs
	Closed	Hostim / Beroun	1959		SÚRAO	Closed in 1997
	Operation	Bratrstvi / Jáchymov	1974		SÚRAO	Disposal facility for naturally occurring radioactive materials (NORM) waste; closure is planned to start in 2025
	Operation	Richard/Litoměřice	1964		SÚRAO	Disposal facility for institutional radioactive waste
DK	Planned		2073		Danish Decommissioning	
EE	Planned	Paldiski	2040		AS ALARA	Planned near surface disposal of LLW together with shaft for ILW
FI	Operation	Loviisa NPP	1998		FORTUM	Intermediate depth disposal for LLW and ILW
	Operation	Olkiluoto NPP	1992		TVO	Intermediate depth disposal for LLW and ILW
FR	Operation	Centre de l'Aube	1992		ANDRA	Near surface disposal for LLW
	Closed	Centre de la Manche	1969		ANDRA	Near surface disposal for LLW
	Operation	Morvilliers-Cires	2003		ANDRA	Landfill disposal for VLLW
DE	Construction	Konrad/Salzgitter	Early 2030s	40	BGE	Disposal facility (at least 800 m below the surface) has been under construction since 2007

	Status	Site	Commissioning	Planned operation (years)	Responsible	Comment
	Remediation planned	Wolfenbüttel, Lower Saxony / Asse II salt mine	1967	1978	BGE	Retrieval of all disposed waste is planned
	Closing	Morsleben / Endlager für radioaktive Abfälle Morsleben (ERAM)	1971	27 years	BGE	Disposal facility at least 480 m below the surface
EL	Planned				ODRA, but creation of a waste management organisation is planned	
HU	Operation	Püspökszilág	1976		PURAM	Near surface disposal for institutional radioactive waste
	Operation	Bátaapáti	2008		PURAM	Intermediate depth disposal for LLW and ILW from NPPs
IE	Not planned					
IT	Planned				SOGIN	
LV	Operation	Baldone	1962		Latvian Environment, Geology and Meteorology Centre	Near surface disposal for LLW and ILW
LT	Operation	Ignalina	2024		Ignalina NPP	Landfill disposal for VLLW
	Construction	Ignalina			Ignalina NPP	Near surface disposal for LLW
	Planned	Ignalina			Ignalina NPP	Planned conversion of the bituminous radioactive waste storage facility into a near surface disposal facility
LU	Not planned					

	Status	Site	Commissioning	Planned operation (years)	Responsible	Comment
MT	No decision on a disposal solution					
NL	Operation	Lelystad, Middenmeer			Afvalzorg B.V.	Landfill disposal for NORM waste
	Operation	Rotterdam			Mineralz B.V	Landfill disposal for NORM waste
PL	Operation	Rózan	1961	1961-2040	Radioactive Waste Management Plant (ZUOP)	Near surface disposal for LLW
	Planned		2033	2033-2152	Radioactive Waste Management Plant	Near surface disposal for LLW
RO	Operation	Baita Bihor	1985	55	IFIN-HH	Near surface disposal for institutional radioactive waste
	Planned	Saligny	2028		ANDR	Near surface disposal for LLW from NPPs
SK	Operation	Mochovce	2001		JAVYS	Near surface disposal for LLW
	Operation	Mochovce	2016		JAVYS	Near surface disposal for VLLW
SI	Construction	Vrbina	2028		ARAO	Near surface disposal for LLW together with shaft for ILW
ES	Operation	El Cabril	1992		ENRESA	Near surface disposal for LLW
	Operation	El Cabril	2008		ENRESA	Landfill disposal for VLLW
SE	Operating	Forsmark/SFR	1988		SKB AB	Intermediate depth disposal for LLW
	Planned				SKB AB	Intermediate depth disposal for ILW. Planned application for licence in 2030
	Operation	Forsmark			Forsmarks Kraftgrupp AB	Landfill disposal for VLLW
	Operation	Oskarshamn / Oskarshamn NPP			OKG AB	Landfill disposal for VLLW

	Status	Site	Commissioning	Planned operation (years)	Responsible	Comment
	Operation	Ringhals/Ringhals NPP			Ringhals AB	Landfill disposal for VLLW
	Closed	Studsvik/Studsvik Tech Park			AB SVAFO	Landfill disposal for VLLW

(•) The Fund for the Financing of the Decommissioning and Disposal of Radioactive Waste and Spent Nuclear Fuel from Krško Nuclear Power Plant

3.3. Self-assessments and international peer reviews

In line with Article 14(3) of the Directive, Member States are required to arrange for self-assessments of their national framework, competent regulatory authority, national programme and its implementation. They are also required to organise an international peer review of their national framework, competent regulatory authority and/or national programme regularly and at least every 10 years.

The aim of these self-assessments and international peer reviews is to ensure high safety standards in managing radioactive waste and spent fuel. The Member States set out the scope, timing and type of international peer reviews in line with Article 14(3) of the Directive. The Directive had to be transposed by 2013, and subsequently, Member States had to conduct self-assessments and invite international peer reviews for the first time by 2023. A Member State must report the outcome of these international peer reviews to the Commission and to the other Member States. The results may also be made publicly available, unless this would compromise security and/or proprietary information. Most Member States only addressed regular self-assessments and international peer reviews in a general way in their national programmes and reports.

- *Services for international peer reviews*

While Member States are free to choose and devise the international peer reviews, the International Atomic Energy Agency (IAEA) offers services in this area, which have been the main method for carrying out international peer reviews for more than a decade. The main advantages of carrying out reviews within the same system are the guarantee of a higher level of consistency and the maintenance of pools of trained experts. For these reasons, the Commission has been consistently supporting the IAEA in setting up, developing, and maintaining these services.

