



Council of the
European Union

Brussels, 29 September 2017
(OR. en)

12478/17
ADD 1

ATO 41

'I/A' ITEM NOTE

From: General Secretariat of the Council

To: Permanent Representatives Committee/Council

Subject: Report on the implementation of the obligation under the Joint Convention
on the Safety of Spent Fuel Management and on the Safety of Radioactive
Waste Management

- Sixth Review Meeting of Contracting Parties

Delegations will find in the annex a pre-copy of the above document¹.

¹ This report is in the process of being formally adopted by the Commission

ANNEX

EUROPEAN ATOMIC ENERGY COMMUNITY

REPORT

**On the implementation of the obligations under the Joint Convention on the Safety of Spent
Fuel Management and on the Safety of Radioactive Waste Management**

Sixth Review Meeting of Contracting Parties

Vienna, May 2018

Foreword

The European Atomic Energy Community ('Euratom' or 'the Community') is a regional organisation within the meaning of Article 39(4) of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management². Euratom has been a Contracting Party to this Convention ('Joint Convention') since 2 January 2006. To date, all EU Member States are Contracting Parties.

Euratom was established by a Treaty signed in Rome on 25 March 1957, under the general objective to tackle the shortage of conventional energy in the 1950s. The Euratom Treaty also mandates the adoption by the Community of basic safety standards for the protection of workers and the general public. In addition, it provides for a safeguards system which prevents nuclear materials from being diverted from their intended uses. The powers of Euratom are limited to civil applications of nuclear energy³.

Each Member State can decide whether it wants to include nuclear power in its energy mix. Nuclear power plants generate 26,5% of the electricity produced in the EU⁴. As of 2016 there are 129 operating nuclear power reactors in 14 Member States, and 90 in a shutdown status.

² INFCIRC/546 of 24 December 1997.

³ Thus, they do not cover spent fuel or radioactive waste within military or defence programmes.

⁴ Eurostat, June 2016.

Euratom neither possesses nor operates nuclear power plants itself. However, Euratom owns nuclear research facilities located at the Commission's Joint Research Centre (JRC) sites, in Ispra (Italy), Geel (Belgium), Karlsruhe (Germany) and Petten (the Netherlands). The JRC's Decommissioning and Waste Management Programme launched in 1999 details all the activities that the JRC plans and carries out for the safe decommissioning and dismantling of its obsolete facilities (historical liabilities) and the integration of the decommissioning and dismantling plans of its still operational nuclear research facilities (future liabilities). The programme also covers the management of the historical radioactive waste and the waste arising from the decommissioning and dismantling activities of the programme.

As these installations are located in the territory of Euratom Member States, they are subject to all safety, environmental and other relevant legal and regulatory requirements of the host countries. Notwithstanding the information related to Euratom facilities that could be provided in the National Reports of the host countries, the present Euratom Report includes relevant information on the activities of the JRC and the inventories of radioactive waste and spent fuel, pertinent to the obligations under the Joint Convention, as well as on the progress achieved within the aforementioned JRC's Decommissioning and Waste Management Programme.

All Member States of Euratom handle radioactive waste. It is generated by various activities, such as electricity production in nuclear power plants and a range of radioisotope applications in medicine, industry, agriculture, research and education. Spent fuel has been generated and is managed currently by the 21 Member States with current or past nuclear power programmes or research activities.

It should be clarified that it comes within the discretion of each Member State to define its own fuel cycle policy, considering spent fuel as a valuable resource that may be reprocessed or as waste destined for disposal. In addition, some Member States declare NORM waste⁵ as radioactive waste, while others do not.

The management of radioactive waste and spent fuel has been addressed at Community level through various legal instruments adopted under the Euratom Treaty. Council Directive 2011/70/Euratom⁶, establishing a Community framework for the responsible and safe management of radioactive waste and spent fuel, is the central legislation in this field. A side-event of the European Commission's activities under this directive was organised by Euratom on the occasion of the 5th Review Meeting. Council Directive 2011/70/Euratom aims at ensuring responsible and safe management of radioactive waste and spent fuel to avoid undue burdens on future generations. It is based on the International Atomic Energy Agency (IAEA) Safety Standards and reaffirms the principles of prime responsibility of licence holders for the safety of this management, under the supervision of the national competent regulatory authority, and the ultimate responsibility of Member States for the management of the radioactive waste and spent fuel generated in them. Member States are required by Council Directive 2011/70/Euratom to establish and maintain an appropriate national policy and a national programme for its implementation, as well as a framework which amongst other provides for coordination between national bodies. Further, there are provisions in Council Directive 2011/70/Euratom which lay down obligations regarding the periodical conduct of self-assessments and international peer reviews, with the aim of ensuring that high safety standards are achieved in the radioactive waste and spent fuel management.

The present Report indicates in its respective chapters several developments and initiatives taken by Euratom since the last Review Meeting at EU and at international level.

⁵ Waste containing naturally occurring radioactive material

⁶ OJ L 199, 02.08.2011, p.48. The Directive had to be transposed in the EU Member States legislation by 23 August 2013.

At EU level, the main development concerns the submission by EU Member States to the Commission of national programmes for the management of spent fuel and radioactive waste and of national reports on the implementation of the Directive 2011/70/Euratom. On the basis of these documents, as well as the notifications of the national legal measures transposing the Directive 2011/70, the Commission has released its first report to the Council and European Parliament on progress made with the implementation of the Directive as well as an inventory of spent fuel and radioactive waste present in the EU's territory⁷.

In addition, the Commission has been reviewing the national transposition measures for the Directive 2011/70/Euratom and initiated exchanges with Member States in this respect. Interactions with Member States have also taken place to ensure the appropriate implementation of the directive. The Commission is organising an event in 2017 (6-8 November, Brussels) with EU Member States to present the outcomes of the first review on Member States implementation of Directive 2011/70/Euratom and to discuss ways to support Member States in addressing the remaining challenges. It plans to continue this interaction on the subject on an annual basis.

In addition, the Commission is preparing its second report on Member States implementation of the Council Directive 2006/117/Euratom on the supervision and control of shipments of radioactive waste and spent fuel. The report is foreseen to be submitted to the European Parliament, the Council and the European Economic and Social Committee in the 2nd half of 2017.

⁷ Report from the Commission to the Council and the European Parliament on progress of implementation of Council Directive 2011/70/Euratom and an inventory of radioactive waste and spent fuel present in the Community's territory and the future prospects, COM(2017)236final of 15 May 2017 (see <https://ec.europa.eu/energy/en/topics/nuclear-energy/radioactive-waste-and-spent-fuel>).

Moreover, the Nuclear Safety Directive⁸, which covers, inter alia, spent fuel storage facilities, as well as storage facilities for radioactive waste that are on the same site and are directly related to a nuclear installation, was amended in July 2014⁹. The amended directive sets out an EU-wide safety objective to further reduce nuclear safety risks.

In May 2017, the Commission published its Nuclear Illustrative Programme, the so-called PINC¹⁰. The PINC provides an overview of Member States' plans in terms of investments in the EU for all the steps of the nuclear lifecycle. With the EU nuclear industry moving into a new phase characterised by increased activities in the back-end of the lifecycle, it will contribute to an informed debate on the associated investment needs and the management of nuclear liabilities. The nuclear power facilities in the EU are ageing and should individual EU Member States opt to maintain or introduce nuclear energy in their energy mix, significant investments will be needed for the replacement or for the long term operation (and related safety improvements) of existing nuclear plants, for the decommissioning of closed facilities and for the long-term storage of nuclear waste.

At the international level, pursuant to the Memorandum of Understanding with the IAEA of 2013 for a partnership on nuclear safety cooperation, the European Commission on behalf of Euratom has been supporting the development of the ARTEMIS¹¹ tools for international peer reviews required by Article 14(3) of the Directive 2011/70/Euratom. Two workshops have been organised with EU support in 2016-2017 to discuss the ARTEMIS guidelines with EU (2016) and also non-EU Member States (2017). The first review missions in the EU are scheduled in Poland in 2017, France, Bulgaria and Spain in 2018, and Germany in 2019.

⁸ Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations, OJ L 172/18, 2.3.2009.

⁹ Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations, OJ L 219, 25.7.2014

¹⁰ COM(2017) 237 final

¹¹ IAEA integrated review service for radioactive waste and spent fuel management, decommissioning and remediation programmes

The European Commission has also been working together with IAEA and Nuclear Energy Agency (NEA) to the Organisation for Economic Co-operation and Development (OECD), and also in cooperation with the European Nuclear Safety Regulators Group (ENSREG), on possible ways of harmonisation of spent fuel and radioactive waste inventories. A project will start in 2017 that aims to facilitate EU Member States reporting in the next cycle.

At the same time, collaboration continued in the context of European fora such as the ENSREG and the European Nuclear Energy Forum (ENEF). ENEF discussed spent fuel and radioactive waste management aspects at the last meeting in May (22-23) 2017 in Prague. In particular, the potential for shared radioactive waste repositories has been discussed.

Shared disposal solutions have been considered by a number of EU Member States as a primary or secondary policy option. In this respect the Commission supported the Joint Convention topical meeting on Challenges and Responsibilities of Multinational Radioactive Waste Disposal Facilities (September 2016, IAEA) and is also planning to launch the debate on this topic in 2017. The main instrument to support research at European level in the fields covered by the Joint Convention is the Euratom Research and Training Programme 2014-2018 which complements Horizon 2020, the EU Framework Programme for Research and Innovation.

In addition, the Report sets out the conclusions drawn from the discussion of the Euratom reporting at the last Review Meeting of Contracting Parties and outlines positive features in recent Community actions and practices.

The present Report covers the status of implementation of the obligations arising under the Joint Convention, in Euratom, until June 2017 and how the challenges identified in the last review meeting have been addressed.

TABLE OF CONTENTS

Foreword	2
-----------------------	---

Section A. INTRODUCTION

A.1	Main themes and structure of the Report.....	14
A.2	Introduction to Euratom and its accession to the Joint Convention	17
A.2.1	The Euratom Treaty vis-à-vis the Treaties establishing the European Community and the European Union: history and evolution	17
A.2.2	The institutional structure of Euratom	18
A.2.3	Member States of Euratom	20
A.2.4	Euratom competences in the framework of the Joint Convention.....	20
A.2.4.1	Accession of Euratom to the Joint Convention.....	20
A.2.4.2	Declaration by Euratom according to the provisions of Article 39(4)(iii) of the Joint Convention regarding Community competences in the framework of the Joint Convention	22

Section B. POLICIES AND PRACTICES

(Article 32(1) of the Joint Convention)

B.1	General Euratom policies and practices.....	23
B.1.1	Foreword: relevant data	23
B.1.2	General Euratom policies	25
B.1.3	European Nuclear Safety Regulators Group	27
B.1.4	European Nuclear Energy Forum	28
B.1.5	Decommissioning Funding Group	28
B.1.6	The Sustainable Nuclear Energy Technology Platform.....	29
B.1.7	The Implementing Geological Disposal Technology Platform	29

B.1.8	..Complementary solutions to disposal	30
B.1.9	..Public opinion	31
B.1.10	Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste.....	32
B.2	Euratom policies in the framework of the Joint Research Centre (JRC)	33
B.2.1	General introduction to the JRC and the Decommissioning and Waste Management Programme	33
B.2.2	Brief overview of JRC nuclear installations and liabilities	35
B.2.3	Policies and practices at JRC nuclear sites	39
B.2.3.1	Spent fuel management policy	39
B.2.3.2	Spent fuel management practices	40
B.2.3.3	Radioactive waste management policy	40
B.2.3.4	Radioactive waste management practices.....	41
B.2.3.5	Waste categorisation criteria	42
Section C	SCOPE OF APPLICATION (Article 3 of the Joint Convention)	43
Section D.	INVENTORIES AND LISTS (Article 32(2) of the Joint Convention)	
D.1	JRC Geel (Belgium)	45
D.2	JRC Karlsruhe (Germany)	46
D.3	JRC Petten (Netherlands)	47
D.4	JRC Ispra (Italy)	48
D.5	Commission premises in Luxembourg	54

Section E. LEGISLATIVE AND REGULATORY SYSTEM

(Articles 18 and 19 of the Joint Convention)

E.1	Legislative and regulatory framework (Article 19 of the Joint Convention)	55
E.1.1	Primary law	55
E.1.2	Secondary legislation	57
E.1.3	Soft law	66
E.2	Implementing measures (Article 18 of the Joint Convention)	68

Section F. OTHER GENERAL SAFETY PROVISIONS

(Articles 21, 24, 25 and 26 of the Joint Convention)

F.1	Responsibility of the licence holder (Article 21 of the Joint Convention)	72
F.2	Operational radiation protection (Article 24 of the Joint Convention)	73
F.3	Emergency preparedness (Article 25 of the Joint Convention).....	76
F.4	Decommissioning (Article 26 of the Joint Convention).....	82
F.4.1	Implementing legislation	82
F.4.2	Qualified staff and adequate financial resources	84

Sections G and H. SAFETY OF RADIOACTIVE WASTE MANAGEMENT

AND SAFETY OF SPENT FUEL MANAGEMENT

(Articles 4, 6 to 11 and 13 to 16 of the Joint Convention)

G-H.1	General safety requirements (Articles 4 and 11 of the Joint Convention)	90
G-H.2	Siting of proposed facilities (Articles 6 and 13 of the Joint Convention)	92
G-H.3	Design and construction of facilities (Articles 7 and 14 of the Joint Convention)	95
G-H.4	Assessment of safety of facilities (Articles 8 and 15 of the Joint Convention)	97
G-H.5	Operation of facilities (Articles 9 and 16 of the Joint Convention)	99
G-H.6	Disposal of spent fuel (Article 10 of the Joint Convention).....	100

Section I. TRANSBOUNDARY MOVEMENT

(Article 27 of the Joint Convention)

- I.1 Council Directive 2006/117/Euratom on the supervision and control of shipments of radioactive waste between Member States and into and out of the Community 103
- I.2 Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste 107

Section J. DISUSED SEALED SOURCES

(Article 28 of the Joint Convention) 109

Section K. GENERAL EFFORTS TO IMPROVE SAFETY

- K.1 Implementation of Council Directive 2011/70/Euratom 111
- K.2 Euratom Research Programmes 113
- K.3 Euratom loans 117
- K.4 Instrument for Nuclear Safety Cooperation 118
- K.5 Instrument for Pre-Accession Assistance 118
- K.6 EU Stress Tests (post-Fukushima) 119
- K.7 Revision of Council Directive 2009/71/Euratom 121
- K.8 Memorandum of Understanding between Euratom and the IAEA 122
- K.9 Promotion of international peer reviews 123
- K.10 Promotion of openness and transparency 124
- K.11 Financial support for measures connected with decommissioning in Bulgaria, Lithuania, and Slovakia..... 125

K12 Conclusions of the previous Review Meeting on the last Euratom reporting
– highlights and strong features of recent Euratom actions –
past and future challenges and priorities.....127

Appendix. Euratom Research in the field of spent fuel and radioactive waste management

Section A

INTRODUCTION

A.1 MAIN THEMES AND STRUCTURE OF THE REPORT

This Report is submitted in compliance with Articles 30 and 32 of the Joint Convention, in view of the forthcoming Sixth Review Meeting of the Contracting Parties, to be held in Vienna, in May 2018.

It is based on the previous Report submitted by Euratom to the Fifth Review Meeting of Contracting Parties to the Joint Convention held in May 2015. Updated information is highlighted in bold italics font.

The Report has taken account of the developments that took place in the past three years in the scope of the Joint Convention. It displays Euratom actions that are relevant to the following themes, which according to the conclusions of the Fifth Review Meeting of Contracting Parties should be considered by latter National Reports:

- Staffing, staff development, reliability of funding, and other human resource areas;*
- Maintaining or increasing public involvement and engagement on waste management, to provide public confidence and acceptance;*
- Developing and implementing a holistic and sustainable management strategy for radioactive waste and spent fuel at an early stage; and*
- Management of disused sealed sources.*

It also pays specific attention to reporting on progress in the areas identified as challenges during the previous Review Meeting, i.e.:

- Ensuring the correct transposition and implementation of Euratom directives;*
- Continued safe management of the JRC operational decommissioning program, including waste treatment and storage;*
- Need to progress on transfer of JRC-Ispra liabilities to Italy.*

The report also contains descriptions of the overall situation on spent fuel and radioactive waste management in the EU, which, when needed, is illustrated with concrete examples of management in the Member States.

In addition, the Report contains information on the Euratom Treaty and the Community itself, the legal measures which can be adopted by Euratom, their effect on national law and the respective obligations of Member States¹².

An overview matrix, in accordance with paragraph 12 of the Guidelines, is also included¹³.

The Report covers the regulatory obligations of Euratom under the Joint Convention. It furthermore provides information on the nuclear research installations located at sites of its Joint Research Centre (JRC), in: Ispra (Italy), Geel (Belgium), Karlsruhe (Germany) and Petten (the Netherlands). Further details on these installations, as regards safety obligations arising under the Joint Convention, can be found in the respective National Reports of the above Member States, in whose territories the installations are located. Nuclear *research* installations at JRC sites are subject to the regulatory framework and supervision in the *host* country¹⁴. Nevertheless, for clarity reasons and with a view to ensure a more comprehensive reporting, the present Report gives account of the nuclear research facilities at JRC sites and of the progress of the JRC's Decommissioning and Waste management Programme *aiming at the safe decommissioning and waste management of its obsolete facilities, as well as the long-term integration of decommissioning and dismantling plans of operational nuclear research facilities and the management of radioactive waste accumulated in the past, and the waste generated during the implementation of the Programme*¹⁵.

¹² See Sections A.2 and E below.

¹³ See Section B.2.2 below.

¹⁴ Accordingly, licenses are issued by the competent authorities of the Member States and the monitoring of the safety of nuclear facilities and activities takes place at national level.

¹⁵ This information is available at Sections B.2 and D of the Report.

The structure of the Report is as follows:

- in addition to the foregoing, the present Section (A) includes an introduction about the Euratom Community and the Euratom Treaty, the institutional structure and Member States of the Euratom Community and the latter's competences in the framework of the Joint Convention;
- general Euratom Community policies in the field of radioactive waste and spent fuel management, as well as relevant activities in the JRC nuclear research facilities, are set out in Section B, while Section D reports on the inventories in the nuclear research installations at JRC sites;
- Section C is linked with Article 3 of the Joint Convention (scope of application);
- Section E presents Euratom's legal system and regulatory framework, and cites all main legislative measures in force;
- Sections F to J follow an article-by-article review of the implementation of the Joint Convention, citing several measures adopted by Euratom with regard to general safety provisions and requirements (such as those relating to siting and operation, or the safety assessment of nuclear facilities), transboundary movement of radioactive waste and spent fuel, and the management of disused sources;
- Section K mentions various complementary actions aimed, inter alia, at enhancing nuclear safety at both Euratom and international level (such as the conclusion and follow up of "stress tests" at European nuclear power plants) and advancing research in the field of radioactive waste management. It also explains the measures taken by Euratom to address the challenges identified at the 5th review meeting in 2015.

Moreover, in accordance with the Guidelines on the drafting of national reports, this Section:

- recalls Euratom provisions relating to international peer reviews and transparency matters,
- mentions the conclusions drawn from the discussion of Euratom's reporting at the previous Review Meeting of Contracting Parties and measures taken to address the identified challenges,
- summarises strong features in recent Euratom actions and foresees future challenges and priorities;
- the Report closes with *Appendix* (additional information on Euratom initiatives implemented through *Euratom Research and Training Programme*).

A.2 INTRODUCTION TO EURATOM AND ITS ACCESSION TO THE JOINT CONVENTION

A.2.1 The Euratom Treaty vis-à-vis the Treaties establishing the European Community and the European Union: history and evolution

Since its entry into force in 1958, the Treaty establishing the European Atomic Energy Community¹⁶ ('Euratom Treaty' or simply 'Treaty') has not faced extensive amendments.

Following the entry into force of the Treaty of Lisbon in 2009, the European Community was dissolved into the European Union ('EU') and the Treaty establishing the European (Economic) Community of 1957 was thus renamed "Treaty on the Functioning of the European Union" ('TFEU')¹⁷. On the other hand, Euratom has not been dissolved into the EU and it therefore maintains to date its separate legal personality¹⁸.

However, Euratom is closely associated with the EU. More specifically, the Treaty of Lisbon recalls in its Protocol No. 2 that the provisions of the Euratom Treaty shall continue to have full legal effect, yet certain amendments are made to this latter Treaty. These amendments for the most part concern institutional and financial aspects. Accordingly, the new Article 106a(1) of the Euratom Treaty lists up all those provisions of the EU Treaties (i.e. the TEU¹⁹ and the TFEU²⁰) that shall also apply to the Euratom Treaty, the majority of which *concern* the institutions, legislative procedures and financial matters²¹.

¹⁶ Treaty establishing the European Atomic Energy Community (consolidated version) (Official Journal of the European Union) C84/1 of 30 March 2010.

¹⁷ The current text of the "Treaty on European Union" (TEU) states that the EU "*shall replace and succeed the European Community*" and "*shall be founded on the present Treaty (TEU) and the Treaty on the Functioning of the European Union (TFEU)*"; Article 1 TEU.

¹⁸ Article 184 of the Euratom Treaty states: "*The Community shall have legal personality*".

¹⁹ OJ C83/13 of 30 March 2010.

²⁰ OJ C115/1 of 9 May 2008.

²¹ Article 106a(1) provides: "*Article 7, Articles 13 to 19, Article 48(2) to (5), and Articles 49 and 50 of the Treaty on European Union, and Article 15, Articles 223 to 236, Articles 237 to 244, Article 245, Articles 246 to 270, Article 272, 273 and 274, Articles 277 to 281, Articles 285 to 304, Articles 310 to 320, Articles 322 to 325 and Articles 336, 342 and 344 of the Treaty on the Functioning of the European Union, and the Protocol on Transitional Provisions, shall apply to this Treaty*".

However, Article 106a(3) of the Euratom Treaty lays down a basic rule, according to which this Treaty is *lex specialis* and prevails in case of conflicting rules between the provisions of the EU Treaties and its own provisions²².

A.2.2 The institutional structure of Euratom

The institutional structure of Euratom is linked with that of the EU. Thus, the fulfillment of the tasks entrusted to Euratom is ensured by the Council of the European Union ('Council'), the European Parliament, the European Commission, the Court of Justice and the Court of Auditors, which are all institutional organs of the EU. Each of these institutions acts within the limits of the powers conferred to it by the common institutional framework provided in the Euratom Treaty, the TEU and the TFEU²³.

The Council is the main decision-making institution, but it also exercises budgetary as well as policy-making and coordinating functions. Each Member State presides over the Council for a six-month period.

The European Parliament represents the citizens of the Member States. The members of the European Parliament are elected by direct universal suffrage. Together with the Council it exercises legislative and budgetary functions. In the framework of the Euratom Treaty, the European Parliament has only a consultative role in the legislative process.

²² Article 106a(3) provides: "*The provisions of the Treaty on European Union and of the Treaty on the Functioning of the European Union shall not derogate from the provisions of this Treaty*".

²³ Respectively: Articles 106a, 134, 135, 144, 145, 157 and 164 of the Euratom Treaty; Articles 13 to 19 TEU; and Articles 223 to 270, 272 to 274, 277 to 281 and 285 to 287 TFEU. :

The Commission promotes the general interest of the EU and Euratom, and takes appropriate initiatives to that end, including the preparation and making of legislative proposals. In principle, legislative acts in the field of nuclear energy may only be adopted (by the Council) upon the basis of a Commission proposal. The Commission also ensures the application of the Treaties and of measures adopted pursuant to them and it can initiate judicial proceedings before the Court of Justice of the EU for non-compliance with this law. In addition, the Commission has an executive role, for example it executes the budget and manages *Euratom* research programmes.

The Court of Justice of the EU ensures that the law is observed in the interpretation and application of the Treaties.

In addition, several advisory bodies exist under the Euratom Treaty, some of which are unique to Euratom while others are common to the EU and Euratom. The purpose of these bodies is to assist the decision-making institutions of Euratom in the exercise of their functions. For example, the Economic and Social Committee is such an advisory body operating within both the EU and Euratom, and is consulted by the Council, the European Parliament or by the Commission where it is so provided. In principle, the Economic and Social Committee has a consultative role in the legislative process. Other advisory bodies, which are attributed exclusively to Euratom, include the group of scientific and health experts provided for in Article 31 of the Euratom Treaty. This group gives its opinion to the Commission during the development of basic safety standards for the protection of the health of workers and the general public against ionising radiation. Further, Article 134 of the Euratom Treaty provides for the Scientific and Technical Committee, which is attached to the Commission and has an advisory status. *Amongst other, this Committee advises the Commission on strategic aspects of nuclear research.*

A.2.3 Member States of the Euratom Community

The following twenty eight (28) States are presently members of Euratom: the Kingdom of Belgium, the Republic of Croatia, the Czech Republic, the Kingdom of Denmark, the Federal Republic of Germany, the Republic of Estonia, the Hellenic Republic, the Kingdom of Spain, the French Republic, Ireland, the Italian Republic, Republic of Bulgaria, the Republic of Cyprus, the Republic of Latvia, the Republic of Lithuania, the Grand Duchy of Luxembourg, Hungary, the Republic of Malta, the Kingdom of the Netherlands, the Republic of Austria, the Republic of Poland, the Portuguese Republic, the Republic of Romania, the Republic of Slovenia, the Slovak Republic, the Republic of Finland, the Kingdom of Sweden, the United Kingdom of Great Britain and Northern Ireland²⁴.

