JULY 29, 2015

REVIEW OF THE NUCLEAR REGULATORY COMMISSION'S LICENSING PROCESS

U.S. HOUSE OF REPRESENTATIVES COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,

SUBCOMMITTEE ON ENERGY

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COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
CHAIRMAN LAMAR SMITH

For Immediate Release
July 29, 2015

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Statement of Energy Subcommittee Chairman Randy Weber (R-Texas)
A Review of the Nuclear Regulatory Commission's Licensing Process

Chairman Weber: Good morning and welcome to today's Energy Subcommittee hearing on the Nuclear Regulatory Commission's licensing process as it relates to the Department of Energy's Nuclear R&D programs. Today, we will hear from the Honorable Stephen Burns, Chairman of the U.S. Nuclear Regulatory Commission (NRC), regarding the extent to which the NRC and DOE may cooperate to enable vital nuclear energy research. Chairman Burns, we thank you for your attendance today.

Over the next 5 minutes or so, I want to give a quick overview of this Subcommittee's previous hearings that have led us to hold this hearing today.

Last December, we heard from a startup company and an environmental institution explaining that tech companies trying to develop the next generation of nuclear technology need greater regulatory certainty to raise capital in today's market. They suggested that the DOE should use its national labs as a forum to allow private developers to carry out this work.

In May, we heard from another tech company explaining that research infrastructure to provide versatile neutron irradiation capabilities is vital for universities and the next generation tech companies to research new materials and fuels. We also heard from the director of DOE's nuclear energy innovation HUB that the increased capabilities to model and simulate nuclear reactions will allow researchers to eliminate assumptions, which can speed up and lower the cost to develop new technologies across the board.

So what does this all mean? I'll keep it simple: we have the best engineers in the world that want to take on commercial risk and develop these next generation technologies if we just give them the opportunity.

These new technologies can:

- Mitigate proliferation risk
- Increase fuel utilization
- Reduce waste yields
- Achieve higher safety margins
- And reach high levels of thermal efficiency

The United States is at its best when we provide a clear path for our technology innovators to do what they do best – find creative solutions to the world's challenges. So now I'll explain what we intend to discuss today.

This Committee has often found bipartisan support for the nation's open-access user facilities that provide unique capabilities for both basic and applied R&D. This is a particularly good model because the users ultimately take on whatever form of commercial risk they so choose while the government simply provides the infrastructure capability. The prospective DOE user facility we're considering today would be a fast-reactor based neutron source. As a practical matter, the construction of such a facility will almost certainly require some form of technical assistance from the NRC and that will be an interesting topic to explore.

Another issue, and perhaps the most challenging question for the Subcommittee, is how the federal government can make the process simpler for entrepreneurs to conduct experiments that would enable them to translate theories for alternative reactor concepts to reality. The NRC has a regulatory process for non-power reactors, but the time required to issue a license appears to have created a barrier to investment. This raises several important questions relevant to our discussion today. Can the DOE use its authority to host private developers to conduct novel experiments advancing next generation nuclear technology, and could the NRC benefit in any way by allowing its staff to provide technical expertise and gain firsthand knowledge of such reactor experiments?

It is important that we work together to find solutions to these challenges. America must not lag behind our global competitors in this area of critical technology.

Again, I thank Chairman Burns for his testimony today, and I look forward to hearing from you on the NRC's role in advancing nuclear energy for our nation.

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Statement of Chairman Lamar Smith (R-Texas)

A Review of the Nuclear Regulatory Commission's Licensing Process

Chairman Smith: Today's hearing will examine opportunities for advances in nuclear fission and fusion energy technologies.

We will hear from the Chairman of the U.S. Nuclear Regulatory Commission, Stephen Burns, who will provide the regulatory perspective on matters of policy for the next generation of nuclear energy technology.

The Nuclear Regulatory Commission (NRC) is an independent regulatory agency that licenses and regulates America's civilian nuclear material and technology. The NRC was established in 1974 when Congress separated the supportive nuclear research and development (R&D) aspects of the Atomic Energy Commission from its regulatory side. Currently, the Department of Energy (DOE) supports nuclear R&D to advance nuclear science while the NRC licenses new technologies as the private sector brings them to the market.

Today, we will get a better understanding of how DOE can more effectively advance innovation in nuclear energy and align its R&D priorities to fill gaps where the NRC is not permitted to do so. Nuclear energy provides reliable, zero-emission power. This technology represents a great opportunity for innovation to increase our Nation's economic prosperity and global competitiveness.

