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Environmental Evaluation of Accident Tolerant Fuels with Increased Enrichment and Higher Burnup Levels

**Comment On:** NRC-2023-0113-0001
Draft NUREG: Environmental Evaluation of Accident Tolerant Fuels With Increased Enrichment and Higher Burnup Levels

**Document:** NRC-2023-0113-DRAFT-0006
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## General Comment

See attached file(s)

## Attachments

NUREG 2266 COMMENTS

Public comment
Docket ID NRC–2023–0113

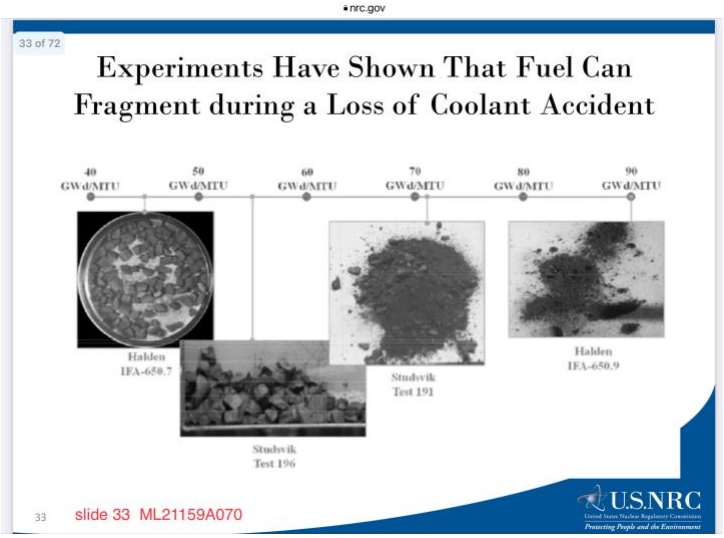
## NUREG 2266 will only aggravate the serious national spent fuel waste problem.

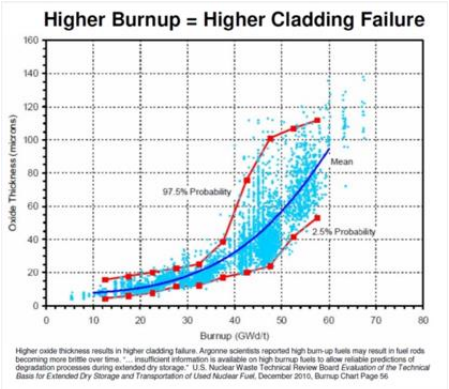
NUREG 2266 proposes to allow the generation of new, MUCH higher burnup spent fuel waste, while ignoring known and unresolved urgent problems with existing high burnup spent fuel waste and canisters. The NRC knows but ignores that existing high burnup fuel causes in-reactor hydride formation in the cladding, and on-going degradation mechanisms in storage, such as hydride reorientation, thinning and embrittlement of cladding. And the NRC continues to ignore the urgency of canister degradation concerns, including the lack of technology to identify, prevent or stop canister cracking.
The NRC has never provided a technical response to evidence of explosion risks with a breached canister. ML18269A037

The 2019 DOE Gap Analysis Report established high priority gaps. The highest priority gaps include canister corrosion, monitoring, assessment of consequence of canister failure, fuel transfer options, cladding hydrides, hydride reorientation, cladding embrittlement and fuel transfer options. https://www.osti.gov/servlets/purl/1592862

NUREG 2266's referenced **Continued Storage GEIS** document fails to address these issues.

**NUREG 2266 proposes allowing experimental ATF and MUCH higher burnups.**
The NRC knows that fuel with much higher burnup can suffer Fuel Fragmentation Relocation Distribution (FFRD) in a Loss of Cooling Accident (LOCA).
This could indicate that ATF is less (not more) resistant to a nuclear incident.




Evidence from over 4,400 measurements from commercial fuel-rods from reactors around the world show medium and high burnup fuel (>35 and >45 GWd/t) increases fuel cladding oxide thickness. This increases fuel damage and explosion risks from hydrides.

NUREG 2266 and supporting documents contain no technical documents showing that ATF cladding will prevent FFRD and / or cladding bursts in a LOCA.