A.2.4 Euratom competences in the framework of the Joint Convention

A.2.4.1 Accession of Euratom to the Joint Convention

With regard to Euratom's aspirations in the international scene, the signatory States stated in the preamble to the Euratom Treaty that they were, inter alia:

"Desiring to associate other countries with their work and to cooperate with international organisations concerned with the peaceful development of atomic energy".

²⁴ On 29 March 2017, the United Kingdom notified the European Council of its intention to leave the European Union, in accordance with Article 50 of the Treaty on European Union, as well as the European Atomic Energy Community, in accordance with Article 106a of the Euratom Treaty.

Hence, the Euratom Treaty stipulates that Euratom may, within the limits of its powers and jurisdiction, enter into obligations by concluding agreements or contracts with international organisations or third States²⁵. In fact, Euratom is Contracting Party to several bilateral and multilateral international agreements as well as important Conventions in the area of nuclear energy, which, apart from the Joint Convention, include the Convention on Nuclear Safety²⁶, the Convention on Early Notification of a Nuclear Accident²⁷ and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency²⁸.

Euratom acceded to the Joint Convention by a Commission Decision of 14 June 2005²⁹, following a Council Decision of 24 January 2005³⁰. The instruments of accession were deposited with the Director General of IAEA on 4 October 2005. Euratom's accession came into effect on 2 January 2006, in accordance with Article 40(2) of the Joint Convention. ***To date all EU Member States are Contracting Parties to the Convention.***

The instruments of accession included the declaration required by Article 39(4)(iii) of the Joint Convention. In particular, Article 39(4)(iii) of the Joint Convention stipulates that: "*When becoming party to this Convention, such an organization shall communicate to the Depositary referred to in Article 43, a declaration indicating which States are members thereof, which Articles of this Convention apply to it, and the extent of its competence in the field covered by those articles*".

²⁵ Article 101.

²⁶ INFCIRC/449, 5 July 1994.

²⁷ INFCIRC/335, 18 November 1986.

²⁸ INFCIRC/336, 18 November 1986.

²⁹ C (2005) 1729.

³⁰ 2005/84/Euratom, OJ L 30, 03.02.2005, p. 10.

A.2.4.2 *The declaration by Euratom according to the provisions of Article 39(4)(iii) of the Joint Convention regarding Community competences in the framework of the Joint Convention*

In December 2002, the Court of Justice defined the perimeter of competences of Euratom with regard to the Convention on Nuclear Safety³¹. In its judgment³², the Court found that Euratom possesses competences relating not only to radiation protection, but also to nuclear safety³³. Based on this landmark ruling, the existing basic safety standards, aiming at the protection of the health of workers and of the general public against the dangers arising from ionising radiations, can be "supplemented" with safety requirements governing the safe management of radioactive waste and spent fuel. Moreover, the Court had already adjudicated in 1988 that the provisions of Title II, Chapter 3, of the Euratom Treaty, on health and safety, form a coherent whole conferring powers of a considerable scope, in order to protect the population and the environment against risks of nuclear contamination³⁴.

The declaration of competences of Euratom, under Article 39(4)(iii) of the Joint Convention, was consistent with the above principles established by the Court. It stated:

"The Community declares that Articles 1 to 16, 18, 19, 21 and 24 to 44 of the Joint Convention apply to it.

The Community possesses competences, shared with its Member States, in the fields covered by Articles 4, 6 to 11, 13 to 16, 19 and 24 to 28 of the Joint Convention as provided by the Treaty establishing the European Atomic Energy Community in Article 2(b) and the relevant Articles of Title II, Chapter 3, entitled 'Health and Safety'."

³¹ The Convention on Nuclear Safety was adopted on 17 June 1994. Euratom acceded to this Convention by a Commission Decision of 16 November 1999 (Commission Decision 1999/819/Euratom concerning the accession to the 1994 Convention on Nuclear Safety by the European Atomic Energy Community, OJ L 318, 11.12.1999, p. 2), following a Council Decision of 7 December 1998. The instruments of accession were deposited with the Director General of IAEA on 31 January 2000. Thus, for Euratom the Convention on Nuclear Safety entered into force on 30 April 2000, in accordance with Article 31(2) of the Convention.

³² Case C-29/99 *Commission v. Council*, ECLI:EU:C:2002:734, p. I-11221; judgment of the Court of 10 December 2002.

³³ In paragraphs 82 and 83 of the Court's reasoning, it is stated that: "*it is not appropriate, in order to define the Community's competences, to draw an artificial distinction between the protection of the health of the general public and the safety of sources of ionising radiation. Those considerations should inform the determination as to whether the Community possesses competences in the fields covered by articles of the Convention...*".

³⁴ Case C-187/87, ECR 1988, p. 5013.

Section B

POLICIES AND PRACTICES (Article 32(1) of the Joint Convention)

ARTICLE 32. REPORTING

1. In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:

- (i) spent fuel management policy;*
- (ii) spent fuel management practices;*
- (iii) radioactive waste management policy;*
- (iv) radioactive waste management practices;*
- (v) criteria used to define and categorize radioactive waste.*

B.1 GENERAL EURATOM POLICIES AND PRACTICES

B.1.1 Foreword: relevant data

Through its Member States, Euratom is a significant producer of radioactive waste and spent fuel³⁵. As a result, management of radioactive waste and spent fuel is one of the key issues in Europe's nuclear energy policies. This is also reflected in the number of legal instruments the Community has produced, upon the basis of the Euratom Treaty, regulating amongst other radioactive waste management and decommissioning. An overview of the relevant Euratom legislation can be found in Section E.1 of this Report.

Fourteen (14) of the twenty eight (28) Euratom Member States have nuclear power plants in operation³⁶. Each Member State may define its fuel cycle policy, considering spent fuel as a valuable resource that may be reprocessed or as waste for direct disposal. General data about the spent fuel quantities are presented below.

³⁵ The main producers of radioactive waste and spent fuel in terms of volume and radioactivity are France, the UK and Germany.

³⁶ The Member States having nuclear power plants in operation are: Belgium, Bulgaria, the Czech Republic, Finland, France, Germany, Hungary, the Netherlands, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

As of the end of 2013 the estimated total inventory of radioactive waste on the territory of the EU is 3 313 000 m³ (see Table 1), of which about 70 % has been disposed of (2 316 000 m³) and about 30 % is in storage (997 000 m³). The main composition of the total volume of radioactive waste is 74 % low level waste (LLW), 15 % very low level waste (VLLW), 10 % intermediate level waste (ILW) and 0.2 % high level waste (HLW) (see Figure 1).³⁷ ILW and HLW are generated and stored across the EU predominantly in the Member States with nuclear programmes.

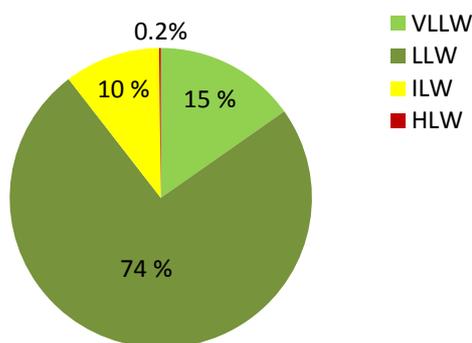


Figure 1. Radioactive waste category distribution (end of 2013)

³⁷ The IAEA General Safety Guide GSG-1 Classification system also defines exempted waste (waste with concentrations of radionuclides small enough to not require provisions of radiation protections) and very short lived waste (waste containing only very short half-life radionuclides allowing it to be stored until it has fallen beneath levels of clearance and managed as conventional waste). These do not require future long-term management or disposal as radioactive waste owing to their short lifetime and/or activity levels enabling exemption from regulatory control. Consequently, exempt waste and very short lived waste are in most cases not reported by Member States. Thus, these waste classes have not been used for data aggregation in this document.

Waste category	Total amount (m ³)			
	2004	2007	2010	2013
VLLW	210 000	280 000	414 000	516 000
LLW	2 228 000	2 435 000	2 356 000	2 453 000
ILW	206 000	288 000	321 000	338 000
HLW	5 000	4 000	5 000	6 000

	Total amount (tHM)			
Spent Fuel	38 100	44 900	53 300	54 300

Table 1. Evolution of total volumes of radioactive waste and spent fuel in the period 2004-2013³⁸

At the end of 2013³⁹ over 54 000 tHM of spent fuel was stored in the EU. Around 800 tHM of spent fuel — about 1.5 % of the total inventory — was stored in a third country pending reprocessing with the expected resulting material to be returned to the EU after 2017.

B.1.2 General Euratom policies

All Member States generate radioactive waste, and 21 of them also manage spent fuel on their territory. This requires containment and isolation from humans and the living environment over a long period of time. By adopting Council Directive 2011/70/Euratom, Member States have acknowledged their legal and ethical obligation to ensure a high level of safety when managing radioactive waste and spent fuel and to avoid undue burden on future generations.

³⁸ The Commission estimates for 2004, 2007 and 2010 are based on the information from the 6th and 7th Situation reports. Figures in the table have been rounded up (e.g. to the nearest thousand).

³⁹ The cut-off date for most of the data is the end of 2013 in order to reduce reporting burden on the Member States and facilitate a joint reporting with the Joint Convention. Article 14(1) of the Directive states “...taking advantage of the review and reporting under the Joint Convention.” In the last Joint Convention reporting cycle (5th Joint Convention meeting in May 2015) the Member States used 2013 as a reference date. Nevertheless, a few have chosen to report more recent inventories with dates ranging from 2014 to 2016.

Radioactive waste and spent fuel management policy remains largely a national competence and varies between Member States. Some Member States are reassessing their waste management options, as well as the associated decision-making processes. Some regard spent fuel as waste, others as a resource from which valuable quantities of fissile and fertile material can be extracted, while others have not yet defined their policy. However, Member States are obliged to define their spent fuel policy as part of their implementation of Council Directive 2011/70/Euratom.

Although historical and current practice in certain Member States is to reprocess spent fuel, the majority of Member States operating nuclear power plants intends to dispose of their spent fuel in deep geological facilities without reprocessing in the future. This is expected to lead to an increase in the volume of high level waste for storage and disposal. Considering the planned shutdown of the reprocessing facilities in the United Kingdom by 2020, France will remain the only Member State with an industrial policy on reprocessing domestically, while some other Member States are reprocessing fuel abroad and are considering doing so in the future.

The most important outstanding issue in a large number of Member States with regard to national policies is the decision on the long-term management of intermediate level waste, high level waste and spent fuel, and specifically their disposal. A few countries have established precise programmes for the development of geological disposal with fixed milestones and deadlines: Finland, France and Sweden expect to have operational disposal facilities for intermediate and high level waste by 2030.

While Council Directive 2011/70/Euratom allows shared disposal solutions to be developed, a policy based only on this option, without a clear path towards implementation, cannot be regarded as being in line with the aims of the Directive. Indeed, there are important challenges in putting shared solutions into practice, for example related to the identification of the host country, as well as resolving legal questions in relation to responsibilities, liabilities and ownership. Moreover, as is the case for the development of any disposal facility, engagement with all stakeholders and the public, and commitment at the highest political level are needed.

Therefore, according to the 1st Commission report (COM(2017)236final, specific attention needs to be paid to the development and implementation of the national policies and the principles on which the national policies are to be based under Article 4(3) of the Directive to ensure that adequate measures for long term safety and generators responsibilities are in place or foreseen to avoid undue burdens to future generation.

B.1.3 European Nuclear Safety Regulators Group

The European Nuclear Safety Regulators Group (ENSREG) (established on 17 July 2007⁴⁰) plays an important role in advising the Commission on the development of policies and legislative proposals in the area of nuclear safety as well as spent fuel and radioactive waste management. *Nineteen members (Eighteen Members States⁴¹ and the European Commission) and two international organisations – IAEA and NEA/OECD (as observers) participate in the ENSREG Working Group 2 “Improving Radioactive Waste Management, Spent Fuel and Decommissioning Arrangements” (WG2) and meet twice per year to discuss specific regulatory issues related to spent fuel and radioactive waste.*

In the last three years the WG2 focus was on the identification of lessons learned from the first Member States reports on Council Directive 2011/70/Euratom and the successful organisation of a workshop held on 26-27 October 2016 in the UK (hosted by Office for Nuclear Regulation - ONR)⁴².

ENSREG also conducts biannual conferences to address at a high level progress and challenges in the field of nuclear, radiation and waste safety the latest to be held 28-29 June 2017 in Brussels.

⁴⁰ By Commission Decision 2007/530/Euratom, OJ L 195/44 of 27.07.2007.

⁴¹ Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Lithuania, The Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom

⁴² See also at: <http://www.ensreg.eu/news/ensreg-working-group-2-workshop-member-states-lessons-learned-notification-national-programmes>

B.1.4 European Nuclear Energy Forum

The European Nuclear Energy Forum (ENEF) is a platform for a broad discussion on the opportunities and risks of nuclear energy, including spent fuel and radioactive waste management, as well as on transparency issues. ENEF gathers all relevant stakeholders in the nuclear field, such as the governments of all Member States of Euratom, European institutions (including the European Parliament and the European Economic and Social Committee), nuclear industry, electricity consumers and the civil society.

In its 22-23 May 2017 meeting ENEF also discussed the spent fuel and radioactive waste management's aspects and challenges.

B.1.5 The Decommissioning Funding Group

Commission Recommendation 2006/851/Euratom⁴³ addresses the management of financial resources for the decommissioning of nuclear installations, spent fuel and radioactive waste. Taking efforts to increase cooperation between the Commission and the Member States, the Commission has established the Decommissioning Funding Group in order to be assisted in its proceedings in the context of this Recommendation. A certain degree of harmonisation should be suggested with regard to the concepts used in decommissioning, spent fuel and radioactive waste management matters. Recital (24) of the Commission Recommendation states: “Without prejudice to the principle of subsidiarity, a certain degree of harmonisation should be suggested with regard to the concepts used in decommissioning matters. Such harmonisation should be progressed through the Decommissioning Funding Group where commonly agreed interpretations of this Recommendation should be reached for its practical implementation and in particular with a view to harmonisation of methodologies for cost calculation of decommissioning activities”.

⁴³ OJ L 330, 28.11.2006, p.31.

B.1.6 The Sustainable Nuclear Energy Technology Platform

The Sustainable Nuclear Energy Technology Platform (SNE–TP) was launched in September 2007. It aims at promoting the research, development and demonstration of European nuclear fission technologies and gathers about eighty (80) organisations (research organisations, utilities, vendors, technology providers, technical safety organisations, universities, consultancy companies and non-governmental organisations).

Within the framework of the Strategic Energy Technology Plan (SET-Plan), stakeholders have formulated a collective vision of the contribution which fission could make towards Europe's transition to a low-carbon energy mix by 2050, with the aim of integrating and expanding R&D capabilities in order to reach this objective.

A new version of a Strategic Research Agenda, issued in February 2013, is electronically available⁴⁴. It is the result of the contribution of nearly 100 scientists and engineers from the member organisations of SNE–TP. In the area of radioactive waste management, it concentrates on waste minimisation.

B.1.7 The Implementing Geological Disposal Technology Platform

The Implementing Geological Disposal Technology Platform (IGD–TP⁴⁵), launched *in* November 2009, is a tool to support the confidence-building in the safety and implementation of deep geological disposal solutions⁴⁶. It *facilitates* access to expertise and technology, interacts with the stakeholders and communicates the results to the benefit of all of Europe. The vision of the platform members (waste management organisations) is that by 2025 the first geological disposal facilities for spent fuel, high level waste and other long-lived radioactive waste will be operating safely in Europe.

⁴⁴ See also at: <http://www.snetp.eu>

⁴⁵ See at : <http://www.igdtp.eu/>

⁴⁶ IGD-TP, Vision document of October 2009. See also at: www.igdtp.eu

Within the ongoing JOPRAD project⁴⁷, some organisations have developed in the IGD-TP a comprehensive dialogue with a number of nationally supported research entities and also with technical support organisations engaged to support national regulatory bodies. Current activities include the identification of possible areas for joint R&D work between implementers, academia and technical support organisations which could provide the basis for a future Joint Programme.

B.1.8 Complementary solutions to disposal

Complementary solutions to disposal are also under investigation in some countries, in particular partitioning and transmutation (P&T). In the case of P&T, research is still on-going. While having the potential to reduce significantly the quantities of long-lived and/or radiotoxic radionuclides (in particular minor actinides) in the most hazardous waste forms, P&T would not completely eliminate all such waste constituents and therefore is not a replacement for geological disposal. Nonetheless, it could be a valuable complement, enabling optimum use to be made of the geological repositories, in particular by reducing the heat generation of the waste.

Surface and sub-surface storage *of radioactive waste and spent fuel is* considered as a temporary option, provided a permanent *disposal* solution is defined *by Member States* with associated milestones and deadlines. While envisaged by most experts in the short to medium-term, especially to allow time for implementing geological disposal and also to allow for the temperature decrease of heat emitting wastes, storage is not considered sustainable in the longer term.

⁴⁷ JOPRAD is the project funded under Euratom WP 2014-2015 mentioned in table 2 of the Appendix to this report.

B.1.9 Transparency and public opinion

European citizens are concerned about the management of spent fuel and radioactive waste in Europe. The Eurobarometers published in July 2008⁴⁸ and April 2010⁴⁹ show that European citizens think that Member States should take up their responsibilities and implement now demonstrated solutions for high-level radioactive waste, instead of leaving it for the future, and that nuclear waste management should be regulated at European level. An open consultation carried out in the website of the Commission during the months of March to May 2010 showed similar conclusions, where an overwhelming majority of the respondents declared their support for the development of binding Community legislation in this area⁵⁰.

The public, workers and other stakeholders are interested in various aspects of spent fuel and radioactive waste management. Transparency is of high importance for Euratom. The majority of Member States have mechanisms in place to ensure public information and opportunities for public consultation in line with Article 10 of the Directive 2011/70/Euratom. Almost all Member States have clearly indicated that the national competent regulatory authority is responsible for providing information to the public in the field of its competence in spent fuel and radioactive waste management.

However, according to the 1st Commission report (COM(2017)236final, beyond the information and consultation of the public, public involvement in the decision-making process for spent fuel and radioactive waste management (such as working groups, advisory bodies or national commissions) remains an issue to be clarified in several EU Member States.

⁴⁸ Special Eurobarometer survey 297 – Attitude towards radioactive waste, Commission, 2008: http://ec.europa.eu/public_opinion/index_en.htm

⁴⁹ Special Eurobarometer survey 324 – Europeans and nuclear safety, Commission, 2010: http://ec.europa.eu/energy/nuclear/safety/safety_en.htm

⁵⁰ Public Consultation, 31 March 2010 to 31 May 2010 – Approaches for a possible EU legislative proposal on the management of spent fuel and radioactive waste: http://ec.europa.eu/energy/nuclear/consultations/2010_05_31_fuel_waste-en.htm

Moreover, it should be noted that to continue exploring the options for the Commission to support Member States in the development of geological disposal, the Commission will launch a debate on shared facilities for disposal in 2017.

B.1.10 Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste

Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste was adopted on 19 July 2011⁵¹.

The general objective of the directive is the establishment of a Euratom framework for the responsible and safe management of spent fuel and radioactive waste to avoid imposing undue burdens on future generations, ensuring that Member States provide for appropriate national arrangements for a high level of safety, as well as for necessary public information and participation.

The Commission has reviewed the majority of the national transposition measures for Directive 2011/70/Euratom and initiated exchanges with Member States in this respect. Interactions with Member States have also taken place to ensure the appropriate implementation of the directive.

Besides, EU Member States had the obligation to submit to the Commission their national programmes for the management of spent fuel and radioactive waste and of national reports on the implementation of the Directive 2011/70/Euratom. The Commission has requested clarifications to Member States and may express its opinion on whether the content of the individual national programmes is in accordance with Article 12 of the Directive, focusing, among other things, on the following:

- Whether policies, concepts and plans for the disposal of radioactive waste (in particular intermediate level waste and high level waste) and spent fuel are in place, accompanied by milestones, time frames and key performance indicators to monitor progress towards the implementation.
- Whether policies for shared disposal solutions are accompanied by a demonstration of their feasibility, including site-specific matters.

⁵¹ OJ L 199, 02.08.2011, p.48.

- Whether cost assessments are reliable, complete and reviewed periodically.
- The independence and resource sufficiency of the competent authorities.
- Information on safety demonstrations for existing facilities and frequency of safety reviews.
- Suitability of measures for post-closure and for the retention of knowledge to ensure long-term safety, as well as for the availability of properly trained and competent staff.

*On the basis of these documents, as well as the notifications of the national legal measures transposing the Directive 2011/70/Euratom, the Commission has released its first report to the Council and European Parliament on progress made with the implementation of the Directive as well as an inventory of spent fuel and radioactive waste present in the EU's territory*⁵².

References to specific aspects of this directive are made in subsequent parts of this Report.

B.2. EURATOM POLICIES IN THE FRAMEWORK OF THE JOINT RESEARCH CENTRE (JRC)⁵³

B.2.1 General introduction to the JRC and the Decommissioning and Waste Management Programme

The JRC was set up at the beginning of the 1960s, under Article 8 of the Euratom Treaty, with sites in Ispra (Italy), Geel (Belgium), Karlsruhe (Germany), Petten (Netherlands), Brussels (Belgium) and, later, Seville (Spain). Article 8(1) of the Treaty provides in particular: "*After consulting the Scientific and Technical Committee, the Commission shall establish a Joint Nuclear Research Centre. The Centre shall ensure that the research programmes and other tasks assigned to it by the Commission are carried out...*".

Originally, the JRC was dedicated entirely to nuclear research, but since then it has diversified its activities. The mission of the JRC, *as the science and knowledge service of the Commission, is to support EU policies with independent evidence throughout the whole policy cycle.*

⁵² Report from the Commission to the Council and the European Parliament on progress of implementation of Council Directive 2011/70/Euratom and an inventory of radioactive waste and spent fuel present in the Community's territory and the future prospects, COM(2017)236final of 15 May 2017 (see <https://ec.europa.eu/energy/en/topics/nuclear-energy/radioactive-waste-and-spent-fuel>).

⁵³ See the paragraphs in bold on the 1st page of the Foreword as the status of JRC facilities.

In 1999 the Commission decided to launch the Decommissioning and Waste Management Programme ("D&WM Programme") for decommissioning its obsolete nuclear *research* installations on the JRC sites. *The Programme allows the Commission to implement a comprehensive global approach to the decommissioning and dismantling of its nuclear research facilities, and to manage the radioactive waste generated as a consequence of past research activities, as well as that generated as a consequence of decommissioning and dismantling, following up-to-date practices and strategies.*

The Programme is implemented by the recently established Nuclear Decommissioning Department in the Nuclear Safety and Security Directorate of JRC, and is governed by a High Level Steering Committee that provides guidance and takes strategic decisions, supported by an Operational Level Steering Committee for the more direct day-to-day management.

The decommissioning and related waste management costs are paid through a dedicated budget line, which is fixed on a seven-year basis. Costs associated with the running operational waste production of research activities are covered by the research budget or by third parties if the research is performed on their account.

The Commission issues a Communication to the Council and European Parliament on the progress of the D&WM Programme approximately every four years. The next Communication is planned for 2018, and will include the current status of implementation of the Programme as well as future plans and the budgetary forecast. The previous Communication⁵⁴ of 2013 presented a consolidated estimate for the entire JRC D&WM Programme after 2013 of EUR 989,2 million.

⁵⁴ 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).

B.2.2 Brief overview of JRC nuclear installations and liabilities

On the largest JRC site in Ispra, Italy, most of the nuclear installations are either obsolete or no longer required. *They include research reactors (Ispra-1 and Essor), a cyclotron, three major buildings for experiments (a radiochemical laboratory, a hot cell fuel handling laboratory and a fuel melting oven) and installations for the processing of the solid and liquid waste. It also concerns areas where historical raw unconditioned research waste was stored in temporary facilities and areas where conditioned waste was either temporarily stored in dedicated facilities or buried.*

Currently, almost all the nuclear research installations of the JRC-Ispra site have been definitively shut down, and therefore require decommissioning. For this reason, the decommissioning programme at JRC-Ispra is the most advanced.

