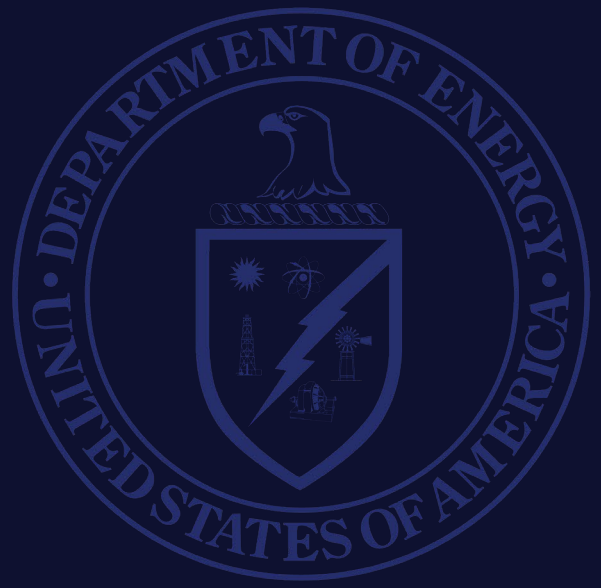


U.S. DEPARTMENT *of* ENERGY

Office of Nuclear Energy

Regulatory Framework Modernization Program Review

Overview of DOE Regulatory Development

Advanced Non-Water Technologies

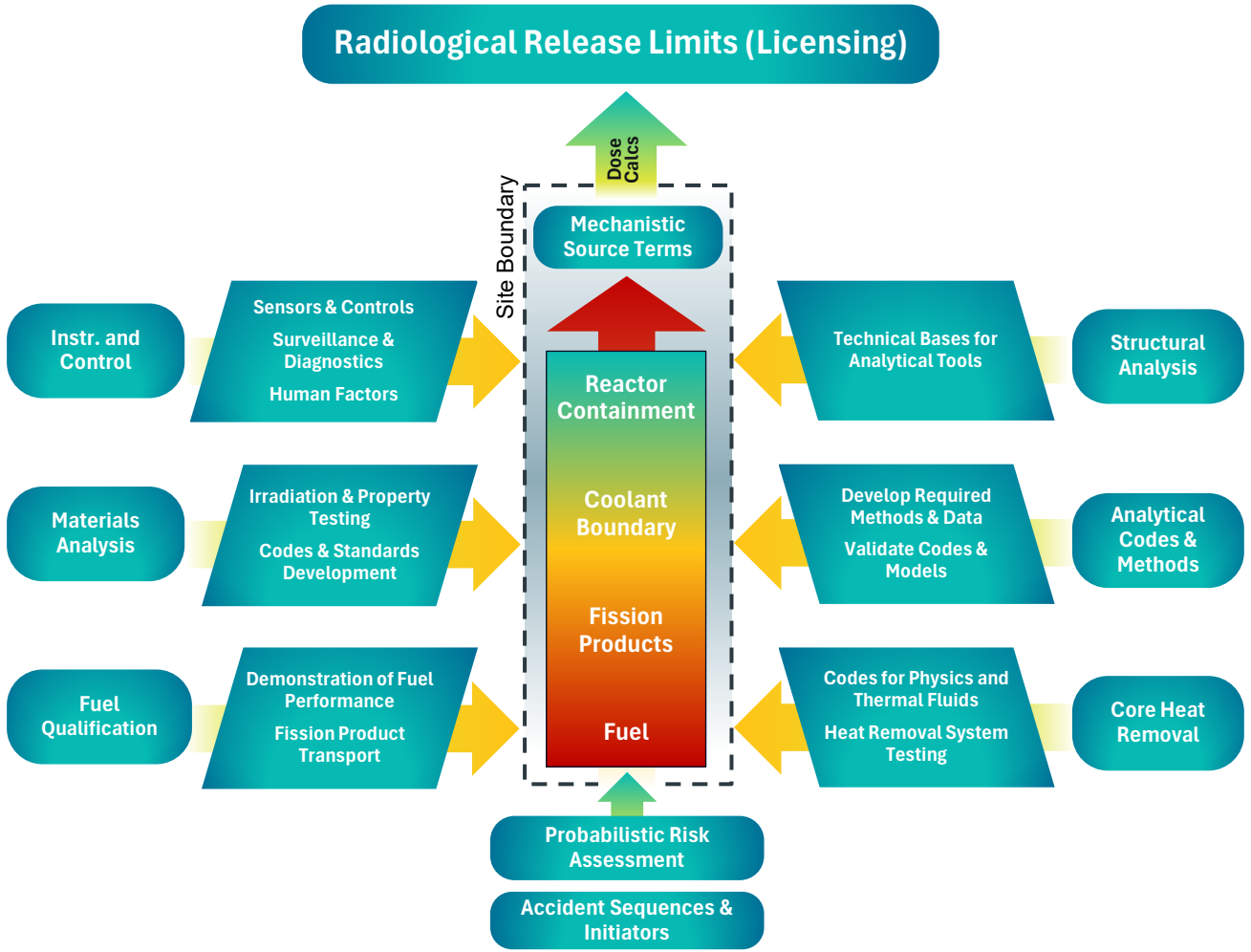
Regulatory Framework Modernization Program Review

Scott Ferrara, *National Technical Area Lead DOE Regulatory Development &*
Division Director (acting), Nuclear Safety and Regulatory Research, INL

April 2025

Overview of DOE Regulatory Development - Advanced Non-Water Technologies

- All advanced reactor deployments will need to develop a design and associated safety case that satisfy regulatory requirements regarding protection of the public.
- Multiple and integrated technical inputs are needed (advanced materials, cybersecurity, radionuclide transport analysis, etc.), and rely heavily on DOE programs.
- Multiple DOE program efforts, including NRIC and the Advanced Reactor Regulatory Development Program, seek to help close technical and regulatory gaps that are inherent in the licensing tree depicted above for new advanced technologies.



