

UCS Perspectives on “Accident-Tolerant” Fuel

**Dr. Edwin Lyman
Director of Nuclear Power Safety
Climate and Energy Program
Union of Concerned Scientists**

January 24, 2023

Is “Accident-Tolerant” Fuel False Advertising?

- UCS strongly supports efforts to develop fuels that would genuinely increase safety
- But that no longer appears to be the main goal of the current “accident-tolerant” fuel (ATF) program
- “Because of the economic link between ATF technologies, higher burnup, and increased enrichment ... NRC staff considers the pursuit of higher burnup and increased enrichment a component of the ATF program”
– NRC ATF Licensing Project Plan, version 2.1 (2021)
- Raises the possibility that higher-burnup risks will outweigh the safety margins (if any) that accident-tolerant features might provide

ATF uncertainties

- Uncertainties and tradeoffs of ATF concepts relative to conventional fuels (even the “near-term” approaches) make it difficult to assess the overall safety benefits
 - FeCrAl cladding in particular
- NUREG/CR-7282/ERI-NRC/21-203, 2021:
 - “It is seen that there is conflicting information about the impact of doping on fission gas release behavior ...”
 - “The available literature is much more complete with respect to ATF design characteristics than with ... the behavior of ATF ... under severe accident conditions.”
 - “Within considerable variation, [ATF-related severe accident simulations] tend to confirm a widely held impression that ATF designs typically afford a *modest* increase in coping time and a reduction of hydrogen generation, *at least until very late times.*”

High-burnup/increased enrichment risks

- UCS is concerned about the EPRI “alternate licensing strategy” to allow fuel fragmentation, relocation, and dispersal (FFRD) to be excluded from large-break loss-of-coolant accident analysis
 - The potentially serious safety implications of FFRD must be fully assessed for any HBU fuel proposal
- Safety impacts of increased enrichment also must be thoroughly evaluated
 - Power peaking, lower control rod worth, recriticality
- 2021 NRC-led Phenomena Identification and Ranking Tables severe accident study examined ATF concepts and high-burnup/increased enrichment (HBU/IE) with conventional fuel/cladding, but did not consider ATF and HBU/IE together, even though that is the most likely batch loading that licensees will pursue

And don't forget the spent fuel

- Potentially deleterious impacts of alternative cladding materials and HBU/IE on spent fuel management and disposal should be fully assessed before batch loading is approved

The need for 50.46(c)

- The proprietary nature of much fuel design and performance data limits opportunities for public understanding of the basis for regulatory decisions and diminishes public confidence
- This is exacerbated by the absence of clear and consistent regulatory requirements for approving the safety of new fuel types
- Swift approval of the 50.46(c) rule by NRC would go a long way toward closing this gap

Acronyms

- **ATF: Accident-Tolerant Fuel**
- **ERI: Energy Research, Inc.**
- **FeCrAl: Advanced Stainless Steel**
- **FFRD: Fuel Fragmentation, Relocation, and Dispersal**
- **HBU: High Burnup**
- **IE: Increased Enrichment**
- **UCS: Union of Concerned Scientists**