The radiochemistry laboratory has been fully decommissioned, and the dismantling of the Fuel Melting test facility (FARO), is 90% completed. Other facilities such as the research reactor ESSOR, the hotcell laboratory LCSR, the old liquid effluent stations STRRL, the cyclotron and the waste handling complex area 40 are undergoing pre-decommissioning activities. The process for obtaining the decommissioning licenses is on-going, at different stages of development. The research reactor Ispra-1 is maintained at safe conservation awaiting the implementation of the agreement between Euratom and the Italian Government.

The implementation of the D&WM programme at the JRC-Ispra site has focused on the design and building of several waste handling and interim storage installations for waste sorting, characterisation, decontamination, material "clearance" from radiological control, and condition and temporary storage of radioactive waste until adequate radioactive waste interim long-term storage facilities or waste disposal facilities are available in Italy.

This JRC-Ispra D&WM programme has five main objectives:

- keeping obsolete installations safe in accordance with the safety standards in force (operations which are known as "safe conservation");

- constructing or improving of waste characterisation, treatment, conditioning and interim storage installations;
- recovering, treating and reconditioning existing waste;
- conditioning nuclear materials with a view to their storage on-site or their transfer to third parties;
- decommissioning of obsolete installations and managing the resulting waste.

The overall approach is based on the concept of the JRC as awarding authority, managing and maintaining control of the decommissioning and waste management activities and maximising the use of experienced contractors, when feasible from a technical, managerial and legal viewpoint. A staffing policy has been drawn up, indicating the evolution of profiles and competences as the programme develops. Moreover, major long-term contracts for assistance in managing the various projects have been placed for.

In order to reduce the risks on the Italian liabilities linked to previous common nuclear research activities at the JRC-Ispra site, the risks on the long term waste storage capacities on the site and on the waste acceptance criteria, Euratom has signed on 27 November 2009 an Agreement with the Italian Government in order to:

- regularise the historical liabilities on the site by transferring the responsibility for the Ispra-1 reactor decommissioning to the Italian Government;
- formalise the transfer of all waste on the JRC-Ispra site to the future Italian national repository by the end of the D&WM programme;
- limit the risk of later waste reconditioning which could be the result of changes in Italian waste acceptance criteria.

The Agreement has not yet been formally executed by the Italian Government. As a consequence of this, the transfer of the licence of the Ispra-1 reactor to an Italian operator has not yet been completed.

The other JRC nuclear research installations, located in Petten, Geel and Karlsruhe, are still in operation. Decommissioning of the related operating facilities will not start before their shutdown, which is not planned yet. Nevertheless, in accordance with IAEA's recommendations, the Commission has drawn up decommissioning plans including budgetary estimations which are periodically updated. In addition, pre-decommissioning activities are carried out for the dismantling of out-of-use equipment from past research work and for the removal off-site (including transfer of ownership) of obsolete nuclear spent fuel and non-irradiated nuclear materials. *This situation is going to change starting in the next decade, with relatively large decommissioning projects to be initiated at more than one site (e.g. at the Karlsruhe site). The new "multi-site" configuration affecting the D&WM programme of JRC will be reflected in the definition and implementation of updated strategic and operational approaches.*

Table 2 An overview matrix providing the types of liabilities and the general policies and practices for the JRC sites is given hereunder.

Type of Liability	Long-Term Management Policy	Funding of Liabilities	Current Practice/ Facilities	Planned Facilities
Spent Fuel	Reprocessing or long-term storage in national repository	Funds provided from the EU budget	- Interim storage	- Interim storage
Nuclear Fuel Cycle Waste	N.A.	N.A.	N.A.	N.A.
Application Wastes (i.e. research wastes)	National repositories	Funds provided from the EU budget or third parties	- On-site temporary storage - Waste sorting and	- None

			conditioning - Waste minimization	
Decommissioning Liabilities	National repositories	Funds provided from the EU budget or third parties	- Elaboration of decommissioning plans - Clean-up, pre-decommissioning, decommissioning - Waste sorting and conditioning - Interim storage of conditioned waste - Characterisation and free release	- Waste immobilisation
Disused Sealed Sources	Sources collection, ownership transfer and storage at third parties facilities	Funds provided from the EU budget	- On-site temporary storage - Ownership transfer and shipment to third party facilities	None

The policies and practices for managing radioactive waste and spent fuel aim at integrating JRC liabilities to the corresponding final radioactive waste or spent fuel disposal route available, or to be made available in the host State.

B.2.3 Policies and practices at JRC nuclear sites

B.2.3.1 *Spent fuel management policy*

Currently, the Commission is responsible for the management of spent fuel of the JRC Ispra site shutdown reactors: Ispra-1 and Essor.

The spent fuel management policy followed by the Commission is dictated by:

- safety, ensuring interim storage conditions in compliance with the existing regulations in the host country;
- efficiency, producing ultimate waste forms/packages that are compatible with the national disposal requirements;
- economics or the ultimate cost to the EU taxpayer, i.e. making use of existing routes (reprocessing or return to third party) whenever feasible (rather than waiting for theoretical national solutions for which the actual cost is uncertain) .

B.2.3.2 *Spent fuel management practices*

At JRC-Petten the management of spent fuel from the High Flux Reactor (HFR) is the responsibility of NRG (Nuclear Research and Consultancy Group), the Dutch operator and licence holder of the HFR. Spent fuel can be stored on site for a maximum period of five years before being transported to the interim storage facility for high level waste (HABOG) managed by COVRA (the central organisation for nuclear waste management). All High Enriched Uranium (HEU) spent fuel under the responsibility of the JRC was shipped to the USA or to HABOG between 2005 and 2011. At JRC-Karlsruhe, residual irradiated fuel no longer used for research activities which cannot be returned to an external owner is subject to temporary storage in view of joining the relevant waste streams foreseen in Germany for this type of materials.

At JRC-Ispra most of the spent fuel has been returned to the USA. The remaining spent fuel in the pool of the Epsilon reactor and in dry pits and vaults will be temporarily stored in an interim store installed in one of the former hot cells of the Epsilon reactor complex before being repackaged in dual purpose storage casks and subsequently transferred to dry storage on-site, pending shipment to the national long term storage facility when available. An alternative consists in sending all remaining irradiated material to reprocessing; title transfer of the recovered nuclear material, storage of vitrified waste at the reprocessing plant and final shipping to the Italian national repository associated with this option are under evaluation.

About 95% of the non-irradiated nuclear material has been removed from the site, the corresponding title of ownership transferred, and shipped to the USA or France. The last shipment took place in 2015.

B.2.3.3 *Radioactive waste management policy*

The policy of the JRC sites is to reduce the amount of radioactive waste to the lowest level as reasonably achievable and to transfer the resulting waste packages to the national waste management organisation in the host country.

On the JRC sites which have still nuclear facilities in operation, the efforts to reduce waste originating from the research activities are focussed mainly on waste segregation and, when possible, decontamination and release of the waste from regulatory control. Concerning future waste from the decommissioning of the JRC facilities, studies are on-going on technological solutions of waste conditioning which could reduce the volumes of waste anticipated in the decommissioning plans.

B.2.3.4 *Radioactive waste management practices*

At JRC-Petten, radioactive waste generated at the HFR is managed under the responsibility of NRG, the operator and licence holder of the HFR, and transferred to COVRA.

At JRC-Geel, waste is transferred to Belgian National Agency for Radioactive Waste and enriched Fissile Material (ONDRAF/NIRAS) and shipped to the Belgoprocess facilities.

At JRC-Karlsruhe, waste is transferred to the Central Decontamination Operations Department (HDB), located within the premises of the Karlsruhe Institute for Technology (KIT). The HDB manages radioactive wastes originating from the Karlsruhe site, including JRC, and various other sites in Germany.

At JRC-Ispra the waste is temporarily stored in facilities on site, waiting for the availability of a national repository or national long term storage facilities. In the meantime, JRC-Ispra is constructing and refurbishing several waste management facilities in order to treat, characterise, condition and package the existing (historical) waste and the (future) waste arising from dismantling operations according to relevant regulations.

At the JRC-Ispra site, where the main waste management activities are on-going, during the last three years:

- A new facility for the immobilisation of waste is being tendered;***
- A 5 m³ final waste package for the conditioned waste has finalised the qualification process and is awaiting the acceptance by the National Authority;***
- the "interim storage facility" for conditioned waste has been realised, commissioned and authorised for conditioned VLLW and LLW; an application will be submitted to extend the license to host unconditioned VLLW;***

– historical technological waste present in various buildings has been sorted (on-going activity, approximately 40% progress achieved), characterised, properly repacked and stored per category in a dedicated "transit area", awaiting its conditioning.

B.2.3.5 *Waste categorisation criteria*

At each site JRC follows the relevant national waste categorisation criteria, defined by law or by national standards. Reference is made to the national reports from Belgium, Germany, Italy and the Netherlands for the corresponding legislation and criteria.

Section C

SCOPE OF APPLICATION

(Article 3 of the Joint Convention)

ARTICLE 3. SCOPE OF APPLICATION

- 1. This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.*
- 2. This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.*
- 3. This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.*
- 4. This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.*

The scope of application of various requirements under the Joint Convention is defined in the aforementioned declaration submitted by Euratom at the time of its accession⁵⁵.

In addition, the following observations are made:

- To date, Euratom has not made a declaration under Article 3(1) of the Joint Convention⁵⁶.

⁵⁵ See Section A.2.4.2 above.

⁵⁶ Reprocessing is not covered further by this Report.

- Euratom has not made a declaration under Article 3(2) of the Joint Convention.
- Euratom has not made a declaration under Article 3(3) of the Joint Convention⁵⁷.

Section D

INVENTORIES AND LISTS⁵⁸ (Article 32(2) of the Joint Convention)

ARTICLE 32. REPORTING

(...)

2. *This report shall also include:*

(i) a list of the spent fuel management facilities subject to this Convention, their location, main purpose and essential features;

(ii) an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

(iii) a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

(iv) an inventory of radioactive waste that is subject to this Convention that:

(a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;

(b) has been disposed of; or

(c) has resulted from past practices.

This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides;

(v) a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

⁵⁷ The Court of Justice has ruled that activities falling within the military sphere are outside the scope of all the provisions of the Euratom Treaty, as well as of Euratom secondary legislation {Case C-61/03 *Commission v. UK* [2005] ECR I-2477 and Case 65/04 *Commission v. UK* [2006] ECR I-2239}.

⁵⁸ See the paragraphs in bold on the 1st page of the Foreword as the status of JRC facilities.

D.1 JRC GEEL (BELGIUM)

The current nuclear installations of the Institute for Reference Materials and Measurements (IRMM) at the JRC-Geel site consist of two major accelerator buildings (GELINA and Van de Graaff) and a series of research laboratories located in two separate buildings.

In 2002, JRC-Geel completed a first stage of its programme for the removal of obsolete facilities: a radiochemical laboratory building was decommissioned and is now being used for non-nuclear activities; one obsolete old Van de Graaff accelerator was dismantled. *Since then, no important decommissioning project has taken place.*

Radioactive waste inventory and practices

The radioactive waste produced on the JRC-Geel site is transferred to Belgoprocess in Dessel, where it is conditioned and stored, pending its disposal.

No radioactive waste originated from the refurbishment of the research facilities in Geel remains on-site.

A detailed radiological investigation was conducted of all still active nuclear installations, with a view to establishing an accurate forecast of future waste volumes and decommissioning costs. This evaluation of future liabilities also includes the provisional decommissioning plan. It was formally approved by ONDRAF/NIRAS in 2001 and is updated every five years.

The most up-to-date version (2016) states that the expected waste volumes that will be produced as a result of the decommissioning of all installations amount to 1300 m³ (non-conditioned waste) and around 2500 tons of recyclable waste.

About 80% of this amount is related to the evacuation of the activated concrete shielding of the GELINA facility.

Sealed source inventory and practices

Currently, 225 sealed or encapsulated sources are still in use for research purposes and related activities.

D.2 JRC KARLSRUHE (GERMANY)

The nuclear research installations at JRC-Karlsruhe are located within the German site of the Karlsruhe Institute of Technology (KIT) and comprise a series of annexed buildings ("wings") for actinides, nuclear safety and safeguards scientific and technological research. The research activities are mainly performed in glove boxes and hot cells. A new building (wing M) is currently under construction.

The continuously evolving research activities have led to a variety of nuclear facilities being installed, nuclearized and renewed. Equipment which is no longer operational is gradually removed to allow optimum utilisation of the nuclear infrastructure. The focus of the JRC-Karlsruhe decommissioning and waste management programme is on management of historical waste and the dismantling of obsolete nuclear equipment, such as glove boxes. In the next decade, with the start of operation of the new wing M, some of the old laboratory wings will become obsolete and thus will be decommissioned.

Spent fuel inventory

The quantity of JRC Karlsruhe owned irradiated fuel related to research activities is approximately 50 kg. Additional irradiated fuel owned by external research partners is temporarily stored on site, waiting to be returned to its owners.

Specific installations are under development for the treatment of the obsolete irradiated material for which no further use is foreseen, to allow its transport and later disposal in deep geological disposal facilities, according to relevant national regulations.

Radioactive waste inventory and practices

The radioactive waste produced at JRC-Karlsruhe is transferred to the conditioning and interim storage facilities of HDB⁵⁹, located on-site within the premises of KIT.

Currently, about 40 m³ of non-conditioned waste originating from past research activities as well as from dismantling works are present at JRC-Karlsruhe. This historical legacy waste is currently being repackaged, characterised and transferred to HDB (to be completed by mid-2018). At HDB, the waste is conditioned and stored until the ILW disposal repository Konrad is operational.

The total waste volumes that will be produced after the decommissioning of all installations have been estimated at 4500 m³ (conditioned waste).

Sealed source inventory and practices

All sources present on the site are inventoried according to the terms of the German legislation.

Currently, the feasibility of transferring disused neutron sources to external facilities for recycling is being investigated.

D.3 JRC PETTEN (NETHERLANDS)

Since 2005 the operating licence of the HFR at the Petten site has been transferred from JRC to the Dutch company NRG, which previously operated the reactor under a JRC licence. This has clarified the responsibilities towards the national safety authorities as the operator and the licence holder became a single body. Nevertheless, the Community will continue to own the HFR (under a long term lease contract with the Dutch Government) and has the liability for its later decommissioning.

Spent fuel inventory and practices

All JRC-owned spent fuel was shipped back to the USA or to the Dutch spent fuel and radioactive waste management agency (COVRA) by March 2011. Since then, all HFR spent fuel is managed under NRG responsibility.

⁵⁹ Hauptabteilung Dekontaminationsbetriebe

Radioactive waste inventory and practices

In 2005 and 2011, JRC-Petten has conducted detailed assessments of these future decommissioning liabilities, including the amount of waste that will be generated. The total waste volumes that will be produced after the decommissioning of all installations have been estimated at 1300 m³ (non-conditioned waste). *An update of the assessment is currently being prepared and will be finalised by the end of 2017.*

Sealed source inventory

There are no sealed sources of significant activity present at JRC-Petten.

D.4 JRC ISPRA (ITALY)

Currently, almost all the nuclear research installations of the JRC-Ispra site have been definitively shut down. It concerns two former research reactors (Ispra-1 and Eссор), a cyclotron, three major buildings for experiments (a radiochemical laboratory, which has been decommissioned and released from regulatory control in 2010, a hot cell fuel handling laboratory and a fuel melting oven) and the older installations for the processing of the solid and liquid waste having reached the end of their technical lifetime, as well as areas where historical raw unconditioned research waste was stored in temporary facilities and areas where conditioned waste, according to applicable Italian norms and prescriptions issued in the 60's/70's, was either temporarily stored in dedicated facilities or buried.

Italy has currently no central site able to store the JRC-Ispra waste and for this reason JRC has built its own interim storage facility for conditioned waste and has also focussed on the construction or refurbishment of waste characterisation and treatment installations on its site.

Spent fuel inventory and practices

About 700 kg of spent fuel is still present on the JRC-Ispra site, essentially residual fuel assemblies, bundles and pins from past experiments. Most of this fuel is currently stored in the pool of the Essor reactor and in dry pits and vaults. ***Additionally, there are about 900 kg of flashed bars made of U-Pu metallic alloy stored in a protected location inside the Essor reactor. The same strategy applied to the spent fuel is currently envisaged.***

The reference strategy is to dismantle and repack part of the experimental fuel in dry storage structure inside a hot cell. In a second stage all the fuel will be transferred in one or two dry storage dual-purpose casks and temporarily stored in a dedicated building, pending the shipment to the national storage or repository.

An alternative option, currently under evaluation, consists in sending all remaining irradiated material to reprocessing, transferring the title of the recovered nuclear material, storing the vitrified waste at the reprocessing plant and finally shipping it to the Italian national repository when it is ready.

Radioactive waste inventory and practices

The total radioactive waste inventory for the JRC-Ispra site can be summarised as follows:

- 2000 m³ of unconditioned historical waste from previous operational and dismantling activities;
- 1200 m³ of conditioned bituminised historical waste;
- 700 m³ of historical waste conditioned in concrete pits and concrete blocks;
- ***700 m³ of waste generated during the pre-decommissioning activities***
- 5000 m³ of unconditioned waste expected to be produced in future decommissioning activities. This figure does neither include the Cyclotron, shut-down in 2014, nor the new or refurbished facilities built to manage on site the historical and the decommissioning waste (up to its interim storage), whose definitive shutdown and related decommissioning is planned close to the end of the whole JRC-Ispra D&WM Programme (2038).

General criteria for waste management strategy

The general waste management strategy is based on the criteria listed in the national guide for the waste management, called "Guida Tecnica 26". These criteria are:

- 1) Radiological and environmental protection guided by the ALARA principle;
- 2) Waste volume reduction;
- 3) Classification of waste based on the radioisotope qualities and quantities into three different categories which necessitate different confinement times, conditioning and management strategies.

Currently, this "Guida Tecnica 26" has been revised, in relation to waste classification, by Ministerial Decree of August 7, 2015, in view of the implementation of Council Directive 2011/70/Euratom. However, in relation to the establishment of requirements for the different waste categories, this revision is ongoing.

In order to implement the strategy, the infrastructures created during the 60's to supply routine services, including storage of all radioactive waste coming from research and development activities carried out in the JRC, underwent significant modifications and improvements.

Waste pre-treatment, characterisation and conditioning

Pre-treating operations are carried out on the site. The following installations have been installed over the last *decade*:

- waste drum measurement systems (*under upgrading*);
- facilities for waste sorting, cutting and decontamination (in operation);
- an abrasive blasting unit (in commissioning phase);
- a waste release facility (in operation);

- a renewed radiochemical laboratory (*under construction*);
- a new treatment station for liquid waste (in operation);
- *a new grouting facility for waste conditioning (under construction).*

Concerning waste conditioning (volume optimisation and reduction), the choice has been made to use external service providers, mainly off site. This includes the following contracts:

- super-compaction services (*contract in place, pending authorisation*);
- metal melting services (contract *in tendering phase*);
- incineration (planned – contracts in tendering phase);
- conditioning of sludges (planned).

Final Waste Package and Waste Immobilisation

A standardisation of waste containers is pursued. JRC-Ispra will generally employ for its low level waste 5.2 m³ prismatic containers (IP-2 containers). A dedicated design in conformity with the Italian UNI standards *has finalised its qualifications phase. The containers are awaiting the approval of the National Authority, which is also subject to the declaration of conformity with the waste acceptance criteria of the future final disposal facility.*

Where necessary, alternative qualified 440 L drums will also be used, e.g. for the conditioned sludges (not planned yet).

The turn-key contract for the supply of an on-site immobilisation facility (grouting station) had to be repeated. The procurement has been relaunched by splitting the services in two parts: civil works (contract awarded) and electro-mechanical equipment (in tendering process).

For the packing of the intermediate level waste, suitable existing qualified containers are under investigation, *awaiting the issuance from the Italian standardisation body (UNI) of a specific norm for ILW containers, currently in preparation.*

Interim Storage Facilities

For the temporary storage of the conditioned and immobilised low level waste, JRC-Ispra has opted for a lightweight interim storage facility (ISF, **commissioned in 2013**) realized in the vicinity of other waste management facilities (commissioned in 2013). The building has been designed to store 10.500 m³ of waste (conditioned mainly in 5,2 m³ containers, but partially also in 440L drums) for a period of 50 years. ***This facility is already licensed for conditioned waste; due to the delay in the realisation of the grouting station, and considering that the licensing procedure of the conditioning process is in progress, JRC is applying for a license to use ISF for unconditioned VLLW.*** A small complementary facility for the storage of intermediate level waste and the irradiated material packaged in dual-purpose dry casks is currently in the planning phase.

Management of historical waste on the site

Since 1999 actions have been undertaken to sort and if necessary treat the historical non-conditioned waste stored on the site. ***This waste is re-packed in standard 200 L drums. All the waste drums will be characterised and shipped for super-compaction to an external facility.***

In addition, some of the waste from previous research activities, which has been conditioned in the past according to existing applicable Italian norms and prescriptions, are temporarily stored in a dedicated facility or buried inside the site waste management area. The conditioning and packing doesn't comply with the current applicable international standards as well as the storage underground practices. For this reason this waste will have to be retrieved, re-conditioned and packed according to the current applicable standards and norms. It concerns:

- about 1200 m³ of low level waste (about 6000 drums) conditioned in bitumen and disposed in three underground trenches covered with earth, which will be retrieved, characterised and incinerated in an offsite facility (contracts in tendering phase). This activity is planned to be completed by 2024;

- about 700 m³ of low/intermediate level waste conditioned in concrete; part is stored underground in 15 concrete pits, which will be retrieved, characterised and dismantled to segregate waste from the inert matrix. This activity is planned to be completed by 2022; part is conditioned in about 230 concrete blocks which are stored in a dedicated facility and the blocks must undergo characterisation, segregation and/or repacking. This activity is planned to be completed by 2025.

It should be noted that no safety-reportable events have been recorded during the period of storage of the above mentioned conditioned waste.

Decommissioning activities

In parallel, the decommissioning of the shutdown installations has been initiated on the JRC-Ispra site. During the period between the shutdown and decommissioning of a nuclear installation, a programme of routine activities is undertaken to keep the installation in a safe state, in compliance with regulatory and site requirements. These activities also include keeping operating and maintenance knowledge and records of shutdown nuclear installations and existing radioactive wastes for radiological characterisation of the installations, with a view to decommissioning. In this respect all installations and equipment have been submitted to a global physical and radiological characterisation.

Clean-up and preliminary dismantling works are undertaken and in parallel decommissioning plans are elaborated. Where applicable, decommissioning licence requests are prepared.

Sealed source inventory and practices

From 2007 to 2010, three campaigns were organised to collect and evacuate obsolete sealed sources present on the site. More than 1700 sources were evacuated as such for recycling and/or future disposal.

Currently about 300 sealed sources are still in use for research purposes, instruments calibration and training activities (the large majority of which in the Safeguards Performance Laboratory (PERLA)). Like in the past, it is envisaged to transfer disused sources to a third party, either for recycling or for future disposal.

D.5 COMMISSION PREMISES IN LUXEMBOURG

Sealed source inventory and practices

All sources present are inventoried according to the terms of the licence issued by the Health Ministry of Luxembourg. The Directorate-General for Energy (DG ENER) holds a total number of 122 low-radioactivity sealed sources and 28 fissile materials calibration standards.

The sources and calibration standards are used for calibrating and testing safeguards non-destructive measurement equipment and for calibrating and testing radiation detection instruments.

The radioactive sources *inventory is subject to annual updates reported* to the Luxembourg radiation protection competent authority and the fissile materials are under Euratom safeguards. *Whenever a radioactive source becomes disused, it is envisaged to transfer it to a third party either for recycling or for future disposal.*

Section E

LEGISLATIVE AND REGULATORY SYSTEM

(Articles 18 and 19 of the Joint Convention)

E.1 LEGISLATIVE AND REGULATORY FRAMEWORK (ARTICLE 19 OF THE JOINT CONVENTION)

ARTICLE 19. LEGISLATIVE AND REGULATORY FRAMEWORK

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.

2. This legislative and regulatory framework shall provide for:

(i) the establishment of applicable national safety requirements and regulations for radiation safety;

(ii) a system of licencing of spent fuel and radioactive waste management activities;

(iii) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence;

(iv) a system of appropriate institutional control, regulatory inspection and documentation and reporting;

(v) the enforcement of applicable regulations and of the terms of the licences;

(vi) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.

3. When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.

The sources of EU and Euratom law are the respective Treaties, which are regarded as "primary" sources of law, and secondary legislation that can be enacted by the institutions participating in the legislative process by virtue of the powers bestowed to them under the Treaties. Additional sources of law in both EU and Euratom legal order are: the case-law of the Court of Justice of the EU, general principles of law, fundamental rights and agreements or contracts with third countries or nationals of third countries or other international organisations.

E.1.1 Primary law

According to the above, the Euratom Treaty constitutes Euratom's "primary law", in other words the original supreme source of law on the strength of which the Community is established and secondary legislation can be adopted. It is the legal basis for the competences and activities of Euratom.

