Advanced Reactor Stakeholder Public Meeting

December 7, 2023

Microsoft Teams Meeting

Bridgeline: 301-576-2978

Conference ID: 977 164 568 #

Time	Agenda	Speaker
10:00 am – 10:10 am	Opening Remarks	NRC
10:10 am – 10:15 am	Advanced Reactor Integrated Schedule	NRC
10:15 - 10:25 am	Advanced Reactor Digital Instrumentation & Control Workshop Announcement	NRC
10:25 - 10:55 am	Micro-Reactor Next Steps	NRC
10:55 - 11:05 am	BREAK	
11:05 - 11:20 am	Overview and Recent Experience with the NRC's Application Acceptance Review Processes	NRC
11:20 - 11:50 am	Final Rule on Emergency Preparedness for Small Modular Reactors (EPSMR) and Other New Technologies	NRC
11:50 am - 1:00 pm	LUNCH BREAK	
1:00 - 2:00 pm	Selection of a Seismic Scenario for an EPZ Boundary Determination	NEI/NRC

Time	Agenda (Continued)	Speaker
2:00 - 2:30 pm	Options for Optimizing Hearing Opportunities Associated with Two-Part Applications	NRC
2:30 - 2:40 pm	Closing Remarks	NRC
2:45 pm	Adjourn	

Advanced Reactor Integrated Schedule of Activities (Slide 1 of 2)

- Micro-Reactor Licensing and Deployment Considerations: Fuel Loading and Operational Testing at a Factory – SECY paper publication expected soon

- NRC and Nuclear Energy Institute (NEI) discussion on Draft NEI 23-01, "Operator Cold License Training Plan for Advanced Nuclear Reactors" – public meeting on Dec. 14

- Draft Regulatory Guide (DG)-4034 (RG 4.7, Rev. 4), "General Site Suitability Criteria for Nuclear Power Stations"
  - Publication on Oct. 12 (ML23123A090) & related public meeting on Oct. 27
  - *Federal Register* Notice for public comment published on Oct. 18, public comment period closed on Nov. 17, 2023
  - Staff reviewing public comments received from NEI (ML23326A031), NuScale Power, LLC (ML23326A030), and The Breakthrough Institute (ML23326A032)

Advanced Reactor Integrated Schedule of Activities (Slide 2 of 2)

- Public Outreach Meeting for the Forthcoming TerraPower Natrium Demonstration Reactor Construction Permit Application held on Nov. 7 in Kemmerer, Wyoming
- Advanced Reactor Content of Application Project (ARCAP)/Technology Inclusive Content of Application Project (TICAP) Guidance Documents – Advisory Committee on Reactor Safeguards (ACRS) briefing on Dec. 6
- Material Compatibility Interim Staff Guidance – publication of final version expected this calendar year

NEW INTEGRATED SCHEDULE

PUBLIC RELEASE PENDING

egulatory Activities Integrated Schedule

integrated review schedule is based on six core strategies described in our implementation action plan, an

ties to ensure review readiness for anticipated advanced reactor applications.

THE FUTURE IS NOW

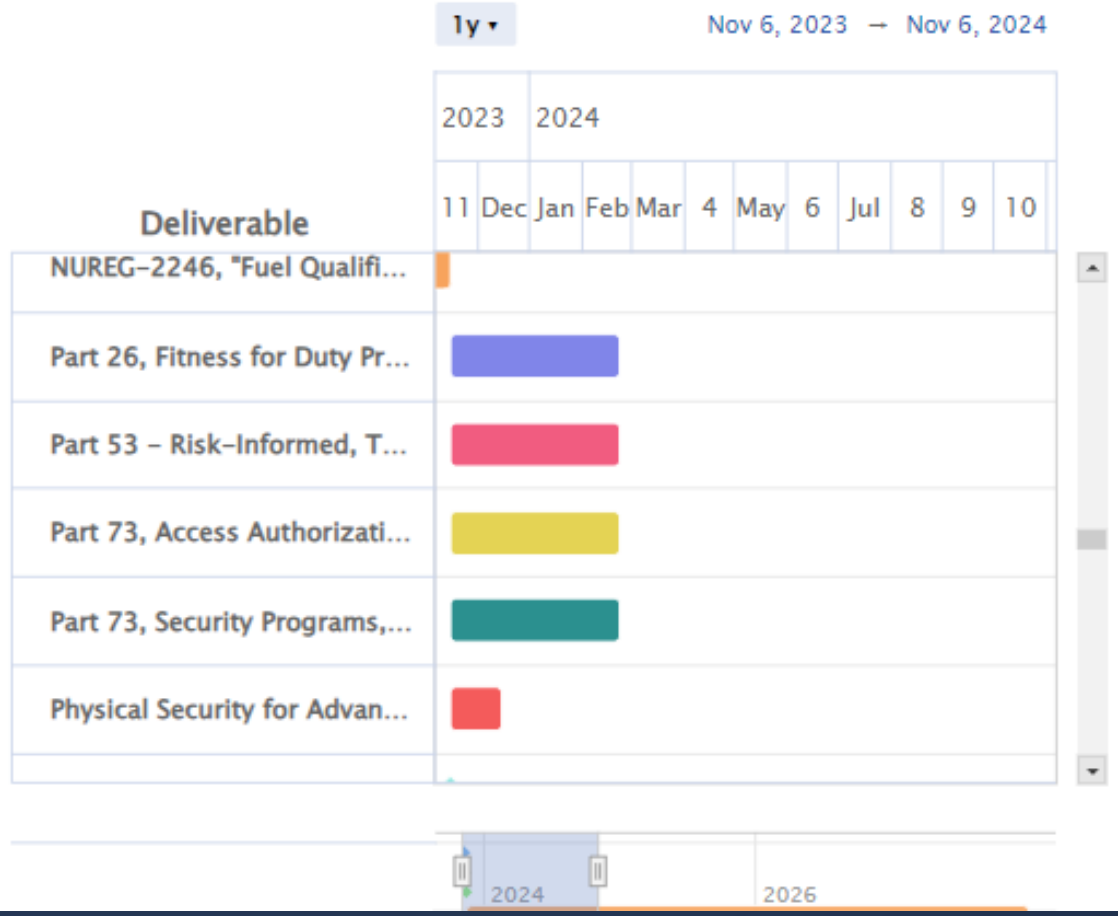
Advanced Reactor Implementation Action Plan

NRC's approach to advancing risk-informed, performance-based and consequence oriented approaches, and resolution of key policy issues.

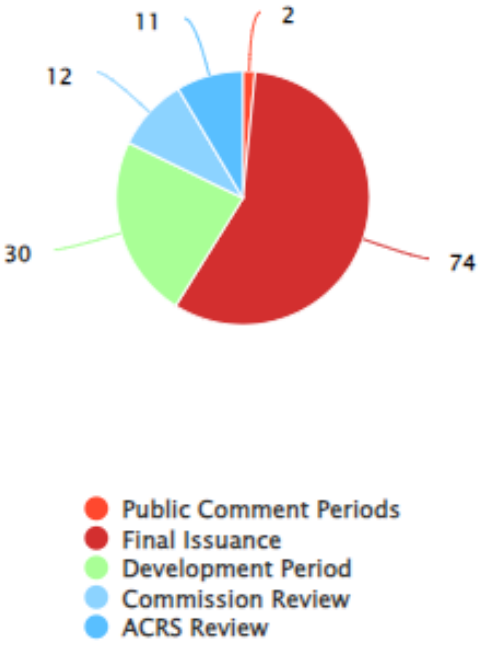
ISD Dashboard

GRAPHS

Deliverables Schedule



Milestone Status



DELIVERABLES

Clear Filters | Regulatory Applicability | Filter

Deliverable	Lead	Topic	Project Manager	Next Milestone	Milestone Completion	Project Completion	Description	Strategy	Acti
Deliverable							Description		
(LEAD) ARCAP/TICAP	L		Sebrosky, Joseph				-		
(LEAD) DEVELOPMENT OF NON-LWR COMPUTER MODELS AND ANALYTICAL TOOLS - CODE ASSESSMENT REPORTS	L	Codes	Armstrong, Ken			12/31/2027	-	2: Computer Codes and Review Tools	
(LEAD) PART 50/52 UPDATES	L						-		
(LEAD) PART 53 RULE	L					7/31/2025	-		
(LEAD) REVIEW OF NON-LWR FUEL CYCLE ASSESSMENT OF REGULATORY INFRASTRUCTURE	L	Guidance	Piotter, Jason				-	3: Flexible Review Processes	
Alloy 617 Code Cases (N-872 and N-898)			Chereskin, Alexander				-	4: Consensus Codes and Standards	
Annual Fees for Non-Light Water Reactors and Microreactors		Policy Issues	Cubbage, Amy				-	5: Policy and Key Technical Solutions	
ARCAP - Chapter 10 - Occupational Doses Interim Staff Guidance		Guidance	Orenak, Michael	ACRS Review	11/16/2023	1/30/2024	ARCAP Chapter 10 - occupational doses interim staff guidance	3: Flexible Review Processes	

DELIVERABLES

Clear Filters

Regulatory Applicability

Filter

Deliverable	Lead	Topic	Project Manager	Next Milestone	Milestone Completion	Project Completion	Description	Strategy	Action
Delivera				Cc			Description		
Develop draft Generic Environmental Impact Statement for Advanced Reactors. Final GEIS.*(Has been voted to rulemaking by Comm.)		Rulemaking	Sutton, Mallecia	Commission Review	11/30/2023	11/30/2023	-	3: Flexible Review Processes	
DG-5075 Part 73, Establishing Cybersecurity Programs For Commercial Nuclear Plants Licensed Under 10 CFR Part 53		Guidance	O'Driscoll, James	Commission Review	2/23/2024	2/23/2024	Programs - Cyber Security	3: Flexible Review Processes	
Draft DRO-ISG-2023-01, "Operator Licensing Programs"		Guidance	Font, Ossy	Commission Review	2/23/2024	12/31/2022	Part 53, Subpart F (This draft ISG was used for early stakeholder and ACR...	3: Flexible Review Processes	

DELIVERABLES

Clear Filters

Regulatory Applicability

Filter

Deliverable	Lead	Topic	Project Manager	Next Milestone	Milestone Completion	Project Completion	Description	Strategy	Action
Deliverat				F			Description		
DG-4034 (RG 4.7. Rev4) - General Site Suitability Criteria for Nuclear Power Stations		Guidance	Sosa, Belkys	Public Comment Period	11/17/2023	2/29/2024	This regulatory guide (RG) describes the major site characteristics related…	5: Policy and Key Technical Solutions	
RG 1.242 - Performance-Based Emergency Preparedness for Small Modular Reactors, Non-Light-Water Reactors, and Non-Power Production or Utilization Facilities		Guidance	Cubbage, Amy	Public Comment Period	11/15/2023		Programs- Performance-Based Emergency Preparedness for Small…	3: Flexible Review Processes	

