U.S. DEPARTMENT OF ENERGY | Office of NUCLEAR ENERGY

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Accident Tolerant Fuel Program Supporting Power Uprates

March 13, 2024

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Outline

- **Background 1: Overview of Existing ATF Vendor Concepts**
- **Background 2: Operational Impacts of ATF Technology**
- **Background 3: National ATF R&D Infrastructure**
- **ATF Uprate Related Considerations**

Background 1: Accident Tolerant Fuel Concepts Under Development

Framatome

- Cr-coated M5 cladding
- Doped UO_2 for improved thermal conductivity and performance
- SiC cladding

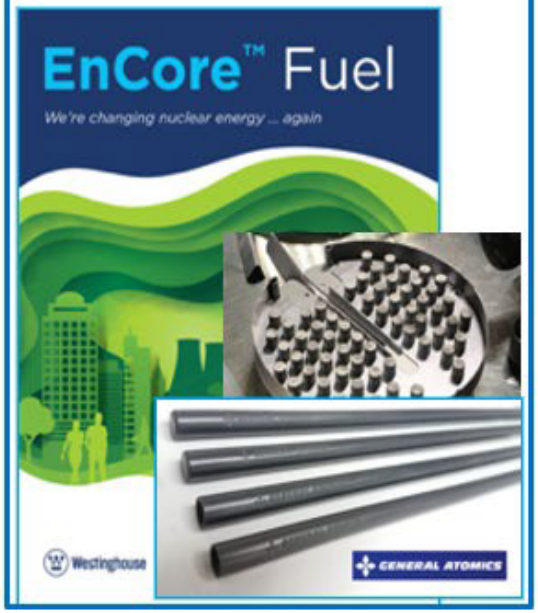
General Electric

- Coated Zr cladding
- Doped UO_2
- Iron-based cladding (FeCrAl)
- ODS variants for improved strength

GE imagination at work

Westinghouse

- Cr-coated Zirlo cladding
- Doped UO_2
- SiC cladding
- High uranium density fuel



Background 2: Operational Impacts of ATF Technology

- DOE sponsored ATF Technology primary driver was to enhance nuclear power plant safety related resilience under off-normal and severe accident conditions.
- However, ATF features also create additional operational performance margins that can provide an economic driver for accelerating deployment.
- ATF program R&D with higher burnup (HBU and LEU+) technology development may also be an enabler for power uprate considerations.

Background 3: National R&D Infrastructure: *Supporting the Entire Fuel Development Lifecycle*

- **Specialty Material Fabrication**
  - Production of novel ceramic compounds and metal alloys in unique configurations for testing
  - Full spectrum of enrichments available
  - Bench to pilot scale fabrication technology development and demonstration
- **Integral Irradiation Testing**
  - Performance assessment in prototypic environments (PWR/BWR Loops)
  - Real-time instrumentation, pools-side NDE, and full-service PIE
- **Lead Test Rod Examination**
  - Full size rod examinations
  - Support to complementary R&D programs: used fuel transportation and storage, recycle.
- **Fuel Safety Testing**
  - Integral in-pile LOCA and RIA testing
  - Semi-integral LOCA furnace testing
- **Material Characterization and Properties**
  - Thermo-physical properties measurement for both fresh and irradiated materials
  - Micro-structural characterization of fresh and irradiated materials
- **Separate Effects Testing for accelerated behavioral model development**
  - Specialty in-pile and out-of-pile experiments on fresh or irradiated materials to investigate critical behaviors and develop/validate descriptive models
- **Modeling and Simulation**
  - Development of advanced tools to investigate and describe integral fuel performance
  - Development of mechanistically based models to describe complex fuel behaviors

ATF Uprate Related Consideration

The DOE AFC campaign's industrial partners and the EPRI CRAFT Technology Expert Group has caused us to raise several questions regarding power plant uprate considerations:

- **Can current ATF development supporting LEU+ and High Burnup be expanded to include Uprate development related needs?**

- **How should the ATF R&D program interact with the NE-LWRS program's related effort? What about Modelling?**
  - Because of IRA time limitations, a joint roadmap with LWRS may be worthwhile.
  - As we start planning tests to support uprate considerations, how can the modelling folks assist in reducing the variables needing testing?

- **What part of our existing ATF related facility infrastructure can be used to support Uprate related development needs?**
  - Can uprated related safety limits be identified that our test infrastructure could address?

Thank You