U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

# NRC Code Development and Assessment for Accident Tolerant Fuel

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# Research Concentrates on 3 Areas

- Literature Reviews and PIRTs
- Computer Code Development
- Experimental Programs

# PIRTs Help Focus Our Research

- Lit reviews identify areas where more information would be useful
- PIRTs help focus on what is most important / least understood
- We have completed:
  - Severe accident (2020/2021) and Cr-coated in-reactor (2019) PIRTs
  - Lit reviews on in-reactor, storage, and transportation behavior

Completed reports can be found on the NRC website:
https://www.nrc.gov/reactors/atf/related-docs.html

# We Are Updating Our Codes for ATF

- SCALE
  - SCALE 6.3 will have additional ATF compositions and new dopant properties
- FAST
  - Material properties library (MatLib) makes it easy to add new properties
    - Properties available for FeCrAl, Cr-coating
  - Embedded Lua allows users to specify their own properties
    - Useful for proprietary models

# We Are Updating Our Codes for ATF

- TRACE
  - Coupling to FAST will allow
    - TRACE to benefit from FAST ATF development
    - FAST to benefit from TRACE thermal-hydraulic models
- MELCOR
  - New generalized oxidation model allows users to model FeCrAl, Cr-coated zirc
    - Validated for FeCrAl against QUENCH-19 experiment

# We Are Assessing Our Codes for ATF

- Assessments are based on available data
  - FAST assessment of doped fuel centerline temperature and fission gas release tests (TopFuel 2018)
  - MELCOR assessment of FeCrAl oxidation from QUENCH-19 test
  - SCALE assessments of
    - ATF/LEU+/HBU on decay heat
    - ATF/LEU+ on fresh fuel storage

# We Participate in Experimental Programs

- NRC collaborates with domestic and international partners
  - Meetings with DOE and national laboratories
  - International research programs
- Experiments will
  - Help improve understanding of ATF behavior
  - Provide data for code development and assessment

# We Participate in International Research

- QUENCH-ATF
  - Design basis and beyond design basis tests on bundle with Cr-coated cladding
- Framework for Irradiation Experiments (FIDES)
  - Reactivity-initiated accident tests on ATF samples
  - Cr-coated cladding creep tests
- Studsvik Cladding Integrity Project (SCIP-IV)
  - Some tests on additive fuels
- NEA Working Group on Fuel Safety
  - Led development of Technical Opinion Paper on ATF

# PIRTs, Codes, Experiments are Inter-Related