This Treaty was signed in Rome on 25 March 1957, for an indefinite duration⁶⁰. On the basis of the Treaty, the Community coordinates research programmes in the area of nuclear energy. Further, it seeks international cooperation and it aims to prevent nuclear materials from being diverted from their intended uses as declared by the users⁶¹.

The Treaty also foresees the adoption of appropriate basic safety standards. Article 2(b) of Title I of the Euratom Treaty states that in order to perform its task, Euratom shall "*establish uniform safety standards to protect the health of workers and of the general public and ensure that they are applied*". In turn, Title II, Chapter 3, of the Treaty ("Health and Safety" – Articles 30 to 39) sets out a number of detailed provisions intended to establish and apply basic safety standards, so as to materialise the proviso of Article 2(b). Thus, Article 30 of the Treaty stipulates: "*Basic standards shall be laid down within the Community for the protection of the health of workers and the general public against the dangers arising from ionising radiations...*". In addition, Articles 31 and 32 provide for the details regarding the adoption and the revision of such Community standards, while Article 33 ensures that Member States' implementing legislation complies with them. Articles 34 et seq. ensure, in various ways, the monitoring by the Commission of national health and safety measures, including any plans for the disposal of radioactive waste⁶².

In the context of the Lisbon Treaty, which entered into force on 1 December 2009, a limited number of amendments were agreed for the Euratom Treaty, while explicitly recalling the necessity that the provisions of this Treaty should continue to have full legal effect⁶³.

⁶⁰ Article 208 of the Euratom Treaty provides: "*This Treaty is concluded for an unlimited period*".

⁶¹ It is recalled that Euratom activities are limited to peaceful civil uses of nuclear energy.

⁶² For more details on these Treaty provisions, see Section E.2 below.

⁶³ See above, Section A.2.1.

E.1.2 Secondary legislation

It has been explained that "secondary law" means measures that are adopted by the institutions under the express empowerment of a Treaty provision.

Under the combined provisions of Article 106a(1),(2) of the Euratom Treaty and Article 288 TFEU, the secondary legislative and other relevant instruments adopted by Euratom, as well as their impact on the national regulatory systems of the Member States, are as follows:

"...the institutions shall adopt regulations, directives, decisions, recommendations and opinions.

A regulation shall have general application. It shall be binding in its entirety and directly applicable in all Member States.

A directive shall be binding, as to the result to be achieved, upon each Member State to which it is addressed, but shall leave to the national authorities the choice of form and methods.

A decision shall be binding in its entirety. A decision which specifies those to whom it is addressed, shall be binding only on them.

Recommendations and opinions shall have no binding force".

Therefore, with the exception of recommendations and opinions, the other three types of instruments mentioned in Article 288 TFEU, namely regulations, directives and decisions, are legally binding (either on all Member States⁶⁴ or on those to whom they are specifically addressed⁶⁵).

⁶⁴ This is the case of regulations.

⁶⁵ This is the case of directives and decisions.

In fact, a substantial corpus of Euratom binding secondary legislation has been adopted and updated over the years. With regard to spent fuel and radioactive waste management, the central legislative act is Council Directive 2011/70/Euratom establishing a Community framework for such responsible and safe management. The Directive applies to all stages of management of spent fuel and radioactive waste from civilian activities. It supplements the basic standards referred to in Article 30 of the Euratom Treaty, as regards the safety of spent fuel and radioactive waste, and is without prejudice to the basic safety standards directive (Council Directive 96/29/Euratom⁶⁶, which is repealed by Council Directive 2013/59/Euratom⁶⁷ with effect from 6 February 2018).

Council Directive 2011/70/Euratom

Council Directive 2011/70/Euratom reflects the main principles and requirements of the IAEA Safety Standards and of the Joint Convention. The directive imposes *legal* obligations on the Member States to establish and maintain a national policy, as well as a national legislative, regulatory and organisational framework for the management of spent fuel and radioactive waste that allocates responsibilities and provides for coordination between relevant competent bodies. The national framework shall provide for the following:

- a national programme for the implementation of spent fuel and radioactive waste management policy;
- national arrangements for the safety of spent fuel and radioactive waste management;
- a system of licencing of spent fuel and radioactive waste management activities, facilities or both, including the prohibition of spent fuel or radioactive waste management activities, of the operation of a spent fuel or radioactive waste management facility without a licence, or both and, if appropriate, prescribing conditions for further management of the activity, facility or both;

⁶⁶ Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation, OJ L 159, 29.6.1996.

⁶⁷ Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom, OJ L 13, 17.1.2014. The Directive 2013/59/Euratom has to be transposed by the Member States by 6 February 2018.

- a system of appropriate control, a management system, regulatory inspections, documentation and reporting obligations for radioactive waste and spent fuel management activities, facilities or both, including appropriate measures for the post-closure periods of disposal facilities;
- enforcement actions, including the suspension of activities and the modification, expiration or revocation of a licence together with requirements, if appropriate, for alternative solutions that lead to improved safety;
- the allocation of responsibility to the bodies involved in the different steps of spent fuel and radioactive waste management;
- national requirements for public information and participation;
- the financing scheme(s) for spent fuel and radioactive waste management.

The effective independence of national regulatory bodies in the field of safety of spent fuel and radioactive waste management is also addressed by the directive. Article 6, entitled "competent regulatory authority", provides:

"1. Each Member State shall establish and maintain a competent regulatory authority in the field of safety of spent fuel and radioactive waste management.

2. Member States shall ensure that the competent regulatory authority is functionally separate from any other body or organisation concerned with the promotion or utilisation of nuclear energy or radioactive material, including electricity production and radioisotope applications, or with the management of spent fuel and radioactive waste, in order to ensure effective independence from undue influence on its regulatory function.

3. Member States shall ensure that the competent regulatory authority is given the legal powers and human and financial resources necessary to fulfil its obligations in connection with the national framework (...)"

With reference to transparency issues, Article 10 requires Member States to ensure that necessary information on the management of spent fuel and radioactive waste is made available to workers and the general public. This obligation includes ensuring that the competent regulatory authority informs the public in the fields of its competence.

Moreover, Member States shall ensure that the national framework is improved where appropriate, taking into account operating experience, insights gained from the decision-making process and the development of relevant technology and research.

At least every ten years Member States have to carry out self-assessments and invite international peer reviews of their national framework, competent authority and/or national programme (the first one is due by August 2023). The Member States shall also inform the Commission and the other Member States about the outcome of such reviews, which may be made available to the public where there is no conflict with security and proprietary information. Poland has scheduled its ARTEMIS review in 2017, France, Bulgaria and Spain in 2018, and Germany in 2019.

Finally, Member States must submit a report to the Commission on the implementation of the above directive. ***This needed to be done*** for the first time by 23 August 2015, and every 3 years thereafter, taking advantage of the review and reporting under the Joint Convention. ***To date all Member States have submitted their national reports to the Commission.***

According to Articles 11 and 15 paragraph 4 of the Directive, Member States shall notify to the Commission by the same date the content of their national programme, setting out how they intend to implement their national policies for the responsible and safe management of spent fuel and radioactive waste, to secure the aims of this directive.

Other Euratom secondary legislation

Other Euratom legislative instruments include the following:

- Council Directive 2006/117/Euratom of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel (repealing previous Council Directive 92/3/Euratom)⁶⁸ lays down a Community system of supervision and control of transboundary shipments of radioactive waste and spent fuel in, through and outside the Community. In particular, it provides for a compulsory and common scheme of notification and a standard control document, for shipments of radioactive waste or spent fuel which have a point of departure, transit or destination in an EU Member State, provided that the quantities in question exceed certain limits. ***The Directive establishes an Advisory Committee⁶⁹ to support the Commission in its work in the field of shipments of spent fuel and waste (e.g. review the Commission's 3-year reports to the Council, the European Parliament and EESC on implementation of this Directive). The first report (2009-2011) was published in 2013 and the second report for the period 2012-2014 is foreseen to be adopted in 2017.***

⁶⁸ OJ L 337, 05.12.2006, p. 21–32.

⁶⁹ The 10th meeting of the Advisory Committee was held on 25 January 2017, Luxembourg (attended by 20 Member States)

- Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations ('Nuclear Safety Directive')⁷⁰ imposes obligations on the Member States to establish and maintain a national legislative, regulatory and organisational framework for nuclear safety. Like Council Directive 2011/70/Euratom, Directive 2009/71/Euratom supplements the basic standards referred to in Article 30 of the Treaty, as regards the safety of nuclear installations, and is without prejudice to the basic safety standards directive (Council Directive 2013/59/Euratom, referred to *below*). **Directive 2009/71/Euratom was amended in July 2014⁷¹ ('the amended NSD'), following the lessons learned from the Fukushima-Daichi accident and the EU stress tests⁷² and is based on various sources of technical expertise, such as the Western European Nuclear Regulators Association⁷³ and the technical provisions of the IAEA. It has been drawn up in close cooperation with national regulators. The amended NSD sets out an EU-wide safety objective to further reduce nuclear safety risks. It sets up a European system of regular topical peer reviews to ensure a common application of high nuclear safety standards and to exchange experiences. It also increases transparency in nuclear safety and strengthens the independence and the powers of national regulators⁷⁴. The amended NSD is to be transposed by the EU Member States by 15 August 2017.**

The goal of Nuclear Safety Directive is to promote the continuous improvement of nuclear safety and to ensure that at all times a high level of nuclear safety is provided by the Member States to protect workers and the general public against dangers arising from nuclear installations. Towards this end, it reflects the fundamental safety principles and requirements of the Joint Convention on Nuclear Safety⁷⁵ and the Joint Convention and is builds upon the Fundamental Safety Principles⁷⁶ established by the IAEA⁷⁷.

The Nuclear Safety Directive also covers spent fuel storage facilities, as well as storage facilities for radioactive waste that are on the same site and are directly related to a nuclear power plant, an enrichment plant, a nuclear fuel fabrication plant, or a reprocessing plant, a research reactor facility.

⁷⁰ OJ L 172, 02.07.2009, p. 18.

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

⁷² See Section K.6 below.

⁷³ See at: <http://www.wenra.org>

⁷⁴ For further information, also Section K.7 below.

⁷⁵ See Section A.2.4.2, footnote 38 above.

⁷⁶ IAEA Safety Standard Series No. SF-1 (2006).

⁷⁷ Detailed reference to Council Directive 2009/71/Euratom has been made in the Euratom report on the implementation of the obligations under the Convention on Nuclear Safety which was submitted to the Secretariat of the IAEA in 2010, in view of the Fifth Review Meeting of Contracting Parties (Vienna, April 2011).

- Following the entry into force of the Euratom Treaty, a comprehensive set of legislation establishing basic safety standards has been enacted on the basis of Article 31 of the Treaty. The main pillar of that legislation has been the basic safety standards directive ('BSS Directive'), which was first adopted in 1959 and subsequently updated in 1962, 1966, 1976, 1980, 1984, 1996 and 2013.

Council Directive 2013/59/Euratom is laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation ('the new BSS Directive')⁷⁸. The new BSS Directive consolidates the existing set of Euratom radiation protection legislation into one single piece of legislation, repealing five Directives – the Medical Exposure Directive⁷⁹, the High Activity Sealed Sources Directive⁸⁰, the Outside Workers Directive⁸¹, the Public Information Directive⁸² and the previous BSS Directive (96/29)⁸³.

Euratom adopted the new BSS Directive in order to: (i) take account of the scientific and technological progress since 1996, in particular the new recommendations in Publication 103(2007) of the International Commission on Radiological Protection (ICRP) but also of the operational experience with the current requirements, and (ii) to consolidate the existing set of Euratom radiation protection legislation into one single piece of legislation. These recent basic safety standards offer the highest protection of workers, patients and members of the public based on latest scientific knowledge. The new BSS Directive establishes uniform standards for the protection of the health of individuals subject to occupational, medical and public exposures against the dangers arising from ionising radiation. The directive applies to any planned, existing or emergency exposure situation which involves a risk from exposure to ionising radiation which cannot be disregarded from a radiation protection point of view or with regard to the environment in view of long term human health protection. The directive applies in particular to the manufacture, production, processing, handling, disposal, use, storage, holding, transport, import to, and export from the Community of radioactive material.

⁷⁸ OJ L 13, 17.1.2014

⁷⁹ Council Directive 97/43/Euratom of 30 June 1997 on health protection of individuals against the dangers of ionising radiation in relation to medical exposure. OJ L 180/22, 9.7.1997

⁸⁰ Council Directive 2003/122/Euratom of 22 December 2003 on the control of high-activity sealed radioactive sources and orphan sources. OJ L 346, 31.12.2003

⁸¹ Council Directive 90/641/Euratom of 4 December 1990 on the operational protection of outside workers exposed to the risk of ionising radiation during their activities in controlled areas. OJ L 349/21, 13.12.1990

⁸² Council Directive 89/618/Euratom of 27 November 1989 on informing the general public about health protection measures to be applied and steps to be taken in the event of a radiological emergency. OJ L 357/31, 7.12.89

⁸³ Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation. OJ L 159/1, 29.6.96

The directive introduces a graded approach to regulatory control of practices by way of notification, authorisation and appropriate inspections commensurate with the magnitude and likelihood of exposures resulting from the practice, and commensurate with the impact that regulatory control may have in reducing such exposures or improving radiological safety. Authorisation can take the form of a registration or a licence. Justified practices, such as the disposal or storage of radioactive waste, need to be notified prior to the practice commencement. Article 28 stipulates that Member States shall require licencing, inter alia, for the operation, decommissioning and closure of any facility for the long term storage or disposal of radioactive waste, including facilities managing radioactive waste for this purpose. Article 30 defines the requirements for release of regulatory control and defines general clearance criteria. ***It is worth noting that this graded approach to regulatory control now consistently applies also to practices involving naturally-occurring radioactive material (NORM) and leading to exposure of workers or members of the public which cannot be disregarded from a radiation protection point of view.***

The directive clearly defines the responsibilities of an undertaking or an employer for the radiation protection of their workers, including emergency workers, and provides for detailed requirements on the radiation protection programme for workers. The operational protection of exposed workers⁸⁴ is based on:

- prior evaluation to identify the nature and magnitude of the radiological risk to exposed workers;
- optimisation of radiation protection in all working conditions;
- classification of exposed workers into different categories;
- control measures and monitoring relating to the different areas and working conditions, including individual monitoring;

⁸⁴ Article 32.

- medical surveillance of workers;
- education and training of workers.

It provides also for the protection of members of the public in normal circumstances, as well as in emergency exposure situations. The operational protection of members of the public⁸⁵ from practices subject to licencing, in normal circumstances, shall include:

- examination and approval of the proposed siting of the facility from a radiation protection point of view;
- acceptance into service of the facility subject to adequate protection being provided against any exposure or radioactive contamination liable to extend beyond the perimeter of the facility or radioactive contamination liable to extend to the ground beneath the facility;
- examination and approval of plans for the discharge of radioactive effluents;
- measures to control the access of members of the public to the facility.

For practices where a discharge authorisation is granted, the radioactive discharges into the environment need to be monitored and reported. Further to this, the BSS Directive requires the estimation of doses to members of the public from authorised practices, and the set-up of an environmental monitoring programme.

The directive requires that Member States shall establish an adequate legislative and administrative framework ensuring the provision of appropriate radiation protection education, training and information to all individuals whose tasks require specific competences in radiation protection. In addition, it contains detailed requirements for radiation protection education, training and information of workers, including emergency workers, and members of the public.

⁸⁵ Article 65.

Member States shall transpose the new BSS Directive⁸⁶ in their national legal order by 6 February 2018. *During the last three years the Commission has organised seven workshops to discuss with Member States various aspects of the new BSS Directive in view of its transposition, some of which have been attended by civil society representatives.*

Council Regulation 2013/1368/Euratom⁸⁷ and Council Regulation 2013/1369/EU⁸⁸

Upon accession, Bulgaria, Lithuania and Slovakia committed to close down within the respective deadlines and subsequently decommission of eight Soviet design nuclear power units before the end of their scheduled operational lifetime. The EU agreed to assist financially the three Member States to decommission the concerned power reactors, as follows:

- *Kozloduy (KNPP) units 1 to 4 in Bulgaria;*
- *Ignalina (INPP) units 1 and 2 in Lithuania; and*
- *Bohunice VI (VI NPP) units 1 and 2 in Slovakia.*

The EU assistance was implemented in distinct periods:

1. *Pre-accession period through the PHARE programme,⁸⁹*
2. *Post-accession under the Protocols to the relevant Acts of Accession,^{90,91,92}*
3. *Extension until 2013 as per relevant Council Regulations.^{93,94,95}*

⁸⁶ The text of the directive is available at:

http://ec.europa.eu/energy/nuclear/radiation_protection/radiation_protection_en.htm

⁸⁷ Council Regulation (Euratom) No 1368/2013 of 13 December 2013 on Union support for the nuclear decommissioning assistance programmes in Bulgaria and Slovakia, and repealing Regulations (Euratom) No 549/2007 and (Euratom) No 647/2010, OJ L 346, 20.12.2013 and OJ L8, 11.1.2014, p.31.

⁸⁸ Council Regulation (Euratom) No 1369/2013 of 13 December 2013 on Union support for the nuclear decommissioning assistance programme in Lithuania, and repealing Regulation (EC) No 1990/2006, OJ L 346, 20.12.2013, p. 7–11 and OJ L8, 11.1.2014, p.30 & OJ L121, 24.4.2014, p.59.

⁸⁹ Programme of aid to central and east European countries

⁹⁰ OJ L236, 23.9.2003, p.33 and p.944

⁹¹ OJ L236, 23.9.2003, p.33 and p.954

⁹² OJ L157, 21.6.2005, p.11 and p.38

⁹³ OJ L 411, 30.12.2006, p.10

⁹⁴ OJ L 131, 23.5.2007, p.1

⁹⁵ OJ L 189, 22.7.2010, p.9

Two Council Regulations [2013/1368/Euratom](#) and [2013/1369/EU](#) have established a new legal base, providing further support to the decommissioning programmes for the period 2014-2020. The scope of the nuclear decommissioning assistance programmes is to assist the relevant Member States in implementing the steady process towards the decommissioning end-state whilst ensuring that the highest safety standards are applied.

In all three cases, the end-state is defined as brownfield: the equipment in nuclear reactor buildings will be dismantled as well as those auxiliary buildings that are not intended for re-use; near-surface repositories will be built or upgraded to dispose of low and intermediate level radioactive waste from decommissioning; and interim storage facilities will be commissioned for spent fuel and radioactive waste that cannot be disposed of in near-surface repositories. Beyond decommissioning the disposal of spent fuel and radioactive waste in a deep geological repository is developed by each Member State in its national programme for the management of spent fuel and radioactive waste as required by the relevant Council Directive [2011/70/Euratom](#).

E.1.3 Soft law⁹⁶

Also, the following (non-binding) Recommendations relate with the management of spent fuel and radioactive waste:

- *Commission Recommendation of 15 September 1999 on a classification system for solid radioactive waste (SEC(1999) 1302 final)⁹⁷ – that will be reviewed in light of the first Commission report on Council Directive [2011/70/Euratom](#).*

⁹⁶ EU and Euratom non-binding acts are often called "soft law". Such acts include recommendations, as well as opinions, which, as it is expressly provided in Article 288 TFEU, "have no binding force". However, while this precludes soft law measures from having legally binding effect on the national legal order, it does not immunize them from the judicial process. It is, for example, open to a national court to make a reference to the Court of Justice of the EU concerning the interpretation or validity of a measure of that kind. Moreover, soft law instruments are useful for developing Community policy.

⁹⁷ OJ L 265, 13.10.1999, p. 37–45.

- Commission Recommendation of 24 October 2006 on the management of the financial resources for the decommissioning of nuclear installations, spent fuel and radioactive waste⁹⁸. The focus lies on the adequacy of funding, its financial security and the transparency in its use, ensuring that the funds are only used for the intended purposes;
- *The standard document for shipment of spent fuel and radioactive waste and its corrigendum*⁹⁹.
- Commission Recommendation 2008/956/Euratom of 4 December 2008 on the criteria for the export of radioactive waste and spent fuel to third countries¹⁰⁰. The Recommendation clarifies the main requirements relating to the export of radioactive waste or spent fuel to third countries, referred to in Article 16(1)(c) of Directive 2006/117, as well as the criteria which Member States should take into consideration in order to evaluate whether the above requirements are met;
- Commission Recommendation (2010/635/Euratom) on the application of Article 37 of the Treaty¹⁰¹. Article 37 requires Member States to provide the Commission with general data relating to any plan for the disposal of radioactive waste; thereupon, the Commission delivers an opinion with regard to the plan concerned¹⁰². *The ‘disposal of radioactive waste’ within the meaning of Article 37 actually covers any planned or accidental release of radioactive substances in gaseous, liquid or solid form in or to the environment.* The Recommendation strengthens the assessment of accidental situations by introducing a new requirement for safety-related information on unplanned releases from nuclear reactors and reprocessing plants. Concerning dismantling operations, in addition to nuclear reactors and reprocessing plants, a submission of general data for the dismantling of mixed-oxide fuel fabrication plants is required. *In the period between January 2015 and March 2017, the Commission has delivered 5 opinions on Article 37 submissions related to the predisposal management of radioactive waste.*

⁹⁸ OJ L 330, 28.11.2006, p.31.

⁹⁹ OJ L 343, 23.12.2011, p. 149.

¹⁰⁰ OJ L 338, 17.12.2008, p. 69.

¹⁰¹ OJ L 279, 23.10.2010, pp. 36-67.

¹⁰² See also Sections E.2, F.1, F.4.1 and G-H.2, below.

E.2 IMPLEMENTING MEASURES (ARTICLE 18 OF THE JOINT CONVENTION)

ARTICLE 18. IMPLEMENTING MEASURES

Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.

The obligations under the Joint Convention are reflected in the requirement under the Euratom Treaty to implement the basic safety standards provided for in its Articles 30 et seq. (Title II, Chapter 3, of the Euratom Treaty) and related secondary legislation. More specifically:

- Elaboration of basic safety standards relevant to radiation protection is a task conferred to Euratom by the aforementioned Articles 2(b), 30 and 31 of the Treaty. It is restated that Article 2(b) empowers the Community to establish uniform safety standards for the protection of the health of workers and the general public and to ensure that they are applied, while Article 30 elucidates this general empowerment by stipulating: "*Basic standards shall be laid down within the Community for the protection of the health of workers and the general public against the dangers arising from ionising radiations. The expression 'basic standards' means: (a) maximum permissible doses compatible with adequate safety; (b) maximum permissible levels of exposure and contamination; (c) the fundamental principles governing the health surveillance of workers*".
- Article 31 is specifically concerned with the procedure which is required for the adoption of such uniform basic standards. It provides: "*The basic standards shall be worked out by the Commission after it has obtained the opinion of a group of persons appointed by the Scientific and Technical Committee from among scientific experts, and in particular public health experts, in the Member States. The Commission shall obtain the opinion of the Economic and Social Committee on these basic standards. After consulting the European Parliament the Council shall, on a proposal from the Commission, which shall forward to it the opinions obtained from these Committees, establish the basic standards; the Council shall act by a qualified majority*".

- Article 32 makes express provision for the possibility to revise or supplement the basic standards which have already been adopted, specifying that "*At the request of the Commission or of a Member State, the basic standards may be revised or supplemented, in accordance with the procedure laid down in Article 31*".

To ensure that the basic safety standards are properly incorporated into the legal systems of the Member States, Article 33 of the Treaty provides: "*Each Member State shall lay down the appropriate provisions, whether by legislation, regulation or administrative action, to ensure compliance with the basic standards which have been established and shall take the necessary measures with regard to teaching, education and vocational training. The Commission shall make appropriate recommendations for harmonising the provisions applicable in this field in the Member States. To this end, the Member States shall communicate to the Commission the provisions applicable at the date of entry into force of this Treaty and any subsequent draft provisions of the same kind. Any recommendations the Commission may wish to issue with regard to such draft provisions shall be made within three months of the date on which such draft provisions are communicated*". Thus, Member States are under an obligation to lay down the appropriate provisions to ensure compliance with the basic standards adopted by the Community and to communicate those provisions to the Commission.

Moreover, with regard to Euratom health and safety measures, there are additional provisions in Title II, Chapter 3, of the Euratom Treaty ensuring monitoring by the Commission. Reference is made here below to the following provisions of the Treaty:

- "*Any Member State in whose territories particularly dangerous experiments are to take place shall take additional health and safety measures, on which it shall first obtain the opinion of the Commission. The assent of the Commission shall be required where the effects of such experiments are liable to affect the territories of other Member States*" (Article 34).

