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STATUS OF NUCLEAR POWER IN THE UNITED STATES

by

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Introduction

Mr. Chairman, distinguished guests, ladies and gentlemen: it gives me great pleasure to participate in this opening plenary session of the 13th Pacific Basin Nuclear Conference. As indicated by the previous speakers, this Region is characterized by dynamic change in the application of nuclear technology. The United States benefits strongly from our interaction with you.

This morning I will present a brief overview of the current state of nuclear power in the U.S. and provide my perspective on possible future developments. I will also say a few words about the vital role of international cooperation in helping to ensure that nuclear technology is used safely.

Before I begin my discussion of the current situation in the U.S. with regard to nuclear power, I must note that the U.S. Nuclear Regulatory Commission has no promotional or developmental role for nuclear technology. That responsibility falls to our Department of Energy. The NRC's duty is to ensure through regulatory oversight that nuclear power and other elements of nuclear technology are used in a way that protects public health and safety and the environment. In my view, a strong, independent, technically competent regulator is essential if such a goal is to be achieved.

With that introduction, let me proceed to review the current status and recent history of nuclear power in the U.S., and to discuss possible future developments.

Current Status and Recent History of the U.S. Nuclear Power Program

With 103 operating reactors providing a total of almost 100,000 megawatts, the United States nuclear fleet currently accounts for about one-sixth of our electric generating capacity. The nuclear plants, operating in 2001 at a record capacity factor of approximately 90 percent, generated almost 770 billion kilowatt hours, representing more than 20 percent of the nation's total output of electric energy. Preliminary data for 2001 show that the average production cost of nuclear electricity was around 1.8 cents per kilowatt-hour, lower than that for coal or natural gas. And it is estimated that the U.S. avoids over 160 million tons of carbon emissions by virtue of displacing fossil-fired generation with nuclear plants.

These statistics stand in stark contrast to the mediocre performance of U.S. nuclear utilities at the beginning of the 1990s, and represent the result of more than a decade of steady – one might even say remarkable – improvement in both plant economic performance and plant safety performance. These trends are illustrated clearly if we look at historic performance data. In 1990, with 111 nuclear units in operation, the industry's capacity factor stood at about 65 percent as compared to nearly 90% in 2000 and 2001. Total generation in 1990 was just over 550 billion kilowatt-hours, while today 40 percent more energy is generated with eight fewer plants. Industry economic performance reflects these improvements, with the production cost of nuclear electricity falling from close to 3 cents per kilowatt-hour to less than 2 cents.

What accounts for these impressive improvements? I believe that they reflect the fact that around 1990, both the industry and the NRC turned their attention to improving plant operations. As it happens, the industry's safety performance in 1990 was as unimpressive as was its economic performance at that time. More than 50 events were classified as "significant," or almost one for every two units, and each unit, on average, experienced one safety system actuation during the year. In 2000, however, the number of significant events had decreased by more than an order of magnitude, and the average number of safety system actuations per year decreased from one per unit to about one for every three units. Other safety performance data show similar trends.

It is little wonder that when industry "pundits" looked at plant economic performance in the early 1990s, they predicted that, with the beginning of the deregulation of retail pricing of electricity, nuclear plants would be unable to compete economically, and many would be shut down prematurely. Today's situation tells a much different story, however, and clearly demonstrates the correlation between plant safety performance and plant economic performance. A plant that operates safely also operates reliably, and is thus able to contribute to the financial bottom line.

The improvements in nuclear plant safety and economics do not mean, however, that either the NRC or the industry can become complacent about operations. Indeed, we have seen time and again that failure to maintain safety as a first priority can cause rapid degradation in plant performance. Moreover, we have learned that we can still be surprised – often unpleasantly – by unanticipated events or plant behavior. The recent, well-publicized experience with severe corrosion of the reactor vessel head at the Davis Besse plant demonstrates clearly that we are still learning about the things that can go wrong at a nuclear plant, reinforcing the need for continued vigilance both in licensee operations and maintenance programs and in NRC oversight.

Notwithstanding the issues raised by experiences at Davis Besse, the significant improvements in nuclear plant safety and economic performance have helped to create renewed interest in extending the capabilities of the current generation of plants and even in the possibility of building new plants. Let me review briefly the developments in each of these areas.

