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Chairman Simpson, Ranking Member Kaptur and Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss the President's fiscal year 2015 budget request for the Office of Nuclear Energy (NE) at the Department of Energy.

This past year has been another historic one for nuclear energy. Construction of the first new nuclear builds in this country in more than 30 years continued with completed basemat foundation pours for two new reactor units at VC Summer in South Carolina and two new units at Plant Vogtle in Georgia. Last month, the Department of Energy's Loan Programs Office also announced that two of the owners of Plant Vogtle will receive a $6.5 billion loan guarantee. Together these newly constructed units will provide enough reliable, low-emission, baseload electricity to power 3 million homes in the Southeastern United States. New nuclear builds, in addition to the currently operating nuclear power fleet, will also play an important role in President Obama's Climate Action Plan to reduce greenhouse gas emissions, as well as achieving American energy independence.

While we are celebrating new nuclear construction in South Carolina and Georgia, we must also look ahead to the future of nuclear reactor technology. In 2013 the Office of Nuclear Energy announced a second Funding Opportunity Announcement (FOA) to execute cost-shared first-of-a-kind engineering and design development work to help accelerate the timelines for commercialization of Small Modular Reactors (SMRs). In December 2013, DOE selected NuScale Power, LLC, headquartered in Corvallis, Oregon, under this FOA for an SMR Licensing Technical Support award. For this FOA, the Office of Nuclear Energy solicited innovations that can improve SMR safety, operations and economics through lower core damage frequencies, longer post-accident coping periods, enhanced resistance to hazards presented by natural phenomena, and potentially reduced emergency preparedness zones or workforce requirements.

These new SMRs, as well as the AP1000 reactors being built at VC Summer and Vogtle, are designed with passive safety features to minimize any requirement for prompt operator action and prevent auxiliary system failures from contributing to future accidents. Passive safety further enhances the safety of nuclear power plants.

Another essential research development on the horizon in FY15 is the planned restart of the Transient Test Reactor (TREAT) at the Idaho National Laboratory to reestablish a domestic transient testing capability. Transient testing will enable the NE R&D programs to understand fuel performance as well as provide a capability to screen advanced fuel concepts, including accident tolerant fuels, which allows for early identification of the limits of fuel performance.

Finally, although this year has brought many exciting developments in new nuclear power construction and technologies, it has unfortunately also been a year of unprecedented nuclear power plant closures. Complex market policy factors and the abundance of natural gas have made operating nuclear power plants uneconomical in some parts of the country, resulting in shutdowns of four nuclear reactors, with another planned for next year. Nuclear power provides over 60% of this country's low-carbon electricity. The shutdown of these power plants is therefore a significant loss of low-carbon electricity. Beyond emissions, these closed nuclear power plants are a considerable loss of baseload electricity supply and a loss of energy diversity. America's nuclear power fleet is a

national asset on many fronts, and our programs continue to ensure nuclear remains a key player in America's clean energy future.

The President's fiscal year 2015 budget requests $863.4 million for the Office of Nuclear Energy, a decrease of 2.8 percent (or $25 million) from the FY 2014 enacted budget.

OFFICE OF NUCLEAR ENERGY (NE) PROGRAMS

Supercritical Transformational Electric Power Generation - $27.5 million

Supercritical Carbon Dioxide (SCO2) Brayton cycle energy conversion is a transformative technology that offers significant improvements in energy and environmental performance over the steam-Rankine cycle, which is used for roughly 80% of the world's electricity generation. The higher thermal efficiency of the SCO2 cycle could produce a 40% reduction in fuel consumption and emissions, a 95% reduction in cooling water consumption, or a 60% increase in electricity generation for a constant heat input when used in appropriate applications.

The Supercritical Transformational Electric Power Generation (STEP) project, funded within NE and coordinated among the Offices of Nuclear Energy, Fossil Energy, and Energy Efficiency and Renewable Energy, is a pilot-scale cost-shared demonstration project to accelerate pre-commercial development and validation of advanced of the Supercritical Carbon Dioxide (SCO2) Brayton cycle energy conversion technology. The STEP project is part of a new collaborative effort in the Department of Energy focused on the research, development, and demonstration of supercritical carbon dioxide technologies with the potential for significant improvements in energy and environmental performance over current power generation systems.

