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"NEW ENERGY IN THE PACIFIC RIM"
BY
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OBSERVANCE
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INTRODUCTION

Good morning.

I am pleased to join you today at this special observance of Asian/Pacific American Heritage Month. These programs remind all Americans of the diversity of cultures, traditions, and peoples that are the sources of our modern national identity. In celebrating the contribution made by Americans of Asian and Pacific descent, we are well aware of the rich diversity within that broad category -- diversity of culture, language, and history.

This year's celebration is particularly meaningful to me, because I recently returned from a 17-day journey to the Far East, and was deeply impressed by what I saw, technically and otherwise. From the standpoint of nuclear technology, it is clear to me that the two countries I visited -- Japan and the Republic of Korea -- in contrast to the United States, where the growth of nuclear power has for many years been suspended -- have dynamic, and expanding nuclear power programs. They are also devoting much in the way of resources and creative energy to them.

I would like to share with you some of the highlights of my trip and my observations of the Japanese and South Korean nuclear power development programs, because I think that their advances in the field of nuclear technology will prove to be significant in the years ahead. We at NRC know how much our agency has benefited from the technical expertise and creative thinking of individual personnel of Asian and Pacific origin. We have now arrived, I believe, at a point at which the world can learn from

the advances made by national nuclear power programs of countries of the Pacific Rim.

REPUBLIC OF KOREA

The first stop on my two and one half week trip was the Republic of Korea. South Korea has a very aggressive nuclear power program, with eleven reactors in operation, five in construction, two on order, and still more at the planning stage. The program contains a mixture of reactor designs, including U.S., French, Canadian, and now their own indigenous standard design.

I was invited to deliver a keynote address at the 11th Annual Conference of the Korea Atomic Industrial Forum (KAIF)/Korean Nuclear Society. I spoke about nuclear regulation in the United States, our policy direction, and future prospects for the U.S. nuclear industry. I stressed that there are numerous areas in which regulatory policy is evolving in response to technological, governmental, and other developments. My remarks included specific views about the challenges and changes facing the U.S. nuclear industry and how the Nuclear Regulatory Commission is responding.

I was graciously welcomed by a wide range of South Korean officials and received a broad and detailed overview of their nuclear program. Their regulatory program closely follows our own.

During my week in Korea I met several times with the Minister of Science and Technology, Dr. Kun Mo Chung, as well as key members of the South Korean nuclear power and safety community. I also visited the Ulchin Nuclear Power Station, and the Daeduk Science Center. The first South Korean built standard reactor design is at Ulchin, a design which was adapted from the ABB/CE System 80, incorporating certain more advanced safety features of the ABB/CE System 80+. Unit 3, to be commissioned in 1998, is about 65 percent complete with generator, turbine, and reactor installed. Unit 4 is about 44 percent complete with commissioning expected in 1999.

While at Ulchin, I had extensive discussions with utility and plant personnel on the performance of Units 1 and 2 and the construction experience with Units 3 and 4. I learned that Unit 2 attained a record high of 98 percent capacity factor in 1995. Our hosts explained that these high plant capacity factors are a combination of team work, and good operations and maintenance practices. Further, they stated that their safety record is good, and can be attributed in part to design

improvements incorporated over the years. This reinforces my belief that a safe plant is both reliable and economic.

Describing to my hosts the generally excellent safety, reliability, and availability record of nuclear power in recent years, I suggested to them that paradoxically, this record might also contain a degree of risk: that complacency might subtly erode the vigilance that a true safety culture requires. When asked by the Ulchin reactor operators for advice on maintaining high performance, I cautioned about the dangers of developing operational complacency and advised them to "never, never rest."

I also toured the inside of the Ulchin Unit 3 containment building and visited the Unit 1 control room and turbine hall. The impressive control room had state-of-the-art zero system alarms. The construction site was orderly, clean, and non-distracting.

I visited the new headquarters building of the Korea Institute of Nuclear Safety (KINS), the technical arm of the Ministry of Science and Technology which performs many of the regulatory functions such as safety reviews, technical analyses, inspections, and standards development. I was briefed on radiological emergency planning and preparedness in Korea. I also saw their state-of-the-art computerized technical advisory system for radiological emergency. This system provides information on a real time basis to assess plant safety and off-site radiological consequences. Their capability in this area is perhaps a model for the U.S.