Overview of Regulatory Development Structure

Advanced Reactor Regulatory Development is one part of the DOE's Advanced Reactor Demonstration Program

- Advanced Reactor Demonstration Projects (funded via DOE's OCED)
- Risk Reduction for Future Demonstrations
- National Reactor Innovation Center
- Advanced Reactor Regulatory Development
- Advanced Reactor Safeguards

Advanced Reactor Regulatory Development then has four major components:

- Regulatory Framework Modernization
- Fast Reactor Regulatory Development R&D
- Molten Salt Reactor Regulatory Development R&D
- Gas Reactor Regulatory Development R&D

Connections to DOE-NE Mission

DOE-NE Mission	Advance nuclear energy science and technology to meet U.S. energy, environmental, and economic needs.
Mission Goal #2	Enable deployment of advanced nuclear reactors.
Objectives	Reduce risk and time needed to deploy advanced nuclear technology.
	Develop reactors that expand market opportunities for nuclear energy.
	Support a diversity of designs that improve resource utilization.

Note: *Every commercial deployment of an advanced reactor will require regulatory engagement by the developer and the facility's owner/operator(s).*

NRC's Implementation Action Plan (IAP)

The IAP is an NRC initiative originated in 2015 to establish a strategy to assure NRC readiness to effectively and efficiently review non-water reactors, including consideration of their fuel cycles and waste forms.

- NRC gathered industry inputs in 2015-2017 to identify and confirm readiness needs
- The IAP was issued in 2017, with 6 major focus areas identified

Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6
Knowledge, Skills and Capability	Computer Codes & Review Tools	Flexible Review Processes	Consensus Codes and Standards	Policy and Key Technical Issues	Communication

DOE-funded programs are focused on strategy areas 2, 3, 4, & 5, and include for example:

- 2 NEAMS Program, ART Program, Microreactor Program
- 3 Non-LWR design criteria, Licensing Modernization Project, TICAP/ARCAP
- 4 ASME Section III Div. 5, Non-LWR PRA Standard, ANS 20.2
- 5 Functional Containment, "right-sized" Emergency Planning, Microreactor policy issues

Regulatory Framework Modernization Program

Advanced Non-Water Technologies

Regulatory Framework Modernization Review

Overview Regulatory Framework Modernization Program

Regulatory Framework Modernization within the Regulatory Development subprogram coordinates with the industry and the NRC to address and resolve key regulatory framework issues that directly impact the “critical path” to advanced reactor demonstration and deployment.

This area focuses on risk-informing and adapting (“modernizing”) the regulatory framework for commercial reactor facilities, including:

- Resolving Commission policy issue.
- Developing adaptations of light water reactor (LWR) based regulations for advanced non-LWRs.
- Establishing risk-informed, performance-based NRC license application content and review criteria guidance.
- Establishing risk-informed regulatory approaches for key parts of the plant operations phase.

These program efforts are focused on achieving formal NRC endorsement or approval, where applicable, to ensure these areas of regulatory uncertainty are clearly resolved.

Note: *The identification and prioritization of topics address specific regulatory challenges faced by ARDP Demonstration Project awardees and benefit the broader advanced reactor stakeholder community.*

Outcome and Examples of Completed Program Efforts

Regulatory Framework Modernization Program efforts eliminated regulatory uncertainties in key areas supporting advanced reactor deployments. Key achievements include:

Licensing Modernization Project (LMP) – NRC endorsed in Regulatory Guide 1.233

- Established a risk-informed and performance-based approach to advanced reactor design and licensing.

Technology Inclusive Content of Application Project (TICAP) – NRC endorsed in Regulatory Guide 1.253

- Provides guidance to both industry and NRC staff on LMP-based license application content expectations.
- Being utilized by the two DOE-ARDP awardees (TerraPower & X-energy) for commercial licensing.

Historical DOE experimental databases tor use to support NRC licensing

- NRC Safety Evaluation approving Argonne National Laboratory QA program to qualify certain EBR-II historical data.

DOE R&D program results to used support industry fuel qualification efforts

- NRC Safety Evaluation of EPRI topical report that establishes an accepted foundation for TRISO particle fuel qualification.

Current Framework Modernization Work Examples

Further Development of Risk-Informed and Performance-Based (RIPB) Approach

- Technology Inclusive Risk Informed Change Evaluation (TIRICE): Guidance developed for non-LWRs to evaluate facility changes in accordance with 10 CFR 50.59 for licensees using the Licensing Modernization Project approach.
- Technology Inclusive Management of Safety Case (TIMaSC): Project focuses on integrating various activities associated with risk-informed change management for plants with an LMP-based safety case.

Risk-Informed and Performance-Based Emergency Planning

- Developing a consensus technology-inclusive RIPB approach to establishing the plume exposure EPZ and associated emergency plan.

Hazards

- Developing an approach for the assessment of low frequency external events as part of a RIPB licensing approach.

Liquid Fuel Qualification

- Investigated the MSR-specific NUREG/CR-7299 approach to assess and identify any specific challenges with achieving liquid fuel qualification by addressing the key considerations reflected in NUREG-2246, “Fuel Qualification for Advanced Reactors”.

Sodium Fast Reactor Fire Protection – Industry Standard

- Assist with industry efforts to draft an updated version of ANSI/ANS Standard 54.8 - “Liquid Metal Fire Protection …”

International Collaborations

- Continued GIF-RSWG & IAEA participation focused primarily on development of advanced reactor safety design approaches and criteria.

Questions?

U.S. DEPARTMENT *of* ENERGY | Office of Nuclear Energy

Regulatory Framework Modernization

Regulatory Framework Modernization Program Review

Jason Christensen, *Sr. Regulatory Engineer, INL*

April 2025

What is Regulatory Framework Modernization?

