THE NUCLEAR SAFETY FRAMEWORK IN THE EUROPEAN UNION AFTER FUKUSHIMA

EGMONT PAPER 73

THE NUCLEAR SAFETY FRAMEWORK IN THE EUROPEAN UNION AFTER FUKUSHIMA

Franklin DEHOUSSE
With the collaboration of Didier VERHOEVEN

Royal Institute
for International Relations

December 2014

ACADEMIA PRESS

The Egmont Papers are published by Academia Press for Egmont – The Royal Institute for International Relations. Founded in 1947 by eminent Belgian political leaders, Egmont is an independent think-tank based in Brussels. Its interdisciplinary research is conducted in a spirit of total academic freedom. A platform of quality information, a forum for debate and analysis, a melting pot of ideas in the field of international politics, Egmont's ambition – through its publications, seminars and recommendations – is to make a useful contribution to the decision-making process.

✧ ✧ ✧

President: Viscount Etienne DAVIGNON
Director-General: Marc OTTE
Series Editor: Prof. Dr. Sven BISCOP

✧ ✧ ✧

Egmont – The Royal Institute for International Relations
Address Naamsestraat / Rue de Namur 69, 1000 Brussels, Belgium
Phone 00-32-(0)2.223.41.14
Fax 00-32-(0)2.223.41.16
E-mail info@egmontinstitute.be
Website www.egmontinstitute.be

© Academia Press
Eekhout 2
9000 Gent
Tel. 09/233 80 88 Fax 09/233 14 09
Info@academiapress.be www.academiapress.be

All authors write in a personal capacity.

Lay-out: punctilio.be

ISBN 978 90 382 2452 7
D/2014/4804/272
U 2310
NUR1 754

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the permission of the publishers.

Table of Contents

EXECUTIVE SUMMARY

On 11 March 2011, a devastating earthquake struck Japan and caused a major nuclear accident at the Fukushima Daiichi nuclear plant. The disaster confirmed that nuclear reactors must be protected even against accidents that have been assessed as highly unlikely. It also revealed a well-known catalogue of problems: faulty design, insufficient back-up systems, human error, inadequate contingency plans, and poor communications. The catastrophe triggered the rapid launch of a major re-examination of nuclear reactor security in Europe.

It also stopped in its tracks what had appeared to be a 'nuclear renaissance', both in Europe and globally, especially in the emerging countries. Under the accumulated pressure of rising demand and climate warming, many new nuclear projects had been proposed. Since 2011 there has been more ambivalence, especially in Europe. Some Member States have even decided to abandon the nuclear sector altogether.

This Egmont Paper aims to examine the reactions of the EU regarding nuclear safety since 2011. Firstly, a general description of the nuclear sector in Europe is provided. The nuclear production of electricity currently employs around 500,000 people, including those working in the supply chain. It generates approximately €70 billion per year. It provides roughly 30% of the electricity consumed in the EU. At the end of 2013, there were 131 nuclear power reactors active in the EU, located in 14 countries. Four new reactors are under construction in France, Slovakia and Finland.

Secondly, this paper will present the Euratom legal framework regarding nuclear safety. The European Atomic Energy Community (EAEC or Euratom) Treaty was signed in 1957, and somewhat obscured by the European Economic Community (EEC) Treaty. It was a more classical treaty, establishing institutions with limited powers. Its development remained relatively modest until the Chernobyl catastrophe, which provoked many initiatives. The most important was the final adoption of the Nuclear Safety Directive 2009/71. Thirdly, the general symbiosis between Euratom and the International Atomic Energy Agency (IAEA) will be explained. Fourthly, the paper analyses the initiatives taken by the EU in the wake of the Fukushima catastrophe. These initiatives are centred around the famous 'stress tests'.

Fifthly, the most important legal change brought about by this event was the revision of Directive 2009/71. Directive 2014/87 has been adopted quite rapidly, and has deepened in various ways the role of the EU in nuclear safety. It has reinforced the role and effective independence of the national regulatory authorities. It has enhanced transparency on nuclear safety matters. It has strengthened principles, and introduced new general nuclear safety objectives and requirements, addressing specific technical issues across the entire life cycle of nuclear installations, and in

particular, nuclear power plants. It has extended monitoring and the exchange of experiences by establishing a European system of peer reviews. Finally, it has established a mechanism for developing EU-wide harmonized nuclear safety guidelines.

In spite of these various improvements, Directive 2014/87 Euratom still reflects the ambiguity of the Euratom system in general, and especially in the field of nuclear safety. The use of nuclear energy remains controversial among Member States. Some of them remain adamantly in favour, others against or ambivalent. The intervention of the EAEC institutions remains sensitive. The use of the traditional Community method remains limited. The peer review method remains a very peculiar mechanism that deserves more attention.

INTRODUCTION

On 11 March 2011, a devastating earthquake struck Japan and caused a major nuclear accident at the Fukushima Daiichi nuclear plant. This disaster confirmed that nuclear reactors must be protected even against accidents that have been assessed as highly unlikely. It also revealed a well-known catalogue of problems: faulty design, insufficient back-up systems, human error, inadequate contingency plans, and poor communications. The catastrophe triggered the rapid launch of a major re-examination of nuclear reactor security in Europe.

It also stopped in its tracks what had appeared to be a 'nuclear renaissance', both in Europe and globally, especially in the emerging countries.[1] Under the accumulated pressure of rising demand and climate warming, many new nuclear projects had been proposed. Since 2011 there has been more ambivalence, especially in Europe. Some Member States have even decided to abandon the nuclear sector altogether.

In March 2011, the European Council instantaneously approved the Commission's proposal to organize 'stress tests' (note the worrying parallel in terminology with a damaged banking sector). These tests have produced lengthy reports and now a new Directive. The present synthesis briefly examines the state of nuclear energy in the EU (§ 1), its legal framework (§ 2), the cooperation between the EU and the IAEA (§ 3), the EU's reaction after Fukushima (§ 4), and the new provisions of the 2014 Directive on the safety of nuclear installations (§ 5).

Franklin DEHOUSSE
With the collaboration of Didier VERHOEVEN[2]

[1] W. Nuttall, *Nuclear Renaissance: Technologies and policies for the future of nuclear power*, Taylor & Francis, 2005.
For a smart and balanced introduction to this sensitive topic, see C. Ferguson, *Nuclear Energy: What everyone needs to know*, OUP USA, 2011.

[2] F. Dehousse is professor (in abeyance) at the University of Liège and judge at the General Court of the Court of Justice of the EU. D. Verhoeven is assistant at the General Court. This Paper reflects solely their personal views. The text was updated until 30 October 2014.

1. THE STATE OF NUCLEAR ENERGY IN THE EU

Although sometimes overlooked, the EU's nuclear sector currently employs about 500,000 people, including those working in the supply chain. It generates approximately €70 billion in revenue per year. It provides roughly 30% of the electricity consumed in the EU.[3] This electricity is stable, secure from a supply perspective, CO^2-free, and affordable. On the other hand, the insurance costs of possible damage remain hypothetical, and the treatment of waste unresolved.

Between 1995 and 2012, the share of nuclear power generation followed a downward trend. In many Member States, broader public opinion, especially after the two most serious power plant incidents in history (Chernobyl in 1986 and Fukushima in 2011), was not favourable to nuclear power generation. Germany and Belgium have decided to gradually close existing nuclear power plants, while Italy decided not to restart its nuclear power programme, which was abandoned in the 1980s after the Chernobyl catastrophe. In France, however, nuclear will continue playing an important role in the longer term, even if the present government has decided to reduce progressively its contribution to electricity production.[4]

At the end of 2013, there were 131 nuclear power reactors active in the EU. The 131 reactors are located in 14 countries. Four new reactors are under construction in France, Slovakia and Finland.

Belgium	7
Bulgaria	2
Czech Republic	6
Finland	4 (1)
France	58 (1)
Germany	9
Hungary	4
Netherlands	1
Romania	2
Slovakia	4 (2)
Slovenia/Croatia*	1
Spain	7
Sweden	10
United Kingdom	16
Total	**131 (4)**

Source: Euratom Supply Agency (ESA)[5]

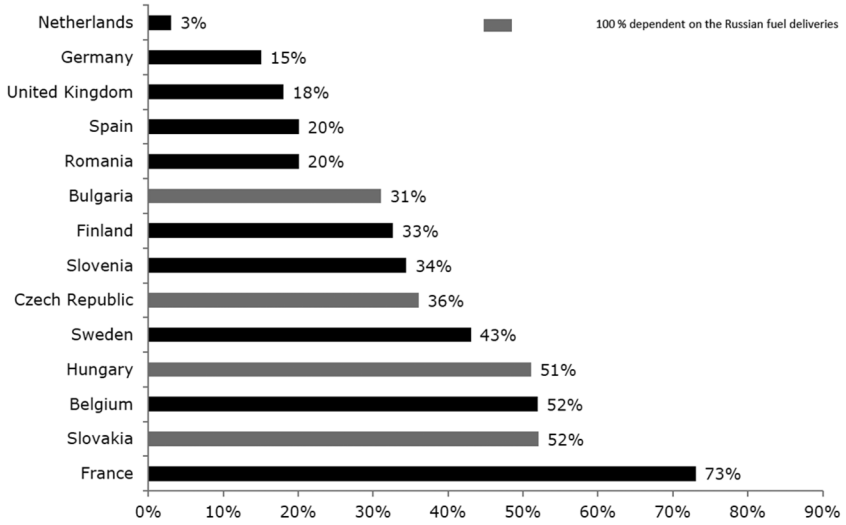
[3] For a general overview, see M. Schneider and A. Froggatt, *The world nuclear industry status report 2014*, SES/H. Boll Foundation, 2014.

