STATEMENT OF

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Mr. Chairman and distinguished members of the committee, good morning and thank you for providing me the opportunity to speak with you on a subject of such great importance to our nation – nuclear power, and the opportunities and challenges associated with it.

As director of Idaho National Laboratory – the nation's nuclear energy laboratory – and as former commander of the U.S. Naval Submarine Forces, I've committed most of my adult life to the safe application of advanced nuclear energy systems. Needless to say, I feel personally responsible for helping chart a prudent course toward a secure and sustainable energy future for this nation – a future enabled by a richly diverse energy portfolio that can maintain and even expands nuclear power's significant contributions.

I'll highlight the Department of Energy's major nuclear energy programs – from my vantage as INL Director – with an eye toward how they address the challenges of cost, waste management and proliferation as cited in your letter of invitation. I'll also discuss the role of the national laboratories in supporting nuclear energy research and development, what is being done to support education and work force development for the nuclear power industry, and challenges that national laboratories face in sustaining our nuclear science and technology infrastructure.

Mr. Chairman, before I get to the core of my remarks today, I'd like to ask you to consider how they conform to the spirit and intent of what you said in your news release of two weeks ago. In acknowledging the 50th anniversary of the Defense Advanced Research Projects Agency – DARPA – you stated, "Given the geopolitical instabilities that threaten global energy supplies, the skyrocketing costs of energy to consumers, the looming threat of global climate change, and the resulting costs from the likely regulation of carbon dioxide emissions, there is a critical need for ground-breaking science-based energy solutions that can be deployed in the marketplace." The Department of Energy and its network of national labs could not agree with you more. That's precisely why we have the following programs.

NUCLEAR POWER 2010

The U.S. Energy Information Administration projects that U.S. electricity consumption will increase 30% by 2030. This means our nation will need hundreds of new plants to provide electricity. Rising demand for energy and electricity, pressure to reduce carbon emissions along with fair consideration of the outstanding performance and economics associated with operating U.S. nuclear power plants have spurred a nuclear energy renaissance in the U.S.

Recognizing that all sources of energy will be needed to meet energy demand, the Department of Energy launched the Nuclear Power 2010 program in 2002 as a joint government-industry cost-shared program to identify sites for new nuclear power plants, develop and bring to market advanced nuclear plant technologies, and evaluate the business case for building new nuclear power plants by demonstrating untested regulatory processes. Together with incentives enacted through the Energy Policy Act of 2005 – federal loan guarantees for low emission energy technologies, federal risk insurance and production tax credits – government and industry are working together to address the last barriers associated with building new plants: the financial and regulatory risks. These federal tools will allow first movers to address and manage the risks associated with building the first few new nuclear power plants. This year's budget request seeks to significantly increase the government's share in the NP 2010 program and to extend the period during which companies can seek loan guarantees by two years. Industry has stated that loan guarantees are essential to ensuring the first new nuclear plants are ordered and built.

Industry has responded with 17 companies and consortia pursuing licenses for more than 30 nuclear power plants in states represented by 20 members of this committee. Nuclear Regulatory Commission review of the first wave of applications has already begun and industry indicates it expects to submit 11 to 15 more applications this year. At the same time, orders are starting to be placed for long-lead items such as forgings. The signing earlier this month of a contract between Georgia Power and Westinghouse for two AP1000 units is yet another signal that the nuclear energy renaissance has begun.

LIGHT WATER REACTOR RESEARCH AND DEVELOPMENT

The combination of low operating and fuel costs which keep electricity prices down, an excellent record of performance, and clean energy benefits means that nuclear energy will remain an important source of energy for our nation's future. The design features of the Generation III and Generation III+ nuclear power plants, which include redundant systems, automatic shutdown systems and multiple layers of protection, combined with a strong safety culture and an excellent regulator means that nuclear power will continue to be a safe and reliable source of energy.

The increased electricity from existing nuclear power plants since 1990 is enough to power 29 cities the size of Atlanta or Boston each year. The outstanding performance of the existing fleet and the prospects that market pull will demand a ramping up in new nuclear plant build projects has prompted consideration of a new government-industry cost-shared initiative in FY 2009 within the Generation IV program for light water reactor research and development. This research and development would be aimed at supporting efficient construction and operation of the dozens of new plant projects anticipated over the next decade and at maximizing the contribution of the existing fleet by further extending the licenses beyond 60 years.

