STATEMENT OF
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BEFORE THE

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Chairman Bingaman, Ranking Member Domenici, and Members of the Committee, it is a pleasure to be here today to discuss the Global Nuclear Energy Partnership or GNEP as it relates to U.S. policy on nuclear fuel management.

It is my objective today to clearly define GNEP, discuss what has been accomplished, and what we plan to accomplish, and how we envision the program developing in the future. And in line with the hearing topic, GNEP is crucial to developing an effective and durable waste management strategy in the United States, as well as around the world. To that end, GNEP is completely compatible with our near-term effort to license and open the waste repository at Yucca Mountain, and as I will discuss, GNEP will complement and enhance its utility.

At the outset, let me stipulate that while some aspects of GNEP have evolved as we have engaged the international community, industry, and other stakeholders, the GNEP vision remains unchanged. This vision is to promote a significant, wide-scale use of nuclear energy in a safe and secure manner, and to take actions now that will allow that vision to be achieved while decreasing the risk of nuclear weapons proliferation and effectively addressing the challenge of nuclear waste disposal. GNEP was created to realize these goals and to ensure the United States is not only a participant, but that we regain our role as global leaders in nuclear energy.

Why Nuclear?

As this Committee knows well, the Department of Energy (DOE) is tasked with promoting America's energy supply through reliable, clean, and affordable energy. It is clear today that with present energy demand projections, an expanded supply of electricity from a variety of resources must be expeditiously developed. The Energy Information Agency projects the demand for electricity in the United States will increase 50% by 2030, and global demand will nearly double over the same period. It is this projected increase in electricity demand that provides the most compelling argument for the expansion of nuclear energy – both domestically and internationally.

Nuclear power is the only large scale, emissions-free source of baseload electricity currently available capable of meeting the growing demand.

Nuclear energy produces 20% of our nation's electricity, and almost 70% of our non-emitting source of domestic electricity. Last year, domestic nuclear power avoided an estimated 681 million metric tons of carbon emissions. That is the equivalent of eliminating carbon dioxide emissions from 96% of all passenger

cars in the United States. Volumetrically, that amount of carbon dioxide would fill an area the size of Washington D.C. rising 1.2 miles.

Many countries around the world are concluding that increased nuclear generation is necessary to support economic growth and to avoid emitting additional greenhouse gases. The global expansion of nuclear power is a reality, with 32 reactors currently under construction and an estimated 222 in the planning phase.

Significant steps toward adding nuclear power generating capacity in the United States were taken last month with the first two complete submissions of combined Construction and Operating License applications to the Nuclear Regulatory Commission. Applications for 32 new nuclear plants are expected from 18 different utilities in the next 3 years. When completed, those plants will provide over 41,000 megawatts of electricity, enough power to supply almost 30 million homes with clean and reliable electricity.

GNEP Vision

Even as nuclear power helps the global community to keep pace with electricity demand, this increased use raises two important concerns: How will the world community deal with the possibility that the expansion may raise the risk of nuclear weapons proliferation? And, how will used fuel from nuclear power be best managed? The President addressed these concerns, and offered an approach to meet the projected growing demand for electricity and concerns over climate change when he announced the Global Nuclear Energy Partnership in February, 2006.

The *National Security Strategy of the United States* of America (March 16, 2006) establishes that the United States "will build the Global Nuclear Energy Partnership to work with other nations to develop and deploy advanced nuclear recycling and reactor technologies. This initiative will help provide reliable, emission-free energy with less of the waste burden of older technologies and without making available separated plutonium that could be used by rogue states or terrorists for nuclear weapons. These new technologies will make possible a dramatic expansion of safe, clean nuclear energy to help meet the growing global energy demand."

