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

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U.S. Department of Energy's Accident Tolerant Fuel Program

U.S. Nuclear Regulatory Commission
Briefing on Accident Tolerant Fuel
February 25, 2020

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Office of Nuclear Energy
U.S. Department of Energy

Outline

- Background and History
- Our Industrial Team, National Laboratories, Universities, and International Collaborators
- Timeline for the Near-Term Coated Clad Concept (courtesy of NEI)
- Final Observations

Congressional Request Post Fukushima, 2012

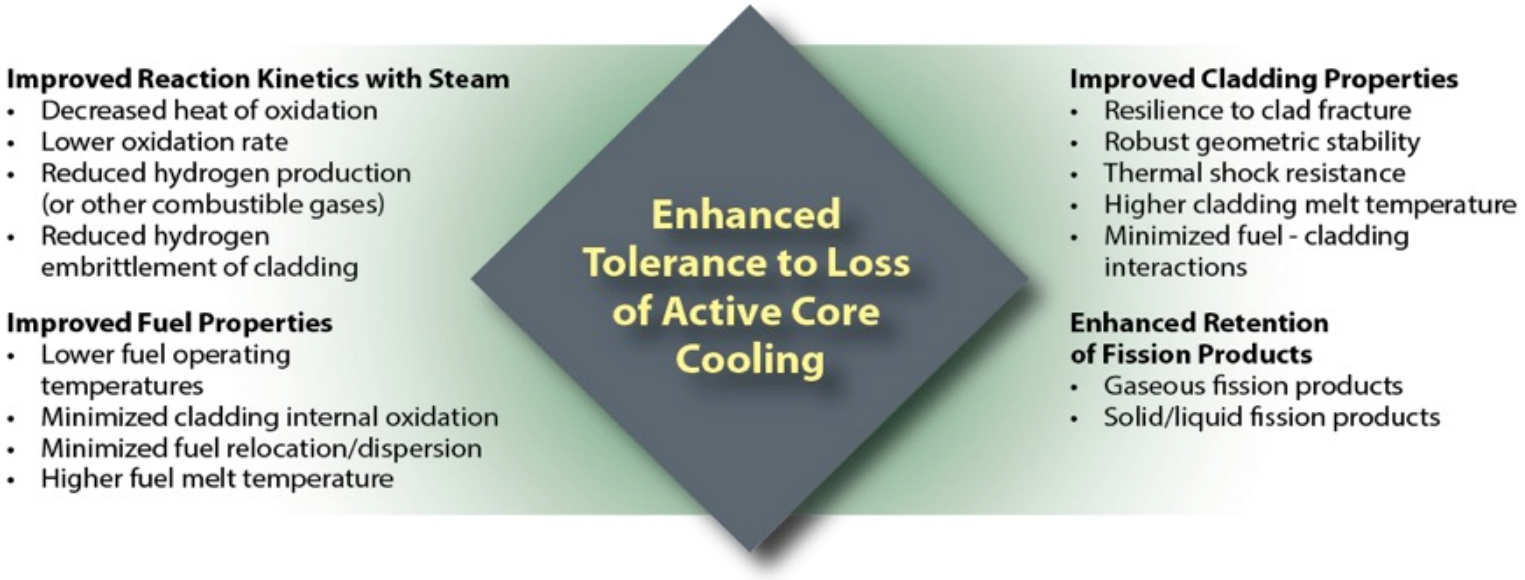
Following the accident at Fukushima, Congress requested the Department to start developing fuel with enhanced accident tolerance that can be used in existing light water reactors.

- "The Committee...urges that special technical emphasis and funding priority be given to activities aimed at the development and near-term qualification of melt-down resistant, accident-tolerant nuclear fuels that would enhance the safety of present and future generations of light water reactors"

  (Senate Appropriations Committee Report for FY 2012, S. 112-75)

Defining Accident Tolerant Fuel

Fuels with **enhanced accident tolerance** are those that, in comparison with the standard UO_2 – Zr system, can **tolerate loss of active cooling** in the core for a **considerably longer time period** (depending on the LWR system and accident scenario) while maintaining or improving the fuel performance during normal operations.



Program Participants

The Department of Energy supports all elements of the accident tolerant fuel program and facilitates coordination among program participants.

