

Advanced Reactor Stakeholder Public Meeting

April 2, 2020

Telephone Bridgeline: (800) 857-9764

Passcode: 2899200#



<i>Time</i>	<i>Topic</i>	<i>Speaker</i>
9:00 - 9:10 am	Opening Remarks	NRC/NEI
9:10 - 10:00am	Update on Status of NRC draft Interim Staff Guidance (ISG) for Environmental Reviews and Generic Environmental Impact Statement (GEIS) Commission Paper	M. Sutton and J. Cushing, NRC
10:00 - 10:30 am	Discussion of PNNL Reports on Approach to Determine the Environmental Data for Table S-3 of 10 CFR 51.51 and Table S-4 of 10 CFR 51.52 for Non-LWRs	D. Palmrose, NRC
10:30 - 10:50 am	NRC Feedback on NEI White Paper, Recommendations for Streamlining NRC Environmental Reviews	K. Erwin, NRC
10:50 - 11:00 am	Break	All
11:00 - 11:30 am	Overview of NEI's Comments on Council of Environmental Quality (CEQ) Proposed NEPA Rulemaking	K. Austgen, NEI
11:30 - 12:00 pm	U.S. Nuclear Industry Council (USNIC) Discussion of Policy Issues	J. Merrifield, USNIC
12:00 - 1:00 pm	Lunch	All
1:00 - 2:00 pm	NMSS Discussion of Potential Advanced Reactor Fuel Cycle Activities (Front End and Back End)	M. Diaz Maldonado and R. Torres, NRC
2:00 - 2:30 pm	Overview of Draft Design Review Guide (DRG) for Instrumentation and Controls (I&C) Reviews for Non-LWRs	J. Hoellman and J. Ashcraft, NRC
2:30 - 2:45 pm	Break	All
2:45 - 3:15 pm	Discussion of NRC Interest to Engage Advanced Reactor Vendors regarding Codes and Standards	L. Lund and T. Boyce, NRC
3:15 - 3:45 pm	Discussion of Financial Qualification, On-site Insurance, Price-Anderson Act Considerations for Non-LWRs	B. Reckley, NRC
3:45 - 4:00 pm	Closing Remarks and Future Meeting Planning	NRC/NEI

Opportunities for public comments and questions at designated times

Advanced Reactor Preparations for Environmental Reviews

**Mallecia Sutton
Senior Project Manager**

**Division of Advanced Reactors and Non-
Power Production and Utilization Facilities**

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Status on Environmental Activities

- Status update on:
 - Interim Staff Guidance for the environmental review of micro- reactors
 - GEIS for Advanced Reactors
 - Guidance on addressing Table S-3 of 10 CFR 51.51 and Table S-4 of 10 CFR 51.52 for Non-LWRs
 - Comments on NEI White Paper on Streamlining NRC Environmental Review

ISG

- How to adapt the best practices to licensing micro-reactors?
- How to scale the practices to reflect reduced potential for adverse environmental impacts?
- How to streamline the practices while maintaining necessary rigor?

GEIS

- Narrowing scope of environmental reviews as appropriate while still meeting NEPA (and associated rules, regulations, and laws)
- Apply results from participation in other government efforts (FAST-41, EO13807, Part 51 update, CEQ Regulations Update)

Environmental Impacts of Non-LWR Fuel Cycle and Transportation

- The NRC regulations under 10 CFR 51.50(b)(3) and 51.50(c) require:

“For other than light-water-cooled nuclear power reactors, the environmental report must contain the basis for evaluating the contribution of the environmental effects of fuel cycle activities for the nuclear power reactor.”

Environmental Impacts of Non-LWR Fuel Cycle and Transportation (Cont.)

- Table S-3 of 10 CFR 51.51 and Table S-4 of 10 CFR 51.52 determined the impacts from the fuel cycle and transportation of and waste for large light water reactors (LWRs).

Comments on NEI Paper

- Staff is reviewing the NEI White Paper
- Staff will discuss the NEI White Paper

Discussion of Advanced Reactor Generic Environmental Impact Statement

**Jack Cushing Senior Environmental Project Manager
Division of Rulemaking, Environmental, and
Financial Support
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission**

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Background

- SECY Paper 20-0020 informed Commission that the staff would develop a Advanced Reactor GEIS
- Use of a technology-neutral PPE approach
 - bound any reactor design with a generating output up to approximately 30 Mwt per reactor with a small site environmental footprint.
- Exact power level would be determined during scoping for GEIS

What Would an Advanced Reactor Generic Environmental Impact Statement (GEIS) Address

- Define the scope of the environmental effects of the construction and operation of advanced reactors
- Identify and determine generic and site-specific environmental impacts

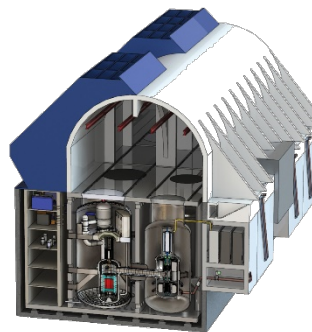
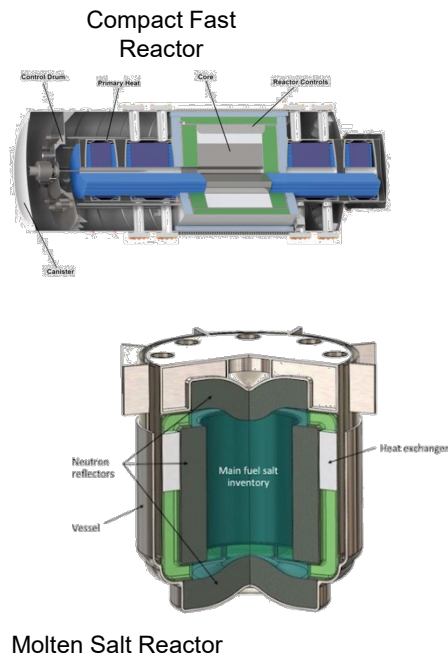
Next Steps

- Tentative GEIS schedule
- May 1, 2020 – Notice of intent to prepare GEIS with 60 day comment period
- May 1, 2021 -Draft GEIS issued for comment
- May 1, 2022 Final GEIS issued

How Would an Advanced Reactor GEIS Streamline the Environmental Review?

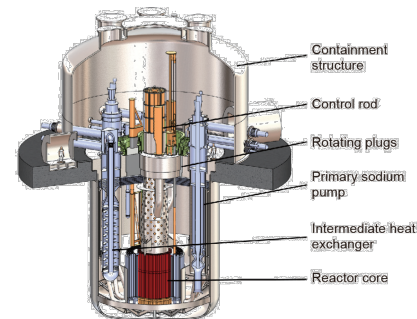
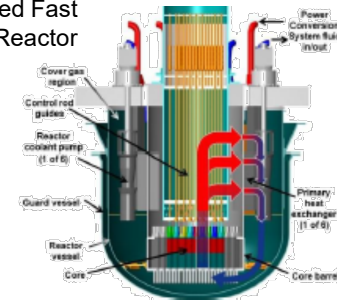
- GEIS process used effectively in license renewal
 - Resolved a majority of issues generically
- GEIS for advanced reactors may provide similar efficiencies

Reactor Technologies



High-Temperature Gas Reactor

Lead-Cooled Fast Reactor



Sodium Fast Reactor

Discussion & Questions

Discussion of PNNL Reports on Table S-3 of 10 CFR 51.51 and Table S-4 of 10 CFR 51.52 for Non-LWRs

**Donald Palmrose, PhD, Senior Nuclear Engineer
Division of Rulemaking, Environmental, and
Financial Support
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission**

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Regulations

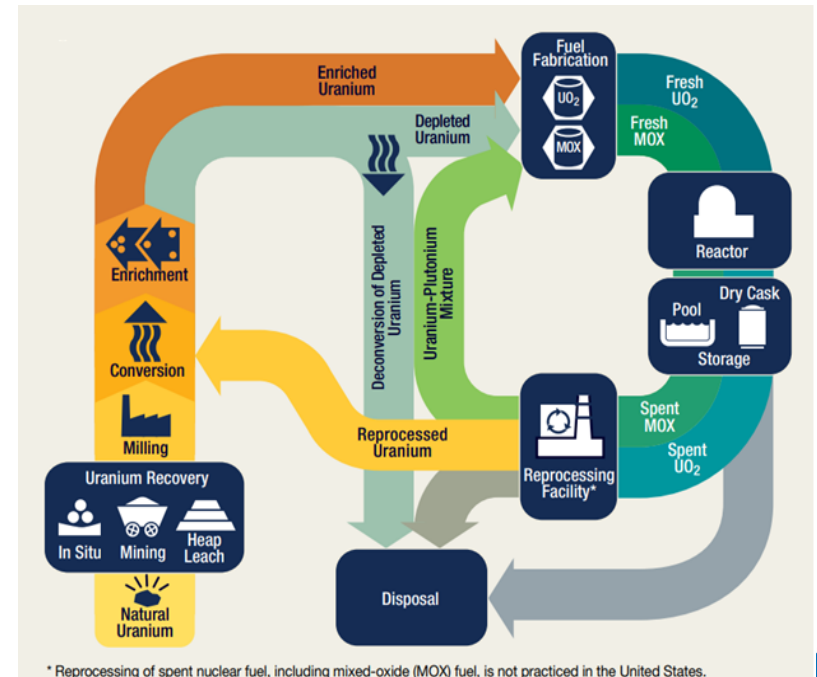
- 10 CFR 51.51, Uranium Fuel Cycle
- 10 CFR 51.52, Transportation of fuels and wastes
- 10 CFR 51.50(c), Environmental Report, Combined license stage
- 10 CFR 51.41, Requirement to submit environmental information

Purpose of the Papers

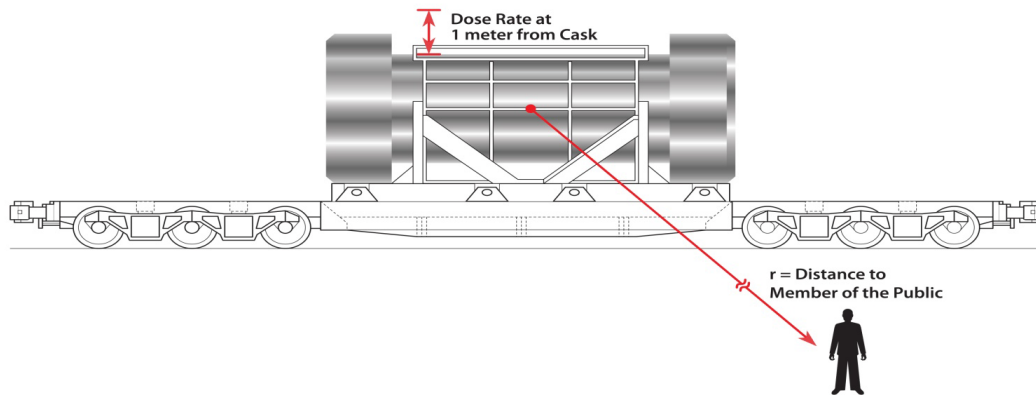
- Not possible to determine the impacts from Tables S-3 and S-4 for non-LWRs
- Developed technology-neutral methodologies to determine the environmental impacts from the fuel cycle and from the transportation of fuel and wastes for all types of non-LWRs
- For use by an applicant and by the NRC in their respective evaluations

Non-LWR Fuel Cycle Environmental Data

- Applicants' Environmental Reports for non-LWRs should contain the basis for evaluating the contribution of the environmental effects of fuel cycle activities
- An approach has been developed to assist with the estimation of non-LWR fuel cycle impacts in terms of natural resource use and emissions



Transportation Analysis for non-LWRs



- The applicant's Environmental Report must contain sufficient information for the NRC to evaluate the transportation impacts for non-LWRs.
- An approach has been developed to provide additional guidance for evaluating transportation impacts for non-LWRs.