- *"Each Member State shall establish the facilities necessary to carry out continuous monitoring of the level of radioactivity in the air, water and soil and to ensure compliance with the basic standards. The Commission shall have the right of access to such facilities; it may verify their operation and efficiency"* (Article 35).
- *"The appropriate authorities shall periodically communicate information on the checks referred to in Article 35 to the Commission so that it is kept informed of the level of radioactivity to which the public is exposed"* (Article 36).
- *"The Commission shall make recommendations to the Member States with regard to the level of radioactivity in the air, water and soil. In cases of urgency, the Commission shall issue a directive requiring the Member State concerned to take, within a period laid down by the Commission, all necessary measures to prevent infringement of the basic standards and to ensure compliance with regulations. Should the State in question fail to comply with the Commission directive within the period laid down, the Commission or any Member State concerned may forthwith, by way of derogation from Articles 258 and 259 of the Treaty on the Functioning of the European Union, bring the matter before the Court of Justice"* (Article 38).

Furthermore, the Treaties guarantee that Euratom possesses the necessary enforcement mechanisms to ensure that Community binding legislation is complied with by the Member States. To this end, the Court of Justice of the EU is entrusted with an important role¹⁰³: this Court, which includes the Court of Justice, the General Court and specialised courts¹⁰⁴, ensures that the law is observed in the interpretation and application of the TEU, the TFEU and the Euratom Treaty, as well as of secondary legislation adopted by the institutions. The Court of Justice has competence, inter alia, over actions brought against Member States for failure to fulfil their obligations, references for a preliminary ruling and appeals against decisions of the General Court. It most commonly adjudicates on matters of interpretation of the Treaties or of secondary law, raised by:

¹⁰³ Article 19 TEU and Articles 251 to 281 TFEU.

¹⁰⁴ According to Article 19(1) TEU: *"The Court of Justice of the European Union shall include the Court of Justice, the General Court and specialised courts..."*.

- claims by the Commission that a Member State has not implemented a Euratom or EU directive or other binding legal requirement, in the framework of an infringement procedure¹⁰⁵.
- references from national courts of the Member States, asking the Court of Justice questions about the meaning or validity of a particular piece of Euratom or EU law¹⁰⁶. The Court gives its ruling on the interpretation of the law, which is binding on the national court.

Council Directive 2011/70/Euratom also comes within the ambit of the above legal mechanisms which ensure compliance of national laws with binding Community rules.

¹⁰⁵ Articles 19 TEU and 258 TFEU, in conjunction with Article 106a of the Euratom Treaty.

¹⁰⁶ Articles 19 TEU and 267 TFEU, in conjunction with Article 106a of the Euratom Treaty.

Section F

OTHER GENERAL SAFETY PROVISIONS (Articles 21, 24, 25 and 26 of the Joint Convention)

F.1 RESPONSIBILITY OF THE LICENCE HOLDER (ARTICLE 21 OF THE JOINT CONVENTION)

ARTICLE 21. RESPONSIBILITY OF THE LICENCE HOLDER

1. Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

2. If there is no such licence holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.

The Commission is involved in the licencing process for radioactive waste management under Article 37 of the Treaty, which states: "*Each Member State shall provide the Commission with such general data relating to any plan for the disposal of radioactive waste in whatever form as will make it possible to determine whether the implementation of such plan is liable to result in the radioactive contamination of the water, soil or airspace of another Member State. The Commission shall deliver its opinion within six months...*". **The 'disposal of radioactive waste' within the meaning of Article 37 covers any planned or accidental release of radioactive substances in gaseous, liquid or solid form in or to the environment in line with Article 1 of Commission Recommendation 2010/635/Euratom and should not be confused with the concept of disposal as in emplacement of spent fuel and/or radioactive waste in a facility without the intention of retrieval.** The licence cannot be granted at national level, before the Commission's opinion is delivered.

The principle of responsibility of the licence holder, incorporated in the IAEA Fundamental Safety Principle 1, is fully endorsed by Council Directive 2011/70/Euratom (Article 7)¹⁰⁷. The directive requires Member States to ensure that the prime responsibility for the safety of spent fuel and radioactive waste management facilities and/or activities rests with the licence holder and cannot be delegated.

Member States reported their measures to ensure that the primary responsibility for spent fuel and radioactive waste management rests with the license holder, as called for in Article 7(1) of Council Directive 2011/70/Euratom .

Council Directive 2011/70/Euratom provides further that each Member State has ultimate responsibility for the management of spent fuel and radioactive waste generated in it, in accordance with the IAEA Fundamental Safety Principle 2. Where radioactive waste or spent fuel is shipped for processing or reprocessing to a Member State or a third country, the ultimate responsibility for the safe and responsible disposal of those materials, including any waste as a by-product, remains with the Member State or third country from which the radioactive material was shipped.

¹⁰⁷ As well as by the new BSS Directive (Article 29).

F.2 OPERATIONAL RADIATION PROTECTION (ARTICLE 24 OF THE JOINT CONVENTION)

ARTICLE 24. OPERATIONAL RADIATION PROTECTION

1. Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:

(i) the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;

(ii) no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection; and

(iii) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.

2. Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:

(i) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and

(ii) so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.

3. Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.

As already noted, Title I, Article 2(b), of the Treaty requires Euratom to establish uniform safety standards to protect the health of workers and of the general public and ensure that they are applied. Hence, Title II, Chapter 3, of the Treaty, empowers the Community to lay down basic standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation.

The current safety standards with regard to radiation protection are set out in ***Council Directive 96/29/Euratom which will soon (in 2018) be replaced by*** the new BSS Directive 2013/59/Euratom. The general principles for radiation protection under the ***new*** BSS Directive remain *dose limitation*, *optimisation* and *justification*. The system of *dose limitation* is laid down in the directive (20 mSv or, in special circumstances, 50 mSv in a year for exposed workers and 1 mSv in a year for members of the public). The key principle in terms of operational protection is *optimisation*: all exposures must be kept as low as reasonably achievable, taking economic and social factors into account. Dose limits are established for occupational exposure and for public exposure. Dose constraints should be used, where appropriate, in the context of optimisation. According to the principle of *justification*, decisions introducing a practice shall be justified in the sense that such decisions shall be taken with the intent to ensure that the individual or societal benefit resulting from the practice outweighs the health detriment that it may cause. Decisions introducing or altering an exposure pathway for existing and emergency exposure situations shall be justified in the sense that they should do more good than harm. Justification, nevertheless, is a matter of judgment by the Member States and the directive does not prescribe how to make this judgment in more detail.

As requested by the national regulations, the operational radiation protection of staff and public and the nuclear safety of the JRC nuclear installations, are ensured by dedicated services and experts. The organisational structure differs between the sites:

- ***at JRC-Geel the radiation safety service managed by a qualified radiation safety expert (“Hoofd Fysische Controle”) and which is part of the site management unit (D.1);***
- ***at JRC-Karlsruhe the Site Management and Radiation Protection Unit (E.1) managed by a qualified radiation protection expert (“Strahlungsschutzbeauftragter”);***
- ***at JRC-Ispra respectively the radiation protection service and the licensing & operation service both integrated in the Nuclear Decommissioning unit (C.1), supported by two qualified radiation protection experts (“esperto qualificato”) from the Safety and Security unit (C.2);***
- ***at JRC-Petten a radiation protection expert (“Stralingsdeskundige”) linked for these tasks to the occupational health and safety service (which is part of unit F.1).***

The JRC has also nominated a Radiation Safety Coordinator to support the continuous improvement of the safety culture on the JRC nuclear sites and to stimulate a corporate approach. The role of this coordinator is complementary to the legal duties of the on-site radiation and nuclear safety responsables and experts as fixed in the national regulations.

F.3 EMERGENCY PREPAREDNESS (ARTICLE 25 OF THE JOINT CONVENTION)

ARTICLE 25. EMERGENCY PREPAREDNESS

1. Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.

2. Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.

General remarks

The primary responsibility of protecting the general public in the event of a nuclear or radiological emergency lies with the Member States' authorities. However, Euratom has some legislative competences regarding emergency preparedness and emergency response. Articles 30 to 32 of the Euratom Treaty confer on Euratom the competence to lay down basic standards for emergency measures, which includes the power to require Member States to draw up plans laying down measures for emergency preparedness in respect of nuclear installations. At the international level, this competence of Euratom in the area of emergency preparedness is reflected in the accession of Euratom to the Convention on Early Notification of a Nuclear Accident¹⁰⁸ and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency¹⁰⁹. The Commission contributes to these actions by initiating and participating in international systems for radiological emergency preparedness.

¹⁰⁸ OJ L 314, 30.11.2005, p. 22.

¹⁰⁹ OJ L 314, 30.11.2005, p. 28.

In light of the above, Article 97 of the new BSS Directive stipulates that Member States shall ensure that account is taken of the fact that emergencies may occur on their territory and that they may be affected by emergencies occurring outside their territory. Member States shall establish an emergency management system and adequate administrative provisions to maintain such a system. Article 98 of the new BSS Directive requires that emergency response plans are established in advance for the various types of emergencies identified by an assessment of potential emergency exposure situations and that these emergency response plans are tested, reviewed and, as appropriate, revised at regular intervals, taking into account lessons learned from past emergency exposure situations and the results of the participation in emergency exercises at national and international level. Undertakings are requested to notify the competent authority immediately of any emergency in relation to the practices for which it is responsible and to take all appropriate action to mitigate the consequences. Further requirements concern the protective measures to be taken. In addition, the directive requires prior information provision to the members of the public likely to be affected by an emergency, as well as an information provision to the affected members of the public in the event of an emergency.

The European Community Urgent Radiological Information Exchange (*ECURIE*)

Council Decision 87/600/Euratom¹¹⁰ outlines the requirements for the early exchange of information in the event of a radiological emergency (ECURIE). The resulting arrangements cover Euratom Member States, Switzerland, *Norway* and the Former Yugoslav Republic of Macedonia, and "*apply to the notification and provision of information whenever a Member State decides to take measures of a wide-spread nature in order to protect the general public in case of a radiological emergency*" (Article 1). A radiological emergency may be declared either due to an accident at a facility where a significant release of radioactive material occurs or is likely to occur, or due to detection of abnormal levels of radioactivity which are likely to be detrimental to public health. Article 2(i) of the decision sets out the actions to be taken by the Member State that initially decides to take measures, as follows: (a) forthwith notify the Commission and those Member States which are -or are likely to be- affected of such measures and the reasons for taking them; (b) promptly provide the Commission and those Member States which are -or are likely to be- affected with available information relevant to minimising the foreseen radiological consequences, if any, in those States. The decision also specifies the nature of the information which shall be provided and requires that the initial information is supplemented at appropriate intervals. The Commission forwards the information it receives from a Member State to all Member States.

¹¹⁰ Decision 87/600/Euratom of 14 December 1987 on Community arrangements for the early exchange of information in the event of a radiological emergency, OJ L 371, 30.12.1987, p. 76.

ECURIE is a 24h emergency notification and information exchange system. The system notifies the competent authorities of the participating states and the Commission in case of a major nuclear accident or radiological emergency. During an emergency, the system provides an information exchange platform for the participating States, in order to inform about the current and foreseeable status of the accident, meteorological conditions, national protective *actions*, etc. The legal basis for the participation of Euratom Member States in ECURIE is the aforementioned Council Decision 87/600/Euratom and the Agreement between Euratom and non-Member States on the participation of the latter in the Community arrangements for the early exchange of information in the event of a radiological emergency¹¹¹. The Commission is responsible for ECURIE management and development¹¹²*and the practical arrangements for the exchange of information under ECURIE are reviewed and agreed with the Competent Authorities at their biennial meetings.*

Also, a set of Euratom regulations¹¹³ lay down maximum permitted levels of radioactive contamination of foodstuffs and feeding stuffs following a nuclear accident or any other case of radiological emergency. These pre-established maximum permitted levels can be made immediately applicable through the adoption of a regulation by the Commission.

¹¹¹ OJ C 102 of 29.04.2003, p. 2.

¹¹² For more details on the ECURIE system, see at: <http://rem.jrc.ec.europa.eu/40.html>

¹¹³ Council Regulation No 3954/87 of 22 December 1987, OJ L 371 of 30.12.1987, p. 11, as amended by Council Regulation No 2218/89 of 18 July 1989, OJ L 211 of 27.07.1989, p. 1; Commission Regulation No 770/90 of 29 March 1990, OJ L 83 of 29.03.1990, p. 78; Commission Regulation No 944/89 of 12 April 1989, OJ L 101 of 13.04.1989, p. 17; Council Regulation No 2219/89 of 18 July 1989, OJ L 211 of 22.07.1989, p. 4.

On 10 January 2014, after having received the opinion of the Article 31 Group of Experts and of the European Economic and Social Committee, the Commission adopted a proposal for a Council Regulation¹¹⁴ amending the above set of Euratom regulations. The opinion of the European Parliament was received on 9 July 2015. Council Regulation (Euratom) 2016/52¹¹⁵ was then adopted on 15 January 2016. This new Regulation provides more flexible procedures allowing specific reactions to any nuclear accident or radiological emergency (in the EU, in the vicinity of the EU or in a remote country). It should be noted that the pre-established maximum permitted levels remain unchanged.

The European Radiological Data Exchange Platform (EURDEP)

Other forms of international cooperation in this area include EURDEP. This is both a standard data format and a network for the exchange of environmental radiation monitoring data between European countries in real-time. Participation of the Euratom Member States is based on Commission Recommendation 2000/473/Euratom¹¹⁶. Participation of the various non-Euratom countries is on a voluntary basis. Those countries that send their national radiological monitoring data have access to the data of all the other participating countries. The system is continuously operating with a daily data exchange routine and *on the basis of a memorandum of understanding it is expected* that participating in the system automatically means that the data transmissions will continue during an emergency *and at* an elevated frequency¹¹⁷.

¹¹⁴ Proposal for a Council Regulation laying down maximum permitted levels of radioactive contamination of food and feed following a nuclear accident or any other case of radiological emergency.

¹¹⁵ Council Regulation (Euratom) No 2016/52 of 15 January 2016 laying down maximum permitted levels of radioactive contamination of food and feed following a nuclear accident or any other case of radiological emergency, and repealing Regulation (Euratom) No 3954/87 and Commission Regulations (Euratom) No 944/89 and (Euratom) No 770/90, OJ L 13, 20.1.2016, p. 2–11.

¹¹⁶ OJ L 191 of 27.07.2000, p. 37.

¹¹⁷ For more details on the EURDEP system, see at: <http://rem.jrc.ec.europa.eu/175.html>

In 2010, the Commission concluded a Memorandum of Understanding with the IAEA concerning the EURDEP-system. This Memorandum makes EURDEP technology available for the IAEA, for creating a global on-line environmental radiation data exchange application. ***This has been implemented during 2016, and EURDEP data makes up the bulk of the data on this system.***

Inter-Agency Committee on Response to Nuclear Emergencies (IACRNE)

Further, the Commission participates in the IACRNE and ***via this mechanism deals with other*** international organisations on arrangements in the area of radiological emergency preparedness. Other radiological emergency preparedness activities of the Commission include training of national authorities ***on ECURIE related issues***, assistance to research activity coordination and regular preparedness exercises.

Emergency Preparedness at JRC nuclear sites.

On the four sites of the Joint Research Centre (Ispra, Karlsruhe, Geel and Petten) where nuclear research and decommissioning activities are performed, internal emergency plans are in place in conformity with the requirements of the national legislation and the competent authorities. As the sites of Karlsruhe and Petten are integrated in national research centres, the plans are also directly linked to the emergency plans of these national sites. On periodic basis, crisis exercises are organised in compliance with the national requirements.

F.4 DECOMMISSIONING (ARTICLE 26 OF THE JOINT CONVENTION)

ARTICLE 26. DECOMMISSIONING

Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

- (i) qualified staff and adequate financial resources are available;*
- (ii) the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;*
- (iii) the provisions of Article 25 with respect to emergency preparedness are applied; and*
- (iv) records of information important to decommissioning are kept.*

F.4.1 Implementing legislation

The EU legislation applying to decommissioning of nuclear and any other facility using radioactive material is the Euratom Treaty, and Council Directives 2013/59/Euratom, 2011/70/Euratom and 2014/87/Euratom. When shipment of radioactive waste is involved, Directive 2006/117/Euratom also applies.

Under the new BSS Directive decommissioning of nuclear installations is still subject to prior authorisation¹¹⁸. This authorisation relates specifically not only to the disposal of radioactive waste from decommissioning, but also to conventional disposal of residues from dismantling with very low levels of contamination, or recycling or reuse thereof (e.g. in foundries). However, such materials may be released from the requirements of the new BSS Directive as per its Article 30, provided they comply with the clearance levels established either by Table A of Annex VII or by national legislation or the national competent authority following exemption and the criteria set out in Annex VII and taking into account technical guidance provided by the Community. Such guidance has been provided by the Group of Experts established under Article 31 of the Euratom Treaty.

¹¹⁸ See Article 28 b),

Until now, specific clearance levels for the recycling of metals, buildings and building rubble, as well as default values (general clearance levels) for any other type of material, were made available to Member States as guidance. Some Member States have incorporated these values into their legislation; others apply them on an ad hoc basis or apply values calculated specifically for the disposal or recycling pathways relevant to national practice. With the new BSS directive, generic clearance levels are prescribed although specific levels and associated requirements for specific materials or for materials originating from specific types of activities can still be established at national level.

Further to the BSS Directive, decommissioning also falls within the scope of Council Directive 2011/70/Euratom with respect to management of all decommissioning waste from generation to disposal. The General Principles defined under its Article 4 require the "generation of waste to be kept to a minimum ... by means of appropriate design measures and of operating and decommissioning practices, including the recycling and reuse of material". According to Article 7, the safety case as part of the licencing of a new facility shall cover inter alia the decommissioning of the facility. The national programmes to be prepared by the Member States shall cover all types of radioactive waste (including decommissioning waste) under its jurisdiction and all stages of radioactive waste management from generation to disposal (see Article 11 and 12).

The Nuclear Safety Directive also applies to safety of decommissioning activities at nuclear sites, including decommissioning of spent fuel and radioactive waste management facilities, other than nuclear installations that are located at the same site.

In order to support Member States in decommissioning planning and cost assessments the Commission is assisted by the Decommissioning Funding Group; this group supported the Commission to issue a number of reports (first in 2004) related to the status of financing mechanisms in EU. The scope of work is proposed to be confirmed and the focus increased in areas such as the cost assessment and financing for managing spent fuel and radioactive waste. The relevant Commission Decision, rules of procedure and future work plan are in preparation to be adopted in 2018.

General data on the dismantling of nuclear installations have to be notified by the Member States to the Commission under Article 37 of the Treaty, which has the objective to forestall any possibility of radioactive contamination of other Member State(s). Following this notification to the Commission, the latter delivers its opinion, thereupon, within six months, after consulting the Group of Experts referred to in Article 31 of the Treaty. The details concerning this procedure are dealt with by the abovementioned Commission Recommendation 2010/635/Euratom¹¹⁹.

¹¹⁹ OJ L 279, 23.10.2010, p. 36.

Over the *period January 2015 to March 2017 included*, the Commission has *delivered 11* opinions on the disposal of radioactive waste from the dismantling/decommissioning of nuclear installations: *Isar KKI (1 BWR), Phénix (1 FBR), the Bohunice A-1 reactor (decommissioning stages III+IV), the La Hague UP2-40 SFRP (partial dismantling), Biblis KWB (2 PWR), Brunsbüttel KKB (1 BWR), Kozloduy units 3+4 (VVER), Barsebäck (2 BWR), Philippsburg KKP-1 (1 BWR), Neckarwestheim GKN-1 (1 PWR) and Unterweser KKW (1 PWR).*

F.4.2 Qualified staff and adequate financial resources

Education and training

With respect to qualified staff, Council Directive 2011/70/Euratom provides that the national framework in place requires all parties to make arrangements for education and training for their staff, in order to further develop necessary expertise and skills, in accordance with the IAEA Fundamental Safety Principles 1, 2 and 3.

It is a key-concern, not only for decommissioning and waste management but of policy makers, regulators and industry in general, that human resources could be at risk, especially because of high retirement expectations in countries with nuclear installations, and a lack of nuclear experience in "newcomer" countries. Highly qualified people are needed over a long time period to safely operate installations, build new facilities, decommission facilities as well as manage radioactive waste and deal with radiation protection issues. For that reason, broad and deeply rooted research and training programmes, at both national and international level, are essential for the proper mastering of the many disciplines used in the nuclear domain and for the strengthening of the nuclear safety culture.

The majority of Member States have legal requirements in place to ensure the training and education of staff of all parties involved in spent fuel and radioactive waste management, in line with Article 8 of the Council Directive 2011/70/Euratom.

In the period 2015-2017 the Commission undertook a Feasibility Study in Support of the Development of a Level Playing Field for Nuclear Safety Assessment by Regulators and Technical Safety Organisations in the EU. This initiative included:

- a. **Training sessions:**
- **Module I (May 2015, Stockholm, Sweden): Legal and regulatory framework and the functions of regulatory body**
 - **Module II (June 2015, Garching, DE): Technical concepts, techniques, methods and tools**
- b. **Three months tutoring of trainees;**
- c. **Final workshop – 4 days (April 2016, Paris, France, to present and discuss results);**
- d. **Commission Report COM(2017)236 final, publicly available on ENER web site - <https://ec.europa.eu/energy/en/topics/nuclear-energy/radioactive-waste-and-spent-fuel>.**

To be mentioned in this context are the JRC's education and training activities. In collaboration with relevant European and international partners, JRC's education and training activities are based on educational and training tracks in the fields of nuclear security and safety, nuclear safeguards, nuclear materials and fuel cycle, nuclear decommissioning and waste management, nuclear data and actinide science. JRC education and training activities cover higher academic education through grants for PhD students; vocational training through specific JRC courses; user facility (access to infrastructure); and knowledge management. In the specific area of decommissioning, JRC and its partners have launched the new initiative ELINDER which aims at creating a European "pool of training initiatives" offering series of courses, visits and practical studies in different locations across Europe. Training will be organised in complementing modules, reducing redundancies, developing commonly shared tools and harmonizing the learning outcomes through application of the European Credit System for Vocational Education and Training(ECVET). The initiative is also seeking to offer an EU "quality label" or "endorsement" to those initiatives contributing to qualitative competence building in decommissioning and waste management. This initiative complements the longer standing Decommissioning and Waste Management summer school in JRC-Ispra, which celebrated its 8th edition in 2016.

With respect to specific studies related to spent fuel and radioactive waste management, the Commission has completed a study on training of safety regulators and their technical supporting organisations.

Aspects relating to financial resources

Nuclear decommissioning is the final step in the lifecycle of a nuclear installation which requires a long term financial planning. The number of nuclear power plants in the EU (as well as research reactors and other nuclear fuel cycle installations) that are definitively closed and undergoing decommissioning is steadily increasing. It is a fair assumption that more than one quarter of the reactors currently operating in the enlarged EU-28 will need to be shut down by 2025, which underlines the increasing importance of decommissioning in the years ahead.

To assure safe decommissioning of nuclear installations and the related management of waste it is vital to have adequate financial resources available in time for its intended use. ***According to the latest information provided by Member States and reported in the PINC, in December 2014 European nuclear operators estimated that EUR 123 billion will be needed for nuclear decommissioning until 2050.***

According to Council Directive 2011/70/Euratom, the costs for the management of spent fuel and radioactive waste shall be borne by those who generated those materials (in accordance with the IAEA Fundamental Safety Principle 1). Member States shall ensure that the national frameworks require that adequate financial resources be available when needed for implementation of their national programmes for the management of spent fuel and radioactive waste, taking due account of the responsibility of spent fuel and radioactive waste generators. The financing scheme(s) for spent fuel and radioactive waste management are mandatory elements of the national frameworks and programmes.

Article 12(1)(h) of the Directive 2011/70/Euratom requires Member States to present an assessment of the national programme costs, basis and profile over time. Based on the reported data until September 2016, the estimated total cost of the management of spent fuel and radioactive waste (including facilities other than nuclear installations, remediation, etc) in line with the Member States' national programmes to date is about EUR 400 billion. In the Commission report COM(2017)236 final, the Commission indicates its willingness to report more extensively, in further reporting cycles under the Directive, on developments related to financing mechanisms, including cost assessment, and the secure management of associated funds. In that case, the Decommissioning Funding Group will be involved in this work. In this regard, the Commission has already launched a study on the risk profile of the funds allocated to finance the back-end activities of the nuclear fuel cycle. Later in 2017, two more studies will be initiated aiming at benchmarking of development of spent fuel and radioactive waste inventory, and on the review of cost estimates for spent fuel and radioactive waste management in the context of the Member States national programmes.

The Commission has adopted in 2006 Recommendation 2006/851/Euratom 120 on the management of financial resources for the decommissioning of nuclear installations, spent fuel and radioactive waste.

Then, in 2007, the second report¹²¹ was adopted comparing EU nuclear operators and Member States funding practice with that detailed in the Commission's Recommendation (of 2006). Whereas the first report of 2004 was limited to power reactors, the second report covers all nuclear installations with an emphasis being placed on those which are at greatest risk, should decommissioning funding be inadequately addressed. The report highlights examples of good practice in countries where the polluter-pays-principle is enshrined in national legislation and where funds show a demonstrable performance from the viewpoint of providing adequate resources when needed. Nevertheless, despite specific national legislation, there are grounds for progress in several aspects of fund adequacy, management and use, in particular through detailed monitoring and reporting at both national and EU level.