In February, the Electric Power Research Institute and Idaho National Laboratory issued a joint Nuclear Power Strategic Plan for Light Water Reactor Research and Development that sets forth 10 objectives, six of which are considered to be of highest priority for this initiative. These high priority objectives include:

- Transitioning to state of the art digital instrumentation and controls
- Making further advances in nuclear fuel reliability and lifetime
- Implementing broad-spectrum workforce development
- Implementing broad-spectrum infrastructure improvements for design and sustainability
- Addressing electricity infrastructure-wide problems

- Sustaining the high performance of nuclear plant materials.

This LWR strategic R&D plan presents a framework for how industry and government should work together on research and development and is the first step in identifying the specific research to be pursued. DOE's budget request includes $10M to support LWR R&D, representing the government's share in FY 2009. Both Nuclear Power 2010 and the LWR R&D initiative will enable the nation to do much to meet near-term domestic power needs, while continuing to avoid generation of the massive amounts of greenhouse gases that would be produced if our nuclear fleet were to be replaced with fossil-fuel plants.

ADVANCED FUEL CYCLE INITIATIVE

In much the same way that Congress has determined that it is in the best interest of our nation to boost the fuel economy of our cars, trucks, vans and SUVs – so, too, has DOE and the global nuclear industry determined that we need to raise the fuel efficiency of nuclear power, while reducing the toxicity and volume of waste that requires disposal. The Department and its system of national laboratories – working in partnership with industry and academia – are pursuing this essential goal through the Advanced Fuel Cycle Initiative.

The once-through fuel cycle used by our nation's 104 nuclear power plants is only able to extract less than five percent of the available energy from their nuclear fuel rods before they have to be replaced. By eventually closing the fuel cycle as envisioned by AFCI, much more of the available energy in nuclear fuel would be extracted, and more easily managed high-level waste would result. Admittedly, significant technology development must occur before AFCI's complete vision is realized, and additional cost analyses should be done to further understand the economics. But waiting until someone determines the economics are right to begin investing in alternate and advanced technologies tends to produce the kind of crises the world faces today with oil prices at well over $100 a barrel.

Over the near term, the AFCI program is conducting research and demonstrating technologies that have a high probability of reducing the volume, heat generation and radiotoxicity of used nuclear fuel materials requiring repository disposal. The AFCI program is developing advanced separations processes for the treatment of used nuclear fuel from current light water reactor and advanced light water reactor systems. While plutonium burning and transmutation of some of the other transuranic elements that impact repository performance can be accomplished in thermal reactors, more complete transmutation of transuranic elements is achievable in fast reactors with a much larger reduction in decay heat and radiotoxicity per unit energy produced in a nuclear power plant. This translates into a reduction in the source term per unit energy produced and hence, more effective utilization of a geologic repository. The AFCI program is conducting R&D aimed at addressing the economics of fast reactor technology and developing the advanced fuels and associated reprocessing technologies for sodium-cooled fast reactors to enable more of the energy value of used nuclear fuel to be recovered, while destroying, and extracting energy from the transuranics.

AFCI is the first DOE Office of Nuclear Energy program to implement a Technical Integration Office model to effectively and efficiently coordinate the research and development across the DOE national laboratory complex, including with universities and international research partners. Research supporting AFCI has been organized into seven campaigns and two cross-cutting functions. The seven campaigns include advanced separations technologies, advanced fuel development, systems analysis, safeguard systems development, advanced reactor design, waste form development, and grid-appropriate reactor development. The two cross-cutting functions are modeling and simulation and nuclear safety and regulatory activities. World-recognized experts at DOE's national laboratories have been assigned to lead each of the campaigns, with much of the research conducted at the Science labs.

AFCI is the domestic R&D component of the Global Nuclear Energy Partnership. GNEP is an international initiative that seeks to enable global expansion of nuclear energy in a safe and secure manner, enabling countries to enjoy the benefits of nuclear power without having to invest in expensive and sensitive enrichment and reprocessing technologies. Although GNEP is a relatively new initiative, 21 nations have formally joined the partnership and four teams comprised of some of the most capable and respected nuclear industry firms have offered approaches to DOE on how best to implement a closed fuel cycle with advanced fuel cycle technologies. In addition, industry has told DOE that meaningful steps can be taken in the near-term to close the fuel cycle by 2020 to 2025, suggesting that government take a fresh look at nuclear waste management through an integrated approach including recycling and repositories.