Transportation Analysis for non-LWRs (Cont.)

- In general, the methods for non-LWRs are similar to the methods that are used to evaluate transportation impacts for LWRs
- Analysis of transportation impacts must include:
 - Transportation of unirradiated fuel.
 - Transportation of spent fuel.
 - Transportation of radioactive waste.



Closing Remarks

- Developed non-LWR guidance for assessing fuel cycle and transportation environmental impacts
- Community feedback will be important
- If developing an application, NRC encourages pre-application meetings under 10 CFR 51.40 to discuss these topics

Discussion & Questions

Discussion of NEI White Paper on Recommendation for Streamlining NRC Environmental Reviews

**Kenneth Erwin
Branch Chief**

**Division of Rulemaking, Environmental,
and Financial Support**

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Comments on NEI Paper

- NRC Staff has been concurrently pursuing multiple ways to streamline environmental reviews including, but not limited to:
- Developing ISG-029 to tailor environmental reviews to micro-reactors
- Developing an Advanced Reactor GEIS
- Assigning a Tiger Team to streamline EISs for large light-water reactors

Comments on NEI Paper (Cont.)

- Use of electronic reading rooms to expedite research and analyses
- Use of enhanced webinar type public meetings to minimize travel costs
- Use of best practices from previous EIS's, including extended audits and minimization of RAIs, where appropriate

Comments on NEI Paper (Cont.)

- Narrowing scope of environmental reviews as appropriate while still meeting NEPA (and associated rules, regulations, and laws)
- Participation in other government efforts (FAST-41, EO13807, CEQ Regulations Update)

Comments on NEI Paper (Cont.)

- NRC staff is seeking to continue to closely coordinate environmental and safety reviews
- NRC staff is seeking ways to institute lessons learned regarding document production

Comments on NEI Paper (Cont.)

- NRC Staff will consider removing regulatory EIS requirement for new power reactors and subsequent license renewals when it performs future rulemaking for 10 CFR Part 51
- NRC Staff is developing a Generic EIS addressing microreactors and other very small reactors

Comments on NEI Paper (Cont.)

- Existing regulations allow for incorporation by reference (IBR) from existing technical reports and analyses, including the applicant's environmental report (ER)
- NRC Staff is exploring opportunities to increase use of IBR from all sources, including but not limited to ERs
- NRC Staff is exploring whether the consideration of alternatives with respect to non-nuclear energy sources is outside of the scope of its environmental reviews

Discussion & Questions

Break

Meeting/Webinar will begin shortly

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Overview of NEI Comments on CEQ Notice of Proposed Rulemaking

Kati Austgen

April 2, 2020



Council on Environmental Quality (CEQ)



- Issued a notice of proposed rulemaking on potential revisions to the Council's implementing regulations for the National Environmental Policy Act (NEPA)
- NEI submitted comments considering:
 - ongoing government-wide initiatives to streamline administrative reviews
 - the nuclear energy industry's historical experiences with NRC NEPA reviews
- NEI comments are consistent with our March 2020 White Paper, "Recommendations for Streamlining Environmental Reviews for Advanced Reactors"

CEQ's Overarching Objective

- revising its NEPA regulations to facilitate more “efficient, effective, and timely NEPA reviews” by:
 - 1) simplifying and consolidating regulatory requirements while eliminating obsolete provisions,
 - 2) codifying certain guidance and federal case law relevant to the proposed regulations,
 - 3) updating the regulations to reflect current technologies and agency practices, and
 - 4) improving the format and readability of the regulations

Streamlining the NEPA Review Process

- CEQ's proposed regulations, if adopted in their current form and implemented by the NRC (among other agencies), would shorten the NEPA review process, thereby facilitating agency compliance with the deadlines set out by EO 13807 and expediting future NRC licensing proceedings.
- NEI provided comments in eight areas of NEPA regulations where CEQ should make changes to further facilitate more “efficient, effective, and timely NEPA reviews.”

Establishing time limits for agency review and page limits for review documents 1/2

Initiate NEPA review process at the earliest reasonable time

Consistent with:

- NEPA's rule of reason
- the Administration's focus on expediting NEPA reviews
- the NRC's own frequent use of preapplication/pre-scoping activities

Early and effective pre-application engagement with NRC and other agencies promotes a more timely and efficient environmental review process.

Establishing time limits for agency review and page limits for review documents 2/2

Incorporation of presumptive time limits for EIS and EA completion in CEQ's regulations

- COL licensing process and associated NEPA documents were very lengthy
- NRC's recent success completing NEPA reviews for several significant licensing actions (ESP and SLR issuances) in under 24 months

CEQ's proposed 2-year presumptive time limit for EISs is reasonable and achievable.

- Justification for use of presumptive page limits is also well supported

Expanding use of categorical exclusions, mitigated CEs, and mitigated FONSI

Agencies should use a practical and flexible decisional framework for assessing proposed actions and choosing the appropriate level of environmental review.

- It should not be presumed that all advanced reactor license applications require preparation of an EIS.
- Current NRC regulations do not—but should—provide for the flexibility afforded by CEQ’s proposed “mitigated CE” approach.
- “Mitigated FONSI” provide a valid and useful mechanism for expediting advanced reactor projects while still seeking “to prevent or eliminate damage to the environment.”

Optimizing the use of tiering, incorporation by reference, and adoption

Well-established practices serve to expedite the preparation and reduce the length of both EISs and EAs.

- NRC already endorses the use of these practices
- NRC can and should use work done by state or local authorities

The NRC need not redo or duplicate prior analyses, or conduct new studies of its own.

- NRC would continue to exercise independent judgement in relying on that information for purposes of its NEPA evaluation

Improving coordination between lead and other agencies

Encourage the CEQ's efforts to help agencies coordinate and synchronize their NEPA processes

- NRC licensing actions typically require the NRC staff to consult or confer with numerous other agencies.
- Interagency consultations have at times delayed portions of the NRC's NEPA review.

Agencies need to better coordinate and synchronize their NEPA processes to ensure an efficient environmental review that does not cause delays.

Clarifying that “reasonable alternatives” must be “technically and economically feasible” and meet the purpose and need for the proposed action

CEQ’s proposal that the statement of purpose and need be based on the goals of the applicant and the agency’s authority is consistent with federal and NRC case law.

- Agency analyses of alternatives to proposed actions have become unnecessarily complex and expansive in scope.
- Agencies should consider only alternatives that will accomplish the underlying purpose of the proposed action as defined by the applicant.

Simplifying the definition of “effects” and explicitly requiring a reasonably close causal relationship to the proposed action

Focuses agency analyses and resources on those effects of most significance

- those that would be directly caused by approval of the proposed action under consideration

Promoting increased agency use of environmental reports prepared by project applicants or sponsors as the basis for agency's draft EA or EIS

Support CEQ's proposal to allow applicants to assume a greater role in contributing information and material to the preparation of environmental documents

- subject to the independent verification of the agency
- NRC's EIS preparations to a large degree duplicate the applicant's efforts.

Streamlining the public comment process



Can be conducted in a more efficient manner that reduces agency burden and related schedule delays

- timely submittals
- specific comments addressing consideration of environmental impacts and/or project alternatives
- agency flexibility in how they respond

CEQ's proposed enhancements to the public comment process should serve to better focus comments and NRC responses thereto.

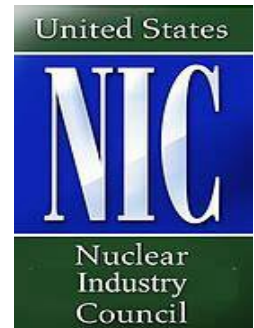
Estimated Timeline

- ~October 2020 – CEQ final rule
- ~October 2021 – agencies (such as NRC) “develop or revise, as necessary, proposed procedures to implement the regulations in parts 1500 through 1508” within 12 months of the date of publication of the final CEQ rule in the Federal Register

U.S. Nuclear Industry Council Discussion of Policy Issues

The Honorable Jeffrey S. Merrifield
Chairman, US Nuclear Industry Council Advanced Reactors Task Force
& NRC Commissioner, 1998-2007

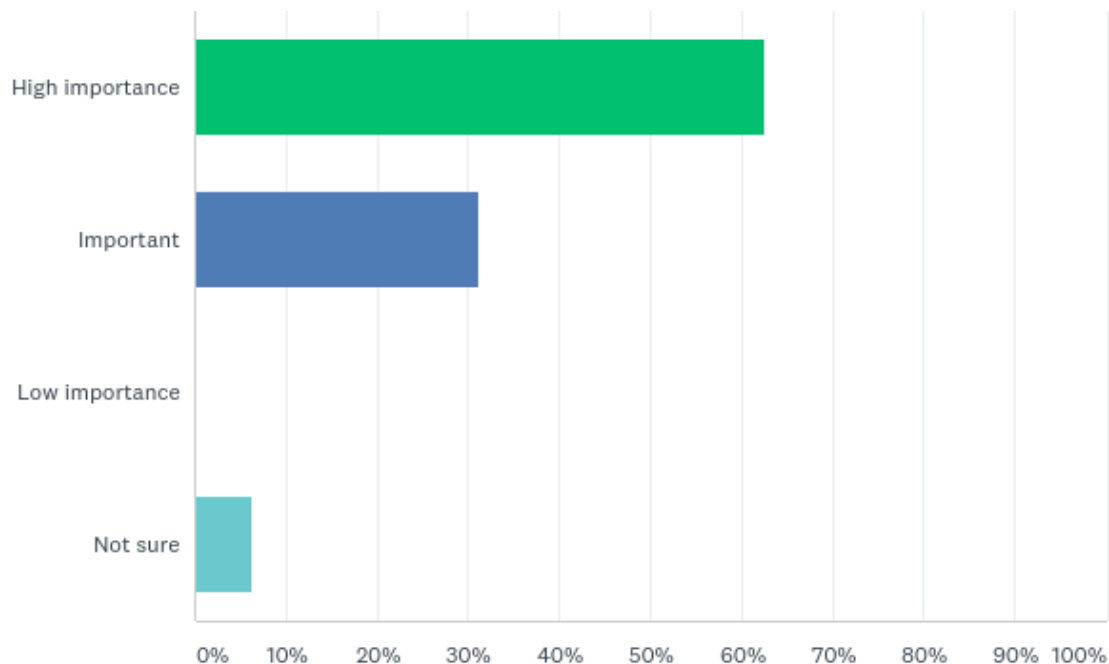
2 April 2020



Overview

- **USNIC commends NRC staff for seeking external comments from advanced reactor stakeholders on policy issues**
- **This presentation provides results of USNIC survey of Advanced Nuclear Developers conducted in March 2020**

Q: How important is the NRC resolution of outstanding generic advanced nuclear licensing “policy issues” to your company?



