POLICY ISSUE
NOTATION VOTE

RESPONSE SHEET

TO: Carrie M. Safford, Secretary

FROM: Commissioner Marzano

SUBJECT: SECY-24-0008: Micro-Reactor Licensing and Deployment Considerations: Fuel Loading and Operational Testing at a Factory

Approved X **Disapproved** ____ **Abstain** ____ **Not Participating** ____

COMMENTS: **Below** ____ **Attached** X **None** ____

MATTHEW MARZANO
Digitally signed by MATTHEW MARZANO
Date: 2025.04.10 08:54:44 -04'00'

Entered in STAR
Yes X
No ____

Signature
Matthew J. Marzano

Date **04/10/2025**

Commissioner Marzano's Comments on SECY-24-0008, "Micro-Reactor Licensing and Deployment Considerations: Fuel Loading and Operational Testing at a Factory"

I appreciate the staff's efforts to explore flexibilities within the NRC's existing regulatory framework to facilitate novel licensing approaches for deployment models proposed by microreactor developers. Microreactors present an opportunity to meet increasing demands for U.S. energy while lowering initial costs to begin operation, reducing the time for manufacturing and construction, supporting rapid, widespread deployment, and reducing radiological consequences and the corresponding impact on the public health and safety.

The staff's paper highlights the importance of adapting to changes in nuclear reactor technology development, fabrication, testing, transportation, and operation. As the nuclear industry looks beyond traditional fixed site construction of large light water reactors and identifies opportunities to fabricate, load fuel, and/or perform operational testing at manufacturing facilities, it is imperative for the NRC to ensure that its regulatory framework is responsive to this evolution in the use of nuclear energy systems.

In addition to addressing the needs of the microreactor community, the strategies in this paper support the NRC's implementation of Section 208 of the ADVANCE Act of 2024, which directs the NRC to "…develop risk-informed and performance-based strategies and guidance to license and regulate micro-reactors…" in eight topical areas: staffing and operations, inspections and oversight, security and safeguards, emergency preparedness, risk analysis methods, decommissioning funding assurance, transportation of fueled microreactors, and siting. The staff's proposals regarding features to preclude criticality and fuel loading at a factory address important considerations for facilitating the transportation of fueled microreactors by obviating the need to issue an operating license or combined license. These recommendations, which do not require a statutory or regulatory change, demonstrate the NRC's commitment to enabling the safe and secure deployment of microreactor technologies through efficient and reliable licensing and regulation, consistent with the NRC's updated mission statement. I also appreciate the staff's foresight to identify ten additional microreactor licensing and deployment topics warranting further consideration. The staff must prioritize its planned work in these areas to will further support implementation of the ADVANCE Act in a timely and comprehensive manner.

I approve Options 1b, 2b, and 3b, as discussed further below. However, should the staff or microreactor developers identify regulatory, technical, or business-related reasons that favor any of the other options presented, the staff should consider these proposals on a case-by-case basis.

<u>Topic 1: Features to Preclude Criticality and Topic 2: Fuel Loading</u>

Because the significance and purpose of loading fuel into a microreactor at a manufacturing facility differ from traditional fuel loading of a large light water reactor at a static construction and operational site, I agree that re-examination of the Commission's position on when a reactor is considered "in operation" is warranted in the context of factory-fabricated microreactor modules. Namely, the determination of when a microreactor is placed into operation should consider practical factors beyond simply the loading of fuel, taking into account the overall deployment model proposed by a given microreactor developer while maintaining an appropriate focus on radiological risk, public safety, environmental impact, and security. By tying the commencement of operation of a reactor to its physical ability to achieve and sustain a nuclear chain reaction for its intended operational or testing purpose, the staff presents an approach that appropriately

facilitates microreactor deployment models that call for transporting fueled reactors from manufacturing facilities to operational deployment sites prior to commencing operation. As part of this approach, the staff should ensure that it is clear that when features to preclude criticality are inserted following operational testing, the reactor is again not considered to be in operation and thus would not require an operating license during transportation to the destination site.

The staff proposes features to preclude criticality while in transportation – such as bolts, locks, or welds to fix control elements in place, decoupling of control element drives so as to preclude the insertion of positive reactivity, and/or additional fixed neutron absorbers. Incorporating such features substantively addresses many traditional programmatic and practical matters associated with radiological risk, public safety, environmental impact, and security, obviating the need for the issuance of an operating license under Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50 or a combined license under 10 CFR Part 52 until such features to preclude criticality are intentionally removed. While I understand the staff is still developing guidance and policy recommendations for the concept of features to preclude criticality, I envision the dynamics of transporting manufactured modules should, at minimum, require some form of physical measures to preclude criticality for modules in transit, especially those that have undergone preoperational testing at the factory.

