Responses for Additional Questions for the Record
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House Energy and Commerce Committee
Oversight Hearing – "American Nuclear Energy Expansion: Power a Clean and Secure Future"
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The Honorable Jeff Duncan

1. You mention in your testimony that an important part of licensing includes environmental reviews but the NRC needs to clarify their "Safety-focused" mission. How can the NRC expedite the time it takes to complete these reviews?

As outlined in my testimony and included in the recommendations provided by INL to your committee there are several areas which should be considered to expedite the time it takes to complete reviews. Areas that should be considered for expediting reviews are identified below along with the section of the above-mentioned report that provides more detail:

- The first area addresses reforms to streamline NRC hearings, including removal of mandatory hearings, removal of contested hearings for environmental topics, and use of a simplified legislative hearing process for contested hearings.

- The second area addresses reforms to expedite NRC safety and environmental reviews, including clarification of the NRC's mission to include timely and efficient licensing of new nuclear projects, reduction of the burden of the Advisory Committee on Reactor Safeguards reviews, timely interactions between applicants and the NRC Staff on substantive topics, exclusion of small non-commercial reactor projects on DOE sites from National Environmental Policy Act reviews, and an external review team to provide recommendations to further streamline the licensing process.

- The third area addresses other NRC licensing reforms, including strengthening the NRC's milestones for new reactor licensing activities and clarification of which non-commercial demonstration nuclear reactor projects may be authorized by DOE.

- The final area addresses reforms to provide financial benefits to new reactor projects, including modification of the NRC fee structure or other financial support, permission of foreign investment by U.S. allies under some circumstances, and extension of the Price-Anderson Act coverage for nuclear hazards indemnification.

Stephen Burdick, John Wagner, Jess Gehin, *Recommendations to Improve the Nuclear Regulatory Commission Reactor Licensing and Approval Process*, INL/RPT-23-72206, May 2023. https://doi.org/10.2172/1974450

2. I asked during the hearing, but would you please elaborate: What are the regulatory costs a new reactor applicant faces when going through the licensing process at the NRC?

The regulatory costs that applicants face include the direct fees that applicants pay to the NRC for the staff and contractor effort to perform the reviews at the annual specified rate to perform document reviews, confirmatory analysis, engage in meetings with the applications, prepare licensing documents and finalize licensing. The NRC accesses fees to recover the costs that provides specific benefits to identified recipient, including for reactor license applications as required by federal law. The NRC annually determines the hourly rate used for fee collection, with the FY2023 hourly rate of $300 per hour. For operating plants and facilities, the NRC applies an annual fee depending upon the facility type.

The overall costs for reactor licensing can vary by applicant depending upon the design details of the design, completeness of the submission by the applicant, and responsiveness of the application to requests for information. The uncertainty regulatory review timelines can also lead to additional unanticipated costs. In addition to the direct regulatory fees, there are related expenses for the application to prepare and submit documents and to participate in meetings, responses to requests for information, etc.

Given the limited recent number of reactor licensing applications, there is minimal information on the actual costs that are incurred by applications for reactor licensing activities. A key aspect is that the extent of the licensing costs is not well-defined at the time of the review and therefore the costs lack certainty for applicants.

The review for the NuScale design certification application represents the most recent information and can provide an example and information provided in a "lessons learned" document provides information on the costs for regulatory reviews. In particular, a recommendation provided by the Nuclear Energy Institute provides the following information (see Page 20):

> "The increasing NRC review costs for new reactor applications are not sustainable and are on a trajectory toward $100 million for each new design. The NRC needs to perform a root cause analysis to determine why the inflation-adjusted review costs continue to increase, even though recent applications are for designs with enhanced safety and lower risks. While we believe NRC could achieve a generic review cost target of $10 million, as a threshold matter, the NRC generic cost target should be well below $50 million (roughly the costs for the AP-1000) for designs that are simple and have high levels of safety."
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> US Nuclear Regulatory Commission, *Lessons Learned from the U.S. Nuclear Regulatory Commission's Staff Review of the NuScale Design Certification Application,* March 2022. https://www.nrc.gov/docs/ML2208/ML22088A161.pdf

3. Can you describe some of the work and research Idaho National Laboratory is doing with reprocessing and where do you see that evolving with advanced reactors and with the existing light water reactor fleet?

As the nation's nuclear energy laboratory, Idaho National Laboratory has a long history of performing research and development of reprocessing including in areas of materials separations and recovery, fabrication of fuels using recovered materials, and irradiation testing and characterization of fuels based on recovered material. This research and development is based on key methodologies for materials separations such as those based on aqueous and electrometallurgical processes at laboratory scale to create data to inform process improvements that can reduce costs while increasing understanding of proliferation risks. This is enabled by the unique nuclear facilities, such as hot cell facilities and test beds, located at INL that enables researchers to perform research with irradiated materials. There is increased interest in recovering materials from advanced reactor fuels, particularly those utilizing higher enriched fuels such as high-assay low-enriched uranium (HALEU) in which the residual material after the use of the fuel has more value. Laboratory-scale research is being performed on light water reactor fuels to investigate materials recovery as well.