DELIVERABLES

Clear Filters

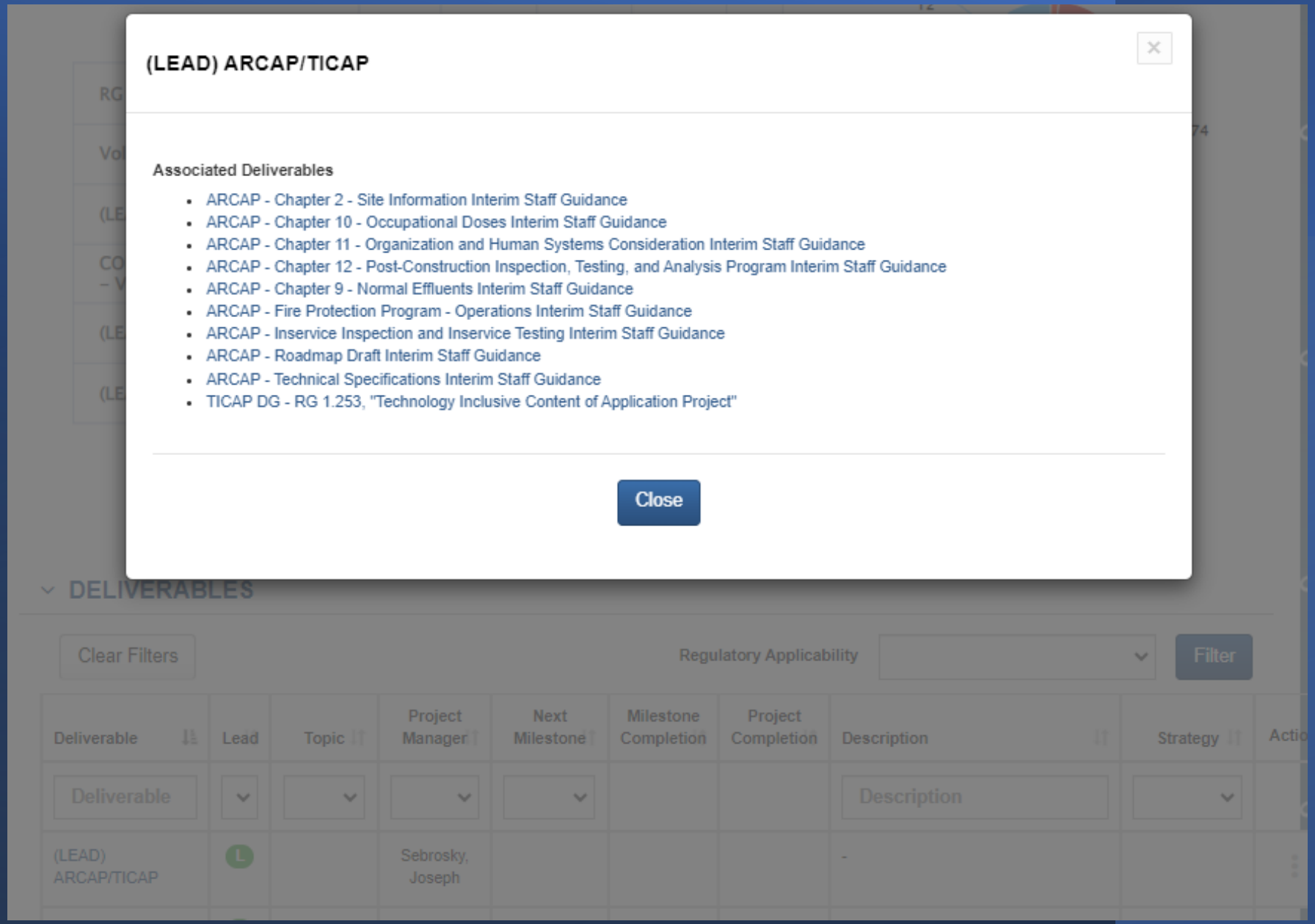
Regulatory Applicability

Filter

Deliverable	Lead	Topic	Project Manager	Next Milestone	Milestone Completion	Project Completion	Description	Strategy	Action
Deliverable							Description		
(LEAD) ARCAP/TICAP	L		Sebrosky, Joseph				-		
(LEAD) DEVELOPMENT OF NON-LWR COMPUTER MODELS AND ANALYTICAL TOOLS - CODE ASSESSMENT REPORTS	L	Codes	Armstrong, Ken			12/31/2027	-	2: C Re	
(LEAD) PART 50/52 UPDATES	L						-		
(LEAD) PART 53 RULE	L					7/31/2025	-		

View Associated Deliverables

View Regulatory Applicability


(LEAD) ARCAP/TICAP
Associated Deliverables
ARCAP - Chapter 2 - Site Information Interim Staff Guidance
ARCAP - Chapter 10 - Occupational Doses Interim Staff Guidance
ARCAP - Chapter 11 - Organization and Human Systems Consideration Interim Staff Guidance
ARCAP - Chapter 12 - Post-Construction Inspection, Testing, and Analysis Program Interim Staff Guidance
ARCAP - Chapter 9 - Normal Effluents Interim Staff Guidance
ARCAP - Fire Protection Program - Operations Interim Staff Guidance
ARCAP - Inservice Inspection and Inservice Testing Interim Staff Guidance
ARCAP - Roadmap Draft Interim Staff Guidance
ARCAP - Technical Specifications Interim Staff Guidance
TICAP DG - RG 1.253, "Technology Inclusive Content of Application Project"
Close
DELIVERABLES
Clear Filters
Regulatory Applicability
Filter
Deliverable
Lead
Topic
Project Manager
Next Milestone
Milestone Completion
Project Completion
Description
Strategy
(LEAD) ARCAP/TICAP
Sebrosky, Joseph

Deliverable Details

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(LEAD) ARCAP/TICAP

Summary | Milestones

Lead

Deliverable

(LEAD) ARCAP/TICAP

Strategy

Lead Project Manager

Sebrosky, Joseph

Regulatory Applicability

- Part 50
- Part 52

Topic

Project Completion Date

Upcoming Milestone

Milestone Completion Date

Description/Additional Information

Associated Deliverables

ARCAP - Chapter 2 - Site Information Interim Staff Guidance , ARCAP - Chapter 10 - Occupational Doses Interim Staff Guidance , ARCAP - Chapter 11 - Organization and Human Systems Consideration Interim Staff Guidance , ARCAP - Chapter 12 - Post-Construction Inspection, Testing, and Analysis Program Interim Staff Guidance , ARCAP - Chapter 9 - Normal Effluents Interim Staff Guidance , ARCAP - Fire Protection Program - Operations Interim Staff Guidance , ARCAP - Inservice Inspection and Inservice Testing Interim Staff Guidance , ARCAP - Roadmap Draft Interim Staff Guidance , ARCAP - Technical Specifications Interim Staff Guidance , TICAP DG - RG 1.253, "Technology Inclusive Content of Application Project"

ARCAP - Roadmap Draft Interim Staff Guidance

Summary | Milestones

Deliverable

ARCAP - Roadmap Draft Interim Staff Guidance

Strategy

3: Flexible Review Processes

Lead Project Manager

Sebrosky, Joseph

Regulatory Applicability

- Part 50
- Part 52

Topic

Guidance

Project Completion Date

1/30/2024

Upcoming Milestone

ACRS Review

Milestone Completion Date

11/16/2023

Description/Additional Information

ARCAP Roadmap interim staff guidance

Associated Deliverables

(LEAD) ARCAP/TICAP Lead

Deliverable Details

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ARCAP - Roadmap Draft Interim Staff Guidance

Summary | Milestones

Milestone	Projected Completion Date	Actual Completion Date	ML#
(All)			ML#
ACRS Review	11/16/2023		ML22048B546

DELIVERABLES

Clear Filters | Regulatory Applicability | Filter

Deliverable	Lead	Topic	Project Manager	Next Milestone	Milestone Completion	Project Completion	Description	Strategy	Action
code ass							Description		
(LEAD) DEVELOPMENT OF NON-LWR COMPUTER MODELS AND ANALYTICAL TOOLS - CODE ASSESSMENT REPORTS	L	Codes	Armstrong, Ken			12/31/2027	-	2: Computer Codes and Review Tools	
CODE ASSESSMENT REPORTS - VOLUME 1		Codes	Armstrong, Ken			12/31/2027	-	2: Computer Codes and Review Tools	
CODE ASSESSMENT REPORTS - VOLUME 2		Codes	Armstrong, Ken			12/31/2027	-	2: Computer Codes and Review Tools	
CODE ASSESSMENT REPORTS - VOLUME 3		Codes	Armstrong, Ken			12/31/2027	-	2: Computer Codes and Review Tools	
CODE ASSESSMENT REPORTS - VOLUME 4		Codes	Armstrong, Ken			12/31/2027	-	2: Computer Codes and Review Tools	
CODE ASSESSMENT REPORTS - VOLUME 5		Codes	Armstrong, Ken			12/31/2027	-	2: Computer Codes and Review Tools	

Deliverable Details

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(LEAD) DEVELOPMENT OF NON-LWR COMPUTER MODELS AND ANALYTICAL TOOLS - CODE ASSESSMENT REPORTS

Summary | Milestones

Lead

Deliverable

(LEAD) DEVELOPMENT OF NON-LWR COMPUTER MODELS AND ANALYTICAL TOOLS - CODE ASSESSMENT REPORTS

Strategy

2: Computer Codes and Review Tools

Lead Project Manager

Armstrong, Ken

Regulatory Applicability

- Part 50
- Part 52
- Part 53: Framework A
- Part 53: Framework B

Topic

Codes

Project Completion Date

12/31/2027

Upcoming Milestone

Milestone Completion Date

Description/Additional Information

Associated Deliverables

CODE ASSESSMENT REPORTS - VOLUME 1 , CODE ASSESSMENT REPORTS - VOLUME 2 , CODE ASSESSMENT REPORTS - VOLUME 3 , CODE ASSESSMENT REPORTS - VOLUME 4 , CODE ASSESSMENT REPORTS - VOLUME 5

Deliverable Details

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CODE ASSESSMENT REPORTS - VOLUME 2

