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Accompanying the document

Proposal for a Council Regulation

establishing a dedicated financial programme for decommissioning of nuclear facilities and management of radioactive waste, and repealing Council Regulation (Euratom) No 1368/2013

{COM(2018) 467 final}

Glossary

Term or acronym	*Meaning or definition*
BG	Republic of Bulgaria
D&WMP	JRC decommissioning and waste management programme
EBRD	European Bank for Reconstruction and Development
ECA	European Court of Auditors
ESIF	European Structural and Investment Funds
ESSOR	Essai Orgel research reactor at JRC Ispra
EVM	Earned Value Management
HFR	High-flux research reactor at JRC Petten
IAS	Internal Audit Service
ISPRA-1	Research reactor at JRC Ispra
ISSG	Inter-service Steering Group
JRC	Joint Research Centre
KPI	Key Performance Indicator
MFF	Multi-annual Financial Framework
NDAP	Nuclear Decommissioning Assistance Programmes, whereby the EU provides financial support to Lithuania to shut down and decommission two reactors at the Ignalina NPP, to Bulgaria to shut down and decommission four reactors at the Kozloduy NPP, and to Slovakia to shut down and decommission two reactors at the Bohunice V1 NPP.
NPP	Nuclear Power Plant
'Radioactive Waste' directive	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
SERAW	State Enterprise Radioactive Waste (BG)
SIEA	Slovak Innovation and Energy Agency
SK	Slovak Republic
VVER	Water-Water Energetic Reactor is a series of pressurised water reactor designs originally developed in the Soviet Union.

1. INTRODUCTION: POLITICAL AND LEGAL CONTEXT

1.1. Scope and context

The present ex-ante evaluation relates to the funding programme for financial assistance for "Decommissioning of Nuclear Facilities and Management of Radioactive Waste", (the 'programme') that addresses the decommissioning of nuclear facilities and the management of the arising waste under a common instrument to optimise synergies and knowledge sharing in order to secure meeting of relevant obligations.

This ex-ante evaluation identify the following needs on a current basis:

- The Kozloduy nuclear power plant units 1-4 (Kozloduy, Bulgaria) and the Bohunice V1 nuclear power plant (Jaslovské Bohunice, Slovakia) consist of six pressurized water reactors originally developed in the Soviet Union (VVER 440). The decommissioning of these plants contributes towards increased nuclear safety in the region and in the EU as a whole.

- The Commission's Joint Research Centre (JRC) owns nuclear research installations in four sites: JRC-Geel in Belgium, JRC-Karlsruhe in Germany, JRC-Ispra in Italy and JRC-Petten in the Netherlands. Some of these installations are still in use today while others have been stopped. The JRC is responsible for the decommissioning of these installations and for the safe management from generation to disposal of the resulting spent fuel and radioactive waste.

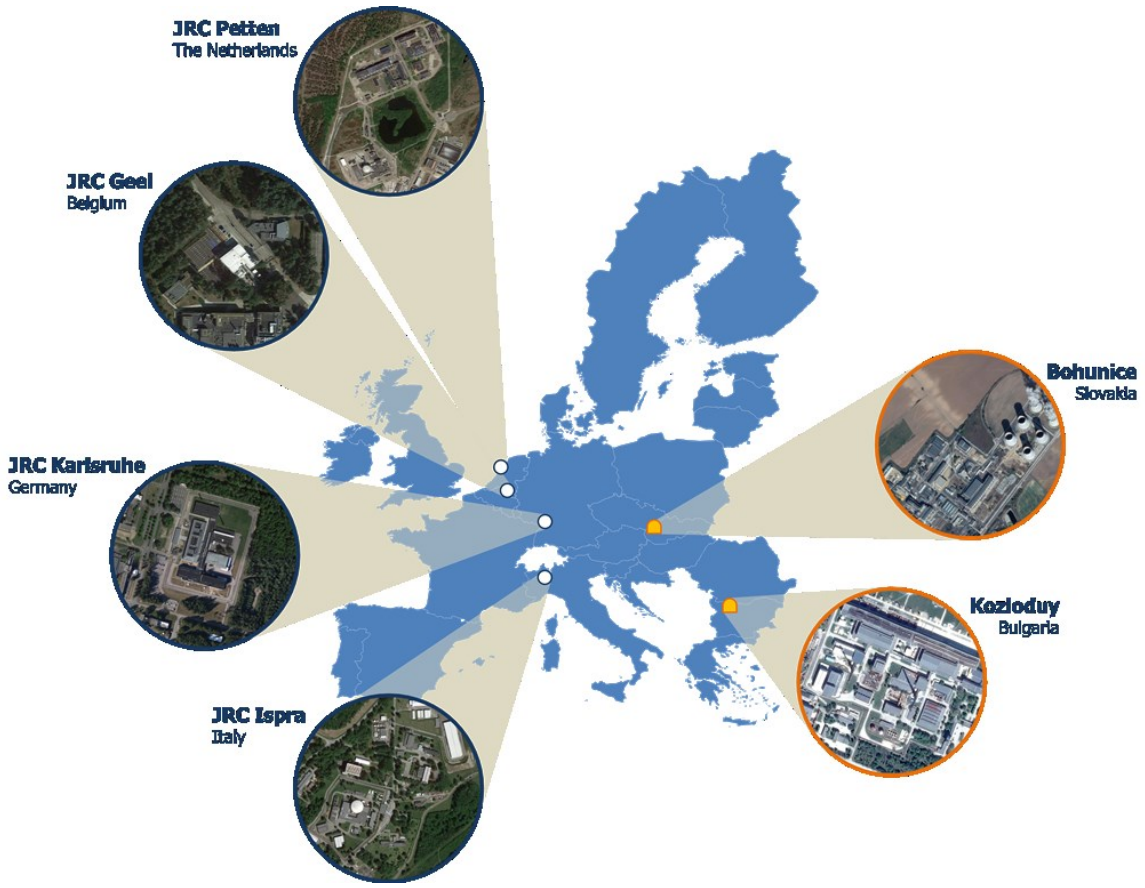

Figure 1 – Decommissioning sites.

Given this making, the programme is naturally subdivided into:

(i) the two programmes providing financial support to Bulgaria and Slovakia to safely decommission six nuclear reactors at the Kozloduy nuclear power plant units1-4 and the Bohunice V1 nuclear power plant (respectively the 'Kozloduy programme' and the 'Bohunice programme'); and

(ii) the programme of Joint Research Centre (JRC), implementing safely the decommissioning process and the management of the resulting radioactive waste of the Commission's own nuclear installations at the JRC sites (the 'JRC decommissioning and waste management programme', D&WMP).

This ex-ante evaluation is carried out in preparation of the next MFF and it is based on the lessons learnt and progress achieved so far.

1.1.1. Kozloduy programme and Bohunice programme

The Kozloduy and Bohunice programmes originated in the context of the negotiations for accession to the EU of Bulgaria and Slovakia, which took the commitment to close and subsequently decommission their old Soviet-designed nuclear reactors by a commonly agreed date. The closure commitment of the two Member States as well as the commitment of the EU to provide financial support was foreseen in the corresponding Accession Treaties[1,2] (Slovakia acceded in 2004; Bulgaria in 2007). The two Member States and the EU have fulfilled their respective Accession Treaty commitment.

On the basis of Article 203 of the Euratom Treaty[3] and to ensure continuity of safety related measures, the EU provided financial assistance[4,5] to the decommissioning of Bohunice V1 NPP beyond the timeframe that was stipulated in Slovakia's Accession Treaty[6]. Similarly, following the period covered by Bulgaria's Accession Treaty[7] the EU continued providing financial assistance[5,8] for the safe decommissioning of the Kozloduy NPP Units 1-4.

The programmes have been subject to extensive audits in the first part of the current MFF: an internal audit conducted by the Internal Audit Service (IAS) that resulted in three recommendations[9], all implemented to date; a performance audit of the European Court of Auditors that issued a special report[10] resulting in eight recommendations, either fulfilled or under implementation according to the established plan. In particular, the recommendation no 5 issued by the European Court of Auditors (ECA) calls for discontinuation of the programmes after 2020 or transfer under other instruments (such as the European Structural Investment Funds, ESIF). Therefore, as per the reply provided by the Commission[11], an assessment of policy options is presented in this ex-ante evaluation in order to examine if the existing instruments for support to Bulgaria and Slovakia should be:

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1 OJ L236, 23.9.2003, p. 33 and p. 954

2 OJ L157, 21.6.2005, p.11 and p. 38

3 "If action by the Community should prove necessary to attain one of the objectives of the Community and this Treaty has not provided the necessary powers, the Council shall, acting unanimously on a proposal from the Commission and after consulting the European Parliament, take the appropriate measures." (Article 203 Treaty establishing the European Atomic Energy Community)

4 Council Regulation (Euratom) No 549/2007 of 14 May 2007 on the implementation of Protocol No 9 on Unit 1 and Unit 2 of the Bohunice V1 nuclear power plant in Slovakia to the Act concerning the conditions of accession to the European Union of the Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia (OJ L 131, 23.5.2007, p. 1)

5 Council Regulation (Euratom) No 1368/2013 of 13 December 2013 on Union support for the nuclear decommissioning assistance programmes in Bulgaria and Slovakia (OJ L 346, 20.12.2013, p. 1)

6 Article 2.1 "During the period 2004-2006, the Community shall provide Slovakia with financial assistance in support of its efforts to decommission and to address the consequences of the closure and decommissioning of Unit 1 and Unit 2 of the Bohunice V1 Nuclear Power Plant" ." (Act of accession, Protocol No 9 - OJ L954, 23.9.2003)

7 Article 30.2 "During the period 2007-2009, the Community shall provide Bulgaria with financial assistance in support of its efforts to decommission and to address the consequences of the closure and decommissioning of Units 1 to 4 of the Kozloduy Nuclear Power Plant." (2005 Act of accession, Protocol Concerning the conditions and arrangements for admission of the republic of Bulgaria and Romania to the European Union (OJ L157, 21.6.2005))

8 Regulation (Euratom) No 647/2010 of the Council of 13 July 2010 on financial assistance of the Union with respect to the decommissioning of Units 1 to 4 of the Kozloduy Nuclear Power Plant in Bulgaria (Kozloduy Programme) (OJ L 189, 22.7.2010, p.9)

9 The recommendations concerned the assessment of ex-ante conditionalities, the control strategy, and the co-financing.

10 ECA Special Report 22/2016 - EU nuclear decommissioning assistance programmes in Lithuania, Bulgaria and Slovakia: some progress made since 2011, but critical challenges ahead.

11 The Commission's reply to recommendation 5 ("Discontinue dedicated funding programmes for nuclear decommissioning in Lithuania, Bulgaria and Slovakia after 2020") of the ECA Special Report 22/2016 reads: "The Commission will carry out an impact assessment […] with regard to proposals of new [nuclear decommissioning] initiatives. This impact assessment will explore whether funding should be continued and if so the most suitable financing mechanisms."