- Fuel vendor teams
- National laboratories
- Reactor owner/operators
- Universities
- International collaborations

Participating in independent regulatory oversight role:

- U.S. Nuclear Regulatory Commission

Our Team - Industrial Accident Tolerant Fuel Concepts Under Development

Framatome

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

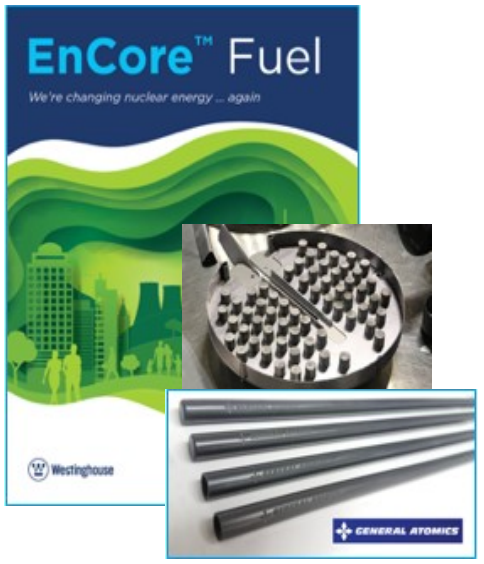
General Electric

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

GE imagination at work

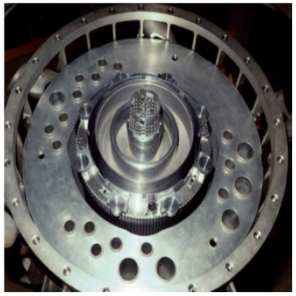
Westinghouse

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

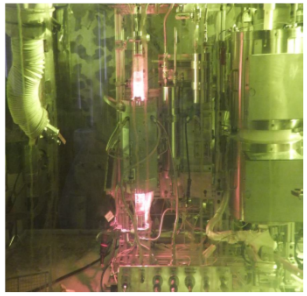


Our Team: The National Laboratories

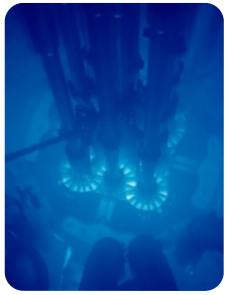
Test Facilities



High Flux Isotope Reactor



Severe Accident Test Station

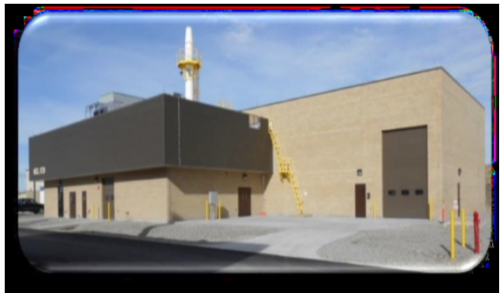


Advanced Test Reactor

Transient Reactor Test Facility

Examination Facilities

Hot Fuel Examination Facility



Irradiated Materials Characterization Laboratory

Thermal Property Cell within IMCL

Our Team: Universities and International Collaborations

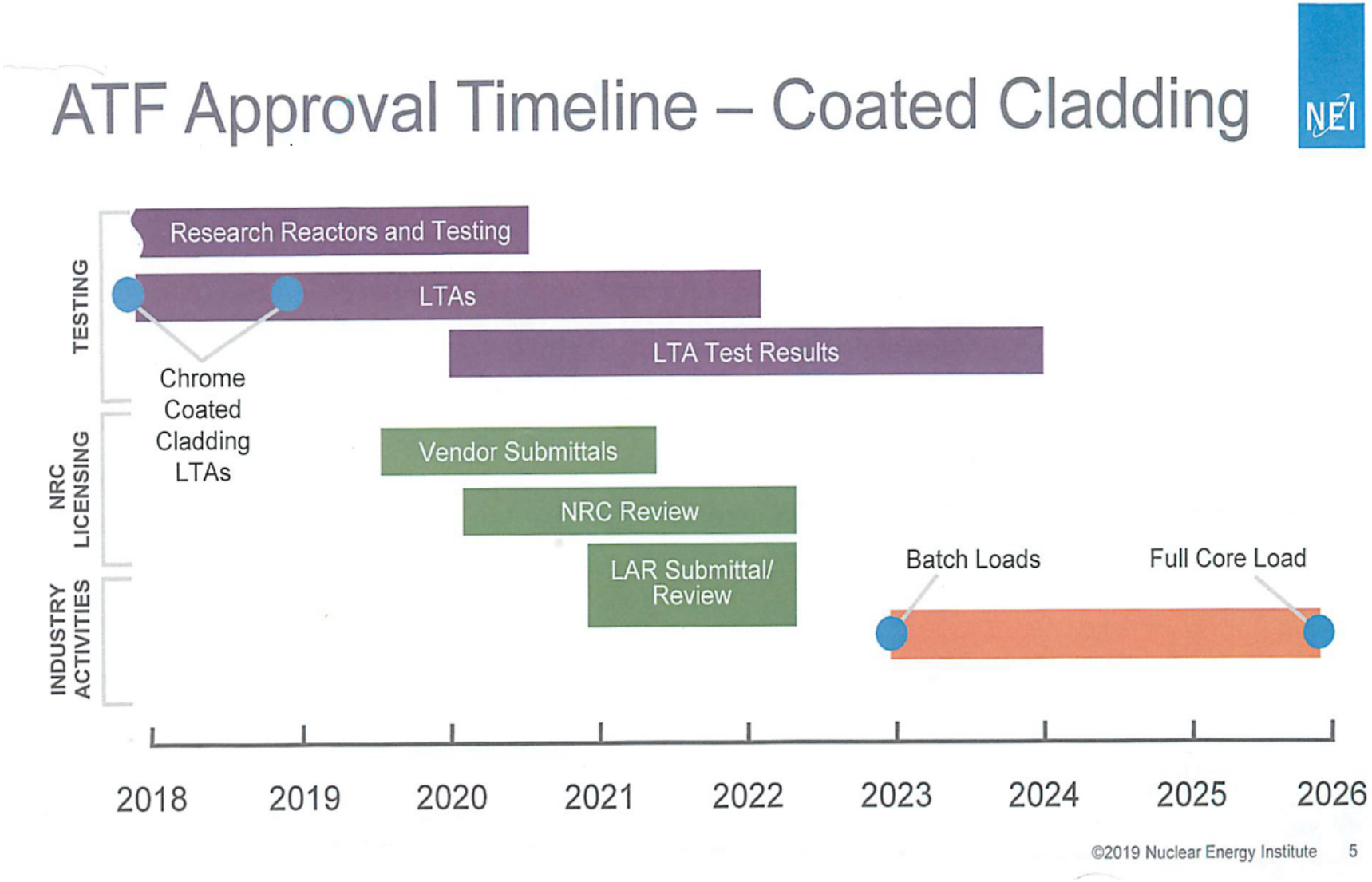
Universities

- MIT Integrated Research Project (2016-2018)
  - Data Gaps and Failure Modes
