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Mr. Yukiya Amano  
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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. My past letters are available at the INSAG website at <http://goto.iaea.org/insag>.

In each past letter I have discussed a cluster of challenges. In this letter, I seek to highlight one particular issue – the challenge of enabling those countries that are embarking on nuclear construction for the first time to succeed. I focus on this matter because I seek to emphasize that prompt and comprehensive action is necessary to meet the needs of the new entrants, not because other matters do not warrant attention. I see assistance of the new entrants as a time-sensitive and high-priority issue. To some extent, the issues that are raised in this letter also apply to countries with existing limited nuclear power programs, but that are considering the expansion of their programs.

As you know, we live in a time of renewed interest in nuclear power. About 50 reactors are under construction around the world today, nearly all in countries familiar with nuclear power. However, one striking change from the past is now emerging – namely, the interest in the pursuit of nuclear power by a large number of countries that have no previous experience with power reactors. A first power reactor is under construction in Iran; contractual relationships with vendors are advancing in Turkey and the United Arab Emirates; and aggressive efforts to introduce nuclear power are underway in Belarus, Chile, Egypt, Indonesia, Jordan, Lithuania, Malaysia, Morocco,

Mr. Yukiya Amano

August 25, 2010

Page 2

Nigeria, Poland, and Vietnam. And despite the current economic challenges, many other new-entrant countries are carefully considering nuclear power. In fact, I understand that more than 60 countries have informed the IAEA of their possible interest.

There are many positive features associated with this development. Electricity is a central and indispensable foundation for societal development and economic growth. It is in the interest of all to ensure that the critical need of the developing world for energy is satisfied. The factors that explain the interest in nuclear power as a means to meet this need include volatile fossil fuel prices, the geographic concentration of significant oil and gas reserves with resultant energy-security concerns, and economic considerations. A factor of increasing salience is the need to avoid the adverse climate impacts of fossil fuels. Given the threat from growing concentrations of greenhouse gases in the Earth's atmosphere, increased reliance on nuclear power is a welcome means for satisfying energy demand.

Of course, the expansion of nuclear power does present challenges. Substantial growth in nuclear power in a wide group of nations could present proliferation risks. In this instance, the principal concern is not so much the existence of more nuclear reactors in more places as it is a possible expansion of fuel-cycle activities. More reactors obviously mean more demand for enrichment services and the eventual existence in more places of plutonium-laden used fuel. Involvement in uranium enrichment activities or in the reprocessing of used fuel could provide access to weapons-usable material, a concern for all those in the world who seek to avoid a nuclear cataclysm. Since the expansion of nuclear power itself is well underway, it is apparent that a high priority should be placed in meeting the fuel-cycle needs of the new entrants in ways that do not expand proliferation risks. The response should involve efforts to provide fuel assurances so that countries do not need to develop domestic enrichment capability, to reach agreements for the disposition of used fuel so that reprocessing does not expand proliferation risks, and to strengthen the international non-proliferation regime to ensure that the overall system can function effectively.

Security issues are also of concern as a result of the outbreak of terrorist activities around the globe. Because of the fear that is associated with nuclear matters, reactors are targets that might be attractive to terrorist elements. The new entrants must have the capability to prevent either the diversion of radioactive materials or a successful attack that could result in a release to the environment.

The focus of this letter, however, is on the safety-related dimension of growing reliance on nuclear power. I recognize that the proliferation and security issues discussed above are of paramount significance. But the

proliferation challenge arising from wider participation in nuclear activities will arise only if a country abrogates its commitments under the Treaty on the Non-Proliferation of Nuclear Weapons. And a security challenge will arise only if a terrorist seeks to attack a nuclear facility or to steal material. Safety, on the other hand, is a challenge that every new entrant will necessarily confront. It is an inevitable and on-going challenge at every nuclear site.

It is in the interest of all those involved in the nuclear enterprise to ensure that the new entrants are successful in achieving safety. This interest arises not only from a humanitarian impulse to help others avoid a serious accident, but also from the practical consequences of such an accident. To some extent every user of nuclear power is hostage to the safety performance of other users because of the adverse consequences that would arise if there were a nuclear accident anywhere. The enthusiasm and interest in nuclear power would likely be significantly dampened by the public concerns that would arise in the aftermath of a major nuclear event. Given that nuclear power is a vital tool in advancing economic development, providing energy security, avoiding greenhouse gas emissions, and enhancing the well-being of the world's population, it would be a tragedy if its prospects were dimmed by an avoidable accident. It is thus in the interest of all to ensure that the new entrants gain the benefit of the hard lessons that have been learned over many years from those countries with nuclear experience.