¹²⁰ OJ L 330, 28.11.2006, p.31.

¹²¹ COM (2007) 794 final and SEC (2007) 1654.

The Commission expressed its intention to focus on the adequacy of funding, its financial security and the ring fencing that is required in order to ensure that the funds are only used for the purposes intended.

For future nuclear constructions a common approach to methodology should be progressed, but for currently operating systems the Commission's activities need to be based upon independent evaluation and reporting.

Following the adoption of the Commissions' second report in 2007, the third report on the use of financial resources earmarked for the decommissioning of nuclear installations, spent fuel and radioactive waste was adopted in 2013¹²². This report is based on Member States' responses to a dedicated survey. The survey was aided by specific guidance, elaborated by *the Decommissioning Funding Group*, as to the interpretation and implementation of the 2006 Recommendation.

Subsequently the Commission updated the survey with the support of the Decommissioning Funding Group and complemented the relevant information on financial issues related to decommissioning and waste management in the PINC.

Regarding financial resources for decommissioning, there is a *specific* case in which the Community has taken part in the raising of financial resources and provides financial support under the specific terms of accession of Lithuania, Slovakia and Bulgaria to the EU, where certain nuclear power reactors were subject to early shutdown as pre-condition to grant accession. Funding support has been extended for the years 2014 to 2020, based on Council Regulation (Euratom) No 1368/2013 and Council Regulation (EU) No 1369/2013, adopted in December 2013¹²³.

JRC Decommissioning and Waste Management Programme staff and financial resources

The management of the decommissioning programme requires a specialised workforce experienced in various fields such as leading of nuclear projects, nuclear safety licensing and radiation protection. Part of the work is currently ensured by JRC staff, part of the work is outsourced to external companies.

¹²² <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2013:0121:FIN:EN:PDF>

¹²³ OJ L 346, of 20.12.2013, p. 1 and p.7.

Approximately 65 JRC staff manage the D&WM projects and ensures the safe conservation and/or the safe operation of the research facilities and radioactive waste management facilities, including licensing obligations, updates of the decommissioning plans, evacuation of nuclear material, operation and maintenance, safety surveillance, administrative support, management of outsourced activities, and radiation protection of the staff and of the environment.

The staff actually dedicated to decommissioning activities in the JRC sites is complemented with the staff belonging to the companies to which decommissioning activities are outsourced. The great majority of these resources are working in the JRC-Ispra part of the Programme.

The budget needed for the implementation of the JRC D&WM Programme was secured with the approval of the first Communication to the Parliament and the Council (COM(1999)114 final, 17.03.1999). The D&WM Programme is financed through a dedicated budget line. The funds are earmarked in the framework of the multi-annual financial programs of the European Commission and made available annually following a dissociated credits mechanism (commitment and payment credits).

After 1999, three further Communications followed (COM 2004/621, COM 2008/903 and COM 2013/734 [2-4]). These documents updated the D&WM Programme progress, its status and financial perspectives. In 2018, an updated Communication to the Parliament and the Council will be presented.

Sections G and H

SAFETY OF RADIOACTIVE WASTE MANAGEMENT AND SAFETY OF SPENT FUEL MANAGEMENT

(Articles 4, 6 to 11 and 13 to 16 of the Joint Convention)

G-H.1 GENERAL SAFETY REQUIREMENTS (ARTICLES 4 AND 11 OF THE JOINT CONVENTION)

ARTICLE 4. GENERAL SAFETY REQUIREMENTS

Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management, individuals, society and the environment are adequately protected against radiological hazards. In so doing, each Contracting Party shall take the appropriate steps to:

- (i) ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed;*
- (ii) ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted;*
- (iii) take into account interdependencies among the different steps in spent fuel management;*
- (iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;*
- (v) take into account the biological, chemical and other hazards that may be associated with spent fuel management;*
- (vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;*
- (vii) aim to avoid imposing undue burdens on future generations.*

ARTICLE 11. GENERAL SAFETY REQUIREMENTS

Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

- (i) ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed;*
- (ii) ensure that the generation of radioactive waste is kept to the minimum practicable;*
- (iii) take into account interdependencies among the different steps in radioactive waste management;*
- (iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;*
- (v) take into account the biological, chemical and other hazards that may be associated with radioactive waste management;*
- (vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;*
- (vii) aim to avoid imposing undue burdens on future generations.*

General safety requirements and the regulatory framework set up by the new BSS Directive have already been reported in Section E.1.2 above.

Avoiding undue burdens on future generations is an objective of Council Directive 2011/70/Euratom, in accordance with the IAEA Fundamental Safety Principle 7. Through the implementation of this directive Member States will have demonstrated that they have taken reasonable steps to ensure that that objective is met. The directive requires that the national policies on spent fuel and radioactive waste management are based on the following principles, taking also into account the IAEA Fundamental Safety Principles 3 and 7:

- the generation of radioactive waste shall be kept to the minimum which is reasonably practicable, both in terms of activity and volume, by means of appropriate design measures and of operating and decommissioning practices, including the recycling and reuse of materials;
- the interdependencies between all steps in spent fuel and radioactive waste generation and management shall be taken into account;
- spent fuel and radioactive waste shall be safely managed, including in the long term with passive safety features;
- implementation of measures shall follow a graded approach;
- the costs for the management of spent fuel and radioactive waste shall be borne by those who generated those materials;
- an evidence-based and documented decision-making process shall be applied with regard to all stages of the management of spent fuel and radioactive waste.

The directive specifies requirements for demonstration of the safety of any activity or facility for spent fuel and radioactive waste management, related in particular to the IAEA Fundamental Safety Principles 1 and 3.

Member States must, at least every ten years, invite international peer review of their national frameworks, competent regulatory authority and/or national programmes with the aim of ensuring that high standards are achieved in the safe management of spent fuel and radioactive waste. The outcome of any peer review will be reported to the Member States and the Commission.

As regards the nuclear installations at JRC sites, it is recalled that they are located in the territories of Member States, therefore all safety requirements of the specific Member States have to be met.

G-H.2 SITING OF PROPOSED FACILITIES (ARTICLES 6 AND 13 OF THE JOINT CONVENTION)

ARTICLE 6. SITING OF PROPOSED FACILITIES

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:

- (i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime;
- (ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment;
- (iii) to make information on the safety of such a facility available to members of the public;
- (iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.

ARTICLE 13. SITING OF PROPOSED FACILITIES

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:

- (i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;
- (ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;
- (iii) to make information on the safety of such a facility available to members of the public;
- (iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11.

All Member States have predisposal measures in place that differ in scope and scale. For the disposal of intermediate level waste, high level waste and spent fuel, the concepts for disposal are not concrete in most of the Member States, often due to the need for policy decisions to be made or sites to be selected. Of the Member States that are planning to develop geological disposal facilities in the coming decades, Finland, France and Sweden have so far selected sites, demonstrating the challenges of moving from the planning stage to practical implementation. Globally, Finland is the first country in the EU and in the world where the construction of a deep geological facility has begun and is expected to be in operation by 2022, with France and Sweden expected to start operation by 2030 (see Figure 2).

Another 12 Member States have plans for a deep geological repository and are at different stages of implementation.

In addition, half of the Member States are considering the possibility of shared solutions for disposal either as a preferred or as an alternative option (the ‘dual track’ approach¹²⁴). However, none of the Member States’ programmes or reports have yet set out concrete milestones or measures towards the implementation of such a solution.

In relation to the disposal of very low level waste and low level waste, most Member States with nuclear programmes have formulated solutions for handling their very low level waste and low level waste and they are progressing with the implementation of these solutions. However, this remains a challenge in other Member States. To date, over 30 disposal facilities have been developed in 12 Member States and about half of all Member States are planning to build new disposal facilities in the next decade.

As required by Council Directive 2011/70/Euratom, siting of radioactive waste and spent fuel management facilities is subject to national licencing processes. The directive requires for a "safety demonstration" as a part of the licencing a facility or activity in accordance with the IAEA Fundamental Safety Principles 1 and 3¹²⁵.

Similarly, Article 65 of the BSS Directive requires licensing of the proposed siting of installations by the national competent authorities. In terms of emergency preparedness (Article 99 of the BSS Directive), Member States must seek to cooperate with other Member States, or non-Member States, in relation to possible radiological emergencies that might affect other Member States. The assessment of such consequences is an important feature of the procedure under Article 37 of the Euratom Treaty. The general data on the proposed site, features of the surroundings, planned discharges and envisaged magnitude of design basis accidents, which could lead to unplanned discharges, enable the Commission to give an opinion on the impact on other Member States, both during normal operation and in the event of an accident. While the site location and distance to borders are important in this judgment, the Commission does not give an opinion on the proposed siting as such.

¹²⁴ In this case, Member States are continuing with the development and implementation of their own national programmes, while leaving open the option of a shared solution.

¹²⁵ See more detailed information given in Section G-H.4 below.

Also, according to Articles 41, 42 and 43 of the Treaty,

- *"Persons and undertakings engaged in the industrial activities listed in Annex II to this Treaty shall communicate to the Commission investment projects relating to new installations and also to replacements or conversions which fulfil the criteria as to type and size laid down by the Council on a proposal from the Commission..."*,
- *"The projects referred to in Article 41 shall be communicated to the Commission and, for information purposes, to the Member State concerned not later than three months before the first contracts are concluded with the suppliers or, if the work is to be carried out by the undertaking with its own resources, three months before the work begins..."* and
- *"The Commission shall discuss with the persons or undertakings all aspects of investment projects which relate to the objectives of this Treaty. It shall communicate its views to the Member State concerned"*, respectively.

Other legal instruments regulate in more detail the obligation established by Article 41 of the Treaty: Regulation No 2587/1999¹²⁶ specifies what types of investment projects should be communicated to the Commission on the basis of that article; Regulation No 1209/2000¹²⁷ determines procedures for effecting such communications.

In recent years, the Commission has expressed its views under Articles 41-43 of the Treaty:

- Hanhikivi; Creating a new nuclear installation
- Marcoule (PHENIX); Decommissioning of Phénix reactor
- Olkiluoto; Encapsulation plant and geological repository of spent nuclear fuel
- Alameda; Mining and concentration of uranium ore
- Paks II; New build
- Retortillo; Mining and concentration of uranium ore
- Bohunice; NPP decommissioning stages
- Loviisa; Post-Fukushima safety improvements

¹²⁶ Council Regulation (Euratom) No 2587/1999 of 2 December 1999 defining the investment projects to be communicated to the Commission in accordance with Article 41 of the Treaty establishing the European Atomic Energy Community; OJ L 315, 09.12.1999, pp. 1-3.

¹²⁷ Commission Regulation (EC) No 1209/2000 of 8 June 2000 determining procedures for effecting the communications prescribed under Article 41 of the Treaty establishing the European Atomic Energy Community - OJ L 138, 09.06.2000, pp. 12-14.

- Cerca; Fuel fabrication for research reactors and medical applications
- Doel; long term operation
- Tihange; long term operation.

G-H.3 DESIGN AND CONSTRUCTION OF FACILITIES (ARTICLES 7 AND 14 OF THE JOINT CONVENTION)

ARTICLE 7. DESIGN AND CONSTRUCTION OF FACILITIES

Each Contracting Party shall take the appropriate steps to ensure that:

- (i) the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;*
- (ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account;*
- (iii) the technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis.*

ARTICLE 14. DESIGN AND CONSTRUCTION OF FACILITIES

Each Contracting Party shall take the appropriate steps to ensure that:

- (i) the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;*
- (ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;*
- (iii) at the design stage, technical provisions for the closure of a disposal facility are prepared;*
- (iv) the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.*

The measures required by the Joint Convention concerning design, construction and operation of nuclear installations can come under the provisions which the Member States lay down to ensure compliance with the basic safety standards, adopted in accordance with the first paragraph of Article 33 of the Euratom Treaty. The Commission has powers to make recommendations for harmonising those provisions, as is clear from the second paragraph of Article 33.

With reference to the opinions delivered by the Commission under Articles 41-43 of the Euratom Treaty¹²⁸, these also take into account aspects relating to design and construction.

As mentioned above the first deep geological facilities are planned to be put in operation in the 2022-2030 period. The rest are mainly planned for 2045-2065. In addition to the existing five underground laboratories in 4 Member States, three more Members States are planning such laboratories for the research and development of geological disposal facilities. A few Members States are also planning to develop and operate near surface disposal facilities (BE, BG, LT), and a number is considering remediation of existing sites used in the past for disposal.

Pursuant to Council Directive 2011/70/Euratom, design of radioactive waste and spent fuel management facilities is included in national licencing processes. The Directive requires for a "safety demonstration" as a part of the licencing of a facility or activity in accordance with the IAEA Fundamental Safety Principles 1 and 3¹²⁹.

¹²⁸ See Section G-H.2 above.

¹²⁹ See more detailed information given in Section G-H.4, below.

G-H.4 ASSESSMENT OF SAFETY OF FACILITIES (ARTICLES 8 AND 15 OF THE JOINT CONVENTION)

ARTICLE 8. ASSESSMENT OF SAFETY OF FACILITIES

Each Contracting Party shall take the appropriate steps to ensure that:

- (i) before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;*
- (ii) before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).*

ARTICLE 15. ASSESSMENT OF SAFETY OF FACILITIES

Each Contracting Party shall take the appropriate steps to ensure that:

- (i) before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;*
- (ii) in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;*
- (iii) before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).*

In accordance with Article 33 of the Euratom Treaty, the Commission makes appropriate recommendations for harmonising the provisions applicable in this field in the Member States, and therefore requires Member States to communicate those provisions to the Commission.

As stipulated in Article 65 of the new BSS Directive (Council Directive 2013/59/Euratom), all Member States shall ensure the operational protection of the population through a set of measures including for example the examination and approval of the proposed siting of the facility from a radiation protection point of view, taking into account relevant demographic, meteorological, geological, hydrological and ecological conditions.

Council Directive 2011/70/Euratom introduces the concept of "safety demonstration" (or "safety case" according to the IAEA Safety Standards). Member States shall ensure that the national framework in place requires licence holders, under the regulatory control of the competent regulatory authority, to regularly assess, verify and continuously improve, as far as is reasonably achievable, the safety of the radioactive waste and spent fuel management facility or activity in a systematic and verifiable manner. This shall be achieved through an appropriate safety assessment, other arguments and evidence.

As part of the licencing of a facility or activity, the safety demonstration shall cover the development and operation of an activity and the development (i.e. siting, design, construction and commissioning), operation and decommissioning of a facility or closure of a disposal facility as well as the post- closure phase of a disposal facility. The extent of the safety demonstration shall be commensurate with the complexity of the operation and the magnitude of the hazards associated with the radioactive waste and spent fuel, and the facility or activity. The licencing process shall contribute to safety in the facility or activity during normal operating conditions, anticipated operational occurrences and design basis accidents. It shall provide the required assurance of safety in the facility or activity. Measures shall be in place to prevent accidents and mitigate the consequences of accidents, including verification of physical barriers and the licence holder's administrative protection procedures that would have to fail before workers and the general public would be significantly affected by ionising radiation. That approach shall identify and reduce uncertainties.

Member States shall further ensure that the national framework requires licence holders to establish and implement integrated management systems, including quality assurance, which give due priority for overall management of spent fuel and radioactive waste to safety and are regularly verified by the competent regulatory authority (cf. IAEA Fundamental Safety Principles 1 and 2).

In addition, Member States shall ensure that the national framework requires licence holders to provide for and maintain adequate financial and human resources to fulfil their obligations with respect to the safety of spent fuel and radioactive waste management (cf. IAEA Fundamental Safety Principle 1).

G-H.5 OPERATION OF FACILITIES (ARTICLES 9 AND 16 OF THE JOINT CONVENTION)

ARTICLE 9. OPERATION OF FACILITIES

Each Contracting Party shall take the appropriate steps to ensure that:

- (i) the licence to operate a spent fuel management facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;*
- (ii) operational limits and conditions derived from tests, operational experience and the assessments, as specified in Article 8, are defined and revised as necessary;*
- (iii) operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures;*
- (iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a spent fuel management facility;*
- (v) incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;*
- (vi) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;*
- (vii) decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body.*

ARTICLE 16. OPERATION OF FACILITIES

Each Contracting Party shall take the appropriate steps to ensure that:

- (i) the licence to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;*
- (ii) operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary;*
- (iii) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure;*
- (iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility;*
- (v) procedures for characterization and segregation of radioactive waste are applied;*
- (vi) incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;*
- (vii) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;*
- (viii) decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;*
- (ix) plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.*

Article 35 of the Euratom Treaty requires Member States to establish the "*facilities necessary to carry out continuous monitoring of the level of radioactivity in the air, water and soil and to ensure compliance with the basic standards*" and gives the Commission the right of access to such facilities for verification purposes. Article 36 of the Treaty requires periodic communication to the Commission of the monitoring data referred to in Article 35.

The new BSS Directive (Council Directive 2013/59/Euratom) states in Article 28: "Member States shall require licencing for the (...) operation and decommissioning of any nuclear facility".

Equally, according to Council Directive 2011/70/Euratom, operation of facilities is subject to national licencing processes. As already noted, the directive requires for a "safety demonstration" as a part of the licencing of a facility or activity¹³⁰. Concepts or plans for the post-closure period of a disposal facility's lifetime, including the period during which appropriate controls are retained and the means to be employed to preserve knowledge of that facility in the longer term are mandatory elements of the national programmes.

G-H.6 DISPOSAL OF SPENT FUEL (ARTICLE 10 OF THE JOINT CONVENTION)

ARTICLE 10. DISPOSAL OF SPENT FUEL

If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Chapter 3 relating to the disposal of radioactive waste.

Council Directive 2011/70/Euratom provides for the same requirements in respect to disposal of radioactive waste and spent fuel destined for disposal if regarded as radioactive waste. It is clearly stated in the Preamble to this directive that storage of radioactive waste (including storage of spent fuel considered as radioactive waste, as well as long-term storage), is an interim solution, but not an alternative to disposal.

¹³⁰ See Section G-H.4 above.

As mentioned earlier, Finland is the first country in the EU and in the world where the construction of a deep geological facility has begun and is expected to be in operation by 2022, with France and Sweden expected to start operation by 2030. Another 12 Member States have plans for a deep geological repository and are at different stages of implementation. The Members States that rely on shared disposal solutions consider this option either as a main scenario or a back-up.

Section I

TRANSBOUNDARY MOVEMENT

(Article 27 of the Joint Convention)

ARTICLE 27. TRANSBOUNDARY MOVEMENT

1. Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments. In so doing:

- (i) a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;
- (ii) transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;
- (iii) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;
- (iv) a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to transboundary movement;
- (v) a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

2. A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

3. Nothing in this Convention prejudices or affects:

- (i) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;
- (ii) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;
- (iii) the right of a Contracting Party to export its spent fuel for reprocessing;
- (iv) rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

I.1 COUNCIL DIRECTIVE 2006/117/EURATOM ON THE SUPERVISION AND CONTROL OF SHIPMENTS OF RADIOACTIVE WASTE BETWEEN MEMBER STATES AND INTO AND OUT OF THE COMMUNITY

Council Directive 2006/117/Euratom of 20 November 2006 on the supervision and control of shipments of radioactive waste and nuclear spent fuel¹³¹ replaced previous legislation¹³² containing the rules applicable for authorising the movement of radioactive waste from one country to another and extended these rules to spent nuclear fuel, whether it is intended for disposal or for reprocessing, while making the rules easier to apply and more consistent with other EU and international provisions.

It lays down a standardised system of controls and authorisations for the transboundary shipments of radioactive waste and spent fuel, from the point of origin to the destination, and prevents illegal trafficking in them.

It applies both to shipments between Member States and to imports into and exports out of the Community. It ensures that the Member States of destination and of transit are informed about movements of radioactive waste or spent fuel to or through their country and that they have an opportunity to object to, or impose conditions, in relation to a shipment of radioactive waste or spent fuel which requires their consent.

As well, the mandatory acknowledgement of receipt of the application by the authorities of the countries of destination and transit, together with the extension of the period for granting consent, allow tacit approval to be assumed with a high degree of certainty.

¹³¹ OJ L 337, 05.12.2006, p. 21.

¹³² In particular, Council Directive 92/3/Euratom of 3 February 1992, OJ L 35, 12.02.1992, p. 24.

As regards exports, the authorities of the third country of destination should not only be informed of the shipment, but should also give their consent to it. Export of radioactive waste to certain places is totally forbidden, e.g. to the Antarctic, to the parties to the Cotonou ACP¹³³-EC Agreement or to States which do not have the administrative and technical capacity and regulatory structure to manage the radioactive waste or spent fuel safely.

Directive 2006/117 is fully consistent with the existing legislation for the health protection of workers and the population against the dangers arising from ionising radiation. It also ensures consistency with international Conventions, in particular with the Joint Convention.

Commission Decision 2008/312/Euratom of 5 March 2008¹³⁴ established the standard document for the supervision and control of shipments of radioactive waste and spent fuel, referred to in Article 17 of Directive 2006/117¹³⁵. This standard document is made available in electronic form and is used for any shipments of radioactive waste or spent fuel between Member States, or into, out of and through the Community, which come within the ambit of Directive 2006/117.

¹³³ African, Caribbean and Pacific countries.

¹³⁴ OJ L 107, 17.4.2008, p. 32.

¹³⁵ A corrigendum was issued in 2008.

Moreover, on 4 December 2008, the Commission issued Recommendation 2008/956/Euratom on the criteria for the export of radioactive waste and spent fuel to third countries¹³⁶. The Recommendation clarifies the main requirements relating to the export of radioactive waste or spent fuel to third countries, referred to in Article 16(1)(c) of Directive 2006/117, as well as the criteria which Member States should take into consideration in order to evaluate whether the above requirements are met. In doing so, the Recommendation draws a distinction between "leading" criteria and "additional" criteria. The former include amongst others *"IAEA membership and resultant adherence to the relevant safety standards of the International Atomic Energy Agency"* and the *"signature and ratification of, and compliance with the Joint Convention on the Safety of Radioactive Waste Management and the Safety of Spent Fuel Management, the Convention on Nuclear Safety, the Vienna Convention on Civil Liability for Nuclear Damage, the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage, the Convention for Supplementary Compensation for Nuclear Damage or the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982"*. The latter encompass the *"signature and ratification of, and compliance with the Convention on Assistance in the Case of a Nuclear Accident and Radiological Emergency and the Convention on Early Notification in a Nuclear Accident, to demonstrate that appropriate information will be given to the affected population in the event of a radiological emergency and that adequate protective and corrective measures, including the preparation and testing of emergency plans, will apply in the event of a radiological emergency in order to control the release and mitigate its effects"*. Finally, the Recommendation invites the competent authorities of the Member States to cooperate, with a view to exchanging information on its application.

Under Council Directive 2006/117/Euratom, the Commission is obliged to report on the implementation of this directive to the Council, the European Parliament and the European Economic and Social Committee, based on the Member States' reports to the Commission.

The first such report from the Commission was published on 25 April 2013¹³⁷. In this report, the Commission notes that the directive is now being fully implemented so as to guarantee an adequate protection of the population. The implementation of the directive has not given rise to any major problems. The report provides a first summary overview of authorisations given in the Community. The number of authorisations of shipments is relatively small and there is a clear picture on exports outside Euratom. ***It also identified two main areas for future work: shipment of NORM waste and application of harmonised clearance levels. Both aspects are being addressed in the new Commission Review of the Current Situation Regarding Transport of Radioactive Material in European Union Member States***¹³⁸.

¹³⁶ OJ L 338, 17.12.2008, p. 69.

¹³⁷ https://ec.europa.eu/energy/sites/ener/files/documents/1st_report_shipment_dir_final_en.pdf

¹³⁸ <http://ted.europa.eu/udl?uri=TED:NOTICE:162478-2017:TEXT:FR:HTML>

Based on all Member States reports, the Commission is preparing its second report under Article 20 of this Directive for the period 2012-2014. Views were also exchanged with the Advisory Committee in supervision and control of shipments (Article 21 of the Directive) on 25 January 2017. The report includes the following main observations:

- *Since Croatia joined the EU (1st of July 2013) and transposed the Directive in November 2013, all Member States have transposed this Directive;*
- *For the 2012-2014 period, of the 28 EU Member States, 20 Member States (about 71 %) reported authorised shipments within the scope of the Directive. Member States reported 400 issued approvals¹³⁹, which include 190 authorisations of Member State of origin and consents to shipments¹⁴⁰.*
- *Five Member States account for 76 % of the reported authorisations for 2012-2014. In the previous reporting period (2009-2011) 14 Member States reported 161 authorisations within the scope of the Directive with 74% of authorisations related to shipments of radioactive waste, and remaining 26% shipments of spent fuel.*
- *Concerning radioactive waste and spent fuel, from 190 shipment authorisations of Member States of origin 155 (82%) were related to shipment of radioactive waste and 32 (17%) to spent fuel. Three shipments are reported for materials other than radioactive waste and spent fuel (see Figure 2).*

¹³⁹ Although the Directive does not define the term "approval" and clearly refers only to "authorisation", "consent" and "refusal", national reports from Member States do not always refer to the official definitions and often do not make the difference between authorisations and consents. Therefore, for the purpose of this report, the term "approval" is used to include both "authorisations" and "consents".

