Changes to the ATF Project Plan

U.S. NRC Public Meeting
July 22, 2021
10:00 am – 12:00 pm

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

Introductions and Meeting Logistics

Welcome

- Joe Donoghue – Director, Division of Safety Systems

NRC Staff Presenters

- Michael Wentzel, NRR – ATF Lead Project Manager
- Joey Messina, NRR – Technical Reviewer, Nuclear Codes Branch

- Participants will be on mute until the presentations are complete.
- The NRC will call on those with their hands up one at a time to provide feedback.
- Today's meeting is an Observation meeting. The public will have an opportunity to participate prior to the end of the meeting.
- No regulatory decisions will be made at today's meeting.

Purpose

- Provide an overview of changes being made to the NRC's ATF Project Plan and solicit feedback on those changes.

REVISION 1.2 OF THE ATF PROJECT PLAN

Michael Wentzel
Lead ATF Project Manager
Office Of Nuclear Reactor Regulation

ATF Project Plan

- Designed to:
  - Increase regulatory stability and certainty
  - Enhance and optimize NRC review

- How to accomplish the above goals?
  - Increased stakeholder engagement
  - Proactive licensing activities
  - Independent confirmatory calculations

Project Plan Revision 1.2

The NRC staff is revising the Plan because:

- Change in industry plans
- NRC accomplishments and activities
- Streamlining to improve useability

Significant Changes in Revision 1.2

- General status updates
- Increased focus on managing schedule risk
- New Appendix A
- New Appendix B

Managing Schedule Risk

- Enhanced focus on effectiveness of new paradigm by clarifying certain activities considered key to success.

- Updated to include areas not previously considered.

New Appendix A

- Information in previous Appendix A incorporated back into the body of the Plan.

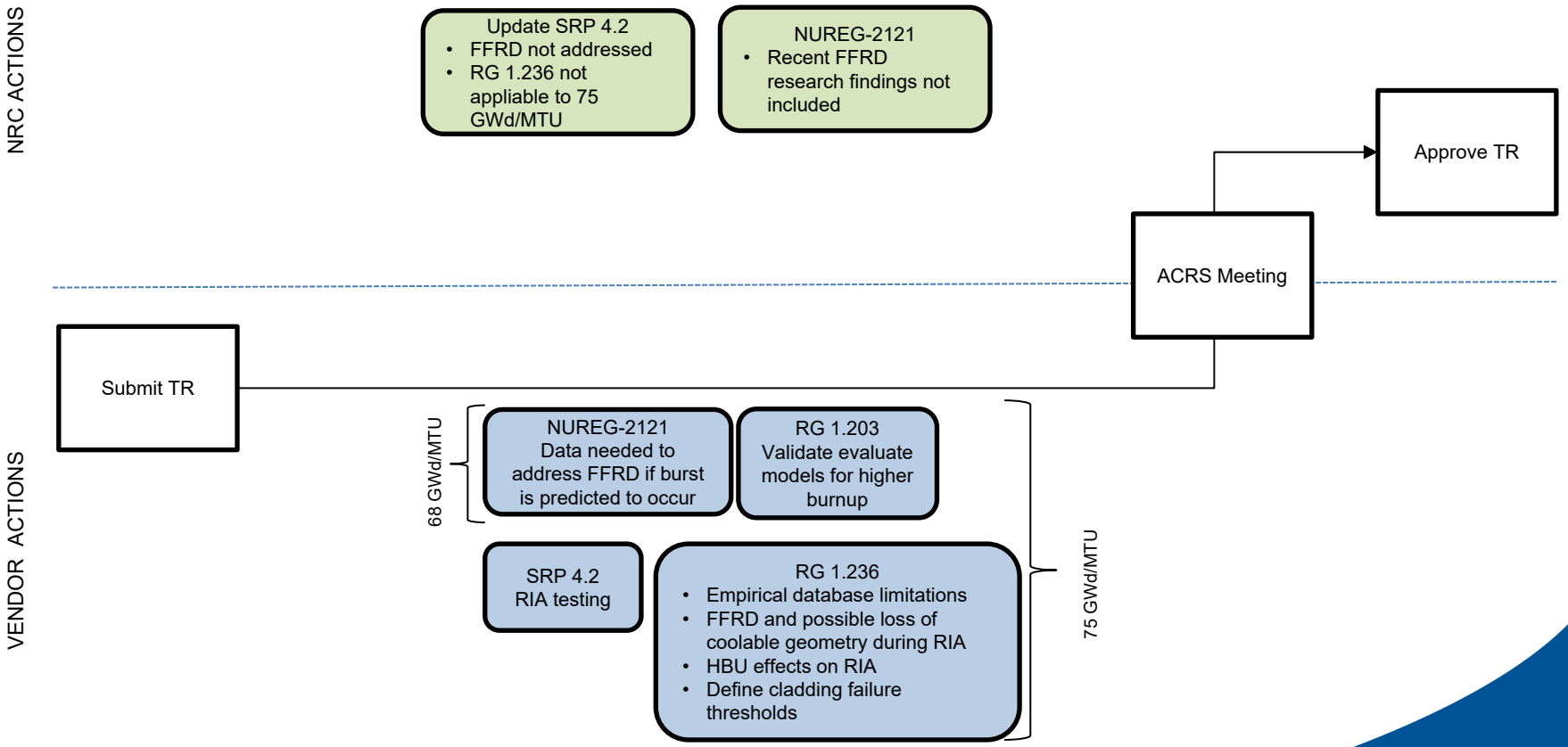
- Replaced with the Regulatory Framework Applicability Assessment.