Yet the status quo is not working to bring new reactor concepts to the market. One challenge is that the NRC's licensing mechanism for alternative reactor concepts is not yet fully developed. This is not necessarily a fault of the NRC as it must first oversee the safety of its licensees, which fund 90 percent of the Commission's budget. The NRC's strict mission focus has helped the U.S. nuclear industry attain one of the safest working environments in the world.

This Committee's responsibility, however, is to look beyond today. We must search for opportunities where our Nation's R&D can help make our future brighter. The DOE national laboratories provide vital capabilities for the private sector to invest in innovative energy technologies. This includes its open-access user facilities, which are one-of-a-kind machines that allow researchers to investigate fundamental scientific questions.

These facilities enable a wide array of researchers from academia, defense, and the private sector to develop new technologies without favoring one type of design. This represents a better approach than simply picking winners and losers through energy subsidies.

DOE's labs also provide the fundamental research capabilities that lead to scientific publications or proprietary research. For nuclear energy R&D, this research is especially challenging because of the inherent regulatory burden that comes with using nuclear material.

For this reason, the DOE and NRC should cooperate where appropriate to ensure that the R&D investments we make today will reach the market for the benefit of all Americans tomorrow.

Thank you Mr. Chairman and I yield back.

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WRITTEN STATEMENT
BY STEPHEN G. BURNS, CHAIRMAN
UNITED STATES NUCLEAR REGULATORY COMMISSION
TO THE
HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY
July 29, 2015

Good morning, Chairman Weber, Ranking Member Grayson, and distinguished Members of the Subcommittee. I appreciate the opportunity to appear before you today to discuss the Nuclear Regulatory Commission's (NRC) licensing policies as they apply to current and prospective Department of Energy (DOE) nuclear energy research and development programs.

I will begin with a brief overview of NRC responsibilities. NRC conducts licensing and oversight activities for commercial nuclear power reactors, research and test reactors, decommissioning and waste management activities, uranium recovery facilities, fuel facilities, and radioactive materials users, including those overseen directly by the 37 states, known as "Agreement States," that have agreements with the NRC to assume regulatory responsibility for the use of certain radioactive materials.

In January, the NRC marked its 40th anniversary as the independent agency responsible for licensing and regulating the nation's civilian use of radioactive materials to ensure protection of public health and safety, common defense and security, and the environment. The NRC's regulatory program has been substantially strengthened, based in part on what we have learned from domestic and international operating experience. Our role begins during pre-application discussions with prospective applicants, and continues through the entire plant life-cycle, from plant design certification, combined license, manufacturing license, or operating license, construction, operations, through decommissioning, and, finally, radioactive waste storage and disposal.

The NRC has been involved in many significant activities regarding commercial nuclear power generation. To date, the NRC has renewed operating licenses for 74 of the 99 currently operating nuclear power reactors, extending the licensed life for each of these units. The NRC has granted 156 power uprates, which translates to 7,326 additional megawatts of electrical capacity for the nation.

In the area of new reactors, the NRC has issued six design certifications and is currently reviewing one design certification application. The agency also has issued combined licenses for five new nuclear reactor units, four of which are currently under construction. The NRC is poised to hold hearings for three additional combined license applications and one early site permit in 2015 and in 2016. In addition, the NRC is reviewing an application to operate Watts Bar Unit 2, for which construction had been suspended in 1985 after a substantial portion of the plant had been built.

With respect to advanced reactors, the NRC staff has made significant progress in preparing to review design certification applications for small modular reactors, one of which is expected to be submitted in late 2016. The NRC is also taking initial steps to prepare for the review and licensing of non-light water reactor (non-LWR) designs.

<u>License Extension Beyond 60 Years;</u>

The NRC's license renewal process provides reasonable assurance of safe plant operation for extended plant life for 20 additional years beyond the initial 40-year operating license term. In addition to the NRC's regulatory requirements, the staff issued a "Standard Review Plan," or SRP, for reviewing license renewal applications and a "Generic Aging Lessons Learned Report," which is commonly referred to as the GALL Report. These documents describe

methods acceptable to the staff for implementing the license renewal rule and evaluating license renewal applications to ensure quality and uniformity in NRC reviews.