Currently operating plants are the subject of two major initiatives: power uprates and license renewal. Power uprates are not new; the NRC has previously approved more than 80 applications to increase reactor power, resulting in an increase in generating capacity of almost 4000 megawatts electric. However, licensees may now increase power by taking advantage of improved power measurement techniques, and better analytical methods have permitted licensees to demonstrate that reactor power can be increased, in some cases substantially, without unacceptable reduction in safety margins. We have been informed by our licensees that they expect to submit at least 51 applications for power uprates over the next five years, resulting in the addition of almost 2000 megawatts of electrical generating capacity.

License renewal, on the other hand, is a relatively recent initiative undertaken by the NRC and our licensees. The statute governing the NRC permits the issuance of power reactor operating licenses for periods of not more than 40 years. But that same law permits us to renew those licenses at the end of that initial 40-year period. The first application seeking an additional 20 years of operation was submitted to the NRC in 1998, and was approved in 2000. We have continued to receive applications at a steady pace, and to date, five plants, comprising 10 units, have had 20-year license renewals approved. Ten applications (covering another 16 units) are currently under review, while approximately 16 applications (covering 29 units) are expected to be submitted over the next three years. All told, approximately half of the operating nuclear units in the U.S. are currently involved at some stage in the license renewal process, and we ultimately expect that almost all operating plants will eventually apply for license renewal. If the licensees are successful in obtaining 20-year extensions, the net effect of the license renewal program will be to extend the period during which the current generation of plants contributes significantly to the U.S. electrical supply well into the early 21st century.

Outlook for the Future

If nuclear power is to continue to be a significant factor in electric power generation in the U.S. beyond the first third of this century, new nuclear plants will need to be constructed. In an effort to streamline the licensing process for new nuclear power plants, the NRC has put in place rules for certifying the designs of standardized nuclear plants, for "banking" reactor sites for future use through early site permits, and for issuing combined construction permits and operating licenses. During the 1990s, the NRC certified three advanced plant designs under this new process: General Electric's Advanced Boiling Water Reactor, or ABWR; Combustion Engineering's System 80+; and Westinghouse's AP600.

In the last two years, the vastly improved performance of the current nuclear fleet has created substantial interest in the possible construction of new nuclear plants. The NRC has restructured its reactor regulation organization to prepare for more design certification reviews and for possible combined license applications. We are currently reviewing Westinghouse's application for certification of the AP1000 design, an upgraded version of the AP600. We have also been informed of several vendors' intentions to submit certification applications for five designs within the next several years — GE's natural circulation ESBWR, Framatome-ANP's SWR-1000 boiling water reactor, AECL's ACR-700 (an advanced CANDU concept), GA's GT-MHR (a modular, gas-cooled reactor), and Westinghouse's IRIS, a small integral PWR. And we

are expecting to receive applications for early site permits from three electric generation companies – Dominion, Exelon, and Entergy – all of which will involve sites on which reactors are currently operating.

As most of you are aware, the U.S. Department of Energy is sponsoring the Nuclear Power 2010 program, the objective of which is to license and build a new nuclear power plant in the U.S. by the end of this decade. Although the NRC is not involved in this developmental program, we are following DOE's progress with great interest, since one of the most important steps in achieving its objective would be the submission of an application to the NRC for a combined operating license for an advanced reactor design. The next few years are likely to be busy and challenging as we once again turn our attention to licensing new plants.

One other relatively new program at the NRC also deserves special mention. Earlier this year, the Secretary of Energy formally recommended proceeding with the Yucca Mountain site for a high-level waste repository. His recommendation was accepted by President Bush and approved by the U.S. Congress. Although we expect this issue to be the subject of ongoing legal challenges that may take several years to resolve, the NRC has begun to move forward in planning to review DOE's application to construct the Yucca Mountain repository. Without prejudging the outcome of the licensing process, let me just note that the technical challenges involved in the review should not be underestimated; we must find that strict standards will be satisfied for a period of 10,000 years, which is longer than recorded history. Nonetheless, the first steps toward the disposition of spent fuel have been taken -- an important benchmark for the future of nuclear power.

An Important Regulatory Initiative

Let me now turn to an important issue for our ongoing regulatory program. Although I could mention several ongoing challenges, I will focus on risk-informed regulation because of the short time I have today.

