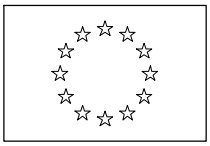

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**COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT**

**on the comprehensive risk and safety assessments ("stress tests") of nuclear power plants in the European Union**

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## 1. INTRODUCTION

There are currently 134 nuclear reactors in operation in the EU, grouped on 68 sites. EU citizens must therefore be confident that Europe's nuclear industry is safe. This requires continuous improvements of the EU nuclear safety and security framework making it the most effective in the world, based on the highest safety standards.

The challenges which nuclear safety and its governance face were highlighted in the accident at the Fukushima reactors in Japan following the earthquake and the tsunami in March 2011. This event demonstrated that nuclear reactors must be protected even against accidents which have been assessed as highly improbable. Events at Fukushima revealed well-known and recurring issues: *faulty design, insufficient backup systems, human error, inadequate contingency plans,* and *poor communications*. The EU must learn the lessons of Fukushima to further reduce the risk of nuclear incidents in Europe.

The Fukushima accident resulted in unprecedented efforts to review the safety of nuclear installations in Europe and worldwide. Initiatives were taken at national, regional and international level.

In the EU, the European Council, in March 2011[1] concluded 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"); the European Nuclear Safety Regulatory Group (ENSREG) 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 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); 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 within the ENSREG and should be made public." In addition, the European Council asked the Commission to invite EU neighbouring countries to take part in the stress test process, to "review the existing legal and regulatory framework for the safety of nuclear installations" and to "propose by the end of 2011 any improvements that may be necessary".

This Communication presents the response to the European Council's mandate and highlights the Commission's conclusions and recommendations based on the stress tests. It also considers the international dimension of nuclear safety and security and outlines how the nuclear safety framework in the EU can be improved, underlining the dynamic nature of nuclear safety: enhancing nuclear safety is not a one off exercise, it must be continually reviewed and updated. Above all, it brings together all the strands of the review exercise with a view to developing legislative, non-

[1] EUCO 10/11 (paragraph 31).

legislative and project proposals. All these measures seek to improve the safety of the plants and related governance at EU and national level, and to promotee EU values for nuclear safety and security in the international context.

Details on the technical findings and the stress test methodology are presented in the accompanying Commission Staff Working Document.

## 2. THE PROCESS, KEY FINDINGS AND IMMEDIATE FOLLOW-UP TO THE RISK AND SAFETY ASSESSMENTS

### 2.1. An unprecedented review of nuclear safety and security

In response to the Fukushima accident and the subsequent mandate given by the European Council to the Commission, many layers of activities ran in parallel. These are presented briefly below:

- The safety assessments lead by ENSREG

All fourteen EU Member States that operate nuclear power plants[2] plus Lithuania[3] participated in these assessments on a voluntary basis. The 134 nuclear reactors in operation in the EU are based on different technologies and types, but are mainly Pressurised Water Reactors (PWR), Boiling Water Reactors (BWR) or gas cooled reactors. Peer review teams mainly composed of experts from the Member States visited 24 sites out of the total of 68, taking into account the type of reactor as well as the geographical location. Teams visits to selected sites in each country were organized in order to firm up the implementation of the stress tests, without encroaching on the responsibilities of national authorities in the area of nuclear safety inspections, which organised inspections of each operating nuclear power plant (NPP) in the EU after the Fukushima accident. Information on each NPP can be found in the accompanying Commission Staff Working Document as well as its references to information made available by plant operators, the national regulators or ENSREG as a whole (see also table in annex).

Following the presentation of the Commission Interim Report[4], an extensive EU wide peer review process was carried out from January to April 2012. It produced an overview report by the ENSREG Peer Review Board, endorsed by ENSREG, and seventeen individual national reports[5] with detailed recommendations. In July, ENSREG agreed on an Action Plan to follow up the implementation of the peer review recommendations.

- Work on nuclear security by the Council (Ad Hoc Group on Nuclear Security, AHGNS)

In order to deal with matters related to the security of nuclear power plants, a new *ad hoc* group was set up in the Council. The group met regularly since September 2011, chaired by the Polish and Danish Presidencies. It comprised security experts from the

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2 Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Netherlands, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom.

3 Where the Ignalina NPP is being decommissioned.

4 COM 784 final, 24.11.2011.

5 14 Member States operating nuclear power plants (Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Netherlands, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom), Lithuania (where the Ignalina units are being decommissioned under operating licenses) and Switzerland and Ukraine as EU neighbouring countries.

Member States with the Commission closely associated. In contrast to the ENSREG safety assessments, the AHGNS did not look at individual installations but assessed the state of nuclear security in the EU as a whole, by looking at methodology for the evaluation and protection of nuclear power plants including preventive measures.

The AHGNS encouraged the exchange of existing practices and identified possible methodological improvements, making mainly use of good practices in the existing International Atomic Energy Agency (IAEA) guidance. It concluded its work in May 2012.

- Involvement of EU neighbouring countries in the process

Switzerland, Ukraine and Croatia participated fully in the EU stress tests and the peer review process, while other neighbouring countries (e.g. Turkey[6], Belarus and Armenia[7]) that agreed to work on the basis of the same methodology, are working within different timetables. The Russian Federation also carried out re-assessments and identified improvement measures at its NPPs, using its own methodology . Switzerland is fully committed to follow up the recommendations of the stress tests, while Ukraine has included the stress tests finding in the modernisation programme of its nuclear power plants. The Commission appreciates these efforts to converge with the EU's approach in this field.