Summary | Milestones

Deliverable

CODE ASSESSMENT REPORTS - VOLUME 2

Strategy

2: Computer Codes and Review Tools

Lead Project Manager

Armstrong, Ken

Regulatory Applicability

- Part 50
- Part 52
- Part 53: Framework A
- Part 53: Framework B

Topic

Codes

Project Completion Date

12/31/2027

Upcoming Milestone

Milestone Completion Date

Description/Additional Information

Associated Deliverables

Volume 2 (Fuel Performance): FAST code assessment for metallic fuel , Volume 2 (Fuel Performance): FAST code assessment for TRISO fuel , (LEAD) DEVELOPMENT OF NON-LWR COMPUTER MODELS AND ANALYTICAL TOOLS - CODE ASSESSMENT REPORTS Lead

Deliverable Details

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Volume 2 (Fuel Performance): FAST code assessment for metallic fuel

Summary | Milestones

Deliverable

Volume 2 (Fuel Performance): FAST code assessment for metallic fuel

Strategy

2: Computer Codes and Review Tools

Lead Project Manager

Esmaili, Hossein

Regulatory Applicability

- Part 50
- Part 52
- Part 53: Framework A
- Part 53: Framework B

Topic

Codes

Project Completion Date

12/31/2027

Upcoming Milestone

Final Issuance

Milestone Completion Date

3/17/2021

Description/Additional Information

Associated Deliverables

CODE ASSESSMENT REPORTS - VOLUME 2

Deliverable Details

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Volume 2 (Fuel Performance): FAST code assessment for metallic fuel

Summary | **Milestones**

Milestone	Projected Completion Date	Actual Completion Date	ML#
(All)			ML#
Final Issuance	3/17/2021		ML20330A203
Final Issuance	3/17/2021		ML21076A416

QUESTIONS

Advanced Reactor Digital I & C Workshop Announcement

- Public Workshops on the I&C Licensing Framework for Advanced Reactors
  - Workshop 1 held on 23-Feb-2023 & 16-Mar-2023
  - Workshop 2 held on 04-Apr-2023
- Workshop meeting summaries available on newly added webpage to the advanced reactor rulemaking and guidance website dedicated to I&C
  - https://www.nrc.gov/reactors/new-reactors/advanced/modernizing/rulemaking-and-guidance/digital-instrumentation-and-control.html
- Proposed agenda for next Workshop in Jan – Feb 2024 timeframe:
  - SRM-SECY-22-0076, expansion of existing policy for digital I&C common-cause failures (SRM-SECY-93-087) to allow the use of risk-informed approaches to demonstrate appropriate level of defense-in-depth
    - Non-light-water reactors that follow the risk-informed and performance-based approach in RG 1.233 and Design Review Guides for Instrumentation and Controls
  - Codes & Standards for Advanced Reactors I&C Systems

SRM-SECY-22-0076

"The Commission has approved the staff's recommendation to expand the existing policy for digital instrumentation and control (I&C) common-cause failures to allow the use of risk-informed approaches to demonstrate the appropriate level of defense-in-depth, subject to the enclosed edits. The staff should clarify in the implementing guidance that the new policy is independent of the licensing pathway selected by reactor licensees and applicants. Given the regulatory importance of this issue, the staff should complete the final implementing guidance within a year from the date of this Staff Requirements Memorandum." (emphasis added)

SECY-23-0092

In SECY-23-0092, staff informed the Commission of plans for updating implementing guidance addressing new policy for non-LWR DI&C reviews, in parts:

- *While the language used in the DRG does not clearly connect to the revisions of the four points in SRM-SECY-22-0076, the language does not preclude the reviewers from considering alternative approaches. Therefore, the NRC staff will use pre-application engagement to discuss use of the expanded policy with interested applicants to address any questions or concerns. The NRC staff plans to revise the DRG, and possibly RG 1.233, in the future. The revision will address the differences in language discussed above and reflect any additional clarifications or improvements based on lessons learned by the NRC staff and prospective applicants, input received from the stakeholders during the ongoing advanced reactor I&C public workshops, and other interactions.*

Licensing and Deployment Considerations for Micro-Reactors: Priorities and Next Steps

Advanced Reactor Stakeholder Public Meeting
December 7, 2023

William Kennedy
Amy Cubbage
Advanced Reactor Policy Branch
U.S. Nuclear Regulatory Commission

Background

- Updated NRC Staff Draft White Paper on Micro-Reactor Licensing and Deployment Considerations (ADAMS Accession No. ML23264A802)
- Updated NRC Staff Draft White Paper on Micro-Reactor Licensing and Deployment Considerations – Enclosure (ML23264A803)
- SECY-20-0093: Policy and Licensing Considerations Related to Micro-Reactors (ML20254A363)
- NRC Staff Draft White Paper, “Micro-reactors Licensing Strategies” (ML21328A189)

NRC Staff Draft White Paper

- Enhance regulatory clarity, predictability, and efficiency to address increasing stakeholder interest and novel licensing and deployment strategies
- Describes regulatory approaches the NRC staff is developing for consideration by the Commission related to three topics:
  1. Features to preclude criticality
  2. Fuel loading at a factory
  3. Operational testing at a factory
- Includes an enclosure with information on other licensing and deployment topics and potential near-term strategies and next steps the NRC staff is considering

Other Licensing and Deployment Topics and Potential Near-Term Strategies and Next Steps

Timeframe for authorization to operate at the deployment site

- For licensing under 10 CFR Part 52, the NRC staff plans to clarify the circumstances under which the schedule for intended operation and initial fuel load can be accelerated and is considering ways to streamline public notifications, hearings, and the authorization to operate, as appropriate
- For licensing under 10 CFR Part 50, the NRC staff is considering opportunities to expedite steps in the processing and review of applications for facility operating licenses, such as acceptance review and docketing, milestones for hearings, and the supplement to the environmental impact statement

Other Licensing and Deployment Topics and Potential Near-Term Strategies and Next Steps

Licensing replacement reactors

- The NRC staff previously addressed similar concepts and considered licensing options for multi-module facilities in SECY-11-0079 - License Structure for Multi-Module Facilities Related to Small Modular Nuclear Power Reactors (ML110620459)
- The NRC staff is considering approaches under 10 CFR Part 50 and Part 52 where the construction permit application or combined license application would cover all reactors envisioned to be operated at the deployment site and each reactor would be authorized to begin operation under its own facility operating license or combined license once the Commission had made the required findings

Other Licensing and Deployment Topics and Potential Near-Term Strategies and Next Steps

Autonomous and remote operations

- The NRC staff plans to further develop its understanding of the industry deployment models for factory-fabricated micro-reactors with respect to industry plans for remote and autonomous operations, identify any gaps in the existing human factors engineering review needed to address the deployment models, and develop the technical bases for any new guidance that may be needed
- The NRC staff is working with Idaho National Laboratory to organize a Remote Operations Workshop for industry participants to be held January 31 and February 1, 2024, at NRC Headquarters in Rockville, MD
  - Please contact Stephanie Morrow (Stephanie.Morrow@nrc.gov) or Niav Hughes Green (Niav.Hughes@nrc.gov) with related inquiries.

Other Licensing and Deployment Topics and Potential Near-Term Strategies and Next Steps

Transportation of fueled reactors

- The NRC staff intends to use the existing regulatory framework (primarily 10 CFR Part 71) to review transportation of fueled commercial micro-reactors in the near term, which may include the use of the alternate test criteria in 10 CFR 71.41(c), the special package authorization option in 10 CFR 71.41(d), or exemptions, as appropriate

Other Licensing and Deployment Topics and Potential Near-Term Strategies and Next Steps

Storage of fuel after irradiation in a power reactor

- In order to use an independent spent fuel storage installation to store irradiated power reactor fuel withdrawn from a reactor that had undergone decay for less than a year, the licensee would be required to apply for a specific license under 10 CFR Part 72 and request and justify exemptions addressing the one-year decay time requirement in the regulations
- The NRC staff intends to engage with stakeholders as they further develop their strategies for handling and storage of irradiated and spent fuel generated in factory-fabricated micro-reactors

Other Licensing and Deployment Topics and Potential Near-Term Strategies and Next Steps

Decommissioning process and decommissioning funding assurance

- In a scenario in which the reactor module is decommissioned away from the deployment site, the deployment site licensee would need to establish decommissioning funding assurance that considers the cost of removing the reactor from the site and decommissioning it elsewhere in addition to the cost of decommissioning activities at the deployment site.
- The NRC staff may consider site-specific decommissioning cost estimates that appropriately account for all activities at both locations and all waste disposal costs

Other Licensing and Deployment Topics: Potential Near-Term Strategies and Next Steps

Siting in densely populated areas

- In the near term, the staff will continue its effort to revise Regulatory Guide (RG) 4.7, "General Site Suitability Criteria for Nuclear Power Stations," Revision 3, issued March 2014 (ML12188A053) and will review license applications in accordance with current Commission policy that allows alternative population-related criteria but precludes siting a commercial power reactor, no matter the size or type of reactor, within a population center of 25,000 residents or more

Other Licensing and Deployment Topics and Potential Near-Term Strategies and Next Steps

Commercial maritime applications

- The NRC staff will continue to engage with stakeholders and monitor developments related to commercial maritime applications and assess the need for future Commission direction

Commercial space applications

- If developers engage the NRC staff on terrestrial activities related to commercial space applications of factory-fabricated micro-reactors, the NRC staff intends to apply the established regulatory framework, as informed by the potential licensing approaches and strategies outlined in this presentation

Other Licensing and Deployment Topics and Potential Near-Term Strategies and Next Steps

Commercial mobile applications

- The NRC staff will monitor developments in the commercial sector related to deployment models and the demand for commercial mobile micro-reactor licensing. The staff will assess the need for future Commission direction and rulemaking in this area.