Therefore, I approve the staff's recommended Options 1b and 2b, which would establish the appropriate licensing pathways for factory-fueling a microreactor at a manufacturing facility and establishing that operation of a factory-fabricated microreactor begins when features to preclude criticality are removed from the reactor for its intended operational or testing purpose.

Topic 3: Operational Testing at a Factory

Operational testing of a microreactor at the manufacturing facility presents perhaps the most significant departure from scenarios envisioned by NRC's existing regulation but is considered a key aspect of the deployment model for certain microreactor developers. However, while operational testing may introduce novel regulatory considerations to be addressed, the risks associated with limited operational testing differ from commercial operation because of reduced fission product creation and minimal decay heat generation. I agree with the staff's statement in SECY-20-0093 that, provided an applicant can demonstrate that "the safety and security of its design… represents a low risk," there is sufficient justification to determine that "different licensing and regulatory approaches are appropriate for such facilities."

As such, the staff appropriately observes that the "regulatory burden on the manufacturer and NRC staff associated with licensing short duration operational testing under the regulations for nuclear power reactors may not be commensurate with the low risk posed by that activity." The staff also acknowledges in this paper that if a "manufacturer also seeks licenses to operate the reactors at the factory (e.g., for testing), then the design issues that must be resolved for operation at the factory would largely overlap with the design issues to be resolved in a manufacturing license."

The staff's proposal to apply the safety regulations for non-power reactors to the operational testing of microreactors at a factory invokes a well-established, scalable, and largely performance-based regulatory framework that appropriately addresses safety considerations for lower powered reactors. It also allows sufficient flexibility to tailor licensing approaches through the use of license conditions, exemptions, hearing orders, rules of particular applicability, or other regulatory vehicles, as appropriate, to implement the option. For these reasons, I agree that it is still appropriate for the staff to license a factory-fabricated reactor loaded with fuel as a

commercial nuclear reactor under Section 103 of the Atomic Energy Act of 1954, as amended (AEA) and 10 CFR Part 52, Subpart F, “Manufacturing Licenses,” utilizing non-power reactor regulations applied to operational testing.

Therefore, I approve the staff recommended Option 3b to apply the non-power reactor regulatory requirements to microreactors for the purpose of operational testing at a factory using license conditions, exemptions, hearing orders, rules of particular applicability, or other regulatory vehicles, as appropriate. In cases where an exemption would be the most appropriate method to apply non-power reactor requirements, the staff should consider proactively issuing exemptions when sufficient technical and legal justification for issuing an exemption is readily apparent rather than relying on an applicant to first submit a request for such an exemption. Taking such actions demonstrates a commitment to becoming a more proactive and agile regulator in service of our mission.

Concluding Thoughts

While this paper focuses on addressing a limited set of near-term microreactor priorities within the NRC’s existing regulatory framework, the staff should continue to think holistically and plan proactively to develop a comprehensive regulatory framework for microreactors that seeks to combine the activities of a microreactor applicant (e.g., factory fabrication, operational testing, fuel loading, and transportation of microreactors) in a single license. Such an approach would minimize redundancy and optimize microreactor license application reviews and support timely deployments once developers reach nth-of-a-kind production.

The staff should clearly disposition each issue consistent with the direction provided in ADVANCE Act Section 208(a)(2), and, to the extent practicable, the staff should identify appropriate ways to incorporate and/or align the recommendations in this paper with other ongoing rulemaking and guidance efforts, such as those associated with the Part 53 rulemaking. Additionally, the staff should consider whether certain proposed licensing and oversight strategies for microreactors – whether in this paper or in future endeavors – would be applicable to other types of nuclear reactors, including larger power reactors, research reactors, and testing facilities.

To inform future microreactor activities, the staff should continue its engagement with other federal agencies (e.g. the U.S. Department of Energy), national laboratories, microreactor developers, industry groups, non-governmental organizations, and other stakeholders. Forums for this engagement could include periodic advanced reactor stakeholder meetings, dedicated public meetings on specific topics or activities, workshops, and government-to-government meetings. However, the staff should look beyond these traditional methods of cooperation and leverage existing memoranda of understanding established under the Nuclear Energy Innovation Capabilities Act and the ADVANCE Act.

I applaud the staff’s efforts and foresight to identify and address future regulatory topics in support of microreactor licensing and deployment, including areas for potential further engagement with the Commission. I appreciate that the staff has continued to prioritize and address additional microreactor topics as part of a holistic outlook on the licensing needs of microreactor developers since delivering this paper to the Commission. I look forward to future discussions and engagement with the staff on additional microreactor topics such as those identified in the staff’s “Nth-of-a-Kind Micro-Reactor Licensing and Deployment Considerations” (ML24268A310) white paper and associated enclosure (ML24302A292), as well as the Microreactor Activities Integration Tables (ML25036A199).