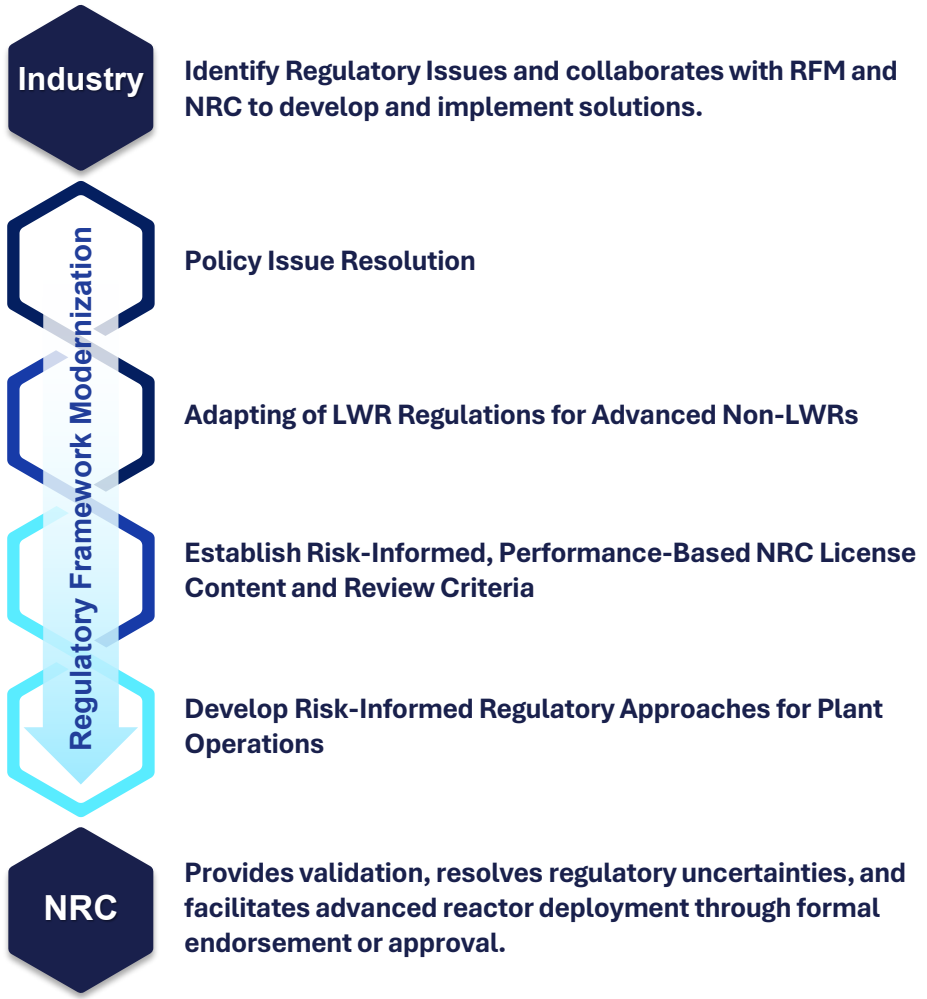
The Regulatory Framework Modernization part of the Regulatory Development subprogram coordinates with the industry and Nuclear Regulatory Commission (NRC) to address and resolve key regulatory framework issues critical to advance reactor demonstration and deployment.

Focuses on risk-informing and adapting ("modernizing") the regulatory framework for commercial reactor facilities, including:

- Commission policy issue resolution
- Adapting light water reactor (LWR) based regulations for advanced non-LWRs
- Establishing risk-informed, performance-based NRC license application content and review criteria guidance
- Developing risk-informed regulatory approaches for key plant operations phases

Efforts aim to achieve formal NRC endorsement or approval, where applicable, to resolve regulatory uncertainties.

- The scope prioritizes addressing specific topics that are specific regulatory challenges to ARDP Demonstration Project awardees, benefitting both the awardees and the broader advanced reactor stakeholder community.



Risk-Informed, Performance-Based Licensing

NRC Probabilistic Risk Assessment (PRA) Policy Statement

- Provides a systematic and comprehensive methodology to evaluate risks, prioritize safety measures, and manage uncertainties in nuclear reactor design and operations.
- Encourages the use of PRA methods to enhance the safety and effectiveness of regulatory decisions.
- Motivates the risk-informed, performance-based (RIPB) approach to modular advanced reactor licensing.

- Complements traditional deterministic design approach to increase the use of risk insights in design and licensing decisions.

Risk-Informed Approach

Incorporates risk insights into decision-making, prioritizing challenges, and managing uncertainties to ensure safety and effectiveness.

- Consideration to a broader set of challenges
- Logical prioritization of challenges
- Consideration of broader set of resources to defend against challenges
- Explicitly identifying and quantifying sources of uncertainty
- Better decision making by testing for sensitivity to key assumptions

Performance-Based Approach

Focuses on measurable parameters and objective criteria to assess and ensure the performance and reliability of systems.

- Use measurable (or calculable) parameters for monitoring
- Objective criteria to assess performance

RFM Work Package Overview

RD-25IN070201: Non-LWR Regulatory Framework Modernization-INL (supports the following)

Technical Area Lead and Program Support

- Technical Area Lead position at INL, including CAM role.

International Collaborations

- Collaborations on advanced reactor safety design and regulatory frameworks.

Non-LWR Regulatory Framework Modernization

- Participation in industry and NRC interactions to influence advanced non-LWR licensing.
- Establishing a defined and predictable regulatory framework.

Regulatory Framework Development

- Supporting the development of regulatory frameworks to facilitate timely advanced reactor deployments.
- Activities include Part 50/52 adaptations, Part 53 review and comments, reactor technology deployment, and material qualifications.

Support for Industry

- Providing a path to solve emerging issues associated with the development of a regulatory framework for advanced reactors.