SECY-20-0093 Summary

- SECY-20-0093 laid out several topics related to micro-reactor licensing and deployment, including information on the current regulations, applicability to micro-reactors, stakeholder perspectives, and NRC staff considerations
- Some topics have been or are being addressed in rulemakings and guidance development, and some are topics considered in the white paper previously discussed in this presentation

SECY-20-0093 Summary

- Security Requirements
- Emergency Preparedness
- **Staffing, Training, and Qualification Requirements**
- **Autonomous and Remote Operations**
- Regulatory Oversight
- Aircraft Impact Assessment
- Annual Fee Structure
- **Manufacturing Licenses and Transportation**
- **Population-Related Siting Considerations**
- Environmental Considerations

Micro-reactor Licensing Strategies

- NRC issued a draft white paper titled, “Micro-reactors Licensing Strategies,” to facilitate the development of optional strategies to streamline the licensing of micro-reactors Enhanced standardization of the design and operational programs
  - Manufacturing license may provide flexibility for design and fabrication in a factory and reduce site-specific inspections and verifications
  - Use of “bounding values” for external hazards and site characteristics could reduce NRC staff review effort
  - Generic Environmental Impact Statement for Advanced Nuclear Reactors (ANR GEIS) rulemaking

Discussion Items

- Are there other topics of interest that are not described in this presentation?
- What do stakeholders see as the highest priority topics to address next?
- Which regulatory topics pose the greatest risks to micro-reactor deployment?
- Other feedback or questions

10 min BREAK

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Overview and Recent Experience with the NRC's Application Acceptance Review Processes

December 7, 2023

Stephanie Devlin-Gill, Senior Project Manager

Advanced Reactor Licensing Branch 1

Division of Advanced Reactors and Non-power Production and Utilization Facilities

NRC Application Acceptance Reviews: Regulations and Guidance

License applications are reviewed for completeness and acceptability for docketing consistent with the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 2.101, "Filing of application"

- 10 CFR 2.101 Paragraph (a)(2) describes that
  - An application will be initially treated as a tendered, then the NRC performs an acceptance review to determination whether the application is complete and acceptable for docketing.
  - Generally, the determination on acceptability for docketing will be made within 30 days. In selected applications, the determination will be made within 60 days.
- NRR has established procedures for conducting acceptance reviews in Office Instruction LIC-117, "Acceptance Review Process for New Nuclear Facility Licensing Applications," (ML20283A188)

www.nrc.gov/reading-rm/doc-collections/cfr/part002/part002-0101.html

NRC Application Acceptance Reviews: Possible Outcomes

Possible outcomes which determine docketing and schedules:

- Application Acceptable for Docketing
  - A schedule is developed
- Application Not Acceptable for Docketing
  - Does not contain sufficient information to conduct the technical review or to develop a schedule and missing/incorrect information **cannot** be supplemented within 6 months.
- Acceptance Contingent on Receipt of Supplemental Information
  - Does not contain sufficient information to conduct the technical review or to develop a schedule and missing/incorrect information **can** likely be supplemented within 6 months. A provisional review schedule may be developed

UC-117, ML20283A188

NRC Application Acceptance Reviews: Factors Influencing Schedule Development

- NEIMA Generic Schedules
- Quality of the application
- Standardization of the design
- Degree of pre-application engagement
- Custom regulatory approach
- Unresolved policy issues
- Risk-profile of the facility

NRC Application Acceptance Reviews: High-Quality Applications

- The NRC prioritizes the review of high-quality applications. Low-quality or incomplete applications can consume significant NRC and applicant resources and could divert attention and resources away from high-quality applications, resulting in potential unnecessary schedule delays.
- Robust pre-application engagement, including participation in application readiness assessments, can assist in the preparation of high-quality applications.
  - Draft DANU-ISG-2022-01, Appendix A, "Pre-Application Engagement Guidance," (ML22048B546)
  - NRR Office Instruction, LIC-116, "Preapplication Readiness Assessment" (ML20104B698)

Thank You

Questions?

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

NRC Emergency Preparedness for Small Modular Reactors and Other New Technologies

Todd Smith, PhD
Senior Level Advisor for Emergency Preparedness and Incident Response
Office of Nuclear Security and Incident Response
U.S. Nuclear Regulatory Commission

Radiological emergency preparedness (EP)—

- *ensures protective actions can and will be taken*
- *is an independent layer of defense in depth*
- *provides dose savings*
- *is risk-informed*

The NRC applies a graded approach to EP

A graded approach is a risk-informed process in which the safety requirements and criteria are set commensurate to facility hazards

Existing NRC regulations use a graded approach to EP

- *Power reactors (low-power testing, power operations, decommissioning)*
- *Research and test reactors*
- *Fuel Fabrication Facilities*
- *Independent Spent Fuel Storage Installations*
- *Monitored Retrievable Storage*

Final Rule published in Federal Register

- Final rule (88 FR 80050) published on November 16, 2023, effective December 18, 2023
- Final rule provides alternative requirements for small modular reactors and other new technologies
- https://www.federalregister.gov/emergency-preparedness-for-small-modular-reactors-and-other-new-technologies
- RG 1.242, “Performance-Based Emergency Preparedness for Small Modular Reactors, Non-Light-Water Reactors, and Non-Power Production or Utilization Facilities” (ADAMS Accession No. ML23226A036)

Preparedness begins with a proven planning basis

The consequences from a spectrum of accidents, tempered by probability considerations, should be considered to scope the planning efforts for—

- *the **distance** to which planning for predetermined protective actions is warranted [the emergency planning zone (EPZ)]*
- *the **time**-dependent characteristics of a potential release*
- *the type of radioactive **materials***

Major provisions of alternative EP regulations

10 CFR 50.160 provides an alternative framework for small modular reactors and other new technologies:

- regulatory framework proportional to facility risk

  required EP functions set commensurate to radiological risk

- technology inclusive, performance based

  performance demonstration in drills and exercises

- hazard analysis for contiguous facilities
- ingestion planning capabilities
- scalable EPZ according to planning needs

Hazard Analysis

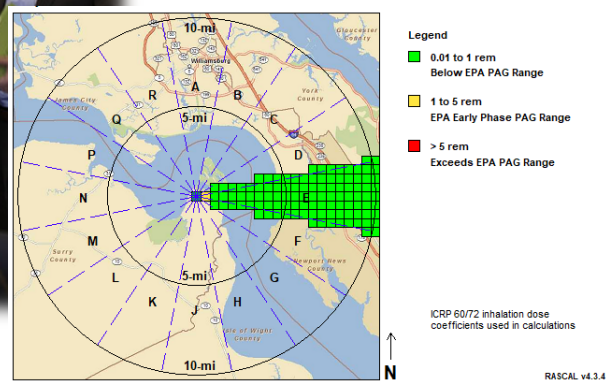
Address the impact on emergency plan implementation from:

- contiguous or nearby facilities and other credible hazards
- potential impacts of industrial plants, other reactors, transportation systems, or combination of factors
- site-specific, credible hazards from other facilities that may require additional EP considerations

Emergency response functions provide capabilities

- Event classification and mitigation
- Protective actions
- Communications
- Command and control
- Staffing and operations
- Radiological assessment
- Re-entry
- Critiques and corrective actions

Emergency Classification Level			
Unusual Event	Alert	SAE	GE
↓	↓	↓	↓
Initiating Condition	Initiating Condition	Initiating Condition	Initiating Condition
↓	↓	↓	↓
Emergency Action Level (1)	Emergency Action Level (1)	Emergency Action Level (1) • Operating Mode Applicability • Notes • Basis	Emergency Action Level (1) • Operating Mode Applicability • Notes • Basis



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Planning activities ensure readiness

- Prepare and issue public information during emergencies
- Implement the emergency plan in conjunction with the licensee's safeguards contingency plan
- voice and data communications with the NRC
- Identify emergency facilities where effective direction and control can be exercised in an emergency
- Site familiarization training for offsite support
- Maintain the emergency plan

Scalable EPZ to support planning needs

The EPZ is a planning tool, not a design feature

The EPZ determination considers form and function:

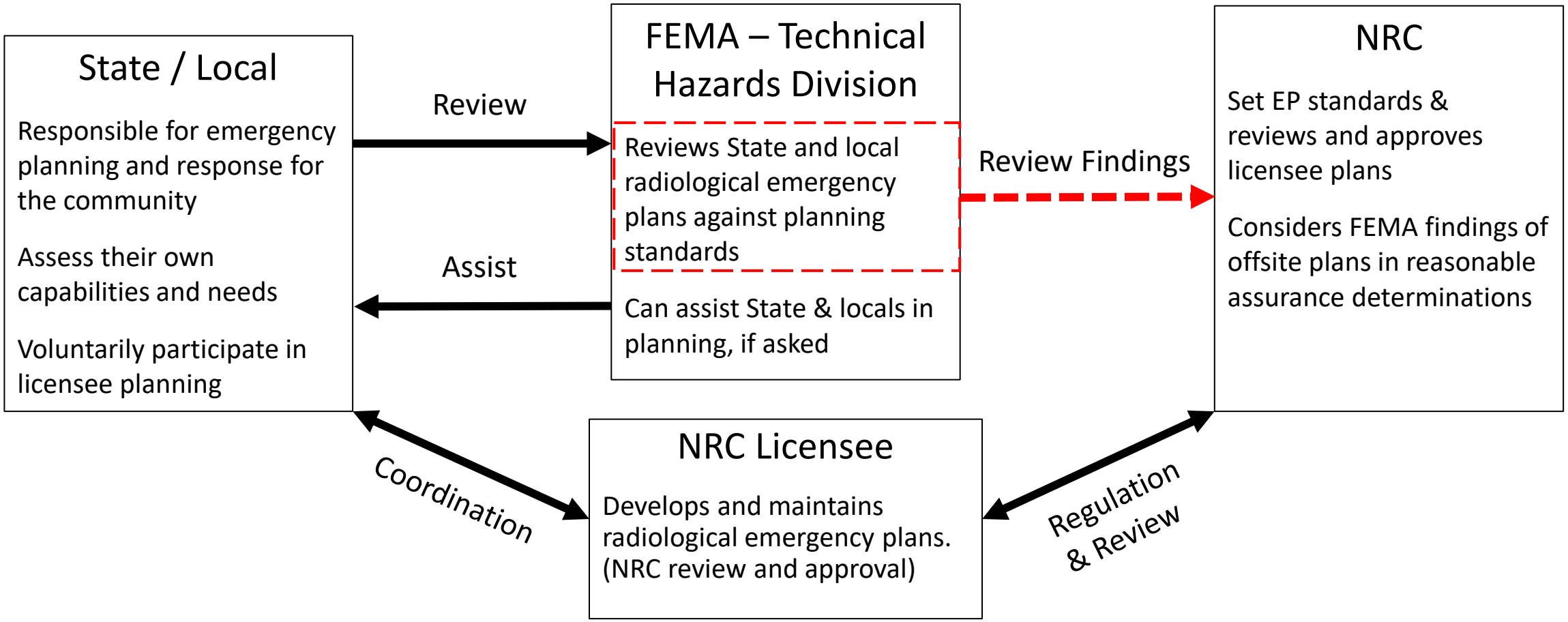
- The area within which public dose is projected to exceed 10 mSv (1 rem) TEDE over 96 hours considering:
  - *accident likelihood*
  - *source term*
  - *timing of the accident sequence*
  - *meteorology*
- The area within which predetermined, prompt protective measures are warranted

Ingestion Pathway Planning

- Emphasizes capabilities and readiness to respond
- Identification of major exposure pathways for ingestion
- Identify resources available at all levels of government to sample, assess, and implement a quarantine or embargo of food and water to prevent ingestion

EP > EPZ

Roles and Responsibilities



Coordination with offsite response organizations

Coordination with offsite response organizations ensures readiness to respond within and beyond the EPZ as conditions warrant.