- *Integrated Regulatory Review Service (IRRS)¹⁷*

The IRRS steers and drives Member States in strengthening and the effectiveness of their regulatory infrastructure for nuclear, radiation, radioactive waste, and transport safety. The IRRS is a tool to review competent regulatory authorities in a broader context than that required by the Directive. Although the IRRS was set up before the adoption of the Directive, it provides relevant results in line with the Directive.

In all Member States, a self-assessment of the competent authorities was carried out through the IRRS. While the majority of Member States reported on IRRS missions, only a few Member States provided details on the self-assessment outcomes of radioactive waste and spent fuel management. IRRS mission reports are generally publicly available; however, only a few Member States reported details of follow-up action taken in response to the outcomes of these reviews in order to achieve a higher

¹⁷ <https://www.iaea.org/services/review-missions/integrated-regulatory-review-service-irrs>.

level of safety. Accordingly, compared with the previous reporting cycle, no improvement has been noted; Member States should therefore give greater attention to the outcomes of the peer reviews in future reports to the Commission.

- *Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS)*¹⁸

When the Directive entered into force, dedicated international peer review services were not available; therefore, since 2014 the Commission has been supporting the IAEA in developing a self-assessment tool based on IAEA safety standards and best practices to enable Member States to meet their self-assessment obligation (Article 14(3) of the Directive). ARTEMIS is an integrated expert peer review service for radioactive waste and spent fuel management, decommissioning and remediation programmes.

As a result of intense work, all the peer review missions were carried out in a timely manner¹⁹, and by the end of 2023, all Member States had completed the first round of self-assessments and international peer reviews. Due to the disruptions caused by the COVID-19 pandemic and to comply with the Directive's requirement to have peer review missions carried out in all EU Member States by 2023, the 18 Member States had an ARTEMIS peer review during the reporting period. Additionally, Germany conducted the ARTEMIS follow-up mission in 2022.

The Commission is closely following how the IAEA is developing and carrying out ARTEMIS peer review services, not only through regular meetings with the IAEA, but also by attending full-scope review missions as an observer.

- *Synergies between international peer review services*

Member States ensure compliance with Article 14(3) through IRRS and ARTEMIS peer review missions (Table 8). Although the IAEA has worked to avoid overlaps between ARTEMIS and IRRS review services, there are still challenges that require further consideration.

Synergies between the ARTEMIS and IRRS missions have been explored in several ways. The peer review mission to Spain in 2018 was the first, and so far, the only occasion when a host country requested a joint IRRS and ARTEMIS peer review mission. Despite some limited advantages, a number of challenges emerged in the attempt to integrate IRRS and ARTEMIS peer reviews.

On the basis of this experience, Member States have preferred to proceed with separate missions, with one taking place shortly after the other (preferably with the IRRS

¹⁸ <https://www.iaea.org/services/review-missions/integrated-review-service-for-radioactive-waste-and-spent-fuel-management-decommissioning-and-remediation-artemis>.

¹⁹ <https://www.iaea.org/services/review-missions/calendar>.

mission followed by the ARTEMIS mission). This approach is referred to as ‘back-to-back missions’. To avoid overlap between the missions, the IAEA has developed additional guidance for back-to-back missions. The first back-to-back mission took place in Slovenia in May 2022. Since then, 7 of the 14 IRRS and ARTEMIS peer review missions requested by Member States (including Slovenia) have followed this approach.

- *Reporting*

Under Article 14(3) of the Directive, Member States are required to report the outcomes of international peer reviews of their national framework, competent regulatory authority, and national programme to the Commission and the other Member States.

All Member States’ ARTEMIS and IRRS reports are published on the IAEA website shortly after the completion of a mission. However, this is not considered a sufficient means of reporting the outcomes of international peer review missions to the Commission. Most Member States that have reported outcomes have chosen to submit the peer review reports as a means of informing the Commission. By 2021, five Member States had submitted their ARTEMIS peer review reports to the Commission. In the current reporting cycle, an additional nine Member States notified the Commission of their ARTEMIS peer review reports.

Some Member States have included a detailed presentation in their national reports of the outcomes of the international peer review missions. However, several have not yet reported these outcomes to the Commission. Therefore, Member States are encouraged to do so in a timely manner in order to comply with Article 14(3).

Table 8: Recent and planned international peer reviews under Article 14(3) of the Directive

	National programme and/or national framework [ARTEMIS]	Competent regulatory authority [IRRS]
AT	2022	2018
BE	2023 (‡)	2023 (‡)
BG	2018	2024
CY	2022	2017
CZ	2023 (‡); 2027-2028 (*)(**)	2023 (‡); 2027-2028 (*)
DE	2019; 2022 (*)	2019; 2023 (*)
DK	2022	2021
EE	2019	2016; 2019 (*)
EL	2023	2012; 2017 (*)
ES	2018 (•); 2025 (*)	2018 (•); 2025 (*)
FI	2022 (‡)	2022 (‡)
FR	2018	2014; 2017 (*)
HR	2023	2015; 2019 (*)
HU	2022	2015; 2018 (*)
IE	2021	2015; 2026
IT	2023	2016; 2026
LT	2022; 2027 (*)	2016; 2020 (*); 2026
LU	2018	2018
LV	2019	2019; 2024 (*)
MT	2022	2015; 2020 (*)
NL	2023 (‡)	2023 (‡)
PL	2017	2023; 2027 (*)
PT	2023	2022
RO	2022	2023
SE	2023 (‡)	2022 (‡)
SI	2022 (‡)	2022 (‡)
SK	2023 (‡)	2022 (‡); 2026 (*)

(*) Follow-up mission.

(**) Times for planned missions are in italics.

(‡) Back-to-back IRRS-ARTEMIS missions.