- Critical Heat Flux (2017)
  - Four projects
- Silicon Carbide Cladding (2018)
  - Six projects
- Coated Cladding: Advanced NDE, Radiation effects in TREAT (2019)
  - Two projects

International Collaborations

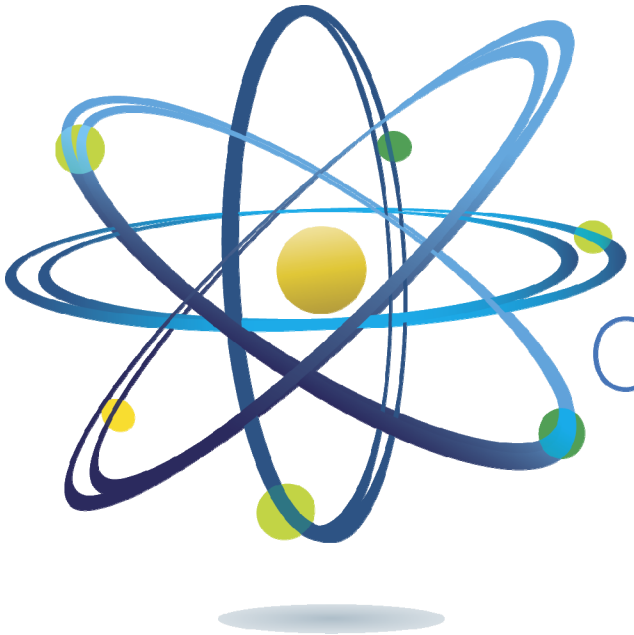
- OECD/Nuclear Energy Agency
  - Expert Group on Accident Tolerant Fuel
  - Working Group on Fuel Safety
  - Framework for Irradiation Experiments (FIDES)
- International Atomic Energy Agency
  - Coordinated Research Project on Accident Tolerant Fuels for Light Water Reactors

Timeline for the Near Term Coated Clad Concept 2018 - 2026



Final Observations

- **We have a great team with impressive participants: Industry, National Laboratories, Utility Representatives EPRI and the NEI**
- **All parties recognize the important, independent regulatory role of the NRC**
- **Significant progress has been made and the program is well on the road to meeting the spirit of the Congressional 2012 request**
- **However, we have significant future challenges:**
  - **Maintain the momentum with budget uncertainties**
  - **Effecting integration of High Burnup & Enrichment**
  - **Defining a post 2025 commercialization related conclusion**



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