FY25 Deliverables

M3RD-25IN0702014

- Submit a report outlining summary status of FY25 regulatory framework development activities and recommendations for regulatory development activities for FY26.
- Due July 25, 2025
- Will directly support FY26 IPL development by providing recommendations for R&D activities as well as areas of need from industry partners.

M4RD-25IN0702013

- Complete Status Memo Summarizing FY25 International Collaborations and Associated Progress.
- Due September 19, 2025

Active Participation in Key Regulatory and Licensing Events

Event participation helps staff determine and prioritize needs in the industry that can be supported through the Regulatory Development Program and RFM.

Recent Participation

- Regulatory Development staff engaged with industry and NGOs to provide input on Part 53 development to the NRC during the public comment period (ended February 28, 2025).

Upcoming and Recent Events

- Regulatory Development staff will attend and participate in events held by NRC, DOE, NEI, and industry. Recent events include:
  - **NEI Advanced Nuclear Forum:** In-person event held on March 10, 2025, in Rockville, MD.
  - **NRC Regulatory Information Conference:** Held from March 11-13, 2025.
  - **NEI New Nuclear Licensing Working Group:** Held on March 13, 2025.

NRC Interactions and Engagement

NRC Advanced Reactor Stakeholder Meetings

- **Frequency:** Typically held every 6 weeks.
- **Participation:** Regulatory Development staff typically present ongoing work during one of the spring meetings.
- **Feedback:** Significant industry and government feedback obtained, including research ideas and areas of need for FY26 (and beyond) work planning.

NRC Regulatory Information Conference

- **Frequency:** Held every March in Rockville, MD.
- **Insights:** Provides insights from NRC leadership on the direction of the agency and key regulatory topics.
- **Technical Sessions:** Includes sessions that dive into details of key regulatory topics currently being worked on within the NRC to support both the current operating fleet and new nuclear reactors.
- **Attendees:** Industry partners, reactor developers, NRC staff, national laboratories, international organizations, and members of the general public.

NEI Interactions: Advanced Nuclear Forum

Purpose

- Facilitate collaboration and knowledge-sharing to promote advancements and address challenges in advanced nuclear technologies for a sustainable and secure energy future.

Frequency and Recent Meeting

- Meets three times per year in-person and periodically via webinar to share information from the nuclear community.
- Latest meeting held on March 10, 2025.

Topics Included:

- Increased enrichment rulemaking
- Department of Navy Shore Nuclear Power
- Risk-Informed, Performance-Based Design for Enhanced Safety and Reliability
- DOE/NNSA support for global deployment of advanced reactors and small modular reactors
- Advanced reactor waste and reprocessing
- Nuclear scaling initiatives

NEI Interactions: New Nuclear Licensing Working Group

Purpose

- Lead industry efforts to resolve new nuclear licensing issues and ensure a predictable and efficient regulatory and licensing framework for new nuclear reactors.

Recent Meeting and Changes

- **Date and Location:** Held on March 13, 2025, in Rockville, MD (immediately following NRC RIC).
- Recently split from the NEI New Reactor Regulatory Working Group.

Topics Included

- Part 53 updates from NEI and industry
- Pre-licensing stage regulatory interactions
- Environmental/Generic Environmental Impact Statement (GEIS) and Population Siting Criteria
- Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy (ADVANCE) Act updates
- Regulations of Rapid High-Volume Deployable Reactors in Remote Applications (RHDRA) updates

DOE Reactor/Campaign Program Reviews

Purpose

- Regulatory Development staff will attend and participate in reactor/campaign program reviews to observe ongoing work and identify areas where regulatory development activities could support licensing actions.

Upcoming Reviews

1. **Fast Reactors**: February 4-6, 2025
2. **Microreactors**: March 4-5, 2025
3. **National Reactor Innovation Center**: March 31-April 3, 2025
4. **Molten Salt Reactors**: April 22-24, 2025
5. **Advanced Materials and Manufacturing Technologies**: May 20-22, 2025
   (Supports FY25 AMMT Scoping Work Package)
6. **Gas-Cooled Reactors**: July 29-30, 2025

Industry Licensing and Regulatory Development Priorities

10 CFR Part 53 Rulemaking Revision and Finalization

- NRC revised Part 53 rulemaking to address comments in the Staff Requirements Memorandum and released the updated draft for comment on October 31, 2024.
- DOE Multi-Lab group submitted comments via Federal Register on February 28, 2025.
  - Endorsed NEI comment package with additional comments (mostly security-related)—some major comments include:
    - Use of “risk evaluation methods” instead of a full plant probabilistic risk assessment.
    - Lack of guidance that should accompany the rulemaking.
- Final rule is expected to be sent to the Commission for final voting.

NRC Review Efficiency and Timeliness

- Leverage prior NRC safety and environmental findings on previously approved designs and sites
- Consideration for microreactors with faster deployment timelines.

Industry Licensing and Regulatory Development Priorities Cont'd

Part 50/52 Lessons Learned Rulemaking Updates

- Incorporate lessons learned from the implementation of Part 52 licenses at Vogtle.
- Modify Part 50 for technical consistency with Part 52 changes.

Construction Oversight

- Address the lack of guidance on NRC oversight of new nuclear reactor construction.
- Include manufacturing licenses and factory fabrication of reactors.

Commercial Codes & Standards

- Consideration and endorsement/approval of commercial codes & standards, including ISO-9001 and other commercial QA standards.
- Many suppliers lack Appendix B programs (or NQA-1) due to low demand for nuclear components in recent decades.

Security and Environmental Priorities

Physical Security

- NRC to issue the final rule for 10 CFR Part 73 for advanced reactors.

Environmental Reviews

- Finalize Generic Environmental Impact Statement (GEIS) and associated 10 CFR Part 51 rulemaking.
- Consideration of expanding and enabling the use of environmental assessments (EAs) and categorical exclusions for new reactors.
- Allowing the use of existing environmental analyses, such as those prepared by other federal, state, and local agencies, to be utilized for an EA or EIS.
- Review recent licensing actions and incorporate lessons learned from recent environmental reviews of new reactors.
- Remove or limit the requirements for NRC analysis of alternatives (such as sites).