In addition to my meetings and site visits, I co-chaired the closing session of the U.S. - ROK Joint Standing Committee on Nuclear and Other Energy Technologies (JSCNOET). My co-chair was Korea's Minister of Science and Technology. The U.S. delegation to JSCNOET is composed of representatives from the Departments of Energy and State, the Arms Control and Disarmament Agency, and the NRC. The JSCNOET meets annually to discuss nuclear non-proliferation, export controls, nuclear exchanges with China and the former Soviet Union, and strengthening of IAEA safeguards. In addition to these policy issues, the group discusses technical matters such as nuclear safety, radioisotope production, and advanced fuel cycle research.

A key item of the JSCNOET agenda is a joint US-South Korea-Canada program to explore the direct use of spent PWR fuel in CANDU reactors. The program, known as DUPIC, explores ways of reusing spent PWR fuel to fuel CANDU reactors. This has the dual purpose of extending uranium resources and improving waste management. DUPIC is a form of co-processing in which, unlike reprocessing, there is no chemical separation of uranium and plutonium. This makes fissile material diversion more difficult, so the project

offers some safeguardability. Spent PWR fuel is repackaged by cutting open the spent fuel rod and crushing the fuel pellets into powder. New pellets are formed, sintered, loaded into a new fuel cladding, and fabricated as a CANDU fuel assembly. The process is expected to reduce the spent fuel volumes by one half, and will save South Korea one third of its uranium fuel needs. The current phase of the experimental DUPIC program will be ongoing until the year 2000. I had the opportunity to visit the DUPIC mock-up facility at the Daeduk Science Center.

South Korean nuclear officials also expressed an interest in a larger and more acknowledged role in the Korean Peninsula Energy Development Organization (KEDO) Project for the supply of the two 1000 megawatt PWRs to North Korea. Many of you will recall that this project has been the subject of sensitive negotiations largely between the United States and North Korea. The KEDO project will provide light water nuclear power reactors in exchange for North Korean dismantlement of their nuclear weapons development program. South Korean officials emphasized the overriding need to consider the safety aspects of the proposed project. Their concerns are similar to those which the NRC has articulated to U.S. Administration officials; namely, that nuclear safety is a fundamental element which must be factored into project planning from the very beginning. Representatives of KINS indicated that they stand ready to provide full advice and assistance in the KEDO project.

On fuel cycle issues, the Koreans view these somewhat differently from the U.S. position. They dominated the discussions in my various meetings. As you know, since 1979 it has been U.S. policy not to reprocess spent fuel, because of concerns over non-proliferation and terrorism, and we have urged other countries to adopt the same approach. In 1991, the South Korean government made a formal commitment not to develop reprocessing or enrichment facilities. This unilateral declaration formed a cornerstone of the North Korea-South Korea non-nuclear declaration. This policy recognized the destabilizing effect within the Korean Peninsula of unirradiated nuclear material directly usable for nuclear weapons. The U.S. strongly endorses this exercise of self-restraint on South Korea's part. At the same time, however, the U.S. recognizes South Korea's desire to extend its uranium resources and better manage its nuclear wastes and, as an advancing nuclear country, to engage in fuel cycle research.

Although South Korean approaches to the nuclear fuel cycle have been somewhat constrained in recognition of non-proliferation and national security concerns, it is clear that the South Koreans are seeking more flexibility, including the possibility of burning mixed oxide (MOX) fuel. My South Korean hosts were keen to discuss a wide range of fuel cycle issues related to nuclear

waste disposal including vitrification, spent fuel storage, and disposition of weapons materials from the dismantlement effort, including the burning of MOX fuel in commercial light water reactors.

In summary, South Korea has, without doubt, become a major player on the world nuclear scene. It is for this reason that Korea seeks broader recognition in the international nuclear community. To this end, the ROK is seeking a permanent, designated seat on the IAEA Board of Governors. In parallel, South Korea is also expanding its roles in the United Nations and the Nuclear Energy Agency, while also forging dialogues with Vietnam and Australia. Korea's clear policy goal is to become a global key policy-maker and supplier.

JAPAN

Now, let me turn to Japan.

As most of you know, Japan has a highly developed nuclear power program. Japan has based its nuclear power program of almost 40 years on the desire for energy independence, rather than on economic and environmental considerations alone. This position has resulted in a mix of light water reactors for nuclear power production and a plutonium-based fuel cycle with breeder reactors. The basic Japanese philosophy for achieving and maintaining nuclear safety is through self-effort. This philosophy is evident throughout their nation's industrial life, and has been crucial in enabling them to become one of the economic giants in the world.