- Commission assessment of the institutional and legal framework

Beyond the review of the safety of the plants, the Commission has assessed the institutional architecture and legal framework for nuclear safety in Europe, taking into account the IAEA Action Plan[8] and the outcome of international discussions on the Convention on Nuclear Safety. It has identified gaps and best practices that can be addressed or included within EU legislation, extended collaboration among Member States or in the implementation of existing EU programmes.

- Effects of airplane crashes

Events that could affect both the safety and the security of nuclear power plants, like aircraft crashes, have been considered within this review exercise. The effects of airplane crashes on the safety of nuclear power plants are covered in the ENSREG stress tests specification. On security, the AHGNS report identifies good practices to be followed by Member States on the prevention of malevolent aircraft crashes.

The Commission has organised a seminar *"Safety of Nuclear Power Plants against Aircraft Impacts"* on 25 September 2012 aimed at upgrading plant safety and exploring alternative protection methods. Participation included Member States safety regulatory authorities as well as contributions from USA and Japanese experts. Invited experts considered the characteristics of existing plants and new designs separately.

- Off-site emergency preparedness

During the peer review phase of the safety stress tests some NGOs requested to extend the scope of the stress tests to off-site emergency preparedness. In the EU, 47 nuclear power plants with 111 reactors have more than 100 000 inhabitants living

6 Stress test report submitted to the Commission in May 2012.

7 Financial and technical assistance from the EU Instrument for Nuclear Safety Cooperation. A report is expected by early 2013.

8 http://www.iaea.org/newscenter/focus/actionplan/reports/actionplanns130911.pdf

within a circle of 30 km. This demonstrates that off site preventive measures are of primary importance. The responsibility for such measures is shared by several national, regional and local authorities. The Commission, with ENSREG support, is launching a study aiming at drawing a picture of current arrangements, focussing on cross border regions in the EU and at making recommendations as necessary. Results are expected by the end of 2013.

- Cooperation in the framework of international organisations

The Contracting Parties to the Convention on Nuclear Safety held an Extraordinary Meeting in August 2012 to review its effectiveness and continued suitability. The Commission prepared a report on behalf of the Euratom Community[9] and has been mandated by the Council to negotiate improvements to the Convention as well as amendment proposals tabled by other Contracting Parties.

## 2.2. Findings from the safety assessments and from the institutional and legal review

The findings are described in detail in the Commission Staff Working Document accompanying this Communication. Key considerations for each topic are summarised in the following paragraphs.

### *2.2.1. Findings on safety measures in existing NPPs*

On the basis of the stress test results practically all NPPs need to undergo safety improvements, as hundreds of technical upgrade measures have been identified. Following the accidents at Three Mile Island and Chernobyl, measures to protect nuclear plants were globally agreed. The stress tests demonstrated that even today, decades later, the implementation of those measures is still pending in some Member States.

Table 1 provides an overview of the findings and the sites visited by the peer review teams, with additional details in the Staff Working Document.

**Examples of significant findings:**

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 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.

[ *Further text will be added here to take into account the findings on safety in the case of airplane crashes, following the seminar organised by the Commission that will take place on 25 September* ]

[9] C(2012) 3196 final, 10.5.2012.

*2.2.2. Findings on safety procedures and frameworks*

The stress tests highlighted best practices as well as shortcomings in Member States. These are detailed in the Staff Working Document. The following key issues have emerged from the stress tests and from other reports on the Fukushima investigations[10]:

- **There is a lack of consistency with respect to assessing and managing external hazards to plant safety.** For example, the International Atomic Energy Agency guidance for seismic loads or the guidelines for flooding are not implemented by all Member States (first ENSREG peer review Board recommendation, see 2.3.2.).
- **The scope and depth of the Probabilistic Safety Assessment** (PSA) used to characterise the safety of nuclear reactors differ significantly and in some Member States there is an urgent need to bring them up to accepted international standards.
- **Severe Accident Management Guidelines** (SAMG's) covering all types of situations have to be available in all NPPs. The stress tests have shown that SAMG's need to be updated and fully implemented as soon as possible in a number of Member States.
- **Improvements in safety culture are needed**. There are **gaps in ensuring comprehensive and transparent identification and management of key safety issues.** A glaring lesson from Fukushima is that the tsunami hazard was underestimated, mostly due to human, systemic and organisational factors.

*2.2.3. **Findings on the legal framework for safety and its implementation***

A number of weaknesses in the existing nuclear safety framework at the European and the Member States level have been identified.

- The key finding relates to **continuing differences between Member States resulting in the absence of a consistent approach to nuclear safety regulation.** There are no codified EU mechanisms to agree on technical standards and ways to conduct safety reviews. The Nuclear Safety Directive does not have any provisions to this end.
- The provisions covering **the independence of the national regulatory authorities and the means to ensure their effectiveness** are minimal and not necessarily sufficient for preventing situations where the regulatory responsibility is split between several entities or is included directly in Ministries (Economy, Environment, etc.). Moreover, the existing catalogue of regulatory competencies is not sufficiently explicit.
- **Transparency** is essential in ensuring that the best possible safety practices are used, as shown by the stress tests. However, the Nuclear Safety Directive contains only generic requirements on public information.
- The **monitoring and verification mechanisms at EU level** are limited to the peer review of the national nuclear safety framework (see point 3.2.4).