Q: Of the Policy Issues listed below, please rank their individual importance:

		High Importance	Important	Low Importance	Weighted Average
1	Appropriate Source Term, Dose Calculations, and Siting	69%	31%	0%	2.69
2	Fuel Qualification	63%	31%	6%	2.56
3	Use of Probabilistic Risk Assessment in the Licensing Process	63%	25%	13%	2.5
4	Fuel Cycle Facilities, Higher Enrichments, Transportation	63%	25%	13%	2.5
5	Functional Containment Performance Criteria	56%	31%	13%	2.44
6	Offsite Emergency Planning (EP) Requirements	63%	13%	25%	2.38
7	Advanced Reactor Licensing NRC Framework	44%	38%	19%	2.25
8	Security and Safeguards Requirements	38%	50%	13%	2.25
9	Licensing Basis Event Selection	38%	44%	19%	2.19
10	Operator Staffing for Small or Multi-Modular Facilities	25%	50%	25%	2
11	Manufacturing License Requirements	19%	63%	19%	2
12	Materials Qualification	38%	13%	50%	1.88
13	Industrial Facilities Using Nuclear-Generated Process Heat	19%	38%	44%	1.75
14	Insurance and Liability	13%	38%	50%	1.63

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Blue for Policy Issues with higher rank than last survey; Green with lower rank than last survey

Q: Additional Policy Issues

Endorsement of Codes & Methods for Advanced Reactors

Adoption of computer codes utilized for design and analysis

Accelerated Fuel Qualification using codes developed by the National Laboratories.

Clearer definition of advanced fuel qualification requirements and pathways.

Review times are too long for designs with only 3-4 safety systems

Remote monitoring and operations

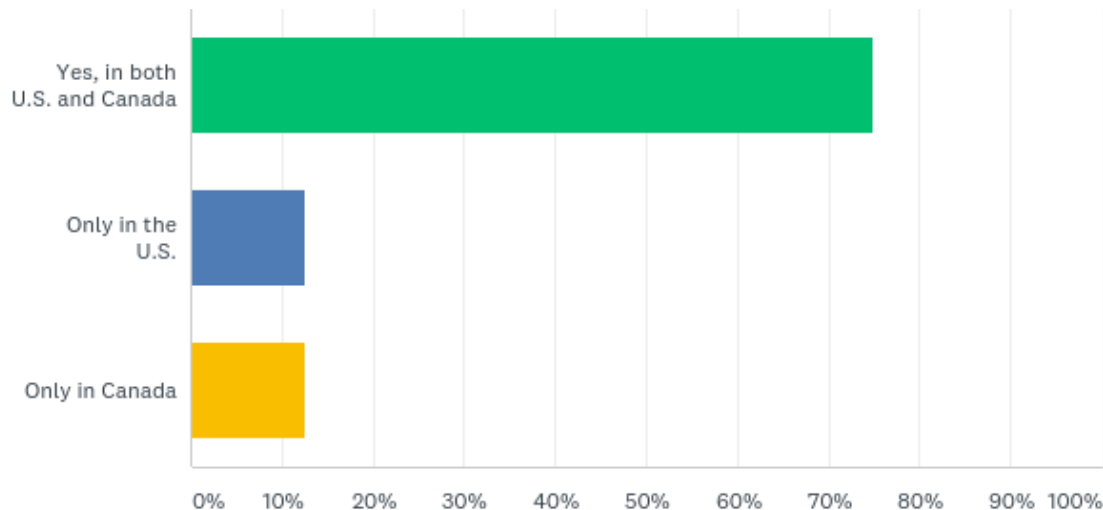
Import of licensing basis from other jurisdictions (such as making use of licensing progress in Canada)

Generic EIS

Consider licensing subcritical accelerator-driven power systems for construction and operation.

Is real-time reactivity measurement important?

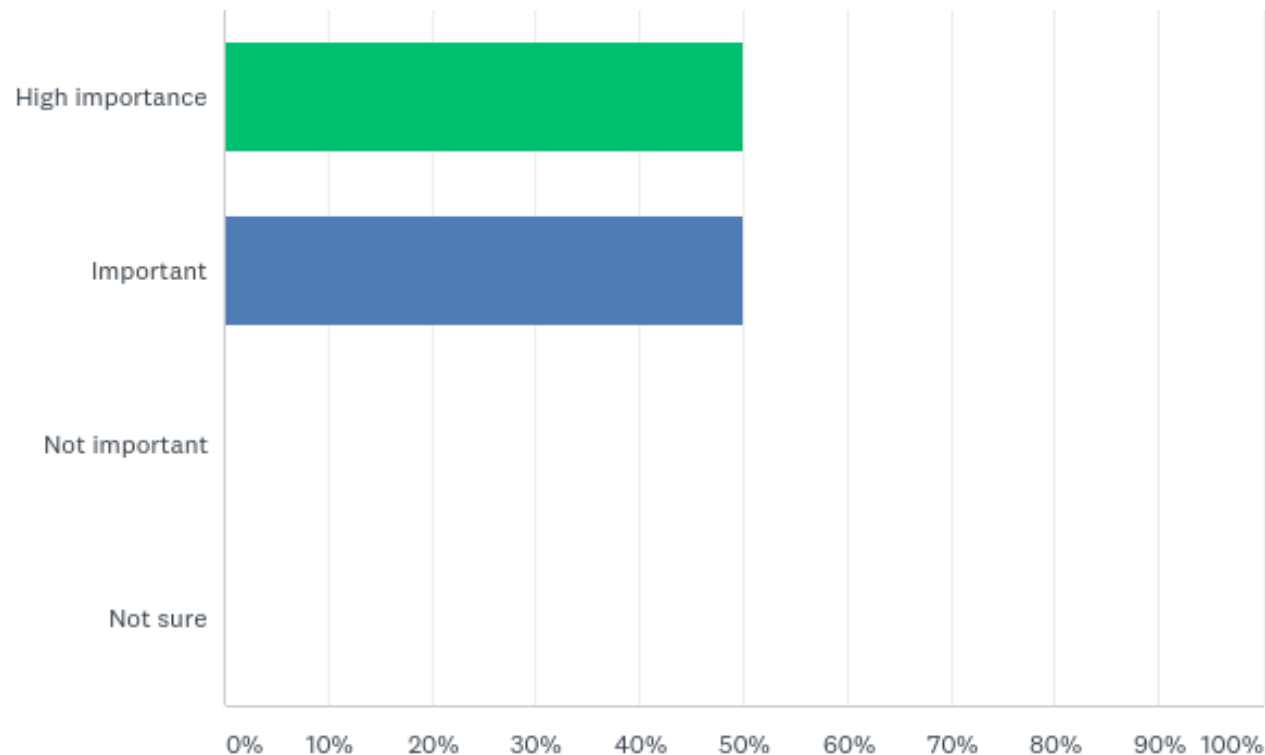
Q: Does your company intend to pursue licensing in both the United States and Canada?



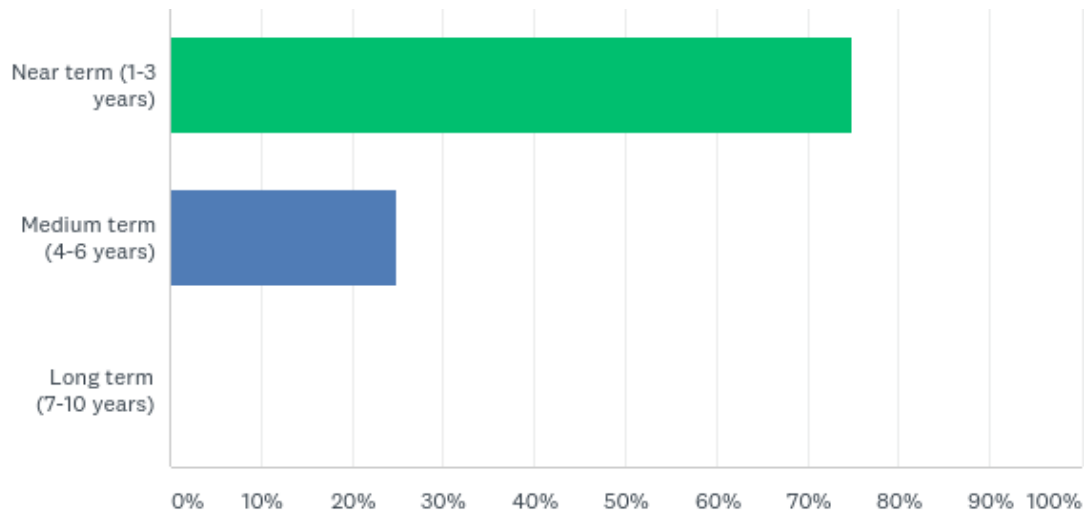
Other countries: Japan, UK, Jordan, Eastern Europe (Poland, Czech Republic, Ukraine) UAE, India, Korea, Indonesia, Ghana

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Q: Does your company support the effort of the U.S. NRC and the Canadian CNSC to align their regulatory review processes?



Q: In what time frame do most of these policy issues need to be resolved by the U.S. NRC and CNSC?



Q: Are there additional actions that the NRC/CNSC and/or Industry can undertake to resolve these issues?

Ensure that the licensing process does not impose any additional burden on the applicants in the short term.

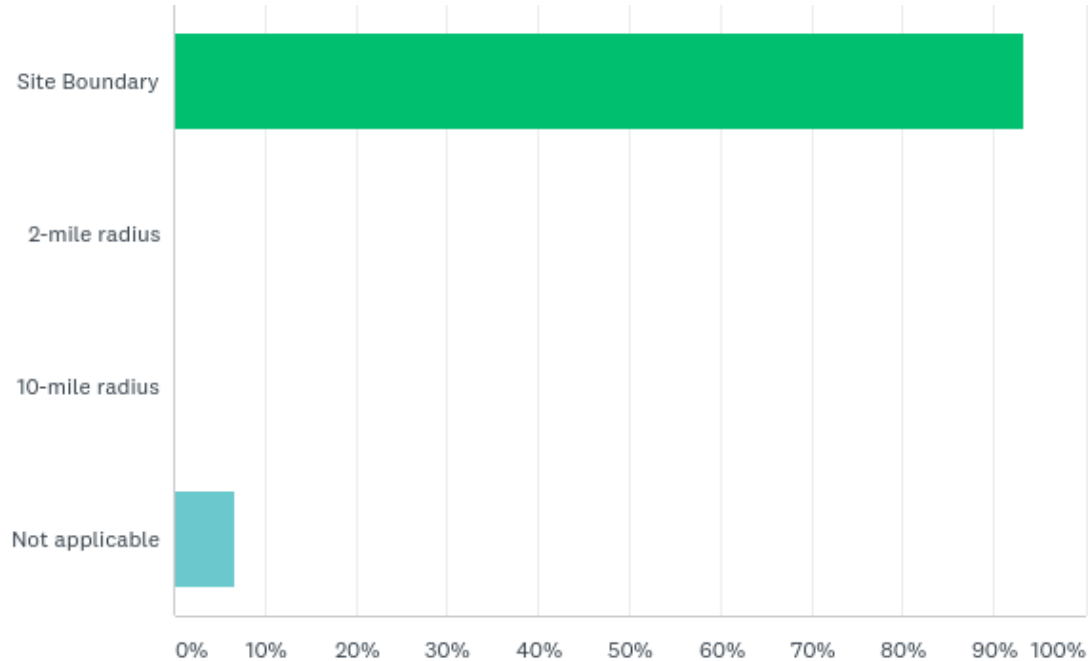
Any resolution of the policy issues within the NRC regulatory framework should be evaluated for potential synergies with CNSC and vice versa.