There are extensive safety-related obligations that a new entrant must be prepared and enabled to shoulder as it embarks on a nuclear power program. These obligations can extend for at least a century – the period of preparation, construction, operation, and then decommissioning of a nuclear power plant -- and even longer if the country takes responsibility for the disposition of used fuel. Perhaps most important and most difficult are the cultural, educational, legal and social components of a nuclear program. Successful nuclear programs demand a commitment to safety that extends far beyond those associated with nearly all other human endeavors. The creation of a culture that enables the achievement of safety takes persistence, commitment and very hard work and needs to start at the moment that a decision is made to embark on a nuclear power program and endure throughout a power plant's life. It is expensive. And it involves an attention to detail and a willingness to accept and learn from intrusive peer review by others. **The nature and scope of this challenge may not be fully apparent to those who have not previously been involved in the nuclear enterprise.**

Meeting the needs of the new entrants should involve all those engaged in the nuclear enterprise:

- New entrants. As noted above, the responsibilities of the new entrants are extensive and endure throughout the life of the NPP. Their entry into the community that relies on nuclear power must reflect a full awareness of and

commitment to meet their obligations. This involves an early emphasis on developing a national nuclear infrastructure, including the determined development of technical expertise. The formal manifestation of this commitment involves entry into and adherence to the global nuclear safety regime, which includes the Convention on Nuclear Safety, the Convention on the Early Notification of a Nuclear Accident, the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, and the Joint Convention of the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. The benefits of adopting these conventions arise in part from the extensive international interaction that arises from participation in them. Full engagement in the global nuclear safety regime will help the new entrant states to benefit from practical lessons that have been learned by those countries with currently operating plants. *See generally Strengthening the Global Nuclear Safety Regime (INSAG-21) (2006).*

The capabilities that must be in place change with the maturation of the nuclear program. At the opening stage, the new entrant must establish the legal framework for nuclear activities and create an independent, competent and well funded regulator with an overriding commitment to nuclear safety. The creation of the overall legal regime will take time and should be fully in place at an early stage in order to provide the framework for interactions with vendors. In this connection, development of personnel with the necessary skills to populate the operating entity and the regulator will be a challenge. The necessary early capabilities include the staffing of the regulatory organization with personnel with sufficient technical knowledge and sophistication to establish the regulatory regime. At the same time, the operating entity must have staff with the capability to interact at a technical level with vendors and related organizations. The licensing process requires staff in both the operating entity and the regulator with a deep understanding of the technical features of the design and experience with quality assurance. Entry into the construction phase requires staff with broad management and engineering expertise. And then operation of the reactor demands further personnel with understanding and experience with operations, maintenance, training, and environmental monitoring. In short, the range and depth of capability must grow continually as a nuclear project proceeds. And at every stage, the achievement of safety must be seen as the overriding priority.

- International Organizations. International organizations can help a new entrant country to understand the safety issues arising from the construction and operation of a nuclear power plant, as well as to help in building competence in the various organizations involved in the program. To achieve this end, **international organizations, including in particular the IAEA, should expand assistance that is tailored to the needs of new**

**entrants.** The nature of the assistance should change with the maturation of a given country's nuclear program. At the early stage, it must include outreach to regulators in the new entrant countries to ensure the development of full familiarity with the appropriate legal and regulatory regime for safety, guidance on the application of safety standards and on the evaluation of siting and environmental issues, and assistance with the monitoring of construction. In particular, support should be provided on design requirements, safety assessment, and in establishing the technical competence for informed interaction with vendors. In short, there should be extensive efforts to ensure that the regulators benefit from the knowledge and experience in the construction and operation of existing nuclear power plants. The IAEA and the World Association of Nuclear Operators ("WANO") can provide similar assistance to operators in the new entrant countries. Continual evaluation of the adequacy of the assistance should be undertaken to ensure that the needs of the new entrants are being adequately satisfied. Of course, assistance by international organizations does not reduce the safety responsibility that must be shouldered by the new entrant countries.

