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Remarks as Prepared for Delivery for Assistant Secretary for Nuclear Energy Dennis R. Spurgeon Second Annual Nuclear Fuel Cycle Monitor Global Nuclear Renaissance Summit Alexandria, VA

Thank you for inviting me to address the Second Annual Global Nuclear Renaissance Summit. My topic is the Department of Energy's role in developing our nation's nuclear energy policy: technologically robust, economically sound, and publically acceptable. Although it's last in the title, public acceptability is where we need to start, because without public acceptance, we are fighting an up hill battle. For us in nuclear power to make things publically acceptable means making them better understood. Not just nuclear power, but the entire picture of our energy challenges, the threat of climate change, the economic implications, and our continued need for national security, which requires energy security.

First and foremost nuclear power's current role in the United States deserves repeating:

- 104 reactors
- 20% of our total electricity supply
- 73% of our non-CO2 emitting electricity supply
- 90% operating capacity
- Power enough for 75 million homes
- 700 million metric tons of CO2 avoided each year
- Best safety record of any major industry

Serious public discourse has begun. The tide of public opinion has started to swing back toward nuclear energy and as climate change grows in the public consciousness, and our options are reassessed, debated, and weighed in the court of public opinion, nuclear power has reentered the mainstream. We are looking at a resurgence here in the United States and it is becoming more and more clear that nuclear power must play a significant role in our future energy mix.

The question then becomes not is nuclear power needed, but rather how many new nuclear plants are needed to make a significant contribution? If the goal is 35% of U.S. electric power produced from nuclear energy by 2035, then we require about ninety-five new nuclear power plants, an average of five new plants coming on-line each year from 2016 to 2035. If the goal is 50% of U.S. electric power produced from nuclear energy by 2035, then we require about 165 new nuclear power plants, an average of nine new plants coming on-line each year from 2016 to 2035. These plants would avoid 2.3 billion metric tons of CO2 emissions per year. These may seem like grandiose numbers but not when placed in a historical perspective.

In the early 1970's the United States had 200 nuclear plants under contract and in 1973 alone, forty-one nuclear plants were ordered. The United States was building a domestic capability to build about twenty new nuclear plants per year. In fact, France, whose average GDP was approximately 18% of the United States' GDP built fifty-five nuclear plants over about a fifteen year period throughout the 1970's and into the 1980's. Other historical facts we should remember are that in the late 1960's and early 1970's our nation was shouldering the challenges of two other major national efforts that were competing for financial resources, technical talent, and manufacturing capability: NASA's Apollo program and the Vietnam War.

This substantial and sustained increase in nuclear power has benefits beyond the energy supply and the environment; it would also mean the revitalization of full sectors of industry, including heavy manufacturing and construction. Significant human capital and construction resources will be needed to realize such growth. The Department projects that construction of only the fifteen new reactors currently undergoing licensing review will require approximately: 2,700 pipefitters; 2,900 electricians; 1,800 construction professionals; 600 boilermakers; 2,500 sheet metal workers; and 2,900 iron workers. And keep in mind those job numbers are only for construction. On average, operating a nuclear power plant employs 800 highly-skilled, highly-paid workers and creates hundreds of additional jobs in the surrounding communities.

These jobs are not only important because they are here in the U.S., but they create secondary support employment and when totaled we can project the creation of several hundred thousand good U.S. jobs. Investing in our U.S. workers to meet our energy needs is much better for our economy then sending billions of dollars overseas to foreign oil and gas exporting nations.

Substantially increasing the use of nuclear power, taken together with increases in wind, solar, and geothermal, can lead us to very low carbon electricity production. And I do not want to ignore the major contribution coal can play in our nation's energy security. Rather than burning most of our coal to produce electricity, why not convert it to liquids or gas for use in transportation and other applications? To do this without increasing the CO2 burden we can use nuclear energy as the source of heat and hydrogen to effect the coal to liquids or gas processes, thus greatly reducing the need for CO2 sequestration. The synergistic benefits of coal and nuclear working together create an enormous opportunity to improve our domestic energy security.