Licensing frameworks are quite different so helping vendors to map similar requirements would assist development of license applications that can be used in both countries

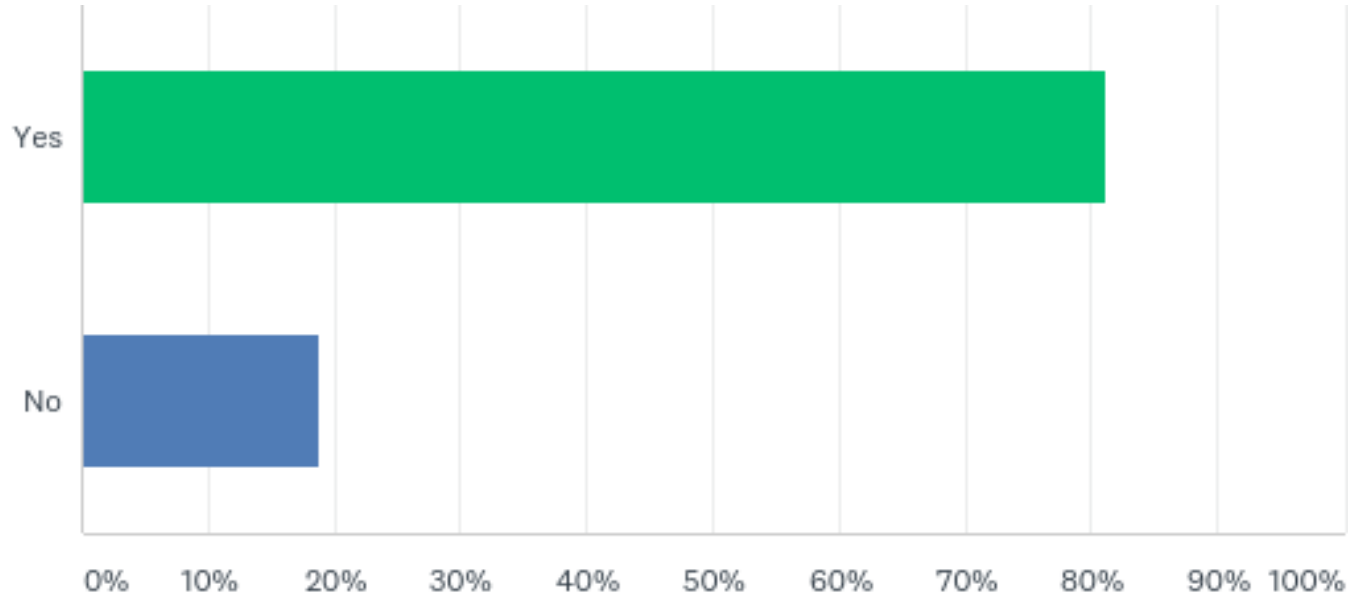
Cooperation on in-reactor testing criteria and/or regimes.

Focus on advanced reactor materials and acceptability including advanced manufacturing techniques.

Q: What is the appropriate Emergency Planning Zone for your technology?

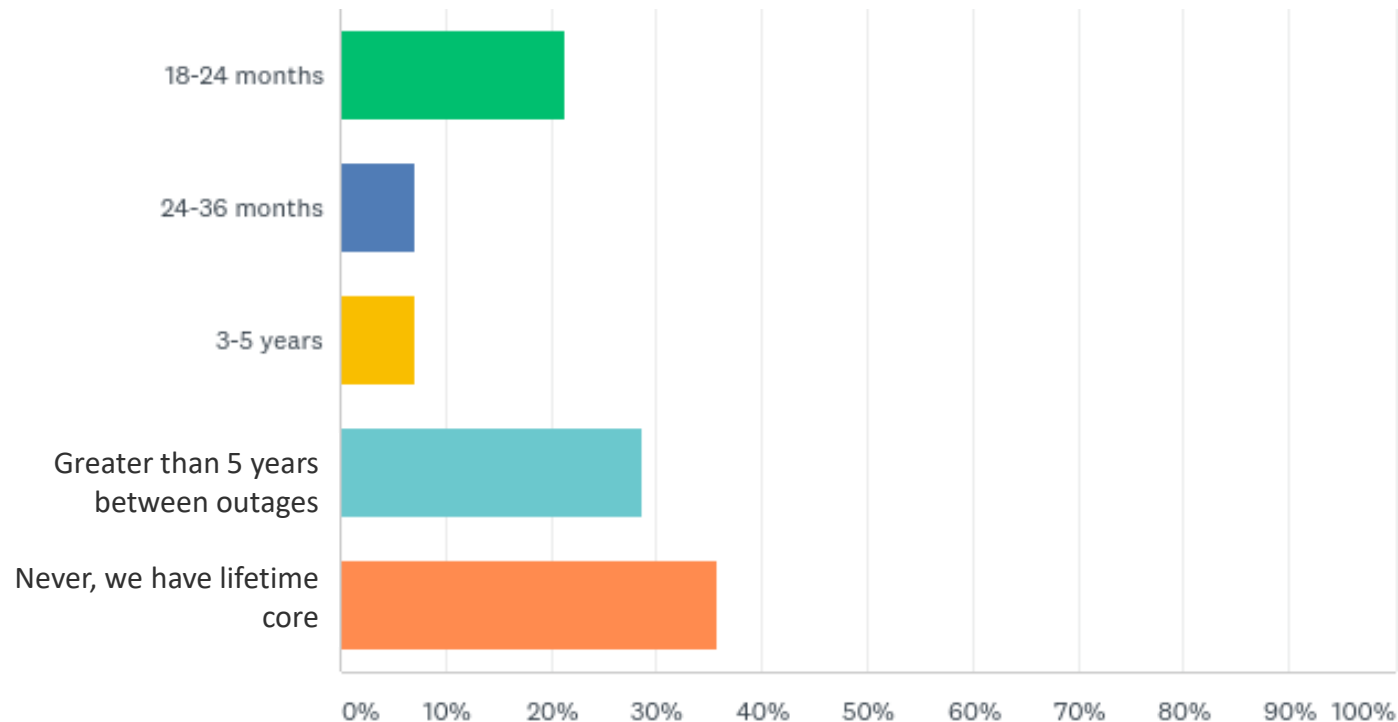


Q: Does your plant design require control room operators to operate the plant?