Siting and Emergency Preparedness Priorities

Siting Guidance

- Lack of guidance for siting of SMRs and non-LWRs in many areas.
- Address population density regulations and population center distance rules.

Near-Term Risk-Informed and Performance-Based Regulatory Guidance

- Include ARCAP, TICAP, Part 53, etc.

Emergency Preparedness

- Develop and finalize emergency preparedness guidelines for new reactor technologies.

Planning for FY26 and Beyond

- Regulatory Development obtains inputs from key stakeholders and reports (DOE, NEI/NEA, Developers, NRC, etc.) to prioritize and propose regulatory projects.

Avenues for stakeholder engagement and input

- Scott Ferrara, Technical Area Lead, Regulatory Framework Modernization Program
  scott.ferrara@inl.gov / (208) 390-5697
- Jason Christensen, Sr. Regulatory Engineer, Regulatory Framework Modernization Program
  jason.christensen@inl.gov / (757) 813-6692

Questions?

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Risk-Informed Performance-Based Emergency Planning

Regulatory Framework Modernization Review

Dave Grabaskas, *Manager, Licensing and Risk Assessments Group, Argonne*

March 2025

Work Package RD-25AN070102 (Part 1)

Risk-Informed Performance-Based Emergency Planning

Goals: Develop a risk-informed, performance-based approach to establishing the emergency planning zone (EPZ) and associated emergency plan for vendors using the Licensing Modernization Project (LMP).

Benefit: Right-sizing of the plant emergency plan and EPZ based on the plant's risk profile can greatly reduce cost and simplify operations.

One of the highest priority licensing items on the EPRI/NEI AR Roadmap

Background

- **Argonne Team (PI)**
- **LMP Developers**
  - Amir Afzali (form. South. Co. & Aalo Atomics)
  - Karl Fleming (KNF Consulting)
- **Industry**
  - Dennis Henneke (ret. GE-Vernova)
  - Partha Chandran (Aalo Atomics)
  - Brandon Chisholm (Southern Company)
- **Expert Reviewers**
  - Mark Cunningham
    - Former Director of NRC Division of Risk Assessment
  - Keith Woodard
    - Radiological consequence expert
  - ANS Risk-Informed Emergency Preparedness Working Group
- **Emergency Preparedness Experts**
  - Bob Kahler
    - Former Branch Chief of NRC Emergency Preparedness Policy and Oversight Branch 2001-2021
  - David Young
    - NEI, Senior Technical Advisor – Security and Incident Preparedness

Background

Project Background:

- Historically, the LWR fleet has utilized uniform, large EPZs
  - Plume exposure pathway EPZ: 10 miles
  - Ingestion exposure pathway EPZ: 50 miles
- The advanced reactor industry would like to develop EPZs and associated emergency plans that are commensurate with plant risk
- The NRC is recently finalized a new emergency planning rulemaking, which provides additional flexibility

Objective:

- Examine existing emergency planning regulation and guidance, along with the new NRC rulemaking activities
- ***Develop an approach to determining the EPZ and developing the associated emergency plan that utilizes the risk-informed, performance-based LMP approach***

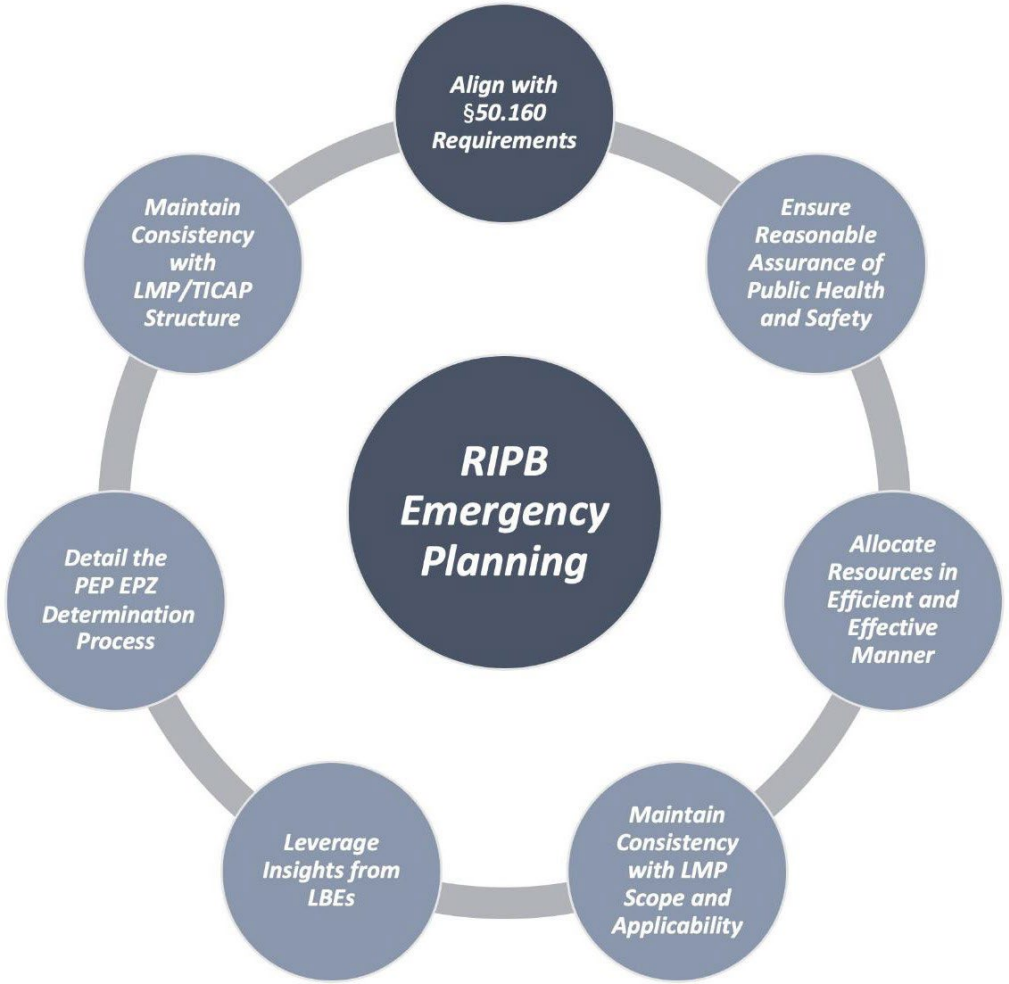
Background

Emergency Planning Background:

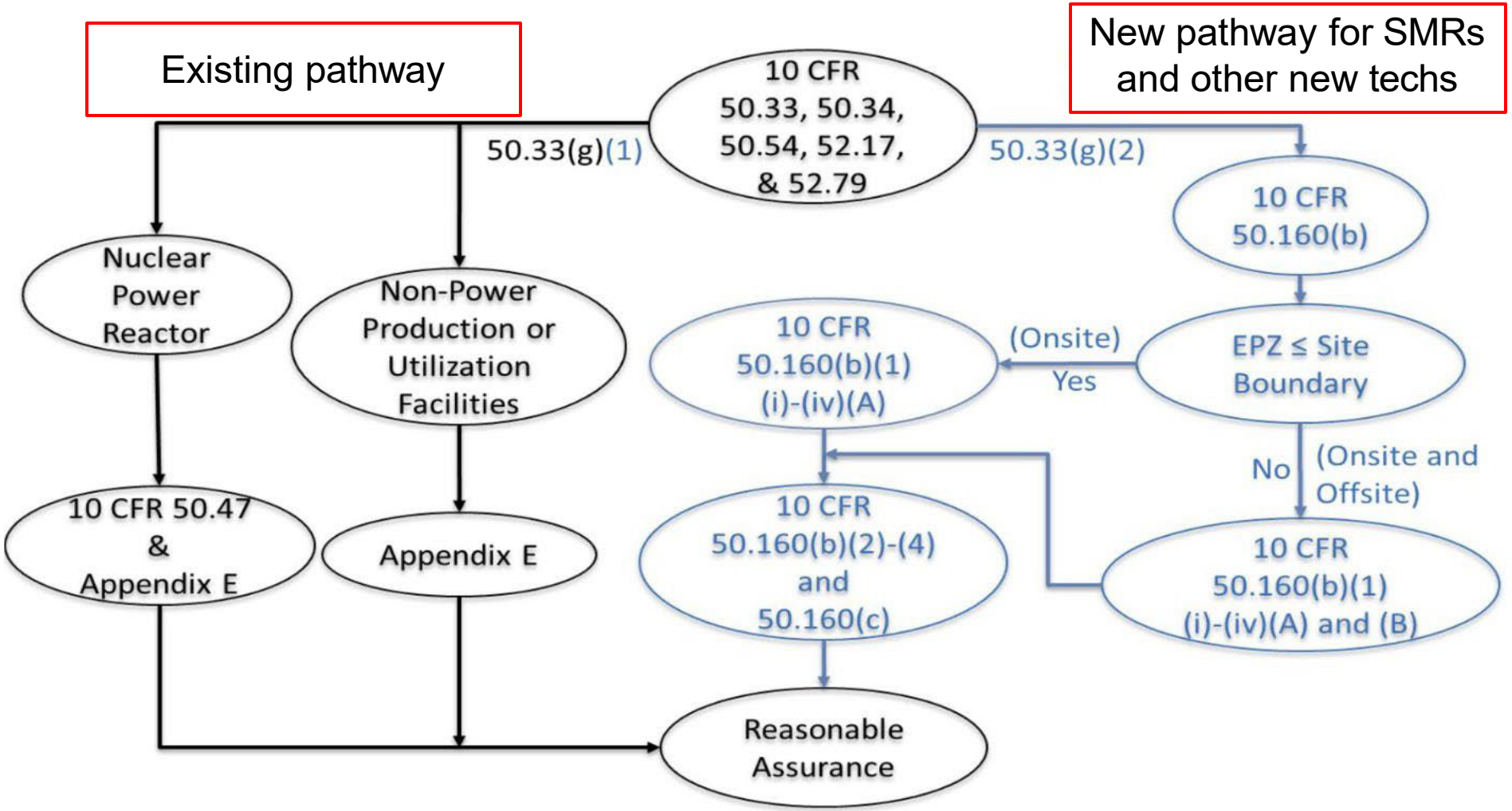
- The goal of emergency planning is to ensure there is reasonable assurance that adequate protective measures can and will be taken in a radiological emergency
- The last line of defense-in-depth

Goals:

- Establish EP approach that leverages RIPB insights from LMP to provide **reasonable assurance** of public health and safety while allocating resources in an **efficient and effective** manner
- High-level objectives of the approach outlined in the figure



Background


Existing pathway
New pathway for SMRs and other new techs
10 CFR 50.33, 50.34, 50.54, 52.17, & 52.79
50.33(g)(1)
50.33(g)(2)
Nuclear Power Reactor
Non-Power Production or Utilization Facilities
10 CFR 50.160(b)
10 CFR 50.160(b)(1) (i)-(iv)(A)
(Onsite) Yes
EPZ ≤ Site Boundary
No
(Onsite and Offsite)
10 CFR 50.47 & Appendix E
Appendix E
10 CFR 50.160(b)(2)-(4) and 50.160(c)
10 CFR 50.160(b)(1) (i)-(iv)(A) and (B)
Reasonable Assurance

