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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

{COM(2019) 632 final} - {SWD(2019) 435 final}

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LIST OF ABBREVIATIONS AND ACRONYMS

ARTEMIS	Integrated review service for radioactive waste and spent fuel management, decommissioning and remediation programmes
EIA	Environmental Impact Assessment
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
LLW	Low level waste
LTO	Long-Term Operation
IRRS	International Regulatory Review Service
NORM	Naturally Occuring Radioactive Material
RAW	Radioactive waste
SEA	Strategic Environmental impact Assessment
SF	Spent fuel
URL	Underground Research Laboratory
VLLW	Very low level waste

1. INTRODUCTION

This Staff Working Document presents details on the outcome of the Commission's assessment of European Union (EU) Member States' notifications on the implementation of Council Directive 2011/70/EURATOM on responsible and safe management of spent fuel and radioactive waste (the "Directive")[1]. This document is primarily based on the information provided in Member States' national programmes for the management of spent fuel and radioactive waste[2] and national reports on the implementation of the Directive[3], as notified to the Commission by March 2019[4]. It provides background information related to the main findings, progress, challenges, and trends presented in the Second Commission Report COM(2019) 632 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 future prospects.

All Member States submitted their second national reports to the Commission by March 2019 and a few Member States also notified to the Commission their final or updated national programmes during the reporting period. In the previous reporting cycle in 2015 most of the EU Member States notified their national programmes for the first time and submitted national reports on the implementation of the Directive at the same time. In most of the cases Member States focused in their national reports on national policies and principles, national frameworks, national programmes and their implementation. As this is the second time that Member States report on the implementation of the Directive, particular attention was given by the Commission to the progress made during the reporting period by the Member States in implementing the Directive.

The second Commission report is based on the information provided in the Member States' national programmes and their second national reports. Its intention is to provide the Council and European Parliament with the comprehensive overview on spent fuel and radioactive waste management in the EU.

2. STATUS OF IMPLEMENTATION

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

2.1.1. National policies

Member States are required to establish and maintain national policies on spent fuel and radioactive waste management. It is a key provision for long term responsible and safe management of spent fuel and radioactive waste.

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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.

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

3 Article 14(1) of the Directive.

4 The deadline in the Directive is 23 August 2018. However, the last national report has been notified to the Commission in March 2019.

According to the Directive each Member State shall bear ultimate responsibility for the management of the spent fuel and radioactive waste generated in it. It is up to the Member States to take a decision whether they will build a single disposal facility for all radioactive waste or a number of facilities for different waste types.

Although the Directive requires that the radioactive waste be disposed of in the Member State in which it was generated, it introduces conditions under which the radioactive waste could be disposed of in another Member State or in a third country (Article 4(4) of the Directive). The export of radioactive waste for disposal[5] in another Member State or in a third country is in practice considered by most Member States without a nuclear programme, or which have one or several research reactors and relatively small quantities of low level waste (LLW) and intermediate level waste (ILW). More details on shipments of radioactive waste and spent fuel within the EU and to third countries is provided in section 2.1.5 of this Staff Working Document.
Article 4(3) of the Directive defines a number of principles national policies shall be based on:

- Keeping the generation of radioactive waste to a minimum;
- Ensuring that the interdependencies between all steps in spent fuel and radioactive waste management are taken into account;
- Safe management of spent fuel and radioactive waste and passive safety features for long term safety;
- Graded approach in implementation of measures for spent fuel and radioactive waste management;
- The costs for the management of spent fuel and radioactive waste shall be borne by those who generated those materials;
- Evidence-based and documented decision making process to all stages of spent fuel and radioactive waste management.

Since the first Commission report few changes took place, however the situation remains broadly the same. Comprehensive national policies for management of spent fuel and radioactive waste are established in the majority of Member States. Since their first national report, three Member States have amended their national policy to include specific types of radioactive waste or spent fuel not included in the previous report, and two other Member States are performing studies on possible options for the final disposal of all their radioactive waste. With the submission of a revised national programme, Ireland has changed its policy by excluding development of a disposal facility. The development of a new policy and a new national programme is ongoing in Denmark. However, the national policy in a few countries still does not cover all types of their radioactive waste or spent fuel.

Most Member States established clearly in their laws and regulations the ultimate responsibility of the State for management of the spent fuel and radioactive waste generated on its territory, however in most cases no details on the practical implementation have been provided.

[5] 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".

Although for most of the Member States, the default option set out in the national policy is the final disposal in the Member State's territory, shared solutions or export of radioactive waste for disposal in another Member State or in a third country is considered as an option by most Member States without a nuclear programme and by some Member State with a relatively small nuclear programme. In this case long term storage[6] (up to 100 years or more) in the Member States is foreseen as an interim step. Croatia is expected to take a decision by 2023 on whether to opt for a shared solution for disposal of spent fuel from the Krško nuclear power plant.

In a few Member States with a nuclear programme, the spent fuel is sent for reprocessing while most of the Member States with a nuclear programme have opted for its direct disposal without reprocessing. A few Member States have kept open the decision to opt for reprocessing or direct disposal of the spent fuel.

The majority of Member States manage radioactive waste on their territory, while a number of Member States send radioactive waste for processing abroad. In the latter case, as per Article 4(2) of the Directive, the Member State of origin remains responsible for the secondary waste as a by-product generated during the processing.

All Member States have included the principles stated in Article 4(3) of the Directive in their legislation. However, although some Member States provide more information in the second national report than in the first, still limited information on the practical implementation of the policy principles have been provided. Over a third of Member States did not report on how all principles have been implemented in practice. Only a few Member States, mainly with large nuclear programmes, provided detailed examples on how the principles defined in Article 4(3) are applied in practice.

2.1.2. National programmes, timeframes and key performance indicators

NATIONAL PROGRAMMES

Member States are required to establish national programmes for spent fuel and radioactive waste management, which define the measures, timeframes and milestones for the practical implementation of national policies. They were also required for the first time to notify these programmes to the Commission before 23 August 2015.

Whereas in 2015 some national programmes were still draft versions, now 27 Member States have legally approved and adopted national programmes. The majority of the programmes have been adopted in the 2015-2016 period, while in one Member State the programme dates as of 2006. Submission of the updated programme[7] (as per Article 13(1) of the Directive) is expected by the Commission. The most recent national programmes date from 2017 (5 Member States) and 2018

[6] Storage is defined in Article 3(14) of the Directive as "the holding of spent fuel or of radioactive waste in a facility with the intention of retrieval".

[7] Spain is in process of updating of its existing national programme for the management of spent fuel and radiaoctive waste.

(4 Member States)[8]. As of September 2019, Italy is the only Member State without a legally approved and adopted national programme.

The majority of the Member States have defined in their legal framework the responsibilities for review, update and implementation of the national programmes, as well as specific arrangements, deadlines and conditions fur such review and update (see Table 1).

Incentives for reviewing and updating the national programmes are most often recommendations of IAEA IRRS and/or ARTEMIS missions, letters of formal notice of non-compliance with the Directive sent by the Commission, and/or national decisions taken on changes to the national policy or national programme, as well as the establishment in some cases of a fixed period for review and update. About one fourth of the Member States have established in their national framework a fixed maximum period of time to carry out the review or update of the national programme. Among the rest, several Member States have announced that their national programmes will be reviewed or updated in the near future. This shows that review mechanisms are an important tool leading (in most cases) to an improvement of the national programmes and national frameworks.

Four of the national programmes that were notified by March 2019 are updates of programmes submitted to the Commission since the adoption of the Directive. Two out of these four have been revised to take account of significant changes in their national framework, whereas the other two were revised following a fixed frequency as established by their national framework.

The Member States that have revised their national programmes to comply with the review periodicity established in their national framework usually include a thorough update of the milestones and timeframes, as well as a detailed description of the progress of the implementation of the programme. The main improvements of these two national programmes are the inclusion of long-term environmental risks, better quality in the estimation of the inventory, and improvements in the interim storage of radioactive waste and spent fuel.

The Member States that have revised their national programmes to account for significant modifications of their national framework have made changes in the roles and responsibilities of the entities responsible for several aspects of the radioactive waste management, and have included legal or organisational changes, implementation of recommendations of international peer-review missions, significant improvements of the national programme, etc.

Almost all of the national programmes cover all types of radioactive waste and spent fuel, but only a few have developed concrete plans from generation to disposal, including deep geological disposal for spent fuel and high level waste. A few Member States recognise the existence of exotic waste from research activities and remediation activities for which a management route needs still to be developed.

Of the fourteen Member States with operating nuclear power plants, a few of them have not yet decided the long-term management option for their spent fuel. In some of these cases, the strategy

[8] Two Member States also notified their revised national programmes to the Commission, respectively in July and September 2019. Modifications resulting from these revised national programmes are not reflected in the present SWD, as this document is based on information notified to the Commission by March 2019.

is to continue implementing the national programme as if the spent fuel were to be disposed of directly, whereas in other cases, no irreversible activities will be implemented before the relevant decision is finally taken.

Member States with nuclear programmes focus on the management of spent fuel and radioactive waste generated in the nuclear industry, and provide much less detail on the management of institutional radioactive waste. The amount of institutional radioactive waste is very small in comparison with the waste generated in the nuclear industry, and is incorporated in the radioactive waste management routes already established.

The national programmes of Member States which have no nuclear power programmes, but have research reactors, address all types of radioactive waste and spent fuel generated from research reactor operation. Only two of these Member States intend to continue the operation of their training and research reactor beyond 2025 and 2040 respectively. The rest has already shut down their research and training reactors. Three of the Member States with research reactors have plans to ship their spent fuel back to the USA. Another one has shipped its spent fuel to the Russian Federation between 2005 and 2008. In addition, two Member States plan to dispose of their spent fuel from research reactors in their territory. One of them will explore the possibility of finding an international solution for the disposal.

The national programmes of Member States with no nuclear programmes and no resarch reactors cover all types of radioactive waste, but these Member States have not yet defined a policy or a route for their disposal, (beyond centralised storage) except in one case. Notwithstanding, they have established decision-making milestones to progressively define more concretely the long term management and disposal of radioactive waste. Most of the Member States without nuclear power programmes consider finding a shared disposal solution. Luxembourg has recently concluded an agreement with Belgium for the management of part of its radioactive waste. The agreement has been ratified by the two Member States.

To summarize, most Member States needs to improve both their reporting quality, as well as adopting more concrete policies in order to avoid postponing the important decisions and thereby placing burdens on future generations. Table 1 (below) gives an overview of all organisations in Member States responsible for developing the programme for managing radioactive waste and spent fuel, the entity approving it, as well as well as the frequency of their (national) review and update requirements. In some cases, the entity responsible for developing the programme and approving the programme is the same, which is not considered best practice.

Table 1. Member States' National Programmes under Directive 2011/70/EURATOM

MS[9]	Organisation developing the programme	Organisation approving	SEA	Review and latest update
AT	Federal Government	Federal Government	Yes	No fixed periods or sets of conditions for review. Adopted in 2018.
BE	National Programme Committee 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	Federal Council of Ministers	No	Regular update when a national policy is adopted or amended.
BG	The review and update of the Programme are carried out by an interdepartmental working group which is appointed by the Minister for Energy and comprises representatives of the Ministry of Finance, the Ministry of Environment and Water, the Ministry of Health, the Nuclear Regulatory Agency, the Institute for Nuclear Research and Nuclear Energy, Kozloduy NPP EAD and the State Enterprise Radioactive Waste (SERAW).	The Council of Ministers	Yes	Every 5 years. 2011 Strategy was revised in 2015. The next revision in 2019.
CY	Radiation Inspection and Control Service (RICS), Department of Labour Inspection (DLI), Minister of Labour, Welfare and Social Insurance (MLWSI)	MLWSI	No	Every 10 years at least by RICS.
CZ	Ministry of Industry and Trade	Government	Yes	Once every 10 years. Last revision in 2014 and the next revision is planned in 2019.
DE	Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety	Federal Cabinet	Yes	Costs and financing, radioactive waste inventory updated every 3 years. Periodicity of update of national programme not clearly stated.
DK	Danish Health Authority	Ministry of Health	No	Not defined in the national programme.

[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), Sweden (SE) and the United Kingdom (UK).

MS[9]	Organisation developing the programme	Organisation approving	SEA	Review and latest update
				A new national policy and associated programme is to be established due to adoption of parliamentary resolution 890/2018 (currently under development).
EE	The updated National Programme has been coordinated by the Ministry of Environment, with participation of A.L.A.R.A. AS, Radiation Monitoring Bureau, QPRE OÜ, the Environmental Board, and experts.	Ministry of the Environment, and coordinated with the Ministry of the Interior, the Ministry of Economic Affairs and Communications, and the Ministry of Finance.	Yes[10]	Regular update at least every 10 years. Last revision in 2018.
EL	Greek Atomic Energy Commission (EEAE)	Minister responsible for the EEAE, the Minister for Education, Research and Religious Affairs	No data	At least once every 3 years and updated by EEAE, upon agreement of the National Committee for Radioactive Waste Management (EEDRA). First revision of the national programme by the end of 2019.
ES	ENRESA[11]	Government upon proposal by Ministry of Industry, Energy and Tourism, being heard the CSN and relevant Autonomous Communities	Yes	Periodic review. 2006 programme is being revised.
FI	Ministry on Employment and the Economy	Ministry on Employment and the Economy	No	The national programme shall be updated on the basis of the results of the self-assessment/international peer-review (every 10 years).
FR	The national programme (PNGMDR) is reviewed and updated every three years by a pluralistic working group co-chaired by the DGEC (Directorate General for	Government	Yes	Every 3 years.

10 The national programme states that SEA is available.

11 The legal basis requires ENRESA to submit to the Ministry of Industry, Energy and Tourism every 4 years, or whenever so required by this Ministry, a draft update of the programme.

MS[9]	Organisation developing the programme	Organisation approving	SEA	Review and latest update
	Energy and Climate) and ASN (French Nuclear Safety Regulatory Authority), and integrated by waste producers and managers, environmental protection associations, administrations, experts, the HCTISN (French High Committee for Transparency and Information on Nuclear Safety) Defence Nuclear Safety Regulator (ASND), and IRSN. The Plan is based on the national inventory of radioactive materials and waste, periodically published by Andra. The Plan is later submitted to, and integrates the comments of the OPECST (Parliamentary Office for the Evaluation of Scientific and Technical Choices),			
HR	State Office for Radiological and Nuclear Safety (DZRNS)	Government of the Republic of Croatia	Yes	The Radioactive Waste and Spent Nuclear Fuel Disposal Programme shall be reviewed every five years at least. The Decommissioning Programme shall be reviewed every five years at least. Adopted in 2018.
HU	Ministry of Innovation and Technology	Government after SEA completion	Yes	Every 5 years
IE	Department of Communications, Climate Action and Environment (DCCAE).	Government	No	Update and revision as necessary. Last revision in 2018.
IT[12]	Ministry of Environment and Protection of Land and Sea, Ministry of Economic Development	Ministry of Environment and Protection of Land and Sea, Ministry of Economic Development	Yes	Every 3 years.
LT	Ministry of Energy on the proposal of a Radioactive Waste Management Organization	Government	Yes	Every 7 years at least.
LU	Radioprotection Division (DRP) within the Department of Health	No available information	No data	No information on periodicity of national programme update.
LV	Minister for Environmental Protection and Regional Development	Council of Ministers	Yes	Every 10 years.
MT	Radiation Protection Commission	Radiation Protection	No	No information.