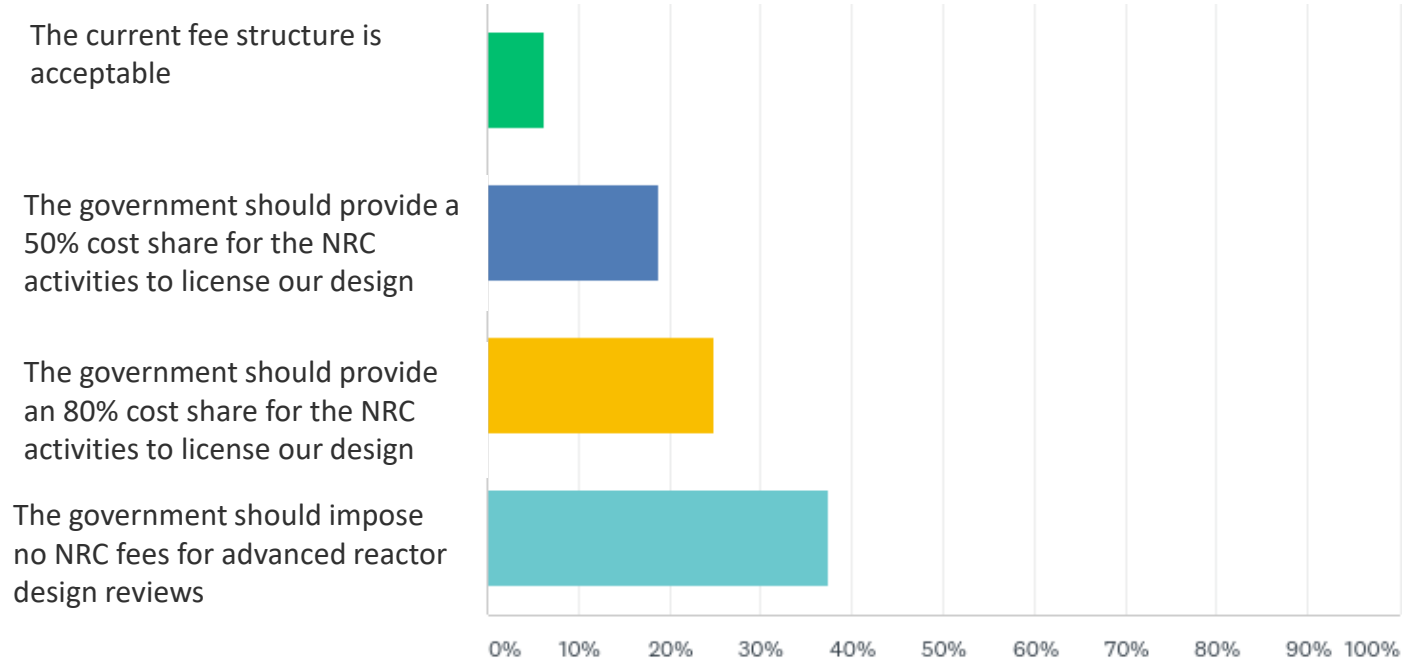


operators/shift (for companies giving details): 1-3 operators/shift

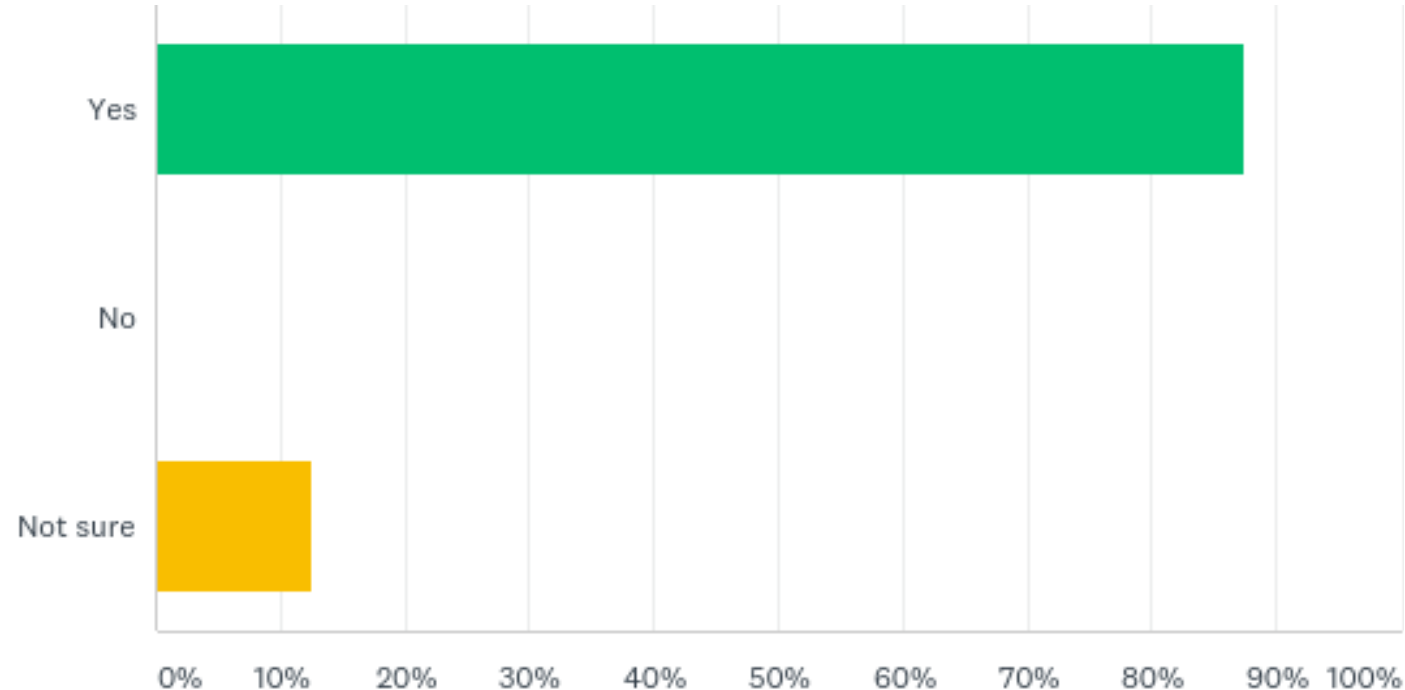
Q: How often do you intend to refuel?



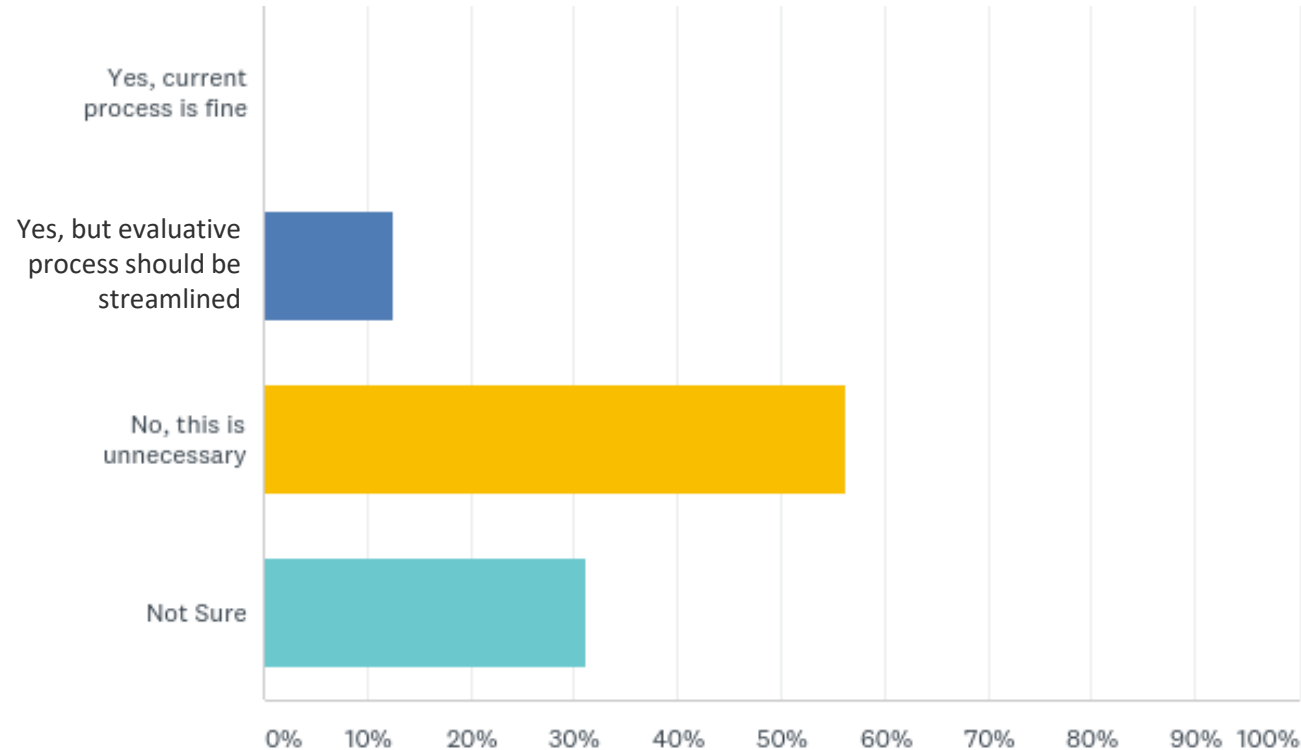
Q: What is an appropriate Nuclear Regulatory Commission fee (for the current regulatory framework and desired future regulatory framework)?



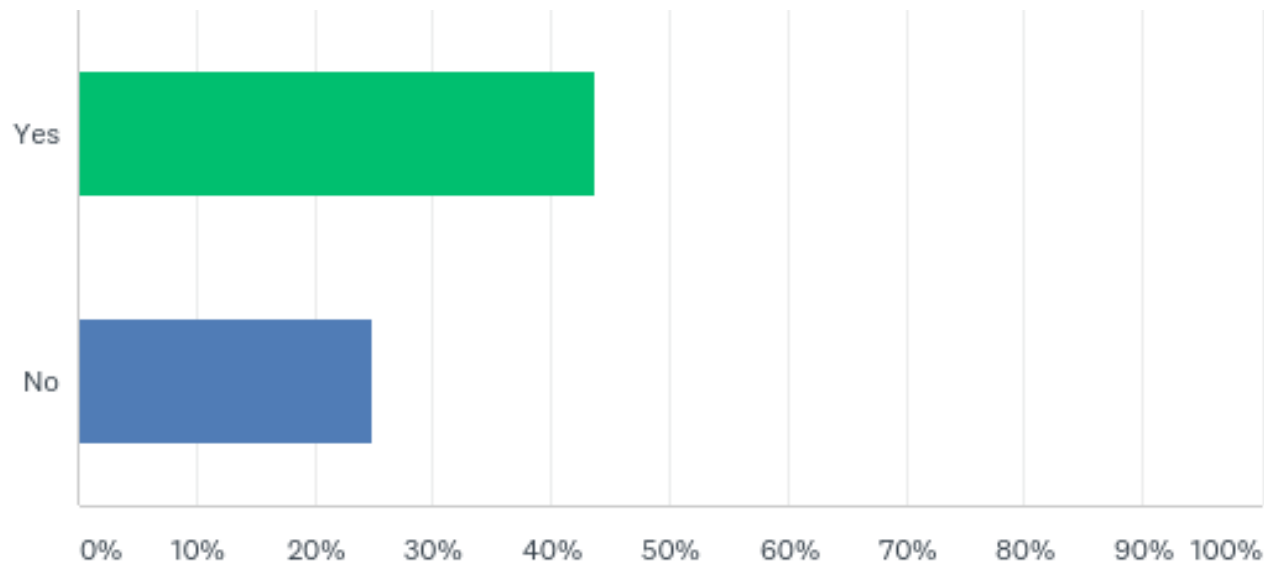
Q: Do you believe the NRC should undertake a process to create a Generic Environmental Impact Statement for advanced reactor designs?



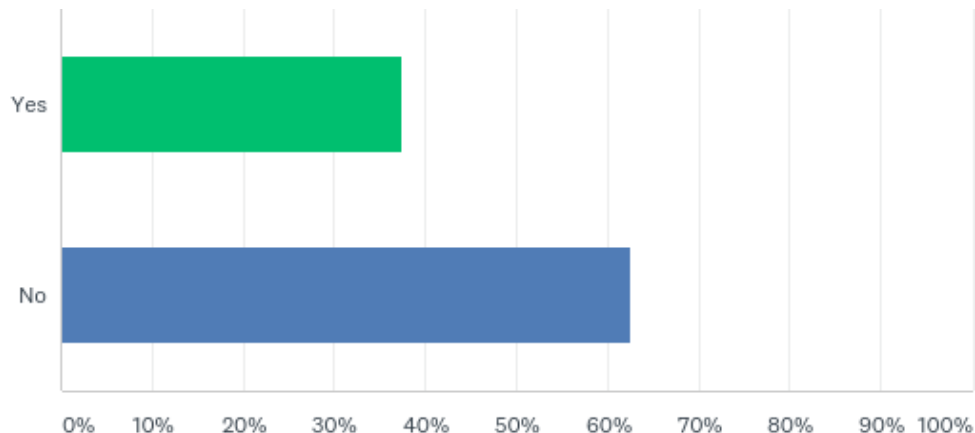
Q: Should the NRC EIS process include a need for power analysis?



Q: Do you plan to seek funding from DOE Loan Guarantee Program?



Q: Was your company a recipient of the DOE GAIN (Gateway for Accelerated Innovation in Nuclear) program?



Q: What are your views regarding the DOE GAIN program?

Good for industry and your company	50%
Funding insufficient	38%
Good for industry but not appropriate for your company	25%
Needs improvement	25%
Efficient for implementing policy	19%
Funding sufficient	0%

Details-- What are your views regarding the DOE GAIN program?

