U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON ENERGY AND COMMERCE

May 19, 2018

TO: Members, Subcommittee on Energy

FROM: Committee Majority Staff

RE: Hearing entitled "DOE Modernization: Legislation Addressing Development, Regulation, and Competitiveness of Advanced Nuclear Energy Technologies"

I. INTRODUCTION

The Subcommittee on Energy will hold a hearing on Tuesday, May 22, 2018, at 10:00 a.m. in 2123 Rayburn House Office Building. The hearing is entitled "DOE Modernization: Legislation Addressing Development, Regulation, and Competitiveness of Advanced Nuclear Energy Technologies."

II. WITNESSES

Panel 1

- **Brent Park**, Deputy Administrator for Defense Nuclear Nonproliferation, National Nuclear Security Administration, Department of Energy; and,
- **Ed McGinnis**, Principal Deputy Assistant Secretary, Office of Nuclear Energy, Department of Energy.

Panel 2

- **Jeffrey S. Merrifield**, Partner, Pillsbury Winthrop Shaw Pittman LLP; Advisor, ClearPath Action;
- **Melissa Mann**, President, URENCO USA, Inc.; Member, U.S. Nuclear Industry Council;
- **Nick Irvin**, Director, Research and Development for Strategy and Advanced Nuclear Technology, Southern Company; Member, Advanced Reactor Working Group, Nuclear Energy Institute; and,
- **Edwin Lyman,** Senior Scientist, Global Security Program, Union of Concerned Scientists.

III. BACKGROUND

The Atomic Energy Act of 1954 (AEA) allows for peaceful, civilian use of atomic energy, specifically noting that "the development, use, and control of atomic energy shall be directed so as to promote world peace, improve the general welfare, increase the standard of living, and strengthen free competition in private enterprise."[1] The law's many broad provisions govern all aspects of nuclear technology, including the requirement of international agreements for civil nuclear trade, export controls, and regulatory standards of "reasonable assurance." The reasonable assurance standard remains the foundation of the regulatory requirements on civilian nuclear licensees. The AEA granted authority to the Atomic Energy Commission (AEC) to oversee the government's nuclear programs and was charged with both regulating government and commercial nuclear facilities, as well as fulfilling the U.S. policy goals to "develop, use, and control" atomic energy to "make the maximum contribution to the general welfare . . . ."[2] The regulatory framework established in the AEA remains the "fundamental U.S. law on both the civilian and military uses of nuclear materials."[3]

Following public concern regarding the potentially conflicting nature of AEC's dual promotional and regulatory roles of the civil nuclear industry, Congress passed the Energy Reorganization Act of 1974 to bifurcate this responsibility to the newly created Nuclear Regulatory Commission (NRC) and the Department of Energy's (DOE) predecessor agency, the Energy Research and Development Administration.[4]

Today, the NRC continues to serve as an independent regulatory agency "to ensure the safe use of radioactive materials for beneficial civilian purposes while protecting people and the environment." The NRC mission is to "licens[e] and regulat[e] the Nation's civilian use of radioactive materials to protect public health and safety, promote the common defense and security, and protect the environment."[5]

In addition to its nuclear defense responsibilities, DOE continues the original AEC mission to provide for the peaceful use of atomic energy, examining over time a range of nuclear technologies.[6] Today, DOE provides funding to support the research and development of prospective reactor technologies, such as small modular reactors (SMR), which are projected to be commercially available by 2026.[7] These reactor designs may overcome some of the challenges to deployment of existing nuclear technology, while potentially providing auxiliary

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[1] Atomic Energy Act of 1954, P.L. 83-703.
[2] 42 U.S.C. 2011.
[3] https://www.nrc.gov/about-nrc/governing-laws.html
[4] P.L. 93-438
[5] U.S. Nuclear Regulatory Commission, *"About the NRC*," Updated January 26, 2018. Accessible at: https://www.nrc.gov/about-nrc.html
[6] For example, what is now the site of Idaho National Laboratory hosted 52 different nuclear reactors to demonstrate various technologies. Notable technologies examined at INL and Oak Ridge National Laboratory included including molten salt and fast breeder reactors, though these designs remain largely unused today due to a lack of a comprehensive regulatory regime and perceived proliferation risks
[7] NuScale Power. "NuScale FAQs."

benefits such as water desalination, hydrogen production, and options to serve as a "load following" electricity source.[8]

Domestic Civilian Nuclear Power

The development and commercial deployment of nuclear energy technology for civilian use derived from activities supporting U.S. national security programs. For example, the Shippingport Atomic Power Station in Pennsylvania, the world's first full-scale nuclear power reactor, was originally intended to be deployed on an aircraft carrier. Admiral Hyman Rickover, who oversaw the development and first three decades of operation of the nuclear navy as Director of (now DOE's) Naval Reactors program, made a decision to utilize light-water reactor (LWR) technology[9] to power the U.S. Navy's fleet of submarines and aircraft carriers. This decision resulted in a de facto selection of LWR designs for commercial use due to the extensive overlap in nuclear supplier capabilities.

