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Communication dated 24 August 2012 from the Chairman of the International Nuclear Safety Group (INSAG)

On 24 August 2012, the Director General received a letter from the INSAG Chairman Richard Meserve, providing his perspective on current emerging safety. The aforementioned letter is circulated herewith for the information of the General Conference.

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August 24, 2012

Mr. Yukiya Amano
Director General
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Dear Director General Amano:

I am writing in my capacity as Chairman of the International Nuclear Safety Group ("INSAG"). INSAG's terms of reference state that INSAG should provide "recommendations and opinions on current emerging safety issues" to the IAEA and others. During my term as Chairman, I have customarily sought to fulfill this obligation on behalf of INSAG by supplementing the various INSAG reports with an annual safety-assessment letter. This letter will constitute this year's contribution. My past letters are available at the INSAG website at http://goto.iaea.org/insag.

As you know, I submitted a letter last year that responded to your request for INSAG advice to guide actions related to the Fukushima accident. *See* 2011 INSAG Safety Assessment Letter. The letter drew on information from the June 2011 Ministerial Conference and sought to provide input to the Action Plan that was subsequently endorsed by the Member States. *IAEA Action Plan on Nuclear Safety* (endorsed Sept. 22, 2011) (http://www.iaea.org/newscenter/focus/actionplan/reports/actionplanns130911.pdf). The agency has undertaken many activities in implementing the Action Plan, some with INSAG's involvement. *See Key International Events in First-Year Implementation of IAEA Action Plan on Nuclear Safety* (http://www.iaea.org/newscenter/news/2012/nsactionplan.html). Moreover, there is an impressive array of Fukushima-related activities that have been launched by regulators and operators around the world, by vendors, and by other organizations, including the World Association of Nuclear Operators (WANO), the Institute for Nuclear Power Operations (INPO), and the OECD's Nuclear Energy Agency (NEA).

Nonetheless, although much has been learned and many changes to enhance safety have been introduced, the full response to the Fukushima accident is still unfolding. Because detailed scrutiny of the damaged reactors has not yet been completed, a full assessment of the accident cannot yet be undertaken. Certainly, there are many lessons still to be learned. But there is much that has been learned already and we should not delay making changes to

accommodate those lessons. Indeed, actions are being taken now by the world community, with able assistance from the IAEA. Many of these lessons are well summarized elsewhere.[1] It is my purpose in this letter to stand back from the accident and to make some broader observations about the accident and the work that is now underway. It is my hope to stimulate further productive progress in strengthening the safety of nuclear power.

First, there is a very commendable effort by all those involved in the nuclear enterprise to analyze the accident forthrightly and to implement change. A possible response might have been that the accident had few implications for most countries on the basis that it resulted largely from glaring defects in the Japanese safety system. *See* Kurkokawa Commission Report, *supra* note 1. But instead, there has been widespread recognition that the accident revealed vulnerabilities that every entity involved in the nuclear enterprise should address. Safety assessments have been undertaken in all countries that operate nuclear power plants ("NPPs"), resulting in new insights and innovative ideas for further enhancing nuclear safety. The cumulative effort is impressive. As a result, so long as an appropriate focus is maintained, lessons learned from the accident will result in enhancement of nuclear safety everywhere. Indeed, the willingness of those involved in the nuclear enterprise to address the implications of the accident forthrightly and aggressively is no doubt a major factor in the maintenance of trust in the promise of nuclear safety by political decision makers and the general public in most countries.

Second, the accident has reinforced the importance of careful attention to external events, such as floods, earthquakes, and tsunamis. Probabilistic risk assessments have tended to show that the vulnerability of plants to severe accidents initiated by **internal** events is very small. This is true as a general rule for older plants as a result of safety upgrades and is more the case with the new plant designs. As Fukushima has demonstrated, the occurrence of extraordinary **external** events is not subject to accurate prediction or control. Indeed, as a result of climate change, the probability of flooding and other extreme weather events is expected to grow over time. The Fukushima accident has reinforced the importance of designing, constructing, and operating plants so as to make them resistant to accidents initiated by natural phenomena. It is