The fulfillment of the IAEA's obligations involves the application of proven safety practices. In this connection, the IAEA safety standards provide crucial general guidance. Unfortunately, the resources available for the development of standards are inadequate and the quality, consistency, and scope of the standards could be improved with more effort. At the same time, practical experience has shown that the availability of high-quality safety standards is not enough to guarantee their effective implementation. The peer review services provided by the agency are also of utmost importance in transmitting knowledge on good safety practices and in making focused safety improvements. But the current resources of the IAEA do not permit timely response to the increasing demand for peer-review services. **With the influx of new entrants, the IAEA's standard-development and peer-review services need to expand significantly.**

- Vendors. As part of their contracts, vendors customarily provide careful assistance through design, construction, and the early stages of operation, with less intensive involvement thereafter. But the achievement of safety requires a sustained effort throughout the life of the plant. Vendors must seek to ensure that a new entrant understands and has the capability to meet its safety commitments. With guidance from the vendor, the operator must develop an understanding of the design in great depth so that safety margins can be maintained in all modes and in all equipment configurations. At the same time, the vendors should help the new entrant to build and maintain the enduring national technical infrastructure that is needed for continued safe operation. Continuing assistance should be seen as part of a vendor's obligation.

- Regulators. Operators customarily obtain extensive assistance from the vendors, but the new-entrant regulators do not necessarily benefit from similar support. Because the regulatory capacity in the new entrant must greatly expand with the introduction of a nuclear power plant, **the international regulatory community should assist in the development of regulatory competence.** This obligation probably should fall most heavily on the regulators with experience with the vendor's design, which most often would include the home country of the vendor. Even with such outside assistance, however, the new regulator should develop a full understanding of the design so that it has the necessary capability to know when to intervene to ensure that safety margins are maintained during both the construction and operating phases of a nuclear power plant. The new regulator cannot simply defer this responsibility to others.

In this connection, experienced regulators should welcome the temporary assignment of new-entrant staff. The opportunity for new-entrant staff to rub shoulders with the staff of more experienced regulators can provide practical experience that will be of great importance to regulatory success. The recent establishment of the Regulatory Cooperation Forum by the IAEA is a very welcome means to enhance the exchange between mature and newcomer regulators.

- Operators. Experienced operators of existing plants can also play a role in helping the new entrants. In particular, operators of existing nuclear plants can bring management and technical skills that could be of great assistance to the new entrant countries. The major lesson that a new operator should learn is the need and challenge of establishing and maintaining a safety culture – that is, an overriding commitment to safety at all levels of the operation.

There are a variety of means by which a new operator might develop the necessary skills. At one extreme, a new entrant country might consider the engagement of an experienced operator to run or to assist in the operation of a plant for at least a term and thereby to facilitate the transfer of knowledge and capabilities. (I understand that this is the approach contemplated by the United Arab Emirates.) The involvement of experienced operators during commissioning and for a period thereafter as part of a team with the new operators can help build skills and competence.

Less formal interactions could also be useful. It would be helpful, for example, for the operator in the new entrant to place its principal staff for a term in an operating plant in a country with long experience so that its staff can develop the many skills that are associated with successful operation. I have confirmed that at least some operators in the United States are willing to welcome personnel from the operating entity in new entrant countries in

their power plants for a term. Operating entities in other countries can and should help in the same way.

- Technical Support Organizations. Technical support organizations (TSOs) provide an important means for the exchange and implementation of safety lessons across national boundaries. The new entrants should augment internal capacity by establishing relationships with such organizations. These organizations, in turn, should recognize their special responsibility to help build capacity in the new entrant countries. The new entrants should start at an early stage to develop national TSOs that provide a capability to meet the technical challenges that will arise (e.g., aging management, evaluation of abnormal events).
- Others. Professional societies, industry groups, vendor-specific support organizations, and standards development organizations also can provide an important means for building capability and exchanging information. Full engagement with these organizations by the new entrants is a part of the means to participate in the global nuclear safety regime.

There is a common theme among all of these recommendations – namely, that outreach and involvement with experienced countries can be of enormous value to those now embarking on nuclear power. There is an obligation of the new entrants to seek and engage with other countries in this way and a counterpart obligation of the experienced countries to assist. In this connection, **I urge the IAEA to facilitate engagement with the challenge presented by the new entrants through encouragement and coordination of efforts by all those involved in the nuclear enterprise**. As noted above, meeting the needs of the new entrants will require that the IAEA enhance the staff and financial resources that are devoted to this challenge.