To facilitate predetermined prompt protective actions offsite, planning activities for an EPZ beyond the site boundary include:

- Contacts and arrangements
- Protective actions
- Evacuation time estimate within the EPZ
- Primary and backup offsite response facilities
- Making and communicating dose projections
- Periodic emergency planning information for public
- General re-entry plans after an emergency
- Drill and exercise programs with offsite response

EP involves the Whole Community

Licensee

State/Local

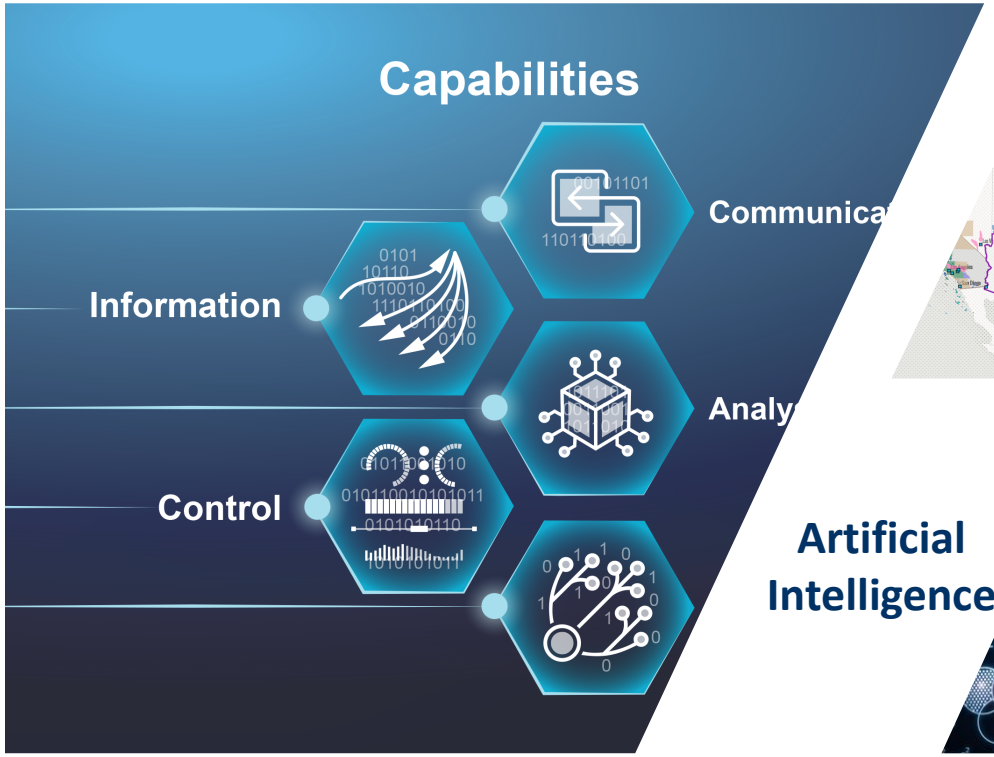
Federal

Risk-informed, performance-based is adaptable

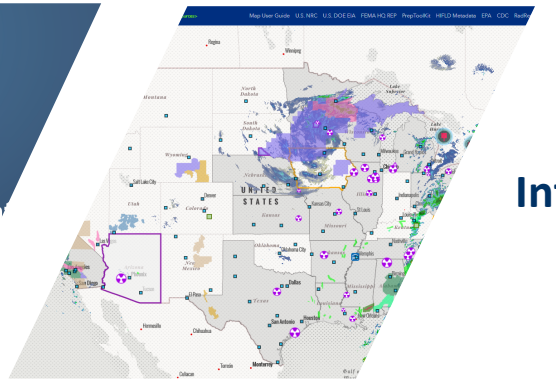
- Flexibility for how to meet an EP function
- Flexible frequency of inspection and oversight
- Scaled response capabilities commensurate with the facility hazards
- Recognizes diversity in design and enhanced safety potential for evolutionary technologies

Technology propels the future of EP

Digital Twins



Geographic Information Systems



Artificial Intelligence

IPAWS

Integrated Public Alert and Warning System

Federal capabilities

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EP is the answer to uncertainty

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DIVISION OF PREPAREDNESS & RESPONSE

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Protecting People and the Environment

LUNCH

67

Selection of Seismic Scenario for EPZ Sizing Determination

December 7, 2023

NUCLEAR ENERGY INSTITUTE

Goal, Objectives, Scope

- Goal – Develop a technology-inclusive approach to selection of seismic scenario for EPZ determination
- Objectives
  - Be consistent with the philosophy discussed in NUREG-0396, “Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants”
  - Allow definition of site-specific plant damage state for performing the EPZ sizing analysis required by 10 CFR 50.33(g)(2) [*per SMR & ONT EP Rule*]
  - Avoid over-reliance on the highly uncertain tails of the hazard curves
  - Not require a site-specific PRA prior to selection of the scenario
- Scope – Cover all new reactor designs except the following
  - Large (gigawatt scale) designs
  - Per RG 1.242, “Facilities that use a maximum hypothetical accident should ensure that the estimated release is bounding for any event at the facility”

The Two Pieces of this Puzzle

- Selection of the earthquake “size” to be used (the “EPZ Earthquake”)
- Definition of the plant damage state given the occurrence of that earthquake (the “EPZ Scenario”)

Selection of the EPZ Earthquake

Can We Risk-Inform the EPZ Earthquake?

- What would a risk-informed framework look like?
- What risk information do we have?
- What insights can this information provide?
- How can those insights be shaped into a framework?
- Can that framework be applied to light-water and non-light-water SMRs?

What Would a Risk-informed Framework Look Like?

- It would be anchored to the site GMRS (which serves as the plant's safe shutdown earthquake).
- It would lead to the selection of a significant earthquake beyond the GMRS.
- It would encourage the reactor designers to suppress the contribution from the moderate earthquakes.
- It would give credit for design features that address the highest risk contributors from the legacy fleet.
- It would put more emphasis on lower release frequency as preferable to a greater dependence on emergency response.

What Risk Information Do We Have?

- SPRAs for a small set of Gen II plants from the NTTF 2.1 submittals
  - These SPRAs have all been peer reviewed.
  - They are of high quality.
  - Arguably, they do represent the “highest potential seismic risk” plants relative to the rest of the fleet.
- There is extremely limited SPRA information for the SMRs.
  - Mostly margins assessments.
  - Paper designs that lack seismic “maturity.”
  - Difficult to place in a true risk context.

What Insights Can This Information Provide?

- What can we learn? There are insights to be gained from the current fleet SPRAs if we keep a few things in mind.
  - The new designs utilize a lot of passive systems, which eliminate many support system dependencies.
    - This will “suppress” (but not eliminate) that contribution of earthquakes that “moderately” exceed the design basis.
    - Design dependent (e.g., instrumentation and control panels and power)
  - For earthquakes that “significantly” exceed the design basis, there won’t be that much difference. The dominant contributors will be structural and RCS component failures.

How Can Those Insights be Shaped Into a Framework?

- How can we use this information?
  - Build a framework
    - Given what we do know, and the NRC EPZ guidance, do the legacy plant SPRAs provide a path to risk-informing the overall approach?
    - Once the framework is formulated, can it be applied in a technology-inclusive context?
  - Look at the big picture and the insights, not each individual piece. Is that picture inclusive, despite the risk profile differences?
- Keeping this in mind, let's look at some results for these specific plants.

Consider the Margin

- Plant core damage HCLPFs range from around 0.15g to 0.4g.
- When compared to the SSEs for these plants, the HCLPFs range up to about 2.5 times the SSE.
- When compared to the GMRS for these plants, the HCLPFs range up to about 2 times the GMRS.
- The comparison to GMRS may be more informative, because these “high hazard” plants have been subjected to various upgrades over the years (i.e., they are no longer just “designed for the SSE”).

A Non-probabilistic Consideration

- Seismic design criteria for plant safety SSCs are not applicable to EP facilities, systems, and equipment.
- The local infrastructure required for implementation of an offsite emergency response (e.g., roads and bridges, emergency operations centers, communications towers) are also not designed to NPP safety systems and are not within licensee control.
- Therefore, at the HCLPF (0.01 CCDP) the conditional probability that emergency response capabilities would be severely degraded likely would be much higher.
- This conditional probability is likely to be close to 1.0 at 1g.

Using This Risk Information

- Margin provided by the legacy plants that can be determined by looking at their seismic PRAs.
- This is a conservative estimate since these are the plants with highest potential for seismic risk.
- This provides a basis for a framework for risk-informed selection of the EPZ earthquake.
- If we were creating a risk-informed framework for selection of the EPZ earthquake for a current plant, it would look like….

Proposed Risk-informed Framework for Selection the EPZ Earthquake

- This information provides useful insights that suggest we should be able to specify:
  - A multiplier to the site-specific GMRS (i.e., an event severity some factor above the design basis).
  - A reasonable upper bound cutoff PGA to select the seismic event to be evaluated in dose calculations for determining the size of the EPZ.
- No magic formula or algorithm for this. Need to step back and “take it all in” holistically.
- Our conclusion – the EPZ consequence calculation for any specific site should be based on the lower of:
  - An earthquake of two (2) times the site-specific GMRS, or
  - 1.0g PGA

Can That framework be applied to LWR and non-LWR SMRs?

- It is not suggested that the newer plants would exhibit the same risk profile as these legacy plants
  - HCLPF and HCLPF/GMRS ratios will be higher.
  - Risk profile will be dominated by failures of major structures and RCS vessels, piping and internals.
- However, if the basis for this framework is a logical extension of the available seismic risk information for an existing plant, then it should be more than adequate for advanced plants.