The Commission has affirmed that the current license renewal regulatory framework is sufficient to support the review of subsequent license renewal for operation from 60 to 80 years. The NRC staff is nearing completion of an updated GALL Report and an SRP to address aging issues that nuclear power plants may experience for operation up to 80 years. The staff plans to issue these documents for public comment by the end of this year and expects to finalize the guidance documents needed to review these applications prior to the first subsequent license renewal application expected to be filed in late 2018 or early 2019.

The NRC staff continues to monitor the industry, DOE, and Electric Power Research Institute's progress on resolving the major technical issues for subsequent license renewal. These issues include reactor pressure vessel neutron embrittlement, irradiation assisted stress corrosion cracking of reactor internals and primary system components, concrete and containment degradation, and electrical cable qualification and condition assessment.

DOE is currently undertaking activities focused on evaluating damage to components and materials that have been collected from decommissioned nuclear power plants. I understand that these research activities can provide direct information on the performance and age-related degradation of safety-significant components. Findings from these activities may inform both the NRC's ongoing development of license renewal guidance document, and the NRC's evaluation of initial license applications for subsequent license renewal. The NRC staff is engaged in collaborative discussions and meetings to harness relevant data, information, and knowledge gained through the Light Water Reactor Sustainability program's research activities to better inform the Commission's subsequent license renewal process.

The NRC staff also is monitoring the activities of the Consortium for Advanced Simulation of Light Water Reactors initiative, primarily in the broad area of nuclear reactor thermal hydraulic analysis. The NRC is not currently aware of any DOE codes developed through the Consortium that have been used to support license renewal or subsequent license renewal at this time. However, we will continue to monitor should there be any new developments in this area.

Regulatory Authorities and Technical Assistance to DOE for Non-Light Water Reactors

The statutory authorities governing co-operation between the NRC and DOE are well established. NRC's role in a project located at a DOE site is shaped by the purpose and function of the proposed project. This includes the projects contemplated in Congressman Hultgren's legislation titled, "Department of Energy Laboratory Modernization and Technology Transfer Act of 2015" (H.R. 1158).

Depending on the specific goal and purpose of the project, the NRC could have licensing and regulatory authority over some of the types of facilities envisioned in H.R. 1158. For example, the Atomic Energy Act of 1954, as amended (AEA), authorizes the NRC to issue licenses for production and utilization facilities for commercial purposes or licenses for research development purposes.

The NRC regulates to ensure "adequate protection to the health and safety of the public" and "in accord with the common defense and security", which the AEA requires as a minimum safety standard. Congress gave the Commission the discretion, in exercising its licensing authority, to determine what constitutes "adequate protection" on a case-by-case basis, based on expert

engineering and scientific judgment, and in light of all relevant information, including improvements in nuclear technology over time.

The NRC would have licensing and regulatory authority over reactors located on DOE-owned facilities that fit the NRC's definition of a "prototype reactor" or for "research and development" that are operated as part of the power generation facilities of an electric utility system, or that are operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor. Under Section 202 of the Energy Reorganization Act, the NRC also has licensing authority for demonstration liquid metal fast breeder reactors and other demonstration nuclear reactors. In contrast, the NRC would not have regulatory authority over reactors located on DOE-owned facilities that are used for the purpose of collecting data for research, testing of materials, or testing of fuels, as is proposed for the fast-reactor user facility. I would note if the data collected in such a facility are intended to be used to make a safety case in a future license application, an NRC quality assurance program under Appendix B to 10 CFR Part 50 or an equivalent NRC-approved program would need to be followed in collecting the data.

Under the NRC's rules, an application for a design certification, combined license, manufacturing license, or operating license that proposes a nuclear reactor design that differs significantly from light-water reactor designs licensed prior to 1997 or uses simplified, inherent, passive, or other innovative means to accomplish its safety function, must meet certain requirements. The regulations provide that such designs will only be approved if the performance of each safety feature of the design, the interdependence of the safety features, and operation of the design over a range of operating conditions have been demonstrated through either analysis, appropriate test programs, experience, sufficient data, some

combination of these methods, or acceptable testing of a prototype plant over a range of operating conditions.

A prototype plant is similar to a first-of-a-kind or standard plant design in all features and size, but may include additional safety features to protect the public and the plant staff from the possible consequences of accidents during the testing period. If a prototype plant developed by DOE and subject to NRC licensing is used to comply with the testing requirements for a first-of-a-kind reactor design that differs significantly from existing light-water reactor technology, then the NRC may impose additional requirements on siting, safety features, or operational conditions for the prototype plant to provide this additional protection.