Of course, for those contemplating reliance on nuclear power, there are resources that more fully explain the range and nature of the obligations that must be assumed by a new entrant. INSAG has prepared a report on this subject entitled *Nuclear Safety Infrastructure for a National Nuclear Programme Supported by the IAEA Fundamental Safety Principles* (INSAG-22) (2008) that seeks to define the various elements of a new entrant's obligations at each stage of the life cycle of a nuclear power plant. This INSAG report supplements various other IAEA documents on this subject. *See Milestones in the Development of a National Infrastructure for Nuclear Power* (2007) and *Considerations to Launch a Nuclear Power Programme* (2007). The IAEA safety standards also provide a general backdrop that defines in greater detail the scope of the safety obligation, including guides that describe the best practices to which a new entrant should aspire. (A new standard, now in draft, may be particularly helpful. See *Establishing a Safety Infrastructure for a*

Mr. Yukiya Amano  
August 25, 2010  
Page 8

*National Nuclear Power Programme (DS 424) (2010).*) These materials are accessible on the web at <http://www-ns.iaea.org/standards/>.

Over the years INSAG has prepared numerous reports that chart areas bearing on the achievement to safety. I have enclosed with this letter a summary of some of the relevant INSAG reports. (The reports will soon be available on a CD.) Two new INSAG reports are in the final stages of preparation and may also provide useful guidance: *On the Relationship between Safety and Security in Nuclear Installations (INSAG-24) (2010)* and *A Framework for an Integrated Risk-Informed Decision-Making Process (INSAG-25) (2010)*.

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I hope that this letter and its enclosure are helpful to you. I believe that the IAEA has a crucial role in facilitating safety and should undertake an aggressive effort that is directed at the needs of the new entrants over the coming years. Please contact me if INSAG can offer further assistance on this or other matters.

Best regards.

Very truly yours,



Richard A. Meserve

Enclosure

cc: Tomihiro Taniguchi  
INSAG members



## NOTE TO DECISION MAKERS IN EMBARKING COUNTRIES

The International Nuclear Safety Group (INSAG) is a group of experts with high professional competence in the field of nuclear safety working in regulatory organizations, research and academic institutions and the nuclear industry. INSAG convenes under the auspices of the International Atomic Energy Agency (IAEA) with the objective of providing authoritative advice and guidance on nuclear safety approaches, policies and principles. In particular, INSAG provides recommendations and opinions on current and emerging nuclear safety issues to the IAEA, the nuclear community and the public.

In 2008 INSAG issued a report entitled “Nuclear Safety Infrastructure for a National Nuclear Power Programme Supported by the IAEA Fundamental Safety Principles”, INSAG-22. In the report nuclear safety infrastructure is defined as “*the set of institutional, organizational and technical elements and conditions established in a Member State to provide a sound foundation for ensuring a sustainable high level of nuclear safety*”.

INSAG-22 was intended to complement the guidance to new entrants provided in other IAEA publications, such as *Considerations to Launch a Nuclear Power Programme* (2007) and *Milestones in the Development of a National Infrastructure for Nuclear Power* (2007), and was the basis for the preparation of the draft safety guide DS-424 on “Establishing a Safety Infrastructure for a National Nuclear Power Programme”.

The development of a safety infrastructure is a prerequisite to the introduction of nuclear power and thus should be considered and established at the early stages of a nuclear power programme. A set of elements need to be introduced to ensure safety for the entire life cycle of a nuclear power plant. Many of these measures are the subject of INSAG reports, such as the need for the implementation of a strong safety culture, the involvement of all stakeholders in the decision making process, and the participation of the newcomer countries in the global safety regime.

The attached table identifies certain fundamental elements of nuclear safety infrastructure that have been addressed in various INSAG reports. The reports seek to convey the importance of these elements and the appropriate measures to implement them.

Attached to this note you will find a CD with the whole set of INSAG reports published up to the present time.

