March 22, 2012

Chairman's Summary

1. General remarks

In furtherance of the IAEA Action Plan on Nuclear Safety (the Action Plan) unanimously endorsed by the Member States as a result of the accident at the Fukushima Daiichi nuclear power plant, the IAEA held an International Experts' Meeting ("IEM") from 19-22 March 2012. The primary objectives of this IEM were to analyze relevant technical aspects of reactor and spent nuclear fuel management safety and performance; to review what is known to date about the accident in order to understand more fully its root causes; and to share the lessons learned from the accident.

These objectives served to pursue several purposes of the Action Plan:

- to discuss the results of Member States national assessments of the safety vulnerabilities of nuclear power plants in light of lessons learned to date (Action Plan, *Safety Assessments in the Light of the Accident at TEPCO's Fukushima Daiichi Nuclear Power station bullet #1*[1]);

- to analyze all relevant technical aspects and learn the lessons from the Fukushima accident. (Action Plan, *Communication and Information Dissemination bullet #4*[1]); and

- to help facilitate and to continue to share with member states a fully transparent assessment of the accident in cooperation with Japan (Action Plan, *Communication and Information Dissemination bullet #5*[1]).

The IEM was attended by approximately 230 experts from 44 Member States and 4 international organizations. There were wide-ranging and open discussions and a full exchange of information. This summary is intended to reflect observations that were made at the IEM, but does not necessarily reflect the consensus of the participants.

The IEM revealed that the Member States (including regulators, industry, and technical support organizations), the IAEA Secretariat, and other relevant organizations had undertaken very significant efforts to analyze the Fukushima accident and to take appropriate actions to respond to it. The overall efforts have been comprehensive, thoughtful, and impressive. It is anticipated that nuclear safety will be greatly strengthened as a result.

The presentations and discussions revealed that the Member States had taken a variety of largely independent efforts to examine the accident. It was reassuring to note that, despite somewhat different terminology and emphases, the analyses had largely converged on the same conclusions. The similarities in actions provide confidence that significant issues have not been overlooked.

There were expected common elements in the efforts of the various Member States directed at assurance of protection from extreme events (e.g. earthquakes, tsunamis, flooding, tornadoes, or other site-specific external hazards), at a capacity to respond to station blackout and to assure a

[*] [1] **GOV/2011/59-GC(55)/14**

heat sink, to improve communications and emergency response, to control hydrogen deflagration and detonation, and to respond to threats to spent fuel pools. But the discussions also revealed a widespread undertaking to strengthen the overall safety framework. Just as the Three Mile Island and Chernobyl accidents brought about an overall strengthening of the safety system, it is already apparent that the Fukushima accident will have a similar effect.

One important element of a broadened safety agenda is the concerted effort to establish a robust capacity to protect against a beyond-design-basis accident. In effect, the presentations revealed an intention to establish an additional layer of protection to prevent a severe accident regardless of the initiating event. This is to be accomplished by additional installed and/or mobile equipment that provides increased assurance of a capacity to meet essential functions, such as a need for electrical power or cooling water. There was emphasis as well on efforts to place a priority not only on preventing accidents, but also mitigating them and placing a priority on preserving containment. Moreover, there are efforts to strengthen severe accident management guidelines and to improve emergency response capacity. The result should be greatly strengthened defense in depth.

In short, good progress has been made on improving safety and a large number of activities are in process. Member States, both regulatory bodies and operators, are taking aggressive actions to increase safety. And the Action Plan is providing an appropriate framework for the development and sharing of essential lessons learned. These efforts should continue.

2. The International Experts' Meeting

A detailed update of current understanding of the accident sequence was presented to the IEM by Japan. There is much still to be learned and continuing investigations will progressively allow an even deeper analysis of the accident. The availability of appropriate data on the accident will be of importance in enabling detailed lessons on a number of matters -- hazards evaluation, safety prevention measures, accident mitigation, and on-site and off-site emergency management capabilities. The IEM thus could provide only initial insights.

