**Subcommittee on Energy**
**Hearing on**
**"Building a 100 Percent Clean Economy: Advanced Nuclear Technology's Role in a Decarbonized Economy"**
**March 3, 2020**

**The Honorable Jeffrey S. Merrifield**
**Chairman**
**Advanced Nuclear Reactor Task Force**
**U.S. Nuclear Industry Council**

**The Honorable Fred Upton (R-MI):**

1. There are a number of advanced reactors designs vying for development;

    a. What is the current most realistic time frame for bringing these new designs to commercial deployment?

    **RESPONSE:**[1] *Advanced reactors fall into a variety of sizes and categories including micro reactors of less than 10 megawatts electric (MWe) as well as small modular reactors (SMRs) with individual modules having outputs ranging up to 300 MWe. These designs comprise both light water reactors as well as designs that include high temperature gas reactors, molten salt reactors and fast reactors. While different designs have varying timetables given their design maturity and licensing schedule with the Nuclear Regulatory Commission, there are multiple advanced reactor designs that could be deployed beginning in 2028 with the NuScale design being furthest along in its design and licensing maturity. Other designs will follow NuScale in the late 2020s and early 2030s and it appears that there will be a diversity of advanced reactor design that will be available for deployment in this time range for energy production as well as other industrial uses. I also foresee that this sector also has healthy export potential in that time range.*

    b. How does that work with utility policy planning, especially when driven by state and federal policy. Is there a risk that integrated resource planning will lock in

[1] Although I testified for the U.S. Nuclear Industry Council, the views I am expressing in these responses do not necessarily reflect all of the members of USNIC, nor those of the law firm on which I am a partner. Further, I would provide the disclaimer that our firm represents a diversity of nuclear suppliers and utilities, and I personally serve as outside counsel for two Advanced Reactor developers.

other technologies before the nuclear units are deployable? How do policymakers address this?

**RESPONSE:** *In my role as Chairman of the U.S. Nuclear Industry Council Advanced Reactor Task Force, as well as the work I undertake on behalf of my clients at Pillsbury, I have met with almost two dozen members of the National Association of Regulatory Utility Commissioners to discuss the current status of the development and deployment of advanced nuclear reactors so that state energy regulators are fully and currently informed about the utility of these designs for meeting clean energy requirements in the late 2020s through the 2050s. I will continue this engagement and will continue to advocate to PUC Commissioners and their staff that advanced nuclear technologies are rapidly advancing to a point where they should be considered for deployment as part of the integrated resources plans of states that are seeking to achieve 100% carbon-free generation. Based on the current science, nuclear is the most efficient and effective method to help achieve these carbon-free goals. Wind and solar power, as intermittent assets, simply cannot meet these goals on their own without expensive and dramatic improvements in battery or other large-scale storage capabilities.*

*As pointed out in the question, there is a risk that state-led integrated resource plans could lock in other technologies before these advanced nuclear designs are widely available. Federal policymaking, including actions undertaken at the Federal Energy Regulatory Commission, should take this factor into consideration, and Congress may have to consider methods to assure that nuclear energy is not unnecessarily disadvantaged in the U.S. energy delivery system. Clearly, advanced reactors should be coming into their own in the late 2020s and early 2030s and provide an additional opportunity to put carbon-free generation on the grid. State and federal policymaking should be tailored with that timetable in mind.*

2. There are a number of U.S. companies pursuing advanced reactor technologies. How does this match up to what other nations are doing, especially China and Russia?

**RESPONSE:** *In my personal view, the United States has a narrow window to reassert its longstanding lead in the development and deployment of nuclear technologies. The range of U.S. advanced nuclear technologies is broader and more innovative than what I have seen regarding similar technologies being developed by China or Russia. That said, China will be deploying several high temperature gas reactors in the near future,*

*and Russia has recently deployed a mobile, barge-mounted light water reactor in the Arctic Circle. Both of these countries invest heavily in their nuclear programs and both have aggressive plans to export these technologies around the world. If the U.S. is to maintain a leading role in the international nuclear arena, there must be a strong level of public-private investment in U.S. advanced reactor technologies.*

a. What are the prospects for U.S. small modular reactors and other advanced reactors making inroads into developing nations ahead of these adversaries, and resurrecting U.S. leadership?