During the 1960s and 1970s, scores of new reactors were constructed, licensed, and placed into service. However, a changing energy landscape and the incident at the Three Mile Island (TMI) site in Pennsylvania resulted in major cost increases and a rise in public skepticism about nuclear energy. No new nuclear plants were ordered by utilities following TMI until Southern Company decided to construct two new reactors at the Vogtle site in 2008. In the early 2000s, with high natural gas prices, policymakers and market experts widely expected a "nuclear renaissance." The renaissance never materialized in large part because hydraulic fracturing technology led to the production of an abundance of relatively inexpensive natural gas for use in electricity generation, which helped depress demand for new nuclear units and exacerbated other economic pressures that persist today.[10]

The continuing economic pressures in today's electricity market have resulted in the premature closing of a number of nuclear power reactors, and at least 12 more are expected to cease commercial operation by 2025.[11] Meanwhile, many of the existing fleet of reactors will reach the end of their licensed service periods in the next 20 years. To maintain the nuclear energy generation, some states, such as New York, Connecticut, and Illinois, have chosen to compensate operating power plants due to the environmental benefits of the technology,[12] while other states, such as Pennsylvania, have expressed support for a Federal solution.[13]

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[8] Locatelli et al. "Cogeneration: An Option to Facilitate Load Following in Small Modular Reactors." *Progress in Nuclear Energy.* Vol. 97 May 2017. Pp. 153-161.
[9] A light water reactor uses normal water (as opposed to heavy water, which contains deuterium) as a coolant and neutron moderator. There are two major types: pressurized water reactors and boiling water reactors.
[10] For example, see Energy and Commerce Subcommittee on Energy hearing, "Power America: Examining the State of the Electric Industry through Market Participant Perspectives," July 14, 2017.
[11] These include Diablo Canyon (2), Beaver Valley (2), Perry, Indian Point (2), Davis Besse, Pilgrim, Palisades, Three Mile Island, and Oyster Creek.
[12] National Conference of State Legislatures. "State Action in Support of Nuclear Generation." Jan. 2017. Some State actions are currently under litigation.
[13] Pennsylvania General Assembly. Senate Resolution 227.

International Civil Nuclear Commerce

To promote peaceful use of atomic energy abroad, the AEA created the two principal mechanisms by which the United States engages with foreign countries in the civil nuclear business: 123 Agreements and the Part 810 authorization process. 123 Agreements, named for section 123 of the Atomic Energy Act, are agreements between the United States and foreign governments to govern "significant transfers of nuclear material, equipment or components from the United States to another nation."[14] These agreements help the U.S. maintain certain assurances about the use and application of nuclear technology. Part 810 is named for the area of the Code of Federal Regulations that governs authorization of the nuclear export of technologies for technology transfers and assistance related to "nuclear fuel-cycle activities, commercial nuclear power plants, and research and test reactors," including transfer of documents, knowledge, and expertise.[15]

Challenges Associated with Advanced Nuclear Technologies

There are a number of companies seeking to design and subsequently license advanced nuclear reactor technologies.[16] Many of the designs would utilize uranium-235 isotopes (U-235) enriched at levels greater than five percent and less than 20 percent. This material, known as high-assay low enriched uranium (HA-LEU) differs from the LEU utilized in the fleet of existing commercial nuclear power plants which is generally enriched at levels lower than five percent.

A recent survey of companies working to develop new technologies identified HA-LEU as the most significant issue to overcome.[17] To have HA-LEU commercially available for the initial deployment of advanced reactors, commercial vendors, the NRC, and potentially DOE will have to complete a number of steps. These include procuring and enriching uranium to the necessary levels, designing and securing NRC certification of transportation packages, and making necessary changes to licenses provided to fuel fabrication and commercial enrichment facilities.

