Strengthening Nuclear Safety: Condition for Sustainable Use of Nuclear Energy

Author Denis Flory

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After 25 years without serious nuclear accident, following the natural disaster of extraordinary magnitude that struck the east coast of Japan 3.11, 2011, the Fukushima Dai-ichi Nuclear Power Plant was badly damaged. Today, the Japanese authorities, TEPCO employees and the nuclear industry are working together to gradually bring the damaged reactors into a stable and safe state.

Nuclear energy actors are going through a major test of their ability to assess their weaknesses, to draw and implement lessons from the accident, to advance nuclear safety, and to rebuild public and government confidence in the possibility of managing and developing the peaceful uses of nuclear energy in a responsible, sustainable and safe manner.

Responsibility for ensuring the application of the highest standards of safety and to respond in an appropriate and transparent manner to emergencies relies primarily on nuclear operators and States. This is part of the fundamental safety principles adopted by the International Atomic Energy Agency (IAEA).

But Fukushima confirmed that nuclear accidents do not respect borders. The Fukushima atmospheric release was detected in both hemispheres. Indeed, no transboundary release that could be of radiological safety significance for another State has been identified. However, a real effect has crossed borders: the deterioration of public confidence in the ability of operators and States to control the nuclear risk.

Therefore the primary responsibility of operators, supplemented by States, must be backed by an international approach to safety. The IAEA is the privileged place where this approach is implemented. It is the organization that was created worldwide to help ensure that a most robust international framework for nuclear safety is effectively established, implemented around the world, and continually strengthened.

Accident in Fukushima

I do not intend to describe in detail here the accident in Fukushima. Though many lessons are still to be learned on the course and causes of the accident, substantial official reports are already currently available (the report of the IAEA international fact-finding expert mission on the Fukushima Dai-ichi accident, the report of the Japanese Government to the IAEA Ministerial Conference on Nuclear Safety, and the additional report of the Japanese Government to the IAEA on the Accident at TEPCO's Fukushima Nuclear Power Stations) and in addition to these reports, the independent investigation commission set up by the Japanese Government should release its findings later next year.

In short, it may be recalled that on 3.11, 2011, a 9.0 magnitude earthquake destroyed the power lines to the Fukushima Dai-ichi Nuclear Power Plant, which lost its external power supply. The tsunami generated by the earthquake then led to the loss of emergency diesel generators, and severely damaged several buildings, leading rapidly to the loss of all means of cooling the reactors and fuel pools of Units 1 to 4 of the nuclear power plant. Overheating seriously damaged the fuel, up to fuel melt. Hydrogen emissions then led to explosions inside buildings, seriously damaging reactors 1, 3 and 4, and releasing radioactive substances into the atmosphere and the ocean.

At the request of the director general of the IAEA, the International Nuclear Safety Group (INSAG) established a series of recommendations to guide future actions related to strengthening nuclear safety in the light of the accident in Fukushima. The INSAG recommendations address the following issues, identified as potential vulnerabilities highlighted by the accident:

- **Regulatory structure**
- **Chain of command**
- **Extreme events**
- **Severe accidents**
- **Loss of power**
- **Loss of cooling**
- **Accumulation of explosive gases**
- **Spent fuel storage pools**
- **Emergency situation management**

These recommendations together with the outputs from the Vienna Ministerial conference and the reports mentioned earlier, are the basis on which the Agency built its Nuclear Safety Action Plan.

International Atomic Energy Agency (IAEA)

The IAEA was established *"to seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity."* In accordance with this objective set in its statute, the IAEA's mission and activities are based on three pillars:

Photo: IAEA

- **Science & technology to mobilize peaceful applications of nuclear science & technology to developing countries**
- **Safeguards & verification to prevent the further spread of nuclear weapons**
- **Safety & security to protect people & the environment from harmful radiation exposure**