(•) Combined IRRS-ARTEMIS mission.

4. Cost assessments, financing mechanisms and available resources

Article 9 of the Directive requires Member States to ensure adequate financial resources for the implementation of their national programmes. In addition, Article 12(h) and (i) require each Member State to have an estimate of the national programme costs and financing schemes in force to ensure the financial resources.

All Member States provided information on the cost assessments of their national programmes, although the estimates vary widely in terms of the methodology, assumptions, completeness of data, scope and time frames (Table 9). Half the Member States (mainly those with nuclear power programmes) have updated their cost estimates recently; however, there are several cost estimates that have not been updated since 2015. In addition, these updates did not always completely reflect cost developments in recent decades. Some Member States added additional costs to their overall cost assessment but did not update the price level on which those calculations were based; for example, in some cases the updated cost assessment was still calculated using price levels from early 2000. As a cost estimate serves as a basis for providing sufficient funding for the implementation of the national programme, it is important to regularly review it and, when necessary, update it.

In the first Commission report, the total cost of radioactive waste and spent fuel management in EU was estimated at around EUR 250 billion (2017). In the second Commission report, the estimate was higher, at around EUR 300 billion²⁰ (2019). This estimate remained at the same level in the third report (2024) and has remained unchanged in the fourth review cycle.

Most Member States provided information on the financing schemes in force to implement national programmes (Table 10). There are considerable differences in the schemes used by different countries: a few Member States rely on a fee levied on electricity generation, others rely on payments based on characteristics of the waste and some rely on state budget. No changes to these financing schemes were reported during the reporting period.

More than half the Member States provided information on the status of the funds for radioactive waste and spent fuel management, although with varying levels of detail. A few Member States reported changes to electricity levies to ensure sufficient payments to the fund following a cost assessment update. In most cases, Member States only applied corrective measures (for example, by increasing payments to the fund) when it became clear that the performance of the funds was below expectations. However, there were cases when Member States acted proactively by regularly reviewing market conditions and adjusting payments to the fund on the basis of these funds' predicted future performance.

Overall, very little information was reported on the performance of the funds. The sufficient and timely availability of funding is crucial for the implementation of the national programmes

²⁰ These figures do not include the UK.

as planned. Member States are encouraged to regularly assess the performance of their funds so they can proactively react to any changes and take corrective measures in a timely manner when needed. Limited information was reported on the investments and management of the funds that are required to ensure that sufficient funds will be available when needed in the future.

The implementation of smaller national programmes (without nuclear power) is funded mainly from the state budget. However, the national reports suggest that the required funding for implementation of the national programmes is not always ensured, which leads to delays. Member States that are funding their national programmes solely from the state budget are encouraged to ensure that sufficient resources are allocated in a timely manner to support implementation as planned.

Table 9: Estimated total cost of radioactive waste and spent fuel management based on Member States' programmes

	Estimated total costs EUR million (*) (year of estimation)	Cost of decommissioning EUR million	Costs of management of radioactive waste and spent fuel EUR million	Assumptions
AT	556	198: Decommissioning in Seibersdorf 18: Decommissioning of TRIGA reactor:	338	Costs up to 2045.
BE	17 857 (2022)	8 769	9 088	Costs up to 2150. The seven existing commercial nuclear reactors will be in operation for 40 years. The geological disposal will take place between 2100 and 2110. The management of the radioactive waste and spent fuel of future nuclear installations is not included.
BG	7 372 (2022) (BGN 14 455)	1 358: Decommissioning of Kozloduy units 1-4 1 600: Decommissioning of Kozloduy units 5-6	1 737: Spent fuel management 2 500: Cost of the DGR	Cost assessment until 2051. Spent fuel management costs are assessed on the assumption that spent fuel will be reprocessed in Russian Federation. The DGR cost estimates are roughly based on other countries' examples. Annual expenses by the SERAW amount to approx. BGN 25 million per year (BGN 1 = EUR 0.51).
HR	870.6 (2015)	192.8		The decommissioning costs will occur after shutdown of the Krško NPP in 2043.

	Estimated total costs EUR million (*) (year of estimation)	Cost of decommissioning EUR million	Costs of management of radioactive waste and spent fuel EUR million	Assumptions
CY	0.5 (2016)			Cost estimation is based on the cost of repatriating disused sealed radioactive sources (DSRSs).
CZ	5 020 (CZK 123.5 billion)	15: Cost of managing RAW from the decommissioning of NPPs and for storing SF during decommissioning	5: Cost of processing operational RAW in the NPPs 3.3: Cost of processing and storing institutional RAW 14: Cost of managing LILW, including closure of repositories 37.8: Cost of storing SNF 132: Cost of constructing and operating the deep repository	Overall cost of implementation of the concept for 2015-2100 (if there are no new NPPs) (CZK 1 = EUR 0.041).
DK	455			Cost of implementation of Parliamentary Resolutions B48/2003 and B90/2018: DKK 1.120 billion and DKK 2.271 billion, respectively (DKK 1 = EUR 0.134)
EE	124			Cost for 2018-2050.
FI	2816 (2023)	Cost of decommissioning: approx. 1 100	~ 5 000: cost of SF disposal ~ 150: cost of management of operational waste	The assessment time frame is up to ~2120. Decommissioning costs cover dismantling and disposal of the radioactive waste in on-site disposal facilities. Cost of spent fuel management covers the construction, operation and closure of the disposal facility, R&D expenses, disposal activities relating to the SF.
FR	110 500 (2014)	45 000	25 000: geological disposal.	Cost estimates up to 2135.
DE	66 900 (2012)	34 000: Cost of decommissioning	32 900	The cost of radioactive waste and spent fuel management are up to 2080.