**Table 1: INSAG Reports with fundamental messages to countries embarking in a nuclear power programme**

INSAG REPORT	PREDOMINANT ASPECT	MAIN MESSAGE
<b>Stakeholder Involvement in Nuclear Issues (INSAG-20)</b>	<b>Organizational</b>	Decisions regarding such matters as the siting and construction of a nuclear power plant are no longer largely the domain of a closed community of technical experts and utility executives. The concerns and expectations of all manner of persons and organizations from the local farmer to the international financial institution must be considered.
<b>Safety Culture (INSAG-4, INSAG-15)</b>		Except for what are sometimes called “Acts of God,” any problems arising at a nuclear plant originate in some way from human error. For these reasons, individuals carry heavy responsibility and they must act in accordance with a “Safety Culture.” Safety culture is defined as the assembly of characteristics and attitudes in organizations and individuals which ensures that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance
<b>Safety Management System (INSAG-13)</b>		Organizations having a strong safety culture have an effective safety management system with the support of and ownership by all staff. The safety management system provides a framework by which the organization ensures good safety performance throughout the planning, control and supervision of safety-related activities.
<b>Improving the International System for Operating Experience Feedback (INSAG-23)</b>		The report focuses on systems for the exchange of operating experience by intergovernmental organizations with close contacts to national regulatory authorities. These systems provide an alternative network to the worldwide system employed by the operators of nuclear facilities known as the World Association of Nuclear Operators (WANO).
<b>Independence of the Regulatory Body (INSAG-17)</b>	<b>Institutional</b>	A common understanding should be developed among legislators and other political decision makers, nuclear safety regulators and licensees as to the importance of independence in regulatory decision making and how to achieve it. The primary reason for independence of the regulatory body is to ensure that regulatory decisions can be made and enforcement actions taken without pressure from interests that may conflict with safety.
<b>Design Knowledge (INSAG-19)</b>		When a plant is first built, its design is shared among a number of entities: the architect-engineer; the vendor of the reactor itself and its supporting systems; contractors; and many others. When the plant is put into service, much of the detailed knowledge used in the design must be transferred to the operating organization. However, the knowledge that is transferred will not be complete. The need to maintain design integrity and to preserve the necessary detailed and specialized design knowledge poses a significant challenge for the organization that has overall responsibility for the safety of a plant over its operating lifetime.
<b>Global Safety Regime (INSAG-21)</b>		The Global Nuclear Safety Regime is the framework for achieving the worldwide implementation of a high level of safety at nuclear installations. Its core is the activities undertaken by each country to ensure the safety and security of the nuclear installations within its jurisdiction. But national efforts are and should be augmented by the activities of a variety of international enterprises that facilitate nuclear safety — intergovernmental organizations, multinational networks among operators, multinational networks among regulators, the international nuclear industry, multinational networks among scientists, international standards setting organizations and other stakeholders such as the public, news media and non-governmental organizations (NGOs) that are engaged in nuclear safety.

INSAG REPORT	PREDOMINANT ASPECT	MAIN MESSAGE
<b>Defence in Depth in Nuclear Safety (INSAG-3 INSAG-10)</b>	<b>Technical</b>	The concept of defence in depth is fundamental to the safety of nuclear installations and applies to all safety activities, whether organizational, behavioural or equipment related.
<b>Potential Exposure in Nuclear Safety (INSAG-9)</b>		The acceptance of nuclear power implies acceptance of risks that can be reduced but cannot be completely eliminated. Such risks include harmful radioactive exposures. What constitutes an acceptable level of safety for a nuclear power plant should be judged by an evaluation using deterministic methods, complemented by probabilistic safety assessment.
<b>Safe Management of the Operating Lifetimes of Nuclear Power Plants (INSAG-14)</b>		Nuclear safety needs to be maintained during the entire lifetime of the nuclear power plant. Degradation of materials and equipment as well as complacency in operation may jeopardize nuclear safety.
<b>The safety of Nuclear Power (INSAG-5)</b>	<b>Organizational Institutional and Technical</b>	If events cause large scale construction of nuclear plants to start again, will the new plants be adequately safe? The report considers the safety of the nuclear industry, including the question of whether disposal of waste from nuclear power plants is so difficult that it rules out increased use of the technology. The report concludes that nuclear plants could be of substantial help in solving environmental problems.
<b>Basic Safety Principles for Nuclear Power Plants (INSAG-12)</b>		Safety principles do not guarantee that nuclear power plants will be absolutely free of risk, but, when the principles are adequately applied, the plants should be very safe and still effective in meeting society's needs for abundant useful energy. The concepts presented in this revision are not new, but they are consolidated and presented in a structured form with explanatory material.