[10] "Investigation Committee on the Accident at Fukushima Nuclear Power Stations of Tokyo Electric Power Company", final report July 2012 (http://icanps. go.jp/) and "The Fukushima Nuclear Accident Independent Investigation Commission", final report July 2012 (http://www.naiic.jp/en/2012/)

## 2.3. Key recommendations from the stress tests on safety

### *2.3.1. Recommendations on safety measures in existing NPPs*

The Staff Working Document provides an overview of the number of safety measures required in individual nuclear power plants.

Follow-up:

AllAll participating countries have begun to take operational steps to improve the safety of their plants. These measures include additional mobile equipment to prevent or mitigate severe accidents, the installation of hardened fixed equipment, and the improvement of severe accident management, together with appropriate staff training measures. The costs of additional safety improvements are estimated in the range from €30 million to €200 million per reactor unit. Thus, the total costs for the 134 reactors operating in the EU could be in the order of €10–25 billion for all NPP units in the EU over the coming years. These figures are based on the estimates published by the French nuclear safety authority (covering more than one third of the reactors in the EU) and are subject to confirmation in the national actions plans.

In line with a Joint Declaration issued by the Commission and ENSREG on 25 April 2012[11], ENSREG agreed an Action Plan in July, which aims at ensuring that the recommendations from the peer review process are implemented in a consistent and transparent manner. This must be a priority for all affected Member States. In view of the high number of recommended improvements, methods and criteria need to be developed and applied to judge the importance of different measures, to prioritise and allocate funding to those areas which bring the greatest safety benefits.

At the same time, the assessment carried out on plants being constructed considered the likelyhood for new reactor designs to be strongly affected by all of these safety upgrading measures as rather low. Therefore, large increases in the investment costs for new nuclear generation capacity in Europe are unlikely if the best available technologies are chosen.

### *2.3.2. Recommendations on procedures and frameworks*

Regarding safety, the ENSREG peer review Board report identified four main areas for further improvement across Europe:

- **European guidance should be developed on the assessment of natural hazards, including earthquake, flooding and extreme weather conditions, and safety margins, in order to increase consistency between Member States**. The Western European Nuclear Regulators' Association (WENRA), involving the best available expertise from Europe (linked with the first finding under 2.2.2.) would be well placed to carry out this task.
- **Periodic Safety Review (PSR) of each NPP should be carried out at least every 10 years**, to maintain and improve the safety and robustness of plants and revaluate the natural hazards to which plants may be subject to.

11 http://www.ensreg.eu/sites/default/files/EC%20ENSREG%20Joint%20Statement%2026%20April%202012%20-Final%20to%20publish.pdf

- **Recognised measures** to protect containment integrity as the last barrier to protect people and the environment against radioactive releases must be implemented.
- **Accidents resulting from natural hazards should be prevented and/or mitigated so as to limit their consequences.** Measures to be considered include bunkered equipment to prevent and manage a severe accident, mobile equipment protected against extreme natural hazards, emergency response centres protected against extreme natural hazards and contamination, rescue teams and equipment rapidly available to support local operators in long duration events.

Follow-up:

The Commission and national regulators have agreed that national action plans with timetables for implementation will be prepared and made available by the end of 2012. The peer review methodology will be applied to them in early 2013. in order to verify that the "stress tests" recommendations are consistently implemented in a transparent way throughout Europe. In areas where additional technical analysis and guidance are needed national regulators will closely collaborate in the WENRA framework.

The occurrence of nuclear incidents, even in Member States with otherwise good safety records, confirms the need for thorough safety reviews on a regular basis and for the assessment of operational experience, and highlights the need for close cooperation and information sharing between operators, vendors, regulators and European institutions, such as the European Clearinghouse of Operating Experience, maintained by the Commission Joint Research Centre (JRC). In addition, ENSREG can play a key role in ensuring that experience and conclusions from any nuclear incident are shared promptly and applied consistently in other Member States. For example, the results of recent investigations into the Doel 3 reactor in Belgium have demonstrated the need to continuously check plant status with state of the art techniques and share information as widely as possible.

Furthermore, the Commission recommends that national regulators include in their future safety reviews more detailed analysis with respect to the effects of multi unit accidents, considering also ageing on equipment and materials, protection of spent fuel storage ponds and possibilities to reduce the amount of spent fuel stored in ponds, in order to reduce risks due to loss of cooling.

The Commission considers that extending the safety assessment to off-site emergency preparedness and response arrangements is an important additional activity to improve citizens' safety. Therefore, as a first step, the Commission is launching a study on the "Review of Current Off-Site Nuclear Emergency Preparedness and Response Arrangements in EU Member States and Neighbouring Countries". The objective is to review the off-site nuclear emergency preparedness and response capabilities in EU Member States and neighbouring countries, to identify inconsistencies and gaps, and to develop proposals (legislative or non-legislative) for possible improvements.

## 2.4. Key findings and recommendations from the security assessments[12]

The final report of the Ad Hoc Group on Nuclear Security[13] presents conclusions on the five themes discussed, namely physical protection, malevolent aircraft crashes, cyber-attacks, nuclear emergency planning, and exercises and training. While being limited by the sensitivity of the subjects and confidentiality constraints, it contains several recommendations to the Member States in order to strengthen nuclear security in the EU. It highlights in particular:

- the urgent need for the Member States which have not yet done so to **complete ratification of the amended Convention on Physical Protection of Nuclear Materials**;
- the added value of **IAEA's guidance and services**, including IPPAS[14] missions on a regular basis in all Member States having nuclear power plants;
- the importance of **regular and close cooperation** between Member States and with neighbouring countries and
- the necessity to define modalities and fora for the **continuation of EU work on nuclear security**.