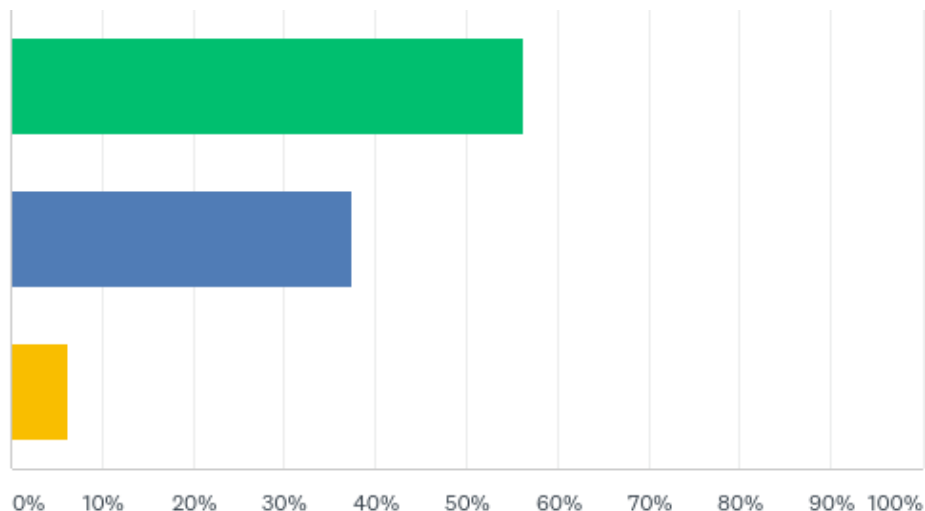
- Overall, DOE GAIN is good for the industry. The effectiveness of the program would increase if less awards were made with higher amounts.
- It appears the GAIN initiative is striking reasonable balance between private industry and federal resources. The planning and facilitation of effective and meaningful workshops and seminars is one example of GAIN providing a very useful bridge.
- GAIN restricts funding to be spent at the National labs - for commercialization we need industry to be part of the recipients. As example, GAIN helps for R&D work in most cases, but once R&D is done we need to start commercializing and perform maneuverability studies, etc. This expertise lies with industry and not the Labs.
- Have not seen the value of GAIN program as it calls for the work to have to be done in the labs.
- Funding levels are too low for some work activities and the limitation on awards is another barrier.
- With our level of maturity, something that might help us on the supply chain, for example, would be more applicable.
- CRADA IP implications should not prohibit development / export opportunities.

Q: Do you plan on using the DOE Office of Nuclear Energy Funding Opportunity (FOA) Awards?

Yes; have received an award

Yes; have not received an award yet
but hope to receive in the future

No; do not expect to use this
program



Q: What issues keep you up at night (multiple answers allowed)?

1	Availability of High Assay Low-Enriched Uranium	63%
2	Sufficient government funding for the development of advanced reactor technologies	56%
3	Ability to sell initial 10-20 commercial units (beyond initial demo unit)	56%
4	Availability of financing for domestic deployment	44%
5	Administration change to one that is not supportive of nuclear	31%
6	Availability of financing for international deployment	31%
7	NRC reactor licensing process	25%
8	Sufficient domestic manufacturing resources to produce your design	25%
9	Potential requirements for safeguards and security	13%

For questions contact

Jeffrey S. Merrifield

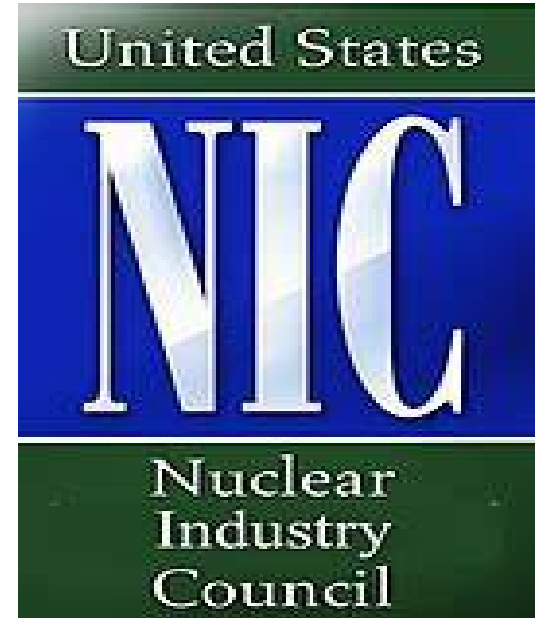
Chairman, US Nuclear Industry Council
Advanced Reactors Task Force

U.S. NRC Commissioner (1998-2007)
Jeff.Merrifield@pillsburylaw.com

Cyril W. Draffin, Jr.

Senior Fellow, Advanced Nuclear,
US Nuclear Industry Council

Cyril.Draffin@usnic.org



Lunch

Meeting/Webinar will begin shortly

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ADVANCED REACTORS - FUEL CYCLE, TRANSPORTATION AND STORAGE REGULATORY ACTIVITIES

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

DIVISION OF FUEL MANAGEMENT

FUEL CYCLE ACTIVITIES

MARILYN DIAZ, PROJECT MANAGER

NRC/NMSS/DFM

TOPICS FOR DISCUSSION

- NMSS/DFM Activities
- Fuel Cycle Facilities
- Training and Preparing Staff
- Transportation and Storage
- Conclusion

NMSS/DFM ACTIVITIES

- Support NRR Advanced Reactor (AR) program.
- Readiness for the review of AR fuel cycle licensing and transportation certification
 - Enrichment,
 - Fuel fabrication,
 - Transportation package certification,
 - Spent fuel storage,
 - Material Control & Accounting (MC&A)

NRC READINESS - FUEL CYCLE FACILITIES

- Regulations (10 CFR Part 70) are adequate for the review of fuel enrichment and fabrication for technologies being developed at higher enrichments.
- We continue to assess our regulatory framework to identify any challenges and/or data needs.
- We are conducting technical evaluations to assess necessary updates for the guidance to account for AR designs
 - Updating NRC guidance for material control and accounting for Category II fuel cycle facilities.
 - Finalizing report on possible material control and accounting approaches for a pebble bed reactor.

FUEL CYCLE FACILITIES – LICENSING ACTIVITIES

- NRC is expecting the following licensing actions:
 - License amendment request from an enrichment facility:
 - Centrus - High Assay Low Enriched Uranium (HALEU) demonstration cascade (FY2020)
 - License application for a new fuel fabrication facility
 - X-Energy for a TRISO-X facility (FY2021)
- Applicants are encouraged to engage early to ensure a common understanding of the implications of new advanced reactor fuel (ARF) designs.

TRAINING AND PREPARING STAFF

- Meetings between AR vendors will help staff gain knowledge on specific designs and technologies.
- Training sessions will provide staff with insights into significant safety features of specific designs and technologies.
- Technical reports addressing safety hazards will help staff risk inform their reviews.
 - Hazards Associated with Molten Salt Reactor Fuel Processing Operations Presentation (ORNL, 2019)
 - Metal Fuel Fabrication Safety and Hazards Presentation (PNNL, 2019)
 - Review of Hazards for Molten Salt Reactor Fuel Processing Operations (ORNL, 2019)
 - Metal Fuel Fabrication Safety and Hazards Final Report (PNNL, 2019)

TRANSPORTATION & STORAGE ACTIVITIES

RICARDO TORRES, MATERIALS ENGINEER
NRC/NMSS/DFM

NRC READINESS – TRANSPORTATION & STORAGE

- We have experience in the approval of transportation packages and storage systems for TRISO and metallic fuels.
- We are completing technical evaluations on transport and storage activities of ARF designs to identify potential information needs and determine whether additional updates to safety review guidance may be warranted.
- We encourage pre-application engagements to support an efficient review of new applications and amendments.

PROSPECTIVE APPLICATIONS & PRIOR OPERATING EXPERIENCE

Prospective Applicant	Non-LWR Technology Type	ARF Type	Applicable Operating Experience
X-Energy	High Temperature Gas-Cooled Reactor	Tristructural isotropic (TRISO)-coated particles in pebble style fuel	United States: Fort St. Vrain; Peach Bottom Unit 1 Germany: Thorium High Temperature Reactor (THTR-300); Arbeitsgemeinschaft Versuchsreaktor (AVR) China: High Temperature Reactor 10
Kairos Power	Fluoride Salt-Cooled High-Temperature Reactor	TRISO-coated particles in pebble style fuel	United States: Fort St. Vrain; Peach Bottom Unit 1 Germany: THTR-300; AVR
Oklo	Sodium-Cooled, Compact Fast Reactor	Nuclear metal fuel (uranium-zirconium U-10Zr fuel alloy with 20% cold worked-316 stainless steel cladding)	United States: Experimental Breeder Reactor-II; Fast Flux Test Facility

NRC EXPECTATIONS

- The use of current NRC-approved transportation packages for new ARF designs is expected to consider the need for:
 - Additional criticality evaluations for transportation of ARF at different enrichments.
 - Additional evaluations to address the structural integrity of metal fuel pins and containment of fuels containing reactive sodium.
 - Revisions to safety evaluations to address test conditions for normal conditions of transport (per 10 CFR 71.71) and hypothetical accident conditions (per 10 CFR 71.73).
- Applicants are encouraged to engage early as they define their plans for transportation of new ARF designs.

SPENT FUEL STORAGE/TRANSPORTATION

- Various in-reactor degradation phenomena of ARF fuels have been identified, which may impact performance in storage/transport

TRISO	Metallic
<ul style="list-style-type: none">• pressure vessel (i.e., the SiC layer) failure caused by internal gas pressure,• irradiation-induced cracking and debonding of the pyrocarbon layers,• fuel kernel migration,• chemical attack of the silicon carbide (SiC) layer,• thermal decomposition of the SiC layer, and• enhanced SiC permeability and/or SiC degradation	<ul style="list-style-type: none">• fuel swelling due to fission gas generation• sodium fusion and migration

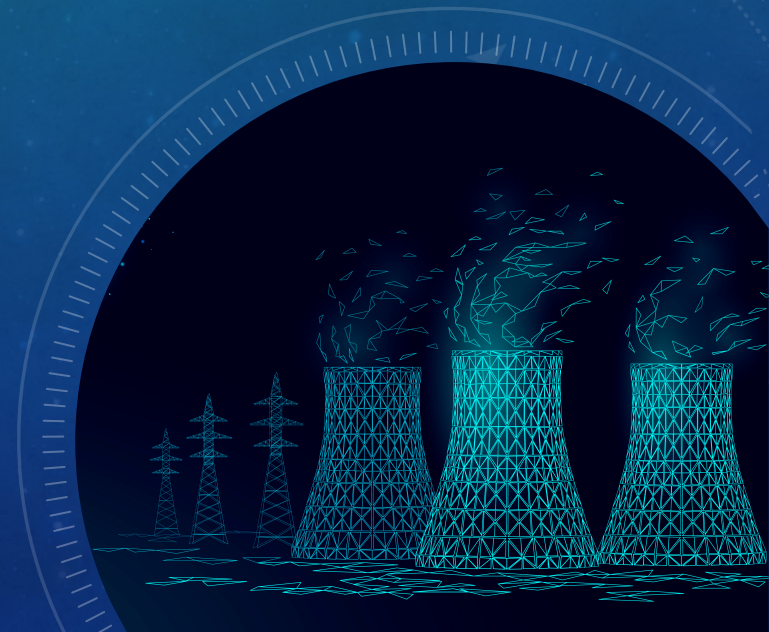
CONCLUSIONS

- NMSS/DFM is proactively identifying potential technical challenges and information needs associated with the safe use of ARFs in the areas of enrichment, fabrication, transport and storage.
- NRC expects some of the efforts related to accident tolerant fuel to benefit the licensing and certification of ARFs.
- Applicants are encouraged to engage early to ensure a common understanding of the implications of new ARF designs.