The bottom line is – GNEP comes at a crucial time in the global expansion of nuclear power, and is an important initiative for addressing challenges associated with nuclear waste management. It's a comprehensive proposal to close the nuclear fuel cycle in the U.S., and engage the global community to minimize proliferation risks – while providing the mechanism for international synergy in policy formation, technical support and technology and infrastructure development.

GENERATION IV NUCLEAR ENERGY SYSTEMS

For the long-term future, the Department is working on the next generation of nuclear energy systems, technologies that represent enhancements in economics, sustainability, reduced waste intensity and proliferation-resistance over today's technologies through the Generation IV nuclear energy systems program. Additionally, the U.S. is part of the Generation IV International Forum or GIF, a multinational effort to work collaboratively on Generation IV technologies. GIF nations are exploring six advanced systems of interest. Overall, the investment of 10 nations in collaborative R&D on Generation IV technologies is over $100M per year on the first two systems.

U.S. Generation IV research is focused on reactor systems that operate at higher temperatures than today's reactors to both improve efficiency and provide a process heat source for a wide range of energy-intensive co-located industrial processes. A mid-term version of the Generation IV Very High Temperature Reactor concept, the High Temperature Gas Reactor (HTGR) nuclear system is being pursued in the U.S. through the Next Generation Nuclear Plant (NGNP) demonstration, authorized by the Energy Policy Act of 2005. The HTGR is an advanced nuclear technology that can provide high-temperature heat for industrial processes at temperatures up to 950^{o}C. Coupled with developmental high temperature electrolytic or thermo-chemical technologies, this advanced HTGR technology can also be used in the production of hydrogen and oxygen from water for existing markets such as refinery upgrading of petroleum crude, chemical and fertilizer plants, as well as in processes such as coal-to-synthetic fuels and hydrocarbon feedstocks. Using the HTGR nuclear heat source will reduce dependence for producing process heat using fossil fuels such as natural gas and oil, for which the long-term prices are increasing and the availability is uncertain. This is achieved without carbon emissions, thus reducing the carbon footprint of these industrial processes.

As currently conceived, the commercialized HTGR will be inherently safe by design and more flexible in application than any commercial nuclear plant in history. The commercialized HTGR will secure a major role for nuclear energy for the long-term future and also provide the U.S. with a practical path toward replacing imported oil and gas with domestically produced clean and economic process heat, hydrogen and oxygen.

As with Nuclear Power 2010, the Advanced Fuel Cycle Initiative and GNEP, the Generation IV program in general and the Next Generation Nuclear Plant project in particular are built on a public-private partnership foundation. DOE has recently issued a Request for Information and Request for Expression of Interest seeking input from interested parties on how best to achieve the goals and meet the requirements of the NGNP demonstration project at Idaho National Laboratory.

Idaho National Laboratory, Oak Ridge National Laboratory and The Babcock and Wilcox Company are developing TRISO-coated fuel and conducting other HTGR research. The research to improve performance of the coated particle fuel recently met an important milestone by reaching a burn-up of nine percent without any fuel failure, demonstrating that the U.S. can produce high-quality gas reactor fuel. Already, significant success has been achieved with the Department's Nuclear Hydrogen Initiative with the development and testing of high-temperature electrolysis cells that take advantage of NGNP's high process heat output to efficiently produce hydrogen and customizable carbon-neutral fuels.

NUCLEAR SCIENCE AND ENGINEERING EDUCATION AND FACILITY INFRASTRUCTURE

While all of the programs I've highlighted for you individually and collectively do much to advance the state of the art in nuclear science and technology, and enable the continued global expansion of nuclear power, there is a great area of challenge confronting nuclear energy's future. As with most other technologically intensive U.S. industries – it has to do with human capital and sustaining critical science and technology infrastructure.