These three pillars set the basis for a responsible, sustainable, safe and secure use of nuclear energy. In the field of Safety and Security, through research and lessons drawn from past events, a comprehensive Global Nuclear Safety and Security Framework has been developed, and is being continuously strengthened. The most significant developments in nuclear safety were the results of the Chernobyl accident back in 1986. This is the time when the development of IAEA safety standards and services saw a strong acceleration, at the same time as when major conventions – the Notification and Assistance Conventions and the Convention on Nuclear Safety – were adopted. A decade later, the Department of Nuclear Safety was created inside the Agency. The history of nuclear security saw a similar acceleration following the terrorist attacks on September 11, 2001, which gave birth to an amendment to the Convention on the Physical Protection of Nuclear Material, adopted in July 2005. Today, nuclear energy is faced with the same challenge of learning lessons from the extreme natural events that crippled the Fukushima NPP.

Strengthening Global Nuclear Safety Framework: IAEA Action Plan on Nuclear Safety

Responding to the Ministerial Declaration adopted by the Vienna Conference on Nuclear Safety in June 2011, the IAEA prepared during the summer of 2011, in consultation with Member States, an action plan on nuclear safety that was approved by the Board of Governors and adopted by the General Conference on September 22, 2011. This plan consists of 12 key actions focusing on: safety assessments in the light of the accident at TEPCO's Fukushima Dai-ichi Nuclear Power Station; IAEA peer reviews; emergency preparedness and response; national regulatory bodies; operating organizations; IAEA Safety Standards; the international legal framework; Member States planning to embark on a nuclear power program; capacity building; protection of people and the environment from ionizing radiation; communication and information dissemination; and research and development.

International Legal Framework

The question of strengthening the international legal framework was acutely raised by the Fukushima accident. Coincidentally, the fifth review meeting of States Parties to the Convention on Nuclear Safety (CNS) was held in Vienna from April 4 to 14, 2011. Confronted directly with the consequences of the accident, the Parties agreed to hold an extraordinary meeting in August 2012. Strengthening the provisions of the CNS was the focus of the discussions; many delegations considered that priority should be given to a strengthening of implementation mechanisms of the CNS, while others favoured the legal approach of amending the Convention.

My personal experience of active participation in the long process of amending the Convention on the Physical Protection of Nuclear Material (CPPNM - the amendment process was launched around 1997, an amendment was adopted in July 2005, and entry into force is foreseen in an optimistic perspective around 2015) leads me to favor a parallel approach: launching a carefully planned amendment process, supplemented by a variety of mechanisms and non-legally binding tools available to the international community. Such an approach, once effectively launched, should respond to the need for urgent actions to strengthen nuclear safety, without foregoing the longer-term, more potent tools of a strengthened international legal regime.

In the field of legal instruments, the issue of international liability

instruments in case of nuclear accident has also been raised, since the non-participation of Japan in any such instruments was probably one of the factors limiting recourse to assistance.

Evaluation of Safety of Nuclear Power Plants

In the immediate aftermath of the accident at TEPCO's Fukushima Dai-ichi Nuclear Power Station, many Member States launched complementary safety assessments of the safety vulnerabilities of nuclear power plants in the light of lessons learned to date from the accident (commonly but improperly called "stress tests"). This action in itself reflects most of the issues encountered as a result of the accident in Fukushima: urgency, transparency, harmonization, independence and international oversight.

This is clearly an urgent action expected by the public and by governments in order to provide a realistic assessment of the safety of existing facilities, and a clear vision of improvements needed in the short term. At the same time, the question of harmonization of these reviews between one State and another is clearly needed, every nation hoping that its neighbors (in the global understanding of a flat world) will address this issue with the same seriousness as its own, and expecting to be informed in a transparent way of the assessments performed. To eliminate any risk of complacency, the independence of regulators in charge of review of the analysis performed by operators is, as always, a strongly formulated requirement, and finally a final review by peers at an international level is an added guarantee of the impartiality of the process.

Within the Secretariat, we have developed a methodology for the evaluation of safety margins of nuclear power plants, based on our existing experience. This will allow us to respond to requests to assist our Member States in their own assessment, and possibly to organise international peer reviews.