[4] See Commission staff working document (SWD) In-depth study of European Energy Security – SWD(2014) 330 final/3 – 2.7.2014 – p. 90

[5] The Euratom Supply Agency was established by the Euratom Treaty, and has been operating since 1960.

With 58 active nuclear reactors, France has almost 45% of all EU nuclear power reactors on its territory, and in 2013, nuclear energy represented 73% of the electricity generated in the country.[6] In terms of electricity production, the 58 active nuclear reactors in France have a net production of 403,703 GWh, or a share of 48.6% of the 831,050 GWh of total electricity generated by nuclear energy in the 28 EU Member States. In 2013, nuclear electricity production accounted for 26.9% of total EU production.[7]

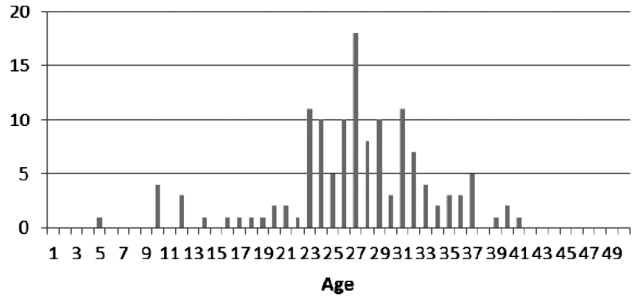
Nuclear power share of total electricity production in 2013



Source: ESA annual report 2013

Most of the reactors in the EU are 20 or more years old.

Age of EU NPPs in 2012



Source: European Commission

[6] Source: Euratom Supply Agency – *Annual report 2013*.
[7] Source: Eurostat – *Electricity Statistics 2013* – online data code: nrg_105a

There are two types of operating reactors in the EU. Utilities use either Western- or Russian-designed reactors. Both have a distinct nuclear fuel procurement approach. Utilities using Western reactors enter into separate contracts for procurement, which allow diversification of all steps of the front end of the fuel cycle (from uranium mining companies to fuel assembly manufacturers, via conversion and enrichment service providers). Utilities operating Russian reactors usually purchase their fuel as integrated packages of fuel assemblies from the same supplier, the Russian company TVEL. In this approach, there is no diversification, nor back-up in case of supply problems (whether for technical or political reasons).

In 2013, Kazakhstan (21.2%) and Canada (18.5%) were the largest suppliers of natural uranium to EU utilities. Russia came in third with 18.1%. In recent years, Kazakhstan has become by far the world's largest producer of natural uranium and is the equivalent of Saudi Arabia in oil production.

In 2013, 60% of the EU requirements for enrichment services were supplied by EU industry, 36% by Russia and 3% by US industry. However, capacities operated by EU industry (AREVA and Urenco) would be sufficient to cover all EU needs for enrichment services if no imports were available. Roughly 20% of EU nuclear power plant requirements for natural uranium and 36% of the requirements for uranium enrichment services are currently covered by supplies from Russia. Two of Finland's four reactors are Russian designed and supplied, while Bulgaria, the Czech Republic, Hungary and Slovakia are 100% dependent on Russian nuclear fuels. In addition, many western EU utilities also have substantial supplies of enriched uranium from Russia (between 20% and 40% of their needs). The EU's high dependence on uranium imports is somewhat risky because of the political uncertainty concerning uranium coming from countries like Russia, Kazakhstan or Uzbekistan, and also from some African countries. Nonetheless, a real shortage appears unlikely in the medium term, while other countries like Canada, Australia or Namibia could increase their production in response. Russia's potential for uranium enrichment services covers approximately half the world's capacity and over twice the EU's annual requirements. Therefore, the risk exists that over-abundant imports from Russia could jeopardize the viability of the EU's own enrichment industry.[8]

Finally, it must be emphasized that the EU strategy in favour of renewable electricity represents a new challenge for the nuclear sector, both for general and specific reasons. From a general point of view, the classical system of base-load electricity production is strongly challenged by the penetration of renewable electricity in many national markets. All producers of electricity using fossil fuels had to adapt during the last decade and get used to producing power intermittently, sometimes at very low

[8] See SWD In-depth study of European energy security – SWD(2014) 330 final/3 – 2.7.2014 – p. 73-79.

prices, and sometimes even at negative prices. In this context, nuclear power plants are strongly quite inflexible, not only due to price, but also to safety:

"Load-following operation is subject to significant technical restrictions. Flexible operation is excluded during the last phase of the fuel load cycle, usually 60 days out of 12-16 months, and load-following should not be carried out with damaged fuel in the core. A delicate core component of the reactor, the control rod drive mechanism, needs to be adapted, and requires increased maintenance and more frequent replacement. Increased inspection and maintenance is needed also for other components. The volume of liquid radioactive waste increases, in average by 2500m^3/unit/year. Turbine efficiency decreases and the risk for disturbance in operations could increase. Also, 'the risk for disturbance in operations could increase … [R]egarding the manoeuvrability of PWRs, load variation operation could reduce safety margins of accidental transients, in comparison to base load operation.'[9]

[9] M. Schneider and A. Froggatt, *The world nuclear industry status report 2014*, SES/H. Boll Foundation, 2014, p. 88 (see the various studies quoted).

2. THE LEGAL FRAMEWORK

2.1. The Treaty

2.1.1. The particularities of Euratom in the Treaty framework

Civil nuclear energy is covered by a specific European treaty, the Euratom Treaty, which established the EAEC. In the 1950s, nuclear energy generated extravagant hopes of unlimited electricity, and was seen as the energy source of the future. However, after the Treaty's conclusion, the development of Euratom's activities was brought to a halt by the proximity of civil to defense aspects. For decades, little happened. It was the Chernobyl disaster that provoked a renewal of interest in these activities.[10] More legislative texts were adopted.[11] Euratom acceded to various international conventions. It concluded bilateral agreements. It also began to offer financial and technical support to third states, especially neighbouring ones.

During the long negotiation of the Lisbon Treaty from 2002 onwards, it remained impossible to integrate EAEC activities into the EU Treaty's general framework. Some Member States remained hostile to nuclear energy. Others were favourable, but did not intend to apply the Community method to this sensitive area of activity. In fact, any revision of the Euratom Treaty raised strong doubts.[12] Consequently, these activities remain covered by a specific treaty.[13]

This, of course, can occasionally generate problems linked to the difficulty of defining the precise border between the general EU framework and the specific Euratom one.[14] More generally, the relationship between the EU and Euratom has become more ambiguous since the entry into force of the Lisbon Treaty. In the past, Euratom was one of the communities upon which the EU was founded (Article 3, old Treaty of the European Union or TEU). The EC Treaty could not derogate from the Euratom Treaty (Article 305 § 2, old TEC).[15] These general references have now disappeared. The TEU and the Treaty on the Functioning of the EU (TFEU) do not refer to the Euratom Treaty. Paradoxically, at the same time, the institutional particularities of

---

10 See J. C. Pirotte, *30 ans d'expérience Euratom*, Bruylant, 1998, chap. 5.

11 For a good description, see CEC, *Fifty years of the EURATOM Treaty*, COM (2007) 124.

12 See D. Fouquet, *The Legal Perspective: The Euratom Treaty and the new Constitution, Energy intelligence for Europe*, 2005; N. Prieto Serrano, 'Wakening the serpent: reflection on the possible modification of the Euratom Treaty', 1 *International Nuclear Law* 11 (2006).

13 See P. Barnes, 'The resurrection of the Euratom Treaty', *Yearbook of European Environmental Law*, 2008, pp. 182-217.

14 See R. Ptasekaite, *The Euratom Treaty v. Treaties of the European Union: limits of competence and interaction*, Swedish Radiation Safety Authority, 2012.