(i) discontinued in the next MFF, or

(ii) merged into the Funds under cohesion policy, or

(iii) merged in a combined programme including the decommissioning of JRC sites (baseline option).

Originally and until 2013 the European Union assistance was designed to support these Member States both in their efforts to shut down and decommission the concerned reactors, but also to address the consequences of the early closure, such as enhancement of security of supply and energy efficiency. This has changed under the current MFF where the scope of the programmes was restricted to decommissioning activities only, i.e. on safety related measures. The disposal of spent fuel and radioactive waste in a deep geological repository was never part of the programme. This shift from financing a complex mix of energy and decommissioning projects towards a dedicated and focused effort on decommissioning programmes resulted in increased effectiveness and efficiency.

More in particular, in the MFF 2014-2020 the programmes objectives have been specified as follows:

Table 1: Specific objectives for MFF 2014-2020

	SPECIFIC OBJECTIVES
Kozloduy programme and Bohunice programme	→ Dismantling of large components and equipment in the reactor buildings; → Dismantling in turbine halls and auxiliary buildings; → Safely managing the decommissioning waste in accordance with detailed waste management plans.

The implementation procedures[12] of the current Regulation established the baseline (decommissioning plans) for each decommissioning programme up to the respective end-state and provided concrete targets per each specific objective of the current MFF.

The European Union financial assistance has been implemented by indirect management[13] since its inception. It has been made available through pillar assessed implementing bodies in the form of contributions:

(i) to two International Decommissioning Support Funds[14] managed by the European Bank for Reconstruction and Development (EBRD) since 2001;

(ii) to Slovak Innovation and Energy Agency (SIEA) for the Bohunice programme since 2016, reflecting increased national ownership of the programme.

The total financial assistance from the European Union to the two Member States for the decommissioning of the concerned reactors as well as for mitigating measures in the energy sector until the end of 2020 sums up to EUR 1 992 million. Thereof EU assistance earmarked for decommissioning of the six reactors until the end of 2020 sums up to EUR 1 446 million (see Annex 2).

12 Commission Implementing Decision of 7.8.2014 on the rules of application for the nuclear decommissioning assistance programmes for Bulgaria, Lithuania and Slovakia for the period 2014-2020 — C(2014) 5449 final

13 Art 60 Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union

14 Kozloduy International Decommissioning Assistance Fund;
Bohunice International Decommissioning Assistance Fund.

As mentioned, for the two nuclear power plants the final decommissioning plans (baseline) were prepared in 2014[15]. These plans set out the schedules, covering a timespan longer than the current MFF, and the cost estimates for the decommissioning activities until the accomplishment of a well-established end-state. Funding provided in this MFF is fit for effective and efficient accomplishment of the related objectives.

In line with the Rome Declaration[16], the EU budget should enable a Europe that is safe and secure; this is a dimension where the nuclear decommissioning programmes have contributed so far and may further contribute. The main positive impact to be achieved by the programmes is indeed the progressive decrease of the level of radiological hazard for the workers, the public and the environment in the concerned Member States but also in the EU as a whole. Nuclear decommissioning and waste management are key processes of a modern, clean and circular economy.

Like all existing EU instruments the programmes need to undergo the EU value added test in line with the reflection paper[17] on the future of EU finances. As reflected in the list of options, consideration is hereby given whether the programmes remain indispensable or whether there is scope for merging programmes or modifying them with a view to budgetary flexibility and/or simplification, which are other key principles underpinning the next MFF. The programmes' EU added value test fits into the lines and principles drawn by the Commission in its communication[18] on a new, modern Multi-annual Financial Framework (MFF) post-2020.

The programmes have taken the attention of both the European Parliament and the Council of the European Union. Both bodies intervened specifically on the Nuclear Decommissioning Assistance Programmes (NDAP) after the publication of the dedicated ECA Special Report[10].

The European Parliament[19] underlined that nuclear safety is of prime importance, not only for the Member States concerned but for the population in the whole Union and its neighbourhood and called upon the Commission to perform a thorough assessment of the needs for continuation of the dedicated funding programmes for nuclear decommissioning in Bulgaria and Slovakia beyond 2020.

The Council[20] also recalled that the premature closure and subsequent decommissioning of the Soviet-designed nuclear reactors in Bulgaria and Slovakia was one of the conditions for accession to the EU. It further underlined the fact that this condition entailed a significant financial burden based on which the EU agreed to provide financial assistance, underscored the need for adequate supporting actions for the decommissioning of the concerned nuclear power plants in the two Member States to ensure successful completion of the decommissioning processes whilst maintaining a high level of nuclear safety, and noted that any potential new EU funding beyond 2020 should include clear rules and the right incentives to pursue decommissioning, with regard to both financing and timing.

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15 The definition of detailed decommissioning plans and the associated financing plans was a pre-condition (ex-ante conditionality) to the launch of the programme in the MFF 2014-2020. These plans describe in detail the decommissioning strategy, how the facilities will be safely dismantled, how radiation protection of workers and the public is ensured, how environmental impacts are addressed, how materials – radioactive and non-radioactive – are to be managed, and how the regulatory authorisation for the facilities and sites are to be terminated.

16 Declaration of the leaders of 27 member states and of the European Council, the European Parliament and the European Commission (25 March 2017)
http://www.consilium.europa.eu/en/press/press-releases/2017/03/25/rome-declaration/pdf

17 Reflection Paper on the Future of EU Finances - COM(2017) 358

18 Communication from the Commission to the European Parliament, the European Council and the Council - A new, modern Multiannual Financial Framework for a European Union that delivers efficiently on its priorities post-2020 - COM(2018) 98 final

19 Committee on Budgetary Control "Report on the Court of Auditors' special reports in the context of the 2015 Commission discharge" (2016/2208(DEC))

20 Council conclusions on the ECA Special Report No 22/2016, adopted by the Council at its 3511th meeting held on 13 December 2016 (document n° 15534/16 ATO 68)

1.1.2. JRC decommissioning and waste management programme

The JRC's D&WMP relates to nuclear facilities and spent fuel and radioactive waste owned by the Commission.

The JRC was established under Article 8 of the Euratom Treaty:

> *(1) After consulting the Scientific and Technical Committee, the Commission shall establish a Joint Nuclear Research Centre. This Centre shall ensure that the research programmes and other tasks assigned to it by the Commission are carried out. It shall also ensure that a uniform nuclear terminology and a standard system of measurements are established. It shall set up a central bureau for nuclear measurements.*
> *(2) The activities of the Centre may, for geographical or functional reasons, be carried out in separate establishments*

In application of this Article, Site agreements were signed during the period 1960-62 between the Community, Germany, Belgium, Italy and the Netherlands. In the two latter cases national nuclear installations were transferred to the Community. An infrastructure geared to nuclear research was put in place at the four sites. Some of these installations are still in use today while others have been stopped, in some instances more than 20 years ago, and have mostly become obsolete.

On the basis of Article 8 of the Euratom Treaty, the JRC has to manage its historical nuclear liabilities and decommission its shut-down nuclear installations. To this end, a budget heading was created in agreement with the European Parliament and the Council. The Commission's objective has always been to provide sound management to clear Euratom's nuclear liabilities, part of which stem from the development of families of reactors at the start of the 1960s and the rest from research programmes on reactor safety.

To this end and based on the 1999 Communication of the Commission "Historical Liabilities Resulting from Nuclear Activities carried out at the JRC under the Euratom Treaty – Decommissioning of obsolete Nuclear Installations and Waste Management" (COM(1999)114), the programme was initiated and a specific ad hoc budget line was created, in agreement with the European Parliament and the Council (European Parliament Resolution on Historical liabilities resulting from nuclear activities carried out at the JRC[21]). Since then, the Commission reports regularly to the Council and European Parliament on the progress of the D&WM programme, thereby providing an updated budget forecast (2004, 2008, and 2013[22]).

The aim of this ex-ante evaluation is to evaluate how the JRC could tackle best the challenges the D&WM programme currently faces. More specifically, there is a need for an appropriate level of flexibility and maximised effectiveness and efficiency. The ex-ante evaluation will also give the rational for the projections and estimations of the budgetary needs, and address the risks associated with the programme implementation.

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21 European Parliament resolution on the communication from the Commission to the European Parliament and the Council on historical liabilities resulting from nuclear activities carried out at the JRC under the Euratom Treaty (COM(1999) 114 + C5-0214/1999 + 1999/2169(COS)) (OJ C 67, 1.3.2001, p. 167)

22 Communication from the Commission to the Council and the European Parliament - Decommissioning of nuclear installations and waste management - Nuclear liabilities arising out of the activities of the Joint Research Centre (JRC) carried out under the Euratom Treaty, SEC(2004)621 final
Communication from the Commission to the Council and the European Parliament - Decommissioning of Nuclear Installations and Management of Radioactive Waste: Management of Nuclear Liabilities arising out of the Activities of the Joint Research Centre (JRC) carried out under the Euratom Treaty, COM(2008)903 final
Communication from the Commission to the Council and the European Parliament - Decommissioning of Nuclear Installations and Management of Radioactive Waste: Management of Nuclear Liabilities arising out of the Activities of the Joint Research Centre (JRC) carried out under the Euratom Treaty, COM(2013)734 final

Scope of the D&WMP

As nuclear operator under Italian, Dutch, German and Belgian laws, JRC is responsible in these four Member States for the decommissioning of these installations and for the safe management from generation to disposal of the resulting spent fuel and radioactive waste.

Initially, the D&WM programme focused on the so-called "historic liabilities", mainly constituted by Ispra's nuclear facilities that had ceased to operate in the previous decades. This also included the historical waste present at the JRC sites. Currently the programme covers also the nuclear installations which will become obsolete in the future at all four JRC sites, including the management of nuclear material. The D&WM programme shall contribute to the JRC host Member States national programmes in their implementation of the Council Directive 2011/70/Euratom on the responsible and safe management of spent fuel and radioactive waste. In line with Article 7 of the Directive, JRC has the prime responsibility for the safe management of the spent fuel and radioactive waste that is generated from its operations. Therefore, the costs of the management of these materials from generation to disposal including the disposal of spent fuel and radioactive waste in a final repository are included in the scope of the programme.

To this end, JRC has re-assessed in detail its strategy, schedule and budget needs for the future. The revised tentative timeframe as of 2017 indicates that:

(i) at JRC Ispra, decommissioning is ongoing and will be completed by 2038;

(ii) at JRC Petten, the JRC-owned High-Flux Reactor (HFR) is operated by a private company and is today one of the major producers of some medical radioisotopes. It is also used in the frame of R&D (by JRC and Member States). Decommissioning will start under the responsibility of JRC after the shut-down of the reactor. This will certainly happen once a replacement reactor will be available (shutdown foreseen in 2025, when the new Dutch research reactor (PALLAS) is expected to be operational according to the Article 41 notification for new investment received by the Commission from the Dutch authorities);

(iii) at JRC Karlsruhe, nuclear R&D operation will normally continue on long-term until the end of the site lease contract in 2059. However, three nuclear laboratory buildings will successively get obsolete and be decommissioned, starting in 2025;

(iv) at JRC Geel, nuclear R&D operation will normally continue on long-term until the end of the site lease contract in 2060.

