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The Role of Nuclear Regulation in a Changing World

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at the

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It is indeed my pleasure and privilege to participate in the U.S. - Japan Nuclear Energy Workshop to share my perspectives as a regulator on the timely subject of the outlook for nuclear energy in a changing world. We value and are enhancing our interactions and technical exchanges with Japan's nuclear regulators in the most important areas of our countries' nuclear programs.

I believe the outlook for nuclear energy is very good, if we consider the improved state of the technology and the assured supplies of fuel, especially when we factor in the expectations of the world for an improved quality of life and for socio-political stability. **However**, It is in responding to "**however**" where I will focus most of my remarks, and I am sure all the speakers and participants in this workshop will -- somehow -- be doing likewise.

A changing world has given new meaning to the words "national security," "energy security and stability," "sustainable economic growth," "environmental stewardship" and "globalization." Complexities have increased. Response times have shortened. I will touch briefly on the issue of security as a platform to begin my remarks.

National security is now a dominant concern of this country and most others, and could remain so for quite some time. Our national security begins and ends with the principles and practices of our

democratic society, and with every component of our society that assures our liberty and the pursuit of happiness. National security does not depend exclusively on any one component of our society but rather on multiple layers of systems and infrastructures, as well as on political and financial elements.

I believe energy security is a key component of national security. Energy security ensures that a nation has a stable, dependable, safe, and abundant supply of energy. In the modern world, energy is the lifeblood of the nation, and those who imagine otherwise are deluding themselves. Energy security, economic security, and national security in the traditional sense are bound together in a seamless web, and we cannot ignore our long-term energy needs without also imperiling other aspects of our security. In this regard, the safe and reliable operation of nuclear power plants is vital to our energy security and, therefore, to the well-being of our people, and I believe it is the same for the people of Japan. From an overall energy and economical perspective, nuclear electricity supply can be a major stabilizing force in energy markets, and I believe it could be especially so if eventually coupled with hydrogen production.

I return now to the “**however**”. Regulation is a tool of society to achieve predictable and beneficial use of an activity. I have said many times: “Regulation must result in a benefit or it will result in a loss.” I dare to say this is particularly true in the case of nuclear power, a technology that is always in the public eye and subjected to public perception, in a still unforgiving environment regarding its performance.

The viability, and the probable growth, of nuclear power is inextricably linked to its regulation. There is no way, presently or in the foreseeable future, to maintain and to advance the use of nuclear power without a strong, predictable, and credible regulatory framework. Therefore, it is essential that regulatory infrastructures be all that they can be: safety-focused, with state-of-the-art know-how in every important safety aspect. Regulators should and must make independent safety-based decisions, listening to and respecting different views, and making decisions in the public interest free from undue external political influence. We also have the obligation of communicating both the good and the not-so-good safety performance, and what we are doing about it. This includes assessing and explaining potential risks with realistically conservative analysis as we carry out our mandate to provide reasonable assurances to protect the public health and safety, the environment, and the common defense and security. The present and the future of nuclear power in a changing world is directly tied to how well this mandate is accomplished, as well as to the perception of how well it is accomplished. Both the regulator and the regulated have the responsibility to address the requirements of this mandate but it is the industry’s responsibility to implement solutions and to manage safety. However, it is the indispensable responsibility of the nuclear regulator to ensure a predictable, stable, and transparent set of licensing and regulatory requirements. The exercise of these responsibilities plays a large role in these turbulent times, when nuclear generation is making a vital contribution to energy security. These responsibilities are also important components for the future outlook and growth of nuclear energy.