## 2.5. Recommendations on linking work between safety and security issues

Sustained efforts are required to link up work on nuclear safety and security and address possible gaps. For example, neither the safety stress tests nor the report on nuclear security answer all relevant questions on issues like airplane crashes or the resistance of nuclear power plants to external events. However, the stress tests have to a considerable extent covered the effects of airplane crashes through the thorough work undertaken on station blackout and loss of plant cooling. While this is an area where competency is shared among different authorities, the Commission intends to further study this area through dedicated expert hearings. On other areas of nuclear security, specific projects under the EU CBRN Action Plan and actions on cyber security will need to be considered in close collaboration with Member States.

More specifically, in the area of protection of NPPs against aircraft crashes the Commission has organised a seminar *"Safety of Nuclear Power Plants against Aircraft Impacts"* on 25 September 2012 aimed at upgrading plant safety and exploring alternative protection methods. Participation included Member States safety regulatory authorities as well as contributions from USA and Japanese experts. This is a domain where further cooperation between the different expert communities and authorities, including at European level, is needed. ENSREG has agreed in its action plan to further collaborate on this issue as far as the legal competencies of national regulators permit.

# 3. STRENGTHENING THE EU NUCLEAR SAFETY FRAMEWORK

## 3.1. Implementing the existing nuclear safety legislative framework

The deadline for the EU Member States to complete the transposition of the *Nuclear Safety Directive*[15] at national level was 22 July 2011. The European Commission

12 This section is based on the Final Report of the Council Ad-hoc Group on Nuclear Security (AHGNS).

13 http://register.consilium.europa.eu/pdf/en/12/st10/st10616.en12.pdf, 31.5.2012.

14 International Physical Protection Advisory Service.

started infringement proceedings against twelve Member States that did not comply with this deadline[16]. To date, two Member States[17] have still not completed their transposing measures. The Commission will now start an in depth analysis of the quality of the transposing measures by the Member States.

## 3.2. Improving the legislative framework for nuclear safety

### *3.2.1. Revision of the nuclear safety directive*

It is crucial to ensure that the lessons learned from the Fukushima accident and the conclusions of the stress tests are properly and consistently implemented in the EU and reflected in the legislative framework. The stress tests, the reports from Japan and the work of the international community in the IAEA have confirmed that there are not only significant differences between Member States, but also gaps in ensuring comprehensive and transparent identification and management of key safety issues.

Moreover a number of weaknesses with the existing EU nuclear safety framework have been identified (see section 2.2.3). In order to address these, the Nuclear Safety Directive requires revision in the following area:

(1) Safety procedures and frameworks. The scope of the existing Nuclear Safety Directive is limited to overall principles, hence it cannot address the technical safety issues identified in the Fukushima nuclear accident and the stress tests. The main framework recommendations arising from the stress tests (e.g. the periodic revaluation of external hazards, the implementation of recognised techniques to minimise the impact of accidents, etc.) need to be translated into agreed mechanisms anchored in the revised directive on which the national regulatory authorities can base their independent decisions. Improvements are needed in preparing and responding to a serious nuclear or radiological emergency. The revised directive should include provisions regarding on-site emergency preparedness and response, as well as indications on the types of measures to be taken by the licence holder. Specific attention needs to be paid to the safety of new nuclear installations. While the revised directive can define basic parameters and safety objectives, the role of ENSREG in providing guidance for their implementation needs to be defined, as shown by recent developments in the reactor in Doel. Those events have once more highlighted the need for dialogue between operators and safety authorities in order to share and implement best practices and state of the art technology. For new reactors, WENRA safety objectives should be considered in the directive.

(2) Role and means of nuclear regulatory authorities. The current provisions on regulatory separation and the effectiveness of nuclear regulatory authorities need to be strengthened to ensure the effective independence of these authorities and guarantee that they have the appropriate means of action.

(3) Openness and transparency. Transparency of regulatory decisions and regular provision of information to the public by nuclear operators should be extended and specified, for example by putting obligations on the licence holders, or by

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15 Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations.

16 Austria, Belgium, Cyprus, Denmark, Estonia, Greece, Italy, Latvia, Poland, Portugal, Slovakia and the United Kingdom

17 Poland and Portugal.

specifying the type of information that should be provided, as a minimum, to the public by the competent regulatory authority.

(4) Monitoring and verification. The provisions on monitoring and verification, for example through the extended use of peer reviews, should be extended to other areas than the review of the national regulatory framework.

*3.2.2. Nuclear Insurance and Liability*

Compensation of victims in case of nuclear incidents or accidents is not covered at all by the current EU legislative framework. Therefore, the Commission will analyse to what extent should the nuclear safety directive be complemented in order to improve the situation of potential victims of a nuclear accident in Europe, i.e. by proposing separately binding legislation in the area of nuclear insurance and liability. In this context, compensation for damage to the natural environment should also be addressed.

*3.2.3. Revising the legislation on food and feedstuff*

The management of food and feedstuff that is contaminated as a result of a nuclear emergency is covered both by the Basic Safety Standards Directive (96/29/Euratom), and it is subject to specific provisions with regard to their placing on the market in Council Regulation (Euratom) No 3954/87 laying down maximum permitted levels of radioactive contamination. The latter legislation has become the subject of a recast procedure[18]. However, the Commission now intends to withdraw the proposal for a recast and to bring this Regulation in line with the new Comitology Regulation[19] which entered into force in March 2011.