IAEA Safety Standards

The foundation of the IAEA safety standards comes from our Statute, which states that *"the Agency is authorised to establish and adopt […] standards of safety for protection of health and minimization of danger to life and property […] and to provide for the application of these standards."* Through the years we have developed a consistent set of more than a hundred safety standards, established through a rigorous process in close cooperation with our Member States; more recently, we have also started developing security guidance.

These standards form the basis for achieving a high level of safety, and we could not ignore the potential consequences of the accident in Fukushima in their content. The Action Plan therefore includes a focused review of relevant safety standards, promptly launched on the basis of the process mentioned above. But whatever the quality of international standards of nuclear safety, the key to achieving a high level of safety is their implementation.

To facilitate their implementation, we provide assistance to Member States for developing in a sustainable and effective manner the national infrastructure and human resources necessary to assume their responsibilities. The benchmark to provide this assistance is our collection of Safety Standards.

IAEA Peer Review Missions

To further facilitate and promote the implementation of safety standards, we provide regulators, operators and the nuclear industry with an external view, in an incentive approach to continuous improvement, through peer review missions. These peer reviews are subject to an increasing demand. The best-known are:

- **IRRS (Integrated Regulatory Review Service - since 2006, 29 missions, including seven follow-ups) to assess regulatory practices**
- **OSART (Operational Safety Review Team - 159 missions in 27 years) to assess the operational safety of nuclear power plants**
- **EPREV (Emergency Preparedness Review - 23 missions between 2004 and 2011) to assess level and measures for emergency preparedness**
- **Site safety assessment and/or reactor design safety, of a generic or specific nature**

These peer reviews are at the heart of the Action Plan. They allow the identification of good practices and recommendations for improvement, for operators or regulators. Their clear foundation in the IAEA Safety Standards strengthens *de facto,* if not *de jure,* the essence of these standards as the international reference.

During the consultations on the way to strengthen peer reviews, the views of Member States ranged from a desire to make these missions compulsory, periodic and automatic, to a clear preference for keeping them voluntary. The formulation finally accepted by all is: *"Member States [are] strongly encouraged to voluntarily host IAEA peer reviews..."*

An in-depth analysis of the IAEA peer review mechanisms shows that without the voluntary and strong involvement of Member States, these missions could not play their role in the objective assessment of the effectiveness of national regulatory systems. The real challenge is not to include this mechanism in a legally binding instrument, but to create a living process, through the incentives provided by transparency and the pressure it creates, but also through demonstration of the enhanced benefits for all of these peer reviews.

Good news came from a recent workshop on lessons learned from past IRRS missions organised jointly by the IAEA and the USNRC in Washington DC in October, where senior regulators from 22 Member States expressed their strong support for the IAEA peer reviews. There was a general recognition that these peer reviews provide national nuclear regulators with an objective view of their strengths and weaknesses and contribute to the continuous strengthening of nuclear safety.

Emergency Preparedness & Response: the Fukushima Case

In the area of emergency preparedness and response, the IAEA works primarily within the two conventions adopted in the aftermath of the Chernobyl accident: the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

To ensure its responsibilities under these Conventions, an "Incident and Emergency Centre - IEC" was created in the

Department of Nuclear Safety and Security. The IEC serves as a focal point for receiving information from the State where an emergency occurred, offers the Agency's "good offices," and transmits the assistance proposals received from Member States, through the Response and Assistance Network (RANET).

Alerted within one hour after the earthquake by on-call IAEA experts/seismologists, and forewarned of the risk of damage to four nuclear power plants in the northeast coast of Japan, the IEC established a first communication with the contact point designated by Japan for emergencies (the Agency for Nuclear and Industrial Safety - NISA) one hour and a half after the earthquake, and called the staff on duty to staff the IEC. It then remained in "full response mode" around the clock until May 3, 2011. Such an operation record for the IEC has been made possible thanks to the efforts of a staff trained in crisis management. Over 200 Agency staff members brought their competencies to the IEC during this period.