New Appendix B

- Information in Appendix B replaced with the Licensing Pathway Diagrams.

Licensing Pathways

Higher Burnup Topical Report Reviews



Regulatory Framework Applicability Analysis

Joseph Messina
Nuclear Methods and Fuels Branch
Office of Nuclear Reactor Regulation

Purpose

- Improve upon the initial scoping study presented in Tables A.1, A.2, and A.4 in the previous revision of the ATF Project Plan
- Evaluate the applicability of existing regulations and guidance, as well as identify any updates needed

Initial Scoping Study

- An initial, rough scoping study was presented in Appendix A of the Project Plan

Table A.1 Potentially Affected Regulations

Regulation (10 CFR)	Title	Affected by:	
		Burnup	Enrichment
50.34	Contents of Applications; Technical Information	✓	✓
50.46	Acceptance Criteria for Emergency Core Cooling Systems for Light Water- Nuclear Power Reactors	✓	✓
50.67	Accident Source Term	✓	✓
50.68	Criticality Accident Requirements		✓
50, Appendix I	Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low as is Reasonably Achievable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents	✓	✓
50, Appendix K	ECCS Evaluation Models	✓	✓
51	Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions (specifically, Tables S-3 and S-4)	✓	✓
70.24	Criticality Accident Requirements		✓
100	Reactor Site Criteria	✓	✓

Table A.2 Potentially Affected Guidance

Guidance Document	Title	Affected by:	
		Burnup	Enrichment
NUREG-0630	Cladding Swelling and Rupture Models for LOCA Analysis	✓	
NUREG-0800	Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition (Section 4.2, "Fuel System Design" in particular for burnup)	✓	✓
NUREG-1465	Accident Source Terms for Light-Water Nuclear Power Plants	✓	✓
NUREG-1555	Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan	✓	✓
NUREG-2121	Fuel Fragmentation, Relocation, and Dispersal During the Loss-of-Coolant Accident	✓	
NUREG/CR-7022 Vol. 1-2	FRAPCON-3.5	✓	✓
NUREG/CR-7023 Vol. 1-2	FRAPTRAN 1.5	✓	✓
NUREG/CR-7024	Material Property Correlations: Comparisons Between FRAPCON-3.5, FRAPTRAN 1.5, and MATPRO	✓	✓
NUREG/CR-7219	Cladding Behavior During Postulated Loss-of-Coolant Accidents	✓	
RG 1.183	Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors	✓	✓
RG 1.195	Methods and Assumptions for Evaluating Radiological Consequences of Design Basis Accidents at Light-Water Nuclear Power Reactors	✓	✓
RG 1.203	Transient and Accident Analysis Methods	✓	✓
DG 1327	Pressurized Water Reactor Control Rod Ejection and Boiling Water Reactor Control Rod Drop Accidents	✓	✓

Regulatory Framework Applicability Analysis

- NRC staff has been working to more thoroughly assess its regulatory framework and expand Tables A.1, A.2, and A.4 in the Project Plan
- This applicability analysis assesses the NRC's regulatory framework to specifically:
  - identify regulations and guidance that are impacted,
  - whether pertinent regulations and guidance do not speak to phenomena unique to high burnup, increased enrichment, or near-term ATF concepts
  - how those could be addressed,
  - and who may need to take an action to facilitate closure