In line with the reflection paper on the future of EU finances, the JRC has undergone the EU value added test. Having the responsibility for the safe management of its own spent fuel and nuclear waste in the four host Member States, the D&WM programme remains indispensable for the fulfilment of the Commission's obligations as licence holder[23] of these facilities. By releasing as soon as possible any obsolete nuclear research facilities free of radiological constraint, it contributes to a Europe that is safe and secure and sets a good benchmark across Europe for the safe and responsible management of radioactive waste and spent fuel. The timely completion of this process though is highly dependent on the host Member State.

[23] JRC is owner and/or license holder for the operation of the nuclear facilities in Ispra, Karlsruhe and Geel. The current license holder for the operation of the nuclear facility in Petten is the private company NRG (medical radioisotope production), but as owner of the facility the JRC is liable for decommissioning and waste management.

Implementation and Financing

As nuclear operator under Belgian, Dutch, German and Italian laws, the Commission is legally obliged to provide for, and maintain, adequate financial and human resources necessary to fulfil its obligations with respect to nuclear safety of a nuclear installation (Article 6 of Directive 2009/71/Euratom). In addition, the Commission as licence holder[23] has the prime responsibility for the safety of spent fuel and radioactive waste management of the facilities and/or activities that fall under its responsibility (Article 7 of Directive 2011/70/Euratom).

Therefore, the D&WM programme is implemented by direct management, under the responsibility of JRC; outsourced services and supplies are financed by an ad hoc budget line specifically created for this purpose by agreement between the Council and the European Parliament. However, this budget line cannot be used for administrative expenses (e.g. staff costs, technical experts) which represent an important part of the decommissioning process. As a result, the human resources necessary for the implementation of the programme (for management and supervision) have been so far funded through the Euratom Research and Training framework programme.

The timely completion of the D&WM programme is highly dependent on the host Member State. Moreover, in light of the expected increase of decommissioning activities at the different sites, continuing financing decommissioning staff from the Euratom Research and Training framework programme bears the risk of penalising the overall JRC's research work programme in the future. Therefore, the Commission services have extensively worked with JRC to identify options to further improve the management and governance in implementing the programme. In the long term, a handing over of JRC nuclear facilities including nuclear material would present financial and legal benefits for JRC – it would ensure that the JRC would cease to be responsible for decommissioning and waste management, would no longer bear the associated costs and it would release JRC from its obligations as nuclear operator. Should the negotiation with host Member states encounter difficulties, the JRC will nevertheless ensure sufficient personnel, to carry out in an appropriate and safe way its decommissioning activities and fulfil its legal obligations also with regard to waste management.

Since its launch in 1999, the D&WM Programme will have consumed EUR 535 million of operational credits by 2020. Pre-decommissioning activities have been pursued under the current licenses, following the granting of ad hoc authorisations by the national Safety Authorities. The greatest part of the budget however has been spent for maintaining the safety of the shut-down nuclear installations in Ispra, for building up the waste management infrastructures in Ispra, and for the management of JRC's nuclear material and waste (see section 2.1.2). This includes the mandatory payments for the ongoing construction of the German repository.

The JRC is regularly reviewing the progress and performance of the programme using independent external advice (D&WM programme Expert Group, external consultants). The programme has made important progress and achievement since its launch. The programme is also audited by the EC Internal Audit Service. Following the recommendations from the last audit, JRC has revised the decommissioning planning and determined expected costs for each JRC site using a harmonised approach, based on recent international recommendations for estimation of decommissioning costs. The new strategy and budget forecast was reviewed by the D&WM Programme Expert Group and received a positive opinion in 2017. Still, significant uncertainties affect the timelines and the cost estimate for the different sites.

In light of the financial uncertainties and the risk to penalise JRC's research work programme in the future, an instrument which fully covers the JRC D&WM programme including administrative costs is fundamental.

1.2. Lessons learned from previous programmes

1.2.1. Kozloduy programme and Bohunice programme

A mid-term evaluation of the NDAP was conducted pursuant to Article 9 of the relevant Council Regulation[5], and in line with the Better Regulation guidelines. The mid-term evaluation considered and assessed the results and impacts, the efficiency of the use of resources and its Union added value. The evaluation focused on the period 2014-2017 but considered where relevant the previous financial framework (2007-2013).

For the mid-term evaluation the Commission gathered relevant information and data by extensively involving key stakeholders (i.e. Ministries, implementing bodies, decommissioning operators, members of the NDAP Committee).

Moreover, an Open Public Consultation was launched by the Commission in June 2017 for an extended duration of 14 weeks. The consultation received limited interest (20 responses). In addition to this consultation, a targeted e-survey consultation was launched in July 2017; it gathered an additional 17 responses (1 from Bulgaria, 4 from Lithuania and 12 from Slovakia) from 90 stakeholders contacted in total. The replies received were overall positive about the NDAP but did not provide any additional input on the programmes. These two consultations were complemented with targeted consultations of around 100 interviews with decommissioning operators and relevant stakeholders.

The conclusions of the NDAP mid-term evaluation can be summarised as follows:

Coherence with EU policies. The mid-term evaluation concluded that the NDAP are **coherent with EU policies aiming at ensuring the highest level of nuclear safety**. The EU support through the NDAP ensures that the immediate dismantling strategy in Bulgaria and Slovakia is steadily pursued and prevents that undue burden is transferred to future generations, while it partially derogates for historical reasons to the ultimate responsibility of the Member States to ensure adequate financial resources for nuclear decommissioning and radioactive waste management. The decommissioning strategy in Bulgaria was modified in 2013 in preparation for the current MFF: the resulting plan advanced the end date of the programme by seven years from 2037 to 2030.

Progress. In line with expectations set for the MFF 2014-2020, **Bulgaria and Slovakia have progressed effectively and efficiently in the decommissioning of their reactors** in line with the agreed baseline (decommissioning plans). There have been challenges and setbacks due to the programmes' complexity, but the management system has proven increasing ability to cope with them. Roadblocks from the previous financial framework have been removed and delays carried over were recovered to the extent possible.

Safety. The analysis demonstrated also that **substantially improved levels of safety** are going to be achieved at the sites as a result of the Union funding in this MFF. Major ongoing developments in the field are:

- in Bulgaria the construction of the disposal facility for low level waste, the management of legacy waste, and decontamination and dismantling works in the reactor buildings;
- in Slovakia the finalisation of the reactor cores dismantling.

Financial scope. The preparation and endorsement in 2014 of the respective decommissioning plans was a major milestone and clarified scope, schedule, and budget of the decommissioning programmes. Between 2014 and 2016, the Commission has analysed these baselines and concluded that they are based on complete and comprehensive plans, and on sound overall cost estimates which could be improved by considering a higher level of contingencies (max 16%). In 2017, the cost estimate until the decommissioning end-state was confirmed for the Bohunice

programme, whereas for the Kozloduy programme the organisation responsible for decommissioning, State Enterprise Radioactive Waste (SERAW), has produced a draft updated cost estimate as part of the compulsory triannual review foreseen under the Bulgarian legislation, which claims a headline increase (+17%) in decommissioning cost and contingencies. This increase of cost estimates does not affect the current MFF and, as per the information currently available, is not linked to any extension of the programme scope and the programme end date is confirmed. Bulgaria has increased the national contribution so that the residual financing gap is about EUR 92 million. At this point in time the cost revision has not been yet agreed by the Commission; Bulgaria needs to provide full justification of the revised cost estimates. The formal revision process should be completed in 2018 in the context of the adoption of the new detailed implementation procedures as per Articles 7 and 9 of the relevant Regulation[5] add will be taken into account during the negotiations for the next programming period.

In both Bulgaria and Slovakia, the residual financing gap beyond 2020 is in the range of EUR 80-90 million per Member State.

National contribution. The mid-term evaluation showed that the **achieved levels of national contribution appear fit to sustain proper efficiency**; nonetheless co-financing is not established in the legal basis, thus creating uncertainties that should be removed. Moreover, the analysis showed that increasing levels of national contribution are a necessary but not sufficient condition to set the right incentives for timely and efficient decommissioning. To this end, the explicit transfer of risks (cost overruns, delays) to the concerned Member States would have a greater impact. This practice has been already introduced to a certain extent under the current MFF where possible.

Governance. The **governance setup has ensured effective and efficient implementation of the programmes** and compensated for the uncertainties mentioned on the national contribution aspects. Main factors of success were clear definitions of roles and responsibilities as well as a strengthened monitoring framework. The analysis has also identified areas for further improvement such as:

(i) increased involvement of the Member States (programme coordinator) for increased ownership together with stronger accountability of the decommissioning operators (final beneficiaries);

(ii) streamlining of procedures to enhance the timeliness of the management cycle;

(iii) increased inter-comparability of the programmes' performance.

Objectives. The mid-term evaluation confirmed that the programmes objectives of the NDAP (see Table 1) remain valid in the current MFF. Nevertheless, some of the expected results, milestones, target dates, as well as the corresponding performance indicators should be adapted in line with the latest updates of the decommissioning plans to allow for effective monitoring for the period 2018-2020.

Although the reduction of the ultimate risk to the general population posed by these facilities while ensuring that the decommissioning is conducted in a safe manner have been the driving factors behind the NDAP, the mid-term evaluation noted that these aspects have not been well captured in the high level monitoring framework that is the basis for communication of the results to external parties (e.g. reporting to the Council and the Parliament). Any post-2020 funding should therefore focus on explicit safety objectives monitored by means of dedicated performance indicators.

Knowledge gain. Finally the mid-term evaluation has highlighted that the experience gained so far from the projects implemented under the Kozloduy programme[24] and the Bohunice programme[25] provide a solid base of knowledge in the EU for conducting future decommissioning programmes of VVER type reactors (e.g. Czech Republic, Hungary, Germany, Finland). These EU co-funded programmes (including the Ignalina programme in Lithuania) may aim at becoming a solid benchmark for governance related issues and management practices such as cost estimation methodologies or planning.

1.2.2. JRC decommissioning and waste management programme

Under the current legal framework, a mid-term evaluation is not mandatory. The JRC is regularly reviewing its progress and performance, using independent external advice (D&WMP Expert Group, external consultants). Due to the high inherent risks of the D&WM programme, such as the risk of delays and resourcing risks, the programme has been selected for two audits by the Internal Audit Service (IAS) during the current MFF, one of which has been launched recently.

The main outcomes and recommendations, as well as their follow-up by JRC, are summarised below. These recommendations together with those from the group of experts should further help JRC to improve the performance of its programme.

Continuous technical advice by the D&WM Expert Group

In managing the D&WM programme, the JRC is regularly advised by a group of independent European decommissioning experts (biannual meetings and additional ad-hoc meetings). Their advice relates to the decommissioning and radioactive waste treatment strategy, the available technology, technical aspects of the organisation and any other aspects relating to the programme (see section 5.2.1).