12 Data provided by Italy in response to infringement procedure, as no national programme is adopted.

MS[9]	Organisation developing the programme	Organisation approving	SEA	Review and latest update
		Commission	data	
NL	Ministry of Infrastructure and Environment	Parliament	No	At least every 10 years.
PL	Ministry of Economy	Council of Ministers	Yes	Every 4 years. The next revision in 2019.
PT	Regulatory Commission for the Safety of Nuclear Installations (COMRSIN)[13]	Council of Ministers	Yes	The next revision in 2019.
RO	Nuclear Agency and for Radioactive Waste (ANDR)	No available information	Yes	Every 5 years.
SE	Swedish Radiation Safety Authority	Ministry of the Environment and Energy	No	Every 10 years.
SI	Agency for Radioactive Waste Management (ARAO) and Slovenian Nuclear Safety Administration (SNSA)[14]	National Assembly	No	Every 10 years.
SK	The administrative board of the National Nuclear Fund for decommissioning nuclear installations and managing spent nuclear fuel and radioactive waste (NNF)	Government	Yes	Every 6 years. The next revision in 2021.
UK	The Lead Document has been prepared by the Department of Energy and Climate Change (DECC) with the cooperation of the Devolved Administrations, waste management organisations and regulators	Department of Energy and Climate Change	No	At least every 10 years.

NORM WASTE

Around half of all EU Member States addressed naturally occurring radioactive material (NORM) in their programmes, whereas the rest either explicitly exclude it from the scope of their national programmes, or do not mention it. This approach is in line with the Directive.

TIMEFRAMES

The Directive requires the national programmes to cover the whole period until disposal of all radioactive waste (Article 11(1)). The overall timescale of Member States' programmes for spent fuel and radioactive waste management vary significantly due to the scope and scale of the current nuclear programmes in each Member State, but can extend to more than one hundred years, excluding long term monitoring. This imposes challenges for the Member States, in particular the

13 Following the entry in force of the new regulatory framework for radiation protection nuclear safety and safe management of radioactive waste on 2 April 2019, the Portuguese Environment Agency became the regulatory authority for Portugal succeeding COMRSIN.

14 ARAO provides the technical basis for the revision of the Programme and based on this, SNSA prepares a draft National Programme which is adopted by National Assembly.

ones with nuclear programmes, to ensure long term safety measures for several decades to centuries in the future.

About two thirds of the Member States have defined milestones and timeframes for their entire programme. A few Member States have developed milestones and timeframes only up to the period of validity of their national programme, or up to the point in which the policy for management of radioactive waste and spent fuel is no longer defined, which is not in line with the Directive. In general terms, the milestones and timeframes are better i.e. more precisely defined for the short-to-medium term, and become more diffuse as the programme progresses in time.

KEY PERFORMANCE INDICATORS

Key performance indicators as required by the Directive allow monitoring the progress of implementation of the national programme. However, only a few Member States have defined key performance indicators in their national programmes. Around one fourth of the Member States use milestones and timeframes defined in their national programmes as means to measure the progress of implementation. This approach may allow monitoring the fulfilment of specific goals in the national programme, but cannot replace a set of well defined key performance indicators which provide more appropriate means to monitor the progress of implementation.

One third of the Member States do not define key performance indicators at all in their national programmes.

The long time frames and associated key performance indicators are a necessary tool, given the long-term nature of most radioactive waste and spent fuel management programmes. Radioactive waste and spent fuel is expected to be also generated from nuclear power plants when decommissioned (please see table 2 for the current schedule of decommissioning of EU nuclear power plants), which shows that the next few decades will see large amounts of such waste being generated.

Table 2. Schedule for Decommissioning of Nuclear Power Plants in EU Member States[15]

MS	Reactors/Units	Start	Shutdown	Decommission-ing	Comments
BE	Doel (unit 1)	1975	2025		End of operation dates by Phase-out Law of 31/01/2003 modified by the law of 28/06/2015.
	Doel (unit 2)	1975	2025		Same as for D1
	Doel (unit 3)	1982	2022		
	Doel (unit 4)	1985	2025		
	Tihange (unit 1)	1975	2025		Same as for D1
	Tihange (unit 2)	1983	2023		

15 At the time of reporting to the Commission (2018).

MS	Reactors/Units	Start	Shutdown	Decommission-ing	Comments
	Tihange (unit 3)	1985	2025		
BG	Kozloduy (unit 1)	1974	2002	Ongoing	Available data until 2030
	Kozloduy (unit 2)	1975	2002	Ongoing	
	Kozloduy (unit 3)	1980	2006	Ongoing	
	Kozloduy (unit 4)	1982	2006	Ongoing	
	Kozloduy (unit 5)	1987	2047		30 years LTO
	Kozloduy (unit 6)	1991	2021 (2051)		Planned 30 years LTO
CZ	Dukovany (units 1-4)	1985-1987*	2038 - 2047		LTO
	Temelin (units 1-2)	2000-2002*	2060-2062		60 years operation
	Dukovany (unit 5)	Planned	No available data		60 years operation
	Temelin (unit 3)	Planned	No available data		60 years operation
DE	10 reactors shutdown	1975-1984	2011-2017		
	7 reactors in operation	1984-1989	2019-2022		
ES*	2 reactors undergoing decommissioning (José Cabrera and Vandellos I)	1969-1972	2006 and 1989	Ongoing	
	1 reactor shutdown (Santa María de Garoña)	1971	2012		
	7 operating reactors*	1981-1988	2021-2027		Assuming 40 years operation
FI	Olkiluoto (unit 1)	1979	2049*	2080-2090	
	Olkiluoto (unit 2)	1982	2042*	2080-2090	
	Olkiluoto (unit 3)	Planned 2019	2078*	2075-2085	
	Loviisa (unit 1)	1977	2027*	2030-2035	
	Loviisa (unit 2)	1981	2030*	2030-2035	
	Hanhikivi	Planned 2028*		2085-2100	
FR	58 reactors and 9 shutdown reactors and EPR Flamanville	1977 – 1999 (operating fleet)	Between 2027 and 2078	After 2030	Operating lifetime of 50 years
HU	Paks (units 1-4)	1982-1987	2032-2037	2061	20 years LTO
	Paks (units 5-6)	2029-2030*			Planned
IT	Caorso	1978	1990	Ongoing	
	Enrico Fermi	1964	1990	Ongoing	
	Garigliano	1964	1982	Ongoing	
	Latina	1963	1987	Ongoing	
LT	Ignalina (unit 1)	1983	2004	Ongoing until 2038	
	Ignalina (unit 2)	1987	2009	Ongoing until 2038	

MS	Reactors/Units	Start	Shutdown	Decommission-ing	Comments
NL	Dodewaard	1968*	1997*	After 2045	
	Borssele	1973*	2033		
PL	New build	2024	2084		
RO	Cernavoda (unit 1)	1996	2026	2063	Possible LTO to 2046
	Cernavoda (unit 2)	2007	2037	2055	Possible LTO to 2057
	Cernavoda (units 3-4)	Planned 2019-2020	Planned	Immediate dismantling	
SE	Barsebäck (units 1-2)	1975 1977	1999 2005		
	Forsmark (units 1-3)	1980 1981 1985	2023 2023 2025		
	Oskarshamn (units 1-3)	1972 1975 1985	2017 2015 2025		
	Ringhals (units 1-4)	1976 1975 1981 1983	2020 2019 2023 2023		Ringhals 1-2 planned shutdown before the end of 2020
SI	Krško	1983	2023	2023	Option to extend lifetime operation up to 2043
SK	Bohunice V1 (units 1-2)	1978* 1980*	2006 2008	Finished in 2025	
	Bohunice V2 (units 1-2)	1984* 1985*	2024 or 2044 2025 or 2045	2031-2048 (40 years operation) 2051-2068 (60 years operation)	Possible LTO to 60 years of operation
	Bohunice A1	1972*	1979	2033	
	Bohunice (unit 3)	Planned (2029)	2089		
	Mochovce (units 1-2)	1998* 1999*	2028 or 2046 2029 or 2066	2046-2063 (40 years of operation) 2066-2083 (60 years of operation)	Possible LTO to 60 years
	Mochovce (units 3-4)	Under construction (2021)	2062 2082	2062-2079 (40 years of operation) 2082-2099 (60 years of operation)	Possible LTO to 60 years
UK*	15 (14 AGR, 1 PWR) reactors in operation	1976-1989	2023-2035 (or 2055)	2023-2083	Possible PWR LTO to 60 years
	30 reactors shutdown				

MS	Reactors/Units	Start	Shutdown	Decommission-ing	Comments
	New build (Hinkley Point C, further 5 plants proposed)				

*Information from other sources to the Commission than the national programmes and national reports

Most of the Member States have reported progress in the implementation of the national programmes in their national reports, mainly by describing what has been achieved since the last report, and many Member States have updated their milestones and timeframes. However, not even the few Member States that have defined key performance indicators in their national programmes report on the status of these indicators in their national reports.

In general terms, and except for a few cases, the implementation of the national programmes is progressing according to the schedule. In some cases, some milestones have been delayed, in other cases they have been brought forward, but without jeopardising the overall implementation in the longer term.

In a few cases, decision timeframes regarding the selection of sites for radioactive waste disposal (generally deep geological disposal for Member States with nuclear programmes, and centralised storage or disposal sites in Member States without a nuclear programme) have been postponed. Ensuring the sufficient storage capacity for radioactive waste and spent fuel until the disposal facilities are available has already been reflected by the Member States e.g. in their plans to monitor the generation of radioactive waste and spent fuel, and their plans to build interim storage facilities.

Member States are expected to progressively define key performance indicators in their national programmes and report on the status of these indicators in the periodic national reports so that the progress of implementation of the national programmes, and the progress of radioactive waste management and spent fuel in the EU at large can be more easily assessed.

2.1.3. National legal and organisational frameworks

Member States are required to establish and maintain a national legislative, regulatory and organisational framework ('national framework') for spent fuel and radioactive waste management that allocates responsibility and provides for coordination between relevant competent bodies (Article 5(1) of the Directive). Member States were required to transpose the Directive by 23 August 2013. This section of the report presents the status of Member States' legal and organizational frameworks, while the regulatory framework is detailed in Section 2.1.4 below.

In the first report the Commission stated that all Member States have communicated to the Commission their transposition measures and declared full transposition. During the conformity assessment of the latest notified legal measures the Commission concluded that the transposition in several Member States is still incomplete. Some Member States already have indicated additional measures to ensure full transposition.

In the second national reports Member States have presented their national framework with different level of details. Most Member States kept the same reporting approach as in the first national reports by listing the legal arrangements and the provisions for the national framework, and only in some cases the national reports have provided details on how those legal provisions are implemented in practice. While reporting changes and developments in the reporting period most Member States only provided a list of new or ammended legal acts without specifying what are the actual impacts of those changes (e.g. is there any change introduced by the new or amended legal acts to the allocation of responsibilities or to the coordination between relevant competent bodies). This approach diminishes the usefulness of the reports, and needs to improve.

It can be noted that Member States with nuclear power plants are more advanced in establishing and maintaining national legal and organisational frameworks, since the main part of the legislation required in the Directive is already present in the Member States´ national laws. Some Member States without nuclear power plants struggle with transposing the Directive (Council Directive 2011/70/Euratom) as they are in the process of transposing the Council Directives 2014/87/Euratom (Nuclear Safety Directive)[16] and 2013/59/Euratom (Basic Safety Standards Directive)[17].

Once a national framework is fully implemented a step-wise improvement of the national framework, through self-assessments and international reviews, can be effectively pursued. Most Member States require an update and improvement of the national framework as per Article 5(2) of the Directive, and establish the responsibilities for that. In general, improvements of the national framework are mainly made through international peer reviews (i.e. IAEA IRRS and ARTEMIS peer-review services). The Commission notes that Member States with nuclear power programmes are more inclined to make self-assessments of the national framework and implement these more rapidly. Almost half of the Member States hosted an IRRS and/or ARTEMIS peer-review during the reporting period (mainly in 2017-2018) and the resulting outcomes/recommendations' implementation/improvements are expected in the following reporting period. Overall, IAEA IRRS and ARTEMIS peer-review missions significantly contribute to the national framework improvement of Member States without nuclear power programmes. Member States with nuclear power programmes already have a comprehensive national framework in place due to regular self-assessments and IAEA peer-reviews in the past.

All Member States have established laws or regulations requiring to take into account operating experience, insights gained from the decision-making process and the development of relevant technology and research. However, most Member States provide in their second national reports very little detail on how the development and review of the national framework takes into account operating experience or research in practice.

All nuclear power and most of non-nuclear power Member States have dedicated radioactive waste management organisations. In their second national reports two Member States (Germany

16 Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations, OJ L 219, 25.7.2014, p. 42–52.

17 Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom, OJ L 13, 17.1.2014, p. 1–73.

and Lithuania) reported significant changes. In most of the cases waste management organisations are public entities (see Table 3), while a few are established by the nuclear power plant operators. In both cases, funding of spent fuel and radioactive waste management activities is based on the principle that the generators of spent fuel and radioactive waste cover the costs associated with the management of this material. In addition to the responsibilities for spent fuel and radioactive waste management, in a number of cases, these organisations deal also with decommissioning. In some cases, it is foreseen that the responsibilities for the disposal facilities will be transferred from the radioactive waste management organisations to the State after the closure of the disposal facility.

Several Member States reported recent reorganisations of their radioactive waste management organisations. The current list of the radioactive waste management organisations in the EU is given in Table 3.