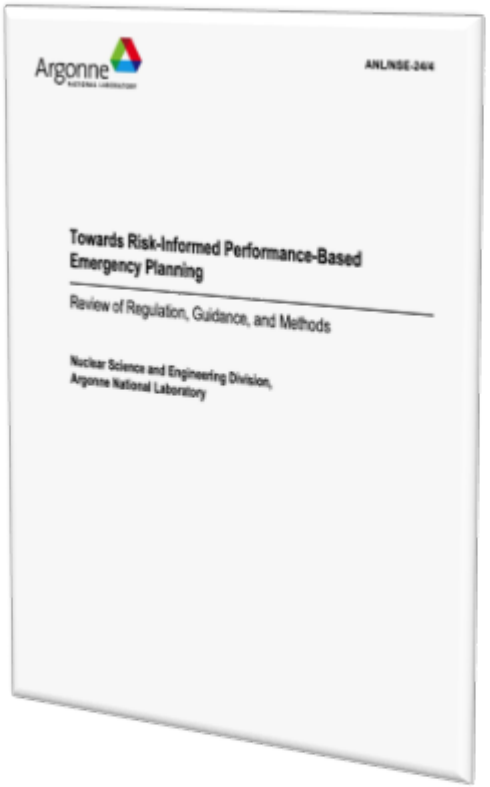
Progress

FY23 and 24

- Completed a study reviewing EP regulation and guidance, along with proposed approaches for EP
  - Documented in ANL/NSE-24/4
- Developed approach for RIPB EP
  - Reviewed by NEI ARRTF and ANS risk-informed EP working group
  - Documented in NEI 24-05 and **submitted to the NRC for review** in June 2024
  - Presented approach at September NRC meeting

FY25

- Awaiting NRC review comments
  - Feedback expected in April 2025
- Working with vendors regarding implementation of the approach



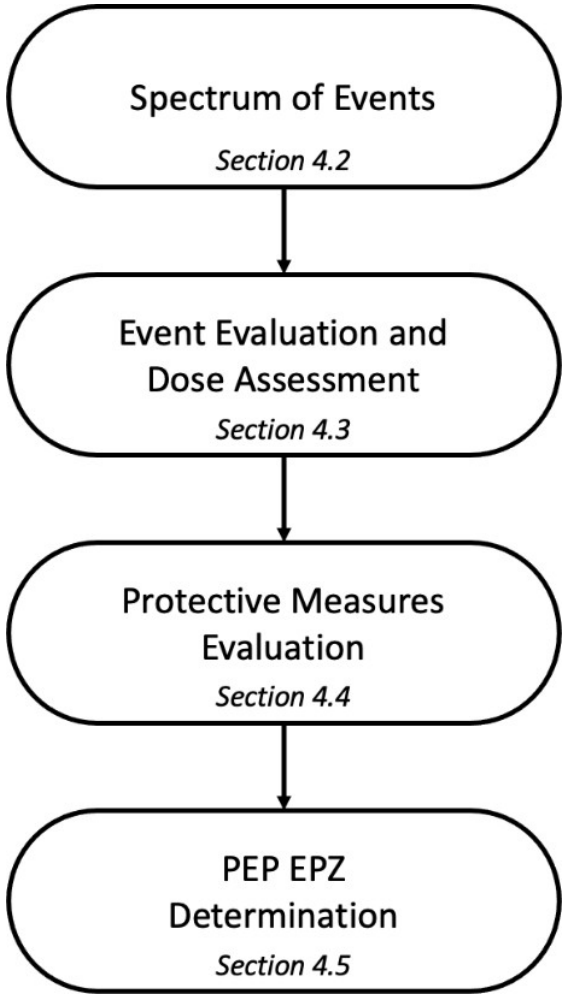
ANL/NSE-24/4 (Review)

NEI 24-05 (Approach)

Approach

EPZ Determination

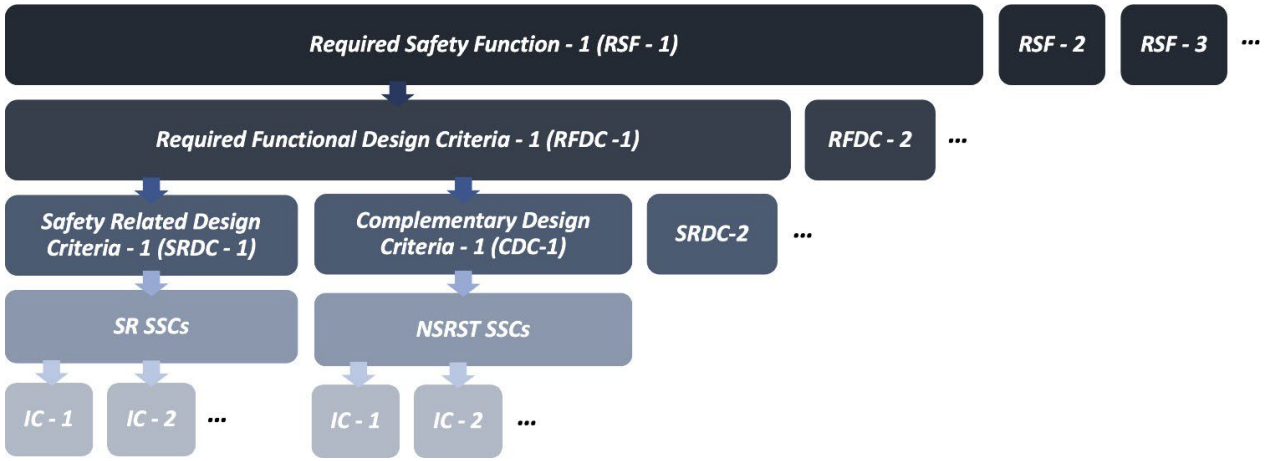
- Utilizes the licensing basis events (LBEs) from the LMP approach to define a “spectrum of events.”
- Dose versus distance curves are developed for the LBEs to determine if the EPA Protective Action Guides (PAGs) are exceeded, and if so, at what distance.
- If the EPA PAGs are exceeded, an analysis is performed to determine if prompt, pre-determined protective actions are necessary.
- Based on this process, three outcomes are possible:
  - No EPZ
  - EPZ at the site boundary
  - EPZ beyond the site boundary



