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

Commission Briefing: Overview of Accident Tolerant Fuel Activities

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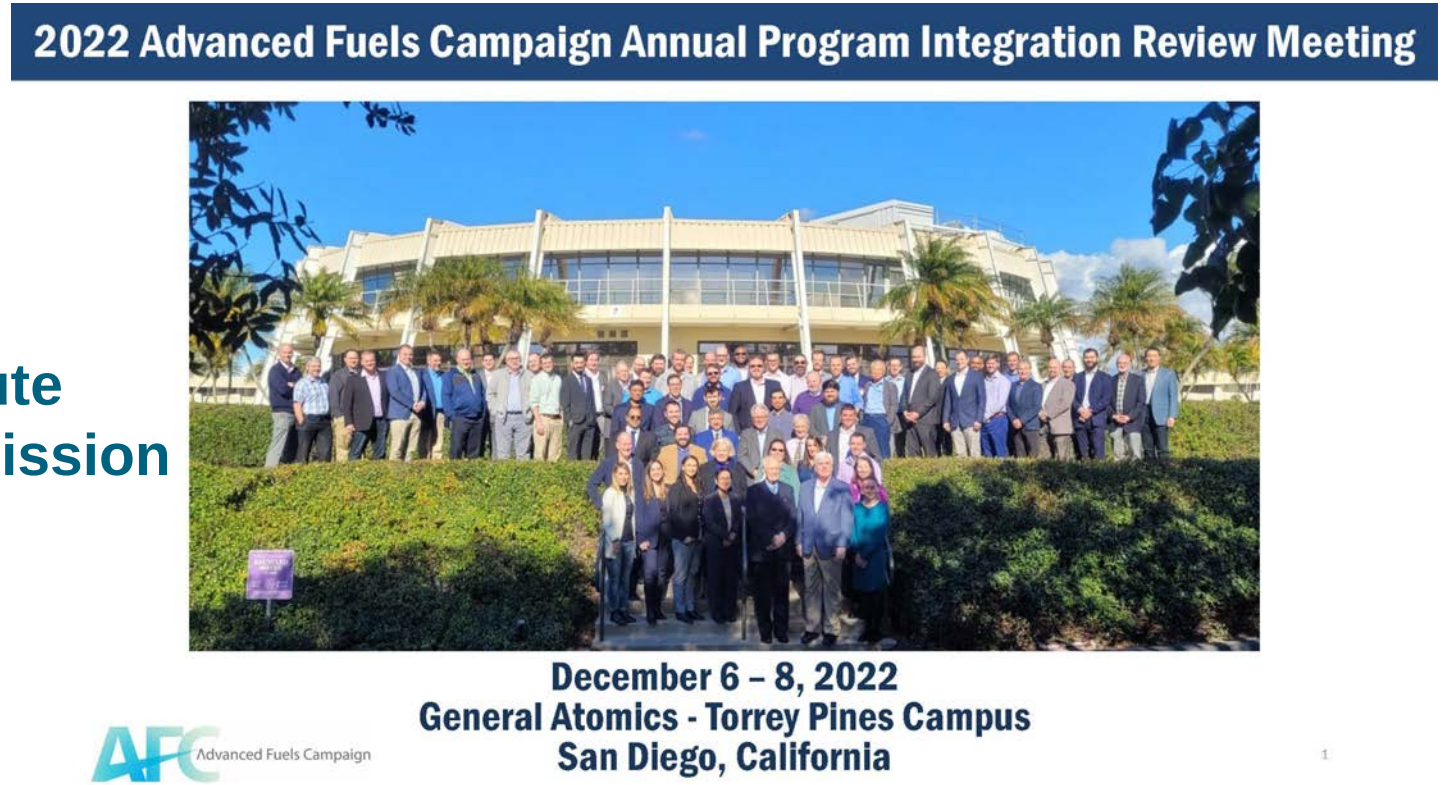
Agenda

- **Program Participants**
- **Framing the Program**
- **Department of Energy Support to Industry**
- **Loss of Coolant Accident Test Plan**
- **Summary**

Communications and Coordination are Key

Fuel Vendors
National Laboratories
Nuclear Energy Institute
Electric Power Research Institute
U.S. Nuclear Regulatory Commission
Universities
International Collaborators



Framing the Program

- **Near-Term Concepts**
  - Coated Cladding
  - Doped UO2
- **Long-Term Concepts**
  - Iron-Chrome-Aluminum Cladding
  - Silicon Carbide Cladding
  - High Uranium Density Fuel
- **Uranium Enrichment**

	High-Assay, Low-Enriched Uranium	
Current LWR Fuel	ATF Fuel at High Burnup	Advanced Reactor Fuel
0% < E <= 5%	5% < E <= 10%	10% < E < 20%