My laboratory, its fellow labs and the commercial nuclear power sector all face a troubling reality – a significant portion of our work force is nearing retirement age and the pipeline of qualified potential replacements is not sufficiently full.

Since I'm well aware of this committee's interests in science education, I'd like to update you on what the Department and its labs are doing to inspire our next generation of nuclear scientists, engineers and technicians. Fundamentally, the Office of Nuclear Energy has made the decision to invite direct university partnership in the shared execution of all its R&D programs and will set aside a significant amount of its funds for that purpose. Already, nuclear science and engineering programs at U.S. universities are involved in the Office of Nuclear Energy's R&D, but this move will enable and encourage even greater participation in DOE's nuclear R&D programs.

In addition, all NE-supported labs annually bring hundreds of our nation's best and brightest undergraduate and graduate students on as interns or through other mechanisms to conduct real research. For example, at INL we offer internships, fellowships, joint faculty appointments and summer workshops that focus on specific research topics or issues that pertain to maintaining a qualified workforce. This year, we are offering a fuels and materials workshop for researchers and a 10-week training course for engineers interested in the field of reactor operations. Last year, DOE designated INL's Advanced Test Reactor as a national scientific user facility, enabling us to open the facility to greater use by universities and industry and to supporting more educational opportunities. ATR is a unique test reactor that offers the ability to test fuels and materials in nine different prototypic environments operated simultaneously. With this initiative, we join other national labs such as Argonne National Laboratory and Oak Ridge National Laboratory in offering nuclear science and engineering assets to universities, industry and the broader nuclear energy research community.

Finally, national laboratories face their own set of challenges in sustaining nuclear science and technology infrastructure – the test reactors, hot cells, accelerators, laboratories and other research facilities that were developed largely in support of prior missions. To obtain a more complete understanding of the status of these assets, the Office of Nuclear Energy commissioned a review by Battelle to examine the nuclear science and technology infrastructure at the national laboratories and report back later this year on findings and recommendations on a strategy for future resource allocation that will enable a balanced, yet sufficient approach to future investment in infrastructure.

CONCLUSION

All of the programs I've cited today – Nuclear Power-2010, the Advanced Fuel Cycle Initiative, GNEP, Generation IV, Nuclear Hydrogen Initiative – ultimately seek to make nuclear power better and safer. Realistically, we as a nation have no silver bullets that in the near- or mid-term can replace nuclear power as a reliable, 24/7 producer of massive amounts of cost-effective and carbon-emission-free baseload electric power and process heat for industrial processes to displace burning of natural gas and oil.

The challenges frequently associated with nuclear power – high costs, waste disposal and proliferation risks – can all, from a technological perspective, be managed. The high cost concerns actually have little to do with the fuel used in a nuclear reactor – they're more related to the rising costs of concrete, steel, copper, and project capital on large, lengthy projects like a nuclear power plant. Many of these same cost concerns apply to virtually every means of generating electricity we have. Nuclear Power 2010 and the other incentives available to first movers of new nuclear plants can effectively address these financial and regulatory challenges.

The waste stream from a nuclear reactor is hazardous and must be isolated – but we know how to handle it safely and we know the pathways we can take to reduce and manage it. The Nuclear Regulatory Commission has concluded that used fuel can be safely stored onsite for 100 years. An integrated approach to used fuel management offers the possibility of recycling the usable components, greater utilization of our uranium resources, and reduced toxicity and/or volume of used fuel requiring geologic disposal.

Finally, proliferation. The fact is that nuclear materials can be redirected for non-peaceful purposes. President Eisenhower acknowledged that a half century ago in his Atoms for Peace address. But the nuclear genie is out of the bottle. Over 430 nuclear reactors are already in operation around the world, and dozens more are under construction or in the planning process. Do we in this country wish to disengage from the global nuclear renaissance and hope for the best – or do we want to help guide the world toward the best nuclear fuel cycle possible?

These programs maintain the viability of today's nuclear reactor fleet and prepare the way for the safe, sustainable future for this large and immediately available global power source. They address the challenges facing nuclear energy, and leverage the best minds in our national laboratories, universities and industry.

As the director of Idaho National Laboratory, I'm proud of the role my 3,800 Idaho colleagues play in carrying out these national priority programs and related efforts that contribute to our nation's energy security.

Thank you.