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Subcommittee on Energy

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Chairman Upton, Ranking Member Rush, and Members of the Subcommittee, thank you for your leadership on nuclear energy issues. It is a privilege to speak with you today about means of increasing the competitiveness of the U.S. nuclear energy industry and facilitating the development of advanced nuclear energy technologies.

I am Melissa Mann, President, URENCO USA, Inc., owner and operator of this nation's only operating uranium enrichment facility.[1] I am here today on behalf of my organization and as a member of the United States Nuclear Industry Council (USNIC) whose 82 members represent the breadth of the commercial nuclear supply chain community.[2] Our companies are focused on revitalizing the existing industry and leading the development of critical new advanced nuclear energy infrastructure.

On behalf of the Council, we salute the full Committee and this Subcommittee's laser focus on sustaining the current fleet and propelling advanced nuclear energy as well as development of critical new infrastructure. These initiatives include U.S. Department of Energy (DOE) oversight

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[1] The URENCO USA uranium enrichment facility is located in Lea County, New Mexico and was the first facility to be licensed and constructed under a Nuclear Regulatory Commission-approved Combined Construction and Operating License. The facility received its license in 2006 and entered into operation in 2010. At its current capacity, the facility is capable of meeting roughly one-third of U.S. reactor demand for low enriched uranium and holds a license authorizing a doubling of its output.

[2] A full list of USNIC members is available at https://www.usnic.org/clients.

and modernization, NRC reform and modernization, an updated Nuclear Waste Policy Act Amendments and accelerated nuclear energy innovation.

To this end, we welcome the multi-faceted initiatives proposed by the suite of four bills under discussion today as a means of enhancing these goals. In general we support the objectives inherent in H.R. 1320 in enhancing NRC licensing surety and fee reform. Similarly, we support the thrust of the discussion draft to streamline the DOE's Part 810 export review procedures. We have provided specific enhancements to Rep. Johnson on this draft which are absolutely pivotal to U.S. exports and jobs. We applaud as well the discussion draft to require the Secretary of Energy to develop a pilot program to site, construct and operate "micro-reactors" at critical government facilities. Along with Gen 3+ reactors, SMRs and non-light water SMRs, micro-reactors can be a workhorse to provide resilient power for national security grid requirements as well as the commercial market in the U.S. and globally.

We particularly applaud the currently-entitled "Advanced Nuclear Fuel Availability Act" and its efforts to drive development of a new fuel supply chain needed to support critical activities, including development of advanced technologies. The comments and recommendations identified herein reflect our experience as a member of the current nuclear fuel cycle but we also well understand the pressures facing advanced reactor designers. My company is also involved in development of a micro-reactor – the U-Battery, a 10 MWt high-temperature gas-cooled reactor. As with other designers, our ability to bring this design to market is dependent on the ability to obtain the fuel.

We welcome the opportunity to discuss:

(1) The need for a High Assay Low Enriched Uranium fuel cycle and the community of users it would support;
(2) The type of supply chain needed to serve this demand;
(3) Need for an appropriate regulatory environment and security framework;
(4) Critical packaging and transportation needs.

High Assay Low Enriched Uranium

The current fleet of light water reactors (LWRs) in the United States relies on uranium fuel enriched in the isotope uranium-235 at a percentage less than 5.0%^{235}U. A nuclear fuel cycle industry exists to mine, convert, enrich, and fabricate the uranium into suitable forms and to package and transport these materials between each of the steps in this supply chain.

A comparable fuel cycle does not exist for many advanced reactor and fuel designs because they require higher enrichments at levels between 5.0%^{235}U and 20.0%^{235}U. We refer to such material as High Assay Low Enriched Uranium (HA-LEU). This designation reflects the clear distinction between HA-LEU and highly-enriched uranium (HEU) - uranium enriched to levels above 20.0%^{235}U which could represent a security and proliferation threat due to its potential application in nuclear weapons.

There is a broad community of users who stand to benefit from HA-LEU supply:

- **Research and test reactors**, including reactors fueled by the U.S. Department of Energy (DOE) in the United States and overseas: Many of these facilities currently rely on fuel enriched to 19.75%^{235}U. The U.S. also has a policy of encouraging other research and test reactors currently using HEU fuel to convert to HA-LEU as part of the nation’s non-proliferation strategy;

- **Advanced reactors**, including many non-LWR designs;
- **Advanced fuel designs**, including Accident Tolerant Fuel for LWRs;
- **Producers of targets for medical isotope production**; and
- **Operators of existing LWRs seeking improvements in fuel reliability and costs** through higher fuel burnup[3] and extended operating cycles: Enrichment levels of 6.0%^{235}U to 8.0%^{235}U could allow utilities to obtain more power from their fuel before replacing it. This means that the reactors can operate longer between refueling and use less fuel per reload batch.