15 See T. Cusack, 'A tale of two treaties: an assessment of the Euratom Treaty in relation with the EC Treaty', 40 *Common Market Law Review* 117 (2003).

the Euratom Treaty have been strongly reduced through many direct references to the TEU and TFEU Treaties.[16]

In a vital domain, however, the subsidies granted by Member States to the electricity sector may be assessed according to the present TFEU rather than the EAEC Treaty. This was, for example, the basis of the General Court's (then the Court of First Instance) 2006 judgment regarding a German tax exemption scheme applied to nuclear power plants.[17] In 2013, this topic came back into the spotlight when the Commission opened a formal inquiry regarding the UK subsidies offered to support the new Hinkley Point nuclear power plant.[18]

2.1.2. The specific meaning of Articles 30 to 32, Euratom

The legal basis of the nuclear safety competence of Euratom is set in Articles 30 to 32 of the consolidated version of the Treaty Establishing the European Atomic Energy Community[19] (the Euratom Treaty).

According to Article 30:

> … 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 ionizing 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.

According to Article 31:

> … 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.

16 A. Biondi, P. Eeckhout and S. Ripley, *EU Law after Lisbon*, pp. 58-60.

17 Case T-92/02, Stadtwerke Schwäbisch Hall GmbH, Stadtwerke Tübingen GmbH and Stadtwerke Uelzen GmbH v Commission of the European Communities, ECR 2006, II, 11.

18 http://ec.europa.eu/competition/state_aid/cases/251157/251157_1507977_35_2.pdf (accessed 30 October 2014).
On this aspect of the project, see also S. Thomas and D. Fouquet, *The new UK nuclear power programme – a FIT for nuclear and a blueprint for illegal state aid?,* Greens/EFA EP Group, 2013.

19 OJ EU C 327, 26. 10. 2012, 1-107.

According to Article 32, finally:

> … 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. The Commission shall examine any request made by a Member State.

First of all, it is essential to distinguish nuclear safety from nuclear security. Simply put, nuclear safety concerns the protection of people from power plants, and nuclear security the protection of power plants from people. Thanks to Articles 30 to 32, nuclear safety constitutes a competence of the Euratom, but nuclear security does not. It could, however, be dealt with in the framework of the fight against terrorism, through the framework of police and justice cooperation. As indicated by the European Nuclear Safety Regulators Group (ENSREG), "Nuclear power plants use fissile materials to produce energy in the form of heat, which is converted to electricity by conventional generating plant. Radioactive materials are produced as a by-product of this process. Whilst radioactive materials can have beneficial uses, such as in cancer therapy, they are generally harmful to health. Their use, and the process by which they are produced, must be strictly regulated to ensure nuclear safety. The scope of nuclear safety and its regulation covers the whole 'nuclear fuel cycle'. The nuclear fuel cycle includes the extraction and enrichment of radioactive ores, the production of nuclear fuels, the transport and use of fuel in the operation of nuclear power plants, the reprocessing of spent fuel to recover reusable materials for more fuel, and the storage of nuclear waste. Apart from the management of fuel, nuclear safety particularly covers the design, construction, operation and decommissioning of all nuclear installations such as nuclear power plants and waste storage facilities. Ensuring nuclear safety also requires the availability of suitably qualified staff, the establishment of an effective safety culture in the workforce, the funding of research into operational and safety issues and an appropriate focus on security. The work of nuclear regulators covers all these aspects."[20]

The Euratom competence on nuclear safety has been recognized by an essential judgment of the European Court of Justice. Case C-29/99[21] concerned the approbation by the Council, in accordance with Article 101 of the Euratom Treaty, of the accession to the Convention on Nuclear Safety (CNS).[22] In this framework, the Council was required to communicate to the depositary a full declaration of the EC competences, which was the object of the conflict.

According to the Court, "it is not appropriate, in order to define the Community's competencies, to draw an artificial distinction between the protection of the health

[20] http://www.ensreg.eu/nuclear-safety
[21] See Case C-29/99. Judgement of the Court of 10 December 2002
[22] See IAEA document INFCIRC/449 – Convention on Nuclear Safety – 5 July 1994.

of the general public and the safety of sources of ionising radiation." "Even though the Euratom Treaty does not grant the Community competence to authorise the construction or operation of nuclear installations, under Articles 30 to 32 of the Euratom Treaty the Community possesses legislative competence to establish, for the purpose of health protection, an authorisation system which must be applied by the Member States. Such a legislative act constitutes a measure supplementing the basic standards referred to in that article."

The Court analysed whether the fields covered by the CNS were also covered – at least in part – by the Euratom competences. It then found that Euratom possesses competences in the fields relating to (a) the establishment of a legislative and regulatory framework to govern the safety of nuclear installations; (b) measures relating to the assessment and verification of safety; (c) emergency preparedness; (d) the siting of a nuclear installation; (e) the design, construction and operation of nuclear installations. Those should have been mentioned in the declaration attached to the Council decision approving the EAEC's accession to the CNS.

The existence of this Euratom competence is important, as indicated by another judgment of the European Court of Justice, concerning the Czech power plant at Temelin.[23] In this context, there was a conflict between Austrian courts over the issue of whether a nationality condition could be used to determine the admissibility of a legal action. The Court had to deal with the impact of the absence of any prohibition of nationality discrimination in the Euratom Treaty. It considered that "Article 12 EC, which prohibits any discrimination on grounds of nationality, is a specific expression of the general principle of equality, which itself is one of the fundamental principles of Community law. In the light of the foregoing, it would appear to be contrary to both the purpose and the consistency of the treaties to allow discrimination on grounds of nationality, which is prohibited under the EC Treaty by virtue of Article 12 EC, to be tolerated within the scope of application of the EAEC Treaty." The existence of the Euratom competence concerning the safety of nuclear power plants was invoked in this context to explain the lack of justification for national measures.[24]

[23] Case C-115/08, *Oberösterreich v. ČEZ as*, 2009 E.C.R. I – 10265.

[24] 'In those circumstances, the Court finds that, if a Member State has enacted a domestic provision which, like Paragraph 364a of the ABGB, as interpreted by the national court, prevents an action for an injunction to prevent an actual or potential nuisance from being brought when the alleged nuisance originates from an officially authorised industrial installation, that Member State cannot, in principle, exclude from the scope of application of such a provision authorisations granted in respect of nuclear installations situated in other Member States by maintaining that such an exclusion is justified on grounds of protecting life, public health, the environment or property rights.
Such an exclusion disregards completely the fact that the Community legislative framework, as described in paragraphs 111 to 134 of this judgment and of which such authorisations form a part, contributes precisely and essentially towards ensuring such protection. That exclusion cannot be regarded as necessary for the purposes of protection and therefore cannot be held to satisfy the requirement of proportionality, either.'

2.2. The Nuclear Safety Directive 2009/71/Euratom

2.2.1. The basis of the 1994 IAEA Convention on Nuclear Safety

The fundamental text in the field of nuclear safety remains the IAEA Convention on Nuclear Safety (CNS), signed in 1994 and entered into force into 1996. It aims 'to protect individuals, society and the environment from harm by establishing and maintaining in nuclear installations effective defences against radiological hazards.'[25] The adoption of this treaty was a direct result of the Chernobyl catastrophe. However, even that did not provoke the adoption of mandatory provisions for safety controls. Instead an 'incentive-oriented' approach was preferred. It was considered at the time that "enlightened self-interest of states in matters of nuclear safety would be stronger than any form of outside control devised under international law; this self-interest would be developed and promoted among the contracting parties with nuclear installations, that is the 'peer group'; peer group 'pressure' or 'persuasion' would be effective in compelling the parties to meet their obligations under the convention and as a result improve nuclear safety in all power plants"[26].

It is very important to remember that description, coming from the secretary of the group of experts in charge of the Convention drafting. Firstly, the drama of Fukushima exposed the limits of this philosophy. Secondly, the notion of 'peer group' remains also, as will be seen, at the centre of the EU regime. This deserves special attention, since it is a quite unusual method for the framework of the EU. The Convention also foresees the organization of review conferences (Article 20, CNS) with the simple purpose of 'reviewing the reports.'[27] There have been six triennial conferences, from 1999 onwards, and they have produced many documents, beginning with guidelines concerning the review process and the national reports.[28] Interestingly, the weakness of the CNS control mechanisms has often been debated.[29]

The adhesion of regional organizations was foreseen by the CNS in its Article 30 (4). The EAEC thus acceded to the Convention after Decision 1999/819 of the Commission on the basis of Article 101 of the Euratom Treaty, following a Decision of the Council of 7 December 1998.[30] It has since participated in the Review meetings of the contracting parties. This participation remains, however, limited to Euratom's fields

25 O. Jankowitsch-Prevor, 'The Convention on Nuclear Safety', in *International nuclear law in the post-Chernobyl period*, 2006, p. 159.

26 Ibid.

27 See C. Stoiber, 'The review conference mechanism in nuclear law: issues and opportunities', *Nuclear Law Bulletin* 2009/1.