¹⁴⁰ Authorisations are often given for several shipments to be carried out over a time period that may exceed the period covered by the present report (2012-2014).

- *Two Member States have reported import of radioactive waste, and one Member State has reported transit through the Community.*

In addition, Commission Recommendation 2009/527¹⁴¹ has been developed for the improvement of the system of transmission of documents and information under directive 2006/117. This Recommendation prompts the competent authorities of the Member States: to cooperate in order to ensure the smooth operation of the automatic consent procedure laid down in Article 9(2) of Directive 2006/117; to take the necessary measures in order to ensure that all information regarding shipments covered by that directive is handled with due care and is protected against any misuse; and to apply general security measures to all information which is processed by them, when applying Directive 2006/117.

*In order to facilitate communication between Member States regarding supervision and control of shipments of spent fuel and radioactive waste, as of September 2016, all Member States provided the Commission with the updated contact details of their competent authority or authorities.*¹⁴²

I.2 COUNCIL DIRECTIVE 2011/70/EURATOM ESTABLISHING A COMMUNITY FRAMEWORK FOR THE RESPONSIBLE AND SAFE MANAGEMENT OF SPENT FUEL AND RADIOACTIVE WASTE

Council Directive 2011/70/Euratom requires that radioactive waste shall be disposed of in the Member State in which it was generated, unless at the time of shipment an agreement, taking into account the criteria established by the Commission in accordance with Article 16(2) of Council Directive 2006/117/Euratom, has entered into force between the Member State concerned and another Member State or a third country to use a disposal facility in one of them. Prior to a shipment to a third country, the exporting Member State shall inform the Commission of the content of any such agreement and take reasonable measures to be assured that:

- the country of destination has concluded an agreement with the Community covering spent fuel and radioactive waste management or is a party to the Joint Convention;
- the country of destination has radioactive waste management and disposal programmes with objectives representing a high level of safety equivalent to those established by this directive;

¹⁴¹ Commission Recommendation of 7 July 2009 for a secure and effective system of transmission of documents and information relating to the provisions of Council Directive 2006/117/Euratom, OJ L 177, 08.07.2009.

¹⁴² The updated information as of Feb 2017 is available on the web site <https://ec.europa.eu/energy/en/topics/nuclear-energy/radiation-protection/transport-radioactive-materials>.

- the disposal facility in the country of destination is authorised for the radioactive waste to be shipped, is operating prior to the shipment, and is managed in accordance with the requirements set down in the radioactive waste management and disposal programme of that country of destination.

The above provisions do not apply to shipment of spent fuel of research reactors to a country where research reactor fuels are supplied or manufactured, taking into account applicable international agreements.

The directive does not affect the right of a Member State or an undertaking in that Member State to return radioactive waste after processing to its country of origin where:

- the radioactive waste is to be shipped to that Member State or undertaking for processing; or
- other material is to be shipped to that Member State or undertaking with the purpose of recovering the radioactive waste.

Finally, the directive does not affect the right of a Member State or an undertaking in that Member State to which spent fuel is to be shipped for treatment or reprocessing to return to its country of origin radioactive waste recovered from the treatment or reprocessing operation, or an agreed equivalent.

As of end of 2013, about 1.5 % of the total inventory was stored in a third country pending reprocessing with the expected resulting material to be returned to the EU after 2017. As mentioned the majority of Member States plan to dispose their radioactive waste in the country of origin.

Section J
DISUSED SEALED SOURCES
(Article 28 of the Joint Convention)

ARTICLE 28. DISUSED SEALED SOURCES

1. Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.

2. A Contracting Party shall allow for re-entry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

The new BSS Directive sets up a system of notification or authorisation of practices with radioactive sources. As a matter of principle, the production, processing, handling, use, holding, storage, transport, import to and export from the Community and disposal of radioactive substances is subject to notification.

As regards high-activity sealed sources (HASS), Council Directive 2003/122/Euratom on the control of high-activity sealed radioactive sources and orphan sources¹⁴³, has been repealed and replaced by corresponding provisions in the new BSS Directive. The new BSS Directive introduces new activity limits for HASS definition, which correspond to the lower limits of the IAEA Category 3 sources. This way the definition of HASS in the EU is harmonised with the IAEA regulations.

In order to facilitate the return of disused sealed sources to suppliers, manufacturers or recognised installations based in another country, Council Directive 2006/117/Euratom expressly excludes such shipments from the administrative authorisation system.

¹⁴³ OJ L 346, 31.12.2003, p. 57.

Council Directive 2011/70/Euratom does not prevent repatriation of disused sources to a supplier or manufacturer. Once the disused sources are considered as radioactive waste according to the directive, they fall within its scope and should be managed according to its provisions.

Council Regulation No 1493/93/Euratom establishes a mechanism for controlling shipments of radioactive substances, in particular radioactive sources, between Member States.

Section K

GENERAL EFFORTS TO IMPROVE SAFETY

This Section mentions a number of safety issues and initiatives, concentrating amongst other on the international dimension. Therefore, it includes information on the European comprehensive risk and safety assessment of nuclear power plants, which covered spent fuel pools and which were carried out and peer reviewed in the course of 2011-2012, and the Memorandum of Understanding which was signed by the Commission and the IAEA in 2013 (covering cooperation in the area of safety of spent fuel and radioactive waste management). This Section further reports on the contribution of Euratom Research Framework Programmes. The recent revision of the Nuclear Safety Directive is also reported. Moreover, based on the information given in other parts of the Report, the present Section recalls certain ways in which Euratom legislation and/or practice has promoted international peer reviews and transparency. *The report also includes information about the specific cases where the Community has taken financial charge to ensure safe decommissioning of reactors in three Member States.* It closes with a summary of the measures taken to address the challenges identified in the previous (Fifth) Review Meeting of Contracting Parties, certain strong features in current Euratom practices and the prospects of future progress¹⁴⁴.

K.1 IMPLEMENTATION OF COUNCIL DIRECTIVE 2011/70/EURATOM

As indicated above, the main development concerns the submission by EU Member States to the Commission of national programmes for the management of spent fuel and radioactive waste and of national reports on the implementation of the Directive 2011/70/Euratom. On that basis, the Commission has released its first report to the Council and European Parliament on progress made with the implementation of the Directive as well as an inventory of spent fuel and radioactive waste present in the EU's territory.

In the past, one aspect of the former Community Plans of Action was the requirement for continuous analysis by the Commission of the situation regarding radioactive waste management in the EU. The results of this analysis had to be presented periodically to the Council.

¹⁴⁴ In accordance with the revised Guidelines.

There have now been seven so-called "situation reports", describing the status of radioactive waste management in the EU. The first four reported on actions were carried out under Community Plans of Action. Although the Plans of Action expired in 2000, it was felt necessary to continue with the concept of a situation report, since it provided the only EU-wide analysis of radioactive waste management activities. The fifth¹⁴⁵ and sixth¹⁴⁶ reports concentrated on the aspect of waste inventories and disposal sites, together with waste management policies and practices. In these last two reports waste quantities were included from Member States which acceded during the enlargements in 2004 and 2007, giving in total twenty seven (27) Member States, of which sixteen (16) have operated nuclear power plants. In addition, the seventh report¹⁴⁷ includes the likely evolution of waste quantities over the coming years (to 2040), as well as the disposal capacities up to 2070.

The reports have shown the continual increase in inventories of high-level waste and spent fuel in line with nuclear power generation. For high level waste/spent fuel it is likely that by 2025-2030 only Finland, France and Sweden will have operational disposal facilities. Germany and Belgium will possibly follow by 2050. The remaining Member States have set target dates which must in some cases be seen as speculative, in view of the low level of activity concerning repository development activities, combined with the fact that a number of states have yet to define specific spent fuel management plans.

There are also significant stocks of long-lived low and intermediate level wastes, which in most circumstances also require deep disposal.

Finally, in the case of the least hazardous waste categories, short-lived low- and intermediate-level waste and very low-level waste, in general terms the estimated disposal capacities will be sufficient to cover the disposal needs. By 2020, if current plans are followed up, all these States having nuclear power plants, with the exception of the Netherlands, could have operational disposal facilities for short-lived low and intermediate level waste.

¹⁴⁵ Fifth Situation Report - Radioactive Waste Management in the Enlarged EU, EUR20653EN, 2003.

¹⁴⁶ COM (2008) 542 final, available at:
http://ec.europa.eu/energy/nuclear/waste_management/waste_management_en.htm.

¹⁴⁷ Report from the Commission - Seventh Situation Report on Radioactive Waste and Spent Fuel Management in the EU, SEC (2011) 1007 final.

The 2010 inventory information provided by Member States was used in the preparation of the Commission's report under Directive 2011/70/Euratom and therefore the Eighth Situation Report on the Management of Radioactive Waste was incorporated. The 7th situation report was the last report in this format. Future reporting on the status of radioactive waste management in the Community and future risings will be combined with the reporting provided for under Council Directive 2011/70/Euratom.

K.2 EURATOM RESEARCH PROGRAMMES¹⁴⁸

Euratom makes a major contribution to the safety of radioactive waste management through its research activities under the Euratom Treaty. The legal basis for research activities in the field of nuclear science and technology is to be found in Title I, Article 2(a), which provides that "*In order to perform its task, the Community shall, as provided in this Treaty: (a) promote research and ensure the dissemination of technical information*", as well as in the provisions of Title II, Chapter 1, entitled "*Promotion of research*" and especially Article 7 which foresees the adoption of Community research and training programmes. As laid down in the Euratom Treaty, Euratom research and training programmes are established by the Council, on a proposal from the Commission, and following consultation of the Euratom Scientific and Technical Committee (STC). The Commission is responsible for the implementation of these programmes.

A distinction is made between "direct actions" and "indirect actions". Direct actions are research activities pursued in the research establishments of JRC and paid for entirely from the EU budget. Indirect actions are conducted in research centres, universities or undertakings, with financial assistance from the EU and on conditions laid down by the rules governing participation in the various programmes.

¹⁴⁸ For additional information on Euratom Research and Training Programmes, see Appendix I.

Euratom Research and Training Programmes

The previous Euratom Framework Programme (FP7) and its extension (FP7+2) was running between 2007 and 2013. The projects funded from this programme have ended or are coming to their end soon. The overall budget for indirect actions related to fission and radiation protection research amounted to EUR 353 million over the period 2007–2013 and covered five (5) main areas of activities: management of radioactive waste (geological disposal, partitioning and transmutation), reactor systems (including installation safety and innovative concepts), radiation protection, research infrastructures, human resources and training.

The currently running Euratom Research and Training Programme (2014-18)¹⁴⁹ complements Horizon 2020¹⁵⁰ in the field of nuclear research and training. The general objective of the Euratom Programme is to pursue nuclear research and training activities with an emphasis on continuous improvement of nuclear safety, security and radiation protection, notably to potentially contribute to the long-term decarbonisation of the energy system in a safe, efficient and secure way. Specific objectives of the Programme include contributing to the development of safe, longer term solutions for the management of ultimate nuclear waste, including final geological disposal as well as partitioning and transmutation.

For fission research, the Programme is fully in line with the post-Fukushima reorientation towards safety aspects agreed in 2011. The budget for indirect actions in fission research and radiation protection amounts to EUR 315 million for the period 2014 – 2018.

¹⁴⁹ Council Regulation (Euratom) N°1314/2013 of 16 December 2013 on the Research and Training Programme of the European Atomic Energy Community (2014-2018) complementing the Horizon 2020 Framework Programme for Research and Innovation

¹⁵⁰ Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decision No 1982/2006/EC

As in the past, implementation of the indirect actions is ensured via calls for proposals announced in the Official Journal of the EU and on the Participant Portal website¹⁵¹. The submitted proposals are evaluated by independent experts from the various fields covered by the call. Successful proposals are funded mainly by a shared-cost mechanism, whereby an EU grant is awarded covering part of the overall project budget, with the project consortium partners contributing the balance of the funding.

Two biennial calls were launched in 2014-2015 and 2016-2017. One more call is planned in 2018. To ensure seamless funding of Euratom research and training activities, a new Council regulation is foreseen to be adopted keeping the main provisions of the current Council regulation 1314/2013. The biannual (2019-2020) Euratom programme will remain an integral part of Horizon 2020, allocating budget for both direct and indirect actions, setting R&D objectives and identifying R&D support instruments. This approach ensures the continuity throughout the full 7-year H2020 period and therefore greater coherence with the Horizon 2020 timeline. This is all the more important in view of remaining consistent with relevant Union policies in fields relating to research and innovation in general and in all nuclear safety aspects in particular.

An overview of activities in the field of radioactive waste management under the Euratom FP7 and FP7+2 is provided in Table I.1 of Appendix I¹⁵². Respectively, Table I.2 summarises the status of implementation of 10 on-going projects co-financed under the Euratom Work Programmes 2014-2015 and 2016-2017.

¹⁵¹ <http://ec.europa.eu/research/participants/portal4/desktop/en/home.html>

¹⁵² Details of projects carried out under FP7 and FP7+2 can be found on the Cordis website: [//cordis.europa.eu/fp7/dc/index.cfm?fuseaction=UserSite.FP7CallsPage](http://cordis.europa.eu/fp7/dc/index.cfm?fuseaction=UserSite.FP7CallsPage)

The nuclear activities of JRC (direct actions) will aim at supporting the implementation of Council Directives 2009/71/Euratom and 2011/70/Euratom, as well as Council Conclusions giving priority to the highest standards for nuclear safety and security in the Union and internationally. JRC shall notably contribute to the nuclear safety research needed for the safe, secure and peaceful use of nuclear energy and other non-fission applications, to provide a scientific basis to relevant Union policies and, where necessary, to react within the limits of its mission and competence to nuclear incidents and accidents. To that effect, JRC will continue to carry out research and assessment, provide references and standards and deliver dedicated training and education in the field of fuel cycle safety and radioactive waste management. *Synergies with relevant cross-cutting initiatives will be sought as appropriate, with the aim of optimizing human and financial resources and to avoid duplication of nuclear research and development in the European Union. The JRC activities in these areas will be conducted taking into account relevant initiatives at the regional, Member State or at European Union level, within the perspective of shaping the European Research Area.*

The JRC will contribute to the development of tools and methods to achieve high safety standards for nuclear installations and fuel cycles relevant to Europe. Those tools and methods will include:

(1) support to severe accident analyses by modelling and experimental activities, with main focus on accident progression studies and debris characterization in view of decommissioning and (damaged) site remediation. Methodologies for assessment of nuclear installations' operational safety margins; supporting the establishment of a common European approach to the evaluation of advanced fuel cycles and designs; and investigation and dissemination of the lessons learnt from operational experience. The JRC will further pursue its 'European Clearinghouse on NPP Operational Experience Feedback' to focus its activities on post-Fukushima nuclear safety challenges, appealing to the Members States' competences in this area;

(2) minimisation of the scientific uncertainties in the prediction of long-term behaviour of nuclear waste and of the dispersion of radionuclides in the environment; and key aspects of research on decommissioning of nuclear installations;

(3) exchange with relevant stakeholders for strengthening Union capacity to respond to nuclear accidents and incidents by research on alert systems and models for radiological dispersion in the air, and by mobilising resources and expertise for analysing and modelling nuclear accidents.

K.3 EURATOM LOANS

Financial support in the form of loans is available for all Member States¹⁵³ and certain non-Member States¹⁵⁴. All projects must have obtained approval from the competent national authorities, in particular the safety authorities.

Member States are granted loans to finance investment projects relating to the industrial production of electricity in nuclear power stations and to industrial fuel cycle installations. Although most are related to electricity production, many have included direct or indirect references to the safety of spent fuel and radioactive waste management.

Projects supported in non-Member States in Europe must give priority to improving the level of safety and efficiency of nuclear power stations and fuel cycle installations which are in service or under construction. Support is also given to projects that relate to the decommissioning of installations where upgrading of safety levels is not technically or economically justified and which would pose a hazard if abandoned. Such measures are eligible for financial support only where no provision was made during the operational life of the installation.

With regard to upgrading the safety of nuclear installations, Euratom loans have in the last decade been granted to projects such as the safety upgrade of the Kozloduy Power Plant Units 5 and 6 in Bulgaria, the safety upgrade of Khmel'nitsky Power Plant Unit 2 and Rovno Power Plant Unit 4 in Ukraine, and the Complex (consolidated) Safety Upgrade Program of Power Units of Nuclear Power Plants also in Ukraine.

¹⁵³ Council Decision 77/270/Euratom empowering the Commission to issue Euratom loans for the purpose of contributing to the financing of nuclear power stations, OJ L 88, 06.04.1977, p. 11, as amended and supplemented (the "Establishing Decision").

¹⁵⁴ Council Decision 94/179/Euratom to authorise the Commission to contract Euratom borrowings in order to contribute to the financing required for improving the degree of safety and efficiency of nuclear power stations in certain non-Member countries, OJ L 84, 29.03.1994, pp. 41-43, as amended and supplemented (the "Scope Extension Decision").

K.4 INSTRUMENT FOR NUCLEAR SAFETY COOPERATION

The EU contributes significantly to the promotion of nuclear safety, including radioactive waste management, also through actions undertaken under the Instrument for Nuclear Safety Cooperation, established by Council Regulation No 237/2014 of 13 December 2013¹⁵⁵. Within the framework provided by this Instrument, the Union engages in cooperation with non-EU countries, amongst others in the field of the promotion of nuclear safety culture, safe management of radioactive waste and safeguarding of nuclear materials. Concrete actions are aimed to address problems related to the safe management of radioactive waste of all types and of nuclear material, including environmental remediation of former uranium mines.

The Commission is responsible for the implementation of these actions with the non-EU countries concerned. The Annual Action Programmes, also containing projects in the field of radioactive waste management, are elaborated by the Commission, based on the Strategy and Multi-annual Indicative Programme established by the European External Action Services, taking into account the opinion of a committee of appointed representatives from the Member States. The next Multi-Annual Indicative Programme will be for the period 2018-2020 and is preceded by the Mid-Term Review of the INSC for the period 2014 – 2017.

K.5 INSTRUMENT FOR PRE-ACCESSION ASSISTANCE

The EU contributed to the safety of radioactive waste management and spent fuel management also through actions undertaken under the Instrument for Pre-Accession Assistance (IPA), established by Council Regulation (EC) No 1085/2006 of 17 July 2006. Since 2013, this assistance is exclusively provided under the Instrument for Nuclear Safety Cooperation (INSC).

¹⁵⁵ Council Regulation No 237/2014 of 13 December 2013 establishing an Instrument for Nuclear Safety Cooperation. OJ L L77, 15.03.2014, p. 109. This Euratom Regulation will be applied from 2014 to 2020.

Within IPA, the EU cooperated with candidate and potential candidate countries in the Western Balkans in the field of safe management of radioactive waste and material, decommissioning of nuclear facilities and safe management of spent fuel¹⁵⁶. The most significant action in the field of radioactive waste management supported the decommissioning programme of Vinča, Serbia. The objective of the Vinča Nuclear Institute Decommissioning (VIND) programme, which is coordinated and partly financially supported by the IAEA, is to condition and store approximately 4000 sealed radioactive sources and safely dismantle the old storage facilities.

The cost of the repatriation and waste management actions in Vinča amounts to EUR 18,4 million.

The IPA support to the VIND programme ended in September 2016. The Commission has started a bilateral cooperation complementary to the IAEA project under the Instrument for Nuclear Safety Cooperation subject to the availability of the budget.

The elaboration and implementation of these projects are similar to the projects implemented under the Instrument for Nuclear Safety Cooperation¹⁵⁷.

K.6 EU STRESS TESTS (POST-FUKUSHIMA)

Europe's response to the events at the Fukushima (Daiichi) I Nuclear Power Plant, initiated by the Tōhoku earthquake and tsunami on 11 March 2011, was immediate. The European Council of 24/25 March 2011 requested that the safety of all EU nuclear plants should be reviewed on the basis of a comprehensive and transparent risk and safety assessment ("stress tests"). These stress tests were defined as targeted reassessments of the safety margins of nuclear power plants, developed by ENSREG, with the participation of the Commission.

¹⁵⁶ Such as repatriation of spent fuel elements from the Vinča research centre, in Serbia, to Russia.

¹⁵⁷ See Section K.4 above.

Specifications on the stress tests¹⁵⁸ defined three main areas to be assessed: extreme natural events, response of the plants to prolonged loss of electric power and/or loss of the ultimate heat sink and severe accident management¹⁵⁹. As such, the main aim of stress tests was to assess the safety and robustness of nuclear power plants with regard to the preliminary lessons learned from Fukushima. For this purpose, they went beyond the safety evaluations made during the licencing process and periodic safety reviews.

All EU Member States that operated nuclear power plants at the time¹⁶⁰, plus Lithuania¹⁶¹, participated in the nuclear stress test exercise¹⁶². Several countries¹⁶³ decided –in addition to the agreed requirements– to include not only operating nuclear power plants but also decommissioned plants or other nuclear facilities.

As a follow up to the stress tests, national action plans (NACPs) were prepared by all participating countries, which set forth actions to improve nuclear safety as well as the schedule for their implementation. The majority of these actions were expected to be implemented by 2015-18, the latest foreseen date for completion being 2020.

¹⁵⁸ Annex I of the ENSREG declaration of 12-13 May 2011.

¹⁵⁹ The methods of investigation were defined nationally and were under the responsibility of the national regulators.

¹⁶⁰ Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, the Netherlands, Romania, Slovak Republic, Slovenia, Spain, Sweden and United Kingdom. Croatia also participated.

¹⁶¹ Despite closure of the last unit in the Ignalina nuclear power plant in 2009 (in fulfillment of the EU accession obligations), there were still site-specific operating licenses in place, as well as amounts of spent fuel stored on-site, hence the participation of this country in the EU stress tests.

¹⁶² Given the potential cross-border implications of nuclear accidents, the European Council asked the Commission to invite EU neighbouring countries to take part in the stress test process. Thus, together with the participating EU Member States, Switzerland and Ukraine also participated in the EU stress tests and the peer review process, while other neighbouring countries that agreed to be involved on the basis of the same methodology (e.g. Turkey) have been working within different timetables.

¹⁶³ Belgium, Bulgaria, Finland, France, Germany, Lithuania, Slovakia, Spain, Ukraine, United Kingdom.

The Commission assessed the progress in collaboration with ENSREG a first time in April 2013 and a second time in April 2015, and will continue to follow the implementation of the measures in EU Member States. Following the assessment of April 2015, ENSREG considered that the rate of safety upgrade implementation should be strengthened to target agreed implementation deadlines, taking into account other safety priorities and quality requirements¹⁶⁴. Updated national action plans should be published by the EU Member States by the end of 2017.

K.7 REVISION OF COUNCIL DIRECTIVE 2009/71/EURATOM

The European Council of 24/25 March 2011 mandated the Commission "to review the existing legal and regulatory framework for the safety of nuclear installations" and propose any improvements that may be necessary.

Thus, in October 2013, the Commission proposed to amend the 2009 Nuclear Safety Directive. The amendment of the Nuclear Safety Directive was adopted on 8 July 2014 and entered into force on 14 August 2014¹⁶⁵

The amendment, amongst other:

- introduces new EU-wide safety objective;
- sets up a system of European topical peer reviews;
- strengthens the role and independence of national regulators;
- increases transparency on nuclear safety matters;
- includes new provisions for on-site emergency preparedness and response.

The definition of "nuclear installations", covered by the Nuclear Safety Directive, encompasses spent fuel storage facilities, as well as storage facilities for radioactive waste that are on the same site and are directly related to a nuclear power plant, an enrichment plant, a nuclear fuel fabrication plant, a reprocessing plant or a research reactor facility.

¹⁶⁴ http://www.ensreg.eu/sites/default/files/attachments/hlg_p2015-31_146_ensreg_statement_nacp_final.pdf

¹⁶⁵ OJ L 219/42, 25.07.2014

The Member States were required to bring into force the laws, regulations and administrative provisions necessary to comply with the Directive by 15 August 2017.

K.8 MEMORANDUM OF UNDERSTANDING BETWEEN EURATOM AND THE IAEA

A Memorandum of Understanding was signed by the Commission and the IAEA on 17 September 2013 for a partnership between them on nuclear safety cooperation¹⁶⁶. The parties envisaged cooperating and consulting with each other, with regard to matters of common interest.

