

# **UCS Perspectives on Accident Tolerant Fuel**

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# **UCS position on accident-tolerant fuel**

- **UCS strongly supports the development of accident-tolerant fuels (ATF) as part of a comprehensive program to strengthen reactor safety after Fukushima**
- **Goal should be to increase safety margin and defense-in-depth, not to justify relaxing safety requirements (“margin exchange”)**
- **Although there may be ways to speed up the process without compromising safety, NRC should not weaken its licensing standards for ATF lead test assembly (LTA) or batch loading to meet unrealistic industry timelines**

# **Lead test assembly (LTA) licensing**

- **Industry is seeking blanket authorization for all ATF LTA demonstration programs**
  - **Without NRC review and approval (e.g. Exelon 3/8/18 Byron license amendment “request”)**
  - **Without exemptions from 10 CFR 50.46**
- **NRC staff issued “preliminary” positions generally supporting the industry in a June 29, 2017 letter**
- **Letter prompted a Differing Professional Opinion (DPO) and objections from a “number of staff members with significant licensing experience” (ACRS Subcommittee meeting, 2/23/2018), claiming the letter is a significant and questionable departure from past practice**
  - **Requirement for use of NRC staff-approved codes and methods**
  - **Need for 10 CFR 50.46 exemptions for non-Zircaloy, ZIRLO, UO<sub>2</sub>**

# **NRC confirmatory testing**

- **The Draft Project Plan on ATF assumes that “the NRC will not perform independent confirmatory testing for specific ATF designs. It is expected that all necessary data ... will come from DOE, industry, or other organizations.”**
- **At a minimum, it seems premature to make such a sweeping assumption -- issues may arise requiring confirmatory testing to resolve**
- **NRC must utilize all means necessary for ensuring its independence as a regulator**

# **Comments in NUREG-1802, September 2001**

**“... one can identify circumstances in which the NRC may ... find it necessary to reproduce experimental or analytical data generated by the industry, especially if there is reason to question the techniques, experimental conditions or assumptions used.” – E. Lyman**

# **Example: Breakaway oxidation times for ZIRLO**

- **Argonne and Westinghouse tests obtained different results for the breakaway oxidation time for hydrided ZIRLO cladding (NUREG/CR-6967, Yan, Burtseva and Billone 2009)**
  - **Argonne found significantly shorter times to breakaway oxidation in a certain temperature range than Westinghouse**
- **Discrepancies highlighted sensitivity of results to test and sample conditions and demonstrated importance of standardized testing: insights that may not have been apparent if Argonne had not conducted its own tests**

# **UCS position on LTAs**

- **The NRC must take dissenting staff views seriously and maintain LTA licensing practices, absent rigorous technical justification for changing them**
- **A “one size fits all” policy is not appropriate**
- **NRC review of LTA irradiation plans will provide opportunities for the early technical engagement that industry says it wants**
  - **Cooperation on LTA tests to ensure they provide the necessary data to support batch licensing**
  - **Collaboration on verification and validation of codes**

# **The most important way NRC can transform ATF licensing**

- **... is prompt issuance of the 10 CFR 50.46(c) final rule**
- **The draft final rule, SECY-16-0033, submitted to the Commission on March 16, 2016, more than two years ago, is intended in part to address safety problems known for more than two decades**
- **The final rule “provides a technology-neutral, performance-based approach for developing design-specific criteria” for compliance with emergency core cooling system performance requirements**
- **NRC says that performance-based reviews for advanced fuel licensing are key to the “Transformation Initiative,” yet this critical performance-based rule is in limbo, requiring ATF applicants to seek exemptions (or assert the rule doesn’t apply)**



# **It is premature to predict ATF economic benefits**

- **“Technologies such as ATF ... will affect large portions of the licensing basis, including security and ... EP. Traditional systems, such as safety-related electrical systems may not be needed.” – NEI, “A Framework for Regulatory Transformation,” March 2018**
- **The industry is jumping the gun here**
  - **Anticipated ATF behavior must be validated with rigorous testing; some features may not pan out**
  - **Changing cladding and fuel design will have many consequences, some beneficial and some adverse**
  - **Possible need for increased fuel density and/or enrichment > 5% raises new safety issues**

# Risk and ATF

- **“While accident resistance and risk reduction are highly desirable, they are not as easily quantifiable as other physical criteria ... the concept of risk reduction in advanced cladding materials is ... more technically challenging to quantify because it cross-cuts all the measurable physical properties.” – Idaho National Laboratory, “Advanced LWR Nuclear Fuel Cladding System Development Trade-Off Study,” Sept. 2012**
- **ATF behavior must be demonstrated before its properties can be credited in probabilistic risk assessments (PRAs)**
- **Risk significance cannot be assessed until PRAs have been fully revised and validated**

# **Role of advanced modeling and simulation**

- **NEI wants the NRC to embrace advanced modeling and simulation in ATF regulatory reviews instead of experimental data (2/5/2018 letter to May Ma)**
- **While advanced modeling and simulation may help in improving understanding of fuel behavior, the codes must be extensively verified and validated before they can be useful for licensing**
- **UCS notes that the NRC staff “is not aware of any computational tool that obviates the need for experimentation to support licensing decisions”**

# **ATF development timelines**

- **New fuel/cladding development takes 20-25 years**
  - **Painstaking process**
  - **NRC licensing not likely the rate-limiting step**
- **Industry hopes to see full-scale ATF deployment by 2023-2026 – accelerating schedule by 5-10 years**
- **First test irradiation samples loaded 4 years ahead of schedule: moving too fast?**
  - **Why was Hatch unable to load fueled FeCrAl segments, as anticipated in its Oct. 2017 Information Report (NEDO-33884)?**
- **Impact on fuel cycle must be taken into account**
- **ATF development must not take safety shortcuts**
  - **deployment is pointless if it introduces new safety risks and increases uncertainty**

# **A modest proposal**

- **Test reactor irradiation capacity issues**
  - **Advanced Test Reactor limitations**
  - **Possible Halden shutdown in 2020**
- **Impact of LTA testing on plant operations**
- **Perhaps DOE (or an industry consortium) should purchase and convert for ATF testing one or two power reactors (PWR and BWR) slated for shutdown for economic reasons**
- **Potentially a far quicker and cheaper option for qualifying LWR ATF than DOE's plan to build a "versatile fast test reactor" (a \$3 billion, > 10 year project)**

# Acronyms

- **ATF: Accident Tolerant Fuel**
- **ATR: Advanced Test Reactor**
- **EP: Emergency Preparedness**
- **LTA: Lead Test Assembly**
- **PRA: Probabilistic Risk Assessment**
- **UCS: Union of Concerned Scientists**