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

February 2, 2018

TO: Members, Subcommittee on Energy

FROM: Committee Majority Staff

RE: Hearing entitled "DOE Modernization: Advancing the Economic and National Security Benefits of America's Nuclear Infrastructure."

I. INTRODUCTION

The Subcommittee on Energy will hold a hearing on Tuesday, February 6, 2018, at 10:00 a.m. in 2123 Rayburn House Office Building. The hearing is entitled "DOE Modernization: Advancing the Economic and National Security Benefits of America's Nuclear Infrastructure."

The hearing will examine issues associated with the current domestic nuclear supply chain, international nuclear market opportunities, nuclear regulatory and policy matters, and options for future development and deployment of nuclear technologies. It will provide Members with information to help assess what is necessary for U.S. global leadership in nuclear technology to maintain long-term economic and national security.

II. WITNESSES

Panel I

- **Ed McGinnis**, Principal Deputy Assistant Secretary, Office of Nuclear Energy, Department of Energy;
- **Art Atkins**, Associate Deputy Administrator for Global Material Security, National Nuclear Security Administration;
- **James Owendoff,** Principal Deputy Assistant Secretary, Office of Environmental Management, Department of Energy; and,
- **Victor McCree,** Executive Director of Operations, Nuclear Regulatory Commission.

Panel II

- **Bill Ostendorff**; Distinguished Visiting Professor of National Security, U.S. Naval Academy;
- **Mark Peters**, Director, Idaho National Laboratory;

- **Maria Korsnick,** President and Chief Executive Officer, Nuclear Energy Institute;

- **David Trimble**; Director, Natural Resources and Environment, Government Accountability Office; and,

- **Ashley Finan,** Policy Director, Nuclear Innovation Alliance.

III. BACKGROUND

Current State of Nuclear Industry and Nuclear Fuel Cycle

Globally, approximately 447 commercial nuclear power plants produce about 10 percent of the world's electricity.[1] In the United States, 99 operating nuclear power plants generate approximately 20 percent of electricity needs. Additionally, about 250 research reactors located in 55 countries are used for research, training, testing, or to produce radioisotopes for medicinal and industrial use.[2]

The U.S. Energy Information Administration forecasts "global nuclear capacity will grow at an average annual rate of 1.6 [percent] from 2016 through 2040, led predominately by countries outside the [Organization for Economic Cooperation and Development]" with China and India leading the world in expected growth with 19 and six reactors under construction, respectively.[3] However, only two new reactors are under construction in the United States with a number of additional projects currently paused or previous licensing proceedings having been terminated.[4]

Generating electricity at nuclear power plants is only one portion of the fuel cycle and one application of nuclear technology. To produce electricity, an entire fuel supply chain and fuel cycle must be maintained. This begins when uranium ore is mined and converted to uranium hexafloride, to be then enriched and manufactured into fuel rods. Enrichment and fuel cycle facilities are heavily regulated and are limited to countries that adhere to international treaty and nonproliferation obligations.

Fuel rods are placed in a reactor vessel, which controls the nuclear reaction to generate heat to produce steam for electricity generation. Commercial nuclear power plants generally replace about one third of the reactor core's fuel every 18 months on a rotating basis. After the fuel rods are removed from the reactor core, the used fuel must be temporarily stored in a spent fuel pool to reduce decay heat before it is either reprocessed to generate electricity again, as France does, or stored until a permanent disposal facility is available.

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[1] World Nuclear Association, *"World Nuclear Power Reactors & Uranium Requirements,"* January 2018. Accessible at: http://www.world-nuclear.org/information-library/facts-and-figures/world-nuclear-power-reactors-and-uranium-requireme.aspx