28 See, for example, the Commission's report for the 6th Review meeting of the Contracting Parties to the Convention on Nuclear Safety (CNS) Vienna, 24 March to 4 April 2014.

29 See O. Jankowitsch, 'The Convention on Nuclear Safety', *Nuclear Law Bulletin*, 1994/2.

30 Commission Decision 1999/819/Euratom of 16 November 1999 concerning the accession to the 1994 Convention on Nuclear Safety by the European Atomic Energy Community (Euratom), OJ L 318, 11.12.1999, p. 20.

of competence. The Convention has also been ratified by all the 28 EU Member States, who are now contracting parties.

The CNS is only the keystone of a complex international system. The new international safety regime … known as the 'Family of Nuclear Safety Conventions' consists of the 1986 Convention on Early Notification of a Nuclear Accident and its twin, the 1986 Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, the 1994 Convention on Nuclear Safety (CNS), the 1997 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (JC), the 1980 Convention on Physical Protection of Nuclear Material (1980 CPPNM)124 and the 2005 Amendment to the Convention on Physical Protection of Nuclear Material (2005 CPPNM). The creation of this 'family' marks an important step in the path toward internationalizing nuclear safety requirements.[31]

After Fukushima, the contracting parties of the IAEA immediately launched an assessment of the events. As indicated by their conclusion at the Second Extraordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety in 2012, 'We must ensure that operators, who have the primary responsibility for safe operation of nuclear power plants, make needed safety improvements to address and draw the lessons learned from the Fukushima Daiichi accident.'

2.2.2. Directive 2009/71/ Euratom

In 2003, the Commission adopted two proposals for Council (Euratom) Directives. The first set out basic obligations and general principles on the safety of nuclear installations, and the second covered the management of spent nuclear fuel and radioactive waste.[32] One essential component was the establishment of common safety standards for existing installations, and a Community body of safety inspectors to control the standards' implementation.

After numerous consultations with the legislative institutions and international organizations (the IAEA and the Nuclear Energy Agency or NEA), it became clear that the national authorities and industries were concerned with these proposals.[33] They were thus amended for the first time in 2004.[34] The debate remained, however,

[31] N. Pelzer, 'Safer nuclear energy through a higher degree of internationalisation? International involvement versus national sovereignty', *Nuclear Law Bulletin*, 2013/1, p. 65. This report provides an excellent analysis of the concept of nuclear safety at the international level.

[32] See proposal for a Council (Euratom) Directive Setting out basic obligations and general principles on the safety of nuclear installations and proposal for a Council Directive (Euratom) on the management of spent nuclear fuel and radioactive waste – COM(2003) 32 final – 2003/0021(CNS) – 2003/0022 (CNS) – 30.1.2003

[33] On the history of this tough legislative procedure, see the excellent comment of Y. Pouleur and P. Krs, 'The momentum of the European Directive on Nuclear Safety', *Nuclear Law Bulletin*, 2010/1, pp. 5-33.

[34] See Amended proposal for a Council (Euratom) Directive Setting out basic obligations and general principles on the safety of nuclear installations and Amended proposal for a Council Directive (Euratom) on the management of spent nuclear fuel and radioactive waste – COM(2004) 526 final – 2003/0021(CNS) – 2003/0022 (CNS) – 8.9.2004

tense, and these revised proposals met various resistances. Consequently, in 2008, the Commission adopted a new proposal for a Council Directive (Euratom) setting up a Community framework for nuclear safety.[35] This proposal was accompanied by an impact assessment.[36] This new text aimed to re-start the process of establishing a common EU framework on nuclear safety, and thus replaced the 2003 proposal.[37]

In 2009, the Council unanimously adopted Directive 2009/71/Euratom, establishing a Community framework for the nuclear safety of nuclear installations[38] (Nuclear Safety Directive). The Nuclear Safety Directive creates a flexible, legally binding framework that defines basic principles and obligations governing nuclear safety. In fact, it chiefly reflects the provisions of the main international instruments on nuclear safety: the Convention on Nuclear Safety of 5 July 1994 and the Safety Fundamentals established by the IAEA.[39] The structure of the Directive is even based on the structure of the Convention. This was meant to distinguish clearly between the objectives and the obligations of the Member States. This, however, has not been fully achieved since there is an 'essential overlap between the scope of application, the definitions and the operational articles.'[40]

Pursuant to Article 1, the Directive defines nuclear safety as the achievement of proper operating conditions, prevention of accidents and mitigation of accident consequences, resulting in protection of workers and the general public from dangers arising from ionizing radiations from nuclear installations. The objectives of the Nuclear Safety Directive are to maintain and promote the improvement of nuclear safety and to ensure that EU Member States provide national arrangements for a high level of nuclear safety, providing protection against dangers arising from nuclear installations.

Article 2 sets the scope of the Directive. This Directive applies to any civilian nuclear installation operating under a licence, and at all stages of this licence. The Directive does not prevent Member States from taking more stringent safety measures. It supplements the basic standards set by Article 30 of the Treaty regarding the nuclear safety of nuclear installations. Several obligations for the Member States are set in the Directive.

---

35 See new proposal for a Council Directive (Euratom) setting up a Community framework for nuclear safety – COM(2008) 790.

36 See SWD *accompanying the document* to the Proposal for a Council Directive (Euratom) setting up a Community framework for nuclear safety – SEC(2008) 2892 – 26.11.2008.

37 The comparison of the first proposal and the Directive 2009/71/Euratom has been made by M. SousaFerro, 'Directive 2009/71/Euratom: the losing battle against discrimination and protection of sovereignty', *International Journal of Nuclear Law*, 2009, Vol. 2, No. 4.

38 OJ EU L 172, 2. 7. 2009, pp. 18-22.

39 See IAEA Safety Standards for protecting people and the environment – *Fundamental Safety Principles* – Safety Fundamentals No. SF-1 – 2006.

40 Y. Pouleur and P. Krs, 'The momentum of the European Directive on Nuclear Safety', *Nuclear Law Bulletin*, 2010/1, p. 15.

Pursuant to Article 4, Member States shall establish and maintain a national legislative, regulatory and organizational framework (hereinafter 'national framework') for nuclear safety establishing the adoption of national nuclear safety requirements, the provision of a system of licensing and prohibiting operation of nuclear installations without a licence. The national framework also sets responsibilities for the provision of a system of nuclear safety supervision, enforcement actions including suspension of operation and modification or revocation of a licence. Member States must guarantee that the national framework is maintained and improved when appropriate.

If standards must be applied, the Directive's authors seemed to believe that they would come from elsewhere. It is useful to build on the process where the national safety authorities of the Member States with nuclear power plants on their territory have been working together in the context of Western European Nuclear Regulators' Association (WENRA), and have defined many safety reference levels for power reactors. (Recital 14).

Article 5 sets the competences of the regulatory authority: Member States shall establish and maintain a competent regulatory authority in the field of nuclear safety of nuclear installations. The competent regulatory authority must work separately from any other body or organization in the field of nuclear energy, including electricity production, and must have effective independence from undue influence in its regulatory decision making. Furthermore, 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 due priority to safety.

Pursuant to Article 6, Member States must ensure that the prime responsibility for nuclear safety of nuclear installations rests with the licence holder, and that this responsibility cannot be delegated. Licence holders, under the supervision of the competent regulatory authority, must regularly assess, verify and continuously improve as far as possible the safety of their nuclear installation, including ensuring that measures are in place for the prevention and mitigation of consequences of accidents. The National framework must require licence holders to establish and implement management systems giving due priority to nuclear safety, which are regularly verified by the competent regulatory authority.

According to Article 7, Member States must guarantee that the national framework requires arrangements for education and training for all parties of their staff who have responsibilities relating to the nuclear safety of nuclear installations. Pursuant to Article 8, Member States must ensure that information in relation to the regulation of nuclear safety is made available for the workers and the general public. This information shall be made available to the public in accordance with national legislation and international obligations.