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[1] In addition to work undertaken by the IAEA pursuant to the Action Plan, some of the other studies include The National Diet of Japan, *The Official Report of the Fukushima Nuclear Accident Independent Investigation Commission* (2012) (hereinafter "Kurokawa Commission Report"); Investigation Committee, *Final Report on the Accident at Fukushima Nuclear Power Stations of Tokyo Electric Power Company* (2012); ASME, *Forging a New Nuclear Safety Construct* (2012); American Nuclear Society, *Fukushima Daiichi: ANS Committee Report* (2012); INPO, *Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station* (2011); Japan Nuclear Technology Institute, *Review of Accident at Tokyo Electric Power Company Incorporated's Fukushima Daiichi Nuclear Power Station and Proposed Countermeasures* (2011); NRC Near-Term Task Force, *Recommendations for Enhancing Reactor Safety in the 21st Century* (2011).

noteworthy that, in so far as I am aware, every regulator and operator included an evaluation of vulnerability to extreme events as an early response to the Fukushima accident. The attention to external events should continue.

Third, the accident reinforces the reality that the assurance of safety requires continuing and careful vigilance and attention. The three major accidents involving commercial power plants – Three Mile Island, Chernobyl, and Fukushima Daiichi – all occurred in technically sophisticated countries with extensive managerial experience in operating complicated engineering systems. These accidents reinforce the importance of strong leadership in all the institutions involved in nuclear power so as to ensure attention to safety, as well as continuing efforts to understand the technology and to improve it. Many new entrant countries – that is, countries without experience with a nuclear power plant, but with the intention to acquire one – do not necessarily have these skills, with the result that the challenges associated with assuring safety will be even more daunting than in the experienced countries. Policy makers in the new entrant countries need to recognize the need to establish a safety infrastructure as a critical early task. An INSAG report now in preparation (INSAG-26) is intended to provide practical guidance to policy makers and managers in the new entrant countries as to the challenges that they must overcome, along with suggestions as to how best to do so. It is in the interest of all to ensure that the new entrants can succeed.

Fourth, although there are engineering lessons to be learned from Fukushima, there are many important lessons that fall into other areas. For example, the accident reinforces the need for every operator to recognize its fundamental responsibility for safety. Tangible evidence of this recognition should be shown through a continuous and self-imposed drive for safety excellence, including regular investments to address insights arising from operating experience and evolving knowledge of external events and to incorporate advances in safety technology. Similarly, even though the prime responsibility for safety rests with the operator, the accident shows that the regulator must be competent, independent, and dedicated to the task of ensuring that safety obligations are fulfilled. Perhaps most important, the accident reinforces the need to establish a safety culture in which safety is the highest priority and in which everyone involved in the nuclear enterprise accepts personal and individual responsibility for it. In many respects, these “soft” elements of the response to Fukushima may be more challenging to implement than the modifications of hardware. But they are no less important.

Fifth, the accident has reinforced the importance of careful attention to accident management and emergency response. The accident showed that it is essential to establish a clearly defined chain of command to ensure that accident-management decisions can be taken promptly at the appropriate operational level. Plant operators dealing with a compromised plant may find themselves overwhelmed by the circumstances, arguing for the establishment of

readily available offsite technical resources, as well as comprehensive planning and challenging exercises to prepare plant personnel. Robust communications capability even with extensive disruption of infrastructure is essential, including preparations for effective, understandable and timely communication of accurate and actionable information to the affected public. There should also be realistic and regularly exercised emergency planning in the vicinity of the plant site, at the national level, and at the international level. In this connection, the IAEA has a clear role in helping to marshal the flow of information internationally and in coordinating external support for emergency response.