Beyond research and development, a number of fuels including EBR-II and naval fuels, were routinely recycled at INL. INL is currently recovering HALEU from irradiated material from the Experimental Breeder Reactor II driver fuel that will provide a source of up to 10 metric tonnes of HALEU to enable reactor demonstrations.

4. Some of the advanced reactors under development in the United States involve international collaboration or collaboration with foreign investors. Would you please describe DOE's Order P 485.1A Foreign Engagements with DOE National Laboratories, and how INL implements that order?

    a. When INL interacts with individual companies, what is the review process, the appeal process, and the role of DOE headquarters in the process?

    b. Does DOE and the national laboratory community need additional direction or clarity from Congress related to the implementation of Order 485.1?

The Department of Energy provides access to national laboratory capabilities through agreements with non-DOE entities including organizations that are considered foreign entities, which defined in DOE Order P 485.1A. For policy purposes, "foreign entities" include U.S. companies that are owned, controlled, or influenced by a foreign government, agency, firm, or corporation. DOE headquarters review and approval is outlined in the order.

This is implemented at INL through requirements in the Battelle Energy Alliance, LLC (BEA) management and operations contract with DOE. BEA obtains information from the company seeking to work with INL and performs an internal review to determine if there is information that indicates foreign engagement. Based on this review and if there is an indication of foreign engagement, BEA submits a request to the DOE Idaho Office (DOE-ID) for approval to proceed with development of an agreement. Based on DOE-ID determination, the request is submitted to DOE headquarters for review by appropriate organizations within DOE. Upon DOE approval, BEA will proceed with the development of the agreement. Should the request be not approved there is no appeal process.

The review time for this process can be highly variable and can add significant time to execute agreements. There are several opportunities to streamline this process to make it more efficient that could be considered, these include:

- Provide more clarity in the definition of what constitutes foreign influence.
- Clarify the roles and responsibilities for executing the processes in the order.
- More consistent implementation across the DOE national laboratories and offices. DOE laboratories use different criteria and approaches for making assessments that can result in different outcomes.
- Improve timelines for reviews, some reviews have taken months to a year to perform.
- Reviews are required for each agreement including when there are multiple, separate agreements with the same commercial organization either with the same laboratory or with different laboratories. Each time work scope is added or modified, the 485.1a review process starts over, adding significant project delays and uncertainty. Agreements with different laboratories also invoke separate reviews. A single organization review could significantly reduce effort and approval times.

The Honorable Greg Pence

1. In your experience at the Idaho National Labs, how have you coordinated with public private partnerships, and what benefits have you seen from these types of initiatives?

INL is working with multiple commercial organizations in the form of public-private partnerships. The Gateway for Accelerated Innovation in Nuclear (GAIN) and the National Reactor Innovation Center (NRIC) represent key programs to enable public-private partnerships with the national laboratories by facility access to laboratory expertise and capabilities and enabling reactor demonstrations. The Advanced Reactor Demonstration Projects, specifically represent a key example where we are working closely with the private sector to develop reactor demonstrations and technologies. This enables the private sector to access the unique research capabilities at the laboratory that would otherwise not be available – including access to research reactors, hot cells, high performance computing and expertise. INL uses a variety of tools and mechanisms to perform RD&D through partnerships: technology transfer; commercialization, cooperative research, and development agreements (CRADAs); and participation in DOE initiatives, including Energy I-Corps, GAIN's voucher program, the Technology Commercialization Fund (TCF), and Strategic Partnership Projects (SPPs). The benefits to INL include involvement in research and development that directly contributes to reactor demonstrations, engagement on real-world projects, working directly with private sector expertise to understand priorities and the ability to transfer lab-developed technologies to the private sector.

2. What role could a leading university such as Purdue University play in advancing research into convergent manufacturing for nuclear?

Universities play a key role in research and development in nuclear energy including in manufacturing in construction. Purdue University has significant scientific and engineering research and development capability and has been very active in construction and manufacturing for nuclear plants including recent work in advanced construction technologies. Specifically, Purdue University is part of a National Reactor Innovation Center Advanced Reactor Construction Initiative project to test advanced reactor construction technologies that offers significant potential to reduce the construction schedule and costs for nuclear energy. A recent test performed at Purdue on steel-concrete composite prototype testing as part of this program was successful and will provide valuable data. Given the need for improvements in construction and manufacturing, there are many opportunities for Purdue to contribute.