GNEP can advance the nonproliferation and national security interests of the United States, particularly by reinforcing policies that aim to reduce the spread of enrichment and reprocessing technologies, and eventually eliminating excess civilian plutonium stocks that have accumulated. GNEP is working to foster collaboration between developed and developing nations to overcome shared barriers to developing and expanding nuclear power, which include high capital costs for new projects, a high degree of requisite technical and industrial expertise, advanced technology development, and efficient regulatory policy.

At the core of the GNEP vision is strengthening nuclear nonproliferation, and improving safety, security, and safeguards to enable the expansion of civilian nuclear power for peaceful purposes. GNEP would make one of its primary contributions to reducing proliferation risk by establishing a reliable and comprehensive fuel service framework. By providing assured supply of fresh fuel and assured disposition of used fuel, this framework would help nations gain the benefits of nuclear power without the need to build their own sensitive fuel cycle facilities. This would discourage the spread of enrichment and reprocessing capabilities, which could be misused to produce weapons.

Additionally, the GNEP vision addresses management of used nuclear reactor fuel, an issue that is most important for the long-term viability of nuclear power. In the United States and in many countries throughout the world, the build-up of used nuclear fuel could inhibit the long-term expansion of nuclear power and requires significant resources to maintain the necessary security and international safeguards. . Domestically, the GNEP vision is a closed U.S. nuclear fuel cycle that would benefit repository capacity,

produce more manageable waste form, conserve resources, reduce current and future stocks of fissile material, and foster the expansion of clean and reliable electricity generation.

What is GNEP?

The Global Nuclear Energy Partnership has both broad international and significant domestic aspects. The global aspect of GNEP is manifested through voluntary international partnership initiated by the United States. The domestic aspect is aimed at effectively managing both the resources available in used nuclear fuel and the associated waste. The Office of Nuclear Energy funds fuel cycle research and technology development at national laboratories and universities through the Advanced Fuel Cycle Initiative (AFCI) and coordinates activities with the Office of Science, the National Nuclear Security Administration, the Office of Civilian Radioactive Waste Management, and the Office of Environmental Management.

International Partnership

The international partnership is an unprecedented voluntary alliance of nations that share the common vision of the necessity of the expansion of nuclear energy for peaceful purposes worldwide in a safe and secure manner. It aims to accelerate development and deployment of advanced fuel cycle technologies to encourage clean development and prosperity worldwide, improve the environment, and reduce the risk of nuclear proliferation by taking advantage of the best available fuel cycle approaches.

GNEP seeks to reduce the risk of nuclear proliferation worldwide by promoting technologies that will reduce foreign stockpiles of separated plutonium generated from the civil nuclear industry. It aims to enhance the international nonproliferation regime by demonstrating safeguard systems that incorporate advanced materials accountability, control, and monitoring to reduce the threat of diversion or misuse. It also aims to develop advanced reactor designs that reduce proliferation risks, and promote infrastructure development to build the capacity of developing nations to utilize clean and reliable nuclear power, while achieving the highest nonproliferation standards.

Cooperation will be carried out under existing, and where appropriate, new bilateral and multilateral arrangements. The international partnership is the overarching organization consisting of like minded nations under which current and future arrangements are developed to further the vision of GNEP set forth in the Statement of Principles, which has been signed by 17 nations.

The Global Nuclear Energy Partnership Statement of Principles outline seven key goals that constitute GNEP's comprehensive vision, identifying areas of cooperation ranging from closing the fuel cycle through recycling technology, to development of reactors appropriate for power grids in developing countries and regions, to cooperating with the International Atomic Energy Agency (IAEA) to strengthen safeguards against nuclear proliferation. In the words of Director General of the IAEA, Dr. Mohamed ElBaradei, at the September Ministerial: "GNEP is…comprehensive because it deals with all aspects of the fuel cycle, both the front end and the back end. GNEP also aims to establish a global partnership… Nuclear energy is an international concern and we need to man it on an international basis."

In an effort to further develop policy, technology and regulatory foundations, multilateral and bilateral arrangements within the partnership are being utilized. This cooperation maximizes opportunities for international cooperation and also allows a secure avenue for engaging in sensitive fuel cycle cooperation.