Findings from external reviews and past audits

The progress of the programme and its budget is periodically reviewed by external experts. Back in 2011, the experts found overall evidence that the activities on the different sites were on track, despite some delays, and that the plans and cost estimates for future decommissioning were established in a coherent way. Nevertheless, several uncertainties and risks were identified, which to a large extent were related to the long-lead times involved: figures were considered in many cases based on best estimates, with no or only few provisions to cover for uncertainties, particularly for the projects planned in the longer term (i.e. after 2020). The experts emphasised the importance of assessing in detail the expected amounts of waste, and encouraged JRC to investigate managerial and technical measures which should be taken in order to limit waste volumes and to reduce to the extent possible any uncertainties on the costs related to their future disposal.

In 2014/2015, the IAS audited the financial aspects of the D&WM programme[26]. It concluded that the current operational set-up provides reasonable short-term assurance for achieving the JRC's objectives. However, such a short-term assurance is not enough for covering the needs of such a long-term complex programme. Among other recommendations, IAS confirmed the

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[24] At Kozloduy, for example, the Plasma Melting Facility represents a state-of-the-art equipment to achieve very high volume reduction of radioactive waste. It is the second application in the domain of nuclear waste management in the world. Demand for such cost-effective technologies can be expected to grow in coming years.

[25] JAVYS – the decommissioning operator and final beneficiary in Slovakia – has included as an objective in its organizational strategy the leverage of gained experience into future commercial opportunities. So far the company has acquired on the international decommissioning market contracts in the area of radioactive waste management with the Czech company ČEZ (NPPs Dukovany and Temelín) and for the Italian company SOGIN (NPP Caorso).

[26] Audit on Nuclear Decommissioning and Waste Management Programme at the JRC – Financial Aspects, IA – 14 – 06 (224); Final Report (Ares(2015)2299901)

necessity of regular in-depth assessments, with focussed review of the decommissioning budget, paying special attention to the assessment of fixed costs and to the improvement of current estimates (Very Important Recommendation). IAS also looked at the mid-term planning needs in the field of human resources.

Recent improvements

Following these consistent recommendations for improving the cost estimates, and in light of the new strategy 2017 (see section 1.1.2), JRC sites with the support of external consultants, re-assessed in more detail their waste inventory and revised their decommissioning planning. A harmonised approach, based on recent international recommendations for estimation of decommissioning costs, has been applied to determine expected costs on each site. The new budget forecast (as of December 2017) includes contingencies, depending on the level of uncertainty associated with the respective activities and the external conditions at the different locations. The new strategy and budget forecast was reviewed by the D&WM Programme Expert Group and received a positive opinion at the end of the process. Still, significant uncertainties affect the timelines and the cost estimate for the different sites, inherent to the long-lead times for nuclear decommissioning and delays caused by the host Member State.

New IAS Audit

The IAS has launched a new audit on the D&WM programme implementation[27]. A draft Scoping Memo has been received on 13 March 2018. One of the main risks identified is in relation to the evolution of the planned activities in the period 2021-2060, which does not appear compatible with flat budget allocations as noted in JRC's updated strategy. The increase of operational D&WM programme activity covering multiple JRC sites will also impact the overall management strategy and need of internal JRC resources. The variable and unpredictable level of expenditures makes it difficult to manage the budget.

Moreover, the dedicated D&WM budget line cannot be used for administrative expenses. In light of the expected increase of decommissioning activities at the different sites, continuing financing decommissioning staff from the Euratom Research and Training framework programme bears the risk to penalise JRC's research work programme in the future. The current trend of the Commission to reduce staff as well as the fact that the D&WM relies heavily on intra-muros is also conflicting with the need to ensure knowledge transfer on long-term.

Other risk factors identified are related to the additional costs due to delays, the complexity of contracts to be managed, the difficulty of implementation of such a multi-site programme and the operational consequences of the long-term risk factors.

The final Audit Report is expected in mid-2018. The findings of the IAS will further help JRC to improve programme performance in the future.

[27] Launch of the 2018 IAS Audit on Nuclear Decommissioning and Waste Management Programme implementation in DG JRC, as notified in the Announcement Letter (Ares(2017)5064966)

2. THE OBJECTIVES

1.3. Challenges for the programmes of the next MFF

The key aim in nuclear decommissioning is the progressive removal of hazards inherently associated to the concerned installations. This process is stepwise in nature, mainly because the removal of major batches of radioactive materials is obtained over several stages. The reduction of the safety measures and associated costs evolves likewise.

The key aim of the programmes is the progressive removal of hazards inherently associated to the concerned installations, however the programmes face different challenges. The differences mainly originate from the type of nuclear facilities covered, and the respective responsibilities of the Commission.

1.3.1. Kozloduy programme (BG) and Bohunice programme (SK)

At this point in time the decommissioning operators[28] are focussing on dismantling activities. Slovakia has advanced the most and is currently carrying out decontamination and dismantling in the reactor building at the Bohunice site, while in Bulgaria at the Kozloduy site decontamination and dismantling are well advanced in the auxiliary buildings and have started in the reactor buildings.

These programmes are on track to accomplish the specific objectives with the funding provided in the current MFF (2014-2020) and a clear trend towards increased efficiency was observed throughout the monitoring activities as confirmed by independent experts[29].

Safety challenges

Progress in the implementation of the Kozloduy and Bohunice programmes in the current MFF (2014-2020) has led already to a significant decrease in radiological hazard to the general public, because the most important sources of radiological hazards are tackled in the current MFF (e.g. decontamination and dismantling of the reactor primary cooling circuits and cores, and completion of waste management routes). Technical and technological challenges have been coped with successfully thus far. For the future challenges, knowledge sharing and synergies are key to ensure continued success, provided that the reactors are of the same model.

The availability of financing in a timely manner is a crucial element for ensuring nuclear safety and the protection of the workers and the EU citizens. In case of insufficient funding, delays could be incurred with subsequent extra-costs, safety implications and increased risk of loss of unique expertise.

In case of continuing the programmes after 2020 in Bulgaria and Slovakia, the budget estimates are reduced to less than one fourth compared to the current MFF. The annual average amounts (commitments) needed in the scenario with unchanged policy (i.e. continuation of the programmes) are shown in Annex 2.

The EU funding under the next MFF and the allocated national contributions will cover the completion of the programmes in Bulgaria and Slovakia, thus addressing all safety challenges. In Slovakia, the funding may be over before the mid-term of the next MFF.

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28 SERAW / ДП РАО (State Enterprise Radioactive Waste / Държавно предприятие „Радиоактивни отпадъци") in Bulgaria;
JAVYS (Jadrova a vyradovacia spolocnost, a. s. / Nuclear and Decommissioning Company) in Slovakia

29 "Support to the mid-term evaluation of the Nuclear Decommissioning Assistance Programmes", EY, An evaluation for the European Commission DG Energy, 2018

Social challenges

The social impact in the concerned regions caused by the shutdown of the reactors was initially important. Kozloduy is located in the Vratsa district (BG) which is one of the poorest areas in Bulgaria with a high unemployment rate[30]. Bohunice is located in the Trnava region (SK) which has a low unemployment rate[31]; social challenges are therefore less significant in Bohunice than in Kozloduy.

Nuclear power plants in operation are located on both sites (Kozloduy NPP Units 5 and 6; Bohunice V2 NPP).

In 2017 under the Kozoduy programme approx. 650 full time equivalents were employed. Under the Bohunice programme 235 full time equivalents are currently working.

Other available EU instruments may be deployed in the regions ensuring this way synergies and complementarities. For example, the European Regional Development Fund (ERDF), the European Social Fund Plus (ESF+) and the Cohesion Fund could support measures to accompany the related social and economic transition, including also energy efficiency and renewable energy measures as well as certain other activities not linked to radiological safety processes. As such these Funds can create additional activities in the concerned regions and utilise the locally available expertise as a major driver of job creation, sustainable growth and innovation. Similarly synergies should be explored with FP9 and / or the Euratom Research and Training programme in areas such as technology development and testing, as well as training and education.

1.3.2. JRC decommissioning and waste management programme

The D&WM programme covers the decommissioning of a variety of experimental research nuclear facilities, and the management of non-standard spent fuel and historical waste. This is notably a key distinguishing feature of this programme in relation to the 'Kozloduy' and 'Bohunice' programmes which have to deal with power generating reactors. Additionally, as owner and nuclear operator under national laws of the nuclear facilities, JRC has the prime responsibility for the safe management from generation to disposal of the spent fuel and radioactive waste it has generated (Article 7 of Directive 2011/70/Euratom), until transfer of ownership to the host Member State or release of the facilities from regulatory control. Actually, JRC is implementing the D&WM programme as license holder in four different Member States.

Uncertainties due to external factors

The four JRC sites face uncertainties of different types. For example, in Ispra, where the D&WMP is more advanced, the complex and long licensing/authorisation process is causing significant delays, both for the management of radioactive waste and for the decommissioning of the facilities.

Italy: Lack of criteria for waste management

Directive 2011/70/Euratom on the safe and responsible management of radioactive waste and spent fuel obliges each Member State to establish a national programme (to be communicated to the Commission) which translates the national policies into concrete plans of actions, in order to ensure that progress is made.

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30 Average unemployment rate in the Vratsa province in the first half of 2016 was 19.0 % compared to the national average of 9.4%.
[https://ec.europa.eu/eures/main.jsp?countryId=BG&acro=lmi&showRegion=true&lang=en&mode=text&regionId=BG0&nuts2Code=%20&nuts3Code=null&catId=9574]

31 Unemployment rate in Trnava region in January 2018 was 2.06% being the lowest rate in Slovakia.
[http://www.upsvar.sk/media/medialne-spravy/v-januari-2018-miera-evidovanej-nezamestnanosti-v-sulade-s-dlhodobym-trendom.html?page_id=764912]

Italy has not yet adopted such a national programme, formulating how it would implement concrete radioactive waste and spent fuel management solutions. This has two essential consequences:

– JRC has no information how the radioactive waste generated during operation and decommissioning needs to be conditioned in order to transfer it to the Italian radioactive waste management organisation. This is commonly referred to as "waste acceptance criteria". In absence of such criteria, there is a risk of having to re-condition the materials a second time – which is a costly operation with increased safety risks due to the radiological hazards involved. Therefore, such operations often require to be put "on hold" until the acceptance criteria are defined, potentially leading to overall delays in the decommissioning process[32].

– JRC cannot transfer the radioactive waste generated during decommissioning directly to the Italian radioactive waste management organisation, i.e. the "waste management route" is not open. As a consequence, capacity for storing the materials has to be maintained on the site (see "Technical and Technological challenges" below).

Italy: pending authorisations for decommissioning

Decommissioning of nuclear facilities is subject to authorisation, a process which in Italy involves agreements from several State Ministries. For each decommissioning phase, the activities to be performed have to be described in detail, including safety, environmental and radiation protection implications as well as the initial and final state of the site and the solution envisaged for waste management and waste disposal. The identification and analysis of possible hazard and of accident scenarios for each phase of decommissioning must be addressed in the application, together with implication for the outside emergency plan and proposal for its updating.