The Honorable Rick Allen

1. Will any of the problems, such as a shortage of workers with experience in nuclear construction, lack of nuclear supply chain infrastructure and inefficiency in module fabrication, that have caused challenges at Vogtle Unit 3, be issues for Small Modular Reactors or Generation III+ Reactors?

The experience with Vogtle Unit 3 and 4 construction has provided valuable lessons learn for the nuclear energy work force development and supply chain that will benefit future reactors. While Small Modular Reactors, by their nature of being smaller, will require a smaller workforce and supply chain for each plant that will offer benefits in cost and schedule, the deployment of large numbers of SMRs would continue to be impacted by workforce and supply chain challenges.

This is also a challenge for first-of-a-kind plants to have a workforce with the necessary skills and to create the supply chain for the fabrication and manufacturing of reactor components. A priority needs to be placed on developing the workforce and building the infrastructure needed for manufacturing.

2. What is the industry doing to ensure that the infrastructure and experience that has been developed, thanks to the construction of Vogtle 3 and 4, is not lost for Small Modular Reactors or other light-water reactors that might be ordered?

The ideal scenario to take advantage of the experience gained in the construction of Vogtle 3 and 4 would be to have workers from those plants move directly on to the next construction project. Unfortunately, there are currently no direct follow-on projects with the next Small Modular Reactors being planned for construction in the later in the decade. With that said, the construction companies involved in the project are involved in future reactor deployments domestically and internationally and certainly benefits from this experience, which will ultimately include future SMRs built in the United States.

However, for these reasons, it's important that future deployments involve multiple plants with a coordinated schedule to leverage the experience, learning and efficiencies that are gained as plants are built out.

The Honorable Russ Fulcher

1. Can you discuss the work that INL is doing in the area of Cybersecurity? Specifically, with the Microreactor project Pele, INL has discussed the strategy and integrating cybersecurity protections into the development and building of reactors and surrounding infrastructure?

The INL cyber security experts are integrated into the Project Pele team and are helping the program meet its cyber security needs. Two ongoing Pele cyber security activities are: (1) Leveraging the Consequence-driven Cyber-informed Engineering (CCE) methodology developed by INL to understand how elements of digital design of the microreactor could be sabotaged using cyber. Then using this information to implement design and/or operational changes to eliminate or reduce the risk of cyber-enabled sabotage events that could disrupt the mission of the reactor. (2) Providing cyber informed training to the microreactor team (federal and contractors) that teaches engineers to design systems that fail safe if there is a cyber security event.

One unique design aspect of Pele is that the control room will be hardwired to the reactor systems and will need no connection to the outside world (Wifi, internet, Bluetooth, other). This will help minimize the ability of hackers to infiltrate the microreactor.

2. My district and large areas of the West are rural, with transmission and infrastructure a real challenge for exiting energy sources. SMRs and advanced microreactors can address this challenge through their ability to operate off the grid. What should this committee know when it comes to ways to ensure that there is not a federal regulatory burden to gain on this unique advantage these novel reactors bring?

Microreactors and Small Modular Reactors are well-suited for distributed electricity generation since they can be located closely to the demand need and operate off grid or part of a local microgrid. The primary areas needed to ensure that nuclear energy is available for these applications are similar to those for all nuclear reactors including fuel and component supply chain, work force, improvement in regulatory time frames, and support for first movers and first of a kind deployments. Additionally, enabling long-term power-purchase agreements (e.g. 30 years) is needed to enable the deployments, particularly in support of federal sites. Demonstrations of reactors in an off-grid or microgrid environment are needed to provide information to support broader deployments.

Recommendations for improvements in regulatory time frames are outlined in the following INL report:

Stephen Burdick, John Wagner, Jess Gehin, *Recommendations to Improve the Nuclear Regulatory Commission Reactor Licensing and Approval Process*, INL/RPT-23-72206, May 2023. https://doi.org/10.2172/1974450

In particular, an areas of emphasize to consider for distributed deployments involve efficient siting of reactors considering streamlined environmental approvements.

3. A long-term workforce is critical in this field, as with others, I know Idaho's public universities are working with INL. Can you discuss ways in which we can build on apprenticeship and other programs to help ensure you have a readily available workforce?

INL does work closely with Idaho's Universities and Community Colleges, and we rely on them for the development of the work force that executes our mission. Through the Center for Advanced Energy Studies, a partnership of the state universities and the lab, the collaborative computing center, and engagement with the College of Eastern Idaho, we support workforce development and research collaborations. Areas of potential interest is expanding co-op programs to develop specific knowledge and expertise on INL projects and programs. There is also a need to continue to develop technicians that are needed in operation our research facilities and execution of our research and development programs.