Table 3. Radioactive waste management organisations in the EU

MS	Radioactive waste management organisation	Public/ private	Responsibilities
AT	Nuclear Engineering Seibersdorf GmbH (NES)	Public/ private	Collecting, processing, conditioning and storing radioactive waste, decontaminating installations and laboratories.
BE	Organisme national des déchets radioactifs et des matières fissiles enrichies/Nationale instelling voor radioactief afval en verrijkte splijtstoffen (ONDRAF/NIRAS)	Public	Managing radioactive waste from all sources, managing spent fuel when declared as radioactive waste, including disposal.
BG	State Enterprise Radioactive Waste (SE RAW)	Public	Radioactive waste and spent fuel management and decommissioning.
CZ	Radioactive Waste Repository Authority (SURAO)	Public	Operation of all low and intermediate level waste repositories. monitoring of the now closed Hostim repository, development of deep geological repository for disposal of HLW and spent fuel.
DE	Federal Company for Radioactive Waste Disposal (BGE)	Public/ private legal entity	In July 2016, the Bundesgesellschaft für Endlagerung mbH (BGE) was founded as a private-law entity under the sole ownership of the Federal Government. Its remit is to act as a project sponsor for the planning, construction, operation and decommissioning of final repositories, and manage the relevant funds. Operator responsibilities were transferred to BGE on 25 April 2017.
	Federal Company for Radioactive Waste Storage (BGZ)	Public/ private legal entity	Interim storage of irradiated fuel elements and radioactive waste generated by the operators referred to BGZ by the Act reassigning responsibility for radioactive waste management. Since August 2017, BGZ has operated the centralised interim storage facilities in Ahaus and Gorleben. On 1 January 2019, responsibility for the 12 decentralised interim storage facilities at the sites of the German nuclear power plants was transferred to BGZ. On 1 January 2020, responsibility for the 12 interim storage facilities for low-level and intermediate-level radioactive waste at the nuclear power plant sites (as referred to in the Act) will also be transferred.
DK	Danish Decommissioning (DD)	Public	Decommissioning and receiving, handling and storage of radioactive waste. Also licensed operator for all radioactive waste.
EE	A.L.A.R.A. AS	Public	Former Paldiski nuclear site and Tammiku radioactive waste repository management and decontamination.
EL	National Committee for Radioactive Waste Management (EEDRA)	Public	EEDRA is a collegiate body with advisory and supportive role towards the Minister on the implementation of the practical aspects of the national policy and national framework and on the coordination of the bodies involved in RW management. EEDRA can be interpreted as having a WMO-like role in the country by being independent from the waste producers,

MS	Radioactive waste management organisation	Public/ private	Responsibilities
			maintaining its autonomy in relation to the regulatory authorities due to its diverse composition, and having a flexible, optimal and effective form.
ES	National radioactive waste company (ENRESA)	Public[18]	Management of radioactive waste and spent fuel, decommissioning nuclear power plants.
FI	POSIVA	Private[19]	Radioactive waste management facilities - site selection, design, construction, commissioning, operation, rehabilitation and reconstruction, decommissioning and closure/post closure.
FR	National agency for management of radioactive waste (ANDRA)	Public	Long-term management of radioactive waste.
HR	Radioactive Waste Management Centre (RWMC)	Public	The Centre for the Management of Radioactive Waste is a unit of the Fund for financing the decommissioning of the Krško Power Plant and the management of the Plant's radioactive waste and spent nuclear fuel and comprises the facilities for the processing, conditioning, handling, long-term storage and disposal of radioactive waste and disused sources originating on the territory of the Republic of Croatia, including the central repository, and radioactive waste and spent nuclear fuel which did not originate on the territory of the Republic of Croatia but for which there is a waste management obligation under the International Treaty.
HU	Public Limited Company for Radioactive Waste Management (PURAM)	Public	Management of all types of radioactive waste, decommissioning of nuclear facilities, as well as related to research and development.
IT	Company for the Nuclear Installations Management, Società Gestione Impianti Nucleari (SOGIN)	Public	Treatment and conditioning into certified form of all liquid and solid wastes, ready to be delivered to the National Repositor. Perform all the actions needed for managing spent fuel; contribute to the decommissioning of all nuclear facilities owned by other licensees. Implement the single phase decommissioning strategy in all nuclear installations, reactors and fuel cycle facilities, pending the realization in due time of the temporary and final repository of radioactive waste.
LT	State Enterprise Ignalina Nuclear Power Plant	Public	Assigned as sole entity which is responsible for safe management of all the Lithuanian radioactive waste and spent nuclear fuel, defined major requirements for the preparation of the final closure plan of the disposal facility.
LV	Latvian Environment, Geology and Meteorology Centre (LEGMC)	Public	Processing, reprocessing, storage for an extended period of time (long-term storage) and disposal of radioactive waste.
NL	The Central Organisation For Radioactive Waste (COVRA)	Public	Implementing the Dutch policy with regard to radioactive waste in the Netherlands. Treatment and storage of all radioactive waste and spent fuel.

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

19 Owned by the NPP operators Teollisuuden Voima Oyj and Fortum Power & Heat Oy.

MS	Radioactive waste management organisation	Public/ private	Responsibilities
PL	Radioactive Waste Management Plant (ZUOP)	Public	Collection, segregation, and treatment, conditioning and interim storage/final disposal of all radioactive waste arising in the country. Operating the National Radioactive Waste Repository in Różan.
PT	Instituto Superior Técnico (IST)	Public	Collecting, segregating, conditioning and storing solid and liquid radioactive waste.
RO	Nuclear Agency for Radioactive Waste (ANDR)	Public	Promotion, development and monitoring of the nuclear activities. Coordination of the safe management of radioactive waste and spent nuclear fuel, including final disposal, at national level.
SE	Swedish Nuclear Fuel and Waste Management Company (SKB)	Private[20]	Planning and construction of all facilities required for the management of spent nuclear fuel and radioactive wastes as well as for research and development programmes necessary for the provision of such facilities.
SI	Agency for Radwaste Management (ARAO)	Public	Collecting, transporting, treating, storing and disposing of low and intermediate level waste and for the disposal of HLW. Management of the closed uranium mine.
SK	Nuclear and Decommissioning Company (JAVYS)	Public	Management of spent nuclear fuel and radioactive waste. Decommissioning of the nuclear power plants.
UK	Nuclear Decommissioning Authority (NDA)	Public	Implementing Government policy on the long-term management of nuclear waste, including the decommissioning and clean-up of the civil public sector nuclear sites.

2.1.4. Regulatory framework and competent regulatory authorities

Member States are required to establish and maintain a competent regulatory authority in the field of safety of spent fuel and radioactive waste management. This authority shall be functionally separate from any other body or organisation concerned with the promotion or utilisation of nuclear energy or radioactive material, or with the management of spent fuel and radioactive waste. It shall and be given the legal powers, as well as human and financial resources necessary to fulfil its obligations (Article 6 of the Directive).

As it was concluded in the first Commission report, all EU Member States have established national competent authorities with defined responsibilities and legal powers in the area of spent fuel and radioactive waste management (see Table 4). The majority of Member States have only one competent authority, while in others, two or more organisations have competence and regulatory functions in different aspects of spent fuel and radioactive waste management. In these cases, one of the authorities is competent for regulation and oversight of the management of spent fuel and radioactive waste originating from nuclear facilities, while another one is responsible for the safe management of institutional radioactive waste.

[20] Reactors licensees.

In some Member States, there are regional regulatory authorities (such is the case of the United Kingdom and Germany), along with federal or national ones. As a general trend, Member States with nuclear programmes have provided more information and details on the authority that regulates nuclear energy than on the ones responsible for the regulation of the institutional waste. The Commission notes that there is insufficient information in the national reports on the local/regional competent authorities (when applicable) dealing with radioactive waste management.

In order to strengthen regulatory supervision recently a few Member States have introduced changes to their competent regulatory authorities, such as the creation of new authorities, reorganisation or consolidation of functions and few Member States are planning changes to be introduced soon.

Most of the Member States declare the independence of their regulatory authorities from any other organisation or body (i) promoting or using nuclear energy or (ii) managing spent fuel and radioactive waste. In most cases, functional or administrative independency is established in the relevant national law. The regulatory authority is in some cases embedded in a Ministry, and in others it is an autonomous body which reports to the national Parliament, the Council of Ministries, or the Government.

Most of the Member States have successfully demonstrated functional independence of their competent regulatory authority. However, further efforts are needed to demonstrate and achieve functional independence of the competent regulatory authority in one fourth of the Member States.

In general terms, regulatory authorities from countries without nuclear power programmes are usually small, corresponding to the radioactive waste inventories to be managed, and often form part of the administrative structure of the State. In one particular case, the national regulatory authority has neither staff, nor budget, and carries out its regulatory function through staff of other governmental bodies. In March 2019, the regulatory authorities of two EU Member States (Italy and Portugal) were being reorganised with the objective of reinforcing their functional independence, while the regulatory bodies of Germany and the Netherlands had been reorganised recently.

In addition to the functional and administrative independence, technical and financial capacity are also necessary elements for an effectively independent regulatory authority capable of implementing its responsibilities within the licensing system put in place for the safety of radioactive waste and spent fuel.

The national reports of most of the Member States have provided information on measures for ensuring technical and financial independence. Examples of such measures include, for instance, ensuring adequate human resources and sufficient funding by law, establishing fees to the licensees, negotiation of the budget, etc.

The national reports of most of the Member States provided information on the human resources of the competent authority by indicating actual number of staff. However, information given by a few Member States was limited to a generic statement that resources are sufficient. Only in a few cases staff needs to fulfil regulatory functions were clearly indicated, thus in most of the cases it is

difficult to evaluate sufficiency of human resources. Most of the Member States kept staff numbers stable during the reporting period and few Member States increased number of staff. Demonstration of the technical independence of the competent regulatory authorities still requires further improvements. Only half of the Member States provided information on the competence of their staff, availability of technical support organisations or other experts' support as well as on the mechanisms in place to maintain staff competence. A few Member States have not reported any information on competences of their staff or on mechanisms in place to maintain staff competence.

Half of the Member States have clearly or partially reported financial resources available to their competent regulatory authorities (see Table 4). A few Member States provided information on how the management of the regulatory authority is appointed or dismissed, to show that management is not subject to undue influence in its regulatory mission.

Member States (and in particular those without nuclear energy programmes) face challenges with respect to maintaining adequate human resources in the long term. Even if the total staff number remains stable, some Member States expressed concerns due to the high turnover rate of the staff and related challenges in knowledge preservation, training of new staff, and build up of competence. Only a few Member States have clearly indicated the available limited budget and/or human resources to perform the regulatory functions of the national competent authorities.

It has to be noted that some Member States provided very limited information on their competent regulatory authorities in the national reports, while their Joint Convention reports provided significantly more information (e.g. on financial and human resources, mechanisms to maintain competence, etc.).

Table 4. National Competent Authorities for spent fuel and radioactive waste management[21]

MS	Competent authority	Responsibilities for spent fuel and radioactive waste	Reporting to	Staff [year]
AT	Federal Ministry for Sustainability and Tourism (BMNT) Federal Ministry of Education, Science and Research (BMBWF)	BMNT-regulatory authority for the operation of facilities for the disposal of radioactive waste. BMNT is also competent as regards the enforcement of legal regulations and requirements applicable to facilities for the disposal of radioactive waste and also further obligations arising from licences. BMBWF – is the competent authority for the TRIGA research reactor.	Federal Government	Data not available
BE	Federal Agency for Nuclear Control (FANC)	With regard to the safety of disposal facilities, the competent regulatory authority, i.e. the AFCN/FANC, retains all of its prerogatives.	Ministry of Home Affairs	~160 [2018]

[21] The data does not include staff of separate technical support organisations that exist in some Member States.

MS	Competent authority	Responsibilities for spent fuel and radioactive waste	Reporting to	Staff [year]
BG	Nuclear Regulatory Agency of the Republic of Bulgaria (BNRA)	BNRA has been assigned responsibility for all regulatory matters concerning radioactive waste and spent fuel management facilities.	Council of Ministers	103 [2015] 101 [2016] 94 [2017]
HR	State Office for Radiological and Nuclear Safety (DZRNS)	Establishes the legislative framework in the area of radiological, nuclear and physical safety. Coordinates the drafting of the Strategy. Regulates spent fuel and radioactive waste management. Coordinates the drafting of the National programme for implementation of the Strategy. Participates in administrative procedures for obtaining permits and authorisations for management facilities included under the Strategy. Reporting and public information on the management of radioactive waste and spent fuel.	The Government of the Republic of Croatia	22 [2015] 22 (49 positions foreseen) [2018]
CY	Radiation Inspection and Control Service – Department of Labour Inspection (RICS/DLI)	The MLWSI, acting through the RICS/DLI, is the regulatory authority for radiation protection and nuclear safety and has the responsibility for the administration of the relevant legislation and authorisation of all sources and practices involving risks of exposure to ionising radiation or release of radioactive materials in the environment.	Ministry of Labour, Welfare and Social Insurance (MLWSI)	5 [2015] 5 [2018]
CZ	State Office for Nuclear Safety (SUJB)	State administration and supervision of the utilization of nuclear energy and ionizing radiation and in the field of radiation protection.	Prime Minister	209 [2014] No data. Only qualitative statement [2018]
DK	The Danish Health Authority	Regulates all use of radioactive substances, including management of radioactive waste in Denmark. Regulatory oversight of the nuclear installations at Risø.	Minister of Health	No data. Only qualitative statement [2018]
	The Nuclear Division of the Danish Emergency Management Agency	Regulatory oversight of the nuclear installations at Risø.	Minister of Health	No data
EE	The Radiation Regulatory Authority in	The Environmental Board takes part in drawing up and implementing policies,	Ministry of the Environment	17 [2014]

MS	Competent authority	Responsibilities for spent fuel and radioactive waste	Reporting to	Staff [year]
	Estonia is exercised by the: Ministry of Environment The Environmental Inspectorate The Environmental Board	development plans and programmes. It processes and issues radiation practice licences, assesses the radiation safety of planned and ongoing radiation practices, maintains radiation-related databases and cooperates with the Environmental Inspectorate to arrange supervision of radiation practice licences. The Environmental Board also organises the monitoring of radioactivity and the analysis of the results, undertakes laboratory analyses of the radioactivity of substances, conducts studies of natural exposure, assesses public exposure and ensures the functioning of the essential early warning service for radiation safety. State supervision of radiation safety, including of radioactive waste management, is conducted by the Environmental Inspectorate. Infringing the requirements of a licence and acting without a licence where a licence is required are both punishable offence.		Environmental Board: 386 (**16** in the Radiation Safety Department. The Environmental Inspectorate: 175 (116 inspectors, 15 of them involved in radiation supervision). [2017]
FI	Radiation and Nuclear Safety Authority (STUK)	STUK is responsible for controlling that the Radiation Act and other regulations based on the Act are followed. STUK grants safety licences for the use of radiation. The regulatory rights of STUK are described in the Radiation Act. In May 2015 the Nuclear Energy Act and the Radiation Act were amended in such a way that the mandate of STUK was increased. Based on those legal changes STUK has the authority to issue binding regulations, which have replaced some of the lower level government decrees related to nuclear and radiation safety.	Ministry of Economic affairs and Employment Ministry of Social Affairs and Health	342 [2014] 326 [2017]
FR	The Parliament, the Government and Nuclear Safety Authority (ASN)	Regulates, authorises, controls and helps the public authorities to manage emergencies, participate in the public information.	The ASN submits regular reports on its activities to Parliament and in particular to the Parliamentary Office for the Evaluation of Scientific and Technological Choices	470 [2013] 500 [2018]

MS	Competent authority	Responsibilities for spent fuel and radioactive waste	Reporting to	Staff [year]
			(OPECST) and parliamentary committees	
DE[22]	The Federal Office for Radiation Protection (BfS)	Federal tasks relating to supervision and licensing in the area of nuclear energy, interim storage, repository site selection and repository monitoring were transferred from the BfS to the BfE. The BfS will concentrate on the federal radiation protection tasks, e.g. in the *field* of defence against nuclear hazards, medical research, mobile communication, UV protection or the measuring networks for environmental radioactivity.	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)	188 [2014] No data [2018]
	Federal Office for the Regulation of Nuclear Waste Management (BfE)	The regulation of the site selection procedure for a repository especially for high-level radioactive wastes and the co-ordination of the associated public participation that has to be organised. Nuclear licences for interim storage facilities and transports of nuclear fuels. Procedures under mining, water and nuclear law relating to radioactive waste disposal. Issues related to the safety of nuclear waste management. Task-related research in these areas.		No data [2018] BfE is currently still in the construction phase.
	BMU, the Directorate-General Reactor Safety (RS)	Competent authority for nuclear safety and radiation protection. Legal and technical supervision of the Federal Office for Radiation Protection and of the Federal Office for the Regulation of Nuclear Waste Management. Responsible for the obligations under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.		36[23] [2014] 36 [2017]
	16 Länder	Land Ministry is responsible for licensing and supervision of spent fuel treatment facilities.	Federal government	270[24] [2014] 270 [2018]

22 Germany as a federal state, the "regulatory body" and consists of authorities of the Federation and the Länder – the regulatory structure comprised of BMU, BfE, BfS and the Land Ministry. The Federal Office of Economics and Export Control (BAFA) is responsible for the import and export of radioactive materials.

23 Directorate RS III (Nuclear Fuel Cycle).

24 About 120 staff working on radioactive waste management and 150 staff working on support the nuclear authorities of the Länder either at subordinate authorities or as authorised experts.