In addition to new arrangements, existing multilateral arrangements ensure a means to further international cooperation to achieve GNEP's stated goals. The Generation IV International Forum (GIF), a thirteen-nation

research and development consortium, is leading the way toward innovative nuclear energy systems of the future. GIF has identified six advanced nuclear energy systems, and the consortium is pursuing the research and development pathways for establishing technical and commercial viability, demonstration, and potential commercialization. Advanced technology systems being explored under GIF share parallel objectives with GNEP, and GIF's work has wide-ranging applicability for GNEP technology. GIF is an active member of GNEP, recently attending the GNEP Ministerial meeting as an observer.

DOE's International Nuclear Energy Research Initiative (I-NERI) also plays an important and complementary role as an existing multilateral agreement. I-NERI, with five international partners, collaborates on research and development for advanced fuel cycle technology, as well Generation IV and hydrogen technology.

Bilateral cooperation that benefits GNEP in its international technical development efforts includes arrangements between the United States and Russia, Japan, China, Australia, and Jordan. As an example, the U.S.-Russian Bilateral Action Plan outlines national strategies in nuclear power; identifies the common basis for U.S.-Russian cooperation in advanced recycling reactors, exportable small and medium reactors, nuclear fuel cycle technologies, and nonproliferation—all tenets of GNEP. Similarly, under the U.S.-Japan Bilateral Program Plan, we have formed working groups to conduct joint research and development, furthering the work being carried out in other bilateral agreements under the GNEP umbrella.

Research and Technology Development – AFCI

International cooperation leverages technology development activities of several countries to maximize benefits to all. In that context, significant domestic technology development and industrial investment will be needed to realize the GNEP vision.

The Department of Energy and specifically, the Office of Nuclear Energy's technology mission objective is to facilitate the research and development of advanced technologies and make them available to market.

DOE facilitates both of these objectives through its AFCI program. The driving intent of AFCI is to close the nuclear fuel cycle by fostering existing technologies as well as to develop advanced technologies that are cleaner, more efficient, less waste-intensive, and possibly even more proliferation-resistant than the once through system.

In order to discuss the underlying technology AFCI is developing, it is important to understand what we are working to accomplish. To do this we need to look at the back end of the fuel cycle as an integrated system. The fundamental goal of closing the fuel cycle is to separate used fuel into reusable materials and waste. Through this process, both components may be more efficiently managed. This allows not only the reuse of the fissionable materials that can provide significant amounts of energy, but also provides options for minimizing and efficiently managing the resulting waste.

In our current "once-thru" fuel cycle, the used nuclear fuel is planned for ultimate disposal in a permanent geological repository at Yucca Mountain, Nevada. Recycling used nuclear fuel rather than permanently disposing of it in a repository would result not only in utilizing more of the energy in nuclear fuel, but also reduce the amount of material that needs disposal in a repository, and the level of risk posed by that material.

By separating just the uranium and plutonium for reuse as fuel, the remaining material could reach roughly the same level of radiotoxicity as the originally mined uranium ore in approximately 10,000 years. When advanced recycling technologies are deployed, the separation out of most long-lived actinides and fission

products will result in an even great reduction of risk and accordingly greatly diminish the amount of material that needs disposal in a repository.

Present day separation technologies allow uranium to be separated sufficiently enough to be re-enriched for use as fresh fuel. Modified versions of those technologies allow a plutonium-uranium combination to be extracted and made into fuel, but this would not achieve the ultimate goal of GNEP. More advanced technologies under development through AFCI could be able to further partition used fuel by extracting those chemical elements heavier than uranium, the transuranics, for use as fuel to further shorten the time it takes for the waste to reach the radiotoxicity of natural uranium. Making transuranic elements into fuel for use in a fast reactor, also under development in AFCI, could allow additional reductions of the long-term radiotoxicity of the waste, perhaps reaching the radiotoxicity of natural uranium within only hundreds of years. In practical terms, consuming the transuranic elements has the potential to increase the capacity of a repository by reducing overall volume and heat loading by more than a factor of ten.