DOE currently services its research and test reactor clients through use of inventories including HEU stocks that are down-blended to HA-LEU. These are finite resources and DOE's National Nuclear Security Administration (NNSA) is investigating industry interest in developing a HA-LEU fuel supply capability. NNSA held an Industry Day in November 2017 and received several strong indications of interest to participate in development of such a fuel cycle.

Response to NNSA's Industry Day demonstrates clear commercial interest in developing a HA-LEU fuel cycle but much more is needed to ensure that a fully-functioning HA-LEU fuel production capability exists.

The HA-LEU Fuel Cycle

A complete and sustainable HA-LEU fuel cycle would include three fundamental capabilities:

- A **uranium enrichment** facility licensed to produce enrichments up to 19.9%^{235}U: Such uranium will be in the form of uranium hexafluoride (UF_6);

[3] Higher burnup is generally deemed to exceed the current, average burnup of roughly 45 gigawatt-days per metric ton of uranium (GWd/MTU).

- A **conversion** facility to convert HA-LEU UF_6 into metal or oxide as appropriate for different reactor designs and fuel types;
- One or more **fabrication** facilities that can manufacture the specific fuel types required by the various reactor and fuel designs.

There is strong potential to develop a HA-LEU fuel cycle in the United States. While the existing New Mexico enrichment plant delivers material at a maximum level of 5.0%^{235}U, its advanced gas centrifuge design is currently capable of producing at the full span of HA-LEU enrichments without further development or testing. Only an amended Nuclear Regulatory Commission (NRC) license would be required to support a new HA-LEU enrichment module. We estimate that if detailed design, site permitting and contractor selection were undertaken during the NRC review process, we could construct, commission and start-up such a module within 24 months of NRC licensing.

Two U.S. fuel fabrication plants are already licensed by the NRC to use higher enrichments: the Nuclear Fuel Services facility in Erwin, Tennessee and the BWXT Nuclear Operations Group facility in Lynchburg, Virginia. These facilities are employed in support of the U.S. Naval Reactors program but also support NNSA in its existing HEU down-blend activities and the production of research reactor fuel. These currently-operating facilities demonstrate the viability of licensing and operating at higher enrichments.

Three critical factors underpin the further development of this new U.S. fuel cycle:

Firstly, it is imperative that enrichment, conversion and fabrication capabilities be licensed and developed on concurrent schedules. Otherwise there will be gaps in the fuel cycle and the industry will not be able to reap the benefits of advanced designs and Accident Tolerant Fuels.

Secondly, the licensing framework needs to support development of the HA-LEU fuel cycle. Earlier this year USNIC partnered with the Nuclear Innovation Alliance and the Nuclear Energy Institute to highlight the need for a streamlined and predictable licensing pathway for development of new nuclear technologies. Many of the same principles apply to licensing the new and/or modified fuel facilities needed for the HA-LEU community. Moreover, the regulator needs to have sufficient resources to support timely, contemporaneous licensing reviews.

Finally, companies making investments in HA-LEU facilities need to be sufficiently assured that appropriate return on these expenditures is viable.

A consortium-based approach involving the full gamut of the user community – in partnership with the DOE – to purchase HA-LEU materials and to develop a schedule for full cost recovery as articulated in the “Advanced Nuclear Fuel Availability Act” would be a significant step in providing such assurance.

This approach would also be key to positioning U.S. companies to develop a robust HA-LEU fuel cycle and serve the growing community of users. Such public-private cooperation would: foster development of a domestic infrastructure supporting HA-LEU supply to already-operating research and test reactors; provide suitable HA-LEU materials for testing and start-up of prototype fuels and reactors by the middle of the next decade; and further support deployment of advanced technologies by the end of that decade.

Licensing and Security Aspects of the HA-LEU Fuel Cycle

NRC licensing of HA-LEU fuel facilities involves several technical and regulatory issues, many of which are linked to nuclear criticality controls associated with HA-LEU enrichment levels.