MS	Competent authority	Responsibilities for spent fuel and radioactive waste	Reporting to	Staff [year]
EL	Greek Atomic Energy Commission (EEAE)	Control, regulation and supervision in the fields of nuclear energy, nuclear technology, radiological, nuclear safety and radiation protection. According to its statutory role EEAE has the legal power to exercise the regulatory control of facilities and activities in the fields of radiation protection and radiation and nuclear safety. As described in detail in Article 43, par. 4 of the new Law 4310/2014, the competencies (legal powers) of EEAE include: - development of safety procedures, regulations and legislation; - licensing and inspection procedures; - environmental radioactivity monitoring; - radiological surveillance; - emergency preparedness; - research in the fields of its competence; - public information; - international cooperation and national representations; - education and training; - personal dosimetry and calibration services Following IRRS mission findings, the new internal organisation of EEAE provides for the operational separation between its regulatory functions and scientific and technical services.	Minister of Education, Research and Religious Affairs	74 [2014]* 75 [2018]
HU	Hungarian Atomic Energy Authority (HAEA)	The supervisory and administrative regulatory competence relating to nuclear safety and physical protection regarding nuclear installations, radioactive waste disposal facilities as well as nuclear and radioactive materials lies with the HAEA in Hungary. The Atomic Energy Act authorises the HAEA to perform is supervisory activity. On 1 January, 2016, the HAEA took over additional regulatory tasks from the Chief Medical Officer's Office of the National Public Health Service.	The Minister appointed by the Prime Minister, the Minister of Innovation and Technology.	80 [2014] 167 [2017] Additional tasks
IE	Responsibility for nuclear safety policy is vested in the Minister for Communications, Climate Action and	Regulates radioactive material including practices involving radioactive waste, and radiation sources through a licensing system. The EPA is an independent public body	Government	34 in the Office for Radiological Protection [2015]

MS	Competent authority	Responsibilities for spent fuel and radioactive waste	Reporting to	Staff [year]
	Environment (DCCAE), under the Radiological Protection Acts. DCCAE is assisted by the Environmental Protection Agency (EPA) to execute nuclear safety and radiation protection tasks.	that reports to Government. Radiation Protection Regulation in EPA is under the overall responsibility of the Director with responsibility for the Office of Radiation Protection and Environmental Monitoring (ORM) who reports to the Director General and Board of the EPA.		70 in the ORM Office of Radiation Protection and Environmental Monitoring [2018]
IT	National Inspectorate for Nuclear Safety and Radiation Protection (ISIN)	The assessment and the inspection activities on nuclear installations, as well as for approving detailed designs or activities related to the construction of nuclear facilities, which are part of the general construction licence granted by the Minister of Economic Development.	Ministry of Economic Development	Less than 60 [2018]
LV	Radiation Safety Centre of the State Environmental Service (VVD RDC)	The VVD RDC ensures national supervision and control in the area of radiation and nuclear safety and also organises and coordinates training of the personnel whose work is related to radiation safety in order to increase the level of radiation safety in the country.	Ministry of Environmental Protection and Regional Development	No data [2018]
LT	State Nuclear Power Safety Inspectorate (VATESI)	Regulation and supervision of nuclear safety, radiation safety of nuclear energy activities involving sources of ionizing radiation, physical security of nuclear installations, nuclear materials and/or nuclear fuel cycle materials and accountancy and control of nuclear materials as well as supervision of requirements arising from international nuclear weapon non-proliferation obligations of Republic of Lithuania.	The Cabinet of Government and the President	75 [2015] 66 [2018]
	Radiation Protection Centre (RPC)	Coordinates actions of state and municipal institutions in the area of radiation protection.	Ministry of Health	59 [2015] 59 [2018]
LU	Radiation Protection Division (RDP)	The RPD is in charge of a) preparing the technical aspects of draft laws, regulations and orders b) lays down the conditions for licences. It has also published several guidelines.	Minister for Health	9 [2015] 9 [2018]

MT	Radiation Protection Commission (RPC)	Develops policies and strategies to be followed by the Secretariat, and regulations relating to the protection against ionising and non-ionising radiation. Is the national body which gives effect to any decision of the UN Security Council or International Atomic Energy Agency, European Commission or internationally recognised entity or competent authority in the field of nuclear safety and radiation protection. Implement the regulatory requirements of Conventions and other EU legislation within the scope of this Act. Prescribe the fees to be paid in respect of the issue, validation, renewal, extension or variation of any certificate, licence or other document or the undergoing of any examination or test required by this Act or any regulations, directive or order made thereunder and in respect of any other matters in respect of which it appears to the Commission to be expedient for the purpose of the Act, regulations, directive or order to charge fees.	Ministry of European Affairs and Equality	1 [2018]
NL	Authority for Nuclear Safety and Radiation Protection (ANVS)	Preparing legislation and regulations and policy (including the national programme). Awarding licences and the accompanying review & assessment and evaluation Tasks. Supervision and enforcement; informing interested parties and the public. Participating in activities of international organisations. Maintaining relationships with comparable foreign authorities and national and international organisations. Supporting national organisations with the provision of knowledge; Having research in support of the implementation of its tasks.	Ministry of Infrastructure and the Environment (I&M)	122 [2016] 130 (141 planned) [2018]
PL	Nuclear Atomic Energy Agency (PAA)	Tasks that involve ensuring national nuclear safety and radiological protection, in particular: - supervision over activities; - promulgation of technical and organisational recommendations concerning nuclear safety and radiological protection; - performing the tasks involving the assessment of national radiation	Minister competent for environmental matters	123 (including 26 nuclear regulatory inspectors) [2017]

		situation in normal conditions and in radiation emergency situations, and the transmission of relevant information to appropriate authorities and to the general public; - performing the tasks resulting from the obligations of the Republic of Poland - activities involving public communication, education and popularisation; - cooperation with governmental and local administration authorities in matters involving nuclear safety and radiological protection; - preparing opinions; - cooperation with appropriate foreign national entities and international organisations; - developing the drafts of legal acts; - giving opinions on the draft legal acts developed by authorised bodies.		
PT[25]	Regulatory Commission for the Safety of Nuclear Installations (COMRSIN)	Licensing, evaluating, monitoring and inspecting facilities and activities relating to the management of spent fuel and radioactive waste (encompassing all phases, from initial choice of siting to decommissioning).	COMRSIN is governed by three Commissioners, appointed by the Prime Minister for five year renewable terms, chosen on the basis of academic, scientific and technical merit. COMRSIN has no staff of its own (2018)	4 [2015] 3 [2018]
RO	National Commission for Nuclear Activities Control (CNCAN)	Regulation, licensing, and control of nuclear activities.	Prime Minister, through the General Secretariat of the Government	No data [2014] 88 [2017]* Number of positions increased to 170 (amended Law 111/1996)

25 As indicated in footnote 13, the Portuguese Environment Agency succeeded to COMRSIN as regulatory authority for Portugal following the entry in force of the new regulatory framework for radiation protection nuclear safety and safe management of radioactive waste on 2 April 2019.

SK	Nuclear Regulatory Authority of the Slovak Republic (ÚJD SR)	State regulatory activities in the field of nuclear safety of nuclear installations, including management of radioactive waste, spent fuel and other parts of the fuel cycle, as well as transport and management of nuclear materials including their control and record keeping system. It is responsible for the assessment of goals of nuclear energy programme and of quality of the classified equipment, as well as for commitments of the Slovak Republic under international agreements and treaties in the said field.	The Government and subsequently to the National Council	108 [2014] 126 [2017]
	Public Health Authority (UVZ SR)	Permanent and continuous state supervision over radiation protection in nuclear facilities and workplaces, where activities are carried out for which it has issued permit. UVZ SR authorisation is a condition for issuing a licence.	Ministry of Health	30 [2017]
SI	Slovenian Nuclear Safety Administration (URSJV)	Nuclear safety of facilities and the safety of industrial radiation sources.	Ministry of Environment and Spatial Planning	41 [2014] 44 [2017]
	Slovenian Radiation Protection Administration (URSVS)	Radiation protection in medicine and veterinary practice, medical surveillance of exposed workers, surveillance of workplaces, dosimetry and dose registers and education in the area of radiation protection.	Ministry of Health	No data
ES	Nuclear Safety Council (CSN)	Reporting on nuclear safety and radiological protection and authorisations to nuclear and radioactive installations as well as carrying out inspection and control and issuing Instructions, which take the form of mandatory rules.	Parliament	205 [2014] 448 (of which 214 in the Nuclear Safety and Radiological Protec-tion Corps) [2017]
SE	Swedish Radiation Safety Authority (SSM)	SSM supervises the Swedish Nuclear Fuel and Waste Management Co (SKB), the power plant operators and other licensees of nuclear activities in fulfilling their responsibilities for safe operation of facilities and transports as well as in planning for decommissioning and disposal.	Ministry of the Environment	321 [2015] 302 [2017]

UK[26]	Office for Nuclear Regulation (ONR, UK)	Regulates: - nuclear safety; - nuclear site health and safety; - nuclear security; - nuclear safeguards; - transport.	Government Department of Energy & Climate Change accountable to Parliament for an appropriate budget for ONR	330[27] [2014] 372[28] [2017]*
	Environment Agency (EA, England)	Responsible in England for regulating disposals of solid radioactive waste on or from nuclear licensed sites and for non-nuclear premises using radioactive substances. EA is the competent authority for authorising shipments of radioactive waste into and out of England in accordance with the Transfrontier Shipment of Radioactive Waste and Spent Fuel 2008.	Government Department of Environment, Food & Rural Affairs	EA: 70 nuclear specialists [2017]*
	Natural Resources Wales (NRW)	Regulating radioactive substances (disposal of solid radioactive waste from nuclear licensed sites and non- nuclear premises using radioactive substances). It is accountable to an independent Board appointed by and accountable to the Welsh Ministers.	Welsh Government	
	Scottish Environment Protection Agency (SEPA)	Environmental regulator and is responsible in Scotland for regulating accumulation and disposals of radioactive waste from nuclear licensed sites and non-nuclear premises using radioactive substances.	It is accountable through Scottish Ministers to the Scottish Parliament.	SEPA: 1250 (around 20 involved directly in nuclear site regulation) [2017]*
	Northern Ireland Environment Agency (NIEA)	Regulates the accumulation and disposal of radioactive waste from non- nuclear premises. It is an Executive Agency within the Northern Irish Department of Environment and leads on advising on and implementing the Government's environmental policy and strategy including radioactive waste management, in Northern Ireland.	Northern Ireland Assembly	
	Health & Safety Executive (HSE)	Regulates health and safety for England, Wales and Scotland. Regulates the use of ionising radiation in the non-nuclear sector.	Government Department of Work & Pensions	

26 The environment agencies regulate the accumulation of radioactive substances and the disposal of radioactive wastes at all sites, with the exception of radioactive wastes at nuclear sites which are regulated by ONR.

27 Nuclear safety specialists.

28 Technical Specialists (i.e. Nuclear Safety, Nuclear Security, Conventional Health and Safety, Fire Safety and Safeguards specialists)

	Environmental Agency	Her Majesty's Government of Gibraltar has appointed the Environmental Agency as the competent regulatory body (see Legal Notice 140 of 2018, published in the Gibraltar Gazette on 21 June 2018). The Environmental Agency Limited already fulfils statutory obligations under other legislation regarding waste and is functionally separate from any other body or organisation concerned with the promotion or utilisation of nuclear energy or radioactive material, including electricity production and radioisotope applications, or with the management of spent fuel and radioactive waste.	Her Majesty's Government of Gibraltar	

* Information from other sources to the Commission than the national programmes and national reports

2.1.5. Shipments within EU and to third countries

Radioactive waste shall be disposed of in the Member State in which it was generated, unless an agreement with another Member State or third country is in force and the conditions set out in Article 4(4) of the Directive are met. The Directive imposes conditions prior to the shipment of radioactive waste regarding safety arrangements in the destination country, and availability, operation and management of appropriate disposal facilities. This requirement is not applicable to: (i) the repatriation of disused sealed sources to a supplier or manufacturer, (ii) the shipment of spent fuel of research reactors to countries that supply or manufacture research reactor fuel (and according to international agreements), or (iii) Krško nuclear power plant spent fuel or radioactive waste shipped between Slovenia and Croatia.

Spent fuel and radioactive waste can be shipped to a Member State or third country for reprocessing and processing. In this case, the ultimate responsibility for the safe and responsible disposal of those materials, including any radioactive waste and by-products that could be generated, shall remain with the Member State from which the spent fuel or radioactive waste originates (Article 4(2) of the Directive).

In the first report the Commission concluded that the majority of Member States have legal requirements in place for the spent fuel and radioactive waste sent for processing or reprocessing abroad, among which the allocation of the ultimate responsibility within the Member State originating the material. In most cases, the ultimate responsibility remains with the Member State or third country in which the spent fuel or radioactive waste was generated. For a few Member States issues on the transposition of Article 4(2) and 4(4) of the Directive were identified by the Commission. Most of these Member States are, however, well on the way to address the identified issues and to improve their national legislation.

The majority of Member States with research reactors foresee the return of their spent fuel back to the supplier (USA and the Russian Federation) in the period 2019-2026, without returning the possible arising radioactive waste back to the originating countries (this is in line with the Directive). A few Member States with research reactors have plans to ship the spent fuel for

reprocessing, and a number of Member States with training and demonstration reactors have not yet defined the strategy for the long term management of spent fuel.

There are multiple transboundary movements of radioactive waste and spent fuel reported by Member States to the Commission under the Council Directive 2006/117/Euratom[29], which requires such movements to be duly authorized. Member States are sending radioactive waste for treatment/conditioning to other Member States. In all the cases return of the resulting radioactive waste is ensured. With few exceptions Member States provide almost no information on those shipments in their national reports.

To date, seven Member States that have opted for spent fuel reprocessing will receive radioactive waste after reprocessing in the EU or outside the EU in the period 2018-2052 (see Table 5). One Member State (Hungary) has not yet taken the final decision on the reprocessing of the spent fuel.

Table 5. Return of By-products from Spent Fuel Reprocessing to EU Member States

MS	Type of material	Timeframe
BE	Around 16 % of the spent nuclear fuel from NPP has been reprocessed in the past at La Hague (France). Most has been returned and the remaining secondary waste will be returned in 2017.	2018
BG	Return of HLW from Kozloduy NPP spent fuel reprocessing in Russia	After 2025
CZ	Return of residual waste from highly enriched Uranium (LRV-15 reactor) sent to Russia.	First part in 2024 and second part after 2033
DE	Radioactive waste from spent fuel reprocessing in the UK and France is expected to be returned to Germany. Vitrified fission products were already returned from France in the period 1996 - 2011	2019-2021
IT	98% of NPP spent fuel is shipped to the UK and France. The remaining 2% will be shipped to France in 2016. The return of radioactive waste from the UK is scheduled between 2020 and 2025.	2020-2025
NL	Waste from spent fuel reprocessing in the UK returned. Part of vitrified HLW from France received and additional expected to be returned.	latest in 2052
ES	Products from reprocessing that need to be returned to Spain are vitrified high level waste located in France (spent fuel from Vandellos I NPP) and recovered U and Pu in the UK (spent fuel from Santa Maria de Garoña NPP).	2021[30]

SHARED REPOSITORIES

None of the Member States have reported any shipments of radioactive waste and spent fuel for disposal. However, some cases of possible disposal of limited spent fuel and radioactive waste quantities in EU Member States is under clarification and discussion.

29 Council Directive 2006/117/EURATOM of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel, OJ L 337, 5.12.2006, pp. 21 – 32.