So far, only one laboratory has been fully decommissioned and released from regulatory control as this did not require this authorisation process. Dismantling of some internal parts of the installations in Ispra is currently possible within the existing licenses for running the facilities, but only if special ad hoc authorisations are granted by the Safety Authorities. The implementation of the 'Settlement Agreement' that was signed in 2009 between Italy and the Commission, transferring over the responsibility for the decommissioning of one of the two reactors at the Ispra site to the Italian authorities, started only in 2018.

The JRC Ispra decommissioning programme end date has already been postponed from 2028 to 2030, and it is currently scheduled for 2038.

Petten: Uncertainties regarding operational life time

In Petten, the end of operation of the High-Flux Reactor (HFR) was not defined until recently. On November 21, 2017 the Commission received the Notification of Investment for the new Dutch research reactor (PALLAS), to be built in Petten. According to this notification, HFR would be shut down once PALLAS becomes operational (scheduled for 2025). However, there is no guarantee that the new reactor will be built. For this, the Dutch Authorities should give final authorisation (after completion of the Environmental Impact Assessment, licensing etc.)

[32] JRC has mitigated the financial risks for potential re-conditioning by signing a 'Settlement Agreement' with the Italian State in 2009, as to which the costs have a certain ceiling; this agreement however was only recently recognised by Italy. The agreement ("Accordo Transattivo … sui principi governanti le responsabilita' di gestione dei rifiuti radioattivi nel sito del Centro Comune di Ricerca di Ispra", signed on Nov 27, 2009) is based on three commitments by the Italian Government: take charge of decommissioning the Ispra-1 reactor; take ownership and manage the interim storage facility and the conditioned waste stored therein; cap costs for potential re-conditioning of waste. The agreement was pending implementation by the Italian Government. Only recently it was recognised by publishing the Italian Budget Law for 2018 (Leggi di Stabilità) which included provisions for 2018 to implement one of Italy's commitments, namely that to take charge of one of the two reactors at the Ispra site

Cost increases

Costs for delays currently amount to EUR 10 million per year for the safe conservation of the nuclear facilities at the Ispra site, in addition to the staff costs (58 members of JRC staff paid from Euratom R&D budget).

Today, the best available cost estimate of decommissioning is significantly higher than past estimates (EUR 1.6 billion vs EUR 0.9 billion forecasted in 2013). Real costs could be even higher at the time of completion of the programme, depending on which risks actually materialise.

In Ispra, the current estimate for waste disposal (EUR 138 M) is conditional to high uncertainties due to the lack of any national disposal path for radioactive waste and nuclear material (lack of national repositories and definition of Waste Acceptance Criteria by the host Member State).

Belgium, Germany and the Netherlands have established waste disposal paths for low level waste. It has to be noted that waste disposal costs increased by 60% in Belgium within the last 5 years. The cost estimate in Karlsruhe does not include the disposal of nuclear material and spent fuel due to the current lack of a disposal path. These costs will be incurred in the frame of future decommissioning activities in Karlsruhe (around 2030 and beyond).

Technical and technological challenges

The nuclear facilities at the JRC Ispra site include two research reactors (ESSOR and Ispra1), a hot-cells laboratory building, a former test facility for nuclear material, a cyclotron building, and a liquid treatment station with 'tank farm'. Even though the nuclear research facilities have been shut down long time ago, the decision to go ahead with their decommissioning was postponed for different reasons. As regards the ESSOR reactor, the final decision to proceed with decommissioning was taken in 1998.

Italy is only at the beginning of the process of identifying a national radioactive waste repository, and all the waste generated by the operation and decommissioning of nuclear installations in Italy is currently stored in the sites of origin. In this context, JRC Ispra has started to build new waste treatment and storage facilities on its premises to manage its own radioactive waste until the final Italian repository will be available.

Part of the JRC Ispra premises was used for the treatment and storage of waste and nuclear material. In the frame of the D&WM programme, new facilities for waste treatment, characterisation and safe storage have been, or are being established. The establishment of state-of-the-art procedures for the safe treatment of historical waste is one of the key challenges of the programme. The knowledge gained by JRC in this kind of "pilot tests" would be a valuable contribution to Member States national decommissioning programmes. Where appropriate from licensing, technical and financial point of view, external nuclear facilities are used to process waste and nuclear material.

In comparison with the technological, administrative and environmental challenges JRC Ispra is facing, the decommissioning activities in Karlsruhe (low activity laboratories and Hot Cells), Geel (low activity laboratories and two accelerators) and Petten (one research reactor) are more straightforward: waste disposal paths have been established by the host Member States, and future decommissioning will build on the experience gained by JRC during the R&D operation of the facilities (e.g. regular disposal of obsolete laboratory equipment and waste).

Availability of adequate resources

Decommissioning is a long-term industrial activity which requires adequate resources, in terms of budget and staff, throughout the programme. Budget, as well as the JRC staff dealing with

decommissioning, should be available throughout the duration of the decommissioning activities which are expected to peak around 2025 and remain high for several years until circa 2040.

A specialised workforce is required, with skills in the technical field (engineering /physics /chemistry /radiation protection), in industrial project and contract management, and with specific knowledge in the licencing processes of the four host Member States. In the current framework, the workforce is stemming and paid from the Euratom R&D budget. If – in light of the current staff reduction strategy of the Commission – DG JRC has to maintain the number of staff or even reduce it, increasing the number of staff in decommissioning in the future would mean decreasing the number of staff engaged in other important activities of JRC (research, policy support, etc.).

The decommissioning programme as an "industrial activity" depends on strong administrative support to prepare and manage high-volume and technically complex contracts (legal advice, procurement staff). In the past, the preparation of such contracts, moreover their implementation, were frequently behind schedule and caused additional delays and budget underspending (on average 20% of unspent yearly payment allocations in the current MFF). Unexpected technical difficulties or contamination levels are possible in any decommissioning project, and might require additional licensing, negotiations and/or lawsuits with existing contractors, and preparation of additional contracts. Flexibility in budget allocation would be needed throughout the programme.

1.4. Objectives of the programmes of the next MFF

1.4.1. General objectives

The 'Kozloduy' and 'Bohunice' programmes aim to **assist Bulgaria and Slovakia in managing the radiological safety challenges of the decommissioning process**.

The D&WMP programme **pursues the decommissioning of the Commission (JRC) sites**, and **explores and develops options for anticipated transfer of decommissioning and waste management liabilities to the JRC host Member States**.

These two main general objectives are complemented by the aim of enhancing the EU added value of the programme through **dissemination of knowledge** (thereby generated) to all EU Member States on the decommissioning process.

Finally, a key policy objective remains the increase of Member States' ownership of the decommissioning and waste management processes.

1.4.2. Objectives of the Kozloduy and Bohunice programmes

The specific objectives for the programmes in Bulgaria and Slovakia need to be adapted to the actual progress of the decommissioning programmes and the need to foster knowledge sharing and potential synergies.

The disposal of spent fuel and radioactive waste in a deep geological repository is excluded from the scope of the programmes, and has to be developed by each Member State in its national programme for the management of spent fuel and radioactive waste as required by the relevant directive[33,34]. The Slovak national programme covers the realisation of a deep geological

[33] Council Directive 2011/70/Euratom of 19 July 2011 on establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste, OJ L199, 2.8.2011, p. 48-56.

[34] 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 – C(2017) 236 final.

repository and schedules it in 2065; however until 2020 the alternative option to explore solutions for disposal in other countries will be also considered. The Bulgarian national programme presents a cut-off date in 2030, therefore does not cover the funding for a deep geological repository.

Three specific objectives reflect the need to progress in the removal of radiological hazards:

(1) Finalise dismantling and decontamination of the reactor primary circuit and big components in accordance with the decommissioning plan; progress has to be measured by the quantity and type of materials removed as well as earned value;

(2) Finalise safe management of the decommissioning and legacy waste up to interim storage or to disposal (depending on the waste category), including the completion of the waste management infrastructure where necessary. This objective has to be accomplished in accordance with the decommissioning plan; progress has to be measured by the quantity and type of safely stored or disposed of waste as well as earned value; and

(3) Continue downgrading of radiological hazards; this objective has to be measured through the safety assessments of the activities and the facility, identifying ways in which potential exposures could occur and estimating the probabilities and magnitude of potential exposures. Removal of the facilities[35] from regulatory control is planned by 2025 in the Bohunice programme and by 2030 in the Kozloduy programme.

The plans shall include a proper set of milestones (output, date and budget) and target amounts.

Other two specific objectives reflect the general policy objective to increase Member States' ownership:

(4) Specify the maximum level of EU co-financing both in relative and absolute terms. The EU funding provided under the next MFF is the final allocation for the completion of the Bohunice and Kozloduy programmes;

(5) Support national initiatives to develop implementing agencies to ensure local capacity and increased ownership to govern decommissioning and waste management.

1.4.3. Objectives of the JRC decommissioning and waste management programme

The main general objective of the JRC D&WM programme is to pursue the decommissioning of the Commission's JRC installations in four sites: JRC-Geel in Belgium, JRC-Karlsruhe in Germany, JRC-Ispra in Italy and JRC-Petten in the Netherlands and to safely manage the spent fuel and radioactive waste until the transfer of responsibilities to the host Member State. Activities financed under this programme in the period 2021-2027 have to deliver the following:

(1) For all sites:

Explore and develop options for anticipated transfer of decommissioning and waste management liabilities to the host Member State.

(2) At JRC-Ispra (depending on release of the relevant authorisations by the Italian Safety Authorities):

[35] Refers exclusively to Kozloduy nuclear power plant units 1-4 and Bohunice V1 nuclear power plant.

- Retrieval, treatment and safe storage of the historical waste until transfer of ownership to the host Member State;
- Retrieval, treatment and safe storage of nuclear material and spent fuel until transfer of ownership to the host Member State;
- Decommissioning of licensed nuclear facilities;
- Safe management of decommissioning radioactive waste and materials.

(3) At JRC-Karlsruhe:

- Decommissioning of obsolete equipment;
- Safe management of decommissioning radioactive waste and materials;
- Reduced inventory of obsolete nuclear material and spent fuel;
- Decommissioning of shut-down facilities;
- Preparatory phases of the decommissioning of building parts

(4) At JRC-Petten:

- Safe management of historical and decommissioning waste and materials;
- Reduced inventory of obsolete nuclear material and spent fuel.
- Preparatory phases of the decommissioning of the HFR, in coordination with the current operator

(5) At JRC-Geel:

- Decommissioning of obsolete equipment;
- Safe management of decommissioning radioactive waste and materials.

The D&WM programme shall contribute to the JRC host Member States national programmes on their implementation of the Council Directive 2011/70/Euratom on the responsible and safe management of spent fuel and radioactive waste. To this end, the costs for the disposal of spent fuel and radioactive waste in a final repository are included in the scope of the programme.