	Estimated total costs EUR million (*) (year of estimation)	Cost of decommissioning EUR million	Costs of management of radioactive waste and spent fuel EUR million	Assumptions
		and management (without disposal)		
EL	9.95 or 10.7 (2023)	Decommissioning the research reactor: 1.8	2.5: Recycling DSRS and nuclear materials 1.65: Classification of legacy waste 1.5: Upgrading existing radioactive waste management facility Up to 1.95: New disposal facility 1.3: Management of RAW until disposal	The cost will depend on the site of the disposal.
HU	5 300 (2015) (HUF 1 650 402 million)	1 237 (2015)	4 063 (2015)	Cost estimate is up to 2064. Cost estimate covers decommissioning of 4 NPP units in operation; decommissioning of spent fuel interim storage facility; radioactive waste disposal facilities; HLW disposal facility; PURAM operating costs, supervision fees, fund management and support to local governments. (HUF 1 = EUR 0.0024 in 2024)
IE	0.6 (2022)			For 2022-2026.
IT	17 700 (2023)	7 880 for completing the decommissioning of the 4 NPPs and the nuclear fuel cycle facilities		2030 (excluding geological disposal).
LV	7.1 (2021)	Maintenance and decommissioning of research reactor: 4.188	2.91: Management and development of disposal facility	
LT	5 323 (2016)			Cost estimate up to 2138: 2021-2030: EUR 1.001 billion, mainly Ignalina NPP decommissioning; 2031-2038: EUR 0.922 billion, mainly Ignalina NPP decommissioning;

	Estimated total costs EUR million (*) (year of estimation)	Cost of decommissioning EUR million	Costs of management of radioactive waste and spent fuel EUR million	Assumptions
				2038-2138: EUR 3.4 billion, mainly implementation of deep geological repository and further decommissioning activities.
LU	EUR 15 948 a year			Up to 2029. Only orphan sources and materials considered. Cost of shipment to Belgium and interim storage.
MT	0.433-0.901			Cost for 10 years.
NL	2 300 (2023) + EUR million 17.7 a year		2 300 (2023) for the DGR. ~17.7 a year: Cost of the above-ground management of radioactive waste at COVRA: approx.	Up to 2130.
NL	2 300 (2023) + 17.7 a year		17.7: Annual cost to manage radioactive waste	Up to 2130. Deep geological repository cost estimate: EUR million 2 300 (2023).
PL	3 680 (2018)			Up to 2152.
PT	EUR 200 000 - 250 000 a year			Annual costs.
RO	EUR 4 864 + EUR 5.865 million EUR a year	1 860	123.7 plus additional 5.7 a year: predisposal activities 2 880 plus additional 0.165 a year: Disposal costs	Decommissioning estimate for four reactors.
SK	1 237 (2019)		No further details on other SF and RAW management costs.	No new information. These are only the total estimated decommissioning costs for one of the NPPs
SI	1 381	192.8	125.52, to be evenly divided between Slovenia and Croatia = 62.76 each LILW disposal costs: 136.88 in total, to be evenly divided between Slovenia and Croatia = 568.44 each. Cost of storing HLW and SF 29.8:	Up to 2112. The immediate decommissioning scenario. Cost of decommissioning does not include cost of storing HLW and SF. Costs shown for Slovenia are half the total cost (based on the agreements between Croatia and Slovenia). LILW disposal construction, operation and closure between 2024 and 2058. Cost of implementing the programme of research, development and demonstration

	Estimated total costs EUR million (*) (year of estimation)	Cost of decommissioning EUR million	Costs of management of radioactive waste and spent fuel EUR million	Assumptions
			Costs of HLW and SF disposal	activities in the area of RAW and SF management.
ES	28 156 (2023) of which EUR 20 200 is for 2024-2100.	5 787 of which 4 765 is for 2023-2100	18 846 of which 15 453 for 2023-2100	Estimate for 1985-2100, including the incurred costs. Open cycle, present fleet, closure of all operating nuclear power plants by 2035.
SE	10 673 (2022)	659: Costs already incurred 2 084: future costs	3 537: Costs already incurred 7 117: future costs	Reactors operating time of 60 years. Reference takes into account existing and planned facilities. Remaining basic costs from and including 2024 (SEK 1 = EUR 0.086).

(*) Otherwise specified.

Table 10: Financing mechanisms by Member State

	Financing mechanisms	Comments
AT	When radioactive waste is transferred to NES, the waste generator pays a fee consisting of two parts: - a treatment fee to cover the costs of processing and interim storage by NES; - a disposal fee (advance fee) that is collected by NES and transferred to the federal government, earmarked specifically for financing the subsequent disposal of the waste. However, Austria covers the cost of constructing the required management facilities and any major changes needed to meet current technical standards. Additionally, the federal government accepts responsibility for costs associated with the management and disposal of radioactive waste where no other provision or funding mechanism is in place.	NES reviews their fees annually.
BE	The cost of radioactive waste and spent fuel management are financed through two main mechanisms: - NPP operators' financing mechanisms to cover their spent fuel and waste management activities, the decommissioning of their installations and the transfer of waste to ONDRAF/NIRAS; - financing mechanisms by ONDRAF/NIRAS for management of the waste it accepts, including disposal. Three main funds below are in place. i. A long-term fund is financed by producers every time they transfer radioactive waste to ONDRAF/NIRAS, under a mechanism designed to ensure that ONDRAF/NIRAS can cover the fixed costs of storage and disposal, while also meeting variable costs as they arise. ii. A medium-term fund is financed by contributions from the producers, calculated on the basis of the total volumetric capacity of the disposal facility (surface or geological) and the total quantity of waste from each producer intended for disposal in that facility. The obligation for producers to contribute to the fund begins as soon as the disposal facility has received its nuclear construction and operating licence and the required non-nuclear permits. The amount set by law must be fully established no later than three months after the disposal facility has been authorised to start operations. iii. An insolvency fund to finance waste management services following the bankruptcy or insolvency of the financially liable bodies, as well as the management of orphan sources and radioactive waste. The fund is financed by invoicing producers a reserve of 5% calculated on the costs of the transport, treatment, conditioning, storage, and, since 2020, disposal services provided by ONDRAF/NIRAS. The federal state is responsible for financing the management of historical waste from the specified sites.	- Every five years, ONDRAF/NIRAS assesses whether the established and planned provisions are in place and sufficient to cover the management costs. - Every three years, the Commission for Nuclear Provisions assesses whether the provisions for NPP operators are in place, are sufficient and are available. - Since 2019, fee increases related to the long-term fund have been passed on to producers on the basis of their full radioactive waste production programme, covering both waste already transferred to ONDRAF/NIRAS and waste still to be transferred.
BG	Kozloduy NPP covers the costs of managing radioactive waste and spent fuel before transfer to SERAW by incorporating these costs into electricity prices. Long-term liabilities for decommissioning nuclear power plants and managing radioactive waste by SERAW are covered by two funds.	The financing system does not cover costs related to deep geological disposal.