The Subcommittee also expressed an interest in a privately funded facility to be constructed and operated at a DOE site. As I understand it, the purposes of such a proposed facility would be to resolve technical uncertainty, prove concepts by reducing theory to reality, generally conduct research and development activities to improve nascent technologies, build upon existing theories, generate verifiable data, and improve reactor technologies. However, if such a facility would likely be used ultimately as a basis for commercial power reactor technologies, or ownership of the facility would be held by private parties, such a facility would fall within the NRC's regulatory purview and an NRC license would be required, even though the facility would be located on a DOE site.

In the alternative, if a proposed DOE facility is outside of the NRC's regulatory authority, the NRC could provide technical assistance to the DOE if resources are available. Examples of this assistance could include support in areas such as construction inspection and radiation safety for plant personnel. To maintain our regulatory independence, if a DOE facility requires an NRC license, the agency would be precluded from providing developmental technical assistance to

the DOE. However, the same regulatory and safety guidance provided to any potential NRC license applicant would be available to the DOE. The specific mechanisms used to provide the requested technical assistance would be determined concurrent with development of the required budget authorities needed to provide the requested assistance.

There are many examples of NRC and DOE cooperation on non-LWR projects. In 1982, the NRC reviewed the Clinch River Breeder Reactor Preliminary Safety Analysis Report submitted as part of a construction permit application developed in part by DOE's predecessor agency, the Energy Research and Development Administration. The NRC issued a Final Safety Evaluation Report for the Clinch River facility in 1983. In addition, beginning in 1986, the NRC staff conducted a pre-application review of the DOE-sponsored Modular High Temperature Gas Reactor (mHTGR) design. The review objectives were to identify key safety, research, and licensing issues and to provide feedback to the DOE on the licensability of the design. In 1989, the NRC issued a draft Pre-Application Safety Analysis Report for the mHTGR design.

In 1987, the NRC staff conducted a pre-application review of the GE-Hitachi PRISM Preliminary Safety Information Document prepared by the DOE. The NRC staff issued a Pre-application Safety Evaluation Report for the PRISM design, which identified no obvious impediments to licensing the PRISM design. Also beginning in 1986, the NRC performed a similar review of the DOE's Pre-application Safety Information Document for the Sodium Fast Reactor Design.

Most recently, in 2008, the NRC and DOE jointly issued the "Next Generation Nuclear Plant Licensing Strategy, A Report to Congress."[1] This report outlined the licensing strategy for a

[1] The NGNP project was formally established by the Energy Policy Act of 2005 (EPAct 2005), designated as Public Law 109-58, 42 USC 16021, to demonstrate the generation of electricity and/or hydrogen with a high-temperature nuclear energy source. The project is being executed in collaboration with industry, DOE national laboratories, and

very high-temperature gas-cooled reactor (HTGR) to be built on a DOE-owned site. In 2010, the DOE taught a HTGR technology course for NRC staff. In 2012, the DOE submitted a series of technical and policy issue white papers that were reviewed by the NRC. The NRC issued a comprehensive technical assessment of the key licensing issues in July 2014. In each case, the NRC and DOE provided valuable input while staying within their congressionally mandated roles and responsibilities.

Adapting the Current Regulatory Regime for Non-Light-Water Technology

The NRC has substantial experience in reactor licensing, with licensing processes that are well established and which have been applied to an array of reactor technologies and designs. The NRC has taken a number of proactive steps to consider how it might apply these processes efficiently and effectively to the review of new advanced reactor designs.

In 1986, the Commission issued a Policy Statement on the Regulation of Advanced Reactors, later updated in 2008. The policy statement expresses the intent of the Commission to develop the capability for timely assessment and response to innovative and advanced reactor designs that might be presented for NRC review. It also encourages the earliest possible interaction between the NRC and applicants, vendors, and other government agencies to provide for early identification of regulatory requirements for advanced reactors and to provide all interested parties, including the public, with a timely and independent assessment of the safety and security characteristics of advanced reactor designs.

U.S. universities. The U.S. Nuclear Regulatory Commission is responsible for licensing and regulatory oversight of the demonstration nuclear reactor.

The NRC has determined that its current reactor licensing regulations are adequate for conducting reviews of advanced reactor applications. However, because the NRC's current reactor licensing regulations and guidance documents were developed based on light-water reactor technologies, the NRC recognizes the potential knowledge gaps for both the staff and prospective applicants in understanding the acceptance criteria for non-light water reactor designs.