The experience gained from the events in Fukushima and Chernobyl demonstrated a need to differentiate between instruments regulating the import of food from third counties and those for the placing on the market of food in case of an accident within the EU. On the basis of this experience , the Regulation needs to be revised in order to provide more flexible tools which will allow specific, targeted reactions to any nuclear accident or radiological emergency (in the EU, in the vicinity of the EU or in a remote country).

**3.3. Strengthening human resources and training**

Whether a country has chosen to continue the use of nuclear energy, to phase out the use or to start using this energy source for the first time, ensuring the availability of an experienced workforce should be a top priority.

At European level the EC Joint Research Centre, in cooperation with EU nuclear safety regulators and TSOs, manages the Operating Experience Feedback initiative. The Joint Research Centre will open these activities to all national nuclear regulatory authorities, who want to participate, in order to establish a permanent European Nuclear Safety Laboratory for the continuous improvement of safety. This laboratory will provide scientific and technical support for effective work for the continuous improvement of nuclear safety in particular through incident analyses and assessments, which may be identified by the Commission or ENSREG.

In Euratom research and innovation actions (Horizon-2020), special attention should be dedicated to the lessons from Fukushima, and better coordination between

[18] COM(2010)184 final, 27.4.2010.

[19] Regulation EU 182/2011.

national, European and international actions in this area is needed. Further exchanges of best practices should be encouraged as a way of continuously improving and harmonising nuclear safety culture.

### 3.4. Building up international cooperation

The Commission will continue to encourage all EU neighbouring countries to share the results of their stress tests, and ensure that experiences in the implementation of recommendations are shared to improve nuclear safety both inside the EU and at its borders. A Euratom loan is currently being considered for Ukraine, in order to speed up the implementation of its comprehensive safety upgrade programme.

Contacts are also under way to develop bilateral cooperation on stress tests and regulatory issues with Japan. A draft Memorandum of Understanding for better cooperation on nuclear safety has already been submitted to the IAEA. More generally, the Commission will work with the European External Action Service (EEAS) in order to make the best use of existing external cooperation instruments in the field, in particular the Instrument for Nuclear Safety Cooperation, the Instrument for Stability in its Chemical, Biological, Radiological and Nuclear risk mitigation component and the Instrument for Pre-Accession.

### 3.5. Improving the global legal framework for nuclear safety

Through the IAEA, the main instruments governing nuclear safety are internationally agreed safety standards and conventions, in particular the Convention on Nuclear Safety (CNS), and the Convention on the Early Notification of a Nuclear Emergency, to which the Euratom Community is a Contracting Party. The extraordinary meeting of the Convention on Nuclear Safety in August 2012 agreed to set up a working group tasked with reporting in 2014 on a list of actions to strengthen the Convention and on proposals to amend it, if necessary. Taking into account the IAEA safety standards , regulatory independence and effectiveness, extended use of peer reviews as well as improved openness and transparency were highlighted by the majority of nations participating to this working group. The Commission will take full account of these principles and objectives. The continued commitment of Member States and EU institutions is needed to ensure that the EU legislation is reflected to the extent possible in future revisions of the international nuclear safety framework. The Commission will continue its efforts to make this possible.

## 4. REINFORCING NUCLEAR SECURITY

The Commission supports the findings and recommendations highlighted in the final report of the AHGNS. In order to contribute to the work on nuclear security matters, the Commission will use the existing competencies and programmes to encourage Member States in progressing further on the implementation of specific measures. In particular, the Commission will continue to work with Member States on:

– the reduction of the threat of Chemical, Biological, Radioactive, Nuclear (CBRN) incidents of intentional origin, including acts of terrorism and detection of radioactive and nuclear materials, through the implementation of the EU CBRN Action Plan and the management of programmes on CBRN security;

– the revision of Directive 2008/114/EC on the identification and designation of European critical infrastructures[20], foreseen in 2013 which should be extended to cover and include aspects like cyber security and other aviation security that can also threaten nuclear installations;

– adoption of the proposal for the revision of the Union Civil Protection Mechanism[21] that facilitates co-operation between the Member States in civil protection assistance interventions in the event of major emergencies, including radiological and nuclear accidents as well as prevention and preparedness actions (e.g. risk assessments and risk management plans, CBRN modules, training and exercises for large-scale disasters, scenario development and contingency planning);

– the speedy ratification of the amended Convention on Physical Protection of Nuclear Materials by all Member States. The Commission will complete the ratification process by Euratom as agreed by the Council in 2006.

The Commission also considers that there remains a need to tackle more explicitly aspects located at the interface between nuclear safety and security. The Commission is committed towards further progress in this area by setting up the competent fora and organising dedicated events in close collaboration with the Member States to ensure that the exchange of information and best practices between the different stakeholders proceeds as smoothly as possible.

Outside the EU, the Instrument for Stability - the EU CBRN Centres of Excellence programme - will enhance institutional capacities of selected countries and regions against chemical, biological, radiological and nuclear risks.

## 5. CONCLUSIONS AND WAY FORWARD

The EU nuclear stress tests were an unprecedented exercise in terms of extent, collaboration and commitment of all parties involved. They have been used internationally either as basis or as a benchmark for the safety assessment of nuclear power plants[22]. The public availability of all safety-related reports and the participation of non-nuclear countries have made the exercise an example of transparency.