30 When interim spent fuel /HLW storage facility is available.

About half of the Member States keep shared disposal solutions as an open option. However, none of the Member States has reported concrete plans or activities towards implementation of the shared disposal solution. Moreover, discussions on the shared disposal solution are jeopardized due to the fact that most Member States have forbiden by law import of radioactive waste into their territory (see Table 6). A few Member States do not expect progress in development of shared disposal solutions and decided to focus primarily on development of a national disposal facility.

Member States are required to include in their national programmes any agreement(s) concluded with a Member State or a third country on management of spent fuel or radioactive waste, including on the use of disposal facilities (Article 12(1)(k) of the Directive). In the first report the Commission noted that only a few Member States submitted their agreement(s) with other Member States or a third country, while most Member States with no nuclear programmes did not notify having such agreements in place to date. As part of the second national reports only one member State (Luxembourg) notified a new agreement between Luxembourg and Belgium for management of small amounts of institutional waste. In addition, two Member States (Slovenia and Croatia) were working towards a common disposal solution for spent fuel and radioactive waste generated by the shared nuclear power plant and an agreement on a common solution was expected by 2023. However, it is reported in the second national report that a mutually satisfactory common solution is not achieved.

Table 6. Radioactive waste import and shared disposal policy

MS	Import for disposal policy	Shared solution for disposal policy
AT	Import of RAW into the Austrian federal territory is only authorised in the case of waste from material previously taken out of Austria for treatment purposes.	Open option
BE	Not indicated. Import of disused sealed sources from Luxembourg within the framework of the existing convention between Luxembourg and Belgium.	Not indicated
BG	The import of RAW into Bulgaria is banned.	Open option
HR	The Act explicitly bans any import of RAW, disused sources or SF to the country, unless differently prescribed by international agreements.	Open option
CY	The disposal of RAW is allowed only for RAW generated within the territory of the Republic of Cyprus and is accomplished in an authorised facility.	Open option
CZ	The import of RAW is prohibited by Section (§) 7, paragraph 3 of the Atomic Act.	Open option
DK	Not indicated	Open option
EE	Import for final disposal forbidden by Radiation act paragraph 86.	Not considered
FI	It is prohibited to import disused sources to Finland for the purpose of disposal.	Not considered
FR	The Environment Code prohibits the disposal in France of RAW produced in other countries (except from Monaco).	Not considered
DE	Not indicated	Not considered

MS	Import for disposal policy	Shared solution for disposal policy
EL	The import of RAW within the country's borders for management, including disposal, is prohibited.	
HU	Not indicated	Not indicated
IE	Prohibition of the importation of RAW from third countries.	Not indicated
IT	Not indicated	Open option
LV	No RAW may be brought into Latvia from other countries.	Open option
LT	Legislative provision of the Republic of Lithuania precludes the entry into the territory of the Republic of Lithuania of SF and RAW generated outside the territory of the Republic of Lithuania.	Not considered
LU	Not indicated	Waste disposal in Belgium
MT	Malta will not accept RAW to be imported into Malta for any purpose.	Open option
NL	There are no statutory limitations on the importing of radioactive (RAW) substances from abroad, for storage and disposal in the Netherlands.	Open option
PL	It is forbidden to import SF and RAW to Poland for the purpose of disposal.	Open option
PT	Portugal does not authorise the entry into national territory of SF or RAW generated or resulting from activities carried out by or under the jurisdiction of other states.	Not considered
RO	The import of RAW is prohibited.	Not considered
SK	Disposal allowed only of RAW that is produced in its territory.	Open option (Decision to proceed or abandon this option to be taken by 2030)
SI	Not indicated	Open option
ES	Not indicated	Not indicated
SE	Not allowed, except small quantities.	Not considered
UK	General policy is not to import for disposal, exception possible for small quantities from small users	Not considered

2.1.6. Self-assessment and international peer reviews

At least every 10 years, Member States are required to arrange for self-assessments of their national framework, competent regulatory authority, national programme and its implementation, and to invite an international peer review of their national framework, competent regulatory authority and/or national programme. The aim is to ensure that high safety standards are achieved in the safe management of spent fuel and radioactive waste. It is the Member State's decision to define the scope, timing and type of international peer reviews as long it complies with provision of Article 14(3) of the Directive and is carried out by 2023. Member States are required to report the outcomes of these international peer reviews to the Commission and the other Member States, which may be made available to the public, unless there is a conflict with security and proprietary information.

The majority of the Member States address periodic self-assessments and international peer reviews in a general way in their national programmes and reports. Some Member States have clearly defined timeframes for review and update of the national programmes (which is assumed to cover the self-assessment requirement); however, only a few Member States provided information on self-assessment of the national framework for spent fuel and radioactive waste management.

In most Member States self-assessment of the competent authorities has been established and carried out through the IRRS missions of the IAEA. While the majority of Member States reported IRRS missions, a few Member States provide details on the self-assessment outcomes related to spent fuel and radioactive waste management. Although the majority of IRRS missions' reports are publicly available, details on the Member States' follow up actions addressing the outcomes of theses reviews for achieving higher level of safety have been reported by a few Member States.

In comparison to the previous reporting period, there is no improvement to be highlighted. Therefore, the implementation of this Article still requires further attention in the future Member States' reporting to the Commission.

Since 2014 the Commission is supporting the IAEA in development of a self-assessment tool based on the IAEA safety standards and best practice to enable EU Member States to fulfil their obligations for periodic self-assessment (Article 14(3) of the Directive). During the 2017-2018 period the first ARTEMIS (Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation) peer-review missions took place in Poland, France, Bulgaria, Luxembourg and Spain. The peer-review mission to Spain should be highlighted as this was the first time when a joint IRRS and ARTEMIS peer-review mission was requested by a host country.

Most of the Member States indicate in their national programmes and national reports the planned international peer reviews related to their spent fuel and radioactive waste management only vaguely. At the time of submission of their second national reports only one third of the Member States presented specific timeframes of planned international peer-reviews. However, the Commission is aware through ENSREG that most Member States have specific plans to invite ARTEMIS peer review service and to host missions until 2023 (for details see Table 7).

Assuming this planning is kept, Member States are on track to implementing the requirements of Article 14(3) of the Directive by 2023. Planning of ARTEMIS peer-review missions likely will need some fine-tuning, as the number of planned ARTEMIS peer-review missions varies significantly from year to year. At the moment preliminary plans indicate 7 ARTEMIS missions for 2021. This planning could be challenging to implement due to need and availability of large number of experts to take part in those peer-reviews.

According to the Article 14(3) of the Directive, Member States are required to report the outcomes of the international peer reviews to the Commission and the other Member States. By

March 2019 four[31] Member States have reported to the Commission the outcomes of the conducted international peer-reviews of their national framework, competent regulatory authority, national programme and its implementation. Since then another two[32] Member States notified their ARTEMIS peer review reports.

Table 7. Recent and planned international peer reviews as per Article 14(3) of the Directive[33]

MS	National programme and/or National framework	Competent regulatory authority
AT	2020 (ARTEMIS)	2018 (IRRS)
BE	2022 (ARTEMIS)	2013 (IRRS), 2017 (IRRS follow-up)
BG	2018 (ARTEMIS)	2013 (IRRS), 2016 (IRRS follow-up)
HR	2021 (ARTEMIS)	2015 (IRRS), 2019 (IRRS follow-up)
CY	2020 (ARTEMIS)	2017 (IRRS), 2021 (IRRS follow-up)
CZ	2023 (ARTEMIS)	2013 (IRRS), 2017 (IRRS follow-up)
DK	2020 (ARTEMIS)	2020 (IRRS)
EE	2019 (ARTEMIS)	2016 (IRRS), 2019 (IRRS follow-up)
FI	2022 (ARTEMIS)	2012 (IRRS), 2015 (IRRS follow-up), 2022 (IRRS full scope)
FR	1996 and 2005, IAEA Review of specific waste management projects 2018 (ARTEMIS)	2014 (IRRS), 2017 (IRRS follow-up)
DE	2019 (ARTEMIS)	2019 (IRRS)
EL	*No data*	2012 (IRRS), 2017 (IRRS follow-up)
HU	2021 (ARTEMIS)	2012 (IRRS follow-up), 2015 (IRRS), 2018 (IRRS follow-up)
IE	2021 (ARTEMIS)[34]	2015 (IRRS), (IRRS follow-up requested in 2018)
IT	2021 (ARTEMIS)	2016 (IRRS), 2021 (IRRS follow-up)
LV	2019 (ARTEMIS)	2019 (IRRS)
LT	2021 (ARTEMIS)	2016 (IRRS), 2020 (IRRS follow-up)
LU	2018 (ARTEMIS)	2018 (IRRS)
MT	2023 (ARTEMIS)	2015 (IRRS), 2020 (IRRS follow-up)
NL	2023 (ARTEMIS)	2014 (IRRS), 2018 (IRRS follow-up), 2023 (IRRS)
PL	2017 (ARTEMIS) after 2020 (ARTEMIS follow-up)	2013 (IRRS), 2017 (IRRS follow-up)
PT	*No data*	2020 (IRRS)
RO	2019 (ARTEMIS)	2011 (IRRS), 2017 (IRRS follow-up), 2021 (IRRS)
SK	2021 (ARTEMIS)	2012 (IRRS), 2015 (IRRS follow-up)
SI	2021 (ARTEMIS)	2011 (IRRS), 2014 (IRRS follow-up), 2021 (IRRS)
ES	2018 (ARTEMIS)	2008 (IRRS), 2011 (IRRS follow-up), 2018 (IRRS)
SE	2022 (ARTEMIS)	2012 (IRRS), 2016 (IRRS follow-up), 2022 (IRRS)
UK	*No data*	2006, 2009, 2013 (IRRS), 2014 (IRRS follow-up),

31 Poland, France, Luxembourg and Bulgaria.

32 Spain and Estonia.

33 The information in grey is provided by Member State through the ENSREG Working Group 2 or other source (e.g. IAEA), however not included in the national programmes and national reports of Member States.

34 The 2nd national report of Ireland only indicates expected ARTEMIS invitation date (Q3/2018).

MS	National programme and/or National framework	Competent regulatory authority
		2019 (IRRS)

2.1.7. Notification and reporting

All Member States have submitted their second national reports to the Commission as required by Article 14(1) of the Directive. As part of their national report, three Member States (Czechia, Germany and Estonia) have notified to the Commission their Joint Convention[35] reports (dated 2017) for the 6th Joint Convention review meeting held in May 2018.

With exception of Italy, all Member States submitted to the Commission their final national programmes. Since the first Commission report, four Member States (Austria, Croatia, Czechia and Portugal) finalized their draft national programmes and submitted them to the Commission.

In the first report the Commission noted that the national programme of Spain has been drawn-up in 2006 and therefore some of the information reported is out-dated. With the second national report Spain has presented updated information on the spent fuel and radioactive waste management activities, as well as an updated inventory of the spent fuel and radioactive waste. All this information has been used in the preparation of this report.

During the 2016-2018 period several Member States have updated and notified to the Commission their national programmes. Almost half of the Member States plan to update their national programmes in the coming years.

2.2. Assuring the safety of spent fuel and radioactive waste management

2.2.1. Licence holder's responsibilities

Member States are required to ensure that the prime responsibility for the safety of spent fuel and radioactive waste management facilities and/or activities rests with the licence holder and that this responsibility cannot be delegated (Article 7 of the Directive).

There are no significant changes reported in the second national reports. All Member States have measures in place to ensure that the primary responsibility for spent fuel and radioactive waste management is with the license holders and that it cannot be delegated. The provisions presented are mainly legal and focus on legal requirements, license conditions and enforcement actions in case of non-compliance. However, in several cases examples have been provided with regard to the practical implementation of these legal provisions (e.g. by explicitly referring to licence conditions and their application). The Commission has identified issues on incomplete transposition of Article 7(1) of the Directive in two Member States and the transposition issues are well on the way to be solved. Three Member States reported in the second national reports changes already implemented or planned to their legal framework to improve clarity on the application of Article 7(1) of the Directive.

[35] Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Management.

Licence holders shall establish and implement integrated management systems, which give due priority for overall management of spent fuel and radioactive waste to safety and are regularly verified by the competent regulatory authority. Overall the majority of Member States have reported their legal requirements for integrated management system or quality assurance for spent fuel and radioactive waste management that focus on safety. However, about a third of the countries provide only limited information in the national reports on how these requirements are implemented in practice. Many Member States provided more details on integrated management and quality assurance systems within their national operators, bodies or organisations related with nuclear facilities (through examples in some cases), and less or none within organisations dealing with institutional waste. A few Member States have not addressed management systems in their reports. Since the last report, a couple of Member States have amended their legislation to address issues related to the implementation of the requirements set out in the Directive and information on the integrated management and quality assurance systems of licence holders was provided by a few Member States that had not provided this information in the previous report.

Licence holders have to provide for and maintain adequate financial and human resources to fulfil their obligations for safe long term management of spent fuel and radioactive waste. The majority of Member States have legally established requirements in this regard. For a few Member States issues on the transposition of Article 7(5) of the Directive were identified. Most of these countries are however well on the way to improving their national legislation.

The legal requirements such as, a license can be granted only in case the applicant does demonstrate sufficient human, technical and financial resources, are described in variable detail.

The majority of Member States did not provide further information on licensees financial or human resources or provisions for bankruptcy cases. Only in very few cases Member States have provided very detailed figures on human and financial resources currently available in the licensees.

2.2.2. Concepts and plans (including post closure)

National programmes are required to include the concepts or plans and technical solutions for spent fuel and radioactive waste management from generation to disposal (including the post-closure phase), in particular related to institutional control and preservation of knowledge in the longer term (see Article 12(1)(d) and Article 12(1)(e) of the Directive).

Since the publication of the first Commission report and until March 2019, five Member States finalised and adopted their national programmes and four Member States revised their national programmes. The adopted/updated national programmes overall have not introduced significant changes and have not affected the overall EU situation with regards to the implementation of Article 12(1)(d) and Article 12(1)(e) of the Directive. During the reporting period, one Member State has appointed an Authority that will issue a recommendation regarding the disposal of radioactive waste, and one Member State has taken the decision to establish a surface and shallow-depth facility for the disposal of its low and intermediate level waste. Except these two cases, the situation in Member States remained broadly the same.

All Member States have developed concepts or plans, and technical solutions for the management of radioactive waste and spent fuel in the shorter term. This includes in general predisposal concepts up to, and including interim storage. Disposal concepts, plans and technical solutions are in place for very low- and low-level waste, especially in Member States with nuclear power plants, while disposal of intermediate and high-level waste, as well as spent nuclear fuel, except in three cases, remains to be further developed.

Only very few Member States have not described such concepts, plans and technical solutions, and state that they will be prepared and included in their next review of the national programme.

In general, Member States with nuclear power or research reactors have described with different levels of detail the concepts, plans and technical solutions for the management of very low, low and intermediate radioactive waste up to interim storage, encompassing for instance, characterisation, sorting, decay, decontamination; volume reduction technologies such as compaction, supercompaction, smelting of contaminated metal, and incineration; as well as conditioning and immobilisation through cementation, and interim storage. Member States without nuclear reactors' concepts, plans and technical solutions consist mainly in the control of disused radioactive sources, through an up-to-date inventory, the return to the manufacturer, if possible, and the interim storage in a centralised facility yet to be sited, designed and commissioned.

Those Member States that have developed very low, low and intermediate level waste disposal concepts rely on surface or shallow-depth disposal facilities: landfills, trenches and vault type disposal facilities, and intermediate depth disposal facilities (a few tens to a hundred meters depth).

