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SAFE NUCLEAR DEVELOPMENT IN THE PEOPLE'S REPUBLIC OF CHINA

**INTRODUCTION**

I am very pleased to be here today to discuss with you a topic that will certainly interest you as business men and women working in an area that will soon be part of China: the role of nuclear safety in the Peoples Republic of China (PRC). My visit this month will be my fourth to the Asian Pacific Rim as NRC Chairman. With each visit, I am more impressed with the positive changes I see. As you know, China's economy is expanding rapidly. In fact, some U.S. economists predict that it will exceed Japan's economy by the year 2000, and, if current growth trends continue, China could be the largest economy in the world by the year 2012. To fuel this economic growth, increased electrical generating capacity is critically needed. Even though China's generating capacity has more than doubled over the past decade, it is still far short of demand. If China's electrical demand were to grow no faster than the economy over the coming decades, at say 7% a year, the country would need to open one medium-sized power station [not necessarily nuclear] a week by 2000 and every few days thereafter.

To satisfy a sizable portion of its energy demand, China is turning to nuclear power. Particularly in Guangdong Province, nuclear power will play a significant role. Already, China has placed three nuclear power plants into operation during the past two years [two 900-MW PWRs of French design at Daya Bay, and one 300-MW PWR unit of indigenous design at Qinshan] and is planning several additional reactors, including four 600-MW PWRs at Qinshan, and four additional 900 MWe units for the Daya Bay area. And this is just the beginning. In the long term, China plans to install 150,000 megawatts of nuclear power by 2050, with 10,000 megawatts being operational or under construction by the end of

2000. This is an ambitious plan that, if followed through, would result in one of the largest nuclear programs in the world.

Given that China has already made the decision to invest in nuclear energy, it is in everyone's best interest to ensure that this development is done safely. As the world has learned from the Three Mile Island and the Chernobyl accidents, it is much cheaper to prevent accidents than it is to clean them up. And just one significant event can seriously undermine a country's electrical capacity and industrial production. By some estimates, the value of lost industrial output is roughly **18 times** the value of lost power. The impact of a significant event on China's economy, and viability as a trading partner, could be very large. And the negative repercussions on other Pacific Rim nuclear programs would be serious as well.

For nuclear power to succeed in China, as well as in any country, nuclear development must be coupled with a sound regulatory program and a pervasive top-down safety culture in which safety is a high priority in the decision-making process. And I see a strong supporting role for business and investors to play in furthering the safe development of nuclear power.

#### **LESSONS LEARNED IN THE U.S.**

The U.S. has almost 2,000 reactor years of nuclear energy experience, more experience than any other country in the world. One of the lessons we have learned is that the safe use of nuclear energy depends on many conditions. Economic, scientific, industrial, institutional and legal elements must all be integrated to achieve high levels of safety. One of the most important of these elements is a nuclear safety culture derived from certain fundamental principles that are applicable worldwide. To prove this point, one only has to compare safety history in the G-7 countries with corollary developments in the former Soviet Union and Eastern Europe. This comparison will show that one key difference is the role a strong, independent regulatory authority has been able to play in monitoring the nuclear industry's commitment to safety.

With specific regard to the regulatory dimension, four principles are especially important in establishing and maintaining an adequate nuclear safety culture.

First, every nuclear nation must provide a firm legal foundation for a strong and independent regulatory authority to monitor and enforce high levels of safety. Where regulators have not traditionally had the independence or political authority to carry out their job effectively, when there is no effective oversight body with the power to close down nuclear power plants

for safety violations, there is a tendency to cut corners to produce needed power as cheaply as possible.

Second, no amount of regulatory authority is going to be effective if the regulator does not have the necessary resources at its disposal. This means a well-trained and adequately paid staff to perform on-site inspections, review plants at all stages from design to decommissioning, and analyze errors to improve operations in the future. It also means a confirmatory research capability.