SMR Licensing Technical Support - $97 million

The Small Modular Reactor (SMR) Licensing Technical Support program is designed to support first-of-a-kind activities for design certification and licensing activities for SMR designs through cost-shared arrangements with industry partners in order to promote accelerated deployment of these technologies. The acceleration provided by the cost-shared funding is expected to improve U.S. global competitiveness, enhance domestic energy security and contribute to meeting greenhouse gas reduction goals. The program will help demonstrate the potential of nascent SMR technology and encourage new competition in the marketplace.

The Office of Nuclear Energy remains committed to the small modular reactor program and believes strongly in the potential for SMRs to promote American competitiveness, the creation of manufacturing jobs here at home, and the reduction of CO_2 emissions through clean, safe, and reliable nuclear power. The Department's FY15 request, taken in combination with already appropriated funds, can support both the Babcock & Wilcox mPower and NuScale Power projects. The cost-shared technical assistance provided through the SMR program will help enable industry's efforts to obtain certification by the Nuclear Regulatory Commission and ultimately deploy this advanced technology.

Reactor Concepts Research, Development and Demonstration - $100.5 million

The Reactor Concepts Research, Development and Demonstration (RD&D) program is designed to develop new and advanced reactor designs and technologies that advance the state of reactor technology to improve its competitiveness, and help advance nuclear power as a resource capable of meeting the Nation's energy, environmental, and national security needs. Program activities are designed to address technical, cost, safety and security issues associated with advanced reactor technologies such as liquid metal-cooled, liquid salt-cooled, high

temperature gas-cooled reactors (HTGRs) and others. Additionally, Reactor Concepts RD&D will conduct research and development on advanced technologies to support life extensions of currently operating Light Water Reactors (LWRs) and address the impacts of the Fukushima accident with a focus on enhancing the accident tolerant characteristics of reactors and their operation.

Light Water Reactor Sustainability - $30.3 million

The existing U.S. nuclear fleet has an excellent safety and performance record and today accounts for about 20% of the U.S. electricity supply and more than 60% of the low greenhouse-gas-emitting, domestic electricity production. The Light Water Reactor sustainability (LWRS) subprogram is focusing research on material aging issues where research results will help support subsequent license renewal applications expected from industry in the 2016 to 2018 time period. Activities in the Reactor Safety Technologies area have been expanded to address lessons learned from the Fukushima Daiichi accident, particularly in understanding and managing Severe Accident (SA) events. These include evaluation of SA instrumentation needs to better monitor and manage SAs, computer analysis of SA progression, and preparation and planning efforts in support of eventual examination of the damaged reactors. The LWRS program has partnered with industry to closely coordinate research needs and share costs. The program also coordinates with the Nuclear Regulatory Commission to improve utility of research results.

Advanced Reactor Technologies - $70.2 million

The Advanced Reactor Technologies (ART) subprogram reflects the consolidation of the Advanced Small Modular Reactor (AdvSMR) R&D and the Advanced Reactor Concepts (ARC) subprograms. This consolidation will allow better integration of R&D activities and use of a portfolio approach with an emphasis on long-term activities and collaborations with industry and international partners. The consolidated program will continue R&D on advanced reactor technologies and will support work on generic topics that can apply to various advanced reactor concepts. This consolidated program focuses on efforts in the following areas: advanced reactor coolants, safety and technology for advanced reactors, advanced energy conversion, advanced instrumentation and controls, support the NRC in its development of an advanced reactor licensing framework, liquid metal reactor component testing, TRISO fuel and graphite material qualification, advanced materials development and codification, continued international collaborations, and industry supporting research. Research results from this program are expected to help reduce design and construction costs, contribute data to the technical bases for the operation of safety systems, improve proliferation resistance, and provide critical insights to help solve key feasibility and performance challenges.

Fuel Cycle Research and Development – $189.1 million

The mission of the Fuel Cycle Research and Development (FCR&D) program is to conduct research and development (R&D) and non-R&D activities related to used nuclear fuel (UNF), nuclear waste management and disposal issues and conduct R&D on advanced sustainable fuel cycle technologies that have the potential to improve resource utilization and energy generation, reduce waste generation, enhance safety, and limit proliferation risk. The program employs a long-term, science-based approach to foster innovative, transformational technology solutions to achieve this mission. Advancements in fuel cycle technologies and solutions support the enhanced availability, affordability, safety, and security of nuclear-generated electricity in the United States.