Some Member States, especially those without nuclear programmes, keep open the possibility of exploring shared solutions for the disposal of their radioactive waste. In general, disposal of radioactive waste in these Member States are developed only at a conceptual level, and the pertinent activities (e.g. site selection, research, design etc) have been postponed in some cases.

Table 8 lists the existing and planned near-surface and intermediate depth disposal facilities in EU.

Over 30 dedicated disposal facilities for VLLW and LLW are in place in 13 Member States, and of these, 6 plan new facilities. Bulgaria and Lithuania categorised their past disposal facilities of RADON type[36] as storage facilities, and a few Member States plan or consider remediation of existing disposal facilities and contaminated sites (e.g. Germany, Estonia). Five Member States are planning to build their first disposal facilities and capacities in the next decade.

Table 8. Near surface and intermediate depth disposal facilities in EU

MS	Existing/ planned	Siting	Commis-sioning	Operation (years)	Closure	Institutional Control (years)	Responsible organization	Comment

[36] "RADON" type facilities for institutional waste built in the 1960s.

MS	Existing/ planned	Siting	Commis-sioning	Operation (years)	Closure	Institutional Control (years)	Responsible organization	Comment
BE	Planned LLW (Category A waste)	Dessel site	4 years after construction/operation license (2023)	54 years after construction/operation license (2073)	104 years after construction/operation license (2123)	300	ONDRAF/ NIRAS	Surface disposal. Under licensing application review for construction. License expected by the end of 2019.
BG	Existing for LLW and ILW (institutional, short-lived waste)	Novi han site	1964				SERAW	Used for storage. Planned decommissioning by 2025.
	Planned near surface	Radiana	2021		2086		SERAW	
CZ	Dukovany (existing)	Dukovany NPP	1995	95	2090	300	SÚRAO	Capacity sufficient for all RAW from NPPs Dukovany and Temelín, including LTO
	Hostim (existing)	Beroun	1959	5	1964	Ongoing (at least 50 yrs more)	SÚRAO	Closed. Final sealing 1997.
	Bratrstvi (existing)	Jáchymov	1974		2025 (=start of closing process)	120	SÚRAO	Capacity until 2020 for NORM waste
	Richard (existing)	Litoměřice	1974		Not before 2025	120	SÚRAO	First phase of refurbishment started 2018. Second phase planned 2020-2022.

MS	Existing/ planned	Siting	Commis-sioning	Operation (years)	Closure	Institutional Control (years)	Responsible organization	Comment
EE	Planned	2019-2023	2040		2050		A.L.A.R.A. AS	Concept for LLW and ILW disposal to be decided
FI	Loviisa NPP (existing) (LILW)	Loviisa	1998		2060	Not foreseen	TVO	LLW and ILW in granite bedrock at 110 m depth
	Olkiluoto NPP (existing)	Olkiluoto	1992		2080 or 2100	Not foreseen	FORTUM	LLW and ILW in granite bedrock at 60-95 m depth. Planned to be extended in 2030 for all LILW from OL 1-3.
	Hanhikivi (planned)	Hanhikivi (Pyhäjoki)	After 2035		2120	Not foreseen	FVO	LILW planned several tens of meter depth in bedrock
FR	Centre de L'Aube (existing)	Aube district	1992		Later than 2050	300	ANDRA	LLW and ILW-short lived
	Centre de La Manche (existing)	Manche district	1969		1994	300 (since 2003)	ANDRA	LLW and ILW-short lived
	Cires (existing)	Morvilliers	2003		Saturation in 2025		ANDRA	VLLW disposal facility
DE[37]	Konrad	2007	2027		Several decades		BGE since	Under constructio

[37] Asse II salt mine remediation is planned around 2033.

MS	Existing/ planned	Siting	Commis-sioning	Operation (years)	Closure	Institutional Control (years)	Responsible organization	Comment
							April 2017	n with delay in time schedule presumably to 2027
	Morsleben (existing)	Morsleben	1971	Until 1998	In progress		BGE since April 2017	Closed. Decommissioning plan approval ongoing
HU	Radioactive Waste Treatment and Disposal Facility (RWTDF, (existing)	Püspökszilágy	1976		2067	150	PURAM	Institutional waste
	National Radioactive Waste Repository (NRWR, existing)	Bataapati	2008		2084	50	PURAM	Waste nuclear power plants
IT	National repository (planned)	Ongoing	2026				SOGIN	
LT	RADON (Existing)	Maišiagala	1964		1989		Ignalina NPP from beginning of 2019	For institutional waste to be retrieved and facility remediated. Site release in 2023
	Industrial landfill for VLLW disposal (planned)	Ignalina NPP			Decision to retrieve or leave 2018 - 2025		Ignalina NPP from beginning of 2019	Planned investigation for possible conversion of an existing industrial landfill to a VLLW

MS	Existing/ planned	Siting	Commis-sioning	Operation (years)	Closure	Institutional Control (years)	Responsible organization	Comment
								disposal facility
	Landfill disposl facility (B19-1, B19-2 VLLW (planned)	Ignalina NPP	February 2019	2019	2038	Active 30 Passive 70	Ignalina NPP from beginning of 2019	
	Near Surface Repository (NSR)- B25 Short Lived LILW Ignalina (planned)	Sabatiškė site	2021-2023	2023	2038	Active 100 Passive 200	Ignalina NPP from beginning of 2019	
	Bituminised Ignalina (planned)	Ignalina NPP	Decision in 2022					
LV	Baldone (existing)	Baldone	1962				LEGMC	Also used for storage
PL	NRWR (existing)	Różan	1961	64 years	2025-2029	No data	ZUOP	Operating
	NNRWR (planned)	Selection in 2018	2030	120 years	2144-2155	2144-2303	ZUOP	Planned
PT	Pavilhão de Resíduos Radioativos (existing)	CTN/IST campus					IST	Surface storage facility licensed as disposal facility in 2016
RO	Baita Bihor (existing)		1986		Around 2040	100 active 200 passive	ANDR	
	DFDSMA (planned)	2017	2026		2090	100 active 200 passive	ANDR	
SI	LILW (Planned)	Site selected: Vrbina in 2009	2020		After 2061		ARAO	Pending agreement with HR
HR	Radioactive waste disposal (planned)	Čerkezovac	2062		After 2065			
ES	LLW and ILW (existing)	El Cabril	1992		2040	300 years	ENRESA	
	VLLW (existing)	El Cabril	2008		2040	60 years	ENRESA	
SK	Mochovce LLW	Mochovce	2001	After 2080	Extension to be	Several decades	JAVYS	Existing facility;

MS	Existing/ planned	Siting	Commis-sioning	Operation (years)	Closure	Institutional Control (years)	Responsible organization	Comment
	(existing)				decided in 2018	active; and 200-300 years passive		extension planned in 2018/19 next periodic safety review 2019
	Mochovce VLLW (planned)	Mochovce	Module 1 (A1) in operation since 07/2016 Module 2 (V1) Construction ongoing				JAVYS	
SE	SFR (low and intermediate level waste) (existing)	Forsmark	1983-1988		Extension requested in 2014	2070-2075	SKB AB	Expected extension in 2023
	SFL (long lived LLW and ILW) (existing)	License to be submitted in 2030	Planned 2045			2075	SKB AB	
	Forsmark NPP (VLLW) (existing)	Forsmark				30	Forsmarks Kraftgrupp AB	Operational
	Oskarshamm NPP (VLLW, existing)	Oskarshamm				30	OKG AB	Operational
	Ringhals NPP (VLLW, (existing)	Ringhals				30	Ringhals AB	Operational
	Studsvik (VLLW, (existing)	Studsvik				30	AB SVAFO	Operational
UK	Drigg VLLW/LLW (existing vaults and trenches)	Sellafield	1950		2050	100	Low Level Waste Repository Limited NDA	Foreseen extension of capacity after 2050 for operation until 2129
	CLESA	Sellafield			2026		NDA	Decommis

MS	Existing/ planned	Siting	Commis-sioning	Operation (years)	Closure	Institutional Control (years)	Responsible organization	Comment
	(existing)							sioning waste and site clearance waste
	Calder landfill VLLW	Sellafield					NDA owner	
	South landfill VVLW (existing)	Sellafield					NDA owner	
	Dounreay shaft (existing)	Dounreay			2005		NDA owner	Closed
	Dounreay LLW (existing)	Dounreay 2014			2028		Dounreay Site Restoration Limited (DSRL) NDA-owner	
	Onsite pits and trenches (existing)	Harwell, Springfield, Sellafield, and Dounreay						
	Near-surface disposal in Scotland (planned)							

Concepts, plans and technical solutions for the management of spent fuel from nuclear power plants range from reprocessing to direct disposal. Two Member States have reported reprocessing their own spent fuel (France and the United Kingdom), and others have agreements with France, the UK or the Russian Federation. A few Member States have not yet decided their national strategy with regards to spent fuel management. Spent fuel from research reactors will be shipped back to the US or Russian Federation, if possible, but a few Member States will dispose of it within their territory.

All but one of the Member States with nuclear programmes, plus one Member State with research reactors and planning to build nuclear power plants have plans for deep geological disposal (see Table 9 for details). Finland, France and Sweden expect to have their disposal facilities operating by 2035, while the timeframes for the other twelve Member States range from 2065 to 2100, or

even later. In view of these long timespans, Member States have put in place plans for long-term spent fuel storage, mainly planning using dry storage technology for long-term storage.

Table 9 lists the planned Deep Geological Disposal Facilities in EU Member States.

Table 9. Planned Deep Geological Disposal Facilities[38] in EU Member States

MS	Siting	Com-mis-sioning	Opera-tion (years)	Closure	Institu-tional Control	Cost (billion EUR[39])	Respon-sible organi-zation	Comment
FI	Eurajoki (Olkiluoto) site	2024	90	2110	Not foreseen	3.5 (2012, 5 units)	POSIVA	Licence for constructio n (2015)
	Hanhikivi site	Planned for 2090				Not specified	FVO	FVO submitted an EIA in June 2016.
FR	Cigeo: sited in the Border of the Meuse and Haute-Marne	2035	More than 100	After 2125[40]		25 (2016)	ANDRA	100 year reversibi-lity. Concept for submission for au-thorization.
SE	Forsmark site	2020-2032	40	2072-2073	Not foreseen	2.39 (reference scenario 40+6years, SEK 24.97 bn)	SKB	Licence application for con-struction under review
UK	England and Wales SF and HLW	2040	Until 2089	2140		GBP 9.8 bn (2017/2018) (undis-counted)	NDA	
DE	Site selection by	2050				7.7	BGE since	The cost is for a new

38 The terms near surface, intermediate depth and deep geological disposal are used in the meaning of IAEA Safety Guide GSG-1 "Classification of Radioactive Waste", 2009.

39 Otherwise specified.

40 Law on reversibility (100 years) passed in 2016.

MS	Siting	Com-mis-sioning	Opera-tion (years)	Closure	Institu-tional Control	Cost (billion EUR[39])	Respon-sible organi-zation	Comment
	2031						July 2016	geological disposal facility
RO	2025	2055	100	2150		USD 1.02 bn (2 units) to USD 2.04 bn USD (4 units) (2006)	ANDR	Siting not started yet
HU	Site selection ongoing	2064	20[41]	2084[42]	Not yet established	HUF 745 278.5 million (2015)	PURAM	Research activities are planned – laboratory in operation in 2038
SK	Site selection first stage (2013-2016) Site selection in 2030	2065	40-60	2105-2115	Not foreseen	3.7-4.4 (2014)	JAVYS	3.7 bn for 40 years NPP operation and 4.4 bn for 60 years NPP operation
SI	Site to be selected (2045-2055)	2065	10	2075	No data	Not available	ARAO	Agreement with Croatia pending
HR	~2050 (start of siting)	2068 or 2088[43]					The Fund (via its RAW Management Centre)	Possible agreement wih Slovenia by 2023
CZ	2 sites by 2022	2065				4.1 (2011) or CZK 111.4 bn	SÚRAO	Ongoing site selection. Two sites to be selected.

41 If Hungary opts for reprocessing of the spent fuel of the new-built, the operation of the deep geological disposal will be 50-60 years instead.

42 It could be 2114-2124.

43 Depending on possible lifetime extension of Krško NPP.

MS	Siting	Com-mis-sioning	Opera-tion (years)	Closure	Institu-tional Control	Cost (billion EUR[39])	Respon-sible organi-zation	Comment
LT	Site selected by 2033	2066	6	2072		1.89 (2004 prices)	Ignalina NPP	From 2019 Ignalina NPP takes over all responsibil ities of RATA
ES	Site selection 2023-2027	2069				3 (2005)[44]	ENRESA	
BG	Prefeasibi-lity study ongoing and 6 potential sites selected					Not available	SERAW	No con-cepts as yet for ILW / HLW other than interim storage
NL	Decision in 100 years	About 2130				2 (2017)	COVRA	Cost estimate updated in the OPERA reseach programm e (costs discounted to 2130, real term 2017)
BE	No date defined pending national policy	Not available	20 years after authorisati on is given	At least 100 years after construct ion and operatin g license		3.2 (2012)	ONDRA F/NIRAS	The disposal cost is for waste category B and category C
PL	22nd century	22nd century	Around 50 years	Mid-22nd century		Not available	ZUOP	New build

44 Data from the 6th General Radioactive Waste Plan. In addition, the estimated total cost for spent fuel management is about EUR 7 bn (2015) for a 40 years NPP operation scenario.

Less detail has been provided regarding the management of institutional waste in those Member States with nuclear programmes. Institutional waste is incorporated to the existing management routes for radioactive waste generated in the nuclear power plants and fuel cycle facilities, and disposed of in the existing or planned disposal installations. A few Member States are working on solutions for the management of small amounts of radioactive waste (disused sources, waste from research activities, or waste from remediation activities) which do not yet have a management route.

The national programmes should address post-closure measures for disposal facilities and measures for knowledge preservation (Article 12(1)(e) of the Directive).

No changes have been reported with regards to post-closure measures for disposal facilities and for knowledge preservation. As in the previous reporting period, the majority of countries report on the legal requirement to cover the post-closure but as more detailed regulations are not always available, the information is very general or the post closure measures for the disposal facilities are not addressed in their notifications. Of the countries with a present or past nuclear programmes, only a few have presented detailed and defined plans for the post-closure period of the disposal facilities. Some of the Member States present plans for the post-closure period only for the near-surface disposal facilities closed or in operation, while the post-closure period of the deep geological facilities, or other radioactive waste disposal facilities not yet built, is either not detailed or not foreseen. The reported period for post-closure monitoring of surface and near surface disposal facilities ranges from 100 years after closure for very low-level waste to 300 years after closure for low-level waste. Several Member States do not require post-closure measures after the closing of deep geological disposal facilities.

No developments regarding the preservation of knowledge after the closure of the disposal facilities has been reported. The situation reported from the first report of the Commission, as taken from the national programmes remains the same: very little information is available, which is limited to studies in this area, as well as clarification on the entity responsible for the record keeping.

2.2.3. Safety demonstration

The licensees are required to regularly assess, verify and continuously improve, as far as is reasonably achievable, the safety of the radioactive waste and spent fuel management facility or activity in a systematic and verifiable manner, by applying the graded approach (see Article 7 of the Directive).

In the second national reports the majority of Member States presented only the legal basis and provisions for regular safety reviews. Only a few Member States provided in their national reports concrete examples on how these provisions have been applied in practice where available (e.g. safety assessments performed in the reporting period or planned in the future for spent fuel and radioactive waste management facilities, reviews of the facilities by the competent authority and implementation of the review results to improve overall safety).