Existing LWR fuel facilities are licensed to deliver materials at an enrichment level of up to 5.0%^{235}U. Significantly, the criticality analyses and benchmarking codes underpinning these existing licenses do not adequately address HA-LEU enrichment levels.

New criticality benchmarking data will be required to support licensing of enrichment, conversion and fabrication facilities (as well as transport packages) at HA-LEU enrichments. Ideally, such data would also be developed on a consortium basis with DOE backing. This would provide for use of consistent data across the industry and allow the NRC to focus its resources on evaluating use of these federally-backed codes for specific applications and facilities. The language proposed in the “Advanced Nuclear Fuel Availability Act” is a significant step in supporting this need.

HA-LEU at enrichments between 10.0%^{235}U and 20.0%^{235}U is classified as “Special nuclear material of moderate strategic significance,” also known as “Category II” material, under NRC safeguards regulations. HA-LEU fuel facilities licensed to handle and produce Category II material must be capable of developing and implementing appropriate physical protection and security plans. Development of clear NRC guidance for implementing such programs, especially if done in coordination with DOE, would provide a consistent approach for licensees.

Similarly, Category II facilities need to develop Material Control & Accountability (MC&A) programs that are responsive to special nuclear material of moderate strategic significance. In combination with physical protection plans, MC&A procedures allow licensees to effectively deter, prevent or respond to unauthorized possession or use of enriched material via theft or diversion and to take measures to protect against radiological sabotage of such materials and facilities. The NRC has clear MC&A guidance for the existing low enriched facilities (Category III facilities) and for HEU facilities (Category I) but does not currently have full guidance available for Category II sites. This gap should be addressed in the near-term to support HA-LEU licensing needs.

The balance of NRC licensing requirements for fuel cycle facilities will also need to be met. The U.S. nuclear energy industry has decades of experience in licensing activities, experience that provides a strong baseline for new regulatory approvals. One means of reducing the time and burden associated with new licensing reviews is to consider siting of HA-LEU capabilities on existing NRC-licensed sites so as to take advantage of well-characterized and understood geographies and environmental impacts and of existing site infrastructure, manpower and security.

Critical Packaging and Transportation Needs

The specially-designed packages currently used to transport commercial volumes of low enriched uranium between existing fuel cycle facilities are licensed for a maximum enrichment of 5.0% ^{235}U. Critical to the HA-LEU fuel cycle is development and certification of new packages for the transport of higher enrichments. The time frame required to design, test and license new packaging designs for fissile contents – in my experience typically between four and seven years – means that activity should be undertaken with dispatch in order to ensure that new reactor testing and deployment schedules are not disrupted.

Especially critical is development of a new shipping package that is authorized for uranium hexafluoride at HA-LEU enrichment levels. NRC regulations for transport packages (10 U.S. Code of Federal Regulations Part 71) impose additional performance criteria for UF_6 exceeding 5% enrichments.

Approved packages are also required for HA-LEU materials once converted to metal or oxide form and additionally for fabricated fuels. Given the potential diversity of final fuel forms, multiple package designs are likely to be required for fabricated materials.

An alternative approach for managing UF_6 packaging needs would be to consider the co-location of HA-LEU enrichment and conversion facilities. Such co-location would allow consolidation of HA-LEU processing at fewer sites and would obviate the need to transport HA-LEU as UF_6 on public roadways, thus reducing the expenses associated with new packages for this transport segment. Co-location could conceivably be extended to encompass the fabrication step as well.

As with facility licensing, new nuclear criticality codes will be required to support licensing of new package designs. Such codes should be developed via an industry-DOE-NRC approach and used on a consistent basis. The proposed bill clearly and appropriately recognizes this need.

Summary

In summary, we welcome the timely and crucial focus on increasing the competitiveness of the U.S. nuclear energy industry and facilitating the development of advanced nuclear technologies. The multiple initiatives proposed by the four bills under discussion today advance discussion on improvements that can be made.

The “Advanced Nuclear Fuel Availability Act” is a significant step in advancing the development of advanced reactor and fuel technologies as it recognizes the critical importance of the fuel cycle in enabling the deployment of these innovative designs.

In general we support the objectives inherent in H.R. 1320 in enhancing NRC licensing surety and fee reform.

Similarly, we support the thrust of the discussion draft to streamline the DOE's Part 810 export review procedures.

We applaud as well the discussion draft to require the Secretary of Energy to develop a pilot program to site, construct and operate "micro reactors" at critical government facilities.

We look forward to working further with members of Congress on these issues of mutual interest.