1.4.4. Common specific objectives

An additional specific objective should reflect the opportunity and need to create and share knowledge for all EU Member States managing decommissioning programmes. When possible, additional synergies should be also developed and exploited.

The merger in one instrument of the decommissioning activities in Bulgaria and Slovakia, and of the JRC will build synergies between the two programmes and additional in-house know-how for the Commission to explore and develop options for anticipated transfer of decommissioning and waste management liabilities to the JRC host Member States. As mentioned, synergies with the European Regional Development Fund (ERDF), the European Social Fund Plus (ESF+) and the Cohesion Fund can be strengthened in the next programming period. Similarly synergies should be explored with FP9 and / or Euratom Research and Training programme in areas such as technology development and testing, as well as training and education.

(1) Develop ties and exchanges among EU stakeholders (e.g. Member States, safety authorities, utilities and decommissioning operators) and

(2) document explicit knowledge and make it available through multi-lateral knowledge transfers on decommissioning and waste management governance issues, managerial best practices, and technological challenges, with a view to develop potential EU synergies.

Progress is to be measured by the number of knowledge products created and their outreach.

3. PROGRAMME STRUCTURE AND PRIORITIES

The programme for Bulgaria and Slovakia is indirectly managed through the European Bank for Reconstruction and Development and a national agency in Slovakia. Keeping the decommissioning of these reactors under a dedicated spending programme implies that implementation continues seamlessly through the established implementing bodies. However, the establishment of a national agency in Bulgaria should be assessed.

The programme for the decommissioning of the Commission's sites is managed directly by the JRC.

Having the two programmes under one instrument provides the proper flexibility to maximise effectiveness and efficiency, ensure knowledge sharing and synergies, and support JRC exploring and developing options for anticipated transfer of decommissioning and waste management liabilities to the JRC host Member States.

1.5. Kozloduy programme and Bohunice programme

The common legal basis for the Kozloduy programme and Bohunice programme is the Euratom Treaty. Article 203 of the Treaty establishing the European Atomic Energy Community (EAEC) states that "*the Commission shall establish uniform safety standards to protect the health of workers and of the general public and ensure that they are applied. If action by the Commission should prove necessary to attain this objective and the Euratom Treaty has not provided the necessary powers, the Council shall, acting unanimously on a proposal from the Commission and after consulting the European Parliament, take the appropriate measures.*"

The actions to be funded post-2020 will be derived from the latest version of the decommissioning plans and are generally responding to the safety objective. The main priority for the programmes is to ensure timely availability of funds for the accomplishment of the safety objective.

In order of importance the priorities for the programmes are:

(i) sharper focus on safety (nuclear safety, protection of workers, public, and the environment);

(ii) dissemination of knowledge for the EU nuclear decommissioning market;

(iii) incentivised and enhanced performance through increased ownership;

(iv) simplification and synergies;

(v) solidarity.

Based on the already good established practice of the current MFF, whereby the focus of the programmes was restricted to decommissioning only, the programmes should further focus on activities strictly related to the delivery of the general and specific objectives and the EU added value, i.e. removal of radiological hazards and creation and dissemination of relevant knowledge. The established decommissioning plans will continue to serve as the baseline, defining this way the precise scope for EU assistance. At the same time incentives to pursue decommissioning should be embedded in the funding mechanism, including time limitations and appropriate levels of national contribution from the beneficiary Member States.

The aspect of EU solidarity also deserves the right level of political attention, because it underpinned the agreements between the two Member States and the Union when the decision to prematurely shut-down those reactors was taken.

Hence, it is important that the programme be prioritised for further EU support in the next MFF (2021-2027) as it has the potential for achieving notable EU-added value both in terms of safety and knowledge gain.

1.6. JRC decommissioning and waste management programme

As nuclear operator under Italian, Dutch, German and Belgian laws, JRC is responsible in the four host Member States for the safe management from generation to disposal of the spent fuel and radioactive waste it has generated. This includes the provision of adequate financial and human resources to ensure the safety of spent fuel and radioactive waste. In this context, the availability of the necessary human resources, as well as volume and flexibility of the budget shall be ensured.

Following the proposal of the high level Working Group of Commission Services (see 1.1.2), the handing over of JRC nuclear facilities including nuclear material present financial and legal benefits for JRC – it would ensure that JRC would cease to be responsible for decommissioning and waste management, would no longer bear the associated costs and would release JRC from its obligations (for the safety of spent fuel and radioactive waste management as well as for decommissioning activities). Therefore, the exploration and development of anticipated transfer of liabilities to the JRC host Member States should be prioritised.

The handing-over of JRC's nuclear facilities to the respective host Member State is possible. Such transfers occurred in the past in some of the concerned Member States. Any such financial settlement can take different forms, for example, it could be paid over several multiannual financial framework periods, given the length of the decommissioning process.

It is important to bear in mind that currently the situation needs to be differentiated: in Belgium, Germany, and the Netherlands waste acceptance criteria are defined and therefore, the situation is relatively more stable than in Italy where the waste routes are not clear in the national programme. The higher uncertainties related to the JRC Ispra decommissioning plan are due to the current absence of waste acceptance criteria and the absence of the final disposal facility.

A successful hand-over to Member States will also allow to free JRC human resources for effective transfer of explicit knowledge on decommissioning and waste management issues to Member States, in line with the common specific objectives (2.2.3).

Should the negotiations with the Member States encounter difficulties, the JRC would need to ensure sufficient staff levels (adapted to the volume and pace of activities), to carry out the safe decommissioning of its facilities and fulfil its legal obligations also with regard to waste management. JRC will also ensure the continuous dissemination of knowledge gained throughout the implementation of the programme at the different sites.

4. DELIVERY MECHANISMS OF THE INTENDED FUNDING

1.7. Kozloduy programme (BG) and Bohunice programme (SK)

In the context of the mid-term evaluation the current NDAP has been benchmarked with three 'comparator' instruments[36]: Connecting Europe Facility (CEF), Budget Support aid delivery mechanism and ESIF major projects. The benchmark focused on the identification of relevant best practices concerning the governance, the programme and project management and financial management.

The benchmark showed that the performance monitoring framework for the current NDAP is generally in line with best practice - in particular practices in Budget Support operations – given that a results-based performance monitoring is in place. In this respect the NDAP could be improved by linking additional funding to the achievement of pre-defined targets.

As sought by the current NDAP, all 'comparator' instruments seek to ensure strong national ownership of project implementation through early buy in and strong Member State involvement. Member States are involved early on in the development of the projects or programmes and have input at key phases.

CEF and ESIF have a clearly defined framework for EU co-financing, with minimum and maximum EU co-financing rates set out in the legal base. Unlike CEF and ESIF, the NDAP has no formalised framework for EU co-financing at the moment.

All instruments, the current NDAP inclusive, offer a fully multi-annual rather than annual framework for programming. While 'comparator' instruments all imposed annual monitoring and reporting requirements (similar to NDAP), none had in place an annual cycle for programming and commitments (in contrast to NDAP). Projects are implemented in line with their approved work plans. For CEF and major projects, specific approval is necessary prior to funding as well as for substantive deviations from the approved programme of works or approved budget.

The defining feature of major projects is the specific approval procedure to which they are subject to. This includes a number of analyses carried out by the Commission services with the aim to ensure the quality of the project proposal, its feasibility, maturity and its utility. The NDAP delegates this role to the implementing bodies that are entrusted budget implementation tasks via a delegation agreement.

A new financial regulation is being prepared to provide the EU with enhanced tools to implement the budget. The design of a new delivery mechanism will have to make use of the new features proposed by the financial regulation.

Based on the above, the following three policy options should be considered in assessing the impact of the Kozloduy and Bohunice programmes in the next MFF:

(i) Policy option 1 - Discontinuation of the programmes,

(ii) Policy option 2 - Programmes under cohesion policy,

(iii) Policy option 3 - Programmes combined with the decommissioning of JRC sites (baseline option).

[36] These three comparators were selected because they represent a variety of different approaches for programme implementation and are used to deliver large-scale projects, including notably in the energy sector.

1.7.1. Policy option 1 - Discontinuation of the programmes

Under Option 1 no further financial EU assistance would be provided and consequently the two Member States would have to guarantee safe completion of their decommissioning programme with own national resources.

As mentioned under section 2.1.1 above, in case of insufficient funding, there is a risk of rendering the whole decommissioning process more lengthy and costly, as well as a result in possible safety implications and risk of loss of unique expertise.

Firstly, in Bulgaria and Slovakia significant decrease in radiological hazard to the general public has already been accomplished by the programmes.

Secondly, the Commission services have found in a previous study[37] that the State budgets of the concerned Member States appear able to absorb the additional financing needs.

Finally, the national policies and programmes which are established by the Member States in application of the 'Radioactive Waste' directive include the management of spent fuel and decommissioning waste from the concerned facilities and the associated cost estimates until the completion of the programmes.

In summary, given that national policies and programmes are in place, key safety objectives have been met already, and the national economies appear fit for bearing future charges, the discontinuation option may appear viable in some respect.

However, in such a scenario the Union would have no more leverage on the timely execution of the safety actions within the timescales set out in the approved decommissioning plans.

Moreover, the discontinuation of the programmes could harm the reputation of the EU in Bulgaria and Slovakia as they had to shut down the six reactors on request by the EU at the time of the accession negotiations. They were relying on Union support for the decommissioning as well as for measures mitigating the important effects to their economies due to the loss of inland energy production[38].

These risks should be assessed also in view of the reduced average yearly needs of the programmes altogether, and of the increased programmes' effectiveness and efficiency obtained during the current MFF.

1.7.2. Policy option 2 - Programmes under cohesion policy

Cohesion policy is the Union's main investment policy, aiming to strengthen economic, social and territorial cohesion and reduce disparities among regions. It is a major driver of job creation, sustainable growth and innovation in Europe’s diverse regions.

As a result of a performance audit on the NDAP, in 2016 the ECA recommended[39] discontinuing dedicated spending programmes after 2020 and considering access to ESIF for nuclear

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37 "Nuclear Decommissioning Assistance Programme (NDAP) – Assessment of the robustness of the financing plans considering the economic-financial-budgetary situation in each concerned Member State and of the relevance and feasibility of the detailed decommissioning plans", Deloitte, NucAdvisor, VVA Europe, A study prepared for the European Commission DG Energy, 2016

38 For example Slovakia – as a consequence of the shutdown of Bohunice V1 NPP – changed from an exporter of electricity to an importer country for electricity.

39 Recommendation 5: dedicated funding programmes for nuclear decommissioning in Lithuania, Bulgaria and Slovakia should be discontinued after 2020. If a clear need for the use of EU funds beyond 2020 is established, in one or more of the three Member States, any future EU funding proposed by the Commission and agreed by the legislator should include the right incentives to pursue decommissioning, including by being time limited and by being based on appropriate levels of Member State co-financing. One way to do this would be to consider

decommissioning activities. This recommendation was made with the aim to create the right incentives to pursue decommissioning and adhere to the strict rules on co-financing applicable under ESIF (i.e. fixed maximum EU co-financing rates). The Commission partially accepted this recommendation holding over its prerogative to decide based on an impact assessment (replaced by this ex-ante evaluation) in line with the requirements of the financial regulation and better regulation agenda with regard to proposals of new initiatives.