	Financing mechanisms	Comments
	- The Radioactive Waste Fund covers costs of SERAW's radioactive waste management activities, including waste from Kozloduy NPP, nuclear applications, disused sealed radioactive sources, and legacy waste. The fund is financed from contributions by the radioactive waste generators. - The Nuclear Facilities Decommissioning Fund covers the decommissioning costs for Kozloduy NPP. The fund is financed from contributions by the Kozloduy NPP. The decommissioning of units 1-4 is also supported by the Kozloduy International Decommissioning Support Fund (KIDSF), set up to manage grants provided by the European Commission. Both funds are managed in separate accounts at the National Bank of Bulgaria, with financial management and supervision carried out by the Ministry of Energy.	
HR	The Fund for the Financing of the Decommissioning and Disposal of Radioactive Waste and Spent Nuclear Fuel from Krško Nuclear Power Plant (the Fund) is the primary mechanism for financing radioactive waste and spent fuel management. The Fund's resources come from three main sources: - quarterly payments from Hrvatska elektroprivreda d.d.; - management fees paid to the Fund by generators and owners of radioactive waste and DSRS; - payments from the Croatian state budget. The state budget also covers the costs of the management of institutional waste already in storage, as well as the costs of decommissioning and/or remediation of those research and storage facilities. The generators and owners of radioactive waste and DSRS are responsible for providing resources for the management of other institutional waste and DSRS.	
CY	Radioactive waste generators must bear all costs associated with managing their waste, from production to disposal, including the cost of monitoring waste and waste storage (or in future, repositories after their closure) and the cost of the required research and development. The export/shipment (or in future, processing, conditioning or treatment) of radioactive waste for disposal is paid for by the generator in the form of direct payments to the supplier/manufacturer of the sources or specialist organisations that carry out these activities, wherever applicable. The government is responsible for financing the management of radioactive waste where the generator no longer exists.	
CZ	Funding of predisposal activities is ensured by the own resources of radioactive waste and spent fuel generators. The costs of decommissioning, radioactive waste disposal, and spent fuel treatment and disposal are financed through the two main mechanisms described below. - The Nuclear Account Fund provides funding for the disposal of radioactive waste and spent fuel. The funds come from various sources, such as fees from radioactive waste generators, revenue from financial market operations, and interest from the nuclear account. The account is held at the Czech National Bank and administered by the Ministry of Finance.	

	Financing mechanisms	Comments
	- Decommissioning reserves. Nuclear operators and facilities with significant sources of ionising radiation set up and manage internal segregated funds, specifically intended to cover the future costs of decommissioning, thereby ensuring that sufficient financial resources are set aside to meet these obligations. Licensed operators authorised for the management of radioactive waste collect a fee from institutional waste generators when the waste is delivered.	
DK	The main mechanisms to finance radioactive waste and spent fuel management are the following. - The state budget. The financial resources for implementation of the national programme come from reserve fund allocations. These allocations are recorded as budget positions in the Financial Act, which is adopted annually by the Danish parliament. - Institutional waste generators are subject to management fees on delivery of waste to Danish Decommissioning. Fees are kept at a modest level in order to preserve the incentive for delivering waste.	
EE	Main mechanisms to finance radioactive waste and spent fuel management: - the state budget, as the vast majority of the waste to be managed is legacy waste; - institutional waste generators are subject to radioactive waste management fees on delivery of waste to AS ALARA.	
FI	Operators of nuclear facilities are responsible for financing the costs of the management of radioactive waste and spent fuel and the decommissioning of reactors. Additional backup funds are collected in the Nuclear Waste Management Fund. The obligation to make financial provision starts when the licence is granted for operations that produce nuclear or radioactive waste. For new NPPs, the obligation to set assets in the Fund starts when the NPP has an operating licence and fuel is loaded in the reactor. Institutional waste generators are subject to radioactive waste management fees when waste is delivered for storage or disposal.	
FR	Waste generators must estimate and make financial provision for their future liabilities. Operators of basic nuclear installations are required to maintain segregated assets, which are protected from company creditors and can only be used to cover specific liabilities. By contrast, operators of installations classified on environmental protection grounds that deal with radioactive waste are not required to have segregated assets, but must instead provide financial guarantees that meet specific value and quality requirements.	
DE	The main mechanisms to finance radioactive waste and spent fuel management are the following. - The German Nuclear Waste Management Fund (KENFO) provides funding for the disposal costs of radioactive waste from commercial nuclear power plants. The fund reimburses the federal government for the costs incurred from the moment the disposal obligation was transferred under the Act on the Transfer of Nuclear Waste Liabilities. The fund was created by transferring funds collected by NPP operators to the federal state. - Provision made by nuclear power plant operators ensure funding for the decommissioning, dismantling, and conditioning of radioactive waste in line with acceptance criteria set by BGE. - Provisions made by nuclear fuel cycle facilities and other nuclear installations, for which waste management costs are not covered by the KENFO. - For post-closure financing of a disposal facility, the required funds are provided by the federal government.	