QUESTIONS

NMSS/DFM ADVANCED REACTOR TEAM

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- Ricardo Torres, Ricardo.Torres@nrc.gov
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- Marilyn Diaz, Marilyn.Diaz@nrc.gov





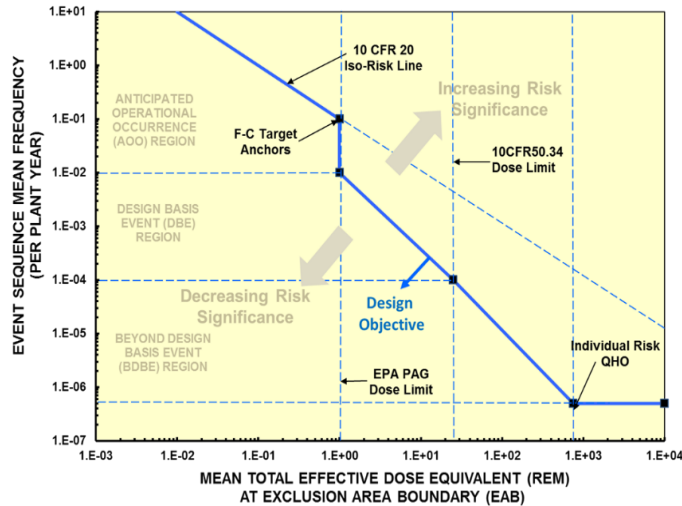
Design Review Guide (DRG): Instrumentation and Controls for Non-Light Water Reactor (Non-LWR) Reviews

Advanced Reactors Stakeholders Meeting
April 2, 2020

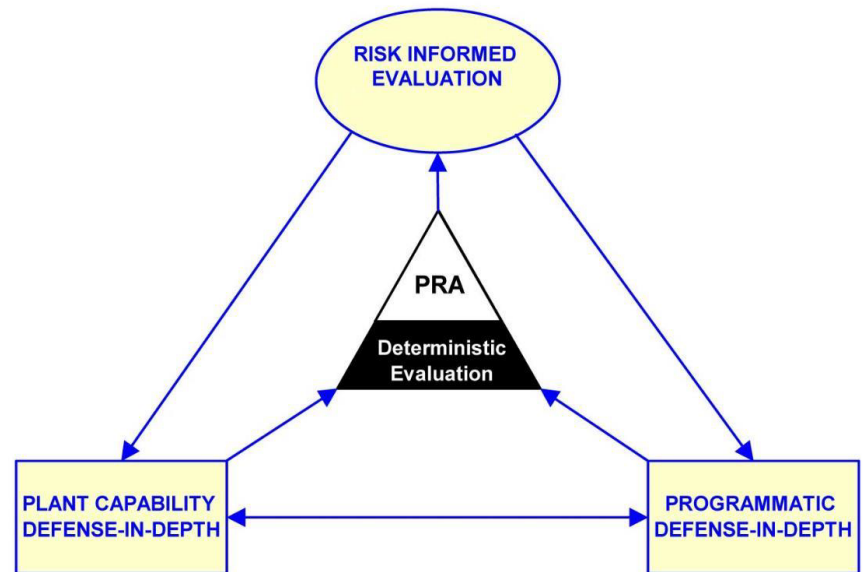
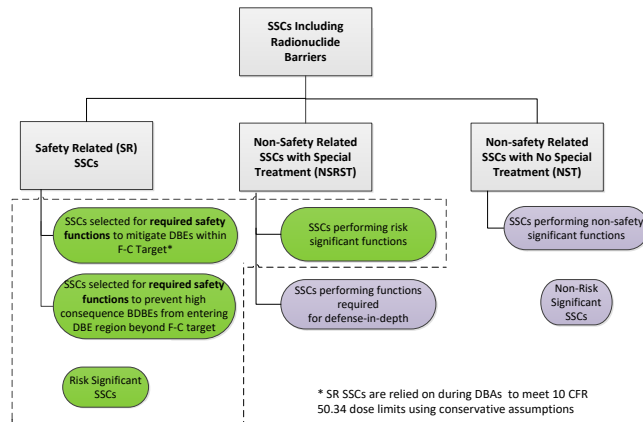
Agenda

- Introduction
 - Licensing Modernization Project
 - Core Review Team Approach
 - Instrumentation and Controls (I&C): Safety-Focused Review Initiative
- Overview of I&C Design Review Guide (DRG) to support NRC staff's safety evaluation of advanced non-light water reactor (non-LWR) applications
 - Goal of DRG
 - I&C System Review Framework
 - Overall I&C Staff Review Approach
- Schedule Milestones

Licensing Modernization Project

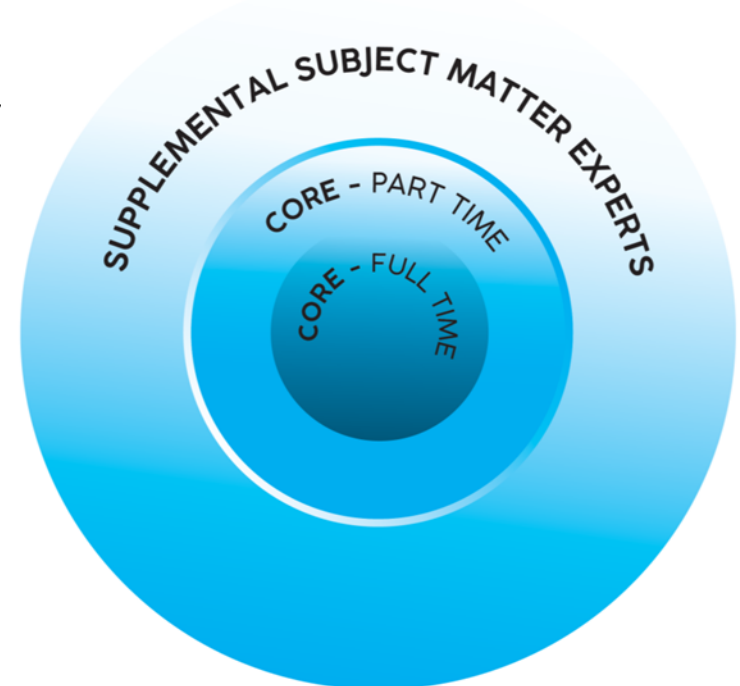


- Licensing Basis Events
- SSC Classification
- Defense in Depth



Core Review Team Approach

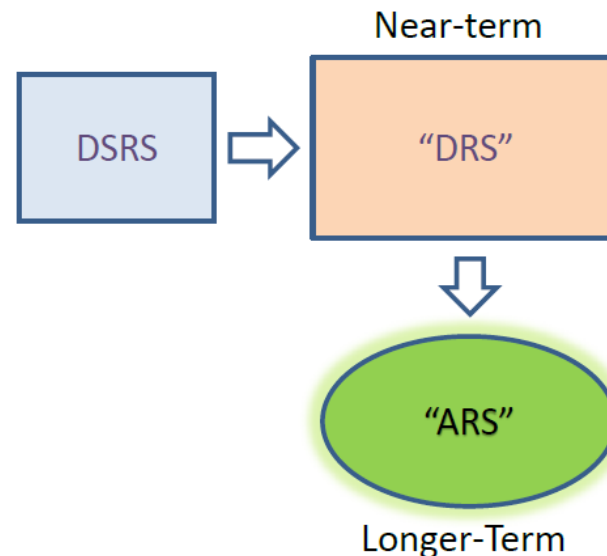
- Non-LWR Review Strategy – successfully implementing for non-LWR preapplication reviews
- Multi-disciplinary core review team supported by subject matter experts from NRR, NMSS, NSIR, RES, OGC
- Focus on the Fundamental Safety Functions
- Perform an Integrated System Design Review
- Demonstrate Compliance with Applicable Regulations



I&C Safety-Focused Review Initiative*

The staff is getting ready for future designs

- Additional lessons learned and new opportunities
- New initiative started
 - Create new, improved guidance for future design reviews in a timely manner
 - Building on DSRS
- Close coordination
 - Advanced reactors
 - I&C modernization
 - Innovation and transformation at the NRC



Evolution of I&C Review Guidance

- NUREG-0800, SRP Chapter 7
 - System-based approach for LWR licensing reviews
 - Guidance not suitable for non-LWRs applications
- NuScale DSRS Chapter 7
 - Improved safety-focused licensing review approach
 - Improved licensing review's efficiency and effectiveness
- Design Review Guide (DRG) for I&C
 - Leverages the DSRS concepts
 - Leverages lessons learned from recent new reactor I&C licensing reviews

Goal of DRG for I&C

- Modernizes the I&C safety review in support of advanced reactor licensing applications

Safety-focused

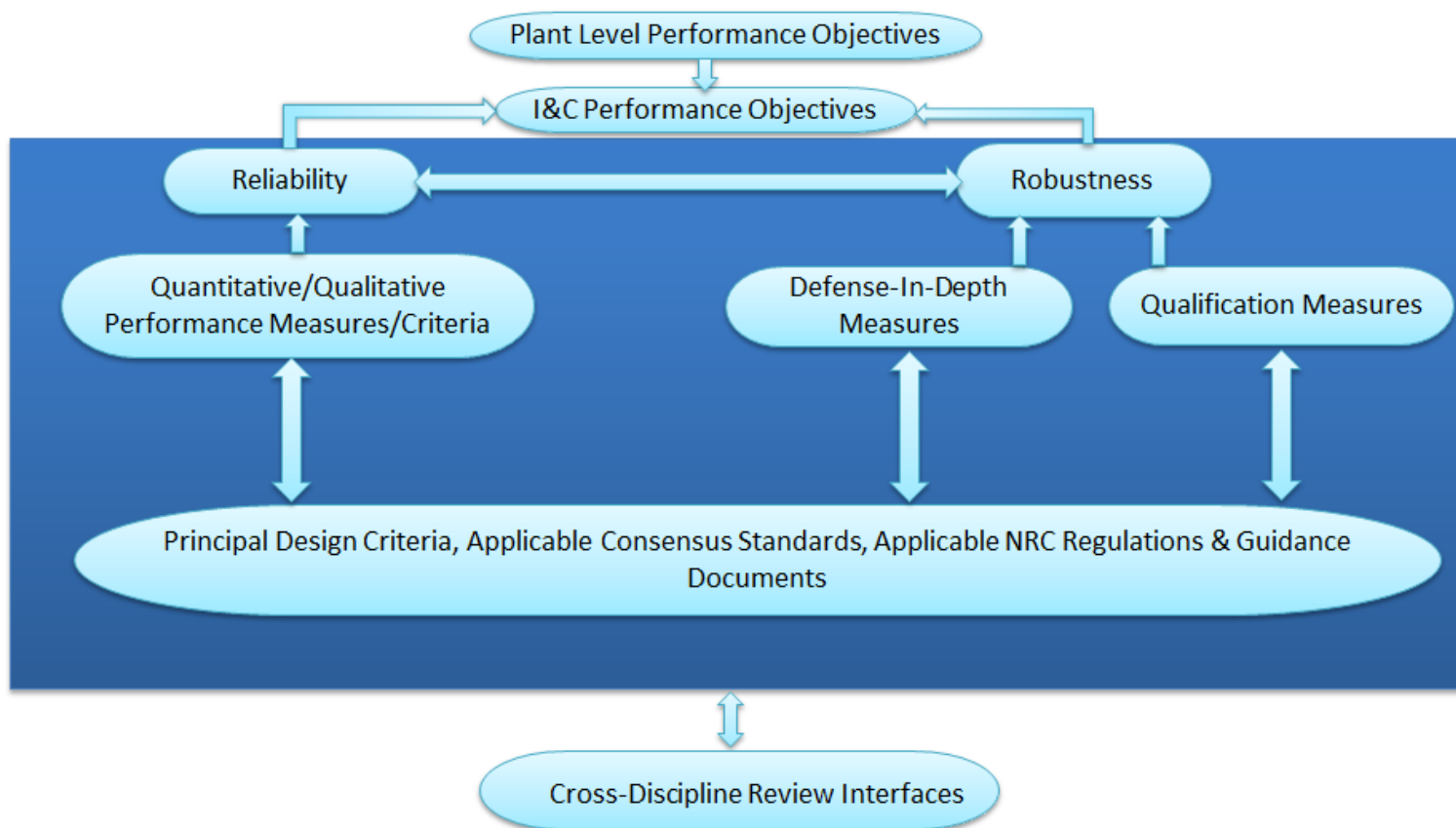
Risk-informed

Technology Neutral

Performance-based

- Supports the NRC's vision and strategy for advanced reactor safety reviews
- Incorporates principles from Draft Guide (DG)-1353