Finally, according to Article 9, Member States shall submit a report to the Commission on the implementation of the Directive for the first time by 22 July 2014, and every three years thereafter. With the aim of continuously improving nuclear safety, Member States shall arrange for periodic self-assessments of their national framework and competent regulatory authorities at least every ten years, and invite an international peer review of the relevant segments of their national framework and/or authorities. The self-assessment and peer review thus replaced the supranational monitoring in the original 2003 proposal. It is important to realize that self assessements and peer review were not meant to constitute – at least in the view of the text's authors – a real inforcement system: The self-assessments followed by international peer reviews are neither an inspection nor an audit, but a mutual learning mechanism that accepts different approaches to the organisation and practices of a competent regulatory authority, while considering regulatory, technical and policy issues of a Member State that contribute to ensuring a strong nuclear safety regime. The international peer reviews should be regarded as an opportunity to exchange professional experience and to share lessons learned and good practices in an open and cooperative spirit through advice by peers rather than control or judgment (Recital 21).[41]

2.3. The nuclear combustible Directive 2011/70/EURATOM

Following the adoption of the Nuclear Safety Directive, the Commission made a proposal for a Council Directive on the management of spent fuel and radioactive waste.[42] This proposed Directive revised the 2003 Commission proposal for a Council (Euratom) Directive on the management of spent fuel and radioactive waste.[43] After some amendments, the Council adopted Directive 2011/70/EURATOM of 19 July 2011, establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste.[44]

2.4. The Instrument for Nuclear Safety Cooperation (INSC)

In 2007, the Council adopted Regulation (Euratom) 300/2007 establishing an Instrument for Nuclear Safety Cooperation.[45] This Regulation establishes a framework for funding measures to provide a high level of nuclear safety and radiological protection, as well as the implementation of safety controls in Non-EU Member States. This

41 Some authors have rather made a parallel with the open method of coordination, which is nonetheless a quite different process. See A. Sodersten, 'The EU and nuclear safety: challenges old and new', *SIEPS*, 2012/10, p. 8.

42 See proposal for a Council Directive on the management of spent fuel and radioactive waste – COM(2010) 618 final – 2010/0306 (NLE) – 3.11.2010.

43 See COM(2003) 32 final and COM(2004) 526 final.

44 OJ EU L 199, 2.8.2011, pp. 48-56

45 OJ EU L 81, 22.3.2007, pp. 1-10.

framework covers the period from 1 January 2007 to 31 December 2013. For that period, a sum of €524 million is involved. The Regulation provides financial support for measures that, for instance, improve nuclear safety, accident prevention and reaction in case of an accident, and also the promotion of international cooperation.

In 2011, the Commission published a proposal for a Council Regulation establishing an Instrument for Nuclear Safety Cooperation.[46] The legislative procedure is the Instrument for Nuclear Safety Cooperation 2014-2020.[47] A Council Regulation establishing an Instrument for Nuclear Safety Cooperation was published in the *Official Journal of the EU* of 31 July 2012.[48] A Report of the European Parliament concerning this proposal was presented during the European Parliament's plenary sitting of 16 October 2012.[49]

In 2012, the Commission published a Report on the Implementation of the Instrument for Nuclear Safety Cooperation.[50] This Report was accompanied by the Commission Staff Working Document the Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of the Instrument for Nuclear Safety Cooperation – Second Report – Action Programmes for 2010 and 2011.[51]

2.5. The nuclear research programmes

Since 1994, Euratom has established the ability to implement Framework Programmes for nuclear research and training activities that are different to but run parallel with the Framework Programmes for Research and Development under the EC Treaty. Euratom research is currently supported by the 7th Euratom Research Framework Programme (FP7), which covers the period 2007-2011.

The Council Decision 2012/93/Euratom concerning the Framework Programme of the European Atomic Energy Community for nuclear research and training activities (2012 to 2013)[52] extends the budget of the 2007-2001 Euratom Framework

46 See proposal for a Council Regulation establishing an Instrument for Nuclear Safety Cooperation – COM(2011) 841 final – 7.12.2011.
47 See 2011/0414(CNS)
48 OJ EU C 229, 31.7.2012, pp. 103-107.
49 See European Parliament Report on the proposal for a Council Regulation establishing an Instrument for Nuclear Safety Cooperation – A7-0327/2012 – 15.10.2012.
50 See Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of the Instrument for Nuclear Safety Cooperation – Second Report – Action Programmes for 2010 and 2011 – 18.12.2012 – COM (2012) 771 final.
51 SWD *accompanying the document* Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of the Instrument for Nuclear Safety Cooperation – Second Report – Action Programmes for 2010 and 2011 – 18.12.2012 – SWD(2012) 436 final.
52 OJ EU L 47, 18. 2. 2013, pp. 25-32.

Programme, which funds nuclear research, to cover the years 2012 and 2013. About €2.5 billion are available for the period from 2012 to 2013 for research projects in fission and radiation protection, as well as the fusion and nuclear activities of the Joint Research Centre (JRC). The Framework Programme covers two specific programmes. One covers indirect actions such as fusion energy research and nuclear fission, safety and radiation protection. The second covers direct research activities of the Joint Research Centre (JRC).[53]

Regarding the first specific programme covering indirect actions, more than €2.2 billion will be allocated to fusion energy research by developing the knowledge base for, and realizing the International Thermonuclear Experimental Reactor (ITER) as a major step towards the creation of prototype reactors for power stations that are safe, sustainable, environmentally responsible, and economically viable. The construction of ITER is the first priority of the strategy to achieve this long-term goal. ITER is being built in Cadarache, in the South of France. ITER aims to prove the feasibility of fusion power through a full exploration of the relevant science and by allowing the testing of key technology components for future fusion power plants. ITER is the biggest energy research project in the world, and an example of international scientific collaboration. The parties developing ITER are China, the EU, India, Japan, Russia, South Korea and the United States. The agreement for the Joint Implementation of the ITER Project[54] was signed in 2006 in Paris.

Regarding the second specific programme covering direct actions, about €230 million were devoted to the nuclear activities of the JRC, with a high priority given to supporting the implementation of the EU Nuclear Power Plants 'stress test' peer reviews. Research on nuclear power plant decommissioning was also included in the JRC nuclear activities.[55]

In 2013, the Commission presented a Report to the Council Specific Monitoring Report on research activities for nuclear safety and security supported by the Euratom Framework Programme 2012-2013.[56] This report was accompanied by a staff working document.[57] Euratom funding corresponds approximately to 9% of the public and private research and development spending in the EU in this field, with 47% spent by public bodies within the different Member States and 44% funded by industry.

53 Joint Nuclear Research Centre established pursuant Article 8, paragraph 1, of the Euratom Treaty.
54 OJ EU L 358, 16. 12.2006, pp. 62-81
55 See Council Decision 2012/93/Euratom – OJ EU L 47, 18.2.2012, pp. 25-32
56 See Report from the Commission to the Council – Specific Monitoring Report on research activities for nuclear safety and security supported by the Euratom Framework Programme 2012-2013. COM(2013) 308 final – 27.5.2013.
57 See SWD accompanying the Report from the Commission to the Council – Specific Monitoring Report on research activities for nuclear safety and security supported by the Euratom Framework Programme 2012-2013.

3. THE COOPERATION BETWEEN THE EUROPEAN UNION AND THE IAEA

Euratom and the IAEA have developed extensive scientific and technological cooperation over many years. The partnership started in 1973 with the signature of the agreement between the IAEA and Euratom in connection with the Treaty on the Non-Proliferation of Nuclear Weapons.[58] In practice and pursuant to Article 17, paragraph 1 of the TEU, the Commission represents the EU and in this case the Euratom Community on international forums and negotiates bilateral agreements with international organizations or third countries.

In recent years, the cooperation between the IAEA and the EU has grown significantly. The EU and its Member States are major contributors to the activities of the IAEA. The EU cooperates with the IAEA using its financial instruments. The partnership is also based on technical expertise (e.g., the Instrument for Nuclear Safety Cooperation[59]). The cooperation used to be based on non-proliferation and ensuring that all nuclear material is used only for peaceful purposes, but since the Fukushima accident, nuclear safety and nuclear security have a more significant role.

In September 2013, a Memorandum of Understanding (MoU) for a partnership between Euratom and the IAEA on nuclear safety cooperation was signed in Vienna[60] to reinforce the nuclear safety cooperation and to make it more structured. This MoU is based on the 1976 Cooperation Agreement,[61] and the 2008 'Joint Statement.'[62] It creates an enhanced framework for planning various forms of cooperation in the field of nuclear safety. Both organizations will benefit from each other's experience, avoid duplication of effort and contribute to increasing nuclear safety in the world as a whole. This cooperation does not mean that the Commission has a decision-making power in IAEA decisions. As set in the rules of procedure of the General Conference[63] of the IAEA, and pursuant to rule 32: 'Representatives of international organizations, other than the United Nations and the specialized agencies … shall be entitled … to attend sessions of the General Conference and to participate

58 See text of the agreement of 14 September 1973 – IAEA doc INFCIRC/193.

59 The Instrument for Nuclear Safety Cooperation was established by Council Regulation (Euratom) 300/2007 of 19 February 2007 – OJ EU L 81, 22.3.2007, pp. 1-10 – and covered the period between 2007 and 2013

60 See text of the Memorandum of Understanding – http://ec.europa.eu/energy/nuclear/safety/doc/20130917_ec_iaea_mou_nuclear.pdf.