I visited Kashiwazaki Kariwa, a large reactor site in Japan, with five operating BWR reactors and two advanced BWR's under construction. Situated on a lovely site on the Sea of Japan, the plant is spotless and well operated. The site is designed so that two thirds of the property will eventually be left for environmental usage. I visited Unit 6 which is beginning its startup testing and Unit 7 which is completing construction. Everywhere, I saw evidence of the meticulous planning that the Japanese invest in their nuclear construction projects. Not only is the project ahead of schedule, but it is designed in concert with nature.

I also visited several Japanese Atomic Energy Research Institute (JAERI) and Power Reactor and Nuclear Fuel Development Corporation (PNC) facilities at Tokai. JAERI operates the ROSA project, a very large scale model for validating computer codes used in modeling safety phenomena for the Westinghouse AP-600 design. The NRC is doing extensive joint research at ROSA, a

facility which has no analogue in the U.S. This is yet another example of Japan's extensive investment in atomic energy.

The Japanese program was highly stimulating. I was impressed by their progress in areas such as materials testing and non-destructive examination. At the same time, I have to confess that it was sobering for me to compare their efforts with the currently reduced state of nuclear research in the U.S. program. Some of my hosts noted with regret that some particular fields related to nuclear research do not seem to be attracting the level of expert attention and capability they received in previous years in the U.S.

I spent a day visiting the Monju fast breeder reactor site which was designed to be the prototype for the future. The Monju fast breeder reactor is being developed by the Power Reactor and Nuclear Fuel Corporation (PNC). Monju is the site of the recent accident involving a broken thermocouple which caused a sodium leak. Because PNC was less than candid in reporting the accident, the event has led to intense scrutiny of both the company and the regulatory authorities. There has also been a soul-searching process of self-assessment by PNC. My host, the President of the PNC, was most gracious in arranging for me to visit the location of the thermocouple break and observe the areas contaminated by the sodium leakage. It was interesting and curious at the same time to note that, while the accident was significant, it posed no threat comparable to that of the 1991 Mihama reactor steam generator tube ruptures. However, Japanese public opinion was deeply affected by this accident, and there is now deep concern at many levels of the Japanese nuclear community about the implications the Monju event may have for the future of the Japanese nuclear program.

In addition to the site visits, I met with agency heads in the variety of Japanese government organizations supervising, promoting or regulating atomic energy. The Ministry of Trade and Industry (MITI) regulates the utilities with assistance and guidance from the Science and Technology Agency (STA). MITI has legal authority to issue fines and even shut down an operating plant if necessary. However, at the same time, it also promotes nuclear power. This dual role could reduce the Ministry's public credibility as an arm's-length regulator, if not carefully managed.

When I delivered a Keynote address at the 29th Annual Japan Atomic Industrial Forum (JAIF) in Nagoya, I spoke at some length about the issue of transparency and public trust. The message I tried to convey was that public trust in nuclear energy, and by extension in those who regulate it, is inherently fragile. It is nurtured and strengthened only when government officials and the industry they regulate are utterly candid and honest -- painful

as that sometimes may be. This is because there is a kind of pact that exists between the public and those who operate and regulate technologies such as nuclear power; and the rock-bottom foundation of that pact is candor. If we are not candid with the public in discussing our shortcomings, we cannot expect to be believed when we describe our successes.

When asked by Japanese nuclear officials for advice on handling the sodium leak accident, I drew on our recent experience with the Northeast Utilities' Millstone plant and its noncompliance with its FSAR. I suggested that, in addition to transparency and public accountability, the Japanese should not lose sight of the technical deficiencies. I suggested the following overall approach: (1) a thorough root cause analysis should be performed; (2) there should be a clarification of relative responsibility and accountability of those with direct plant oversight; (3) appropriate guidance for plant operators should be developed; (4) operator training should be strengthened; and (5) responsiveness to and openness with the public should be improved.