Today, actions have been launched to widen the rapid response capabilities provided through RANET, to expand the participation of Member States in the Network, and in parallel to expand the participation in the Joint Radiation Emergency Management Plan of the International Organizations.

Communication: INES

Communication problems in the case of a nuclear crisis were highlighted on the occasion of the classification by Japan of the accident in the International Nuclear Event Scale (INES). In short, Japan filed a preliminary accident classification on March 18 at level five of the scale ("accident with wider consequences"), then issued a new classification as level seven on April 12 ("major accident"), the maximum level, equivalent to that of the Chernobyl disaster, after Japanese experts had assessed the amount of radioactivity released into the atmosphere. In the meantime, the opinions of international experts had been reported in the media, some holding that the accident was within the seven level, others arguing that the accident should be classified at level six.

Obviously, the objective of providing the public with simple information, prompt and easy to understand, comparable to the magnitude of an earthquake, was widely missed. The review of the operation of INES is one of the actions the Agency has already launched. Rapid information, internationally validated by the IAEA, is needed in case of serious accident. This requires the prompt availability of extended information from the very beginning of such an accident, and the ability for the Agency to implement in real-time national safety analysis capabilities.

Players in Action Plan

The goal is not to analyse in detail the IAEA Action Plan. It contains a number of other actions - a total of 12 - that address for example the strengthening of cooperation between the IAEA and nuclear operators, and above all, the enhancement of transparency and effectiveness of communication and improvement in the dissemination of information. This is not an Action Plan only for the 2000 or so employees of the IAEA. The expected actors are as well Member States, regulators, nuclear operators, and international and intergovernmental organizations involved in nuclear safety and emergency preparedness and response. To strengthen cooperation between the IAEA and the OECD-Nuclear Energy Agency (OECD/NEA) or the World Association of Nuclear Operators (WANO), in accordance with respective mandates, is part of the ambitions of the Action Plan.

Transparency & Action Plan

Beyond the debates that led to the approval of the Action Plan, it is important now not to dwell on words only, but to resolutely address its implementation. In proposing to make a more systematic use by Member States of peer review missions, providing the widest transparency to the results of these evaluations, the Action Plan will play a decisive role towards harmonization of safety practices. It will also demonstrate, to the benefit of the international community, the adequacy of measures taken at a national level to ensure the highest level of nuclear safety.

Transparency on the objective evaluation by peers is a key element of the Action Plan. It is a powerful tool, which will create an obvious incentive, and should meet the expectations of the public and many States. Its effective implementation will strengthen nuclear safety worldwide. This is the necessary first step to rebuild trust between States and with the public.

Safety & Security

As current head of a nuclear safety and security department, it would be inappropriate for me to avoid the issue of the relationship between safety and security in the light of the Fukushima accident. Yes, a nuclear accident could be the result of a malicious act, an act of terrorism. Yes, it is legitimate to consider the lessons of the accident in Fukushima in terms of improvements that could be made to the protection of nuclear facilities against such acts. But the transparency tools that I praised a few lines above are not easily available in the field of nuclear security.

Nevertheless, security has not been overlooked so far. It was addressed in the IAEA's contribution to the study launched by the UN Secretary General in preparation for the High-Level Meeting organised in New York. Nuclear security in light of lessons learned from the Fukushima accident was also present in the Agenda of the Senior Regulators' Meeting during the 55th IAEA General Conference.

Historical Step

By adopting the Action Plan on Nuclear Safety on September 22, the IAEA General Conference took a historical step. This is the first time in the life of the Agency that its 151 Member States gathered in a comprehensive program all the nuclear safety tools to strengthen the global nuclear safety framework at the national, regional and international levels. The implementation of all these tools opens a new period in the quest for a continuous strengthening of nuclear safety worldwide. The IAEA and its 151 Member States are at the heart of this work.

It is only through effective demonstrable strengthening of the global nuclear safety and security framework that further development of nuclear energy can answer the legitimate expectations of the public in a sustainable way. JS

Denis Flory is deputy director general of the IAEA and head of the Department of Nuclear Safety and Security.