I&C System Review Framework



Legend:



Denotes the I&C review boundary

Overall I&C Staff Review Approach



Architecture

- The staff review starts at the I&C architecture level
- Ensure that the information necessary to understand the proposed I&C architecture and system functions is available



Safety/Risk-Significant Functions

- The staff review focuses on safety/risk-significant functions and selected SSCs that support them
- Ensure that the I&C performance objectives are met



Functions Not Safety/Risk-Significant

- The design-related review for SSCs that the staff determined are not safety-related and not risk significant should be less
- The staff review focuses on ensuring that safety/risk-significant functions will not be impaired by such SSCs

Schedule Milestones

	Activity	Completion Date
A.1	Completion of OGC fatal flaw review	COMPLETE
A.2	Staff to address OGC fatal flaw review comments	COMPLETE
A.3	Submission of draft DRG document for BC concurrence	COMPLETE
A.4	Submission of draft DRG document to OGC for NLO	COMPLETE
A.5	Deadline for Staff to address OGC NLO review comments	Early April 2020
A.6	Issue draft DRG for public comments	Early April 2020
A.7	Public comments in-house deadline	June 2020
A.8	Addressing public comments	July 2020
A.9	DRG ACRS Sub-Committee meeting	June 2, 2020
A.10	DRG ACRS FC meeting	July 8, 2020
A.11	Incorporate ACRS recommendations and prepare final DRG document	August 2020



Break

Meeting/Webinar will begin shortly

Telephone Bridgeline: (800) 857-9764

Passcode: 2899200#



Codes and Standards for Advanced Non-Light Water Reactors

Advanced Reactors Stakeholder Meeting
Louise Lund, NRC Standards Executive
Director, Division of Engineering
Office of Nuclear Regulatory Research
April 2, 2020

Legal and Policy Framework

- National Technology Transfer and Advancement Act (NTTAA) of 1995 (Public Law 104-113)
- OMB Circular A-119, “Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities”
- Management Directive 6.5, “NRC Participation in the Development and Use of Consensus Standards”

Legal and Policy Framework (Cont'd)

- Nuclear Energy Innovation and Modernization Act (Public Law 115–439)(Sec. 103(b)(4)(B)(iii) and (iv))
 - (iii) collaboration with standards-setting organizations to identify specific technical areas for which new or updated standards are needed and providing assistance if appropriate to ensure the new or updated standards are developed and finalized in a timely fashion;
 - (iv) the incorporation of consensus-based codes and standards developed under clause (iii) into the regulatory framework—
 - (I) to provide predictability for the regulatory processes of the Commission; and
 - (II) to ensure timely completion of specific licensing actions;

Non-LWR Implementation Action Plan Progress Summary (SECY-20-0010)

- Strategic Area No. 4: Consensus Codes and Standards
 - Supports the objective of enhancing non-LWR technical readiness and optimizing regulatory readiness.
 - NRC is actively participating and supporting codes and standards development activities, including:
 - ASME B&PV Code, Section III, Division 5
 - ASME Qualification of Active Mechanical Equipment (QME) Committee
 - American Nuclear Society (ANS) Standards
 - ASME/ANS Non-LWR PRA Standard

NRC Codes & Standards Program Activities

- NRC is actively participating in the development and use of consensus codes and standards across multiple SDOs
- NRC Standards Forum (ML18256A356)
 - Purpose: Facilitate the identification of needed standards within the nuclear industry that are currently not being addressed by SDOs, and to collaboratively accelerate their development.
 - Engages stakeholders, such as SDOs, utilities, research organizations, and NRC staff to identify and develop standards used in regulatory applications
 - Next Meeting September 2020

American Nuclear Society (ANS) Activities

- Joint ANS/NRC Workshop on Advanced non-LWRs (May 2018)
 - Workshop for industry stakeholders to develop a strategic vision for advanced reactors standards
 - Several standards and codes emerged as priorities between technology groups as candidate for updating and/or harmonization
- ANS Special Report (November 2019) - Setting the Right Bar: How Consensus Standards Help Advanced Reactor Development
 - Provided recommendations to support development of advanced reactors standards in an accelerated fashion to meet the needs of industry and the NRC.

ANS Special Report Recommendations

1. Congress should authorize and appropriate funding for a DOE program to assist SDOs and advanced reactor developers in conducting accelerated development of and/or updates to key standards needed to implement a technology-neutral licensing framework before 2027, as mandated by the Nuclear Energy Innovation and Modernization Act (NEIMA).
2. The DOE, in coordination with SDOs, should solicit input from the advanced reactor developers nongovernmental organizations, and other stakeholders to identify and prioritize key codes and standards for creation/improvement and an overall time frame for their development and regulatory acceptance.
3. The DOE should provide incentives to national laboratories to ensure proactive participation in developing the new data and methods needed to support a comprehensive overhaul of priority advanced reactor codes and standards.
4. The NRC should implement process improvements and/or provide the resources needed to ensure timely adoption of advanced reactor standards. The NRC should reevaluate the need for imposing margins in excess of the margins in endorsed standards and determine whether they are justified from a perspective of reasonable assurance of adequate protection of public health and safety.
5. The DOE and/or the NRC should establish a formal process with the SDOs for achieving harmonization of safety margins among new and/or updated consensus standards.

ORNL Report on Sodium Fast Reactors

- ORNL/SR-2017/520: Assessment of Applicability of Standards Endorsed by Regulatory Guides to Sodium Fast Reactors (SFRs)
 - Pilot program to explore the scope of work required to expand the regulatory framework to SFRs.
Provided:
 - An estimate of the number of standards that need revision,
 - An estimate of the levels of effort required to revise those standards, and
 - A description of the process for revising or creating a new standard, and
 - A description of the NRC's process for endorsing a standard.

NEI-19-03: Advanced Reactor Codes and Standards Needs Assessment

- NEI provided an overview of the report (ML20083G488) during the February 20, 2020 Advanced Reactor Stakeholder Meeting
- Purpose: To identify and prioritize needed codes and standards for advanced non-LWRs.
- A total of 36 standards were included in the prioritization;
 - 18 identified as “High Priority” for near-term development
 - Includes ACI, ANS, ASME, and NFPA Standards
 - 1 expected to be completed by Dec 2020 (i.e. non-LWR PRA Std.)
 - 3 for which development/updates are ongoing
 - 3 requiring limited changes
 - 11 either new/new-substantive effort or existing/substantive effort required

Next Steps

- Gather input from utility/vendors, standards development organizations, and other stakeholders on codes and standards needs and related near term activities
 - Upcoming meetings to discuss updating potential standards
- NRC to continue its participation on SDO activities for the development and or update of priority standards
- Standards Forum – September 15, 2020.

Questions?

Discussion of Financial Qualification, Price-Anderson Act Considerations, On-site Insurance, and Decommissioning

April 2, 2020

Financial Qualifications

- 10 CFR 50.33 & Appendix C; 10CFR 52.77
 - ... information sufficient to demonstrate to the Commission the financial qualification of the applicant...
 - “reasonable assurance” that it can obtain the funds necessary to construct or operate the facility
- **SECY-18-0026**, “Proposed Rule: Financial Qualifications Requirements for Reactor Licensing (RIN 3150-AJ43),” March 15, 2018
 - Applicant Financial Capacity Plan that will inform the NRC's review of whether the applicant appears to be financially qualified to engage in the proposed activities in accordance with the regulations in this part.

Offsite Liability (Price-Anderson)

- Topic of discussion in previous periodic stakeholder meetings
 - Awaiting NRC report to Congress
- Requirements:

< 10 MWt	10 CFR 140.11(1)-(3)
> 300 Mwe	10 CFR 140.11(4)
	<ul style="list-style-type: none">• Primary• Secondary
10 MWt – 300Mwe	10 CFR 140.12

Property Insurance

- Requirements in 10 CFR 50.54(w)

Each power reactor licensee ... shall take reasonable steps to obtain insurance available at reasonable costs ... covering the licensee's obligation, in the event of an accident at the licensee's reactor, to stabilize and decontaminate the reactor and the reactor station site at which the reactor experiencing the accident is located, provided that:

(1) The insurance required by paragraph (w) of this section must have a minimum coverage limit for each reactor station site of either \$1.06 billion or whatever amount of insurance is generally available from private sources, whichever is less.

- Discussed in previous stakeholder meetings as candidate for exemption request

Decommissioning

- 10 CFR 50.33(k)
 - For an application for an operating license or combined license for a production or utilization facility, information in the form of a report, as described in § 50.75, indicating how reasonable assurance will be provided that funds will be available to decommission the facility.
- Requirements in 10 CFR 50.75, “Reporting and recordkeeping for decommissioning planning.”
- Discussed at previous stakeholder meeting as candidate for exemption request with supporting analyses

Annual Fees

- NRC annual fee regulations revised to address light-water small modular reactors (SMR)
- Staff initiating activity to expand regulations to address non-light-water reactors
- Current requirements (light-water SMR)

≤ 250 MWt	minimum* (\$153K, 2015)
> 250 MWt, ≤ 2000 MWt	variable
> 2000 MWt	maximum

*average of the research and test reactor fee class and the spent fuel storage/reactor decommissioning fee class

Path Forward

- Determine if additional short-term actions needed
- Support interactions on any short-term actions
- Support longer-term activities, including Part 53 rulemaking

Future Meeting Planning and Open Discussion

2020 Tentative Schedule for Periodic Stakeholder Meetings

May 7

June 18

August 6

September 24

November 5