The stress tests should not be considered as a one-off exercise, but as an on-going process to improve nuclear safety. The EU must seek to develop a comprehensive European approach to safety,which includes a revision of nuclear safety specific Euratom legislation, complemented by legislative or non-legislative instruments on nuclear liability, on emergency preparedness and response, and by pursuing actions in the area of nuclear security. In this way, citizens in the whole EU can be confident that nuclear power produced in the EU is subject to the most stringent safety conditions in the world.

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20 Council Directive 2008/114/EC of 8 December 2008 on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection, OJ L 345, 23.12.2008, p. 75–82.

21 Proposal COM/2011/0934 under negotiation in the Parliament and the Council to repeal Council Decision 2007/779/EC, Euratom establishing a Community Civil Protection Mechanism (recast).

22 For example the Latin American forum of nuclear regulators, (FORO), the Russian Federation and Japan have followed closely the EU stress tests and made use of part of the specifications.

The stress tests are a major achievement for the EU, which led to tangible results:

- Significant and tangible plant improvements have been identified in all participating countries, and are being implemented or planned.
- Weaknesses in frameworks and procedures, as well as gaps in the legal arrangements, have been identified and proposals to improve these are on the drawing board.
- First bridges have been built between authorities dealing with safety and those dealing with security, and a clear understanding has emerged that linking both aspects is essential to respond to citizens' concerns.

With a view to ensuring proper follow-up to the stress tests, the Commission:

- invites the European Council to commit Member States and to call upon participating third countries to implement swiftly the recommendations of the stress tests. The Commission will ensure openness and transparency during the follow-up of the stress test process. It will **report on the implementation of the stress test recommendations in June 2014**. It will take steps to ensure that the vast majority of the required safety improvements are implemented by 2015;
- will present an **ambitious revision of the EU nuclear safety directive,** which it will submit to the European Parlament and Council by early 2013 at the latest. Presentation of afurther proposal on nuclear insurance and liability is under consideration and will follow in 2013, just as the proposal on maximum permitted levels of radioactive contamination of foodstuffs and feeding stuffs;
- will explore proposals in the Euratom framework programme in 2013 and 2014 aiming to faciliate the exchange between Member States of staff working in the nuclear field;
- will in the framework of IAEA actively participate in the working group on effectiveness and transparency looking at a possible improvement of the Convention on Nuclear Safety and preparing a European joint proposal for the next review meeting in March 2014; the Commission will also maintain the ongoing dialogue with other countries to ensure the maximum convergence on the European proposals;
- will continue to encourage scientific activities aiming at further harmonization of nuclear safety assessments and practices in EU;
- will continue to contribute to the reinforcement of nuclear security building as appropriate on existing work on CBRN and aviation security, by using reinforced cooperation of Member States and EU insitutions as needed as well as external cooperation instruments in close collaboration with the EEAS;

LIST OF ABBREVIATIONS:

| | |
|---|---|
| AHGNS | Ad-hoc Group on Nuclear Security |
| BWR | Boiling Water Reactor |
| CBRN | Chemical, Biological, Radioactive, Nuclear |
| CNS | Convention on Nuclear Safety |
| EEAS | European External Action Service |
| ENSREG | European Nuclear Safety Regulators' Group |
| IAEA | International Atomic Energy Agency |
| INSC | Instrument for Nuclear Safety Cooperation |
| IPPAS | International Physical Protection Advisory Service |
| JRC | Joint Research Centre of the European Commission |
| NPP | Nuclear Power Plant |
| SAM | Severe Accident Management |
| SAMG | Severe Accident Management Guidelines |
| PSA | Probabilistic Safety Assessment |
| PSR | Periodic Safety Reviews |
| WENRA | Western European Nuclear Regulators' Association |

# Annex[23]

## Summary of Issues Recommended by Peer Reviews for Improvement in EU Member State Nuclear Power Plants

| Member State | NPP Site | Total Number of Units | Site visited by Peer Review Team | External hazard safety cases corresponding to an exceedance probability of less than once in 10 000 years should be used: for earthquakes; | External hazard safety cases corresponding to an exceedance probability of less than once in 10 000 years should be used: for flooding. | A Design Basis Earthquake corresponding to a minimum peak ground acceleration of 0.1 g should be used. | Means needed to fight accidents should be stored in places adequately protected against external events. | On-site seismic instrumentation should be installed or improved. | Time for restoration of the safety functions in case of loss of all electrical power and/or ultimate heat sink is less than 1 hour (without human intervention). | Emergency Operating Procedures not covering all plant states (full power to shutdown states). | Severe Accident Management Guidelines not implemented or not covering all plant states (full power to shutdown states). | Passive measures to prevent hydrogen explosions (or other combustible gasses) in case of severe accident not in place (such as Passive Autocatalytic Recombiners or other relevant alternatives). | Containment Filtered Venting Systems not in place. | A backup Emergency Control Room not available in case the Main Control Room becomes inhabitable as a consequence of the radiological releases of a severe accident, of fire in the Main Control Room or due to extreme external hazards. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BE** | Doel | 4 | **X** | | | | | X (4.1) | | | | | X (4.3) | |
| | Tihange | 3 | | | X (4.1) | | | X (4.1) | | | | | X (4.3) | |
| **BG** | Kozloduy | 2 | **X** | | | | X (4.1, 5.2) | | | X (5.2) | X (5.2) | X (5.2) | | X (5.2) |
| **CZ** | Dukovany | 4 | **X** | | | | X (5.3) | | | X (5.3) | X (5.3) | X (5.3) | X (5.3) | |