Test Facilities

- **Advanced Test Reactor (INL)**
- **High Flux Isotope Reactor (ORNL)**
- **Massachusetts Institute of Technology Reactor**
- **Transient Reactor Test Facility (INL)**
- **Severe Accident Test Station (ORNL)**

INL – Idaho National Laboratory

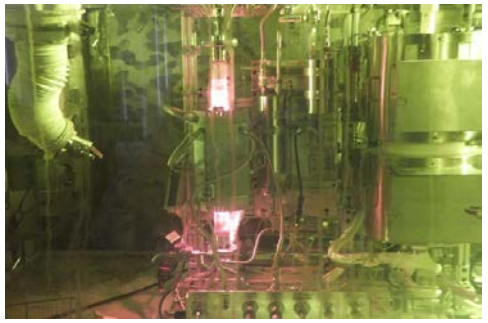
ORNL – Oak Ridge National Laboratory

Shipping and Post-Irradiation Examination

- **Irradiated test rods are shipped from commercial reactors to the national laboratories.**
  - The first two shipments were made in 2020 and 2021.
  - Three shipments are planned for 2023 and 2024.
- **Post-irradiation examination (PIE) is performed at Idaho National Laboratory, Oak Ridge National Laboratory and Pacific Northwest National Laboratory.**
- **DOE is preparing a national shipping and PIE plan in order to make future shipping campaigns routine and coordinate PIE among the national labs.**

Loss of Coolant Accident Test Plan

- **Loss of Coolant Accident (LOCA) test plan developed to address broad stakeholder needs**
  - Leverages the best PIE capabilities in the country
  - Address cross-cutting stakeholder needs
  - Test matrix tailored to large break LOCA conditions
    - Experimental evaluation of identified R&D gaps in fuel fabrication, relocation and dispersal
  - First of a kind approach using both in-pile and hot cell testing facilities
  - Novel in-situ instrumentation



Severe Accident Test Station

2023 | 2024 | 2025 | 2026 | 2027

9 experiments

TREAT LOCA Device Design, Fabrication, and Testing

TREAT-LOC-C Fresh Fuel, In-Pile LOCA Commissioning

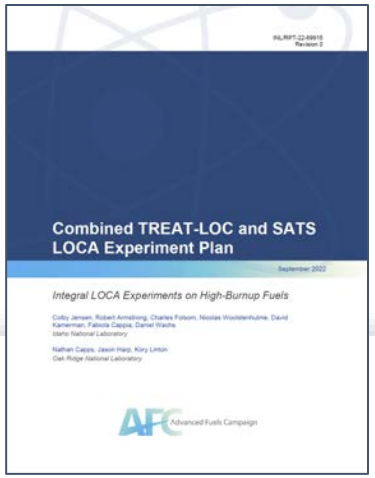
3 years, ~9 experiments/each facility

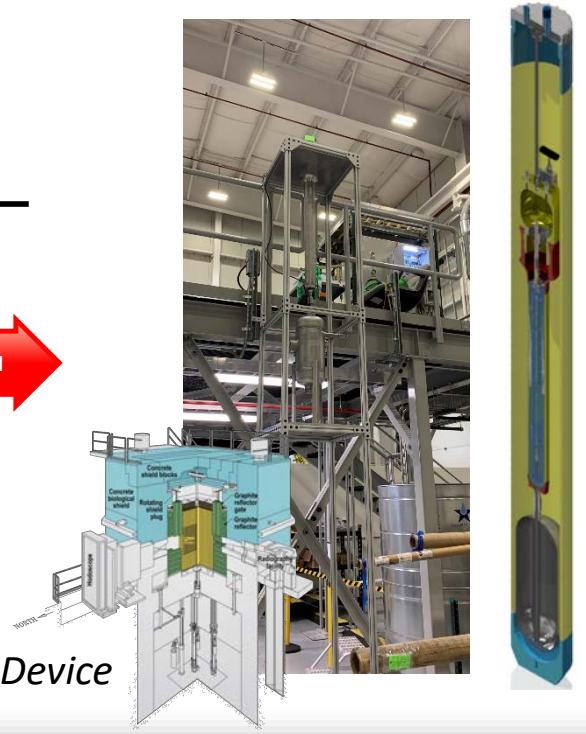
TREAT-LOC-HBu and SATS-HBu

- **Tieback testing to Halden/SCIP**
- **DEH and SEH heating conditions**
- **Burnups from 65-85 GWd/t**
- **Rod length and rod free volume effects**

Phase II

Reirradiation of commercial HBU fuel segments in ATR





TREAT TWIST LOCA Device

Summary

- **Communications and close coordination are key to program success.**
- **The current focus is on coated cladding and doped UO2 for near-term deployment.**
- **Enrichment levels to achieve higher burnup for ATF can be obtained without government assistance.**
- **DOE supports industry's needs with its unique test facilities and state-of-the-art examination facilities.**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