In addition to the themes discussed above, the presentations identified a variety of elements to improve safety in the framework of the Action Plan:

- The response to the threat from external hazards should include combinations of hazards and include consideration of complications that can arise on multiple-unit sites and from disruption of infrastructure;
- Continuing efforts at the estimation of tsunami and earthquake hazard are appropriate and adjustment in regulatory requirements should reflect evolving knowledge;
- More attention is necessary concerning the mitigation of severe accidents;
- Accident analyses should include careful consideration of the time sequence of the possible progress to a severe accident, thereby providing operators with a clear understanding of the time for intervention;
- The severe accident management framework should be strengthened by including it more centrally in regulatory systems, with due regard for organizational, human, technical and safety-culture-related issues;

- Key systems to respond to beyond-design-basis events in order to return the plant to a safe and stable state should be identified and be strengthened;
- The I&C systems necessary for monitoring of critical safety parameters during any accident condition should be hardened;
- The spent fuel pools at the Fukushima accident appear, based on current knowledge, to have survived the earthquake and tsunami well, but the accident revealed the need for more capable instrumentation to monitor the status of the pools and for a robust capability to restore water to the pools;
- On-site and off-site resources, including mobile equipment and facilities for dealing with multiunit and disrupted infrastructure, should be available at the regional, national or even international level;
- Realistic exercises are necessary to insure effective emergency response capability;
- The onsite emergency center at Fukushima, which was in a seismically qualified building with appropriate air filtration, proved to be crucial in enabling accident response;
- Careful evaluation of radiation protection standards under accident and post-accident circumstances should be undertaken;
- The lessons learned from the Fukushima accident should be taken into account in designing, siting, constructing, operating, and licensing new nuclear power plants.
- The Japanese experience in the recovery from the accident, including the decommissioning of the damaged reactors and the cleanup of contaminated land, will provide important lessons for the world community.
- IAEA should enhance its interaction with the industry – including operators, research organizations and vendors;
- IAEA should disseminate information derived from Fukushima-related safety research undertaken by relevant international organizations such as OECD/NEA, regional and national research organizations;
- Response to the Fukushima accident should reflect the need to consider both safety and security and to assure that actions reflect consideration of both;
- There should be strengthened IAEA support for countries embarking on nuclear power in order to identify relevant lessons learned to be applied to new nuclear programs;
- Objective, factual and critical IAEA peer reviews are essential for design, site evaluation, operation and a sound regulatory framework;
- An effective nuclear safety regulatory framework, including an independent regulator, is essential; and
- Regulatory bodies should have sufficient competence and resources and focus their efforts on formulating and updating regulatory guidelines and standards, taking into account the IAEA Safety Standards and applicable knowledge.

At the same time, it was stressed that major safety issues associated with the continued operation of nuclear power plants should continue to receive proper and adequate attention. The interest in Fukushima should not interrupt the important obligation to pursue ongoing programs to assure that plants continue to operate safely. In particular continued and full compliance with the licensing and design basis is of particular importance as it provides assurance that estimated safety margins are actually available in the event of the occurrence of an accident-initiating event.

3. Possible Next Steps

- The information presented at this experts' meeting should be further analyzed and be used in the implementation of the Action Plan. The preparation of a report derived from this IEM is appropriate.

- There remains a need to continue international interaction. Many attendees reported that they have not completely finished their assessments. There is much still to be learned and shared. Indeed, as noted above, the development of the full set of lessons learned will likely take several years. The high level of the presentations at the meeting and the quality of interactions among the participants justify convening a similar event in the future. In the meantime, the upcoming Extraordinary Meeting of the Convention on Nuclear Safety will be an important opportunity for further exchange.

- The IAEA should make available the information from this IEM to the Safety Standards Committees and the Commission of Safety Standards (CSS). The lessons that were discussed at the meeting should be considered in the response to the Action Plan and evaluated for incorporation into IAEA Safety Standards.

- Many countries are pursuing strengthened severe accident management, including for example the venting of containment. This effort raises issues that would benefit from continued interaction among experts from around the world.

Richard A. Meserve