	Financing mechanisms	Comments
	- The financing of the decommissioning of public-sector nuclear installations and facilities, including the management of associated radioactive waste, is ensured by the Federation and the Länder from the public budgets. The state also bears the costs for the closure of the Morsleben repository for radioactive waste and the Asse II mine. - Institutional waste generators pay a fee for the use of federal state collecting facilities, which ensure the long-term management of radioactive waste. The fees are intended to cover all expenses associated with the subsequent management of waste. A portion of these fees levied by the Land collecting facilities is related to the disposal of radioactive waste and is forwarded directly to the Federation. The decommissioning and associated waste management costs for the Joint Research Centre of the European Commission in Karlsruhe are financed by the EU's budget through a dedicated programme.	
EL	Multiple sources are used to finance radioactive waste management, such as: - the state budget; - the deposit fund; - the public investment programme and the Recovery and Resilience Facility.	
HU	The primary mechanisms for financing decommissioning, radioactive waste management, spent fuel management, and disposal costs is the Central Nuclear Financing Fund. Resources to this fund come from two main sources: - annual payments from the Paks NPP for the management of radioactive waste and spent fuel generated during operations and decommissioning; - contributions from the state budget to cover the management of spent fuel and institutional radioactive waste from the licence holders that are financed by the state. Additionally, costs associated with the management of institutional waste from small waste generators are borne by the generators themselves when the waste is transferred to the disposal facility.	
IE	The costs for the disposal of radioactive waste are borne by the company responsible for generating the radioactive waste. When the owner is unable to pay, the recovery of orphan sources or the storage of legacy sources is covered by the Radioactive Waste Management Fund, which is financed from the state budget.	
IT	Decommissioning and radioactive waste management for all publicly owned or financed nuclear installations are financed from the state budget. By contrast, funding for the management of radioactive waste of industrial, medical, and research origin is ensured by the waste generators themselves. The decommissioning and waste management costs for the Joint Research Centre of the European Commission in Ispra are financed from the EU's budget through a dedicated programme.	
LV	Radioactive waste generators are responsible for providing the financial resources for the management of their radioactive waste. This includes covering the costs of transporting the waste to WMO, as well as the costs associated with preparing the radioactive waste for disposal. The state budget finances historical nuclear liabilities, including the operation of the disposal facility, and the decommissioning of the Salaspils research reactor.	
LT	The radioactive waste and spent fuel management activities are financed through the following channels. - Decommissioning of Ignalina NPP and the management of associated radioactive waste and spent fuel are financed from the EU budget and the state budget. These sources fund the development of all new radioactive waste	- Lithuania allocates at least EUR 3 million annually to the Reserve (Stabilisation)

	Financing mechanisms	Comments
	management facilities being built or planned as part of the Ignalina NPP decommissioning process. This process includes the solid radioactive waste management and storage facility, the interim spent nuclear fuel storage facility, and the landfill and near surface disposal facilities. Although the Ignalina programme's funding is based on annual commitments, which can be accumulated over several years to fund major radioactive waste management infrastructure projects. - The implementation of the deep geological repository is financed from a separate account within the Reserve (Stabilisation) Fund. Contributions from the state budget are the main source of income. - Institutional waste generators are responsible for paying for waste collection, transportation, treatment, storage, and disposal services through contracts with the Ignalina NPP. The Ignalina NPP collects fees from institutional waste producers in a separate dedicated account. The management of historical institutional waste is funded from either the state budget or the municipal budget.	Fund, which is dedicated to collecting funds for the DGR. - An interinstitutional working group has been set up to prepare proposals for additional sources of income for the Reserve (Stabilisation) fund and to develop an optimised funding model for the DGR implementation project and its supervision.
LU	The cost of managing the radioactive waste sent to Belgium is paid by the Grand-Duchy of Luxembourg. In addition, the Luxembourgish government covers all related transportation expenses, as well as the costs of radioactive waste management from private individuals, public bodies, and radioactive material for which no legal holder has been identified. In all other cases, waste generators must bear all expenses.	
MT	The licence holders are responsible for ensuring sufficient financial resources to cover radioactive waste management costs. The cost of the management of the country's centralised storage facility is paid from central government funds.	
NL	Radioactive waste generators are responsible for covering the cost of waste management. COVRA incorporates the estimated cost of storage and geological disposal into the tariffs it charges to waste suppliers. A portion of the tariffs is allocated to a fund, which is expected to grow over the storage period, ultimately covering the costs of both above-ground storage and geological disposal. Producers of NORM waste who wish to dispose of their waste at a designated landfill must pay a fee to the province where the landfill is located. This fee is intended to cover the costs of operating the landfill, as well as the costs of monitoring the site after closure. The province is responsible for the aftercare and the monitoring of landfills. The decommissioning and associated waste management costs for the Joint Research Centre of the European Commission in Petten are financed from the EU's budget through a dedicated programme.	Once the tariffs are paid, the financial liability for the waste is transferred to COVRA.
PL	Radioactive waste generators are responsible for ensuring the financing of their waste management, from generation to disposal. The national WMO is authorised to charge fees for its services, which are reviewed annually. Where waste has no identified owner or if the funds raised prove insufficient, the state budget will provide financing to cover the shortfall.	
PT	Radioactive waste generators are responsible for covering the costs associated with their waste management. They are paying the fee for the delivery of the waste to the current storage facility. The difference between collected fees and actual costs is covered by the general state budget and other Instituto Superior Tecnico revenue. Cost of decommissioning the research reactor will be covered by the state budget.	
RO	Radioactive waste and spent fuel management activities are financed through the following channels.	