Material Recovery and Waste Form Development – $35.3 million

The Material Recovery and Waste Form Development subprogram, formerly Separations and Waste Forms, conducts R&D on technologies to improve current fuel cycle performance and advance other fuel cycle technologies with minimal processing, waste generation, and potential for material diversion. In FY 2015, the subprogram is continuing to test the feasibility of a simplified, cost-effective means of separating minor actinides

from used nuclear fuels and for capturing off-gases during the separations process. Also in FY 2015, the subprogram will continue its joint fuel cycle studies with the Republic of Korea. In addition, this subprogram also leverages its expertise by working with others in areas such as environmental remediation and national security missions as needed.

Advanced Fuels – $43.1 million

The development of improved and advanced nuclear fuels is a major objective for both existing LWRs and the entire spectrum of advanced nuclear energy systems. The development of advanced fuels is an essential part of future sustainable fuel cycle options. Advanced fuels is pursuing two major paths: 1) the development of next generation LWR fuels with enhanced accident tolerance, and 2) development over the long term of transmutation fuels with enhanced proliferation resistance and resource utilization.

In FY 2015, the program continues feasibility and assessment activities of accident tolerant fuel (ATF) and clad concepts. This includes bench-scale fuel fabrication and testing involving irradiations, steam environments, furnaces, and mechanical property testing. These feasibility and assessment activities also include establishing modeling capability for these new concepts (largely developed from existing models) as well as studies of impacts on economics, the fuel cycle, operations, safety, and the environment.

System Analysis and Integration – $18.5 million

The Systems Analysis and Integration subprogram provides the critical capability needed to analyze complex fuel cycle system options, assess overall performance under various scenarios, and improve understanding of the interdependencies between various subsystems and associated technologies. Systems analysis coupled with the application of the principles of systems engineering will: 1) help the program objectively and openly identify fuel cycle options worthy of further study; 2) aid identification and prioritization of the R&D needed; 3) help formulate and execute program budgets; 4) enable clearer communication of the rationale for R&D funding decisions; and 5) enhance the ability of the program to rapidly adapt to future decisions. Systems analysis and integration provides support in knowledge management, communications, fostering innovation, project controls, and program integration.

Materials Production, Accounting, & Control Technology – $7.6 million

The Materials Protection, Accounting and Control Technology (MPACT) subprogram strives to develop the technologies and analysis tools to support the next generation of nuclear materials management and safeguards for future U.S. nuclear fuel cycles. It also includes assessing vulnerabilities and security of the consolidated storage of used nuclear fuel. Moving forward to address the energy security needs of the country will require innovative approaches to materials control and accounting to ensure that nuclear material is not misused, diverted, or stolen.

The Office of Nuclear Energy works closely with the National Nuclear Security Administration (NNSA), Department of State, and the Nuclear Regulatory Commission (NRC) on issues related to nuclear nonproliferation. NNSA has broad responsibilities in international nonproliferation and security matters for the present and into the future. MPACT is focused on R&D as it relates to potential future fuel cycle facilities here in the United States.

Used Nuclear Fuel Disposition – $79 million

The Used Nuclear Fuel (UNF) R&D subprogram will continue to conduct scientific research and technology development to enable storage, transportation, and disposal of UNF and wastes generated by existing and future fuel cycles. To support the evolution of the domestic UNF inventory, special emphasis is placed on understanding the behavior of high-burnup fuels.

In January 2013, the Administration released its *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste*. Full implementation of the Strategy's principles and components requires new legislation; however the Department continues to implement elements of the Strategy where possible within existing authorities. The FY 2015 Budget continues funding activities to lay the ground work and develop options for decision makers on the design of an integrated waste management system in alignment with the *Strategy*.

Over the next 10 years the program reflected in the FY 2015 Budget begins operation of a pilot interim storage facility, advances toward the siting and licensing of a larger interim storage facility, and makes demonstrable progress on the siting and characterization of geologic repository sites.

Fuel Resources - $5.6 million

For nuclear energy to remain a sustainable energy source, there must be assurance that an economically viable supply of nuclear fuel is available. The availability of fuel resources for each potential fuel cycle and reactor deployment scenario must be understood. Seawater contains more than 4 billion tons of dissolved uranium. This unconventional uranium resource, combined with a suitable extraction cost, can potentially provide a price cap and ensure centuries of uranium supply even with aggressive world-wide growth in nuclear energy applications.