Five Member States are on their way in solving legal issues in the transposition of regular assessment, verification and continous improvement of the safety by the license holders

requirements. The major non-conformities highlighted by the Commission are being addressed by most concerned Member States.

Safety demonstration as part of the licensing shall cover activities and facilities (i.e. development, operation and decommissioning), as well as the post-closure phase of disposal facilities (see Article 7(3) of the Directive). The majority of Member States have addressed safety demonstration in their reports mainly through presentation or reference to established legal requirements. About one third of Member States (mainly Member States with nuclear power plants) have addressed safety demonstration in their reports though concrete examples of safety assessments and safety cases mainly, for large nuclear facilities and producers of spent fuel and radioactive waste. Member States with research reactors and non-nuclear programmes provide little or no information on practical examples of safety demonstrations and their results, as well as implementation of emergency preparedness measures.

Eight Member States still have to resolve legal issues in the transposition of safety demonstration during licensing requirements. As with the regular safety assessment, the major non-conformities on safety demonstration during licensing highlighted by the Commission are being addressed by most concerned Member States.

It has to be noted, that Member States tend to provide more details on the status of safety assessments or safety demonstrations in their Joint Convention reports but not in the national reports.

2.2.4. Cost assessment, 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.

Almost two thirds of the Member States provided information on the cost assessments of their national programmes although the estimates vary widely in terms of the methodology, assumptions, completenes of data, scope and the time frames. These are mainly the Member States with nuclear programmes and research reactors but there are two Member States with only institutional waste who have provided cost estimation. Part of the cost estimates are not updated since the first reporting period in 2015. One third of the Member States, mainly those with nuclear programmes updated their cost estimates, while nine Member States reported that new national programmes including updated cost assessments will be available in the near future. Given the lack of completeness of the costs, nor an indication of timing, it is not possible for the Commission to report a consistent figure discounted to the present. Thus, similarly to the first report, the overall figure is an aggregation of various “overnight” figures, where available, and cannot be compared to financial resources currently available.

In the first Commission report the estimate of the total cost of the management of spent fuel and radioactive waste in EU was EUR 400 billion (2017). Based on the reported updated information from about a third of Member States, the updated Commision estimate is higher, in the range of

EUR 422-566 billion. The cost increase is mainly driven by the UK estimate of the undiscounted cost scenarios of NDA decommissioning.

The majority of Member States provided information for the financing schemes in force for implementation of the national programmes. There are considerable differences in the schemes used by different countries with part of the Member States relying on a fee levied on electricity generation or on payments based on characteristics of the waste and some on state budget.

About half of the Member States provided information about the status of the funds for spent fuel and/or radioactive waste management although with different level of detail (please see Table 10). Lithuania and Estonia continue to rely on EU funds for radioactive waste and spent fuel management, while a number of Member States declared insufficiency of funds to date.

Table 10. Estimated total cost of spent fuel and radioactive waste management based on EU Member States' programmes[45]

MS	Estimated total costs, billion EUR[46] (year)	Timeframes	Assumptions	Generated capacity (TWh, total estimated for the lifetime)
AT	No data	No data	No final decision yet on the final disposal scenario.	-
BE	15.107 (2015)	Until 2150	Seven existing commercial nuclear reactors will be operated for 40 years. B&C waste will be disposed of in Boom Clay at 200 metres depth (financial hypothesis only). SF from commercial reactors will be reprocessed (contractual hypothesis). Geological disposal of category B waste will start in 2047. geological disposal of category C waste will take place over the period 2100–2110. Cost breakdown: Decommissioning of NPP: EUR 5403 million$_{2015}$. Management of SF: EUR 4925 million$_{2015}$. Does not include the management of the SF and RAW of future nuclear installations. Does not account for substantial changes in the hypothesis.	1748
BG	2.0-4.5 (2015)	2030	Decommissioning, SF processing	807

45 Information from ongoing infringement procedures is not included.
46 Otherwise specified.

MS	Estimated total costs, billion EUR[46] (year)	Timeframes	Assumptions	Generated capacity (TWh, total estimated for the lifetime)
			and storage for Kozloduy NPP units 1-4 and 5-6. The range of costs depends on the extension or not for units 5 and 6.	
CY	EUR 500 000 (2016)		Cost of repatriation or disposal abroad of the legacy disused sealed radioactive sources under temporary storage	-
CZ	4.2 (2011)	Geological disposal after 2160	LLW and ILW disposal up to 2050 CZK 3.25 bn (2013) = EUR 0.11 bn and 0.037 CZK/EUR); includes also decommissioning.	1334
DE	66.9 (2012)	2080	EUR 34 bn for NPP waste, Asse – EUR 5 bn; Morsleben – EUR 2.4-4.7 bn; Konrad – EUR 7.5 bn and new geological disposal facility – EUR 7.7 bn; public RAW management – EUR 6 bn; Gorleben site – EUR 2 bn (40 million EUR/year for 50 years until 2065) all at 2012 prices.	5234
DK	0.303 total cost related to the implementation of the measures associated with resolution B90/2018	2003-2073 Decommissioning and SF&RAW long-term storage By 2073-Geological disposal	Details on financial provisions, mechanisms, costing profiles etc. will be provided together with the notification of the new adopted policy and associated national programme.	-
EE	0.124	Up to 2050		-
EL	EUR 4.6 million (2015: preliminary as not including disposal)		Revision of costs estimation including disposal before end of 2019	
ES	19.8 (2017)	2090	The forecast is made on a 40-year design hypothesis of the Spanish NPPs in operation; open cycle.	3126
FI	6.5 (2012) For 5 reactors (LO1-2, OL1-3)	2023-2115	Not including future NPPs'. EUR 100 million for near surface disposal and EUR 3.5 bn for geological disposal.	1041 (2017)
FR	110.5 (2014)	2135	Including institutional control; EUR 5.1 bn for legacy sites recovery; EUR 45 bn decommissioning; EUR 25 bn for geological disposal	21076
HR	0.87 (2015)	2095	Immediate decommissioning of the Krško NPP after shut-down in 2043. The cost includes: RAW/SF	138

MS	Estimated total costs, billion EUR[46] (year)	Timeframes	Assumptions	Generated capacity (TWh, total estimated for the lifetime)
			management and disposal, decommissioning of Krško NPP.	
HU	5.3 (2015)	2064	HUF 1 650 402 million (2015) for: - Decommissioning of 4 NPP Units in operation; - Decommissioning of SF interim storage facility (ISFS); - RAW disposal facilities; - HLW disposal facility; - PURAM operating costs, supervision fees, fund management and support to local governments.	624
IE	The costs related to the design, construction and operation of the National Radioactive Waste Storage Facility will be met by the exchequer.	No information given		-
IT	18.1	2030 (excluding geological disposal)	EUR 1.5 bn for siting and construction of the Technological Park. EUR 7.2 bn for complete decommissioning of the 4 NPPs and of the nuclear fuel cycle facilities (2017).	143
LT	2.5 (2005-2014)	2038 (but before geological disposal)	RAW management and disposal & SF management: EUR 560.2 million (decommissioning plan 2014); Closure of Maišiagala repository: EUR 4.2 million (specific programme 2013); Other activities: EUR 47.7 million (present cost 2014); SF disposal EUR 1889 million (feasibility study 2005)	311
LU	Estimated EUR 15948 per year	No data	Costs for shipment to Belgium. The government states it is capable of covering any cost.	-
LV	1.08		2002 costs for construction RAW management, Improving safety, compensation to Baldone municipality for RAW storage facility	-
MT	Depending on the RAW management	10 year period		-

MS	Estimated total costs, billion EUR[46] (year)	Timeframes	Assumptions	Generated capacity (TWh, total estimated for the lifetime)
	option costs vary from EUR 75 000 (export) to EUR 900 000 (borehole disposal).			
NL	2 (2017) for the geological disposal. The cost of the above-ground management of RAW at COVRA is estimated at approx. EUR 7.5-8.5 million per year (excluding transport and processing costs)	2130	SF predisposal; SF disposal; RAW predisposal; RAW disposal; 400 m^3 HLW; 70000 m^3 LILW;158000 m^3 NORM. Costs for SF reprocessing and disposal are not available in national programme. Costs for research (to date) amount to: EUR 31 million (OPLA) + EUR 3.5 million (CORA) + EUR 10 million (OPERA): EUR 44.5 million, financed in their entirety by the Ministry of Economic Affairs	-
PL	0.099	2025	Update of the costs is ongoing	-
PT	0.0025		Cost for the SF transfer to USA remaining fuel & decommissioning	-
RO	1.8 to 3.5	Geological repository development should start from 2040	Average of 1.8 and 3.5. 3.5 (includes 2 new reactors) and 1.8 without new build.	448
SE	9.7 (2016)	Remaining basic costs, from and including 2018	Based on 40+6 years of NPPs operation period, SEK 101.4 bn.	3216
SI	0.31 (2005)	2006-2065	Total costs for 2005-2065 extrapolated from 2006-2015 costs.	138
SK	8 (2014)	2060		707
UK	GBP 121 bn (GBP 234.1 bn – discounted) (2018)	2135	The NDA, having considered a number of scenarios, continues to estimate the undiscounted cost within a potential range from GBP 99 bn (EUR 115 bn) to GBP 225 bn (EUR 261 bn)	3445

Table 11. Financial mechanisms and accumulated funds by Member State

MS	Financial mechanisms (organisation)	Gradual	Type of Fund: Internal (I)/ External (E)	Funds accumu lated, billion EUR (year)	Total accumu lated, billion EUR (year)	Preliminary estimate of available funds[47] (%)	Comments
AT	Treatment fee (NES) Disposal fee (transferred from NES to the State)	Both fees are paid upon transfer of the RAW to NES		No information	-	-	
BE	Long-Term Fund (NIRAS/OND RAF) Medium-term Fund (NIRAS/OND RAF)	Both funds financed by RAW producer s	I	No information	-	-	
BG	Radioactive waste management fund (SE RAW)	Annual fees	E	0.057 (2016) (BGN 0.112 bn)	0.797 (2016)		
	Decommission ing fund (SE RAW)	Annual fees	E	0.74 (2016) (BGN 1.445 bn)			
CY	Fund planned	Currently genera-tors' fees and State budget		No information	-	-	The fund costs will cover RAW management (including disposal), decommissioning, R&D, etc.
CZ	Nuclear Account for SF & RAW (Ministry of Finance)	Annual fees	E	1.4 (2014)	1.4 (2014)	33	CZK 37.4 bn, 2014 (0.037 CZK/EUR)
DE	Waste Management Fund (public-	Fee for interim storage	I	24.1 from NPPs operators			Current cost/financial scheme report not

[47] The costs notified by Member States have not been verified by the Commission. The figure in the column is indicative and is based on the available financial resources vs total costs in the national programme as reported by a Member State.

MS	Financial mechanisms (organisation)	Gradual	Type of Fund: Internal (I)/ External (E)	Funds accumu lated, billion EUR (year)	Total accumu lated, billion EUR (year)	Preliminary estimate of available funds[47] (%)	Comments
	law foundation)	and disposal [48];		paid in (2017)			available
DK	Danish State		State funds	No information	-	-	
EE	A.L.A.R.A. AS State budget funds and RAW producers			No fund established	-	-	
EL	Independent deposit fund			EUR 1 million (2018)	-	-	Revision of funding mechanisms before end of 2019
ES	Fund for the financing of activities included in the General RAW Plan (ENRESA)	Annual fees	E	No information	No information		Total costs incurred up to 31/12/2014 - EUR 5.2 billion
FI	The State Nuclear Waste Management Fund	Annual fees	E	2.584 (2017)	2.584 (2017)	40	Based on 5 reactors
FR	Portfolio of dedicated assets under the responsibility of the license holder.	Licensees create a portfolio of dedicated assets.	I	55.9 (31/12/2015)			When sold, the assets must cover the entire estimated cost.
HR	Fund for Financing the Decommissioning of the Krško NPP and the Disposal of NPP	Annual fees	E	0.25 (2017)		29	

[48] NPP operators continue to be responsible for the entire management and financing of decommissioning, dismantling and proper packaging of the radioactive waste until interim storage.

MS	Financial mechanisms (organisation)	Gradual	Type of Fund: Internal (I)/ External (E)	Funds accumu lated, billion EUR (year)	Total accumu lated, billion EUR (year)	Preliminary estimate of available funds[47] (%)	Comments
	RAW and SF						
HU	Central Nuclear Financial Fund	Annual fees	E	0.8 (2015)	0.8 (2015)	15	Fund to cover the costs for management of RAW, SF and decommissioning; HUF 246 386 million, 2015 (0.0032HUF/ EUR)
IE	Radioactive waste management fund (DCCAE)	State budget	I	EUR 50 000 allocated annualy for management of orphan sources	-	-	Costs related to the design, construction and operation of the National RAW Storage Facility will be met by the exchequer
IT	State pays for state owned facilities. SOGIN manages the funds for waste management	Annual fee (levy on the electricit y)		No information	-	-	The national programme cost is until 2030 and exclude geological disposal. Private generators shall pay to a fund (no details on the fund available)
LT	Decommission ing Fund for Ignalina Nuclear Power Plant; State Budget; Ignalina International Decommission ing Support Fund; Ignalina Programme; Other.			No information	No information	-	The national report indicates that the funds are sufficient for SF and RAW management until 2020. Reliance on EU funds after 2020. Decommissioning continues until 2038. No funds for deep geological disposal facility.
LU	Government will provide	No funds created	No funds created		-	-	

MS	Financial mechanisms (organisation)	Gradual	Type of Fund: Internal (I)/ External (E)	Funds accumu lated, billion EUR (year)	Total accumu lated, billion EUR (year)	Preliminary estimate of available funds[47] (%)	Comments
	necessary resources						
LV	Currently generators' fees and State budget			No information	-	-	Provisions for Salaspils research reactor assumed by the State
MT	Polluter pays	Currently gene-rators' fees		No information	-	-	Each owner of a source will need to pay a fee for disposal to the Government The Government will meet any short-fall between the expenses and the income.State to cover the cost of orphan sources.
NL	COVRA	Fees charged to license holders (includin g all estimated costs for processin g, storage, research and geologica l disposal)	E	0.08955 (2017)	-	4.4	At December 31, 2017, the provision for disposal at COVRA amounted EUR 89.55 million.
PL	Polluter pays (National RAW Agency (PAA)	Quarter annual fees		0 (2018)	-	-	No decision on the Polish Nuclear Power Programme
PT	Disposal revenue; General state budget and IST budget	Fees from producer s		No information	-	-	US transfer of remaining fuel to be covered by the State; increase of fees foreseen in 2015

MS	Financial mechanisms (organisation)	Gradual	Type of Fund: Internal (I)/ External (E)	Funds accumu lated, billion EUR (year)	Total accumu lated, billion EUR (year)	Preliminary estimate of available funds[47] (%)	Comments
RO	Waste Disposal Fund (ANDR)	Annual fees	E	0.102 (2014)	0.15 (2014)	4 - 8	4% for new build scenario and 8% without new build. Financing mechanism under revision to address the insufficiency of funds
	Decommission ing Fund (ANDR)	Annual fees	E	0.047 (2014)			RON 209 million (EUR 47 million)
SE	Nuclear Waste Fund	Annual fees	E	EUR 7 bn in 2017 Guarantees: EUR 1.66 bn			
	Studsvik Legacy Fund		I	SEK 1.116 bn (2017)			
	Non-nuclear waste manage-ment of orphan sources		E	SEK 11 million extra -2016-2018			
SI	Slovenia and Croatia governments established a Decommission ing Fund for NEK. Other nuclear installation are funded by Slovenian Government	Slovenia' s share of the funds for NEK are being collected through levy for the kWh delivered to the Slovenia n grid (0.30 EUR/ kWh).	E State funds	0.195 (2016)	0.195 (2016)	13	Estimates only made for period 2006-2015. Financing the decommissioning of the NPP and for the disposal of NPP RAW
SK	National Nuclear Fund	Annual fees	E	1.2 (2015)	1.2 (2015)	18	

MS	Financial mechanisms (organisation)	Gradual	Type of Fund: Internal (I)/ External (E)	Funds accumu lated, billion EUR (year)	Total accumu lated, billion EUR (year)	Preliminary estimate of available funds[47] (%)	Comments
UK	NDA Fund	State funds		83.8 (2015)		30-70 depending on the scenarios	GBP 67 bn = (0.8 GBP/EUR) (activities until 2135, and total NDA cost between GBP 99-225 bn)
	Nuclear Liabilities Fund	Annual fee	E	GBP 9.26 bn (2018)			

Limited information has been reported on the funds' investments and management to ensure availability of funds when needed in the future, and therefore, the Commission is not in a position to assess whether the Directive is complied with on this point.