**RESPONSE:** *As stated in my answer to the question above, I believe a strong partnership between the U.S. developers of advanced reactor technologies and the U.S. government will be vital in ensuring that our country regains a leading role in deploying nuclear technologies around the world. While Russia and China possess strong nuclear programs, and while they too are pursing advanced designs including high temperature gas, molten salt and fast reactors, I strongly believe that the U.S. track record for innovation provides an opportunity for our country to take a leading role in the development and deployment of these technologies. But to be successful, this will require the continued assistance of the national laboratories of the U.S. Department of Energy as well as the continued investment of resources by the U.S. government in these developing technologies.*

b. What is your experience for developing nations wanting to work with the United States?

**RESPONSE:** *In October of 2019, I travelled to Nairobi, Kenya for an international nuclear conference. I met with dozens of representatives of over 17 African countries. I heard a clear message that these countries were eager to purchase U.S. nuclear technologies and many of them demonstrated a strong desire to deploy these technologies as soon as they are available. Similarly, I have spoken to government or utility representatives on virtually every continent, save Antarctica, who have discussed their desire to purchase American-made advanced reactors when they become readily available. They trust the quality of U.S. nuclear products, and they trust U.S. suppliers. I firmly believe if we can get these designs completed and licensed, there will be a strong international market for these designs. To be fully successful, strong assistance from the U.S. ExIm Bank and Development Finance Corporation will be vital is providing the funding tools to allow U.S. advanced reactor developers to compete against State Owned Enterprises. The developing countries with whom I have met clearly recognize*

*that they need carbon-free nuclear power for their economic development and if we fail to present them with U.S. technologies, they will go elsewhere.*

3. Can you talk about the importance of completing the licensing process at NRC for Yucca Mountain, for not only the future of the nuclear industry but also for the development and deployment of advanced nuclear technologies? How will this inform public concerns about the safety of the repository?

**RESPONSE:** *I have visited the proposed Yucca Mountain repository and as a Commissioner of the U.S. Nuclear Regulatory Commission, I reviewed the NRC staff's analysis regarding the safety of this site for the permanent disposition of used nuclear fuel. Based on this information, I believe Yucca Mountain is a perfectly safe location to serve as a permanent repository for U.S. used nuclear fuel. I also believe that it is most unfortunate that the U.S. Government has failed in its duty to allow the Yucca Mountain project to go forward. Despite the false and misleading claims of anti-nuclear activists, the fact remains that used nuclear fuel is the most highly regulated metal in the world and since its origins in the 1960s, there is no record, of which I am aware, that any individual, worldwide, has been killed or seriously injured as a result of the storage of used nuclear fuel. That is an outstanding safety record.*

*Today, used nuclear fuel is stored in wet storage pools at existing reactors, in dry storage adjacent to U.S. nuclear sites and there are currently two locations that have been identified as civilian-owned interim storage facilities. Science and facts tell us that all of these are safe methods of storing used nuclear fuel. Our colleagues in Finland will soon be opening the world's first underground repository for used nuclear fuel. I hope that will open policymaker's eyes that this is a safe method for addressing this issue and I hope it will allow the U.S. to move forward. Our country currently possesses the scientific and technical capability to safely address used nuclear fuel. What we lack is the political will to move this issue forward.*

*Having said that, given the strong U.S. track record of storing used nuclear fuel over the last 60+ years, I do not believe the deployment of advanced reactor technologies should be limited because of a failure on the part of the Federal Government to resolve the issue of used fuel disposition. We can safely manage the future used fuel of these advanced reactors.*

*I frequently receive questions about nuclear waste when I appear publicly but I would note, by way of comparison, that there is no current technology available to recycle the carbon blades of the tens of thousands of wind turbines that are being built all over the U.S . Virtually all of these turbine blades will need to be disposed of, intact, in future landfills. Despite that fact, I have not heard anyone suggest that we should stop deploying wind turbines.*

**The Honorable Robert E. Latta (R-OH):**

1. What are your thoughts about a National Strategic Uranium Reserve to guard against market disruptions or other crises?

   **RESPONSE:** *Given the fact that the U.S. currently imports the vast bulk of its uranium, I believe that the development of such a facility could be beneficial. Not only would it provide resiliency over potential market disruptions, it would also allow the U.S. to maintain its technical capabilities in the mining and milling of domestic uranium resources.*

**The Honorable Bill Johnson (R-OH):**

1. The Department of Energy (DOE) is responsible for reviewing the transfer of nuclear technology to foreign owners, under the Atomic Energy Act. This is the so-called Part 810 process, which you have testified about in the past.

   In the last Congress we enacted into law some reforms to this process, from legislation I developed, that would help streamline DOE decisions, and make it a little easier to export nuclear technologies and enhance U.S. competitiveness.

   One of the purposes of the Part 810 process is to prevent sensitive nuclear technology from getting into the wrong hands and to minimize nuclear proliferation risks.

   a. Can you speak to the nuclear proliferation risks of some of the new technologies? Are they being designed to minimize those risks?