	Financing mechanisms	Comments
	- The cost of spent fuel and radioactive waste management activities at Cernavoda NPP, including the commissioning of the spent fuel dry storage, are covered by the operational costs. - The decommissioning of Cernavoda NPP and the disposal of associated waste are financed from segregated accounts at the national treasury, to which Cernavoda NPP makes an annual contribution. - The financing of the Baita Bihor disposal facility, the decommissioning of the research reactor, and the management of non-fuel cycle radioactive waste are primarily funded from the state budget.	
SK	The primary mechanism for financing decommissioning, radioactive waste management, spent fuel management, and disposal costs is the National Nuclear Fund. The fund ensures financing for the following activities: - decommissioning of nuclear installations operated at the Jaslovské Bohunice site (A-1, V-1, and V-2 NPP); - decommissioning and associated waste management of nuclear installations at the Mochovce site (Mochovce NPP 1-4); - decommissioning of new nuclear installations commissioned after 1 January 2019, including the management of radioactive waste from their decommissioning; - management of nuclear materials of unknown origin and radioactive materials of unknown origin; - implementation of disposal facilities; - management of institutional radioactive waste. The National Nuclear Fund's resources are generated from mandatory contributions or payments, which are held in sub-accounts or analytical accounts. These accounts also include income from depositing these funds and yields from financial operations.	
SI	Radioactive waste and spent fuel management activities are financed through the following channels. - The costs of radioactive waste and spent fuel management, treatment, and storage are included in the operating costs of the Krško NPP (NEK). - The costs of disposing Slovenia's share of radioactive waste and spent fuel are covered by a share of the revenue from the sale of electricity generated by NEK. This share is paid by the direct owner of the Slovenian half of NEK, i.e. GEN energija d.o.o., into the Fund for the Decommissioning of NEK. - The planning of the construction and operation of the repository and disposal of half of the LILW from NEK is financed mainly from the Fund for the Decommissioning of NEK and from the state budget. The key element that decides how the division is to be made between the two funding sources is the proportion of waste from NEK (in volume) and the proportion of waste from other sources (also in volume). - The operation and decommissioning of the TRIGA Mark II research reactor, as well as the management of its radioactive waste and spent fuel management, are financed from the state budget. - Financing the management of institutional radioactive waste comes from the central government budget and the payment made by users of the public service, i.e. when users deliver the waste to ARAO, the waste management organisation.	

	Financing mechanisms	Comments
	- The financial resources for the operation of RŽV, d.o.o. (a public company) are provided solely through the central government budget. The management, long-term surveillance and maintenance of both repositories will be financed through the central government budget as part of the public utility service of radioactive waste management.	
ES	The primary financing mechanism for implementing the General Radioactive Waste Plan is the Fund, which covers the costs of managing radioactive waste and spent fuel from all facilities, as well as activities associated with the decommissioning and dismantling of nuclear facilities. The decommissioning of other facilities is financed directly by licensees. The Fund is primarily financed by contributions from licence holders of nuclear and radioactive facilities, which are legally classified as non-tax contributions to a specific-purpose public fund. The main categories of contributions are described below. - A non-tax public charge relating to: (i) tariffs for managing radioactive waste and spent fuel from NPPs that were taken out of operation before 1 January 2010, and for decommissioning these facilities; (ii) future costs pertaining to NPPs or fuel assembly manufacturing facilities that, after their operation has definitively ceased, had not been anticipated during the operational stage; and (iii) any costs that might arise from the early shutdown of the facility for reasons beyond the control of the licensee. - A non-tax public charge relating to nuclear facilities still in operation. All costs incurred from 1 January 2010 in connection with the management of radioactive waste and spent fuel generated at operating NPPs will be financed by the NPP operators, regardless of the date on which the waste and fuel is produced, together with the costs of their eventual decommissioning and dismantling. The amount payable by each NPP during the operation of the facility is a charge on the electricity generated. - A non-tax public charge relating to the manufacture of fuel elements at the Juzbado facility, intended to cover the cost of the services provided in managing radioactive waste from fuel assembly manufacturing, including the dismantling of fuel assembly manufacturing facilities. The amount is calculated as a rate applied to the amount of nuclear fuel manufactured each year. - A non-tax public charge relating to other facilities is intended to cover the management services for radioactive waste generated at facilities other than those listed above, such as radioactive facilities (medicine, industry, agriculture and research), Ciemat, and other companies. In each case, the costs are applied to the parties concerned at the time the services are provided. The fee payable by the facilities is the result of multiplying the quantity or unit of waste delivered for management by the tax rates. The management of the Fund is entrusted to ENRESA and is governed by the principles of security, profitability and liquidity.	
SE	Radioactive waste and spent fuel management activities are financed through the following channels. - The Nuclear Waste Fund ensures the financing of decommissioning activities for nuclear power programme installations, as well as the management of associated radioactive waste and spent fuel, including disposal. Licence holders pay a fee to the fund and are also required to provide guarantees in the event of premature facility closure or to cover contingencies. If the fund's resources are insufficient to cover costs, licence holders remain liable.	

	Financing mechanisms	Comments
	- Nuclear licensees, other than power reactor operators, are also required to pay fees to the Nuclear Waste Fund and provide a financial guarantee to cover unpaid fees (the credit risk amount). - Institutional radioactive waste generators are responsible for securing financial resources for the management of their waste. In addition, there is a state financing scheme for the clean-up of orphan sources and other legacy waste that is administered by Swedish Radiation Safety Authority.	