[23] This table should be read together with the accompanying Commission Staff Working Document where the issues are explained in more detail. The numbers in brackets refer to the corresponding sections of the Staff Working Document.

| Member State | NPP Site | Total Number of Units | Site visited by Peer Review Team | External hazard safety cases corresponding to an exceedance probability of less than once in 10 000 years should be used:<br>for earthquakes; | External hazard safety cases corresponding to an exceedance probability of less than once in 10 000 years should be used:<br>for flooding. | A Design Basis Earthquake corresponding to a minimum peak ground acceleration of 0.1 g should be used. | Means needed to fight accidents should be stored in places adequately protected against external events. | On-site seismic instrumentation should be installed or improved. | Time for restoration of the safety functions in case of loss of all electrical power and/or ultimate heat sink is less than 1 hour (without human intervention). | Emergency Operating Procedures not covering all plant states (full power to shutdown states). | Severe Accident Management Guidelines not implemented or not covering all plant states (full power to shutdown states). | Passive measures to prevent hydrogen explosions (or other combustible gasses) in case of severe accident not in place (such as Passive Autocatalytic Recombiners or other relevant alternatives). | Containment Filtered Venting Systems not in place. | A backup Emergency Control Room not available in case the Main Control Room becomes inhabitable as a consequence of the radiological releases of a severe accident, of fire in the Main Control Room or due to extreme external hazards. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Temelín | 2 | **X** | | | | X (5.3) | X (4.1) | | X (5.3) | X (5.3) | X (5.3) | X (5.3) | |
| **FI** | Loviisa | 2 | **X** | | | X (5.4) | | X (4.1) | | X (5.4) | X (5.4) | | | |
| | Olkiluoto | 2 | | | | X (5.4) | | X (4.1) | X (4.2) | X (5.4) | X (5.4) | | | |
| **FR** | Belleville | 2 | | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | X (4.3) | X (4.3) | | | |
| | Blayais | 4 | | X (4.1, 3.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | | | | | |
| | Bugey | 4 | | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | | | | | |
| | Cattenom | 4 | **X** | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | X (4.3) | X (4.3) | | | |
| | Chinon | 4 | | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | | | | | |
| | Chooz | 2 | **X** | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | X (4.3) | X (4.3) | | | |

| Member State | NPP Site | Total Number of Units | Site visited by Peer Review Team | External hazard safety cases corresponding to an exceedance probability of less than once in 10 000 years should be used:<br>for earthquakes; | External hazard safety cases corresponding to an exceedance probability of less than once in 10 000 years should be used:<br>for flooding. | A Design Basis Earthquake corresponding to a minimum peak ground acceleration of 0.1 g should be used. | Means needed to fight accidents should be stored in places adequately protected against external events. | On-site seismic instrumentation should be installed or improved. | Time for restoration of the safety functions in case of loss of all electrical power and/or ultimate heat sink is less than 1 hour (without human intervention). | Emergency Operating Procedures not covering all plant states (full power to shutdown states). | Severe Accident Management Guidelines not implemented or not covering all plant states (full power to shutdown states). | Passive measures to prevent hydrogen explosions (or other combustible gasses) in case of severe accident not in place (such as Passive Autocatalytic Recombiners or other relevant alternatives). | Containment Filtered Venting Systems not in place. | A backup Emergency Control Room not available in case the Main Control Room becomes inhabitable as a consequence of the radiological releases of a severe accident, of fire in the Main Control Room or due to extreme external hazards. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Civaux | 2 | | | X (5.5) | | X (5.5) | X (4.1, 5.5) | | X (4.3) | X (4.3) | | | |
| | Cruas | 4 | | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | | | | | |
| | Dampierre | 4 | | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | | | | | |
| | Fessenheim | 2 | **X** | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | | | | | |
| | Flamanville | 2 | | | X (5.5) | | X (5.5) | X (4.1, 5.5) | | X (4.3) | X (4.3) | | | |
| | Golfech | 2 | | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | X (4.3) | X (4.3) | | | |
| | Gravelines | 6 | | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | | | | | |
| | Nogent | 2 | | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | X (4.3) | X (4.3) | | | |
| | Paluel | 4 | | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | X (4.3) | X (4.3) | | | |
| | Penly | 2 | | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | X (4.3) | X (4.3) | | | |