Making this advanced process practical would require making the separation process reliable, but also establishing the ability to fabricate a fuel type that can be used in a fast reactor. The current fleet of light water reactors cannot operate with fuel consisting of these isotopes. Fuel development in AFCI will determine the optimum transuranic fuels which in turn will determine the optimum fast reactor technology.

Separation and recycling technology's foremost contribution is the overall reduction of nuclear waste that requires permanent disposal, and allows for repository medium flexibility. Advanced recycling would reduce the volume, heat-loading, also known as thermal output, and radiotoxicity of nuclear waste, and could exponentially increase the capacity of the geological repository at Yucca Mountain. The successful implementation of recycling would not replace the need for Yucca Mountain. However, GNEP's proposed recycling activity could mitigate the burden on Yucca Mountain's physical limits, and the actual and projected volumes of used nuclear fuel from the current fleet of nuclear reactors and new reactors. In practical terms the ability to transmute, destroy, or burn transuranics in a fast reactor is the principal long-term waste management benefit of GNEP.

GNEP's principles set the path to develop and demonstrate advanced technologies for recycling used nuclear fuel for deployment in facilities that do not separate pure plutonium and eventually eliminate stocks of separated civilian plutonium. Such advanced fuel cycle technologies, when available would help substantially reduce nuclear waste, simplify its disposition and draw down inventories of civilian used fuel in a safe, secure, and proliferation-resistant manner. They would also end the foreign accumulation of separated plutonium in the civil fuel cycle and draw down existing excess stocks worldwide.

GNEP Activities

GNEP is not a static vision, and its related policies and technologies are capable of evolving to meet the ultimate goals of the United States. Since the introduction of the Global Nuclear Energy Partnership last year, we have pursued an aggressive path of seeking input and collaboration in many venues.

<u>International</u>

The GNEP vision is set forth in the Statement of Principles. The landmark first Ministerial meeting on May 21, 2007, was hosted by U.S. Secretary of Energy Samuel Bodman. Ministers and atomic energy officials from China, France, Japan, Russia, and the United States gathered to engage in productive discussion and issued a Joint Statement of Support that clearly recognized the role of nuclear power and a common approach to nuclear power consistent with GNEP vision.

The second Ministerial meeting was held on September 16, in Vienna, Austria. The meeting was attended by a total of 35 nations and three inter-governmental organizations. Sixteen nations signed the Statement of Principles at the meeting and several others indicated interest in signing and becoming a partner upon formal review by their governments. The partners include the original five countries, China, France, Japan, Russia, and the United States, and eleven new countries; Australia, Bulgaria, Ghana, Hungary, Jordan, Kazakhstan, Lithuania, Poland, Romania, Slovenia, and Ukraine. The partnership continues to grow, as evidenced by Italy announced decision to become a partner just yesterday.

In addition to the signing of the Statement of Principles, the September ministerial meeting established the structure and governing procedures for GNEP which provides for an executive committee, a steering group, and expert working groups. Two working groups were approved, and two further working groups are under consideration—setting the partner nations on a path to immediately begin working to address the challenges to development of comprehensive global nuclear fuel services, as well as the necessary nuclear infrastructure needed to ensure nuclear power is developed in a safe, secure, and responsible manner and is used only for peaceful purposes.

Therefore, GNEP is a vehicle for both international cooperation and technology development, and has, is, and will be seeking input as a means of making the partnership a dynamic operational mechanism. Collecting technical, budgetary and environmental data and input enables GNEP to adjust, working to make it the most effective, economic and technically feasible.