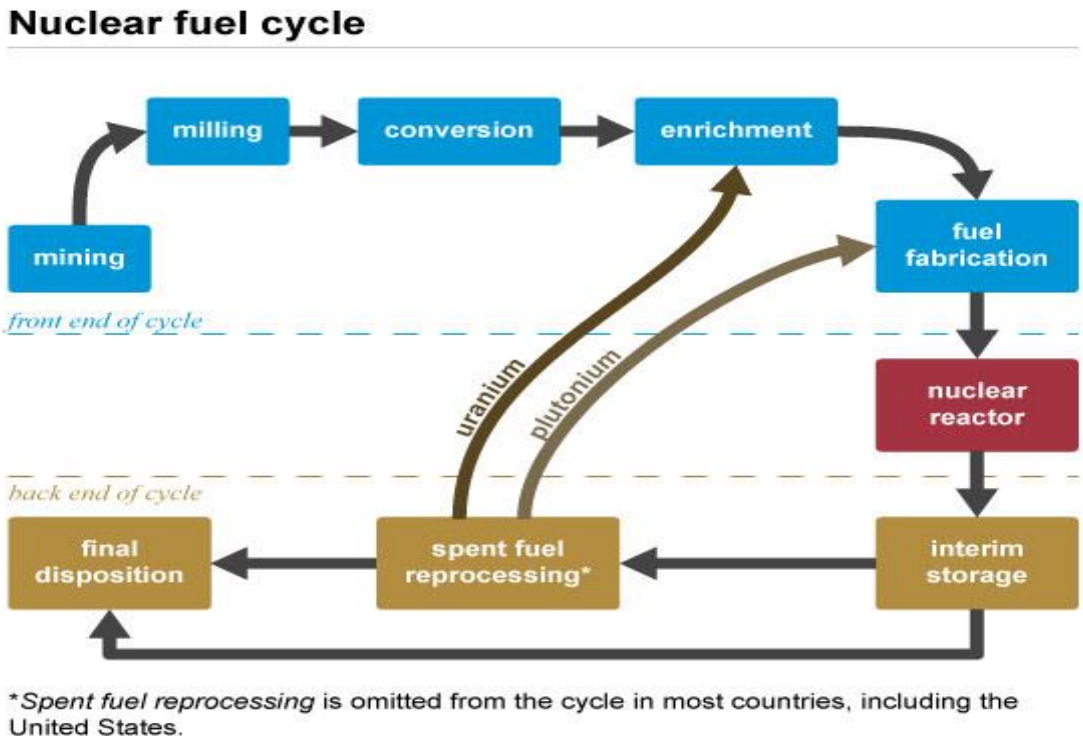
[2] World Nuclear Association, "*Research Reactors*," October 2017. Accessible at: http://www.world-nuclear.org/information-library/non-power-nuclear-applications/radioisotopes-research/research-reactors.aspx

[3] U.S. Energy Information Administration, *"EIA forecasts growth in world nuclear electricity capacity, led by non-OECD countries*," November 8, 2017. Accessible at: https://www.eia.gov/todayinenergy/detail.php?id=33672

[4] In August 2017, two reactors under construction at the V.C. Summer site in South Carolina were terminated.

The domestic uranium industry produces uranium for less than six percent of the fuel consumed by domestic nuclear reactors in 2016, which has trended downward since U.S. uranium production peaked in 1980.[5] Industry estimates that American mined uranium will be less than two percent of U.S. reactor demand in 2018 – the lowest level of U.S. uranium production since the advent of commercial nuclear power plants.[6] Globally, Kazakhstan, Canada, and Australia produce over 70 percent of the world's uranium.[7]

Illustration of the Nuclear Fuel Cycle[8]



Urenco, a German, Dutch, and UK-owned nuclear fuel supply chain company, operates the only U.S.-hosted enrichment facility in New Mexico, and there is no existing enrichment capacity by a U.S.-owned company. State-owned companies in Russia, China, and France, in addition to Urenco, constitute the bulk of the world's total enrichment capacity.

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[5] According to the Uranium Producers of America, "uranium production in the U.S. peaked in 1980 at about 44 million pounds." Current levels of production are less than 10 percent of those peak levels.
[6] Our treaty obligations require that any uranium used for defense purposes, such as powering our nuclear navy fleet or for nuclear weapons programs, must be mined in the United States.
[7] World Nuclear Association, *"Uranium Production Figures, 2007-2016*," Updated July 2017. Accessible at: http://www.world-nuclear.org/information-library/facts-and-figures/uranium-production-figures.aspx
[8] EIA, *"Nuclear Explained: The Nuclear Fuel Cycle*," Updated August 31, 2017. Accessible at: https://www.eia.gov/energyexplained/index.cfm?page=nuclear_fuel_cycle

U.S. Government Nuclear Programs

In 1954, Congress amended the Atomic Energy Act (AEA) to allow for the peaceful, civilian application of nuclear technology as part of President Eisenhower's Atoms for Peace program.[9] Congress had established the Atomic Energy Commission (AEC) to oversee the government's nuclear programs and, following the 1954 amendments, 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…."[10]

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.[11] Much of DOE's and NRC's ongoing statutory authority is still derived from the Atomic Energy Act, as amended.[12]

DOE's activities for the use of civilian nuclear energy technology, application of nuclear technologies, and nuclear-cleanup activities are primarily carried out through three offices:

- the **Office of Nuclear Energy** "advance[s] nuclear power as a resource capable of making major contributions in meeting our nation's energy supply, environmental and energy security needs"[13] and supports research and policy for the development of advanced nuclear technologies;
- the **Office of Environmental Management** is responsible for the cleanup of legacy environmental challenges from the nuclear weapons program and government-sponsored nuclear energy research;[14] and,
- the National Nuclear Security Administration's **Office of Defense Nuclear Nonproliferation** "develops and tests new technologies to advance U.S. capabilities to monitor nonproliferation and arms control treaty and agreement implementation, provides unique training and capacity-building programs, and engages internationally to promote nonproliferation norms and best practices through bilateral and multilateral work."[15]

DOE maintains other nuclear programs, such as programs to produce radiological isotopes to use in nuclear medicine applications. The Department also provides fuel for

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[9] 42 U.S.C. 2011 et. al.
[10] 42 U.S.C. 2011.
[11] P.L. 93-438
[12] Responsibilities pursuant to the Nuclear Nonproliferation Treaty also guide DOE's nuclear programs, which are also coordinated with the Department of State.
[13] Department of Energy, Office of Nuclear Energy. Accessible at: https://energy.gov/science-innovation/energy-sources/nuclear
[14] Department of Energy, Office of Environmental Management, *"Mission.*" Accessible at: https://energy.gov/em/mission
[15] National Nuclear Security Administration, Nonproliferation. Accessible at: https://nnsa.energy.gov/aboutus/ourprograms/nonproliferation

university research reactors, leads international efforts to track and eliminate highly-enriched uranium, and represents the U.S. government in international forums, such as the International Atomic Energy Agency (IAEA).

The NRC serves 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."[16]

International Nuclear Activities

The United States is a part of the Nuclear Suppliers Group (NSG), which is the collection of countries that "seeks to contribute to the non-proliferation of nuclear weapons through the implementation of . . . [g]uidelines for nuclear exports and nuclear-related exports."[17] As a result of the U.S. government's obligations under the NSG, as a signatory of the Non-Proliferation Treaty, and as a leader of the IAEA, the United States maintains strict rules regarding the export, use, and oversight of nuclear material.

The two principal mechanisms by which the United States engages with foreign countries in the civil nuclear business are 123 Agreements and 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."[18] 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.[19]

In addition to restrictions on U.S. export of nuclear technology, the AEA prohibits foreign ownership, control, or domination of U.S. commercial nuclear power plant licensees. There are further limits on foreign-owned entities contracting with DOE.

New Nuclear Technologies

The current fleet of U.S. nuclear power plants uses "light-water technology" and a once through fuel cycle to generate electricity. There are dozens of companies that are in the early

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[16] U.S. Nuclear Regulatory Commission, *"About the NRC*," Updated January 26, 2018. Accessible at: https://www.nrc.gov/about-nrc.html
[17] Nuclear Suppliers Group, *"About the NSG,*" Accessible at: http://www.nuclearsuppliersgroup.org/en/about-us
[18] NNSA, "*123 Agreements for Peaceful Cooperation*," Accessible at: https://nnsa.energy.gov/aboutus/ourprograms/nonproliferation/treatiesagreements/123agreementsforpeacefulcooperation
[19] 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.

stage of developing alternative designs, such as a "small modular reactor" (SMR) technology or reactors that use a substance other than water as a coolant. One recent survey found that about 50 companies, with over $1.3 billion in financial backing, are developing new nuclear technologies.[20]

Proposed Legislation

In the 115th Congress, multiple bills have been introduced affecting DOE and NRC's nuclear energy and nuclear cleanup programs, including:

- H.R. 1320, the Nuclear Utilization of Keynote Energy (NUKE) Act, sponsored by Rep. Kinzinger (R-IL) and Rep. Doyle (D-PA), which amends NRC's user fee recovery process, allows for streamlined license application reviews, and requires NRC to initiate a rulemaking on decommissioning;
- H.R. 2278, Responsible Disposal Reauthorization Act of 2017, sponsored by Rep. Tipton (R-CO), to extend the authorization of the uranium mill disposal site in Colorado; and,
- H.R. 2389, to reauthorize the West Valley demonstration project, sponsored by Rep. Tom Reed (R-NY).

IV. ISSUES

The following issues may be examined at the hearing:

- National security implications associated with U.S. nuclear leadership and a domestic nuclear energy industry;
- The outlook for domestic and international development of nuclear energy and application of nuclear technologies;
- Challenges and opportunities regarding maintaining the components of a domestic nuclear fuel cycle; and,
- Options to develop and deploy advanced nuclear technologies.

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.

[20] Third Way, *"The Advanced Nuclear Industry*," June 15, 2015. Accessible at: http://www.thirdway.org/report/the-advanced-nuclear-industry