| Member State | NPP Site | Total Number of Units | Site visited by Peer Review Team | External hazard safety cases corresponding to an exceedance probability of less than once in 10 000 years should be used:<br>for earthquakes; | External hazard safety cases corresponding to an exceedance probability of less than once in 10 000 years should be used:<br>for flooding. | A Design Basis Earthquake corresponding to a minimum peak ground acceleration of 0.1 g should be used. | Means needed to fight accidents should be stored in places adequately protected against external events. | On-site seismic instrumentation should be installed or improved. | Time for restoration of the safety functions in case of loss of all electrical power and/or ultimate heat sink is less than 1 hour (without human intervention). | Emergency Operating Procedures not covering all plant states (full power to shutdown states). | Severe Accident Management Guidelines not implemented or not covering all plant states (full power to shutdown states). | Passive measures to prevent hydrogen explosions (or other combustible gasses) in case of severe accident not in place (such as Passive Autocatalytic Recombiners or other relevant alternatives). | Containment Filtered Venting Systems not in place. | A backup Emergency Control Room not available in case the Main Control Room becomes inhabitable as a consequence of the radiological releases of a severe accident, of fire in the Main Control Room or due to extreme external hazards. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | St. Alban | 2 | | | X (5.5) | | X (5.5) | X (4.1, 5.5) | | X (4.3) | X (4.3) | | | |
| | St. Laurent | 2 | | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | | | | | |
| | Tricastin | 4 | **X** | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | X (5.5) | X (4.1, 5.5) | | | | | | |
| **DE** | Biblis | 2 | | | | | | X (4.1) | | | X (5.6) | | | |
| | Brokdorf | 1 | | | | X (5.6) | | X (4.1) | | | X (5.6) | | | |
| | Brunsbüttel | 1 | | | | X (5.6) | | X (4.1) | | | X (5.6) | | | |
| | Emsland | 1 | | | | | | X (4.1) | | | X (5.6) | | | |
| | Grafenrhein-feld | 1 | **X** | | | X (5.6) | | X (4.1) | | | X (5.6) | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grohnde | 1 | | | | X (5.6) | | X (4.1) | | | X (5.6) | | | |
| | Gundremmingen | 2 | **X** | | | | | X (4.1) | | | X (5.6) | | | |
| | Isar | 2 | | | | X (5.6) | | X (4.1) | | | X (5.6) | | | |
| | Krümmel | 1 | | | | X (5.6) | | X (4.1) | | | X (5.6) | | | |
| | Neckarwestheim | 2 | | | | | | X (4.1) | | | X (5.6) | | | |
| | Philippsburg | 2 | | | | | | X (4.1) | | | X (5.6) | | | |
| | Unterweser | 1 | | | | X (5.6) | | X (4.1) | | | X (5.6) | | | |
| **HU** | Paks | 4 | **X** | | | | | | | | | | X (5.7) | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LT** | Ignalina *(under decommission-ning)* | 2 | **X** | | | | | X (4.1) | | | | | | |
| **NL** | Borssele | 1 | **X** | | X (5.9) | X (5.9) | X (5.9) | | | | | | | |
| **RO** | Cernavodă | 2 | **X** | X (5.10) | | | | | | X (5.10) | X (5.10) | X (5.10) | X (5.10) | |
| **SK** | Bohunice | 2 | | | | | X (5.11) | X (4.1) | | | X (5.11) | X (5.11) | X (5.11) | |
| | Mochovce | 2 | **X** | | | | X (5.11) | X (4.1) | | | X (5.11) | X (5.11) | X (5.11) | |
| **SI** | Krško | 1 | **X** | | | | | | | | | | | |
| **ES** | Almaraz | 2 | **X** | | | | | X (4.1) | | | | X (4.3) | X (5.13) | X (5.13) |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Asco | 2 | | | | | | X (4.1) | | | | X (4.3) | X (5.13) | X (5.13) |
| | Cofrentes | 1 | | | | | | X (4.1) | | | | X (4.3) | X (5.13) | X (5.13) |
| | Santa María de Garoña | 1 | | | | | | X (4.1) | | | | X (4.3) | X (5.13) | X (5.13) |
| | Trillo | 1 | **X** | | | | | X (4.1) | | X (5.13) | X (5.13) | | X (5.13) | X (5.13) |
| | Vandellòs | 1 | | | | | | X (4.1) | | | | X (4.3) | X (5.13) | X (5.13) |
| **SE** | Forsmark | 3 | **X** | | | | X (5.14) | X (4.1) | X (4.2) | | | | | |
| | Oskarshamn | 3 | | | | | X (5.14) | | | | | | | |
| | Ringhals | 4 | **X** | | | | X (5.14) | X (4.1) | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **UK** | Dungeness B | 2 | | | | | | X (4.1) | | X (5.15) | X (5.15) | X (5.15) | | X (5.15) |
| | Hartlepool | 2 | | | | | | X (4.1) | | X (5.15) | X (5.15) | X (5.15) | | X (5.15) |
| | Heysham 1 | 2 | | | | | | X (4.1) | | X (5.15) | X (5.15) | X (5.15) | | X (5.15) |
| | Heysham 2 | 2 | **X** | | | | | X (4.1) | | X (5.15) | X (5.15) | X (5.15) | | |
| | Hinkley Point B | 2 | | | | | | X (4.1) | | X (5.15) | X (5.15) | X (5.15) | | X (5.15) |
| | Hunterston B | 2 | | | | | | X (4.1) | | X (5.15) | X (5.15) | X (5.15) | | X (5.15) |
| | Oldbury | 2 | | | | | | | | X (5.15) | X (5.15) | X (5.15) | | X (5.15) |
| | Sizewell B | 1 | **X** | | | | | | | | X (5.15) | X (4.3, 5.15) | X (5.15) | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tornes s | 2 | | | | | | | | X (5.15) | X (5.15) | X (5.15) | | |
| | Wylfa | 2 | | | | | | | | X (5.15) | X (5.15) | X (5.15) | | X (5.15) |

Legend:

- *Column "Units"* gives the total number of reactor units per nuclear power plant site.
- *Column "Site visited by Peer Reviews?"* indicates if the site was visited in the course of the stress tests by a site-specific peer review mission in either March 2012 or September 2012.
- The ten *"Issue"*-related columns indicate the presence of a particular safety-related issue as highlighted in the course of the "horizontal" (topical) and/or "vertical" (country-specific) peer reviews. The ensuing number put in brackets refers to the chapter of the Staff Working Document where the description of the corresponding issue can be found (e.g. "$X_{(4.1)}$").