Let me return to the present. I mentioned our obligation to protect public health and safety. The proof of the pudding is in the tasting -- that is a performance-based concept. Let me summarize the results of the efforts of the U.S. nuclear power industry and of the NRC: no member of the U.S. public has been injured from the operation of or from any event or accident at nuclear power plants. No one. The 103 nuclear power plants currently in operation in the U.S., and those now shutdown, have been operated by our licensees in a manner that has protected the public from radiological hazards. I emphasize our licensees because they have the responsibility for the safe operation of the plants; they run them, we regulate them, in a manner that allows the beneficial use of these installations

without compromising safety or security. Because our system makes plant operators responsible for the safety of their plants, it is essential for the NRC to have very clearly defined licensing and regulatory processes that provide predictability in what is required, inspected, and reported to assure safety. Aside from licensing activities, we independently conduct assessments and inspections to verify that adequate safety margins are maintained. Thus, the safety framework includes both the licensees' multiple programs for conducting safe operations, implemented through operational safety programs, and the government's clear role in providing independent analysis and oversight for assurance of safety. In this way, licensees are able to fulfill their intended function; which is to supply -- in a safe and secure manner -- electricity from nuclear power plants.

Operational safety is a broad concept that includes the obligation of nuclear power stations to maintain adequate safety margins. The U.S. Nuclear Regulatory Commission requires nuclear power plants to shutdown when they cannot maintain the essential safety margins embodied in the plant Technical Specifications. But we do not require plants to shut down when there are small decreases in safety margins, as long as the licensees maintain the margins that have been agreed upon as needed for continued safe operation of their plants -- adequate margins to protect public health and safety. Our law is clear, and I quote from our courts: "The level of adequate protection, need not, and almost certainly will not, be the level of zero risk". This is because we recognize and accept the fact that all human activities have a level of risk that is greater than zero. It is not only lawful, but can be beneficial to society to operate facilities, including nuclear power plants, with equipment or processes that have only minor defects or deficiencies as long as they are within acceptable safety standards. It is also important that prompt corrective actions be taken, as they are needed. Safe operation of these facilities can then contribute to the economy and quality of life of the country. I believe U.S. nuclear power plants, operating within these constraints and rights, today have an excellent record of safety and reliability. These two factors, safety and reliability, actually reinforce each other, with one proviso: safety must always be first. I believe that the majority of U.S. nuclear power plant operators, guided by a clear set of safety rules, and by high safety expectations, have focused on safety, and found a corresponding increase in their reliability and competitiveness.

Let me be a bit more specific on the role of regulation in nuclear energy and a changing world. It is more than obvious that under-regulation, over-regulation, or stagnant regulation can have a deleterious effect on the development of nuclear technology. It is not so obvious that a stagnant nuclear technology has the same effect on regulation, yet it does. Both nuclear regulation and technology changed little during the most rapid pace of technological improvements in the history of mankind. A bit of U.S. history would help to emphasize these points:

- (1) the core of deployed nuclear reactor technology is about 40 years old;
- (2) the core of nuclear reactor regulation is about 30 years old; and,
- (3) the technology is defined by a docketed design basis, which lasts the plant lifetime.

For example, the key U.S. reactor safety criteria and regulations, like 10 CFR Part 50 Appendices A and B, ECCS criteria, etc. are about 30 years old and have served their function. **However,**

Surprisingly -- or perhaps not so surprisingly -- the industry performance gains from 1985 to 1996 were achieved by steady, systematic operational and management improvements, without technological or regulatory breakthroughs. The overall performance gains, including improved economics, enabled the industry to make major commitments, like license renewal, power uprates, and technological improvements. All of these enhancements were, and still are, bounded by the traditional design basis and accident criteria, and all they entail. By the mid-1990s, the pace of needed improvements accelerated, and I believe we are now at the threshold of implementation of both technological and regulatory improvements that are significant and beneficial to society.

There are a few lessons in the last 30 years that should not be lost on those seeking to reduce to practice what has been learned. One is very apparent to me: nuclear technology and its regulatory framework must be in-phase with each other, compatible and predictable; and this requires utilizing state-of-the-art know-how for all key issues of safety and technology.

This is a mature industry with a mature regulator, and maturity has a lot to do with the present high performance of the nuclear fleet. In the nuclear business, maturity also requires learning, awareness of the old and new, and the appropriate application of know-how, especially for emerging issues. However, there have been lapses in performance. Indeed, I believe too many reactors in the U.S. have been shutdown for long periods of time, and there have been a few avoidable events of safety significance, because the requisite technical expertise and safety management criteria were not applied in a timely manner to the resolution of design, operational and maintenance problems. This is not acceptable.