Industry

DOE initiated significant industrial input for GNEP in May 2007 when a Funding Opportunity Announcement (FOA) was issued. The FOA sought applications from commercial entities to provide technology development roadmaps, business plans, and a communications strategy supporting the GNEP conceptual design studies for a nuclear fuel recycling center and advanced recycling reactor. The conceptual design studies will address the scope, cost, and schedule to build the initial facilities. The technology development roadmaps will describe the state of readiness for their proposed processes and design concept, and the longer-term technology development needs to achieve the ultimate GNEP vision. The business plans will address how the market may facilitate DOE plans to develop and facilitate commercialization of advanced fuel cycle technologies and facilities. The communications plans will provide DOE with information on the dissemination of scientific, technical, and practical information relating to nuclear energy and closing the nuclear fuel cycle. DOE anticipates receiving responses describing commercial technology that may be deployable in the near-term.

In September DOE awarded over $16 million to four industry-led consortia to begin producing this information and data. We will receive the first data in January of next year and will potentially authorize further work with some of the consortia after analyzing the submissions.

Congress

When GNEP was introduced as part of the President's Advanced Energy Initiative in the Fiscal Year 2007 budget request, we requested $250 million for AFCI. The House of Representatives approved only $120 million in its appropriations legislation and the Senate, as you know, did not ultimately pass an Energy & Water Appropriations bill. In accordance with the Joint Resolution ultimately enacted, AFCI was provided with $167.5 million, one-third below the requested amount. As part of this appropriations process, we received significant input via "report language" accompanying the respective bills.

In February, we submitted the Fiscal Year 2008 budget request, which includes $395 million for AFCI. The House of Representatives passed an appropriations bill providing only $120 million in funding. The Senate

has not passed its version of that legislation yet, but the Appropriations Committee approved a bill which would provide $242 million. Again, Congress provided, and DOE has considered, significant input as part of this process. Additionally, as part of the Fiscal Year 2006 appropriations process, Congress provided funding to provide grants to entities desiring to host recycling facilities to conduct siting studies of the proposed sites. Ultimately, Congress has not provided the level of funding support the Administration felt necessary and DOE has sought to adjust the program accordingly.

Public

Perhaps most importantly, we have sought public input, and will continue to do so in the future. As previously discussed, in August 2006, DOE issued a Funding Opportunity Announcement making funds available to conduct detailed studies of potential GNEP sites. We received responses from entities representing 11 communities in eight states interested in hosting advanced recycling facilities, and awarded over $10 million to conduct the studies.

In January, DOE initiated an environmental review of the GNEP program as part of the process established in NEPA. Subsequently we hosted 13 meetings across the country to receive public comment relating to the scope of this GNEP Programmatic Environmental Impact Statement (PEIS). Ultimately we received over 14,000 comments, and we are in the process of preparing a draft PEIS informed by those comments. We expect to issue the draft in the near future and will again host public meetings and receive comments that will be reviewed and assist us in finalizing the PEIS and preparing in coordination, a Record of Decision next year.

NAS Response

Given the scope of this hearing, I think it is incumbent upon me to address the recent report issued by the National Research Council (Council), and specifically as it treats GNEP. The report's ultimate conclusion that has subsequently received significant media coverage is that, "…the GNEP program should not go forward and it should be replaced by a less aggressive research program." DOE takes issue with several of the premises on which the Council based its conclusion, but I think it's important to first note that inherent in the conclusion is the presumption that DOE should continue to pursue efforts to close the fuel cycle.

However, the Council's conclusion is based on the incorrect premise that DOE has already made selection of technologies and is aggressively moving to facilitate commercialization of those technologies. The Council mistakenly assumed that because the UREX+ separations technology was developed in our National Laboratories and has been designated the "baseline" technology for development and comparison purposes that DOE has in fact selected UREX+, excluding all other technologies. Not only is this not an accurate reflection of the AFCI program, but such a path is not consistent with our National Environmental Policy Act process which ensures such decisions are made in a deliberate and transparent manner, with ample opportunity for public comment.