Definition of the EPZ Plant Damage State (the EPZ Scenario)

How to Decide What Fails and What Succeeds

- One acceptable approach is to implement the concept of Mitigating Strategies Assessment for New Seismic Hazard Information (i.e., the Seismic MSA, Appendix H of NEI 12-06).
    - Established a precedent: “The use of a 90% probability of success is equivalent to a 10% probability of unacceptable performance. This use of the 10% probability of unacceptable performance has been used in the past as a criteria for demonstrating seismic adequacy for beyond design basis seismic performance reviews in standards such as ASCE 43-05 and in commercial criteria such as ATC-63.”
- All SSCs whose $C_{10\%}$ is less than the EPZ earthquake assumed to fail.
- All SSCs whose $C_{10\%}$ is greater than that EPZ earthquake assumed to succeed.
- Applies to both safety, DID/RTNSS, and non-safety SSCs.

Cliff Edge Check

- Such effects have not generally been seen in seismic assessments and PRAs, as the risk and consequences tend to increase smoothly as earthquake severity increases.
- Sensitivity analysis to be performed as a check.
- SSCs whose $C_{10\%}$ is within 10% higher than the EPZ earthquake should be added to the EPZ seismic scenario (i.e., assumed to fail).
- This will determine whether the damage state is significantly altered (as it relates to the size of potential release).

Risk-informed Insights vis-à-vis NUREG-0396

Risk-informed Insights vis-à-vis NUREG-0396

- The EPZ scenario frequency would include
  - The frequency of the 2 x GMRS earthquake
  - The probabilities of the failures (i.e., the list of SSCs with $C_{10\%}$ less than the EPZ earthquake).
- In a practical sense, we would expect that the product of those SSC failure probabilities would be at least 0.1, and likely less.
- Assuming 0.1, the EPZ seismic scenario using this approach at these sites is less than somewhere between 9E-7/yr and 3E-6/yr (below NUREG-0396 “goal” of 5E-5/yr.

Plant	EPZ Earthquake Exceedance Frequency (/year)	EPZ Seismic Scenario Frequency (/year)
A	2.3E-05	<2.3E-06
B	1.1E-05	<1.1E-06
C	1.4E-05	<1.4E-06
D	9.7E-06	<9.7E-07
E	1.0E-05	<1.0E-06
F	2.8E-05	<2.8E-06
G	1.4E-05	<1.4E-06
H	1.1E-05	<1.1E-06
I	9.1E-06	<9.1E-07
J	1.6E-05	<1.6E-06
K	1.2E-05	<1.2E-06

Conclusions

Conclusions

- Despite differences in seismic risk profiles, existing SPRA result (when carefully interpreted) provide useful insights for establishing the EPZ seismic scenario.
- Since the framework is based on the NTTF 2.1 submittals, it likely bounds the understanding of what constitutes an adequate EPZ size.
- Consistent with the guidance in RG 1.242, Appendix A, the seismic event used for the EPZ sizing determination will be a BDBE.
- Consistent with the guidance in RG 1.242, Appendix A, and Appendix I to NUREG-0396, the scenario used for the dose assessment will be below 5×10^{-5} /yr, likely by an order of magnitude or more including uncertainty.

Conclusions

- The EPZ earthquake should be 2 x the site-specific GMRS, capped at 1.0g.
- The EPZ seismic scenario should assume failure of all SSCs with $C_{10\%}$ less than the EPZ earthquake and success of all other SSCs.
- The framework avoids dependence on the highly uncertain tails of the hazard curves.
- Overall, the framework
  - ensures that a “cliff edge effect” is assessed,
  - incentivizes vendors to push high consequence seismic scenarios well out beyond the GMRS since this will lead to a smaller EPZ, and
  - benefits public safety by focusing on prevention over EP.

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NRC Staff Feedback on NEI's draft White Paper, "Selection of Seismic Scenario for EPZ Sizing Determination"

Eric Schrader, Clifford Munson and John Segala

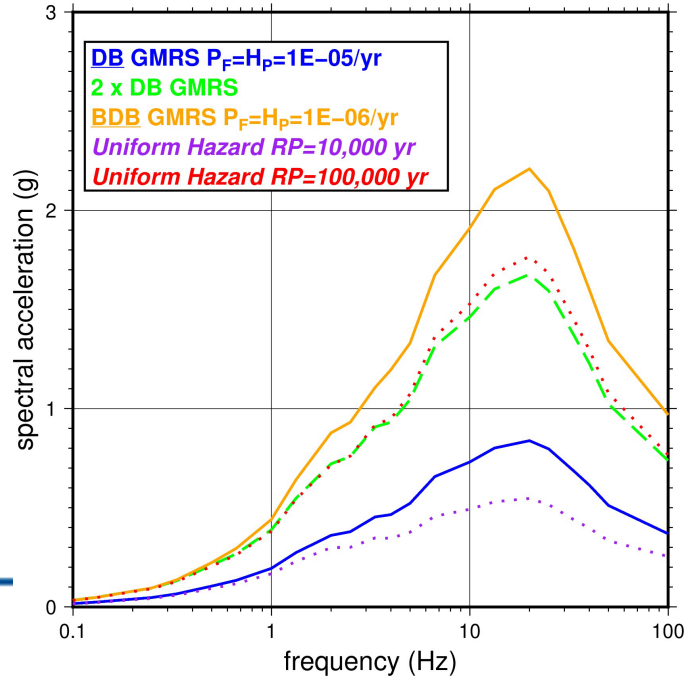
U.S. Nuclear Regulatory Commission

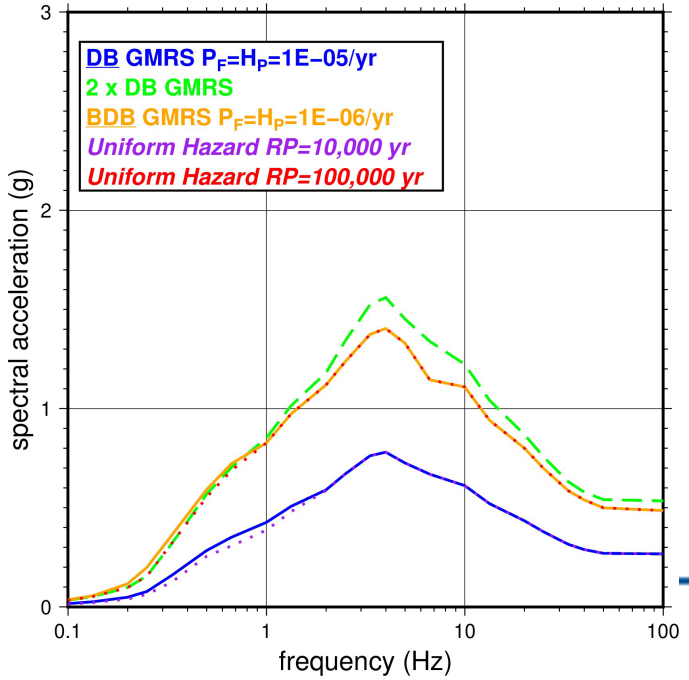
NRC Staff Feedback on NEI's draft White Paper

- Based on the preliminary information provided, the staff has the following initial observations:
  - The concept of using a single BDB seismic event for design- and site-specific EPZ sizing could be acceptable.
    - Other approaches may also be found acceptable
  - Need additional discussion and detail in several areas discussed on the following slides
  - Future submittal would benefit from a demonstration/tabletop to help the staff understand the implementation of the proposed methodology.

Establishing Beyond Design Basis Ground Motion

- GMRS developed using ASCE 43 is a design basis ground motion that is risk-informed and performance-based
- GMRS as required by 10 CFR 100.23 is a free-surface and free-field ground motion
- Using two times the GMRS with a cap at 1.0g PGA for the beyond design basis ground motion results in a ground motion that is not risk-consistent from site to site
  - It is not clear that capping the GMRS PGA at 1g at 100 Hz is appropriate.
  - 100 Hz ground motions are not damaging to SSCs





Structural Response and C10 Capacity

- Once the GMRS is established then the motion at the foundation levels of critical structures, referred to as the Foundation Input Response Spectrum (FIRS) is determined
- Foundation level motion is then transferred into the plant structures to determine in-structure response spectra at various elevations in the plant facility
- NEI approach uses the 2xGMRS 100 Hz value directly and not an in-structure motion for comparison with SSC seismic capacities
- Use of C10 capacity for failure determination is made only at a single spectral frequency of 100 Hz
  - Most SSC resonance frequencies generally between 1 to 10 Hz
- NEI approach does not cover how C10 capacity values will be determined and for which SSCs

Additional NRC Staff Feedback

- The proposal is silent on how the source term will be determined from or assigned to the single BDB seismic sequence.
- It is unclear how the result will be used to compare against criteria in 10 CFR 50.160 and how the methodology interfaces with the remainder of the rule.
- NEI should address how potential cliff edge effects would be handled.
- NEI should address how changes in the facility during the life of the plant would be addressed to assess any changes needed to the emergency plan.
- How does this proposed approach coordinate with other ongoing activities regarding low frequency hazards for design and EPZ sizing for non-LWRs using LMP?

Options for Optimizing Hearing Opportunities for Two-Part Applications

NRR/DANU/UARP

Advanced Reactor Stakeholder Meeting

December 7, 2023

Options for Optimizing Hearing Opportunities for Two-Part Applications

Purpose

- The purpose of the presentation is to inform stakeholders of staff initiative to develop regulatory options for Commission consideration for optimizing hearing opportunities associated with two-part applications
- Have a dialogue with stakeholders on the topic

Options for Optimizing Hearing Opportunities for Two-Part Applications - Background

- 10 CFR 2.101(a)(5) allows for a construction permit (CP) or combined license (COL) application to be submitted in two parts, if each part is submitted within six months of the other
- An exemption would be needed to submit an application in two parts where more than six months would elapse between filing each part
  - There is precedent for applications being submitted in two parts with a greater than six-month gap between each part (e.g., Unistar's Calvert Cliffs COL application)

Options for Optimizing Hearing Opportunities for Two-Part Applications - Options

- The staff is considering providing the following two options to the Commission to address hearing opportunities for CP and COL applications submitted in two parts:
  - Option 1: issue one Notice of Hearing after the entirety of the application is submitted with the direction that environmental contentions be submitted on the draft environmental impact statement (DEIS) if it is available instead of the environmental report
    - This would require the Commission to address the requirements in 10 CFR 2.309(f)(2) that contentions be submitted based on the environmental report

Options for Optimizing Hearing Opportunities for Two-Part Applications – Options (continued)

– Option 2: issue two Notices of Hearing:

- (a) one when the environmental report is docketed and one when the other part is docketed
- (b) An alternative to this option would be to issue one Notice of Hearing after the environmental report is received that also explains in detail the process for filing contentions on the second part upon its docketing

Options for Optimizing Hearing Opportunities for Two-Part Applications - Background

- Commission Policy Statement on Conduct of New Reactor Licensing Proceedings Issued in April of 2008 (73 FR 20963)
  - With two exceptions the Commission's policy is to issue a Notice of Hearing only when the entire application is submitted
    - Neither of the exceptions involve circumstances that the NRC staff expects to encounter in the near future

Options for Optimizing Hearing Opportunities for Two-Part Applications – Discussion Items

- Stakeholders perspectives on options
- Stakeholders perspectives on proposal that environmental contentions be based on the NRC staff's DEIS if it is available versus the applicant's environmental report.
  - Publishing a Notice of Hearing after issuance of the DEIS and limiting contentions to the DEIS rather than the applicant's ER would involve the Commission addressing the requirement in 10 CFR. § 2.309(f)(2) that environmental contentions must be filed on the ER.