Sixth, one of the more interesting elements of the responses to Fukushima is the stimulus the accident has provided for the reexamination of the intellectual foundations of the nuclear safety system. In the absence of experience with nuclear power, regulatory systems were initially established with a focus on certain "design-basis accidents." These were postulated events that an NPP was to accommodate on the basis of engineering features, such as the capability through supplemental systems to continue to cool the core in the event of a large pipe break in the reactor coolant system. In addition, the regulatory system encompassed a variety of safety-enhancing features, including a philosophy of defense in depth, reflected in layers of independent prevention and mitigation capability; redundant and diverse means to respond to events; stringent quality-assurance standards; conservative engineering design; and attention to configuration management, training, maintenance, and operational requirements. This approach provided a solid foundation for safety. But as knowledge has grown, particularly through the use of probabilistic risk assessment, and experience has been gained, there has been increasing attention to challenges that extend beyond the design-basis approach. This resulted over the years in supplemental requirements dealing with such things as so-called "station blackout," which refers to the loss of both offsite and onsite AC power, or anticipated transients without scram. These supplemental requirements were not typically fully integrated into the regulations in the same fashion as design-basis events. Because the loss of on- and off-site power was a fundamental challenge with the Fukushima Daiichi plants, operators and regulators are now ensuring the augmentation of power supply as a short-term action. Given the importance of AC power supply to the fundamental safety functions (reactivity control, decay heat removal, and containment integrity), these actions provide immediate safety benefits. Indeed, the designs for future nuclear plants should seek to eliminate or reduce the dependence on AC power for meeting the fundamental safety functions. In addition, some contemplate a fuller integration of a broader set of challenges to safety into the regulatory system, with the result that protection will be provided for more events than is achieved using the traditional design-basis approach. *See* IAEA, *Safety of Nuclear Power Plants: Design* (No. SSR-2/1, 2012); NRC Near-Term Task Force, *supra* note 1. This should result in a further capability to ensure safety in the face of even improbable events.

Seventh, it is noteworthy that the world has reacted to the Fukushima accident with grave concern, despite the fact that the available information would suggest that significant detectable long-term radiation-related health effects have not arisen and are not expected. No workers have died or suffered permanent injury or acute illness as a result of radiation exposures, although the doses to some workers exceeded regulatory limits. Similarly, the radiation impacts on the health of the Japanese public, if any, were restricted as result of countermeasures that served to limit radiation exposures. It is the case, however, that other impacts on the Japanese public have been very severe as a result of the evacuations, the extensive land contamination, and the disruption of the economy. Although the focus of regulatory systems has been on radiation-related impacts on public health and safety, the Fukushima accident shows that even events that do not have extensive radiation-related health consequences can impose grievous damage. This reinforces the importance of preventing events even in the absence of significant direct radiation-related health impacts and argues for expanding the scope of regulatory assessments to include more emphasis on broader environmental and societal effects.

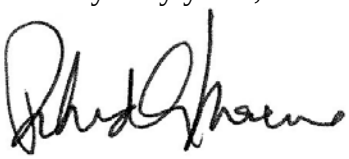
Finally, one of the painful lessons of the Fukushima accident has been the difficulty encountered by the Japanese in dealing with the post-accident consequences. The Japanese have confronted technical challenges in achieving the remediation of contaminated land and water in a cost-effective way. And they have faced serious policy challenges arising from the need for establishing and implementing cleanup and exposure standards. These latter challenges are complicated by the need to find an appropriate balance of science with social/political needs. Indeed, Japan is confronting a severe challenge to its entire energy system in the aftermath of the accident; as a consequence of the loss of public confidence, nearly all of Japan's NPPs, which had provided about 30% of Japan's electrical power, are not in operation. There is much that the world can learn about the need to prepare for and respond to an accident as a result of the ongoing Japanese efforts. We can hope that the safety lessons from Fukushima will be sufficient to enable the world to avoid another serious accident, but we should prepare for one nonetheless. The world should not only provide assistance to the Japanese in dealing with the accident, but also undertake focused efforts to learn from their experience.

It is INSAG's intention to prepare a report about the Fukushima Accident, guided by further information about the accident and the output from the Action Plan and the many other assessments. We will seek not to duplicate the commendable work undertaken by others, but rather to distill the central lessons for various stakeholders – policy makers, regulators, operators, vendors, technical support organizations, and international organizations. We plan to start our work on this project in earnest at our next meeting.

As the Fukushima accident has reinforced, the IAEA has a critical role in advancing nuclear safety. INSAG stands ready to assist you further in any fashion that would be helpful.

Best regards.

Very truly yours,



Richard A. Meserve

cc: Denis Flory
INSAG members