      **RESPONSE:** *The advanced nuclear reactors that are currently under development in the U.S. include a wide range of technologies that will need to be appropriately reviewed to assure that sensitive nuclear technologies do not get into the wrong hands. Toward that end, I support initiatives underway at the Department of Energy to facilitate reviews under Part 810 as well as outreach by National Laboratories to provide technological assistance to advanced reactor developers on safeguards and security matters. For my part, I have also encouraged advanced reactor developers to consider safeguards and security needs as they mature their designs. Congress has provided a helpful role in facilitating and encouraging this dialog between the advanced reactor community and executive branch Departments and Agencies that are charged with protecting against non-proliferation. Clearly, the non-proliferation of nuclear technologies associated with weapons development must remain a priority for our government,*

*but actions of our government to address that priority must be done in a manner that provides a swift analysis and disposition of these concerns and does not unnecessarily impede civilian nuclear technologies that pose no proliferation risk.*

b. To the extent they are low proliferation risk. Does it make sense to pursue additional reforms to streamline DOE reviews of low proliferation risk technologies?

**RESPONSE:** *As a former regulator, I am generally supportive of efforts to streamline licensing and regulatory processes in a manner consistent with meeting the requirements of U.S. laws and treaty requirements. While I have no specific reforms to suggest at this time, perhaps it would be helpful if Congress were to support an outside, independent assessment of these processes to assure that they are not unduly hindering the development, deployment and export of advanced reactor technologies.*

c. How will this help our ability to compete?

**RESPONSE:** *Dating to President Dwight D. Eisenhower, the U.S. NRC and its predecessor the Atomic Energy Commission were expected to review nuclear technologies to assure they could be deployed consistent with providing adequate protection of public health and the environment. At the same time, the Atomic Energy Act requires that the NRC will <u>enable</u> the deployment of these technologies for beneficial purposes so long as they meet these standards. Consistent with that position, reducing unnecessary regulatory burden was a key goal of the U.S. NRC during the time I served on the Commission from 1998-2007. I believe advanced nuclear technologies provide the opportunity for the U.S. to regain a leading role in the deployment of carbon free nuclear generation, and I believe that the U.S. government must be committed to avoid or reduce unnecessary regulatory and legal impediments to their deployment here in the U.S. and abroad.*

2. There is sense in your testimony that the developing countries want to purchase and enter into relationships U.S. nuclear vendors, but they basically say: "Where are the Americans?" What is needed to invigorate U.S. presence in these important markets?

**RESPONSE:** *Yes. Countries outside of the U.S want to purchase American advanced reactor technologies and they are looking for American leadership in this area. The investment that has been made by Congress in the Advanced Reactor Demonstration*

*Program will prove to be a very useful tool to provide public-private partnerships in developing and deploying these nuclear technologies. I would strongly urge that Congress continues to fund the activities of the Department of Energy Office of Nuclear Energy to facilitate the deployment of advanced nuclear technologies.*

*Additionally, recent changes that have been made in the governance of the Development Finance Corporation (DFC) to allow it to provide financing and equity for U.S. nuclear projects deployed abroad is very helpful. The ExIm Bank pledges to continue to finance U.S. nuclear projects will also be a vital tool in ensuring the U.S. gets its fair share of the international nuclear export market. Congress must continue to support the financing of and innovation in U.S. nuclear technologies and it must continue to support funding the export tools that are available at the DFC and ExIm Bank to allow these potential projects to move forward.*

**The Honorable Bill Flores (R-TX):**

1. Several panelists today talk about the importance of the Nuclear Energy Leadership Act, which among other important provisions directs the Secretary to provide a supply of High Assay, Low Enriched Uranium, or HA-LEU advanced fuels for advanced technologies. I agree with the goals of those legislation.

    a. I would like to ask about the model of a public-private partnership for development of HA-LEU. In H.R. 1760, the Advanced Nuclear Fuel Availability Act, which this Committee has successfully moved through the House twice, we create a public-private consortium to help inform development of a market for advanced fuels, and thus ensure taxpayer support is well spent. Do you think a consortium like this can help augment the provisions in NELA for creating a supply of HA-LEU?