61 OJ EC L 329, 23. 12. 1975, pp. 28-29.

62 See http://www.iaea.org/newscenter/news/pdf/iaea_euratom070508.pdf.

63 The General Conference is the highest policymaking body of the IAEA. It is composed of representatives of all the states in the agency. The General Conference meets annually to consider and approve the Agency's programme and budget and to decide on other matters brought before it by the Board of Governors, the Director General, or member states.

without vote on matters of common interest between them and the Agency.' The EU itself has no formal observer status at the IAEA, while the Euratom Community is an observer.

4. THE EUROPEAN UNION'S REACTION AFTER FUKUSHIMA

A few days after the Fukushima accident, a European response was launched.[64] The European Council, in its conclusion of 24-25 March 2011, declared that:

> the safety of all EU nuclear plants should be reviewed, on the basis of a comprehensive and transparent risk assessment ('stress tests'); the European Nuclear Safety Regulatory Group (ENSREG[65]) and the Commission are invited to develop as soon as possible the scope and modalities of these tests in a coordinated framework in the light of the lessons learned from the accident in Japan and with the full involvement of Member States, making full use of available expertise (notably from the Western European Nuclear Regulators Association (WENRA)[66]; the assessments will be conducted by independent national authorities and through peer review; their outcome and any necessary subsequent measures that will be taken should be shared with the Commission and should be made public; the European Council will assess initial findings by the end of 2011, on the basis of a report from the Commission.[67]

4.1. The process of the stress tests

During their March 2011 plenary meeting, WENRA members decided to agree on an independent regulatory technical definition of a 'stress test', and how it should be applied to nuclear facilities across Europe. In May 2011, the European Commission and ENSREG agreed on voluntary tests for the 143 nuclear power reactors in the EU. The stress tests started 1 June 2011. On 23 June 2011, the Commission, the Republic of Armenia, the Republic of Belarus, the Republic of Croatia, the Russian Federation, the Swiss Confederation, the Republic of Turkey and Ukraine agreed on a joint declaration on comprehensive risk and safety assessments of nuclear plants (stress tests).

The Ad Hoc Group on Nuclear Security (AHGNS) was created on 21 July 2011 on the basis of a Coreper decision and a mandate.[68] The AHGNS aims to identify and share

---

64 For a good synthesis of the situation in Fukushima three years on, see M. Schneider and A. Froggatt, *The world nuclear industry status report 2014,* SES/H. Boll Foundation, 2014, pp. 59-72.

65 ENSREG Commission Decision 2007/530/Euratom of 10 July 2007 on establishing the European High Level Group on Nuclear Safety and Waste Management. OJ EU L 195, 27.7.2007, pp. 44-46

66 WENRA is an association of the heads of nuclear regulatory authorities for EU countries with nuclear power plants and Switzerland.

67 See European Council document EUCO 10/1/11 REV 1 – Conclusions of the European Council (24/25 March 2011) – 20.4.2011.

68 Council document No 13111/11 + ADD 1. See also, Council Document 10616/12, 31.05.2012 – *Final report of the AHGNS as agreed on 24 May* – p. 4.

good practices and consider possible ways to improve general security principles based on the nuclear security recommendations of the IAEA.

In November 2011, the Commission adopted a Communication on the interim report on the stress tests for nuclear power plants in the EU.[69] This communication was accompanied by a Commission Staff Working Paper, Technical Summary of the national progress reports on the implementation of comprehensive risk and safety assessments of the EU nuclear power plants.[70]

During the next three months, the Commission organized a Public Consultation seeking the views of stakeholders and other interested parties on the need for additional nuclear safety legislative measures at Euratom level. As a result of this Public Consultation, more than 90% of respondents agreed on the importance of a Euratom nuclear safety framework, setting up common rules for EU Member States, while more than 75% agreed on the need to reinforce the existing safety legislative framework.

In April 2012, the ENSREG stress-test report based on a peer review was adopted.[71] The ENSREG overall report highlights four main areas for improvement, to be explored across Europe: (1) Issuing WENRA guidance with the contribution of the best available expertise from Europe on assessment of natural hazards, including earthquake, flooding and extreme weather conditions, and margins taking account of the existing IAEA guidelines; (2) Underlining the importance of periodic safety review; (3) Urgently implementing the recognized measures to protect containment integrity, and (4) Minimizing accidents resulting from natural hazards and limiting their consequences.

The conclusions of the report are not easy to assess. Firstly, the designs of the nuclear power plants (NPPs) are very different from one country to another. Consequently, the evaluation of the global safety level is difficult. Making recommendations is still more difficult. As the report rightly underlines, plant designers and operators had multiple choices and have chosen the solutions that are often specific to the design or specific site. Therefore different safety features are available to cope with similar scenarios. The strong safety features for one plant would not therefore necessarily be a similarly 'strong' safety feature when transferred to another plant. The selection of features is ultimately specific to the plant/design and site and the advantages and drawbacks have to be carefully considered before any transfer.[72]

---

69 See communication from the Commission to the Council and the European Parliament on the interim report on the comprehensive risk and safety assessments ('stress tests') of nuclear power plants in the EU, – COM(2011) 784 final – 24.11.2011.

70 See Commission Staff Working Paper – Technical Summary of the national progress reports on the implementation of comprehensive risk and safety assessments of the EU nuclear power plants – SEC(2011) 1395 final – 24.11.2011

71 http://www.ensreg.eu/sites/default/files/EU%20Stress%20Test%20Peer%20Review%20Final%20Report_0.pdf (accessed 29 June 2013).

72 Ibid., p. 28.

Secondly, this is a peer review, meaning each national regulator is dependent on the others' appreciation and knows it very well. Some sentences are thus a perfect illustration of bureaucratic carefulness. For example, 'The review process determined that ***in most cases*** the design is robust, with strong safety features,'[73] (authors' emphasis). The conclusion is, from this point of view, a work of art:

> With regard to the external hazards topic, ***overall*** the design basis events were well addressed in country reports. ***Most*** countries have demonstrated an adequate approach to seismic and flooding design bases, although there were significant differences in national approaches. However, the assessment of margins beyond design basis has been ***quite diverse***, and ***very few*** countries assessed cliff-edges in the manner requested by ENSREG. This is possibly because of the short timeframe and the lack of a consistently recognised method in this area. Many regulators also indicated that work in this respect is either ongoing or planned in the near future. The situation is ***even less satisfactory*** with regard to extreme weather, and especially for combinations of extreme weather phenomena.[74] (emphasis added).

The consecutive report from the Commission also provokes unease. Commenting on the findings concerning safety, the Commission first emphasizes that:

> based on the stress tests, national regulators concluded that there are no technical reasons requiring the shutdown of any NPP in Europe, and identified a series of good practices. The Commission is not empowered to make assessments of this nature. However, practically all NPPs need to undergo safety improvements, as hundreds of technical upgrade measures have been identified.

It then mentions a striking inertia: 'following the accidents at Three Mile Island and Chernobyl, measures to protect nuclear plants were globally agreed. The stress tests demonstrated however that in many instances the implementation of those measures is still pending.'[75]

After that, the Commission provides some concrete findings in a less reassuring style than ENSREG:

> In 4 reactors (located in two different countries), there is less than 1 hour available to operators to restore the safety functions in case of loss of all electrical power and/or ultimate heat sink. In 10 reactors, on-site seismic instrumentation is not installed yet. 4 countries currently operate additional safety systems fully independent from the normal safety systems, located in areas

[73] Ibid., p. 33.
[74] Ibid., p. 45.
[75] See COM (2012) 571 final, p. 6.

well protected against external events (e.g., bunkered systems or hardened core of safety systems). A fifth country is considering this option. Mobile equipment, especially diesel generators needed in case of total loss of power, external events or severe accident situations, are already available in 7 countries, and will be installed in most of the others.

In April 2012, the Commission and ENSREG agreed to examine some safety aspects in more detail and prepare a follow-up for the following months.[76] The follow-up activities took place through an Action Plan of the ENSREG that was adopted on 1 August 2012, ensuring that the recommendations and suggestions from the stress-test peer reviews would be addressed by national regulators and ENSREG in a consistent manner. On 10 May 2012, the Commission presented an EAEC Report which considered the main topics arising after the Fukushima accident.[77]

In October 2012, the Commission released the results of the stress tests in a Communication on the comprehensive risk and safety assessments ('stress tests') of nuclear power plants in the EU and related activities.[78] This communication was accompanied by a Commission Staff Working Document: 'Technical Summary on the implementation of comprehensive risk and safety assessments of nuclear power plants in the EU.'[79]

In November 2012, the European Parliament presented a Draft Motion for a Resolution on risk and safety assessments ('stress tests') of nuclear power plants in the EU and related activities.[80] No fewer than 161 amendments related to this four-page Draft Motion for a Resolution were proposed on 3 December 2012.[81] In March 2013, the European Parliament Resolution on risk and safety assessments ('stress tests') of nuclear power plants in the EU and related activities[82] was adopted after a single reading. [83]

4.2. The results of the stress tests

The stress tests have confirmed that there are not only still differences between the EU Member States in ensuring comprehensive and transparent identification and management of key safety issues, but also significant gaps. Strengthened Euratom

76 See Joint statement of the European Nuclear Safety Regulators Group (ENSREG) and the European Commission.

77 See European Atomic Energy Community Report – Second Convention on Nuclear Safety (CNS) Extraordinary Meeting – Vienna, 27-31 August 2012 – C(2012) 3196 final – 10.5.2012.