Options for Optimizing Hearing Opportunities for Two-Part Applications – Discussion Items

- Should approaches other than the environmental report being submitted first be considered?
  - Submitting the ER first appears to be the more complicated scenario because the staff's review of the ER could lead to the DEIS being issued prior to the second hearing opportunity
  - Possibility of the need for exemptions if the preliminary safety analysis report submitted with the environmental report does not contain all the information required by 10 CFR 2.101(a)(5)
    - Example of a recently issued exemption for this requirement can be found in a November 21, 2023, letter to Tennessee Valley Authority for the Clinch River Nuclear Site CP application (see: ML23045A008 and ML23114A098)

Future Meeting Planning

- The next periodic stakeholder meetings are scheduled for January 24, 2024.
- Potential topics for our next meeting include topics that might come up at the stakeholder meeting and other Stakeholder feedback.

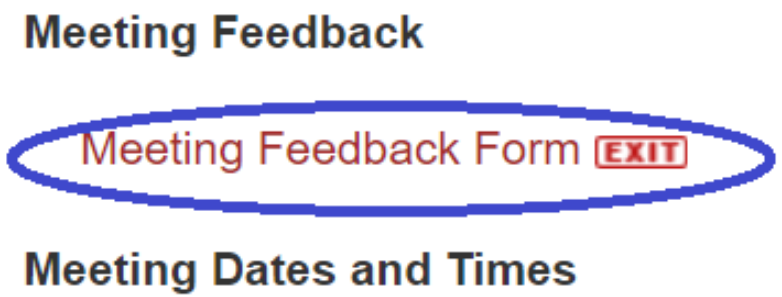
- If you have suggested topics, please reach out to Ramachandran Subbaratnam at Ramachandran.Subbaratnam@nrc.gov.

How Did We Do?

- Click link to NRC public meeting information:

https://www.nrc.gov/pmns/mtg?do=details&Code=20230812

- Then, click link to NRC public feedback form:

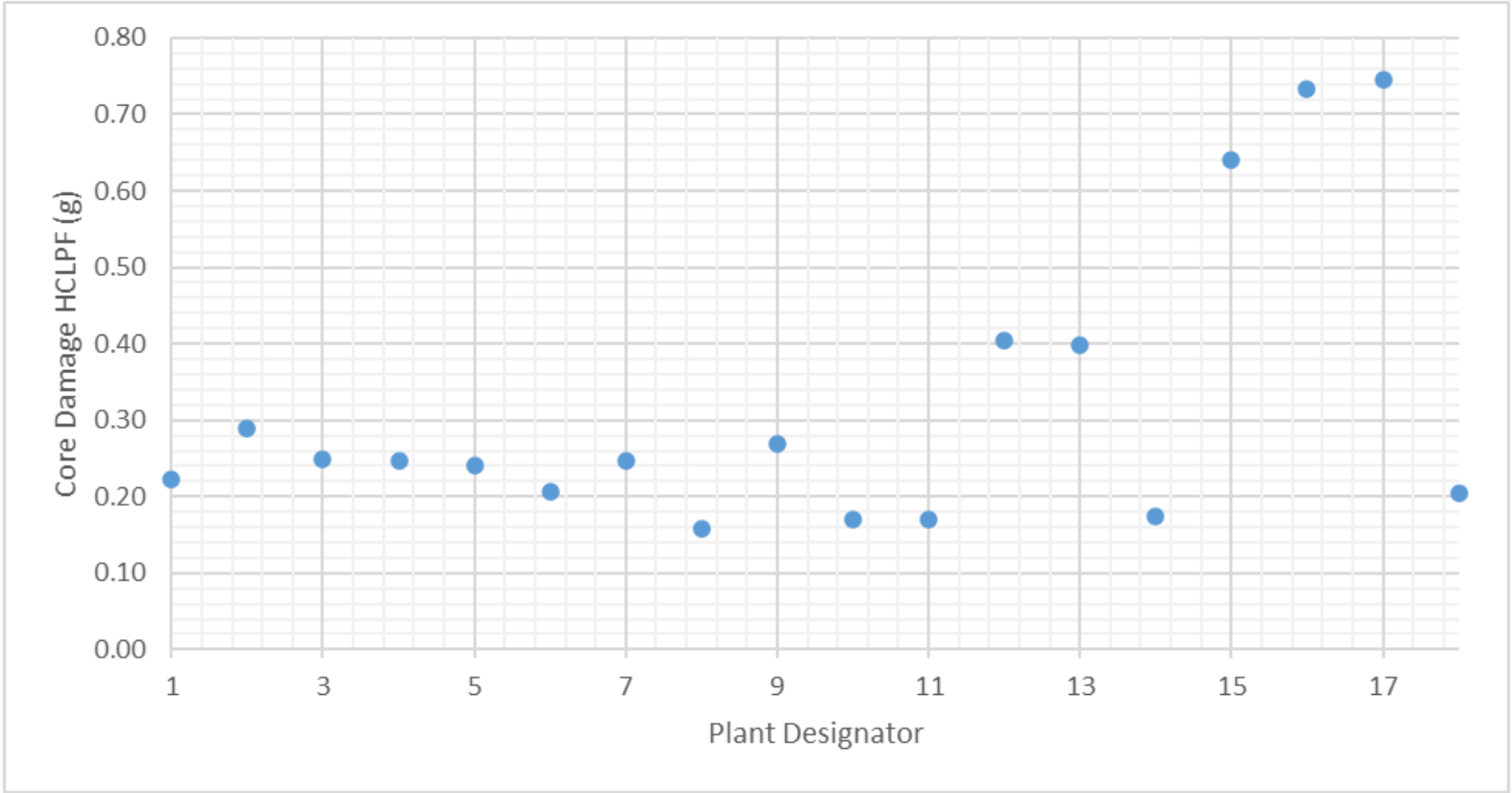


Back-up Slides

Plant Margins

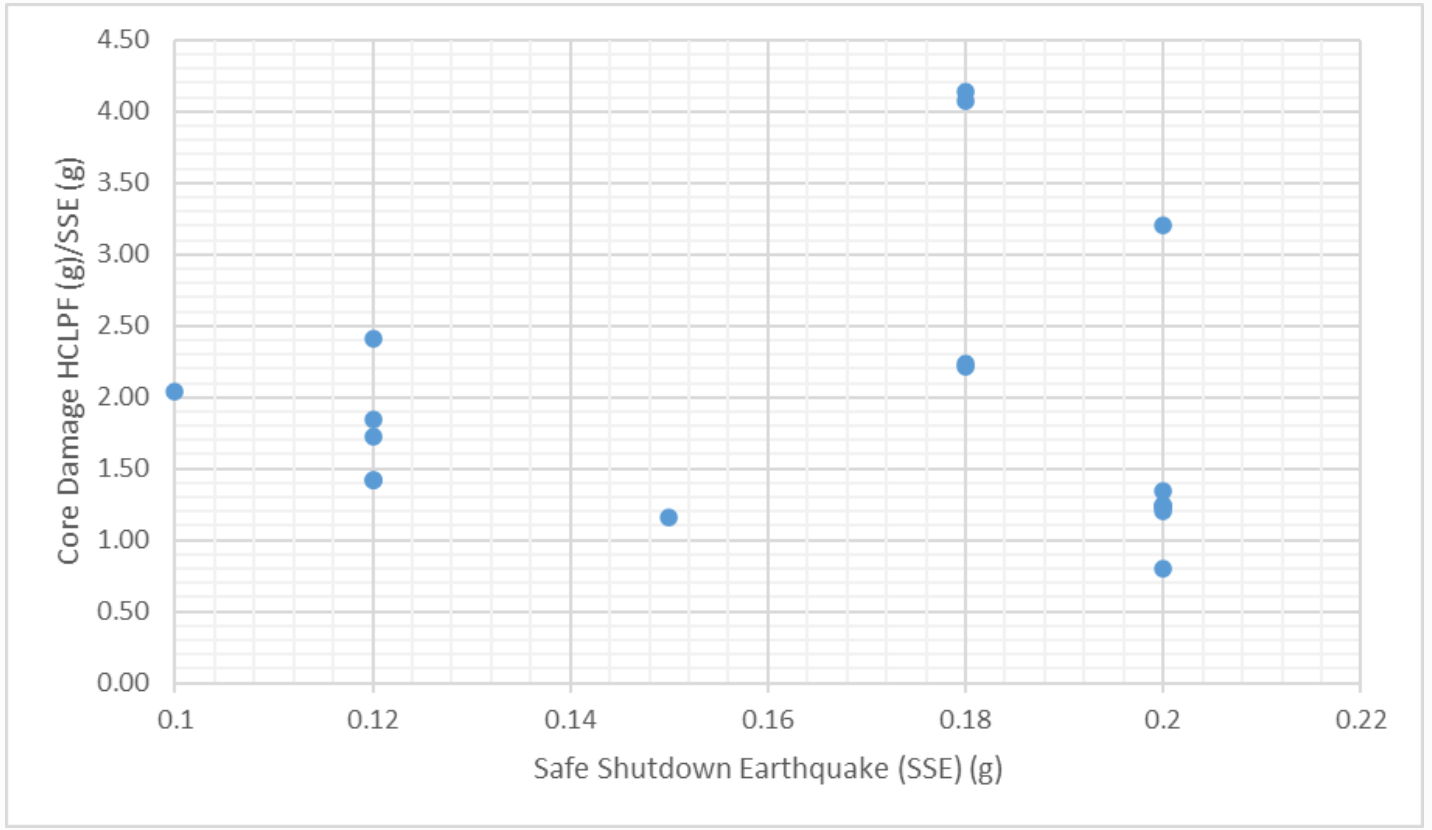
What Margin do These Plants Have?

- HCLPF (0.01 conditional probability of core damage) generally ranges from 0.15g to 0.4g.
- There are a few outliers.
- How does this relate to plant design basis?