It is worth recalling that in preparation of the current MFF (2014–2020) the NDAP was already revised to exclude all measures which were not strictly related to the decommissioning of the concerned facilities. As a consequence, support to energy related projects was taken out of NDAP as it could be supported through other EU funded measures such as ESIF.

Currently, decommissioning of nuclear power stations is explicitly excluded[40] under ESIF (European Regional Development Fund and Cohesion Fund). Therefore, a possible funding of decommissioning under cohesion policy will lead to a fundamental change in the philosophy of these Funds, which are geared to growth objectives, notably in line with the priorities of the Europe 2020 strategy.

Several arguments can be listed *pro* the extension of eligibility under cohesion policy to the decommissioning of these specific reactors:

(i) simplification and reduction of administrative burden;

(ii) well-established, proven and cross-cutting management and control systems;

(iii) increased Member States' ownership of the decommissioning programmes, with clear requirements for national contributions;

(iv) budgetary flexibility transferred to the Member States.

In other words, implementation under the shared management mode could increase the Member States' ownership of the decommissioning programmes (if compared to the baseline scenario) and would allow Member States to prioritise decommissioning projects among other eligible projects under the cohesion policy funding.

However, these advantages are offset by two substantial drawbacks:

(i) making decommissioning an eligible activity under cohesion policy funding, will create a precedence that goes against the principles set by the Council Directive 2011/70/Euratom on the safe and responsible management of radioactive waste and spent fuel, whereby the costs for the management of these materials shall be borne by those who generated those materials; and

(ii) shifting of budget between priorities is possible during the entire lifetime of the programme, therefore there is a risk of de-prioritisation of decommissioning in favour of other activities financed within cohesion policy.

In addition, given the relatively small remaining size (both in time and in costs) of the programmes and the limited number of new projects remaining eligible for EU co-financing a change of the delivery mechanism would appear disproportionate at this stage.

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widening access to the European Structural and Investment Funds to allow nuclear decommissioning activities to be covered, fulfilling these conditions.

40 Article 3.3 Regulation (EU) No 1301/2013 of the European Parliament and of the Council of 17 December 2013 on the European Regional Development Fund and on specific provisions concerning the Investment for growth and jobs goal and repealing Regulation (EC) No 1080/2006;
Article 2.2 Regulation (EU) No 1300/2013 of the European Parliament and of the Council of 17 December 2013 on the Cohesion Fund and repealing Council Regulation (EC) No 1084/2006.

1.7.3. Policy option 3 - Programmes as dedicated spending programme

Safety remains at the heart of the Union policy priorities[18]. The fundamental need of safety has been the basis for the NDAP since their inception, i.e. since the pre-accession time. This need is still the main driver for continuing the programmes under safety policies.

As a result of the NDAP mid-term evaluation the current governance setup has proven to ensure effective and efficient implementation of the programmes. Main factors of success are the clear definitions of roles and responsibilities as well as the strengthened monitoring framework.

Each concerned Member State appoints a Programme Coordinator (deputy minister or state secretary rank) to be responsible for the programming, coordination and monitoring of the decommissioning programme, thus ensuring at national level the comprehensive oversight of the programme and enhancing access to information by the Commission in its supervisory role.

Committees with monitoring and reporting functions are in place for each Member State, co-chaired by a Commission representative and the Programme Coordinators. The Committees are well equipped with a dashboard of key performance indicators and detailed targets, in order to steer the programmes through a well-informed assessment and decision making process. The detailed objectives and indicators (proposed by the three Member States and approved by the Commission) provide quantitative information to measure progress towards the specific objectives. Moreover, the Earned Value Management (EVM) methodology enhances the Commission's supervision on both effectiveness and efficiency with a positive trickle-down effect at national level.

From a legal viewpoint, the base for the continuation of the programmes in Bulgaria and Slovakia is well identified. Nonetheless the analysis and the benchmark have also identified areas for further improvement to be achieved in the establishment of a new Regulation for the next MFF, should this policy option be selected.

In particular on the EU co-financing issue, it is worth noting that presently national contributions are generally within the ranges defined under the ESIF, although the legal basis has not defined the due level of national contribution. While this approach created uncertainties, in the present financial framework levels of national contribution have increased compared to pre 2014-2020 period. From a legal viewpoint there are no obstacles to introduce clearer criteria and provisions (in line with the ESIF ones); the decision in this respect remains truly political.

Likewise, further increase of Member States ownership as well as stronger incentives can be devised in dedicated spending programmes, based on the other lessons learnt from 'comparator' instruments, such as limitation in time for the funding.

The programmes are currently implemented by the EBRD in Bulgaria, and Slovakia as well as by a national agency in Slovakia (SIEA). The implementation via the national agency was established upon request by Slovakia in view of increasing ownership. Continuing the implementation of the programmes through the established implementing bodies would ensure stability in the safe decommissioning process. However, the establishment of a national agency in Bulgaria should also be assessed. This option would further increase the involvement of Bulgaria in the implementation of the Kozloduy programme.

The progress achieved under the current NDAP in both Member States is significant. The existing monitoring tools – remarkably the EVM based methodology - have ensured that issues

that have occurred in the implementation of projects have been addressed in a timely and efficient manner to prevent delays[41].

With regard to the overarching aims in preparing the next MFF (2021-2027) namely agility and simplification, this policy option offers interesting solutions. The budget for the programmes in Bulgaria and Slovakia could be pooled with the Commission's own decommissioning activities (in JRC). This should allow for increased financial flexibility between decommissioning programmes financed by the Commission. As mentioned above, budgetary flexibility is necessary in view of the limited needs for the Kozloduy and Bohunice programmes to complete the decommissioning activities, and the needs also of the JRC decommissioning programme for flexibility of budget allocation resulting from uncertainty in the activities' schedule. Moreover this option creates opportunities for enhanced knowledge sharing and identification of potential synergies between the programmes.

1.7.4. Policy options benchmark

The risks associated to policy option 1 (discontinuation) can be summarised as such: EU would waive leveraging on the safety objectives of the NDAP as well as exploiting the knowledge gained in favour of other EU Member States; moreover, from a political standpoint, the solidarity principle underpinning the NDAP thus far would be disregarded by the Union with negative effect on the European sentiment in Bulgaria, and Slovakia.

Policy options 2 and 3 are mainly differentiated in terms of theme (cohesion vs safety) and delivery mechanism (cohesion policy funding vs dedicated spending programme).

Both solutions are fit for addressing the substantial needs of increased ownership by the beneficiary Member State and of stronger incentives to pursue decommissioning in a timely and efficient manner. However, policy option 3 responds more effectively to the needs of:

(i) EU leveraging on the safety objectives;

(ii) exploitation of the knowledge gain for the decommissioning of nuclear reactors EU wide;

(iii) knowledge sharing and development of potential synergies amongst decommissioning programmes managed by the Commission;

(iv) budgetary flexibility.

Finally, given the progress achieved in Bulgaria and particularly Slovakia, the change of delivery mechanism at this point in time appears disproportionate with respect to the marginal benefits policy option 2 offers.

1.8. JRC decommissioning and waste management programme

As mentioned above, the JRC D&WM programme unlike other programmes, e.g. Horizon 2020, has no secondary legislation. Instead, it relies on the legal base provided by Article 8 of the Euratom Treaty.

To this end and based on the Communication of the Commission "Historical Liabilities Resulting from Nuclear Activities carried out at the JRC under the Euratom Treaty – Decommissioning of obsolete Nuclear Installations and Waste Management" (COM(1999)114), the Programme was

[41] For example: in the project for the decontamination of the primary circuits of the Bohunice V1 reactors the contractor chosen through an open procurement procedure failed to achieve the expected results. Initially the consequent delays impacted the critical path of the programme. However the project was put back on track and the decontamination was completed with excellent results. In parallel, through a review of the programme critical path, any impact was minimised and the end date of the programme (2025) is still valid.

initiated and a specific ad hoc budget line was created, in agreement with the European Parliament and the Council, following the principle of annuality.

Outsourced services and supplies are financed by budget line (Chapter 10.05.01) that cannot be used for administrative expenses. As a result, the in house human resources necessary for the implementation of the programme (for management and supervision) are funded through the Euratom Research and Training framework programme.

The variable and unpredictable level of expenditures in a given year (currently mainly related to the lengthy authorization procedures by national authorities and complex procurement and contract management) makes it difficult to manage the programme in line with the current budgetary and financial setup that is based on the annuality principle as it is not always possible to predict which payments will have to be made in a particular year. For example, payments have often been lower than expected, resulting in apparently "poor" budget execution.

As described in 3.2, the handing over of JRC facilities to the host Member State presents financial and legal benefits for the Commission. This is possible and there is precedence of such transfers in certain of the Member States concerned.

In light of the uncertainties around the D&WMP that may result in increasing volume and uncertainty of budgetary needs more budgetary flexibility is needed.

Pooling the D&WM budget and the Kozloduy and Bohunice programmes would allow for certain financial flexibility. As described in 4.1.3, it would also create opportunities for effective knowledge sharing and identification of potential synergies between the programmes.

5. HOW WILL PERFORMANCE BE MONITORED AND EVALUATED?

Nuclear decommissioning programs are complex and long-lasting (flowing through several subsequent MFFs). Objectives are thus specifically defined for the short term (e.g. year, MFF) under the framework of a multiannual programme aimed at accomplishing the general objective, i.e. achieving a pre-defined end-state at the site as approved by the national nuclear regulator.

1.9. Kozloduy programme and Bohunice programme

1.9.1. Programming, monitoring and control system

Under policy option 3 the programming, monitoring and control system will be further improved and streamlined with respect to the existing one; lessons learnt from the mid-term evaluation will be used in order to ensure continuous improvement.

In 2013, the Commission modified the governance of the programmes for the MFF 2014-2020 in order to set out clear roles and responsibilities, and introduced increased planning, monitoring and reporting requirements. In line with this revised governance approach, each concerned Member State has appointed a Programme Coordinator (deputy minister or state secretary rank) to be responsible for the programming, coordination and monitoring of the decommissioning programme at national level. Currently the Programme Coordinators have to submit the annual work programmes for adoption by the Commission along with the relevant financing decision; in the next MFF the tools provided by the new Financial Regulation will be exploited and more analogies (to the extent possible) with the management and control structure for the cohesion policy funding will be sought in order to ensure streamlining and simplification.

As far as programming is concerned the multiannual nature of the decommissioning programme will be reflected by the adoption of a multiannual work programme and financing decision, in line with the envisaged new financial regulation. This programming process will be evidently

synchronised with the evaluation steps (an interim one after four years, and a final one four years after 2027 to ensure completion of tasks in field).