Third, both the industry and the regulators must apply rigorous nuclear standards such as the principles developed for the International Nuclear Safety Convention, which is expected to be signed in September of this year.

Fourth, by national law or international commitment, a state must put into place legal liability and financial protection arrangements to provide adequate compensation for damage in the event of a nuclear accident, while setting appropriate limits on third party liability. Such protection holds both the nation and the power plant operators accountable for protecting the public health and safety.

Where these principles have been adhered to, a culture of safety has permeated both operations and management, and this has produced a successful nuclear industry. Where these principles have *not* been followed, the goal of electricity production has led operators to override safety objectives when the two came into conflict.

#### **CHINA'S REGULATORY PROGRAM**

As everyone is well aware, foreign capital is critical to almost any large-scale expansion of electrical generation capacity in a developing country. Since foreigners will not invest in the industry if safety isn't well established, a strong regulatory program is important for the sake of attracting capital as well as for safety. And China is clearly taking nuclear safety very seriously.

At China's invitation, the IAEA recently conducted a review of China's nuclear regulatory system and found that it meets international standards. This is very encouraging. It is also heartening to see the vigorous role that China is playing in the international arena. China has been very active in developing the International Nuclear Safety Convention which I mentioned earlier. The Convention contains the principal elements of nuclear safety regulation; we believe that formal agreement and wide adherence to an international nuclear safety regime will help ensure a safer environment for everyone. While some

countries will need to make changes to adhere to the Convention, the IAEA review found that China's program already reflects the safety principles set forth in the Convention.

This is all very reassuring; however, one can not afford to sit back and relax. The production side of China's nuclear program is expanding exponentially, and China will need to take some determined steps to ensure that its regulatory capability does not lag behind. In other words, you will not have a safe nuclear program if industry is driving a finely tuned Mercedes and the regulator is driving a broken down Volkswagen. As China's nuclear program matures, there are four critical issues that I see becoming increasingly important: regulatory resources and authority, design standardization, transparency, and coordination of emergency preparedness.

Resources and Authority One key resource in any regulatory program is an adequate number of well trained and highly competent staff. As the number of nuclear plants multiplies, China's National Nuclear Safety Administration (NNSA) will need greater numbers of personnel to be able to keep up in any meaningful way. One very critical element affecting the regulator's ability to attract and retain talented staff is salary. To ensure retention of competent staff, it is crucial that China set salary levels for its regulatory staff at a level comparable to industry salaries. Otherwise, the regulator will not be able to retain the type of experience and talent so necessary to any effective regulatory program. Another key issue affecting NNSA's ability to carry out its mandate of nuclear safety is the amount of independence and authority it is granted. If NNSA does not have the final authority on whether to license a nuclear reactor or to close a reactor for safety violations, its effectiveness will be severely limited. As we have seen in some countries, a bark without a bite will not ensure nuclear safety, and the results can be disastrous.

Standard Reactor Designs Another lesson learned by the U.S. is the efficiency that can be achieved by limiting the construction of nuclear plants to a few standard reactor designs. As a nation with 41 nuclear utility companies and 109 individual reactor designs, the U.S. knows first-hand the resources required to regulate effectively a large number of reactor types. For China to be able to maintain an adequate base of knowledge and confirmatory research capability, it is imperative that it limit plant construction to just a few standard reactor designs. Otherwise, the technical difficulty and expense required to regulate the industry effectively will be unnecessarily increased, severely undercutting the productiveness of its regulatory program.

Transparency A third issue central to nuclear safety, commonly referred to as transparency, is the reporting of all nuclear incidents to the appropriate international oversight organizations. The number of incidents, even minor, is one of the best objective indicators of the state of a nation's nuclear safety. Without such data, there is no way to objectively gauge the level of safety performance of the reactors. Not only is the public entitled to this information, but investors need this information to help determine if their investment is safe and secure.