So, public acceptance, built from a better understanding of nuclear power doesn't just mean a better understanding of fission or capacity factors, it is the sum total: energy demand, the needed energy supply and the needed reductions in CO2 emissions, the potential growth in high-paying and highly-skilled jobs, and revitalization of heavy manufacturing and construction.

An economically sound policy is one that reduces financial barriers to deployment of new nuclear power. Currently that means loan guarantees, risk insurance, and production tax credits.

Loan guarantees issued by DOE and backed by the full faith and credit of the United States government are most important to near-term deployment of new nuclear power, particularly for new merchant plants. Last month, DOE solicited applications for nuclear power facilities, up to $18.5 billion; and for advanced nuclear facilities for the 'front-end' of the nuclear fuel cycle up to $2 billion. Loan guarantees help sponsors raise the substantial up-front capital necessary for a nuclear facility. This allows project sponsors to increase the project's debt-to-equity ratio, substantially reducing the cost of capital, and ultimately lowering the cost of clean nuclear power to the consumer.

Under one scenario, a new merchant nuclear power plant with 100% loan guarantee and 80/20 debt to equity ratio could realize up to a 39% savings in the levelized cost of electricity when compared to conventional financing with a 50-50 debt to equity ratio.

Government backed risk insurance will ensure financial protection from regulatory and litigation-related delays beyond the control of the project sponsors and production tax credits will be issued to offset some first-of-a-kind expenses. All three encourage first-movers to the market.

Speaking personally, in recent months I have reason to be both encouraged and concerned about the ability of our current energy supply structure to deliver the significant increase in nuclear power this nation needs. I am encouraged by recent state Public Utility Commission actions to allow new nuclear plant costs to be recovered through the rate base as work progresses. This is a tremendous vote of confidence for nuclear power and greatly increases the chances that these rate-based nuclear power plants will be built. However, on the down side it seems clear that new merchant plants are not capable of obtaining non-recourse project financing without federal guarantees, and that even with recourse to the sponsoring utility's balance sheet, very few plants can be supported.

The average market capitalization of our nuclear utilities is less than $25 Billion. The market capitalization of all our nuclear utilities summed together is still substantially less than the market capitalization of EXXON-MOBIL. At an average cost of about $7 billion per plant, $25 billion average market capitalization companies cannot underwrite many nuclear plants. While one can say this underscores the need for more government loan guarantees, one could also say it points to the need for utility sponsors to bring on stronger balance sheet partners and, perhaps, points to the need for some additional consolidation in the nuclear electrical generation industry.

Beyond public acceptability and the financial wherewithal, how will we also reestablish the nuclear R&D infrastructure to support nuclear power growth? Assuming the resurgence does take hold and our efforts result in new reactor orders the need for continued R&D efforts will be even greater. It will be the continued advancements in nuclear technology that can provide assurance that the nuclear renaissance can be sustained into the future.

The challenge of course is how to re-establish a multi-billion dollar nuclear R&D complex that once existed in the United States without a multi-billion dollar capabilities budget. This is not a new problem or one that is unique to nuclear R&D but let me outline how we are addressing this issue.

I have commissioned industry, universities and national laboratories to study nuclear R&D capability requirements and to recommend a 20+ year investment strategy. That work is essentially complete and is under review by the Office of Nuclear Energy's Nuclear Energy Advisory Committee. We will take the recommendations from these sources along with recommendations from the National Academy of Sciences and develop the best assessment of nuclear R&D capability requirements over the next 20 years and beyond, with the goal of publishing our findings later this year.

Our approach is direct basically we are taking stock of what we've got and what we will need. We will identify which types of facilities and capabilities already exist within the DOE complex that are most relevant and suitable to support irradiations testing, post irradiation examinations, and physical testing.

Currently, facilities in the DOE complex can satisfy many of the nuclear R&D requirements, but many of our existing facilities fall short of providing the necessary capabilities required to meet our long-term goals. Due to the age, condition, and original mission of the existing nuclear R&D facilities, many require modifications to support critical R&D needs. In addition, these user research facilities must be made available at reasonable cost to industry and academia. In areas where we simply do not have required capabilities such as test fast reactors we will again assess our options to include the use of public or privately owned domestic or foreign capabilities. Most would agree the last resort option would be construction of new facilities from the ground up. In many cases this results in the highest cost and longest lead time alternative, but in some instances, there simply will be no choice but new construction.