While the Council supports the goal of closing the fuel cycle to the point of rejecting a minority opinion to the contrary, DOE strongly disagrees with the lack of urgency the Committee shows for this important mission. With large expected increases in the demand for electricity as well as serious concerns about climate change, a substantial increase in nuclear capacity is required worldwide. This creates a serious urgency to definitively develop an answer to the "waste question" that is credible and durable, that provides the opportunity for alternative waste disposition paths while also minimizing the requirement for geologic repositories, and makes the most efficient use of nuclear resources.

Economic Justification

Some have questioned the economic justification for closing the fuel cycle and doing so in the near-term. However, most who raise these questions fail to acknowledge that any effort seeking to close the nuclear fuel cycle must be viewed through a macro lens to accurately assess the aggregate costs and benefits. An economic analysis is incomplete without assigning representative value to the important benefits from fuel cycle options.

Previous analyses, including some to be discussed here today, attempt to compare a closed fuel cycle to a direct disposal approach. This is an appropriate comparison of fuel cycle strategies, but in doing so the analysis must consider not only the dollars expended, but also address the goals of the used fuel management, including: minimization of repository requirements in both size and quantity, maximization of repository medium options, conservation of resources, and unquantifiable benefits of positive environmental impacts such as greenhouse gas avoidance, and health benefits stemming from noxious emissions avoidance. Perhaps most notably, most analyses take a narrow and outdated view of the security and nonproliferation benefits of closing the fuel cycle and ignore the significant benefits of offering reliable fuel services to discourage the spread of sensitive fuel cycle technologies.

Beyond the omission of macro analyses, the current studies are heavily dependent upon the principal assumption that direct disposal will be available at a modest cost as we look toward an expansion of nuclear power. This assumption has not proven accurate to date. Additionally, the federal government continues to incur financial liability for failure to remove used fuel from existing reactor sites. This liability could approach $7 billion if Yucca Mountain is opened in 2017, and will grow by an approximate annual average of $500 million for each additional year of delay.

The nation's commercial reactors will have generated enough used fuel for Yucca Mountain to meet its current statutory capacity by the end of this decade, well before the current fleet of reactors is retired and before considering the next generation of plants. Given the challenges we have experienced in opening a repository, the assumption of unfettered expansion of direct disposal is tenuous. The burden of identifying the locations for multiple repositories is a cost that is avoided for at least a century by closing the fuel cycle. Separating used fuel allows for waste forms that can enable alternative, and likely cheaper, disposal options that were not available with a direct disposal approach.

One key nonproliferation goal of GNEP is to enable the global expansion of nuclear power without the spread of sensitive fuel cycle technologies that can contribute to nuclear proliferation. Most analyses comparing direct disposal with recycling do not consider the value of the U.S. participating in a system that would relieve nations of the need to develop these sensitive technologies indigenously. It is difficult to see how the U.S. could take a central role in a fuel supply and take-back arrangement unless we deploy a sustainable waste management system. Additionally, the opportunity to eliminate the civilian foreign stocks of separated plutonium worldwide is enhanced by the availability of additional U.S. power plants licensed to consume plutonium bearing fuels.

The opportunity costs of a closed fuel cycle are hard to quantify, however, an analysis best serves the public by going beyond the strictly monetary or accounting costs of technology development to include all benefits of a closed fuel cycle.

The Secretary of Energy often remarks that there is no silver bullet to our energy challenges or to climate change. However, he is quick to note nuclear power's potential of meeting the growing demand for energy. GNEP comes at a crucial time in the burgeoning expansion of nuclear power, and a crucial time for our nation's energy security. It is the only comprehensive proposal to close the nuclear fuel cycle in the United

States, and engage the international community to minimize proliferation risks as well as provide and benefit from cooperation in policy formation, technical support, and technology and infrastructure development.

This concludes my prepared statement. I would be pleased to answer any questions you may have.