Micro-Reactor Licensing and Deployment Topics

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Introduction

- Goals of this presentation
- SECY-20-0093 summary
- NRC draft white paper on micro-reactor licensing strategies
- Licensing and deployment topics for factory-fabricated transportable micro-reactors
- Discussion items

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Goals of this Presentation

- Inform stakeholders of the micro-reactor licensing and deployment topics currently being considered by the NRC staff for factory fabricated transportable micro-reactors
- Hear feedback from stakeholders, including other topics for consideration and thoughts on prioritization

SECY-20-0093 Summary

- SECY-20-0093[1] laid out several issues related to micro-reactor licensing and deployment, including information on the current regulations, applicability to micro-reactors, stakeholder perspectives, and NRC staff considerations
- Some issues are being addressed in ongoing rulemakings and guidance development, and some are topics for consideration for factory-fabricated transportable micro-reactors as described later in this presentation

[1] SECY-20-0093: Policy and Licensing Considerations Related to Micro-Reactors (https://www.nrc.gov/docs/ML2025/ML20254A363.html)

SECY-20-0093 Summary

- Security Requirements
- Emergency Preparedness
- **Staffing, Training, and Qualification Requirements**
- **Autonomous and Remote Operations**
- Regulatory Oversight
- Aircraft Impact Assessment
- Annual Fee Structure
- **Manufacturing Licenses and Transportation**
- Population-Related Siting Considerations
- Environmental Considerations

Micro-reactor Licensing Strategies

- NRC issued a draft white paper titled, “Micro-reactors Licensing Strategies,” to facilitate the development of optional strategies to streamline the licensing of micro-reactors (https://www.nrc.gov/docs/ML2132/ML21328A189.pdf)
  - Enhanced standardization of the design and operational programs
  - Manufacturing license may provide flexibility for design and fabrication in a factory and reduce site-specific inspections and verifications
  - Use of “bounding values” for external hazards and site characteristics could reduce NRC staff review effort
  - Generic Environmental Impact Statement for Advanced Nuclear Reactors (ANR GEIS) rulemaking

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Licensing and Deployment Topics – Factory-Fabricated and Transportable Micro-Reactors

- The NRC staff is continuing to develop topics related to licensing and deployment of factory-fabricated transportable micro-reactors to identify policy issues and options to address them
- **Loading fuel at a manufacturing facility**

  Developers may propose loading fuel into reactors at the manufacturing facility either during or after the manufacturing process.
- **Qualifications for personnel handling fuel at a manufacturing facility**

  Loading fuel at a manufacturing facility would also require appropriately-qualified personnel to handle the fuel.
- **Timelines for ITAAC closure, hearings, and 52.103(g) findings**

  The process for beginning operation under combined licenses includes several steps with extended timeframes, such as ITAAC closure, the associated 52.103(g) finding, and the ITAAC hearing process (including the AEA 189a.(1)(B) requirement to provide notice of an opportunity for hearing at least 180 days before scheduled fuel load).

Licensing and Deployment Topics – Factory-Fabricated and Transportable Micro-Reactors

- **Licensing replacement of reactor modules**

  Deployment scenarios may involve delivering fueled micro-reactor modules to the power plant site and replacing the modules with some periodicity.

- **Low Power Physics Testing at a Manufacturing Facility**

  Developers may seek to load fuel and conduct low power physics testing at the manufacturing facility.

- **Transportation of fueled reactor modules**

  Reactor modules that are loaded with fresh, irradiated, or spent fuel might be transported between the manufacturing facility, operating power plant site, and a facility for refurbishing or decommissioning reactor modules.

Licensing and Deployment Topics – Factory-Fabricated and Transportable Micro-Reactors

- **Remote and autonomous operations**

  Micro-reactor developers might include capabilities for remote or autonomous operation and monitoring, including cybersecurity features, and propose not having on-site reactor operators.

- **Irradiated fuel and spent fuel**

  The definition of spent fuel (10 CFR Parts 71 and 72) includes criteria that fuel has been withdrawn from a nuclear reactor following irradiation and has undergone at least one year's decay since being used as a source of energy in a power reactor. Depending on how long it has been since the final reactor shutdown of a micro-reactor, different regulations may apply to the storage and transport of the reactor fuel or the fueled micro-reactor module.

- **Decommissioning process/funding assurance**

  Decommissioning transportable micro-reactors may involve independent regulated decommissioning of power plant sites as well as the reactor modules upon removal. Facility licensing and decommissioning licensing requirements may apply to developers who seek to use a centralized facility to decommission reactor modules away from power plant sites.

Additional Topics for Longer-Term Consideration

- **Mobile micro-reactors**

  The NRC staff is aware that deployment of mobile micro-reactors is of interest to some developers.

- **Maritime or space applications**

  The NRC staff is aware that maritime and space applications of micro-reactors may be of interest to developers.

Next Steps

- Stakeholder engagement
- Identify policy issues
- Consider options to address the issues
  - Guidance development
  - Rulemaking
- Draft White Paper to further stakeholder input
- Engage Commission as appropriate

Discussion Items

- Are there scenarios of interest that are not captured in this presentation?
- What do stakeholders see as the highest priority topics to address?
- Which regulatory topics pose the greatest risks to micro-reactor deployment?
- Other feedback or questions

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