78 See communication on the comprehensive risk and safety assessments ('stress tests') of nuclear power plants in the EU and related activities, 4.10.2012 – COM(2012) 571 final.

79 See SWD Technical Summary on the implementation of comprehensive risk and safety assessments of nuclear power plants in the EU – SWD(2012) 287 final – 4.10.2012.

80 See European Parliament document PE497.899v01-00, 6.11.2012.

81 See European Parliament document PE500.594v01-00, 3.12.2012.

82 See European Parliament document T7-0089/2013, 14.3.2013.

83 See European Parliament document B7-0086/2013, 5.3.2013.

legislation could include a set of technical provisions at an appropriate level of detail for a framework legal instrument. These provisions should ensure a common EU approach to nuclear safety.[84]

The most striking conclusion appears, paradoxically, in an assessment report issued by the Commission concerning the new draft Nuclear Safety Directive. It reflects the incredible persistence of essential and highly dangerous problems:

> Although triggered by an earthquake and tsunami of an immense magnitude, investigations of the causes of the accident reveal a range of foreseeable factors which combined to produce a catastrophic outcome. The analysis of the Fukushima accident reveals quite substantial, and recurring technical issues as well as persistent institutional failures similar to the ones from the post-accident evaluations of the Three Mile Island and Chernobyl nuclear accidents decades ago.[85]

This throws quite a harsh light on the extent of the present challenge.

In term of cost, significant gains in safety at least for some NPPs in some Member States would cost around €200 million per reactor unit following the stress test reports. For all the 132 operating reactors in 14 EU Member States, this means a total of approximately €26 billion. According to an OECD/NEA Study on the Economics of Long Term Operation of NPPS published in 2012, some European countries reported an estimated additional post-Fukushima investment cost increase of around 10% for long-term operation investments for the next 15 years.[86]

This must be integrated into a more general rise in nuclear costs. Construction costs are a key determinant of the final nuclear electricity generating costs and many projects are significantly over budget. Investment cost estimates have increased in the past decade or so from US$1,000 to around US$8,000 per installed kilowatt. … In some countries (including France, Germany, the US and Sweden), historically low inflation-adjusted operating costs – especially for major repairs – have escalated so rapidly that the average reactor's operating cost is barely below, or even exceeds, the normal band of wholesale power prices.[87]

---

84 See SWD Executive Summary of the Impact Assessment *accompanying the document* Proposal for a Council Directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations – SWD(2013) 200 final – 13.6.2013, p. 4.

85 SWD (2013) 422, p. 3.

86 OECD/NEA, 2012, Study on the Economics of Long Term Operation of NPPs, A. Lokhov, R. Cameron, IAEA-CN-194-005.

87 M. Schneider and A. Froggatt, *The world nuclear industry status report 2014*, SES/H. Boll Foundation, 2014, p. 8.
A very interesting analysis about the costs of the nuclear power sector was launched in 2012 by the French Court of Auditors, and updated in 2014: http://www.ccomptes.fr/Presse/Communiques-de-presse/Les-couts-de-la-filiere-electro-nucleaire.

The distribution of this additional cost, ranged across the different NPPs in the different Member States, can only be assessed on the basis of the National Action Plans, which will describe the implementation of the recommendations from the stress-tests peer review process at national level, and which were due to be submitted to the Commission by the end of 2012 (to be peer reviewed in early 2013). However, the stress-test peer reviews showed that (1) improvement measures are required at all NPP sites; (2) for many reactor units only relatively minor improvement measures need to be implemented; and (3) more substantial effort is required for the implementation of the available solutions and for development in only a handful of cases.[88]

4.3. The parallel security review

After the European Council of March 2011, on a parallel path, an Ad Hoc Group on Nuclear security was also established to make the security review. The group was meant to deal 'with security of the nuclear power plants in EU in relation to theft, sabotage, unauthorised access, unauthorised movement of nuclear material or other malicious act.' So, safety and security followed two different institutional paths, and security was deemed to fall exclusively under the competence of the Member States.[89]

The group's report was presented to the Council on 31 May 2012.[90] Simply put, the group did not concentrate on specific Member States or situations, but on methods for evaluating, taking preventive measures and protecting NPPs. Its main goal was to identify and share good practices and consider possible ways to improve the general security principles based on the nuclear security recommendations of the IAEA. The report identified 32 good practices (set out in the report's Annex I). They can be grouped into two broad categories: those which relate to the national legal and regulatory framework, and those which relate to the implementation and maintenance of a nuclear security regime.[91]

88 See SWD Impact assessment *accompanying the document* Proposal for a Council Directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations – SWD(2013) 199 final (part 1/2) – 13.6.2013, p. 35.

89 This approach deserves to be noted, considering that general security problems are also covered by the EU Treaty, in the framework of police and justice cooperation. For example, the group covered 'the threat of nuclear terrorism.' As a matter of fact, 'the fight against terrorism' has been defined as one of the objectives of the EU internal security initiatives (Art. 74 TFEU).

90 Doc. 10616/12/AHGNS 20.

91 For a detailed description, see I. Anthony, 'The role of the EU in strengthening nuclear security', *Non Proliferation Papers* 32, 2013.

5. THE 2014/87/EURATOM DIRECTIVE ON THE SAFETY OF NUCLEAR INSTALLATIONS

5.1. The 2013 proposal

In June 2013, the Commission presented a Draft Proposal for a Council Directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations.[92] This draft proposal was accompanied by three Staff Working Documents.[93]

The proposed amendments aimed to enhance the regulatory framework for nuclear safety in the EU, in particular by

- strengthening the role and effective independence of the national regulatory authorities;
- enhancing transparency on nuclear safety matters;
- strengthening principles, and introducing new general nuclear safety objectives and requirements, addressing specific technical issues across the entire life cycle of nuclear installations, particularly NPPs;
- reinforcing monitoring and exchange of experiences, by establishing a European system of peer reviews; and
- establishing a mechanism for developing EU-wide harmonized nuclear safety guidelines.

As stated in Article 31 of the Euratom Treaty, the Commission consulted the European Economic and Social Committee (EESC) to obtain its opinion on the draft proposal. The EESC positively welcomed the proposed amendments to the Nuclear Safety Directive, and its opinion was adopted during its 492nd plenary session in September 2013.[94]

In 2013, the Commission adopted a proposal for a Council Directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations.[95] This proposal was accompanied by four Staff Working Documents.[96] One of these staff working documents is a study called Ex-ante evalu-

---

92 See European Commission Draft Proposal for a Council Directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations – COM(2013) 343 final – 13.6.2013.

93 See SWDs *accompanying the document* Draft Proposal for a Council Directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations – SWD(2013) 199 final, SWD(2013) 200 final and SWD(2013) 201 final – 13.6.2013.

94 See EESC document TEN/529 – Revision of the nuclear safety directive – 18 September 2013 – http://www.eesc.europa.eu/?i=portal.en.ten-opinions&itemCode=29108.

95 See Proposal for a Council Directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations – COM(2013) 715 final – 17.10.2013.

96 See SWDs *accompanying the document* Proposal for a Council Directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations – SWD(2013) 422 final, SWD(2013) 423 final, SWD(2013) 424 final and SWD(2013) 425 final – 17.10.2013.

ation of competitiveness impacts of the Commission's policy proposal on the revision of the European Atomic Energy Community (Euratom) nuclear safety legislative framework.

This proposal provoked several rounds of examination by the Working Party on Atomic Questions (WPAQ).[97] In April 2014, the Parliament adopted, within the framework of a special legislative procedure (consultation of Parliament), a legislative resolution on the proposal for a Council directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations.[98]

5.2. The final text adopted by the Council

In July 2014, Directive 2014/87 Euratom was adopted by the Council.[99] It establishes an EU system of peer review which will be enacted every six years from 2017 onwards. The new text also encourages cooperation, coordination and information exchanges between the safety authorities of neighbouring Member States located near any plant where an accident takes place. At least once every ten years, Member States must organize a regular self-assessment of their national framework and competent regulatory authorities, and they must request an international peer review of the relevant segments of their national framework and competent regulatory authorities. Member States, except those without nuclear installations, must guarantee that the national framework requires on-site emergency and preparedness and response arrangements, and that there is consistency and continuity between those arrangements set by the national framework and those required under Directive 2013/59/EURATOM.[100] Member States have to transmit a report to the Commission on the implementation of the Directive 2009/71 by 22 July 2014, and must transmit another one by 22 July 2020. This Directive's provisions must be transposed into national law within three years.