The NRC is engaged in an ongoing effort to incorporate the consideration of risk more systematically into our regulatory program. After determining in the mid-1990s that the science of quantitative risk assessment was sufficiently mature to permit its use in regulatory decision-making, the NRC began to move forward on several fronts to implement risk insights in our regulatory processes. We overhauled our reactor oversight program to make it more objective, through the use of performance indicators and through the evaluation of inspection findings in terms of their risk significance. Findings that are determined to be of low safety significance are referred back to the licensee for disposition through the plant's corrective action program, while issues of moderate or high significance result in increased NRC oversight. In addition, licensees requesting license amendments concerning certain aspects of plant operation, for example changing allowed outage times for safety-related equipment or modifying inservice testing and inspection programs, may use risk insights to justify their requests.

The most ambitious initiatives in risk-informed regulation involve risk-related changes to the NRC's rules. There are two types of changes: modification of so-called "special treatment" requirements, and revisions to the technical bases of rules. The NRC will soon publish a draft rule that modifies the special treatment requirements for safety-related structures, systems, and components (or SSCs). Safety-related SSCs with low risk-significance will be subject to a reduced level of special treatment, while risk-significant SSCs that are not considered safety-related will require increased controls. Risk-informing the technical bases for regulations requires consideration of the risk significance of requirements using insights from quantitative risk assessments. The NRC recently determined that hydrogen recombiner systems – requirements for which

were put in place after the Three Mile Island accident – would in fact have little impact on the risk associated with accidents. Requirements for these systems are now being removed from the NRC's regulation on combustible gas control. However, certain plants that have vulnerability to hydrogen explosions must retain hydrogen ignitors, and the NRC is considering additional requirements to provide more reliable power supplies to hydrogen ignitors in these plants, again because of risk insights.

Progress in risk-informing our regulations and processes has been quite difficult. Nonetheless, the NRC is committed to this path, as we believe that focusing on risk will encourage licensees to apply their resources to those issues that are most directly related to reducing the potential health and safety impacts of their plants.

Perspectives on International Cooperation

I would like to spend a few minutes in conclusion reflecting on the value of international cooperation in nuclear regulation. The international scope of nuclear power today is seen not only through the fact that over 30 nations have nuclear power programs, but also in looking at the development of new nuclear plant designs. Consider, for example, the AP600 design – developed by a U.S. vendor now owned by a British company, and supported by testing programs conducted in Japan and Italy. Other advanced reactor designs have similar international pedigrees.

In the regulatory arena, while the U.S. has the world's largest nuclear power program in terms of number of reactors, we recognize that we can benefit greatly from the experiences of other countries. Conversely, we hope that our colleagues outside the U.S. will be able to benefit from our experiences. Although the NRC sponsors a broad and comprehensive research program, the cost of building experimental facilities and running testing programs has become so great that it would be impractical for us to attempt to conduct such programs on our own. We therefore participate in multilateral efforts, for example through the International Atomic Energy Agency, the Nuclear Energy Agency of the OECD, and in bilateral exchanges and cooperative programs. We also welcome international assignees for temporary service on the NRC staff, and we send our staff members to other countries for similar purposes.

In the Pacific Basin, the U.S. has maintained active cooperative programs with many of the nations represented at this conference. We have long-standing agreements with Japan and the Republic of Korea, and our cooperative efforts with the People's Republic of China are growing rapidly. I would also like to take particular note of a regional initiative, the Asian Nuclear Safety Network, being developed under IAEA sponsorship. Many of the countries represented in the Pacific Nuclear Council have already indicated their support and cooperation in this effort, and it is hoped that it may serve as a model for the development of other regional nuclear safety organizations.

During my first trip to Asia in 2000, in a speech at the Japan Atomic Industrial Forum conference, I expressed my personal commitment and that of the NRC to continuing our broad participation in international cooperative programs. That commitment is as strong today as it was then. This region currently leads the world in new nuclear plant construction, and as these programs grow, it is essential that we continue to maintain a high standard of operational safety. A significant event at a nuclear power plant anywhere in the world will have an impact on all of us. No matter in which part of the nuclear industry we may work – regulatory, design, or plant operation – each of us has a stake in ensuring that safety is the top priority in the performance of our jobs.

Conclusion

I would like to express my appreciation to the organizers of this conference for inviting me to participate. I extend my best wishes for a useful and productive meeting.

Thank you.