No mitigation technology or strategy has been presented if significant numbers of cladding were to suffer FFRD and burst in the reactor. In addition, questions regarding containment and storage of damaged FFRD fuel remains unaddressed: What technology exists that could gather dispersed fine particles and small chunks of uranium pellets? How would the pulverized and dispersed FFRD fuel from large break be retrieved from the reactor? How would FFRD fuel be stored? In a spent fuel pool? In dry storage? What specific damaged fuel container systems could be used for fine highly irradiated uranium particles?
Justifications based on hope (of no LOCA occurring) is unacceptable.

Industry claims ATF will minimize cladding degradation issues.
But NRC's own Interim Staff Guidance, ATF ISG 2020-01, Appendix C, (ML19343A121) outlines a lengthy list of potential new damage mechanisms with chromium cladding.
For example, cracking and delamination contributing to nucleation sites could have the potential to cause hot spots and localized corrosion.
Also, "As described in Section 6.2.2 of the PIRT report, chromium coating may also impact the fuel rod ballooning characteristics under accident conditions. While no regulatory limits are currently defined to limit the extent of ballooning or the size of the rupture opening, concerns related to fuel fragmentation, relocation, and dispersal may warrant future SAFDLs for fuel rod burnup extensions beyond rod-average values of **62 gigawatt days per metric ton unit**."
NUREG 2266 suggests approving burn levels up to **80 GWd/MTU**.

DOE's High Level Gap Analysis for Accident Tolerant and Advanced Fuels for Storage and Transportation / Spent Fuel and Waste Disposition document states
"The lack of data with respect to potential storage and transportation degradation mechanisms for ATF/AF, especially for the expected higher burnups, higher temperatures and higher internal rod pressures, require a testing program… to ensure that the NRC requirement for preventing gross rupture is met."
"Based on the current knowledge of ATF cladding and fuel designs, attention should focus on damaged spent fuel particulate size and quantity; cladding coating robustness and potential corrosion and hydride potential in areas of damaged cladding coatings…."
The DOE's report lists gaps in knowledge and data which include: Consequence of Canister Failure, Fuel Fragmentation, Fuel Restructuring/Swelling, Fuel Oxidation, Creep, Embrittlement, Thermal Cycling, Hydrogen effects: Embrittlement and Reorientation, Delayed Hydride Cracking, Oxidation, and Wet Corrosion, Thermal Profiles, Stress Profiles, Drying Issues, Fuel Transfer Options. (https://www.osti.gov/servlets/purl/1813674)

**Chromium coated zirconium is in experimental stages and should not be credited for stopping hydride formation or cladding degradation.**
The NRC must not ignore evidence showing that ATF fuels are insufficiently analyzed.

**Other significant issues NUREG 2266 does not address include:**

**Source terms -** Source terms for ATF at the higher burnups have not been analyzed and are still under development.

**Power Uprates** – Industry plans for half the existing reactors to increase power uprates to double the capacity of existing aged reactors. slide 7 ML23242A078.
The NUREG fails to mention power uprates, or the potential "major and costly modifications, such as replacement of main turbines…. and analyses which span many technical disciplines and may be complex…" that must be reviewed by the NRC before license amendments would be permitted. "Components such as pipes, valves, pumps, heat exchangers, electrical transformers and generators must be able to accommodate the conditions that would exist at the higher power levels." https://www.nrc.gov/reactors/operating/licensing/power-uprates/about-power.html

**Where is the NRC's analysis of thermal shock to an aged, uprated embrittled reactor?**

The NUREG Summary states, "To support efficient and effective licensing reviews of new accident tolerant fuels (ATFs) and **to reduce the need for a complex site-specific environmental review** for each ATF license amendment request, this study evaluated the likely impacts of near-term ATF technologies with increased enrichment and higher burnup levels on the uranium fuel cycle, transportation of fuel and waste, and decommissioning of light-water reactors (LWRs) (i.e., **a bounding analysis**)."

NUREG 2266 does not establish a "bounding analysis" or the technical safety basis to be approved. **NRC's suggestion, through this NUREG, of broad sweeping approval of MUCH higher burnup and experimental ATF fuel would be a complete abdication of the NRC's job and responsibility.**

Because this NUREG could negatively affect many individual facilities, reactors and ISFSI's over a large geographical area over the long term (due to the forever nature of highly radioactive spent fuel waste), **NUREG 2266 requires a Programatic Environmental Impact Statement (PEIS).**

**Sincerely,**
**Kalene Walker**