Nuclear Energy Enabling Technologies - $78.2 million

The Nuclear Energy Enabling Technologies (NEET) program sponsors research and development (R&D) in crosscutting technology areas, such as materials and sensors and instrumentation, and advanced manufacturing, that can inform extended economical operation of the current fleet of light water reactors and enable the development of advanced reactor designs and fuel cycle technologies. This program also makes a strong investment in modeling and simulation efforts to bring 30 years of improved computational and material science to reactor and fuel system simulation. The result will provide researchers, designers, and operators with advanced tools to better understand the behavior of nuclear systems and thereby improve safety and efficiency. These technologies will advance the state of nuclear technology, improving its competitiveness, and promoting continued contribution to meeting our Nation's energy and environmental challenges.

Crosscutting Technology Development - $13.9 million

The Crosscutting Technology Development activities support the Reactor Concepts and Fuel Cycle programs. A balanced science-based R&D approach includes both performance enhancement of evolutionary concepts and investigation of novel concepts, which crosscut two or more reactor concepts or fuel cycles. Incorporating these technologies and capabilities as part of an integrated system offers the potential of revolutionary improvement in safety, performance, reliability, economics, and proliferation risk reduction.

Nuclear Energy Advanced Modeling and Simulation - $21.5 million

NEAMS provides support relevant to both reactor and fuel cycle R&D programs by creating analytic tools, codes and methods for use by scientists and engineers who need to simulate nuclear energy systems. NEAMS is developing a computational ToolKit which is comprised of both reactor and fuel systems analysis capabilities that can be exercised either coupled or independently, depending on the needs of the end user. NEAMS tools are already in use by over 60 organizations domestically and abroad. NEAMS tools today define the state of the art in nuclear simulation.

Energy Innovation Hub For Modeling and Simulation - $24.3 million

The Energy Innovation Hub for Modeling and Simulation (Hub) has been creating a virtual model of an actual Tennessee Valley Authority-owned (TVA), Westinghouse-designed, operating pressurized water reactor (PWR) to simulate its behavior. Engineers will be able to use this virtual model to improve the safety and economics of

reactor operations by simulating proposed solutions to reactor power production increases and reactor life and license extensions. The combination of data gained from the virtual model and the physical reactor will be used to resolve technology issues that have long confronted nuclear energy development. The Oak Ridge National Laboratory is currently leading a consortium (CASL – Consortium for Advanced Simulation of Light Water Reactors) of national labs, universities, and industry partners to manage Hub execution.

The FY 2015 budget provides funding for the continuation of the Nuclear Energy Innovation Hub in Modeling and Simulation into a final five year term, assuming the determination is made that the Hub meets all requirements and criteria to be eligible for renewal. The final determination will be completed within fiscal year 2014. If the Hub is renewed, the scope of the final five years will involve completing ongoing activities and extending the capabilities developed by CASL to other types of operating reactors, the next generation of pressurized water reactors that are under construction, and new small modular reactors.

National Scientific User Facility (NSUF) - $18.5 million

The National Scientific User Facility (NSUF) subprogram represents a "prototype laboratory for the future" promoting the use of unique nuclear research facilities for science-based experiments and encourages active university, industry, and laboratory collaboration in relevant nuclear scientific research. The NSUF, through competitive solicitations, provides a mechanism for research organizations to collaborate and conduct experiments and post-experiment analysis at facilities not normally accessible to these organizations.

The Idaho National Laboratory Advanced Test Reactor (ATR) and post-irradiation examination (PIE) facilities at the Center for Advanced Energy Studies and the Materials and Fuels Complex are available as user facilities. In addition, research reactors at Oak Ridge National Laboratory, the Massachusetts Institute of Technology, and North Carolina State University, the Advanced Photon Source beam line capabilities at Argonne National Lab, irradiation experiment design and fabrication capabilities at Pacific Northwest National Laboratory, hot cells and fabrication capabilities at Westinghouse, and examination facilities at the Universities of Wisconsin, Michigan, California-Berkeley, Purdue and Nevada-Las Vegas are partnered with the NSUF, bringing additional user facilities to the research community. Since its designation as a user facility in 2007, NSUF has awarded 72 experiments to 20 universities and 4 laboratories.

Radiological Facilities Management - $5 million

Radiological Facilities Management (RFM) provides support for Radiological Facilities not on DOE property or that do not directly support NE missions. In FY 2015, the Department is requesting funding only for the Research Reactor Infrastructure (RRI) subprogram. RRI supports the continued operation of United States (U.S.) research reactors by providing research reactor fuel services and maintenance of fuel fabrication equipment.