This partnership is based on respect and mutual understanding of the respective strengths, mandates, organisational structures and institutional capacities, as well as the governing rules and policies of the respective sides. The objectives of the partnership are:

- a. to establish a framework for cooperation;
- b. to facilitate the joint identification of programmes for potential cooperation;
- c. to enhance knowledge sharing with a view to fostering co-ordination and synergies, and to support best practices in IAEA Member States, when requested; and
- d. to build on each party's comparative advantage, with the objective to strengthen nuclear safety worldwide.

It was anticipated that working towards these objectives would lead to greater harmonisation, coordination and complementarity of planning and identification of projects for cooperation. Likewise, it would result in a structured framework for cooperation, for shared analysis and exchange of information.

¹⁶⁶ The document is available at:
http://ec.europa.eu/energy/nuclear/safety/doc/20130917_ec_iaea_mou_nuclear.pdf

Subject to the availability of funds, the parties envisaged cooperating in specific areas, which also include:

- "Safe management of spent fuel and radioactive waste"; and
- "Provision of IAEA peer reviews of radioactive waste and spent fuel management of the IAEA Member States which are Member States of Euratom, that so request, in accordance with IAEA Safety Standards and in line with 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".

Based on this Memorandum the Commission on behalf of Euratom is supporting the IAEA in developing the ARTEMIS peer review service. The scope of the project covers development of self-assessment questionnaires, guidance, workshops with Member States proposed to EU Member States, as well as an electronic platform. Two workshops took place in 2016 (for EU Member States) and 2017 (for IAEA Member States) and the first ARTEMIS peer review is scheduled for October 2017 in Poland.

In addition, in July 2017 the EU and IAEA launched a project on development of a harmonised reporting set and tool for spent fuel and radioactive waste inventories of EU Member States. This project aims to assist Member States and reduce the burden on reporting such data to international organisations such as IAEA, Joint Convention, Commission and NEA to OECD.

K.9 PROMOTION OF INTERNATIONAL PEER REVIEWS

Council Directive 2011/70/Euratom has contributed towards the advancement of international peer reviews in the Community. Article 14 of the directive requires Member States to invite periodically (at least every 10 years) international peer review of their national framework, competent regulatory authority and/or national programme, with the aim of ensuring that high safety standards are achieved in the safe management of spent fuel and radioactive waste.

In 2011, the Commission concluded with the IAEA an Agreement to provide a contribution for the implementation of the action entitled "EC-IAEA Cooperation in the Field of Nuclear Safety – Integrated Regulatory Review Services in the EU". In 2014 the Commission on behalf of the EU signed an agreement with the IAEA for “EC-IAEA Cooperation in the Field of Nuclear Safety and Waste Management” aimed at supporting the ARTEMIS peer review service and in this way to provide a tool for Member States international peer reviews required by the Council Directive 2011/70/Euratom.

In December 2016 the Commission and the IAEA concluded a revised 4 year contractual arrangement in support of the Integrated Regulatory Review Service (IRRS) missions to Member States.

K.10 PROMOTION OF OPENNESS AND TRANSPARENCY

To ensure openness and transparency, the outcomes of any peer review shall be reported to the Commission and the other Member States, and may be made available to the public where there is no conflict with security and proprietary information (Article 14 of Council Directive 2011/70/Euratom).

In another Article directly referring to transparency (Article 10), Council Directive 2011/70/Euratom requires Member States to ensure also that necessary information on the management of spent fuel and radioactive waste be made available to workers and the general public. This obligation includes ensuring that the competent regulatory authority informs the public in the fields of its competence. In addition, Member States must ensure that the public is given the necessary opportunities to participate effectively in the decision-making process regarding spent fuel and radioactive waste management, in accordance with national legislation and international obligations.

Moreover, openness and transparency are promoted through discussions at international fora (such as ENSREG, ENEF, specific events, workshops with Member States) and by way of asking the stakeholders' opinion, where appropriate.

Furthermore, since the 1st Communication to the European Parliament and the Council in 1999, the Commission updates every four years the status of the D&WM Programme for JRC nuclear installations. *The next Communication is planned for 2018.* The last Communication on this subject was issued in October 2013. Additionally, the Programme is peer reviewed every year by a panel of independent experts from the Member States having major competences in the nuclear field, in the so-called "Nuclear Decommissioning and Waste Management Expert Group". The Expert Group meets twice a year in the JRC nuclear sites and monitors the Programme's progress, giving advice on the strategy and future technical challenges.

JRC-Ispra, following the advice of the European Parliament, opened in 2006 a dedicated web site (in two languages: English and Italian) to inform the local community and the international research staff working at JRC-Ispra premises about the relevant progress of the D&WM Programme and other significant events organised in this framework.

Alternatively every two years, the JRC-Ispra site, including its nuclear facilities, is open to the general public (JRC Open Day) and to the scholars (JRC School Day) having applied to visit its laboratories. During these visits, conferences are held and information is given on subjects like radioactivity, nuclear waste and the decommissioning programme. Moreover, Communication channels with the mayors of the villages surrounding the site, the local and regional authorities and the local press have been established and are regularly implemented.

Outside the formal authorisation and licencing processes, an informal dialogue with the Italian national authorities and other relevant nuclear stakeholders has been established, in particular with the Italian nuclear inspectorate (I.S.P.R.A.) and the operator of the Italian nuclear facilities undergoing decommissioning (Sogin).

K.11 FINANCIAL SUPPORT FOR MEASURES CONNECTED WITH DECOMMISSIONING IN BULGARIA, LITHUANIA, AND SLOVAKIA.

Upon accession, Bulgaria, Lithuania and Slovakia committed to close down within the respective deadlines and subsequently decommission eight Soviet design nuclear power units before the end of their scheduled operational lifetime. The EU agreed to assist financially the three Member States to decommission the concerned power reactors.

The EU assistance has been implemented since the pre-accession stage and is continuing in the Union's Multiannual Financial Framework 2014-2020. Indeed, in 2013 two Council Regulations 2013/1368/Euratom and 2013/1369/EU have established a new legal base, providing further support to the decommissioning programmes. These Regulations establish a programme for the implementation of Union financial support for measures aimed at the decommissioning of units 1 to 4 of the Kozloduy nuclear power plant in Bulgaria (the 'Kozloduy programme'), units 1 and 2 of the Bohunice V1 nuclear power plant in Slovakia (the 'Bohunice programme'), and units 1 and 2 of the Ignalina nuclear power plant in Lithuania (the 'Ignalina programme').

The general objective of the Kozloduy, Bohunice and Ignalina programmes is to assist the Member States concerned in implementing the steady process towards the decommissioning end state in accordance with their respective decommissioning plans, whilst maintaining the highest level of safety.

K.12 CONCLUSIONS OF THE PREVIOUS REVIEW MEETING ON THE LAST EURATOM REPORTING – HIGHLIGHTS AND STRONG FEATURES OF RECENT EURATOM ACTIONS – PAST AND FUTURE CHALLENGES AND PRIORITIES

The main challenges identified during the 5th Review meeting have been addressed by Euratom as follows:

- **Assuring the correct transposition and implementation of Euratom directives:**

To date all Member States have notified the transposition measures for Council Directives 2011/70/Euratom and 2006/117/Euratom. The Commission is assessing the notified measures and will complete this task in 2017.

Based on the submission by EU Member States to the Commission of national reports on the implementation of Directive 2011/70/Euratom as well as the notifications of the national legal measures transposing Directive 2011/70/Euratom, the Commission has released a report to the Council and European Parliament on progress made with the implementation of the Directive¹⁶⁷.

The challenges identified in the Commission Report are listed at the end of this section.

- **Continued safe management of the JRC operational decommissioning program, including waste treatment and storage:**

The implementation of the JRC Decommissioning and Waste Management Programme has continued steadily during the reporting period.

¹⁶⁷ Report from the Commission to the Council and the European Parliament on progress of implementation of Council Directive 2011/70/Euratom and an inventory of radioactive waste and spent fuel present in the Community's territory and the future prospects, COM(2017)236final of 15 May 2017 (see <https://ec.europa.eu/energy/en/topics/nuclear-energy/radioactive-waste-and-spent-fuel>).

In JRC-Ispra, the old cementation plant had been dismantled to liberate the space for hosting the new grouting facility intended to immobilise low and intermediate solid waste into standardised waste containers, whose qualification is demonstrated but still awaiting formal approval by the Italian Safety Authorities. The turn-key contract for the grouting facility had to be annulled in 2015. Alternative solutions aim at commissioning a new facility in 2018. Contracts for off-site waste treatments (drums super-compaction, metal melting and waste incineration) as well as contracts for retrieval and treatment of legacy waste have been placed or are being placed. The super-compaction of the first batch of drums is pending the authorisation of the safety authorities. The Low and Intermediate Level Liquid Waste has been collected in safer locations, sampled and characterised and is now ready for the subsequent step of cementation. Following the latest shipment in 2015 more than 95% of the non-irradiated material has been shipped off site. A centralised transit safe area is under commissioning to collect the irradiated nuclear material present on site and to allow for its repackaging in dual-purpose dry casks planned for after 2019. A feasibility study for possible reprocessing of irradiated material has been initiated as an alternative solution to dry interim storage.

At JRC-Karlsruhe, the current decommissioning activities are related to disused installations, obsolete nuclear materials and wastes, such as the dismantling of disused obsolete glove boxes and clean-up of hot cells. Facilities to treat residues of the irradiated nuclear material have been prepared with the view of their ownership transfer to third parties. JRC has started the construction of a new state of the art building wing M. With this new building which will host JRC's activities with nuclear material, the preparation for decommissioning of older, obsolete buildings (scheduled after 2020) has commenced.

At JRC-Geel no important decommissioning projects have taken place, except the evacuation of obsolete nuclear materials. The facility Global Decommissioning Plan has been updated and cost calculations have been reviewed. Materials and waste from refurbishment of accelerator have been managed.

At JRC-Petten a contract for updating the decommissioning plan and cost estimation for the HFR has been awarded in 2016. The plan and cost estimation will be available at the end of 2017.

In 2015 nuclear materials from JRC Karlsruhe, JRC- Ispra and JRC-Geel were evacuated to the US, allowing to significantly reduce the inventory of non irradiated nuclear material in JRC sites. These activities are run in parallel with the operation of the research facilities.

During the reporting period a new governance structure with a High Level Steering Committee, and an Operational Level Steering Committee was put in place. The new Department of Nuclear Decommissioning coordinates the development and implementation of the multi-site D&WM programme. The overall Decommissioning and Waste Management strategy as well as the cost estimation and waste inventory are being updated and will be the elements underpinning the new Communication of the Commission to the Council and the European Parliament on the progress of the JRC Decommissioning and Waste Management Programme planned to be issued in 2018.

- *Need to progress on transfer of JRC-Ispra liabilities to Italy.*

Aiming at reducing the risks on the Italian liabilities linked to previous common nuclear research activities at the JRC-Ispra site, the risks on the long term waste storage capacities on the site and on the waste acceptance criteria, Euratom signed on 27 November 2009 an Agreement with the Italian Government in order to:

- *regularise the historical liabilities on the site by transferring the responsibility for the Ispra-1 reactor decommissioning to the Italian Government;*
- *formalise the transfer of all waste on the JRC-Ispra site to the future Italian national repository by the end of the D&WM programme;*
- *limit the risk of later waste reconditioning which could be the result of changes in Italian waste acceptance criteria.*

The implementation of the waste management programme at the JRC-Ispra site has focused on the design and building of several waste handling and interim storage installations for waste sorting, characterisation, decontamination, material "clearance" from radiological control, and condition and temporary storage of radioactive waste, until long term storage or waste disposal facilities are available in Italy.

Most of the spent fuel has been returned to the USA. The remaining spent fuel will be temporarily stored in an interim store installed in one of the former hot cells of the Essor reactor complex before being repackaged in dual purpose casks and subsequently transferred to dry storage on-site, awaiting shipment to a national long-term storage facility when it becomes available. An alternative consisting in reprocessing all remaining irradiated material, title transfer of the recovered nuclear material, storage of vitrified waste at the reprocessing plant and final shipping to a future Italian disposal facility associated with this option are under evaluation.

It should be noted that Euratom has also made progress with respect to the planned activities to enhance safety (presented at the 5th Review meeting), i.e.:

- **Review of National programmes and reports to be submitted to the Commission by 23 August 2015 (Report to the Council and Parliament – 2017)**

The Commission has reviewed the national programmes and national reports of 28 Member States. On that basis, as it is mentioned above, it has prepared a report to the Council and European Parliament (as per Article 14(2) of the Directive) adopted in 2017.

- **Continue to support Member States in implementing Directive 2011/70/Euratom**

The Commission aims to assist Member States to address the common challenges and needs with respect to the management spent fuel and radioactive waste. It is organizing an event with EU Member States on Implementation of the Directive 2011/70/Euratom (6-8 November 2017, Brussels) aiming to (i) present its report; (ii) exchange views and identify mechanisms to support the countries; and (iii) launch a debate on the shared disposal solutions.

In addition, the Commission has launched in 2016 the following studies: on the market for decommissioning nuclear facilities in the EU; on financial risks of decommissioning and the back end of the fuel cycle; and on benchmarking of spent fuel and radioactive waste reporting.

The Commission is also assisting Member States with the aid of the international tool ARTEMIS on peer reviews of the national framework, competent authorities and/or programme; and working with the IAEA on the harmonization of the inventory reporting requirements. Through the ENSREG the Commission is also discussing specific topics of interest of the EU regulatory bodies, and is working on the revision of the ENSREG Guidelines for reporting under Article 14(1) of the Directive 2011/70/Euratom.

- **Continue to support research and development activities, as illustrated by the figures provided in Appendix.**

Future priorities and challenges

Finally, with reference to other future priorities, Euratom will focus on taking further its international cooperation initiatives, continuing research in the nuclear field and supporting Member States to ensure the application of high standards of nuclear safety in Europe. To this effect, Euratom is prepared to support progress of work in ENSREG and ENEF, to follow up the status of implementation of the post-stress tests national action plans aimed at enhancing nuclear safety, to pursue synergies with the IAEA and other international organisations, to prompt Member States to transpose the relevant Euratom legislative framework in their national legal order and to evaluate the alternatives for research projects.

As indicated above, the EU nuclear legal framework has undergone significant changes in the last decade with the adoption of legislation on nuclear safety, radioactive waste and spent fuel management and radiation protection. Member States were at different stages of implementation of their spent fuel and radioactive waste management activities when Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of radioactive waste and spent fuel came into force. While this can explain the differences between Member States in terms of the stage of implementation they are at, planning should not be delayed and implementation must move forward.

In general, there is a good level of compliance with the Directive in terms of the legal and regulatory framework. However, additional effort is needed in a number of areas, in particular with respect to policies, concepts, plans, research and site selection for intermediate level waste and high level waste (including spent fuel) disposal, projections of inventories for spent fuel and radioactive waste, cost assessments and financing mechanisms. Deciding on the development of geological disposal facilities, and specifically on their location, is a complex, long-term process in which continuous efforts towards transparency and public participation play an essential role.

The Commission has requested clarifications to Member States and may express its opinion on whether the content of the individual national programmes is in accordance with Article 12 of the Directive.

Euratom Research

Overall objectives

The overall focus of each Euratom Research and Training Programme (hereinafter Programme) is on nuclear safety and radiation protection, and there is a large degree of continuity in most research fields (including in the area of radioactive waste management), because of the long-term nature of the required research effort. The management of spent fuel, high-level waste and other long-lived radioactive waste remains the only aspect of the fuel cycle that has yet to reach the level of industrial maturity and full implementation. Safety considerations related to the absence of an operational final repository led a number of Member States to consider radioactive waste management a topic of concern and an area where substantial research efforts are being deployed. Euratom Member States are conducting activities aiming at possible start of operation of three first of the kind geological repositories in three different Member States in the next decade. Research and development in this field is supported by the Euratom Programmes in order to offer to other Member States the necessary technical knowledge to develop national programmes and in support to the implementation of final disposal in a geologic repository.

Solutions for ultimate radioactive waste disposal, together with safe interim storage of spent fuel are also considered as an integral element of the overall safety of nuclear reactors by reducing the inventory of spent fuel in wet storage at the nuclear power plants, as it was recalled on the occasion of the earth quake and tsunami in Japan. The Euratom Programme is taking this into consideration to emphasise the need of more research in this field.

Last but not least, it is clear that the objective of protection of man is at the core of any nuclear activity and it is the primary goal of designing safe solutions for radioactive waste management. A better knowledge of the risks arising from exposures to ionising radiation in the low dose and low dose rate ranges and protracted exposures is also sought by the Euratom Programme. With this aim, support is provided to low dose research being organised within framework of the European Joint Programme for Radiation Protection Research (CONCERT).

Euratom Framework Programme 2007-2013 (FP7) and Euratom Research and Training Programme 2014-2018

Euratom FP7 covered research in both fusion and fission (including radiation protection) and specific direct research actions carried out by the JRC in the area of nuclear security and safeguards. The total Euratom support for research in the field of fission and radiation protection (indirect actions) was EUR355M over the seven years 2007-2013.

In the area of geological disposal, the clear emphasis of Euratom FP7 was on implementation-oriented research and technological development, such as investigation and demonstration of technologies and safety of disposal of spent fuel and long-lived radioactive wastes in geological formations. Other objectives *were* to underpin the development of a common European view on the main issues related to the management and disposal of waste. Investigation of ways to reduce the amount and/or hazard of the waste by partitioning and transmutation and/or other techniques, in particular as part of advanced nuclear fuel cycles and systems (Generation-IV) included in the radioactive waste management activity area during Euratom FP7, has been transferred to the activity area 'Reactor Systems' during last two years of Euratom FP7 (2012-2013).

Table I.1, below, summarises the final status of projects launched during Euratom FP7, in the field of radioactive waste management in general and geological disposal in particular. Only the major projects, involving collaborative research activities, are listed, excluding smaller coordination and support actions, including education and training. Indirect actions of Euratom FP7 were implemented through competitive annual calls for research proposals. In total, seven (7) calls have been completed and all the selected projects launched.

Table I.1: Euratom FP7 & FP7+2 – Summary of major radioactive waste management projects

Project acronym and title²	Coordinator	EU contribution / total cost (EUR)	Start date & duration
ACSEPT Actinide recycling by separation and transmutation	CEA (FR)	6M / 23.8M	1/1/08 4 years
RECOZY Redox phenomena controlling systems	FZK-INE (DE)	3.50M / 6.2M	1/4/08 4 years
CARBOWASTE Treatment and Disposal of Irradiated Graphite and other Carbonaceous Waste	FZJ (DE)	6M / 12.3M	1/4/08 5 years
FORGE Fate of Repository Gases	BGS (UK)	6M / 11.6M	1/2/09 4 years 8 months
MODERN Monitoring Developments for safe Repository operation and staged closure	Andra (FR)	2.8M / 5.1M	1/5/09 4 ½ years

Project acronym and title²	Coordinator	EU contribution / total cost (EUR)	Start date & duration
CATCLAY Processes of Cation Migration in Clayrocks	CEA (FR)	0.82M / 1.55M	1/6/10 4 years
PEBS Long-term performance of Engineered Barrier Systems (EBS)	BGR (DE)	2.8M / 6.5M	1/3/10 4 years
CROCK Crystalline rock retention processes	KIT (DE)	1.06M / 1.8M	1/1/11 2½years
SKIN Slow processes in close-to-equilibrium conditions for radionuclides in water/solid systems of relevance to nuclear waste management	ARMINES (FR)	1.2M / 2M	1/1/11 3 years
REDUPP Reducing Uncertainty in Performance Prediction	SKB (SE)	0.9M / 1.6M	1/4/11 3 years
LUCOEX Large Underground Concept Experiments	SKB (SE)	4.4M / 9.35M	1/1/11 4 years
IPPA Implementing Public Participation Approaches in Radioactive Waste Disposal	Karita Konsult (SE)	1.6M / 2.4M	1/1/11 3 years

Project acronym and title²	Coordinator	EU contribution / total cost (EUR)	Start date & duration
INSOTEC International Socio-Technical Challenges for implementing geological disposal	Univ. of Antwerp (BE)	2.0M / 3.25M	1/3/11 3 years
BELBAR Bentonite Erosion: effects on the Long term performance of the engineered Barrier and Radionuclide Transport	SKB (SE)	2.6M / 5.0M	1/3/12 4 years
FIRST-NUCLIDES Fast / Instant Release of Safety Relevant Radionuclides from Spent Nuclear Fuel	FZK-INE (DE)	2.5M / 4.74M	1/1/12 3 years
DOPAS Full Scale Demonstration of Plugs and Seals	POSIVA (FI)	8.7M / 15.74M	1/9/12 4 years
CAST CArbon-14 Source Term	RWM (UK)	4.5M / 14.73M	1/10/13 4 ½ years

¹ All projects are shared-cost (Euratom contributing on average 50%) and involve large multi-partner consortia, with partners from several Member States. Projects were also open to organisations from third countries, though normally such partners did not receive funding from the Euratom programme.

² For further information on FP7 projects, refer to http://cordis.europa.eu/fp7/euratom-fission/home_en.html.

The research on radioactive waste management continues under the current Euratom Research and Training Programme (2014-18)¹⁶⁸. Table I.2 summarises the status of implementation of 10 on-going projects co-financed under the Euratom Work Programmes 2014-2015 and 2016-2017.

¹⁶⁸ Council Regulation (Euratom) N°1314/2013 of 16 December 2013

Table I.2: Euratom WP 2014-2015 & WP 2016-2017– Summary of RWM projects

<i>Project acronym and title²</i>	<i>Coordinator</i>	<i>EU contribution / total cost (EUR)</i>	<i>Start date & duration</i>
JOPRAD <i>Towards a Joint Programming on Radioactive Waste Disposal</i>	ANDRA (FR)	1.1M / 1.8M	1/6/15 2 ½ years
SITEX-II <i>Sustainable network for Independent Technical Expertise of radioactive waste disposal - Interactions and Implementation</i>	IRSN (FR)	1.2M / 1.5M	1/6/15 2 ½ years
MIND <i>Development of the safety case knowledge base about the influence of microbial processes on geological disposal of radioactive wastes</i>	SKB (SE)	4.2M / 4.7M	1/6/15 4 years
Cebama <i>Cement-based materials, properties, evolution, barrier functions</i>	KIT (DE)	3.9M / 6.0M	1/6/15 4 years
MODERN 2020 <i>Monitoring Developments for safe Repository operation and staged closure</i>	ANDRA (FR)	6.0M / 9.7M	1/6/15 4 years
DISCO <i>Modern Spent Fuel Dissolution and Chemistry in Failed Container Conditions</i>	SKB (SE)	4.0 M 4.7 M	1/6/17 4 years

<i>Project acronym and title²</i>	<i>Coordinator</i>	<i>EU contribution / total cost (EUR)</i>	<i>Start date & duration</i>
BEACON Bentonite Mechanical Evolution	SKB (SE)	3.8 M 4.1 M	1/6/17 4 years
CHANCE Characterization of conditioned nuclear waste for its safe disposal in Europe	ANDRA (FR)	4.0 M 4.3 M	1/6/17 4 years
INSIDER Improved Nuclear Site characterisation for waste minimization in D&D operations under constrained EnviRonments	CEA (FR)	3.8 M 4.2 M	1/6/17 4 years
THERAMIN – Thermal treatment for radioactive waste minimisation and hazard reduction	VTT (FI)	3.9 M 4.0 M	1/6/17 4 years

Under thematic priority "Improve nuclear safety including: fuel and reactor safety, waste management and decommissioning, and emergency preparedness" of the Euratom Multi-Annual Work Programme, the JRC activities cover waste management, including interim spent fuel storage, geological disposal conditions, partitioning and transmutation, decommissioning applications related to damaged sites, conditional and environmental issues. Scientific aspects related to the back-end of the fuel cycle, including nuclear reference materials, nuclear data, actinide science and non-nuclear applications (e.g. medical applications of radioisotopes), and knowledge management, training and education issues are also addressed. Within its project on 'Responsible and Safe Management of Nuclear Waste and Decommissioning and Remediation of Damaged Reactors: their cores and sites', the JRC provides data relative to the evolution and behaviour of fuels and waste forms under extended interim storage and disposal conditions, and on the analysis of key radionuclides which are relevant for long-term modelling and safety assessment of repositories in view of their implementation. Special focus is paid to corrosion behaviour of high burn-up UO_2 ¹⁶⁹ fuels, mixed oxide fuel and fuel containing additives. Another important contribution is in safety studies linked to the development of "closed" Generation-IV type fuel cycles, where specially adapted partitioning schemes are tested with the goal of demonstrating the recycling of minor actinides in view of a minimisation of the long-term waste radio-toxicity. Demonstration and safety assessment of the recycling of actinides is achieved using aqueous and dry separation techniques, and by performing post-irradiation examination on fuel compounds which incorporated minor actinides. Research is also carried out in support to decommissioning of damaged facilities, in which degraded or severely damaged fuel is present. Basic data are being measured and a special focus is given to the understanding of the underpinning mechanisms involved in the processes applied.

¹⁶⁹ Uranium dioxide.