To better understand the opportunities for most efficiently adapting the current regulatory framework for non-LWRs, the agency has reviewed, and continues to review, our licensing processes and infrastructure for both light water and non-LWR technologies. These reviews identified process strengths, opportunities for improvement, incorporated lessons learned, and will aid agency planning to make the most effective use of our technical resources.

Some of the challenges associated with licensing non-LWR designs identified in the agency's "Report to Congress: Advanced Reactor Licensing," dated August 2012, and the NRC staff's recent recommendations to the Commission, "Status of the Office of New Reactors Readiness to Review Small Modular Reactor Applications" (SECY-14-0095) include:

- the need for additional non-LWR research, in areas such as materials and structural analysis, so that the analytical methods and experimental data can support the requisite independent safety findings by the NRC staff on non-LWR applications;
- the need for appropriate computational tools for use in non-LWR application reviews;
- the need to ensure that appropriately trained and experienced staff are available to perform non-LWR application reviews.

The NRC has also recognized the importance of appropriate timing in the development of the capability to review non-LWR applications, as described in the Advanced Reactor Policy

Statement. As demonstrated over the last 10 years, industry and financial market turbulence have had a significant impact on the agency's ability to plan for the submission of new reactor applications. The agency uses a wide variety of resources to gain the best available insights on market factors that could impact the timing of potential applications. For example, the Energy Information Agency's recent annual report, "Annual Energy Outlook – 2015," estimates a near-flat growth rate in domestic electricity demand and continued uncertainty in non-nuclear fuel prices through the year 2040.

Recognizing these challenges, the agency intends to continue to develop its capability to execute its mission for non-LWR designs that may proceed to commercial maturity, at a pace consistent with its appropriated resources and Congressional direction.

As emphasized in the Commission's policy statement, maintaining open communications with a wide variety of industry, government, and public stakeholders will provide the agency with information it can use to address approaching challenges. Strong communications assist non-LWR designers and potential applicants in understanding the NRC's roles and responsibilities in the reactor development lifecycle. They also provide the NRC with an early indication of non-LWR design trends, potentially unique design features, and the potential for reaching design maturity. The DOE's role in the research and development process provides the NRC with additional important insights.

Consistent with our mission, the NRC does not favor one particular nuclear technology over another. But, informed by our open communications with the non-LWR developer community and with the DOE, the NRC will be able to optimize its planning processes and resource expenditures to conduct licensing reviews when a complete and technically sufficient non-LWR application is presented for consideration.

The NRC engages its stakeholders using a variety of communications methods and channels. Examples include the annual Regulatory Information Conference, the use of Regulatory Information Summaries to obtain the voluntary submittal of information that will assist the NRC in the performance of its functions, a comprehensive website and social media presence, the use of open public meetings on a wide range of topics, and direct engagement with host communities to nuclear power plants. The NRC also takes advantage of DOE-sponsored industry forums as opportunities to assist non-LWR developers and stakeholders in better understanding the NRC's statutory roles and responsibilities. For example, in March 2015, DOE-sponsored meetings at six universities across the United States. The meetings solicited a wide range of inputs on nuclear power innovation from a broad cross-section of participants. We understand inputs from the workshops are being consolidated to provide a report summarizing all of the regionally focused technical discussions with specific recommendations to the Department of Energy's Office of Nuclear Energy for enhancements or additions to Research Development and Demonstration programs. The NRC participated in four of these workshops as observers. The workshops provided an opportunity for the NRC to collect direct feedback from participants and for the NRC to explain its roles and responsibilities in the technology development lifecycle to workshop attendees.

The NRC, consistent with its mission as an independent safety and security regulator, will continue to look for additional opportunities to work with DOE and make the NRC's licensing processes transparent and navigable to reactor designers/potential applicants, the financing community, and other stakeholders. In this vein, the NRC plans to hold a series of public workshops with the DOE starting this September to engage further with non-LWR designers, potential applicants, industry groups, and the public.

In closing, I will note that the NRC remains a technically adept, independent regulator. Drawing on our regulatory experience and licensing processes that protect public health and safety, we have taken a number of steps to prepare ourselves for the review and regulation of non-LWR technologies in a changing environment. We also recognize the important and complementary role that DOE plays in those preparations. We are prepared to perform additional tasks if funding is provided. Thank you for the opportunity to appear before the Subcommittee today, and I look forward to your questions.