To strengthen the role and effective independence of the national regulatory authorities, Member States must establish a national framework which provides for 'the allocation of responsibilities and coordination between relevant state bodies' (Article 4, paragraph 1 (a)), and 'for a system of regulatory control of nuclear safety performed by the competent regulatory authority' (Article 4, paragraph 1 (d)). Member States must establish and maintain a competent regulatory authority in the

97 The WPAQ forms part of EU cooperation within the areas of nuclear radiation and radiation protection, and handles all legal and technical initiatives within the nuclear field. This committee is comprised of highly specialist experts on atomic safety issues from the 28 Member States.

98 See P7_TA(2014)0274.

99 OJ EU L 219, 25.7.2014, pp. 42-52.
See the consolidated version of Directive 2009/71: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02009L0071-20140814&qid=1419259323368&from=EN.

100 OJ EU L 13, 17.1.2014, pp. 1-73.

field of nuclear safety of nuclear installations (Article 5, paragraph 1). They should also 'ensure the effective independence from undue influence of the competent regulatory authority in its regulatory decision making.' Therefore, the national framework must require that the competent regulatory authority a) is functionally separate from any other body or organization concerned with the promotion or utilization of nuclear energy; b) takes regulatory decisions; c) is given dedicated and appropriate budget allocations to allow the delivery of its regulatory tasks; d) employs an appropriate number of staff with qualifications, experience and expertise necessary to fulfil its obligations; e) establishes procedures for the prevention and resolution of any conflicts of interest; and f) provides nuclear safety-related information without clearance from any other body or organization (Article 5, paragraph 2).

Member States should also guarantee that 'the competent regulatory authority is given the legal powers necessary to fulfil its obligations in connection with the national framework.' Therefore the national framework must entrust the competent regulatory authority with the chief regulatory tasks, namely a) proposing, defining or participating in the definition of national nuclear safety requirements; b) requiring that the licence holder complies and demonstrates compliance with national nuclear safety requirements and the terms of the relevant licence; c) verifying the compliance through regulatory assessments and inspections; and d) proposing or carrying out effective and proportionate actions (Article 5, paragraph 3).

To enhance transparency on nuclear safety matters, Member States must guarantee that 'necessary information in relation to nuclear safety of nuclear installations and its regulation is made available to workers and the general public, with specific consideration to local authorities, population and stakeholders in the vicinity of a nuclear installation,' including 'information on normal operating conditions of nuclear installations' and 'prompt information in case of incidents and accidents' for workers and the general public. Furthermore, prompt information concerning incidents or accidents must be provided to the competent regulatory authorities of other Member States in the vicinity of the nuclear installations concerned (Article 8, paragraph 1). The scope of national restrictions has thus been somewhat reduced.

To strengthen principles, and introduce new general nuclear safety objectives and requirements, address specific technical issues across the entire life cycle of nuclear installations and in particular NPPs, the national framework will provide national nuclear safety requirements covering all stages of the life cycle of nuclear installations. The national framework should also provide a system of licensing and prohibition of operations of nuclear installations without a licence (Article 4, paragraph 1 (b) and (c)). Member States have to ensure that the national framework is maintained and improved when appropriate (Article 4, paragraph 2). The national framework must require that 'the prime responsibility for the nuclear safety of a

nuclear installation rests with the licence holder' – a responsibility that cannot be delegated. The applicant, 'when applying for a licence, is required to submit a demonstration of nuclear safety.' Licence holders must 'regularly assess, verify and continuously improve' the nuclear safety of their nuclear installation. Measures must be in place for 'the prevention of accidents and mitigation of the consequences of accidents.' License holders must 'establish and implement management systems which give due priority to nuclear safety', provide for 'appropriate on-site emergency procedures and arrangements' – including severe accidents management – provide for and maintain 'financial and human resources with appropriate qualifications and competences, necessary to fulfil their obligations with respect to the nuclear safety of a nuclear installation' (Article 6). In order to obtain, maintain and further develop expertise and skills in nuclear safety and on-site emergency preparedness, all parties are required to 'make arrangements for education and training' for staff who have responsibilities relating to the nuclear safety of the nuclear installation (Article 7).

Article 8a sets nuclear safety objectives for nuclear installations and states that Member States must guarantee that the national framework requires that existing nuclear installations and nuclear installations for which a construction licence is granted for the first time are 'designed, sited, constructed, commissioned, operated and decommissioned' with the objective of preventing and mitigating the consequences of accidents. To implement these objectives, where defence-in-depth applies, the national framework must be applied to ensure a minimization of the impact of extreme natural and unintended man-made hazards, to prevent abnormal operations and failures, to control abnormal operation and detect failures, to control accidents within the design basis, to control severe conditions. Also, to achieve the nuclear safety objectives, the national framework must require that the competent regulatory authority and the licence holder 'take measures to promote and enhance an effective nuclear safety culture' (Article 8b). Member States should also guarantee that the national framework requires that any grant of a licence to construct a new nuclear installation or operate an existing nuclear installation, 'is based upon an appropriate site- and installation-specific assessment, comprising a nuclear safety demonstration,' and that the licence holder, 'under the regulatory control of the competent regulatory authority,' reassesses at least every ten years, the safety of the nuclear installation (Article 8c). The national framework structure for on-site emergency preparedness and response must be 'established with a clear allocation of responsibilities and coordination between the licence holder' and competent authorities or organizations, 'taking into account all phases of an emergency' (Article 8d, paragraph 1).

To reinforce monitoring and exchange of experiences by establishing a European system of peer reviews, with the aim of continuously improving nuclear safety, Member States 'shall, at least every ten years, arrange for periodic self-assessments of their national framework and competent regulatory authorities and invite an

international peer review' (Article 8e). The outcomes of these peer reviews must be reported to the other Member States and to the Commission. Member States must ensure that a national assessment related to nuclear safety of the relevant nuclear installation on their territory is performed, that 'all other Member States, and the Commission as observer, are invited to peer review' that national assessment, that 'appropriate follow-up measures are taken of relevant findings' resulting from the peer reviews, and that relevant reports are published when results are available. Topical peer reviews must take place at least every six years starting in 2017. In case of an accident leading to a situation that requires off-site emergency measures, the Member State concerned must guarantee that 'an international peer review is invited without undue delay.'

To establish a mechanism for developing EU-wide harmonized nuclear safety guidelines, Member States will ensure that the competent regulatory authorities exchange or share information on the nuclear safety of nuclear installations with the competent regulatory authorities of other Member States in the vicinity of those nuclear installations (Article 8, paragraph 3).

CONCLUSIONS

The Fukushima catastrophe has had a major effect on the future of nuclear energy everywhere, and especially in Europe. An important, and additional element is that, unlike the Three Mile Island and Chernobyl plants, the Japanese plant continues to leak irradiated components nearly four years after the tsunami.

Japan's economic fate since 2011 can be seen as a cautionary tale. The instantaneous removal of nuclear energy from its power supply system has been expensive. The trade balance has swung aggressively from surplus to deficit, and this remains a persistent problem. Obviously, the relaunch of the post-financial-crash Japanese economy has suffered from this. Consequently, the Abe government has tried to reopen some nuclear power plants. Local populations, however, tend to see things differently. Despite this, it is interesting to note that a gubernatorial election in March 2014 covering this question fell to the pro-nuclear partisans.

This new crisis has in any case provoked a welcome reappraisal of the requirements of nuclear safety in Europe. There is a strong parallel between the work of the IAEA and the EU. In the context of the development of international nuclear law, what is noted is probably no different to other fields of law, in that while progressive developments may take place, the majority of such developments have occurred in response to an initiating event such as the 1986 Chernobyl accident, or the tragic events on 11 September 2011 in the United States with its implications for nuclear security. In a similar way, the Fukushima Daiichi accident is playing an important catalytic role in the further development of international nuclear law.[101]

In a nutshell, the adoption of Directive 2009/71/EURATOM had provoked a lot of resistance (which explains the exceptional length of an unusually simple legislative procedure). Important restrictions had been introduced, but the new Directive 2014/87/EURATOM has abandoned some of them. It has also tried to take into consideration the main lessons of the catastrophe. In so doing, it has slightly enhanced the safety principles (without establishing standards), increased the national regulators' independence, strengthened transparency, and improved the control processes. Euratom, however, remains a specific legal area where the role of Parliament and Commission is weaker, competences are more narrowly interpreted, and the synergy between European and international authorities continues to be complex.

[101] P. L. Johnson, 'The post-Fukushima Daiichi response: The role of the Convention on Nuclear Safety in strengthening the legal framework for nuclear safety', *Nuclear Law Bulletin*, 2013/1, p. 16.