The AEA defines enriched uranium as Special Nuclear Material (SNM). Any person receiving, possessing, using, or transferring SNM must have a license, with different licenses being required depending on the enrichment level.[18] Per NRC regulations, SNM is separated into three categories: Category 1, which encompasses U-235 enriched greater than 20 percent, uranium-233, and plutonium; Category 2, which covers U-235 enriched between 10 percent and 20 percent; and Category 3, which includes U-235 enriched up to 10 percent.[19] Under these

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[14] NNSA, "*123 Agreements for Peaceful Cooperation,*" Accessible at: https://nnsa.energy.gov/aboutus/ourprograms/nonproliferation/treatiesagreements/123agreementsforpeacefulcooperation

[15] NNSA, "*10 CFR Part 810*," Accessible at: https://nnsa.energy.gov/aboutus/ourprograms/nonproliferation-0/npac/policy/10cfr810. These regulations implement Section 57b. (2) of the Atomic Energy Act.

[16] Advanced nuclear technologies may use alternative materials to cool the fuel, different fuel compositions, or be smaller scales than the existing commercial fleet.

[17] Nuclear Energy Institute. "Addressing the Challenges with Establishing the Infrastructure for the front end of the Fuel Cycle for Advanced Reactors." Jan. 2018.

[18] 10 CFR § 70.1-70.2

[19] 10 CFR § 70.4. *Available at* Nuclear Regulatory Commission. "Safeguard Categories of SNM."

guidelines, HA-LEU would necessitate a Category 2 SNM facility, but at present the only operating commercial fuel fabrication facilities are licensed for Category 3. This presents a major regulatory challenge to the wider use of this fuel.[20]

Advanced Nuclear Technology and Applications for Defense Purposes

In 2016, the Department of Defense's (DOD) Defense Science Board[21] (DSB) examined the applicability of certain advanced nuclear reactor designs to meet specific mission-critical needs for defense facilities. The report found that, in coming years, military technologies such as railguns, data centers, and autonomous systems will require increased assurances of uninterrupted, reliable electricity. The report found very small modular reactors (vSMRs), or micro-reactors,[22] are uniquely suited to meet these needs because the reactor designs can provide transportable, deployable energy in a compact footprint. By providing constant on-site generation, micro-reactors can reduce the need for logistics relating to power, particularly in challenging Forward Operating Base (FOB), Remote Operating Base (ROB), and expeditionary force situations. Additionally, deployable nuclear power could enable on-site water treatment, fuel refinement, and munitions production, which can reduce the need for costly and dangerous supply chains. DOE[23] and other nuclear experts[24] have found potential in similar defense applications.

IV. SUMMARY OF LEGISLATION

A. H.R. 1320, Nuclear Utilization of Keynote Energy (NUKE) Act

H.R. 1320, the Nuclear Utilization of Keynote Energy (NUKE) Act, was introduced by Rep. Kinzinger (R-IL) and Rep. Doyle (D-PA) on March 2, 2017. H.R. 1320 amends the requirements governing the NRC's fee recovery process established in the Omnibus Budget Reconciliation Act of 1990. The revisions remove amounts appropriated to the NRC for the development of an advanced reactor regulatory framework, limit the total amounts available for corporate support costs, and cap fees on operating reactors.

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[20] In total, the United States currently has five operating fuel fabrication facilities. Two of these facilities, Nuclear Fuel Services in Erwin, Tennessee and BWXT Nuclear Operations Group in Lynchburg, Virginia, are Category 1 facilities operating under government contracts to produce fuel for the US Navy and to down-blend highly enriched uranium from Soviet and US weapons programs. The other three facilities, Global Nuclear Fuel-Americas in Wilmington, North Carolina; Westinghouse Columbia Fuel Fabrication Facility in Columbia, South Carolina; and AREVA, Inc., in Richland, Washington are Category 3 facilities, meaning they can only process uranium enriched up to 10%. To upgrade one of these Category 3 facilities to a Category 2 facility, the operator would have to file a license modification application with the NRC, which must contain the basis for the changes as well as a detailed description of how the change would affect safety of the workers, the public, and the environment. (See 10 CFR § 70.34.) Upon approval, upgraded facilities will be subject to considerably more stringent reporting and security requirements, as well as a different fee structure. (See 10 CFR § 171.16.)

[21] Department of Defense Science Board. "Task Force on Energy Systems for Forward/Remote Operating Bases." August 2016.