Emergency Preparedness And lastly, coordination of emergency preparedness is critical to any serious nuclear safety program. Emergency planning and response during the early phase of an accident is particularly important for plants in highly populated areas and for plants near international borders. The IAEA review team did note that China needs to strengthen its emergency preparedness program and stressed that the NNSA should play a more active role in the decision-making process. This is clearly an area that China will need to devote additional attention and resources to.

Chinese authorities are well aware of these considerations; in fact they have actively sought help from the NRC and other national and international organizations to meet these issues straight on.

#### **THE U.S. NUCLEAR PROGRAM**

I would like to take this opportunity to discuss the viability of nuclear energy in the U.S. and to point out that nuclear power in the U.S. is not dying on the vine as some would suggest. On the contrary, the U.S. nuclear program is progressing on schedule. New construction in the U.S. is quiet while construction in Asia is so vibrant precisely because the U.S. has already undergone this type of growth within the past few decades and we don't at present have an increased need for baseload power. During the past ten years, 40 new reactors began commercial operation and 7 plants currently have active construction permits. Nuclear power now generates about 22% of our domestic electricity -- more than double the contribution from nuclear power in 1975. The U.S. produces more nuclear-generated electricity than anyone else in the world -- in fact, the U.S. generates almost one-third of the world's nuclear electricity. And with 2000 reactor-years of experience, we have more nuclear experience than any other nation in the world.

As for new reactors, a new streamlined licensing process is in place. The U.S. NRC has issued the design approval for one evolutionary standard reactor design -- the General Electric Advanced Boiling Water Reactor -- and is about to issue another -

- for the ABB-Combustion Engineering System 80+. Our review of the even newer generation of nuclear power plants is also well along. These novel designs employ passive safety features and modular construction. These features should make the reactors easier to construct and to operate, while retaining economic competitiveness. The NRC-certified designs for the passive reactors, achieved after an exhaustive analytic and experimental review process, should be available later in this decade, well in time for programs which are considering using these designs.

While U.S. businesses are prohibited from selling reactor technology and equipment to China, there are other business opportunities available. Restrictions on the sale of U.S. balance of plant equipment for nuclear power facilities to China have been lifted, which should open up the market for sales of U.S. turbine generators and associated components for future nuclear power plants. It has already stimulated sales of turbines for fossil plants. No one should doubt U.S. government support for electricity projects in the region.

#### **U.S. COOPERATION WITH CHINA**

The U.S. Nuclear Regulatory Commission (USNRC) has been very supportive of China's nuclear regulatory program. In January 1993 I visited the People's Republic of China and renewed the NRC-Chinese NNSA Protocol on Nuclear Safety Matters which was signed in 1981 and renewed in 1986. Through this protocol, NRC and the NNSA exchange nuclear safety information on the design, construction, and operation of nuclear power plants. This renewal was particularly timely for China's first nuclear power plant, the 300 MW(e) PWR at Qinshan commissioned in December 1991. NRC has provided technical lectures on power reactor, radiation protection, and nuclear material safety, and safety advice to NNSA to assist in their safety reviews and evaluation of the Qinshan and Daya Bay nuclear power stations. In 1993 there were two high level Chinese visits to U.S. nuclear power plants, with a particular focus on emergency preparedness techniques and procedures. In addition to my own visit in January 1993, other NRC Commissioners have visited China for in-depth reviews of China's nuclear power program. The USNRC is clearly committed to working with our Chinese regulatory counterparts to develop a strong, independent, adequately staffed and funded regulatory regime.

#### **CONCLUSION**

In conclusion, I wish to emphasize the role of the business community in ensuring the safe operations of nuclear power reactors in China. By demanding a sound nuclear regulatory program with sufficient resources and authority, financial investors can manage the positive tendencies in China to make the

necessary investment in and commitment to its regulatory program. This type of investment and commitment would help make China's energy industry a sound financial investment by assuring the long term viability of nuclear energy. In sum, a strong regulatory program is a win-win situation for everyone: not only does it protect public health and safety, but it also ensures reliable and economical energy in the decades to come.