

UCS Perspectives on Part 53

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The foundation of a new reactor licensing rule

- A new reactor licensing rule should
 - Clearly provide for levels of safety, security, and environmental protection at least equivalent to the operating fleet
 - Or preferably, *greater* levels than the operating fleet
 - Employ “risk-informed” provisions only to the extent that state-of-the-art risk assessment methods allow
 - Maintain robust defense-in-depth
 - Contain clear requirements for prototype testing
 - Reject provisions that could result in disproportionate outcomes to disadvantaged communities

The Part 53 process is broken

- Although UCS appreciates the greater degree of public engagement for developing the draft rule language required in SRM-SECY-0020-0032, the “intermittent” and “iterative” process has been ineffective and inefficient, and the high degree of industry involvement threatens to compromise the NRC’s regulatory independence
 - What was intended to be a flexible, technology-inclusive approach has split into at least three alternatives
- Following the next release of draft language, UCS recommends that a more conventional notice-and-comment rulemaking process be restored, and that the NRC consider developing a regulatory basis document

Part 53 should be scrapped

- Development of a “technology-inclusive” rule does not require starting from scratch and rewriting the entire rule book
- The population of new reactor designs that the NRC is likely to receive for review for many years to come is not actually that diverse
 - Coolants: liquid-metal, gas, molten salt
 - Fuels: metal, TRISO, molten salt
 - Size: very small (<20 MWe), small (<300 MWe); medium (<600 MWe)
- The accident spectrum is fairly well-characterized for many of these design categories

Alternative approach

- Rather than a new part, NEIMA's intent can be addressed through a series of appendices to Parts 50/52
 - Coolant-specific, size-specific, and fuel specific
- Each appendix specifies
 - All regulations in Parts 50/52 that are not applicable
 - Design-specific alternatives for inapplicable requirements that correspond to a safety or security function (e.g. 50.46)
- Anticipated operational occurrences, design-basis accidents, and severe accidents determined through a structured process such as the Licensing Modernization Project, with sufficient error bars on frequency estimates to adequately encompass uncertainties
- Should be complemented with a requirement to conduct “systematic searches for hazards, initiating events, and accident scenarios,” as recommended by ACRS

Core safety approach

- To ensure a clear correspondence with requirements for the operating fleet, fundamental defense-in-depth principles for AOOs and DBAs should be maintained on an equivalent level, including safety-related SSCs and the single-failure criterion
- Severe accident risks should not be greater than those for the operating fleet (more on this later)

Alternative approach

- Part 53 will duplicate—or may even be inconsistent with—other rulemakings taking place for new reactors
 - Limited-scope security
 - EP requirements
- The risk-informed licensing approach should focus first and foremost on the design and construction of the plant
 - Requirements covered by other parts of the regulations should remain where they are
 - risk-informed voluntary alternatives should be available once designs have been approved (or demonstrated)
- A structured approach is needed for “application of analytical safety margins to operating flexibilities” to ensure sufficient layers of defense-in-depth are maintained

Severe accidents and the use of PRA

- There is no credible way to “risk-inform” licensing without a PRA other than providing defense-in-depth measures with unquantified risk benefits—i.e. a deterministic approach
- There is no plausible way to define a “maximum credible accident” without a PRA (“maximum credible” implies a likelihood threshold)

Role of Quantitative Health Objectives in licensing

- The QHOs are not adequate metrics for incorporation as regulatory requirements
 - Magnitude is too high
 - latent fatality QHO corresponds to CDFs from 5×10^{-4} for an open containment (NUREG-1860) to 4×10^{-2} for a frequency-weighted average risk (2018 EPRI Margins study), compared to an average of 5×10^{-5} for the operating fleet
 - Do not include societal risks (land contamination)
 - Are based on population-averaged radiological risks that are insensitive to the disproportionate effects of ionizing radiation on disadvantaged populations such as Black people

Conclusion

- The 9-month extension in the Part 53 schedule should provide some room for the NRC to reconsider the direction of the rulemaking
- UCS recommends a more modest approach that preserves the foundational principles underlying the current rules, while providing for design-specific

Acronyms

- **AOO: Anticipated Operational Occurrence**
- **CDF: Core Damage Frequency**
- **DBA: Design-Basis Accident**
- **PRA: Probabilistic Risk Assessment**
- **TRISO: Tristructural Isotropic**
- **QHOs: Quantitative Health Objectives**
- **SSCs: Structures, Systems, and Components**
- **UCS: Union of Concerned Scientists**