[22] vSMRs or micro-reactors have varying definitions, but are generally considered to generate significantly less electricity compared to Small Modular Reactors.

[23] Sandia National Laboratory, "Assessment of Small Modular Reactor Suitability for Use On or Near Air Force Space Command Installations," March 2016.

[24] Dr. Mark Peters, Idaho National Laboratory before the House Energy and Commerce Committee. "Advancing the Economic and National Security Benefits of America's Nuclear Infrastructure." Feb. 6, 2018.

The legislation also requires studies by the Comptroller General to study the feasibility and implications of repealing licensing restrictions to foreign governments and the impact of repealing requirements for mandatory hearings on uncontested licensing under the AEA.

The legislation provides NRC the authority to use informal adjudicatory procedures unless the Commission determines formal procedures are necessary. It also sets certain timelines to review and docket draft and final environmental impact statements.

Section 8 of the bill requires the NRC to initiate a rulemaking proceeding to address the regulatory framework for decommissioning nuclear reactors licensed under section 103 or 104(b) of the AEA.

B. H.R. ___, to amend the Atomic Energy Act of 1954 to improve the process by which the Secretary of Energy authorizes the transfer of civilian nuclear commerce technology and assistance, and for other purposes.

The discussion draft, authored by Rep. Johnson (R-OH), would assess and improve the competitiveness of civilian nuclear technology. The discussion draft requires the Secretary of Energy to submit a report to Congress assessing the impact of legal, regulatory, policy, and commercial practices on the U.S. civilian nuclear industry and make recommendations to improve the competitiveness of U.S. nuclear industry in global markets. The report additionally requires an analysis of how to apply the requirements of certain liability coverage, known as "Price Anderson," to advanced nuclear technologies.

The discussion draft also revises the Atomic Energy Act to improve DOE's review of the Part 810 process. The AEA requires the Secretary of Energy to approve the transfer of civilian nuclear technology and assistance.[25] The discussion draft permits the Secretary to delegate certain approvals, requires DOE to establish expedited procedures for low proliferation risk reactor technologies, and directs the Secretary, to the extent practicable, to review authorizations concurrently with the Department of State's efforts to receive the required assurances by a foreign country.

The discussion draft requires the Comptroller General to review the Secretary of Energy's actions with respect to the retrospective risk pooling program required under section 934(e) of the Energy Independence and Security Act of 2007. The report would assess the Secretary's methodology to determine the formula and evaluate the program.

C. H.R. ____, Advanced Nuclear Fuel Availability Act.

The discussion draft, authored by Rep. Flores (R-TX), would direct the Secretary of Energy to establish and carry out a program to support the availability of HA-LEU for commercial use. The program would (1) authorize the Secretary to provide funding to private entities to design transportation packages for HA-LEU, (2) require DOE undertake surveys of material needs for commercial HA-LEU use, (3) establish a consortium for a public-private

[25] Section 57b. (2) of the Atomic Energy Act.

partnership to coordinate the acquisition of HA-LEU for consortium members and to provide for a full cost-recovery, and (4) develop key data to inform NRC requirements for category II facilities and transportation package certification. The discussion draft also would require the NRC to report to Congress on the need to update regulations, certifications, or other regulatory policies to enable the commercial availability of HA-LEU.

D. H.R. ____, to require the Secretary of Energy to develop a report on a pilot program to site, construct, and operate micro-reactors at critical national security locations.

The discussion draft, authored by Rep. Wilson (R-SC), Rep. Norcross (D-NJ), Rep. Hudson (R-NC), and Rep. Peters (D-CA), would require DOE to develop a report to assess components of a pilot program to ensure the resilience of critical national security infrastructure by contracting to site, construct, and operate a micro reactor at DOD or DOE sites. The report would include:

1. Potential DOD or DOE locations to site, construct, and operate a micro-reactor;
2. Assessments of different nuclear technologies;
3. A survey of potential nuclear commercial vendors to contract to construct and operate a micro-reactor;
4. Options to enter into long-term contracting to finance the pilot program;
5. Technology requirements to provide energy resilience to mission-critical functions;
6. Cost estimates for a pilot program;
7. A timeline to implement a pilot program;
8. An analysis of DOE and DOD authorities to conduct a pilot program; and,
9. Recommendations for any additional or modified authorities.

V. STAFF CONTACTS

If you have any questions regarding this hearing, please contact Andy Zach, Peter Spencer, or Mary Martin of the Committee staff at (202) 225-2927.