What Margin do These Plants Have?

- Margins generally up to about 2.5 times SSE.
- Again, there are a few outliers.
- While informative, this may paint an incomplete picture because of seismic upgrades that have been implemented.

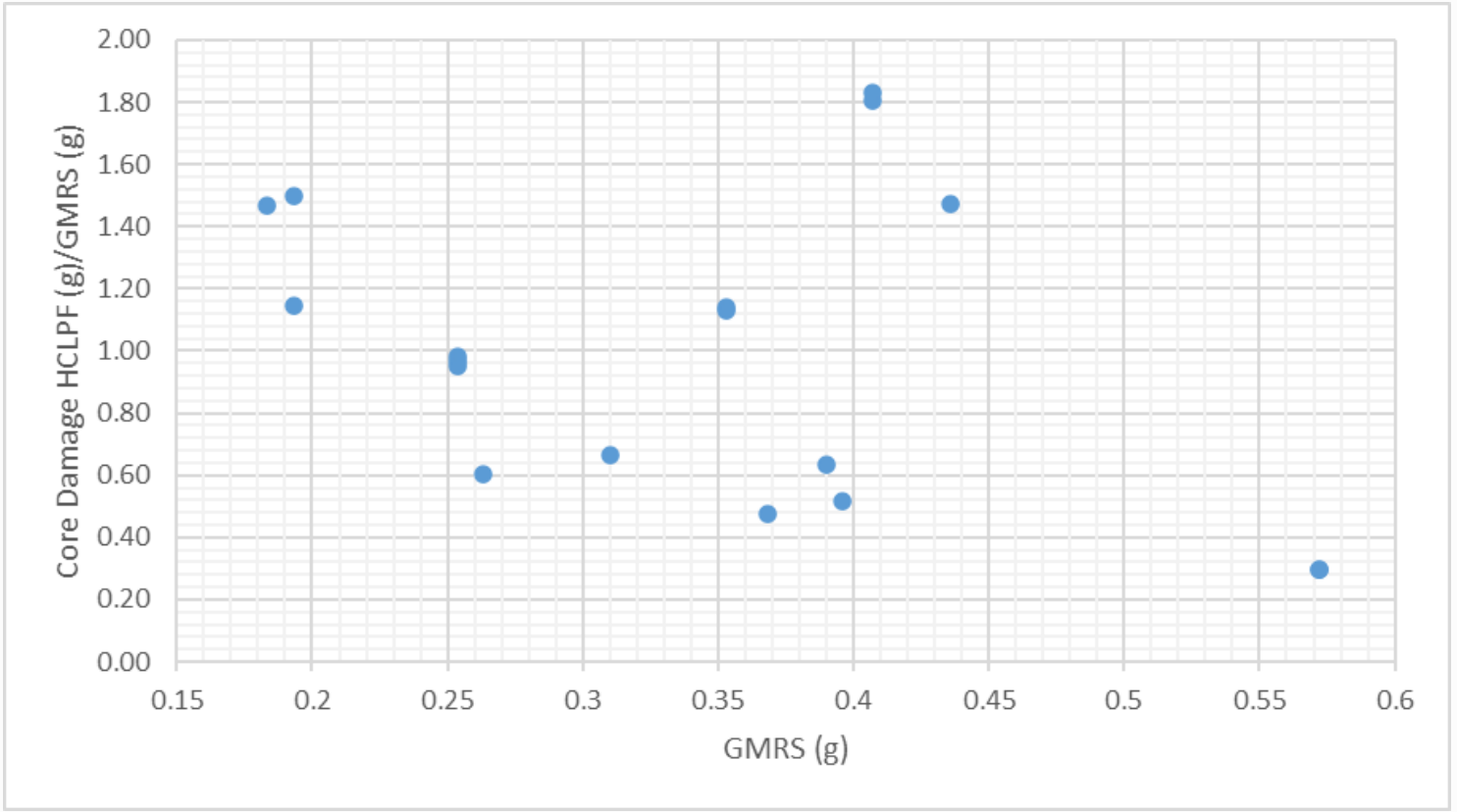


What Margin do These Plants Have?

- Updated seismic design criteria going forward – GMRS.
- These plants have performed IPEEE, ESEP, seismic MSA in addition to their seismic PRAs.
- These plants have effectively addressed the higher hazard associated with the current GMRS through plant improvements designed to reduce risk and/or increase margins.
- Many such improvements have been implemented.
- While these plants are not specifically designed to the GMRS (their design basis is still the original SSE), they have been improved relative to the GMRS.
- Therefore, it is instructive to look at relationship of HCLPF to GMRS for these plants.

What Margin do These Plants Have?

- Margins up to about 2 times GMRS.
- Decided downward trend in ratio as the GMRS increases.
- Not surprising given that HCLPF values seem to be relatively insensitive to the site-specific design level.



Emergency Response Effectiveness

Example: Offsite Power Grid

- Typically considered to have median failure acceleration of 0.3g.
- High failure probability at low acceleration.
- Essentially guaranteed failure by 1g.
- No power to homes and businesses, no power to communications systems, no power for traffic controls, etc.

Table 3 – Fragility of Offsite Power

Peak Ground Acceleration, g	Mean Probability of Failure of Offsite Power
0.2	2.3E-01
0.3	5.1E-01
0.4	7.1E-01
0.5	8.3E-01
0.6	9.0E-01
0.7	9.4E-01
0.8	9.7E-01
0.9	9.8E-01
1	9.9E-01
1.1	9.9E-01
1.2	9.9E-01
1.3	1.0

SOARCA Looked at ER for Seismic

- Considered a severe earthquake in the range of 0.5g-1.0g.
- Concluded that there could be substantial damage to the emergency response infrastructure, the ability to take protective actions would not be significantly impeded.
- Didn’t really provide a basis for this – engineering judgment.
- Did not consider the higher levels of damage (and additional failure modes) that would occur with earthquakes above 1.0g.
- Not suggesting that there is a “cliff” at 1.0g; rather, it would be difficult to show effectiveness at higher levels.

More Risk-informed Insights vis-à-vis NUREG-0396

Risk-informed Insights vis-à-vis NUREG-0396

- Using this approach, the GMRS and EPZ earthquake frequencies for the sites in this study are shown on the right.
- The resultant EPZ earthquake frequencies are in the range of 9E-6/yr to 3E-5/yr.

Plant	GMRS (PGA)	GMRS Earthquake Exceedance Frequency (/year)	EPZ Earthquake (PGA)	EPZ Earthquake Exceedance Frequency (/year)
A	0.19	1.1E-04	0.38	2.3E-05
B	0.25	6.4E-05	0.50	1.1E-05
C	0.31	4.4E-05	0.61	1.4E-05
D	0.39	6.8E-05	0.78	9.7E-06
E	0.26	6.0E-05	0.52	1.0E-05
F	0.18	8.7E-05	0.36	2.8E-05
G	0.57	4.9E-05	1.00	1.4E-05
H	0.37	5.6E-05	0.74	1.1E-05
I	0.44	1.3E-04	0.88	9.1E-06
J	0.41	7.3E-05	0.82	1.6E-05
K	0.40	5.3E-05	0.80	1.2E-05

Risk-informed Insights vis-à-vis NUREG-0396

- The EPZ scenario frequency would then include the probabilities of the failures (i.e., the list of SSCs with $C_{10\%}$ less than the EPZ earthquake).
- In a practical sense, we would expect that the product of those SSC failure probabilities would be at least 0.1, and likely less.
- Assuming 0.1, the EPZ seismic scenario using this approach at these sites is less than somewhere between 9E-7/yr and 3E-6/yr.

Plant	EPZ Earthquake Exceedance Frequency (/year)	EPZ Seismic Scenario Frequency (/year)
A	2.3E-05	<2.3E-06
B	1.1E-05	<1.1E-06
C	1.4E-05	<1.4E-06
D	9.7E-06	<9.7E-07
E	1.0E-05	<1.0E-06
F	2.8E-05	<2.8E-06
G	1.4E-05	<1.4E-06
H	1.1E-05	<1.1E-06
I	9.1E-06	<9.1E-07
J	1.6E-05	<1.6E-06
K	1.2E-05	<1.2E-06

Risk-informed Insights vis-à-vis NUREG-0396

- How does that scenario frequency range comport with NUREG-0396?
- R.G. 1.242, Section A-3.7 states.
  - "The likelihood of exceeding a TEDE of 10 mSv (1 rem) at the proposed EPZ boundary should be consistent with the evaluation in Appendix I to NUREG-0396, which provides relative probabilities of exceeding certain critical doses as a function of distance from the facility for a spectrum of severe accidents. For example, NUREG-0396 examined the conditional probability of exceeding a variety of dose levels of interest, given a core melt accident with a stated frequency of $5x10^{-5}$ per reactor year."
  - Substitute "release" for "core melt."
- Using the proposed approach, the EPZ seismic scenarios would be at least an order of magnitude below this (i.e., a BDB accident state with frequency of approximately 3E-6/yr or less).

Risk-informed Insights vis-à-vis NUREG-0396

- NRC guidance recommends that uncertainty also be considered.
- Table on right shows uncertainty in the hazard for the sites.
- Assuming, again, that the scenario frequency is at least an order of magnitude lower, even the 95%-tile yields frequencies below the 5E-5/yr target cited in NUREG-0396.

Plant	EPZ Earthquake	84%-tile EPZ Earthquake Exceedance Frequency (/year)	84%-tile EPZ Seismic Scenario Frequency (/year)	95%-tile EPZ Earthquake Exceedance Frequency (/year)	95%-tile EPZ Seismic Scenario Frequency (/year)
A	0.38	3.8E-05	<3.8E-06	7.4E-05	<7.4E-06
B	0.50	1.7E-05	<1.7E-06	2.8E-05	<2.8E-06
C	0.61	2.9E-05	<2.9E-06	3.7E-05	<3.7E-06
D	0.78	1.4E-05	<1.4E-06	4.0E-05	<4.0E-06
E	0.52	1.7E-05	<1.7E-06	n/a	n/a
F	0.36	4.3E-05	<4.3E-06	8.7E-05	<8.7E-06
G	1.00	2.2E-05	<2.2E-06	n/a	n/a
H	0.74	1.8E-05	<1.8E-06	n/a	n/a
I	0.88	1.3E-05	<1.3E-06	n/a	n/a
J	0.82	2.8E-05	<2.8E-06	n/a	n/a
K	0.80	1.8E-05	<1.8E-05	3.5E-05	<3.5E-06