THE PACIFIC RIM

The future of nuclear power in any part of the world is, in large part, a question of economic development: how the demand for secure, predictable, and affordable energy will be met. Today, Asia's Pacific Rim is the fastest growing market for electricity in the world. The combined energy needs of Pacific Rim countries will help determine the scope of world electricity production for decades to come, fueling an estimated worldwide increase of electricity consumption over the next 30 years of almost 100 percent. This demand for power threatens to far outstrip current available sources of supply. Oil supply difficulties in the 1970's led the oil-importing nations like Japan and South Korea to develop well-planned nuclear power programs to ensure the long-term availability of electricity. Furthermore, a mounting awareness of the technological challenges of burning coal and other fossil fuels in an environmentally benign way are leading many to look for other fuels for electricity. In this search for the optimum energy mix, many other Asian countries are looking to nuclear power as a viable option to address the electricity shortage.

My trip leads me to believe that Japan and South Korea, with their advancing nuclear programs, will take a lead in developing new markets for their nuclear technology in the Far East, and perhaps elsewhere. Further, the country that sets standards and rules in new technologies will also have the competitive edge. This has not gone without notice in Japan and South Korea. Asia,

too, is the fastest growing market for U.S. exports, giving the U.S. a large and expanding economic stake in the region.

SIMILARITIES AND DIFFERENCES

During my visits, I spoke on nuclear regulation and the challenges of change. U.S. regulatory policy is being affected by four factors: (1) changes in market forces and competitive pressures; (2) the changing role of government, in response to evolving public concerns; (3) the maturing of the nuclear industry which is focussing on issues such as aging, decommissioning, and waste storage and disposal; and (4) technological changes affecting human and plant performance.

The United States is not unique in this respect. In fact, I was amazed to find how various aspects of these four points of change resonated with different individuals and organizations throughout government and industry.

Although the precise character of the response to these challenges may differ between countries, the objectives are largely the same everywhere: (1) improvement in the already high levels of safety in the peaceful uses of nuclear energy; (2) improved nuclear power plant operating performance (which improves economic performance); and (3) better public understanding of the basis for the regulators' confidence that, with proper regulation, nuclear energy can play a part in the economic and social development of nations.

In fact, in each of the countries I have visited during my first year as NRC Chairman, I have seen that securing reliable sources of energy dominates national agendas. However, approaches to energy planning and development are perhaps the key source of difference between the U.S. and other countries. For example, while energy planning and development are highly centralized activities performed by the government in both Japan and South Korea, in the U.S., energy planning is primarily left to the private sector. And while different nations all have governmental bodies responsible for the development and regulation of nuclear energy, they have far different policy perspectives and quite different organizational arrangements. I found that there is no absolute correlation between an independent safety organization like NRC, which performs rulemaking, licensing, research, and inspection activities, and those solely responsible for nuclear safety in Japan and South Korea. At a glance, it appears that NRC embodies much more than the strict technical safety aspects of nuclear power operations. Understanding other countries' nuclear programs requires understanding their fundamental national political and economic

goals, and how energy planning and development are organized accordingly.

CONCLUSION

Overall, I felt that my visits to both Korea and Japan were sincerely welcomed and appreciated by all the individuals and organizations with which I interacted. I will be encouraging the U.S. Administration to adopt a more active, high-level focus and dialogue with these nations in important science and technology areas.

To sum up, I see the key factors contributing to the success of the nuclear programs in Japan and South Korea as the following: (1) long-term national commitment to nuclear power; (2) large investments in research and development; (3) creation and support of academic programs to provide trained personnel; and (4) aggressive international cooperation and information exchange. Both countries have benefited greatly from technology transfers, primarily from the U.S., and both have learned well. They continue to be active partners with NRC in nuclear safety exchanges, involving cooperative research, information on regulatory programs, and exchange programs involving personnel and training.

Although I have visited Japan in the past, this was a working visit, and I regret that there was not nearly enough opportunity to see as much of the landscape or the cultural attractions of Korea and Japan as I would have liked. What I did see, however, was deeply impressive -- shrines, temples, castles, and formal gardens of beauty and power. I look forward to return visits and to seeing much more.

In conclusion, I would be remiss if I did not mention one other factor that is responsible for the success of nuclear programs in Asia, and it is perhaps the most important of all: the human factor. A tradition of emphasizing education, personal discipline and responsibility and a strong work ethic are the bedrock on which the vigorous industrial economies of Asia have been built during the past half century. These are values which immigrants from those lands brought with them when they came to America. These are the traditions undergirding your work here at the NRC. Not only the NRC, but also American society as a whole, continues to be profoundly enriched by Asian and Pacific Americans and the values they embody.

Thank you.

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