The NRC has increased its safety focus on licensing and oversight activities by applying a balanced combination of experience, deterministic models, and probabilistic analysis. We called this approach risk-informed and performance-based. This enhanced safety focus is used by our licensees and by the agency in a concerted effort to ensure adequate protection of public health and safety with a more quantitative and up-to-date technical basis. It has resulted in significant improvements in the effectiveness and efficiency of our activities. Some of the most important of these are license renewals, power uprates, and license amendments. We also apply this safety focus to day-to-day safety regulatory activities. For example, materials degradation and safety system performance are now receiving increased attention to prevent deterioration of safety margins.

Let me turn to the future. Three early site permit applications could indicate that the nuclear option is under serious consideration for the near future, and the proposed "Energy Bill" is setting a firm basis for advanced reactor deployment. In this proposed law, the NRC is called on to work with the President on an assessment of the threats that pose an appreciable risk to the security of various classes of licensees. The NRC is also given licensing and regulatory authority in connection with the new Advanced Reactor Hydrogen Cogeneration Project. I am sure that Mr. Magwood will touch on these and other important aspects of the legislation. And here, in the same manner as for the present fleet, the need for predictability and stability are important to fulfilling the needs of the country. It does not make sense to operate the present U.S. nuclear fleet without using the pertinent advances in safety, regulation, and technological know-how; it makes much less sense to enter into a new nuclear power deployment phase without a state-of-the-art technology and regulation, and the capability to upgrade them in discrete steps. Why? The reason is the need for reliable operation over long periods of time coupled with the need for top-notch safety performance! One fact has emerged recently in the U.S. to illustrate this point: most existing nuclear power plants in the U.S. are expected to operate for 60 years,

and new nuclear power plants might be designed and constructed to last for at least that long, an eternity in the on-going technological revolution.

There are many other reasons that call out for regulatory advances; some are quite technical. For example, the Large Break LOCA is no longer useful as the dominant accident sequence, and neither conventional defense-in-depth nor the design basis have allowed for significant technological and regulatory innovation. We have experienced what happens when regulation is imposed after the fact on a technology being deployed. It was not possible to do it any other way thirty years ago. But it is now possible and necessary to integrate the development of nuclear technology and its regulatory framework. Relevant and extremely valuable experience has been gained from the Evolutionary and Advanced Reactors Design certification programs. These programs allow for the resolution of substantive technological and regulatory issues during the pre-application and application processes. They have produced better reactor designs with minimal patchwork requirements. These experiences have been the right stepping stones for a new way of doing things. There is also no doubt that information technology has supported the implementation of these enhancements to regulatory processes, while maintaining, or even improving, their transparency.

As I stated at the onset, assuring adequate protection of the environment is also part of the NRC mandate. Environmental stewardship is a value that is reflected in our obligation to take the long view. We need to bequeath to our children and grandchildren not only a country that is secure, economically and otherwise, but also livable with a high quality of life standard, where energy sufficiency goes hand in hand with environmental preservation. Nuclear power generation has served as a main supplier of electricity in the United States, and it has done so safely, cleanly and securely, year after year.

I have been talking primarily about the nuclear power situation in the United States, but my remarks also apply to the global community. With increased economic development around the globe, there is an increased need for energy security through diverse sources of energy to continue the improvements in life brought about by economic development. Nuclear power is a valuable asset that can be used as part of the energy mix to provide energy security, with the essential proviso that safety of operation always comes first. I am convinced that we all know how to use commitment to safety, technical expertise, and sound management to achieve the requisite assurance of adequate protection of the public health and safety, the environment, and the common defense and security that regulators demand, and the reliability that the industry needs.

I remain convinced that the cornerstones needed for achieving energy security are available and need to be carefully managed in these dynamic times, and that nuclear energy is well situated to contribute to energy security, with safe and reliable electrical generation.

I am pleased to participate in this workshop, and I wish you success.