    **RESPONSE:** *Yes, I believe this is an innovative reform. HA-LEU will be a key fuel resource needed for the deployment of the coming generation of advanced nuclear reactors, and a consortium that could assist in developing a market for HA-LEU may be beneficial for the streamlined deployment of these technologies.*

2. Another provision of the Advanced Nuclear Fuel Availability Act directs the Secretary to develop, in consultation with NRC, criticality benchmark data for HA-LEU to assist the licensing and regulation of fuel fabrication facilities and certification of transportation packages.

a. If the objective is to get to build, to get the fuel infrastructure in place, would you agree we should place a priority on developing the licensing and regulatory framework for the fabrication facilities and transportation canisters?

**RESPONSE:** *Yes. The provision of HA-LEU is a potential "long pole in the tent" for advanced nuclear technologies. Efforts to promptly address these issues, including the regulatory framework for fabrication facilities and transportation cannisters would be very helpful.*

b. NELA focuses on R&D for transportation packages, but the Advanced Nuclear Fuel Availability Act focuses on developing the regulatory infrastructure. Would you agree we should include focus on the regulations if we are going to meet the timelines?

**RESPONSE:** *Yes. It is vital that any issues of regulatory uncertainty in the development of advanced reactor fuels be addressed promptly.*

c. What other regulations should be addressed to make sure a fuels market develops?

**RESPONSE:** *Beyond the regulatory framework for fabrication facilities and transportation cannisters, I think the NRC should be encouraged to review its overall regulatory framework for regulating advanced fuels to ensure that there are no unnecessary impediments toward the prompt licensing of these designs. In a related matter, I believe there should be a high-level dialog on HA-LEU issues between the U.S. and Canadian Governments. I am seeing a strong overlap between these two markets for the development and deployment of advanced reactor technologies, but I personally believe there is insufficient coordination, at a Government to Government level, on how to address the HA-LEU needs of both Countries. Unlike the U.S., Canada has no indigenous enrichment capabilities and will need to either develop these capabilities or rely on other countries to supply this material. As Canada is the second largest supplier of uranium in the U.S., there is a natural market flow of these materials between the two countries. Providing an integrated approach, with appropriate coordination provided by applicable Departments, Ministries and Agencies of the two countries, could be very beneficial.*

**The Honorable David B. McKinley, P.E. (R-WV):**

1. Mr. Merrifield, you noted that the storage of spent fuel rods "is overseen or clarified by the International Atomic Energy Agency in Vienna," and that there are "international standards and expectations for how that fuel is going to be stored whether it is in a spent fuel pool or in dry cast storage."

    a. We talk a lot about commercializing advanced nuclear technology and exporting it to developing countries in order to help provide them with power.

        i. Should we commercialize these technologies, and export them to developing countries such as the Congo, can we guarantee that those spent nuclear fuel rods will be safely guarded?

        **RESPONSE:** *The International Atomic Energy Agency (IAEA) has developed an approach called the Milestones Approach which is intended to be a comprehensive and phased method to assist countries that are considering or planning their first nuclear power plant. This program includes 19 nuclear infrastructure issues that require specific actions including issues such as an appropriate legal framework, safeguards, a regulatory framework, and nuclear security, all consistent with the IAEA's mission of preventing the proliferation of nuclear technologies for weapons purposes. As a general matter, the IAEA does not provide security for nuclear materials as this is a responsibility of individual sovereign governments. From the standpoint of U.S. exports of nuclear technologies, this would require an agreement between the U.S. Government and the government that wishes to import these technologies under Section 123 of the Atomic Energy Act. As it relates to the Congo, I am not personally aware of an interest of that country to pursue a civilian nuclear power program. I am aware that the National Nuclear Security Administration and the Department of Energy have very active programs to work with countries outside of the U.S. to assist them in securely protecting their civilian used nuclear fuel. I believe these are very beneficial programs that Congress should continue to support so that those countries that choose to deploy civilian nuclear reactors have the effective tools to secure these materials.*

        ii. How can we prevent additional nuclear proliferation by those countries that have not otherwise been engaged in this conversation so far?

        **RESPONSE:** *Countries that choose to engage in civilian nuclear power*

*programs do so with government to government and civilian relationships that can last over 100 years during the development, licensing, construction, operation and decommissioning lifetime of nuclear reactors. Having the U.S. Government and U.S. suppliers actively engaged in deploying U.S. nuclear technologies establishes those long-lasting relationships and provides an opportunity for active engagement with the host country and the potential to meaningfully influence efforts to prevent the inappropriate use of civilian nuclear technologies. Where the host countries choose the technologies of countries such as Russia and China, the U.S. does not have that same opportunity for active engagement and will not be in as strong a position to influence the use of those technologies. For that reason, I believe a strong and healthy U.S. nuclear export policy, consistent with the goals of non-proliferation, is the most effective method of avoiding the inappropriate use of civilian nuclear technologies.*