Critical to the success of this effort is a clear understanding of needs and priorities. Our most immediate needs relate to the preservation of our existing light-water reactor fleet and the educational institutions that underpin our R&D efforts. Our country needs the growth of nuclear education facilities to provide for hands-on education and training for the next generation of scientists, engineers and operators. The growth and sustainability of our nuclear education program lies in its relevance to our national nuclear energy programs. Furthermore, fuel irradiation capabilities require access to test reactors that can irradiate the materials and fuels under conditions that match current operating light-water reactors and the soon-to-be-built advanced light-water reactors.

Other needs arise for advanced fuel cycle R&D such as fast irradiation facilitates to provide a source of fast neutrons to study materials aging issues, develop aging models, and test advanced fuels. Laboratories for separations process development are needed to support the implementation of nuclear fuel recycling that will allow reuse of valuable nuclear resources and put the residual waste in a form that allows for easier ultimate disposal. Also, as the nuclear industry moves beyond light-water reactor technology there is a need to support R&D in technologies such as fast spectrum reactors and the High-Temperature Gas Reactor which has enormous potential for industrial applications.

Overlaid on all of these priorities is the need to apply advanced computational methods to model and simulate nuclear facilities. There is tremendous promise in improving our understanding of complex nuclear processes and systems in order to better predict problems, improve performance, and assure safe and reliable operations. The value of advanced computation has been repeatedly demonstrated in the nuclear weapons programs, science programs, and in commercial manufacturing.

As we move forward into the nuclear renaissance, I do see a need to evolve the way our national nuclear R&D priorities are established. As the nuclear renaissance takes hold and industry revenues begin to grow substantially, industry must increase its own R&D spending proportionately. Industry should be increasingly informing the government's R&D plans. Design data needs should originate with industry, as we have begun to do, so we can have greater assurance that our government R&D dollars are spent on work that will yield results relevant to marketplace needs.

If the United States is to be a leader in the development of future energy supplies, nuclear non-proliferation, and nuclear fuel cycle technologies, we must actively develop nuclear power here in the United States and actively influence the manner in which nuclear power expands globally. We must remain closely engaged with the international community of nations, both those with nuclear power and those considering nuclear power. Simply stated: "You don't get to make the rules unless you play the game," and, "You don't get to call balls and strikes from left field". So how do we get in the game and avoid being isolated in left field? Answer: The Global Nuclear Energy Partnership.

In two years, GNEP has progressed from a vision of the United States to a healthy and growing partnership of 37 participating countries, including 21 charter member countries and 3 permanent intergovernmental organizations. The GNEP member nations represent every major region throughout the world and countries from every stage of economic and civil nuclear energy development. This partnership is now poised to embrace a significant number of additional countries based on a recent decision of the current 21 GNEP partners to invite 25 additional countries to join GNEP. The rapid embrace of this U.S. vision speaks to the compelling and mutually acceptable approach the partner countries share for the future global nuclear fuel cycle – one that is predicated on the highest standards of safety and security, full compliance with nonproliferation and safeguards obligations, and is economically sustainable.

Possibly the greatest reasons for GNEP's international success has been the approach taken in establishing this important framework. The approach is firmly based on building an international partnership whereby each country is treated co-equally, decisions are made voluntarily and on a consensus basis and the rights of each member country are respected. A prime example of this approach is the GNEP Statement of Principles signed by each of the 21 partner countries.

Rising energy demands, our security, our prosperity, and our environment all require reducing our dependence on fossil fuels that emit greenhouse gases. No serious person can look at the challenge of maintaining our national security, reducing greenhouse gases and addressing climate change and not come to the conclusion that nuclear power has to play a significant and growing role. To foster that growing role, our nuclear energy policy itself must take on a more significant role to be technologically robust, economically sound, and publically acceptable for decades to come. Thank you.

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