Example 1

Regulatory Guide or Regulation	Burnup to 68 GWd/MTU	Burnup to 75 GWd/MTU	^{235}U Enrichment beyond 5.0 wt%	Chrome-coated Zirconium Cladding	Doped UO_2 Fuel Pellets
NUREG-0630 Cladding Swelling and Rupture Models for LOCA Analysis	• Not fully applicable • Reason: NUREG-0630 models are hot-rod models and thus do not consider interactions between rods. Interactions between rods affect swelling and rupture behavior, which will impact the amount of fragmented fuel that may disperse, so should not be neglected. Closure: Interactions between rods should be considered for swelling and rupture modelling. • Reason: HBU rod internal pressures may exceed the rod internal pressures of the data provided in NUREG-0630 Closure: If the NUREG-0630 data is desired to be used, it should be shown that HBU rod internal pressures are bounded by the data provided in NUREG-0630.	• Not fully applicable • Reason: NUREG-0630 models are hot-rod models and thus do not consider interactions between rods. Interactions between rods affect swelling and rupture behavior, which will impact the amount of fragmented fuel that may disperse, so should not be neglected. Closure: Interactions between rods should be considered for swelling and rupture modelling. • Reason: HBU rod internal pressures may exceed the rod internal pressures of the data provided in NUREG-0630 Closure: If the NUREG-0630 data is desired to be used, it should be shown that HBU rod internal pressures are bounded by the data provided in NUREG-0630.	• Fully applicable • No data gaps	• Not fully applicable • Reason: Cladding swelling and burst data presented is from bare zircaloy cladding, so should not be used if the benefits of coated cladding are to be realized. Closure: As stated in coated cladding ISG (ML19343A121), if NUREG-0630 is used, it would be useful to show that data bounds the performance of the coated cladding, or if new burst stress and ballooning strain limits are proposed, a significant body of data would be useful to demonstrate that the degree of swelling will not be underestimated. • Framework / approach described for modeling swelling and rupture remains fully applicable.	• Fully applicable • No data gaps

Note: Green text indicates the NRC may have an action to facilitate closure.
Blue text indicates that the industry may have an action to facilitate closure.

Regulatory Guide or Regulation	Burnup to 68 GWd/MTU	Burnup to 75 GWd/MTU
NUREG-0630 Cladding Swelling and Rupture Models for LOCA Analysis	• Not fully applicable • Reason: NUREG-0630 models are hot-rod models and thus do not consider interactions between rods. Interactions between rods affect swelling and rupture behavior, which will impact the amount of fragmented fuel that may disperse, so should not be neglected. Closure: Interactions between rods should be considered for swelling and rupture modelling. • Reason: HBU rod internal pressures may exceed the rod internal pressures of the data provided in NUREG-0630 Closure: If the NUREG-0630 data is desired to be used, it should be shown that HBU rod internal pressures are bounded by the data provided in NUREG-0630.	• Not fully applicable • Reason: NUREG-0630 models are hot-rod models and thus do not consider interactions between rods. Interactions between rods affect swelling and rupture behavior, which will impact the amount of fragmented fuel that may disperse, so should not be neglected. Closure: Interactions between rods should be considered for swelling and rupture modelling. • Reason: HBU rod internal pressures may exceed the rod internal pressures of the data provided in NUREG-0630 Closure: If the NUREG-0630 data is desired to be used, it should be shown that HBU rod internal pressures are bounded by the data provided in NUREG-0630.

Applicability: identified as fully applicable or not fully applicable

Reason(s) stated for why the regulation or guidance is not fully applicable

If closure is necessary and has been identified, it is listed here

Example 2

Regulatory Guide or Regulation	Burnup to 68 GWd/MTU	Burnup to 75 GWd/MTU	^{235}U Enrichment beyond 5.0 wt%	Chrome-coated Zirconium Cladding	Doped UO_2 Fuel Pellets
RG 1.203 Transient and Accident Analysis Methods	• Fully applicable • Note: Vendors will need to validate their evaluation models to higher BU.	• Fully applicable • Note: Vendors will need to validate their evaluation models to higher BU.	• Fully applicable • Note: Vendors will need to validate their evaluation models to higher enrichments	• Fully applicable • Note: 50.46 requirements are discussed, so this RG is only *fully* applicable pending an accepted exemption to 50.46. See discussion on 50.46 for more details. • Note: Vendors will need to update and validate their evaluation models to consider coated cladding	• Fully applicable • Note: 50.46 requirements are discussed, so this RG is only *fully* applicable pending an accepted exemption to 50.46. See discussion on 50.46 for more details. • Note: Vendors will need to update and validate their evaluation models to consider doped fuel

Next Steps

- Update the Regulatory Framework Applicability table and develop and pursue expanding range of applicability, if necessary
- The Regulatory Framework Applicability table is replacing Tables A.1, A.2, and A.4 in the updated ATF Project Plan version 1.2.

NRC/Industry Discussion

Additional feedback can be provided at

accident_tolerant_fuel@nrc.gov

Public Questions

For further information, please visit https://www.nrc.gov/reactors/atf.html