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Chairman Upton, Ranking Member Rush, and Members of the Subcommittee, I am very pleased to appear before you today to discuss high-assay low-enriched uranium (HALEU), that is, uranium that has greater than 5% of the fissile U-235 isotope, but still less than 20%, the cutoff for highly enriched uranium (HEU), and the role it may play in meeting our Nation's energy and national security needs. Although the Administration is still evaluating the bills and has not taken an official position at this time, the Department appreciates the Committee's interest in these topics.

Over the last seven decades, the nuclear energy capabilities pioneered by the United States have served and supported our Nation's energy security, and in turn, national security. Nuclear energy is the largest source of clean energy in the United States, providing over 56 percent of our Nation's emission-free electricity in 2017. Nuclear power plants have served as bedrocks to communities across the country, providing high-paying, skilled jobs to hundreds of thousands of Americans.

Beyond the vital role that nuclear energy plays in support of our economy and environment, and as part of the foundation for reliability and resiliency of our electric grid, nuclear energy is essential for achieving important national security missions. U.S. nuclear energy capabilities strongly support our global nuclear nonproliferation objectives, enhance our country's role as a world leader, and provide a unique and strategically important source of fuel supply for our nuclear Navy.

In recognition of the vital role nuclear energy serves for our Nation, and the current need for our Nation's nuclear energy sector, a White House-led review of U.S. nuclear energy policy is underway, and we are beginning to take steps to revitalize and expand our civil nuclear energy sector. The outcomes of the Civil Nuclear Review will inform our approach to revitalization of this critical sector.

While our Nation's nuclear infrastructure, supply chain, and manufacturing base have been significantly degraded, the United States still leads the world in other key areas of nuclear energy, including reactor operation efficiency, reactor safety operations, advanced reactor designs, and other new innovative approaches, such as accident tolerant fuel and additive manufacturing.

Strong bipartisan support is critical to our collective efforts to revitalize and expand our Nation's nuclear energy sector. The Department of Energy (DOE) is committed to working closely with this Subcommittee to build our nuclear energy revitalization, and we are working hard to fully

leverage DOE's world class national laboratories in strong partnership with U.S. universities and industry.

Some of the most exciting innovation is coming from the U.S. advanced nuclear reactor design sector, with approximately 50 innovative reactor designers working to develop and deploy advanced reactor concepts in North America. These designs, such as advanced small modular reactors, offer the potential for step-change safety enhancements including walk-away safe reactor designs; unprecedented versatility including load-following capability, non-electric applications, and distributed power; dramatically improved financing; and the ability to consume waste as an energy resource. These design features, if proven and commercialized, could be truly transformational and game changing.

To support the nuclear sector revitalization, the Department's investments are focused on early stage research and development of new technologies. With limited U.S. Government research and development investment, we believe that the most mature, advanced U.S. designs could potentially be deployed as early as the mid-to-late 2020s by private industry, demonstrating U.S. leadership in this burgeoning area, as well as enhancing U.S. competitiveness in an emerging global market while supporting U.S. nonproliferation objectives. This is where the need for HALEU arises. Nearly all U.S. advanced reactors under development will require HALEU, including advanced micro reactors. The advanced reactor community has stressed the near-term need and importance of HALEU for advanced reactor fuel qualification testing and for potential demonstration reactors.

HALEU is also important to national security needs. The Department currently provides HALEU to research reactors globally, many of which have been converted from HEU fuel as part of our Material Management and Minimization program to help meet nonproliferation objectives. Successful conversion of these reactor facilities to HALEU essentially eliminates the risk of diversion and potential misuse of HEU while allowing for continued operation to conduct various research activities and produce vital medical isotopes, such as molybdenum-99 (Mo-99), critical for diagnostic medical imaging.

No commercial enricher currently provides HALEU. While current enrichment plants could be modified to produce HALEU, it is unlikely that a commercial HALEU capability would be pursued without further indication of progress toward deployment by advanced reactor vendors. Further efforts toward deployment of advanced reactors require the development and qualification of HALEU fuels. In addition, significant efforts are needed to ensure the development of a fuel cycle infrastructure that supports the use of HALEU. This includes transportation and packaging, conversion of the HALEU to various fuel forms, and fuel fabrication capabilities.

The Department recognizes the industry's concerns regarding HALEU fuel qualification and testing as well as the development of a robust HALEU fuel cycle infrastructure for testing and ultimate deployment of U.S. advanced reactor concepts. We are taking a number of actions intended to support the development of HALEU in the near and longer term.

First, the Department is working with industry to refine its near-term R&D needs for fuel development and qualification, particularly how much material is needed, when, and in what form, and also to understand more about projections for longer-term needs. We are also refining our own needs for HALEU, including for research reactors, Mo-99 production, and other nonproliferation requirements. Understanding these requirements will better inform our efforts in support of infrastructure development, as well as our development of options to meet those needs.

Second, we are leveraging our technical expertise in support of the technical aspects of a commercial HALEU infrastructure development. The Department is aware that HALEU may be needed in various fuel forms (e.g., metallic, oxide, liquid) by different vendors, each of which may result in slightly different infrastructure needs. On the transportation side, there are no large scale shipments of uranium enriched above 5% U-235, and the transportation packages currently used for these smaller shipments may not support commercial-scale operations. The development and certification of shipping packages appropriate for HALEU is an identified gap in the HALEU fuel cycle infrastructure.

Third, the Department is reviewing materials across the DOE complex with an eye toward materials and processing options that may support some near-term industry R&D needs. These options may include material recovery and down blending of certain inventories of fuel from former Department reactor programs. Many of the options under consideration involve fuel that has been irradiated, so the utility of the material for research and proof-of-concept activities will depend upon the tolerance of the advanced reactor designs for certain impurities. Once industry needs in terms of quantities, forms, tolerances for impurities, and timing are known, the Department can evaluate any specific requests from industry for material, alongside our own ongoing needs for research reactor fuel and medical isotope production. Current Department mission needs are supplied from our finite and diminishing supply of HEU.

The National Nuclear Security Administration's (NNSA) Domestic Uranium Enrichment program seeks to create a domestic source of enriched uranium to support tritium production for the nuclear weapons stockpile. NNSA is currently evaluating options, including the status quo and potential commercial and government alternatives, while considering cost, schedule, risk, and effectiveness.

This work has synergies with efforts for a HALEU enrichment capability in the longer run. For example, NNSA's 2017 Request for Information (RFI) for the Supply of Enriched Uranium sought information from industry about their interest and capabilities for producing LEU, HEU, and HALEU for research and test reactors as well as for emerging commercial needs for advanced power reactors. The RFI and subsequent discussions have been coordinated with the Office of Nuclear Energy and we intend to continue our productive collaborations on HALEU in the future.

Conclusion

The Department is working closely with U.S. nuclear innovators to define the challenges to bringing the next generation of advanced nuclear power into the marketplace. As noted earlier,

we recognize the importance of HALEU fuel development and qualification, as well as the development of a robust HALEU fuel cycle infrastructure, for testing and ultimate deployment of these U.S. advanced reactor concepts. We are embarking on a number of actions intended to support the development of a commercial fuel cycle for HALEU in the near and longer term.

We look forward to working with Congress, including this Subcommittee, industry and our partners across the Department on defining and exploring HALEU issues now and in the future.