5. Expertise, skills and R&D

5.1. Expertise and skills

All parties in Member States have ‘to make arrangements for education and training for their staff, as well as research and development activities to cover the needs of the national programme for radioactive waste and spent fuel management in order to obtain, maintain and to further develop necessary expertise and skills’ (Article 8 of the Directive).

Implementation of Article 8 has shown further improvements in some Member States: nearly all of them have set out national legal requirements for training and education of staff involved in radioactive waste and spent fuel management. National schemes and arrangements for education and training have remained largely unchanged and are summarised below:

- post-graduate courses at universities;
- training centres (basic and specialised, some at nuclear power plants);
- training programmes or plans (i.e. at national, facility or organisation level);
- regular self-assessments of staff and needs analysis;
- specialised, regular training for different levels of staff (e.g. on-the-job training with experienced staff);
- specialised courses (e.g. for newcomers or experienced staff).

Some Member States reported improvements, such as the development of new training programmes or the creation of training centres. However, other Member States still lack detailed information on the implementation of their legal requirements. In addition, around one fifth of Member States did not report any training and education activities for regulators or licensees.

5.2. Research and development

Each Member State’s national programme must include ‘the research, development and demonstration activities that are needed to implement solutions for the management of spent fuel and radioactive waste’ (Article 12(1)(f) of the Directive).

In the fourth national reports, Member States provided very little information on their planned research, development and demonstration activities. Research and development activities to build national radioactive waste and spent fuel management expertise were reported by around half the Member States. Only six Member States (mainly with large and medium nuclear programmes) reported on the progress of their research and development activities/programmes since the last reporting period. The other Member States did not report any information or reported only in general terms.

Unsurprisingly, mainly those countries without a nuclear power programme have difficulties in fulfilling the Directive's research and development requirements. By contrast, Member States with a nuclear power programme have, in general, more developed formal arrangements for training and education, and advanced research and development activities. Member States, particularly those without a nuclear power programme, have recognised that international exchanges of experience through peer reviews, workshops, conferences and technical visits are useful tools.

Most Member States with smaller nuclear programmes presented the research and development activities and time frames for the final disposal of intermediate-level waste, high-level waste and spent fuel in very general terms. Nearly half the Member States did not report any details or confirmed that they had no specific research programme in place. Member States with only disused radioactive sources in their inventories do not plan to develop specific research, development and demonstration programmes. However, they rely on participating in or following the results of international programmes or projects (e.g. through the IAEA and European Commission) that are in line with their radioactive waste management needs. Nevertheless, a few of these Member States, recognising the importance of research, plan to conduct their own research, development and demonstration activities and to describe them in future reviews of their national programmes.

Only a few Member States have put in place comprehensive research, development and demonstration programmes that support implementation of their national programmes. Several of these Member States regularly review and update their research programmes and are among those that have made significant progress in developing deep geological disposal facilities. These Member States typically carry out a national research programmes and actively participate in international research initiatives, such as Euratom research programmes. In addition, they participate, drive, and promote international cooperation and exchange forums that have been established at European and international level. Member States with smaller programmes also report participating in international research initiatives. Reporting is usually limited to the list of international projects in which they take part. Member States are encouraged to not only list international R&D projects in their national reports but also provide information on the expected impact of those projects on the implementation of their national programmes.

6. Transparency and public participation

National frameworks must include the national policy and process for transparency (Article 10 of the Directive). Member States have to ensure that the necessary information on the management of radioactive waste spent fuel is made available to workers and the general public (including information from the competent regulatory authority). They also must ensure that the public is given the opportunity to participate effectively in the decision-making process for radioactive waste and spent fuel management, in line with national legislation and international obligations.

All Member States' national programmes and reports contained information on the policy and regulatory arrangements governing transparency and referred to the obligation to inform the public as well as the consultation and participation mechanisms. Most Member States reported no significant changes in these policy and regulatory arrangements. A few Member States reported additional developments, improving their compliance with Article 10.

Information on activities related to radioactive waste and spent fuel management is publicly available in all Member States. Mostly institutional websites are the primary source of information; typically, information is found on the websites of the regulatory authorities and waste management organisations. Key documents (including national programmes, national reports, international evaluations, and annual reports) on strategies and their implementation are usually public. Countries with nuclear power plants generally use a range of information channels and techniques, that a broad audience can understand. Long-term decisions, such as the siting and construction of geological repositories, are often accompanied by national information campaigns.

Some Member States regularly provide information using other media or through information or visitor centres. In a few cases, regular meetings with the general public were reported. Several Member States reported that documents on licencing procedures for nuclear and radioactive waste facilities are public and easily accessible on the authorities' websites. In some cases, every official record of the regulators activities is systematically published.

Several Member States provided descriptions or recent examples of how their transparency policy is implemented in practice, especially effective participation practices. Member States are encouraged to give more examples and descriptions of practical implementation of their transparency policy.

Almost all Member States reported on consultation mechanisms set out in their national frameworks. Public consultation is required for political decisions with environmental implications, including those related to radioactive waste management. Consultations most often take place as part of strategic environmental assessments, environmental impact assessments or during the licencing of activities. In several countries, the adoption of new legislation with an environmental impact is also subject to public consultation. Member States are also encouraged to give more examples and descriptions of practical implementation of the consultation mechanisms in place.

In several cases, national reports and national programmes either did not provide any description of participation or only gave general explanations. The actual impact of public participation on the decision-making process was usually not explained.

Overall, most Member States are well aware of the importance of public information and participation relating to radioactive waste and spent fuel management and have ensured compliance with Article 10 in their national frameworks.