2.2.5. 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 spent fuel and radioactive waste management in order to obtain, maintain and to further develop necessary expertise and skills (Article 8 of the Directive).

Very little change or developments are reported in the second national reports compared to the situation three years ago. More than half of the Member States have not indicated any change with regards to arrangements for education and training.

Three quarters of Member States have legal requirements for training and education of staff involved in spent fuel and radioactive waste management. Slightly more than one third of the Member States only report on the legal requirements for training and education without providing information/examples on the implementation of these legal requirements. Six Member States are on their way in solving legal issues in the transposition of the training and education requirements. In general, training and education of the regulatory authority is better defined than the training and education of operators and other stakeholders/licensees.

Research and development activities are well covered by one third of the Member States, all being countries with nuclear programmes. Almost half of the Member States do not report or report only in very generic terms on their research and development activities. All countries without nuclear programmes have difficulties in covering the research and development requirements of the Directive. Five Member States are working on solving legal issues in the transposition of the research and development requirements.

Nuclear power countries have in general more developed formal arrangements for training and education, and definitely for research and development activities. International exchange of experience through peer reviews, workshops, conferences, visits, etc. has been recognized by Member States as useful tool in particular for non-nuclear Member States.

National schemes and arrangements used by Member States remain unchanged and are summarised below:

- Post-graduate courses at universities;
- Training centres (basic and specialized, some of which at nuclear power plants);
- Training programmes or plans (i.e. at national, facility, or organizational entity level);
- Regular self-assessments of staff and needs analysis;
- Specialised, regular training for different levels of staff (e.g. or on-the job training with experienced staff);
- Specialised courses (e.g. for newcomers or experienced staff).

In the second national reports it was highlighted, mainly by non-nuclear Member States, that international experience exchange through peer reviews, workshops, conferences, visits, etc. serves as a valuable tool for training and education of staff.

2.2.6. Research and development

Each Member State programme is required to include the research, development and demonstration activities needed in order to implement solutions for safe long term management of spent fuel and radioactive waste (see Article 12(1)(f) of the Directive).

There is very little information provided in the second national reports on the research, development and demonstration activities planned to support implementation of the solutions needed for safe long term management of spent fuel and radioactive waste in Member States. Only one third of the Member States, mainly having large and medium size nuclear programmes, provided details on their research programmes, and presented the progress made.

Most of the Member States with smaller nuclear programmes presented in very general terms the research and development activities and timeframes concerning final disposal of ILW, HLW and spent fuel. A few Member States recognize the need for dedicated research in management of exotic waste and fuel.

One third of Member States have not reported any details or confirmed that they do not have a specific research programme defined. Small Member States without spent fuel and having small radioactive waste inventories (disused radioactive sources only) usually do not develop specific research, development and demonstration programmes but rely on participating in, or following the results of international programmes or projects (e.g. the International Atomic Energy Agency, European Commission) in line with their radioactive waste management needs. A few of these, recognising the importance of research, plan to develop their own research, development and demonstration activities and describe them in future reviews of their national programmes.

Overall, the situation remains unchanged - the research programmes in the EU are at different stages of implementation by Member States depending on the status of implementation of their national programmes. Only a few Member States have established research, development and demonstration programmes that are comprehensive and support the implementation of their national programmes. Some of these periodically review and update their research programmes. The most advanced are Member States with significant progress in development of deep geological disposal facilities. Usually, these Member States carry out a national research programme, and are actively participating in international research, namely Euratom research. In addition, strong international cooperation and exchanges have been established at European level, and internationally.

In the specific area of research for deep geological disposal of radioactive waste and spent nuclear fuel, four Member States currently operate five underground research laboratories (URL) for spent fuel, HLW and ILW disposal. A Member State who discontinued research in its URL plans to restart its operation in the coming years. Four more Member States plan to develop such laboratories after 2020-2030 to support the national geological disposal projects (see Table 12).

Table 12. Underground research laboratories (URL) for Disposal of HLW/Spent Fuel in EU[49]

MS	URL	Site	Status	Purpose	Responsible organization for facility development
BE	HADES	SCK•CEN site at Mol	In operation	Methodological and non-site-specific URL in Boom clay (poorly-indurated) at ~ 230 m depth on; has been extended as part of ongoing PRACLAY project.	EURIDICE (cooperation of ONDRAF/NIRAS & SCK CEN)
CZ	Planned	To be selected	2030	Long term site investigations	SURAO
FI	ONKALO	Eurajoki	In operation	Waste characterization, 420 m depth, planned to be incorporated into disposal facility with first disposal about 2025	POSIVA
FR	Bure	Meuse/Haute Marne	In operation since 2006	Callovo-Oxfordian clay (hard) at ~ 450 - 500 m depth	ANDRA
	Tournemire	Southern Aveyron	In operation since 1990	Methodological laboratory (former train tunnel) in sediments (hard clay), 250m depth	IRSN

[49] Several Member States carry out experimental work in the Grimsel Test Site (Switzerland), which is in operation since 1984. The facilities in grey are not in operation any longer.

HU	Planned	Western Mecsek	Preparation 2019-2032 (design) 2032-2038 (operation)	Preparation for implementation of the geological disposal programme	PURAM
PL	PURL	Planned	Planned	Research for the DGR	Minister of Economy, Polish Geological Institute – National Research Institute and other interested institutes[50]
RO[51]	Planned	On the selected site	2030	Confirm the suitability of the underground conditions	
SE	Äspö HRL	North of Oskarshamn	In operation since 1995	Granite, 200 - 500 m depth; Used for research activities on performance of barriers for SF disposal.	SKB

In Member States with nuclear programmes, research, development and demonstration activities are mainly undertaken by the licensee (usually the national waste management organisation) and by research organisations. In some Member States (less than a third) the competent authorities have their own research programmes or fund specific research to support the independent regulatory oversight. Table 13 gives an overview of research reactors in the EU.

Table 13. Operating research reactors in EU[52]

MS	Under decommissioning	In operation
AT	Not applicable	TRIGA MARK II (250 kW)
BE	Not applicable	BR-1 (1 MW); BR-2 (100 MW); VENUS/VENUS-F; MYRRHA (planned)
BG	IRT-2000 (extended shut-down)	Not applicable
CZ	Not applicable	VR-2 (Planned); LVR-15 Řež (10 MW); VR-1 (5 kW); LR-0 (5 kW)
DE	FRM; FRG-1; FRJ-2; FR-2; FRG-2; FMRB; FRN; SUR Hannover; RFR (permanent shutdown); SUR Aachen	BER-II (10 MW, final shutdown planned end 2019); FRM II (20 MW); FRMZ, TRIGA MARK II (100 kW); SUR Stuttgart; SUR Ulm; SUR Furtwangen; AKR-2 (0.002 kW)
DK	DR-3	Not applicable
EL	NTU (Permanent shutdown)	GR-B; GRR-1 (5 MW, extended shutdown)
FI	FIR-1 (decommissioning to start in 2020)	Not applicable
FR	Ulysse; Phebus; G-1; PHENIX; Rapsodie; Éole; Osiris; Minerve; EL 4	Cabri (25 MW); Orphee (14 MW); Isis (700 kW); ILL (58.3 MW); Masurca (5 kW, temporary shutdown); Reactor Jules Horowitz (100 MW, under construction)

50 The minister responsible for the economy, the Polish Geological Institute – National Research Institute (PIG-PIB) and other interested institutions to sign an agreement for supporting the concept of deep disposal of radioactive waste and the construction of an URL and initiating integrated research in these areas.

51 The National Agency for Radioactive Waste is responsible for the research and development.

52 Source: IAEA research reactor database (RRDB).

MS	Under decommissioning	In operation
HU	Not applicable	Nuclear Training Reactor (100 kW); Budapest Research Reactor (10 MW)
IT	L-54M; ISPRA-1 (permanent shutdown)	TRIGA Mark II Pavia (250 kW); TRIGA RC-1 (1 MW); RSV TAPIRO (5 kW); AGN-201 Costanza (0.02 kW); SM-1
LV	SRR Salaspils Research Reactor (permanent shutdown)	Not applicable
NL	LFR ARGONAUT	Delphi; HOR (2.3 MW); HFR (45 MW); PALLAS (Planned)
PL	Not applicable	MARIA (30 MW)
PT	RPI (permanent shut-down)	Not applicable
RO	VVR-S Bucharest	TRIGA II Pitesti
SE	R-2; R2-0	Not applicable
SI	Not applicable	TRIGA- MARK II (250 kW)
UK	DIDO; PLUTO; Dounreay Fast Reactor; BEPO; Dragon; CONSORT; VIPER (permanent shutdown); VULCAN (permanent shutdown)	Neptune (0.3 kW)

2.2.7. Transparency and public participation

Member States' programmes shall include the national policy and process for transparency required by Article 10 of the Directive. They shall ensure that the necessary information on the management of spent fuel and radioactive waste is made available to workers and the public (including the information from the competent regulatory authority) and that the public is given the necessary opportunities to participate effectively in the decision-making process in accordance with national legislation and international obligations.

All Member States provide information in their national programmes and national reports on the policy and regulatory arrangements ruling transparency, referred to the obligation to inform the public as well as providing consultation and participation mechanisms.

In all Member States some information on the activities related to radioactive waste management is publicly available.

Almost all the Member States indicate in their national programmes and national reports that they have consultation mechanisms in place for certain stages of the decision making related to radioactive waste management.

Half of the national reports and national programmes provide evidence of having specific arrangements for dialogue and participation of stakeholders and/or citizens in general.

The mechanisms adopted to put into practice transparency policies are listed in the Table 14 below.

Table 14. Overview of main information and involvement mechanisms

Information	*Consultation*	*Participation*
Websites	Written submission	Working groups and stakeholders boards
Adapted information products	Web based submission	Local community platforms
Conference and seminars	Oral (public hearings)	Independent advisory bodies
Media relations	Opinion surveys and polls	
Info or visitor centres		
Social media[53]		

In general, the Member States' second national reports offer an uneven level of clarity and detail. In some cases, they are focused on the national framework but hardly provide any description or examples of its implementation, especially as concerns effective participation practices. Some consist of general statements on principles and motivations around transparency, but actually providing little factual information.

Transparency is ensured at national level by a set of legal and regulatory acts. We can find reference to the principle of transparency in Member States' general laws or domain-specific laws related to the environment, energy, radioactive waste management or radiation protection. This includes the transposition into the national framework of the Directive (Council Directive 2011/70/Euratom), the environmental assessment Directives (2001/42/EC, 2011/92/EU, 2014/92/EU), or the Aarhus and Espoo Conventions, among other supranational codes. Three Member States[54] explicitly report that access of citizens to public information (understood as public access to official records) is a right established in their national constitution. Eight countries report some update of their national framework relevant for transparency during the reporting period, although the scope of the modifications is not clearly explained in every case.

According to the national programmes and national reports, the provision of information on matters related to nuclear safety and radiation protection constitutes a legal obligation for any entity responsible for radioactive waste management activities. This obligation is almost always allocated to the national regulatory authority. In general, Member States declare that the citizens can access the regulator's acts on the basis of the right of public access to official records, unless there are reasons to justify confidentiality[55]. Several Member States report that documents concerning licensing procedures of 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.

National laws can assign also a legal obligation of information to the licence holders. In some countries there are specific duties set on the operators of radioactive waste facilities to inform

53 Although social media have the potential to become informal consultation platforms, with their present impact they are rather information channels complementary to the websites.

54 Belgium, Slovakia, Sweden.

55 In some case the reasons to keep confidentiality are explicitly listed and published.

local community in the vicinity. Finally, other bodies such as ministries and technical and scientific support organisations sometimes contribute to public information.

Websites are the primary source of information in all Member States. Key documents related to the national strategy on radioactive waste management and its implementation are usually public. This includes national programmes, national reports, international evaluations and annual reports. Countries with nuclear power plants use generally a diversity of information channels and techniques, including adapted products that are understandable for a broad audience. Long term decisions, such as the siting and construction of geological repositories, are often accompained by nationwide information campaigns.

Almost all Member States report on consultation mechanisms present in their national frameworks. Public consultation is required for political decisions with environmental implications, including those related to radioactive waste management. Consultation most often takes place as part of strategic environmental assessments, environmental impact assessments and/or during the licensing of activities related to radioactive waste. In some countries the adoption of new legislation with environmental effects is also subject to public consultation. In addition, opinion surveys can also be used to ascertain the views of the population about radioactive waste management or nuclear activities in general[56].

In the case of a potential transboundary impact, citizens and institutions of neighbouring countries can take part in the consultation, in compliance with the Espoo Convention[57]. However, very few Member States offer descriptions or examples of cross-border consultation.

Eight Member States report on a consultation process carried out during the reporting period. These processess are in general publicly documented and the handling of the proposals and opinions filed has to be reasoned by the agency conducting the consultation.

Half of the Member States report having mechanisms in place to ensure public participation in the decision-making process beyond public consultation. Participatory bodies can be local, for the involvement of the municipalities and communities neighbouring existing facilities, as reported by seven countries. National participation arrangements can take different forms: working groups, advisory boards, mixed parliamentary commissions, etc. Nationwide participatory bodies are often created not yet for the actual decision making, but for devising route maps and participation premises to rule future processes, namely related to final repositories or long term storage facilities. When participation boards are settled, their debates are most often minuted and published.

In many cases, national reports and national programmes either do not provide any description of participation or they offer vague explanations. The actual impact of the public in the decision making is usually not explained. Only three Member States establish the agreement of local communities as a prerrequisite for the siting of facilities.

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56 Opinion surveys are used in at least three Member States.

57 Ten Member States make explicit mention of the Espoo Convention in their national programmes and/or national reports.

Only one third of the Member States reported updates or relevant events related to public participation practices since the release of their first national report.

3. CONCLUSION

The Commission has reviewed the notified national reports of 28 Member States and the newly adopted or updated national programmes submitted until March 2019. Having reviewed these notifications, the Commission prepared its second report to the Council and the European Parliament on the implementation of this Directive. The Commission identified progress, trends and challenges in the spent fuel and radioactive waste management.

In most areas, progress is very little, or insufficiently reported to the Commission.

The next Member States reports to be submitted to the Commission are due by 23 August 2021, when the Commission expects a significant improvement of the quality of reporting.