Idaho Facilities Management - $185.9 million

The mission of the Idaho Facilities Management (IFM) program is to manage the planning, acquisition, operation, maintenance, and disposition of the Office of Nuclear Energy (NE)-owned facilities and capabilities at the Idaho National Laboratory (INL). The IFM program maintains Department of Energy (DOE) mission-supporting facilities and capabilities at INL in a safe, compliant status to support the Department's nuclear energy research, testing of naval reactor fuels and reactor core components, and a range of national security technology programs that support the National Nuclear Security Administration (NNSA) and other Federal agencies such as the Department of Homeland Security in the areas of critical infrastructure protection, nuclear nonproliferation, and incident response.

To enable and facilitate R&D activities, strategic priorities for the IFM Program in FY 2015 include maximizing the utility of existing facilities and capabilities through focused sustainment activities and cost-effective rehabilitation. Activities focus on safe and compliant operation of INL's nuclear research reactor and non-reactor research

facilities, while conducting corrective and cost-effective preventative maintenance activities necessary to sustain this core infrastructure. In FY 2015, these activities include; 1) restarting the TREAT reactor at the INL to reestablish a domestic transient testing capability. This capability will enable the NE R&D programs to understand fuel performance phenomenology at the milli-second to second time scales as well as provide a capability to screen advanced fuel concepts, including accident tolerant fuels, which allows for early identification of the limits of fuel performance and 2) providing onsite replacement of INL's remote-handled low-level waste disposal capability through the Remote-Handled Low-Level Waste Disposal Project. This capability is needed to support ongoing and future programs (including NE and the Department's Office of Naval Reactors) at INL. This project is funded by NE and Naval Reactors.

In FY 2015, activities associated with the Advanced Test Reactor (ATR) Life Extension Program (LEP) will be complete. Since inception in FY 2005, the LEP Program has successfully completed activities and implemented strategies necessary to ensure the ATR remains viable for the nation's nuclear energy needs. Activities completed as part of the program include seismic analyses and upgrades, nuclear safety design basis analyses and documentation, material condition assessments, identification and procurement of critical spare parts and one-of-a-kind components, and system replacement of critical systems.

Idaho Sitewide Safeguards and Security - $104 million

The Idaho Sitewide Safeguards and Security (S&S) program supports the INL complex nuclear facility infrastructure and enables the Office of Nuclear Energy (NE) to conduct research and development in support of multiple program missions. To better align the S&S funding with INL infrastructure and R&D programs, the S&S program was transferred to the Nuclear Energy appropriation in FY 2014.

The S&S program funds base physical and cyber security activities for the INL, providing protection of the Department of Energy's (DOE) nuclear materials, classified and unclassified matter, government property, personnel and other vital assets from theft, diversion, sabotage, espionage, unauthorized access, compromise, and other hostile acts that may cause adverse impacts on our national security; program continuity; or the health and safety of employees, the public, or the environment.

International Nuclear Energy and Cooperation - $3 million

International Nuclear Energy Cooperation's (INEC) mission is to serve as the Department's overall lead for all international activities related to civil nuclear energy, including analysis, development, and implementation of international civil nuclear energy policy and coordination and integration of the Office of Nuclear Energy's international nuclear technical activities. These activities support international bilateral and multilateral engagement and civil nuclear energy R&D activities with countries with an established or planned civilian nuclear power sector.

Program Direction - $73.1 million

Program Direction provides the Federal staffing resources and associated costs required to provide overall direction and execution of the Office of Nuclear Energy (NE) programs. NE staff is located in Washington, DC, the Idaho Operations Office, Oak Ridge Operations Office and the Nevada Site Office. The Idaho site office funding supports their efforts to continue to be a fully functional service center, not only for the Office of Nuclear Energy, but other Department of Energy offices. Activities within the site office support function include execution of headquarters directed procurements, as well as supplemental support for any unforeseen actions.

In addition to appropriated funds, NE also manages approximately $140 million annually in work for others and reimbursable funding from the National Aeronautics and Space Administration and the Department of Defense for

the development of advanced radioisotope power systems for space exploration and national security missions. The Program Direction request reflects NE's continued attempts to optimize support for its Federal workforce, while continuing to improve efficiency and cost-effectiveness and ensure the expert Federal management and oversight of NE mission activities.