The Commission would entrust the implementation of the programmes' budget through pillar assessed implementing bodies (indirect management), i.e.:

(i) in Bulgaria to the EBRD, with contributions to the Kozloduy International Decommissioning Support Fund;

(ii) in Slovakia to the Slovak Innovation and Energy Agency (SIEA); the EBRD will mainly complete the implementation of projects already financed through the Bohunice International Decommissioning Support Fund.

The establishment of a national agency in Bulgaria as implementing body of the Kozloduy programme should be assessed.

Committees with monitoring and reporting functions are in place for each Member State, co-chaired by a Commission representative and the Programme Coordinators. Implementing bodies monitor on a day to day basis. In addition, the Commission services closely follow project implementation through desk and on-the-spot reviews on a biannual basis.

As far as reporting is concerned, the practice of annual reporting to the European Parliament and the Council will be maintained.

Presently the regular programming, monitoring and control cycle is supplemented by thematic verifications based on risk reviews. This practice has to continue in the next MFF.

1.9.2. Performance indicators

The present Regulation[5] has defined SMART specific objectives for the progress to be achieved in the funding period; those specific objectives have been further detailed with targets and indicators within the detailed implementation procedures[12].

Quite a number of output-based physical progress indicators are suitable both for defining specific objectives and for monitoring the performance (i.e. effectiveness) of decommissioning programmes; for example amounts of systems dismantled, materials released from regulatory control, radioactive waste processed, conditioned and stored or disposed of.

Another important category of indicators is project-based; for example milestones i.e. significant events in a project properly budgeted and scheduled. Moreover, project management techniques such as critical path analysis and the EVM that provides robust project-based KPIs enabling the managers to control delays and cost-increases. Accordingly these indicators are used to assess the efficiency of the process.

The combination of output-based and project-based indicators has proven to have a high potential for programmes such as nuclear decommissioning. Output-based indicators put very specific activities under the spotlight; the information they provide is sharp and clear, but also limited in that the full picture is not covered. Complementarily the EVM KPIs provide a complete view of the progress of individual projects/work packages and can be aggregated to inform on the general state of play of the overall programme, both time-wise and cost-wise.

Such set of indicators (fully quantitative) enables control on short-term as well as on long-term issues, providing the managers (up to supervisory organisations) the tools to enact corrective or mitigation measures at the earliest time possible. This is a key feature for nuclear decommissioning programmes because the processes are not yet fully mature world-wide.

The mid-term evaluation of the programmes has shown that this comprehensive toolkit of performance indicators has supported effective and efficient implementation as demonstrated by

the deeds, i.e. accomplishments. Therefore, the performance monitoring and evaluation for the future MFF can be profitably built on both the existing system and the lessons learnt to ensure continuous improvement.

Under policy option 3 other indicators are needed to reflect safety related achievements in an even stricter manner and to match with the new explicit EU-wide knowledge sharing objective.

Progressive and stepwise removal of radiological hazards posed by the facilities under decommissioning will have to be measured based on the safety cases prepared by the decommissioning license holder.

As far as the EU-wide knowledge sharing objective is concerned, the following key items should be monitored without prejudice to the competitive advantage of the decommissioning license holders having created such know-how:

(i) decommissioning cost estimations and estimations methodologies;

(ii) radiation protection and industrial safety issues;

(iii) identification of proven processes (e.g. decontamination of primary circuits).

1.9.3. Preliminary evaluation criteria

The Kozloduy programme and the Bohunice programme are expected to be completed respectively in 2030 and 2025. Thus the effectiveness and efficiency criteria for their evaluation are straightforward: achievement of the defined decommissioning end-state on schedule and on budget.

Given the above, the current cycle of programme evaluations should be maintained, i.e. a mid-term and evaluation has to be scheduled as well as the mandatory final evaluation.

1.10. JRC decommissioning and waste management programme

1.10.1. Programming, monitoring and control system

The D&WM programme is executed under the direct management mode and is governed by JRC senior management through a high level steering committee (chaired by the JRC Director-General)[42]. It meets three times per year to take strategic decisions, set up objectives and monitor the progress of the programme. The strategic decisions include e.g. the scheduling of shut-down of JRC nuclear facilities, taking due account to the infrastructure needs of the JRC Research and Training Work Programme.

The high-level steering committee is supported by the operational-level steering committee, composed of site representatives of the D&WMP, and the responsible officers for legal, financial and procurement support of the D&WM programme. This committee meets three times per year, and aims to coordinate and monitor the D&WM programme activities at the different sites. It discusses technical, legal, financial and procurement issues of the D&WM programme and monitors both technical progress as well as budget implementation.

[42] The D&WM high-level steering committee is composed of JRC Deputy Director-Generals as well as JRC Directorates currently affected by the D&WM programme (the Directorate for Nuclear Safety & Security, responsible for the implementation of the D&WMP; Directorate Strategy and Work Programme Coordination, and Directors responsible for Health & Safety, i.e. Site Directors in Ispra, Geel, Karlsruhe and Petten). Legal support is provided by the JRC unit for Legal Advice.

In line with the European Parliament resolution in 1999[43], the JRC is since the beginning of the D&WMP regularly advised by a group of independent European decommissioning experts (biannual meetings, and additional ad-hoc meetings), the D&WMP Expert Group. Their advice relates to the decommissioning and waste treatment strategy, the available technology, technical aspects of the organisation and any other aspects relating to the programme. Until 2016 experts were appointed by the Commission on the basis of proposals made by the Members of the JRC Board of Governors or by the JRC itself. In choosing these experts, the Commission took care to avoid any conflict of interest and to ensure independence of analysis and foster gender and geographical diversity. Following the new Commissions Decision on the creation of Commission Expert Groups[44], the JRC has launched a new Call for Experts and established the Expert Group fully compliant to the new Commission rules.

Since the beginning of the D&WMP, the Commission is regularly reporting to the Council and the European Parliament the progress and status of the D&MP, thereby providing an updated budget forecast (2004, 2008, and 2013)[45].

Moreover, JRC reports on an annual basis on the mid-term targets and the progress achieved (JRC Management Plan, JRC Annual Activity Report).[46]

In the next financing period the multiannual nature of the decommissioning process will be reflected in the adoption of a multiannual work programme and financing decision, in line with the envisaged new financial regulation and taken into account the role of the JRC Board of Governors (article 4.2 of Commission Decision 96/282/Euratom on the reorganization of the Joint Research Centre). This programming process will be evidently synchronised with the evaluation steps (an interim one after four years, and a final one after 2027 when the completion of tasks in field is expected). Moreover, annual reporting to the European Parliament and the Council will be introduced in order to align and increase synergies between the programmes.

1.10.2. Performance indicators

The specific objectives defined in chapter 2.2.3 lay down the progress to be achieved in the next funding period. Progress has to be measured as appropriate by the establishment of appropriate and authorized pathways to implementation of decommissioning, by the quantity and type of safely stored or disposed of waste, by the quantity and type of safely stored or disposed of nuclear material and spent fuel, by the quantity and type of materials removed. The programme progress has to be generally measure also by earned value.

43 European Parliament resolution COM(1999) – 114 – C5-0214/1999 – 1999/2169(COS): "…ensure that the members of the committee of experts from the Member States that is to assist the JRC in its work are independent and properly qualified"

44 C(2016) 3301 final. COMMISSION DECISION of 30.5.2016 establishing horizontal rules on the creation and operation of Commission expert group

45 COM(1999)114, (COM(2004)621, COM(2008)903 and COM(2013)734).

46 Most recent publications: Management Plan 2017, 2016 Annual Activity Report

Annex 1: Procedural information

1. LEAD DG(S), DECIDE PLANNING/CWP REFERENCES

DG ENER, no entry in Decide Planning required

2. ORGANISATION AND TIMING

21 February 2018 – ISSG meeting
18 April 2018 – ISSG meeting

3. EVIDENCE, SOURCES AND QUALITY

The following documents have been used as input to this ex-ante evaluation:

[1] "Support to the mid-term evaluation of the Nuclear Decommissioning Assistance Programmes", EY, An evaluation for the European Commission DG Energy, 2018

[2] "Report from the Commission to the European Parliament and the Council on the implementation of the work under the nuclear decommissioning assistance programme to Bulgaria, Lithuania and Slovakia in 2016 and previous years" of 20.06.2017 COM(2017) 328 final

[3] "Report from the Commission to the European Parliament and the Council on the implementation of the work under the nuclear decommissioning assistance programme to Bulgaria, Lithuania and Slovakia in 2015 and previous years" of 20.06.2016 COM(2016) 405 final

[4] "Report from the Commission to the European Parliament and the Council on the implementation of the work under the nuclear decommissioning assistance programme to Bulgaria, Lithuania and Slovakia in the period 2010-2014" of 03.03.2015 COM(2015) 78 final

[5] "Report on the assessment of the Nuclear Decommissioning Assistance Programme in view of the mid-term review of the financial framework 2014-2020" [Ares(2016)3562735]

[6] "Nuclear Decommissioning Assistance Programme (NDAP) – Assessment of the robustness of the financing plans considering the economic-financial-budgetary situation in each concerned Member State and of the relevance and feasibility of the detailed decommissioning plans", Deloitte, NucAdvisor, VVA Europe, A study prepared for the European Commission DG Energy, 2016

[7] ECA Special Report 22/2016 "EU nuclear decommissioning assistance programmes in Lithuania, Bulgaria and Slovakia: some progress made since 2011, but critical challenges ahead"

Annex 2: Funding

Programme	Planned end date	Cost estimate [EUR million]	Post-2020 financing gap [EUR million]
Kozloduy	2030	1 296	91
Bohunice	2025	1 238	81
JRC	2060	2 019	

Overall commitments until 2020 (EUR million)

Programme	< 2013	2014 – 2020	Total
Kozloduy	850	293	1 143
Bohunice	624	225	849
Sub-Total	**1 474**	**518**	**1 992**
JRC	330	205	535
TOTAL	**1 804**	**723**	**2 527**

Commitments for decommissioning activities until 2020 (EUR million)

Programme	< 2013	2014 – 2020	Total
Kozloduy	491	293	784
Bohunice	437	225	662
Sub-Total	**928**	**518**	**1 446**
JRC	330	205	535
TOTAL	**1 258**	**723**	**1 971**

EU contribution per year (average) (EUR million)

Programme	MFF 2014-2020	MFF 2021-2027	Δ%
Kozloduy (BG)	41.9	9.0	-79%
Bohunice (SK)	32.1	7.9	-76%
Sub-Total NDAP	**74.0**	**16.9**	**-77%**
JRC	29.3	49.7	+70%
TOTAL	**103.3**	**66.6**	**-36%**

Decommissioning average costs / year (EUR million)

Programme	MFF 2014-2020	MFF 2021-2027	Δ%
Kozloduy (BG)	47.1	30.7	-35%
Bohunice (SK)	107.3	35.6	-67%
Sub-Total NDAP	**154.4**	**66.3**	**-57%**

Sources: European Commission, Decommissioning plans, Monitoring reports, Mid-term evaluation study.