Approach

Emergency Plan Development

- The approach outlines how outputs from the LMP approach and LBEs can inform development of the emergency plan
- Key items include:
  - Determining the Emergency Action Levels and entry conditions
  - Defining onsite and offsite protective actions
  - Command structure and staffing
  - Necessary resources, including monitoring, assessment capabilities, etc.
  - Analysis of how hazards may impact EP implementation



Next Steps

NRC Review

- Respond to upcoming NRC review comments
- Engage with the NRC regarding an update to RG 1.242, which provides guidance on the recent EP rulemaking

Vendor Interactions

- Continue working with vendors regarding implementation of the approach, including collecting feedback and lessons learned

Work Package Title	Description/Milestone	Planned Date
	M4: Progress on NRC submittal and endorsement	3/28/25
	M3: Report on Results, Findings, and Lessons Learned from RIPB Emergency Preparedness and External Hazards Analysis Development and Endorsement Efforts	9/26/25

Questions?

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Regulatory Assessment of Internal and External Hazards

Regulatory Framework Modernization Review

Dave Grabaskas, *Manager, Licensing and Risk Assessments Group, Argonne*

March 2025

Work Package RD-25AN070102 (Part 2)

Regulatory Assessment of Internal & External Hazards

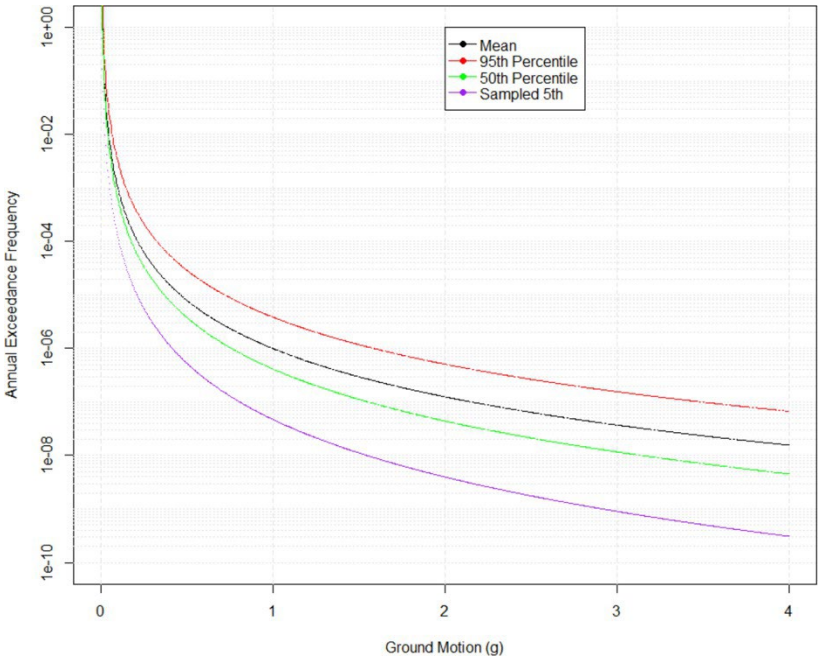
Goals: Assist the advanced reactor industry by identifying, assessing, and addressing key licensing matters regarding external hazards, with a specific focus on low frequency events

Benefit:

Treating hazards in a manner commensurate with overall plant risk can ensure that the plant is sufficiently robust without the need for potentially costly additional protections and/or analysis.

For example, protecting against severe, low frequency external hazards (such as very large seismic events) can be extremely cost prohibitive with debatable impact on reducing plant risk.

Example Seismic Hazard Curves



Background

Internal Hazards:

- Internal hazards are those that can be caused by factors within the plant
- This includes fire, flood (water, oil, other), missile generation, etc.
- Advanced reactor designs address many of the common internal hazard threats present for LWRs, but also introduce new challenges

High Temperature Fluids (Task Complete)

- Study was performed regarding regulatory considerations for the potential release of high temperature fluids (molten salt, sodium, gas) in advanced reactor designs
- Documents challenges, prevention/mitigation strategies, and past licensing experiencing
- Findings presented at NRC advanced reactor stakeholder meeting
- Also informed current sodium fire standard development effort

ANL/NSE-22/35

Background

External Hazards:

- Under the LMP approach, event sequences from the PRA are used to derive Licensing Basis Events (LBEs).
- LBEs include event sequences with frequency as low as 5E-7 per year (1 in 2 million years), with accounting for uncertainty.
- This approach generally differs from the historical, deterministic analysis of external hazards during licensing.

Objective:

- ***Recommend a path forward that ensures a consistent and appropriate treatment of external hazard risk.***
- To the extent practical, foster a common analysis approach for external hazards.

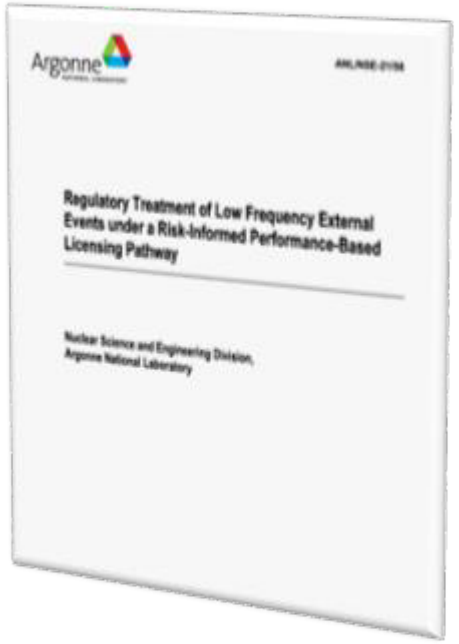
Progress

Prior FYs:

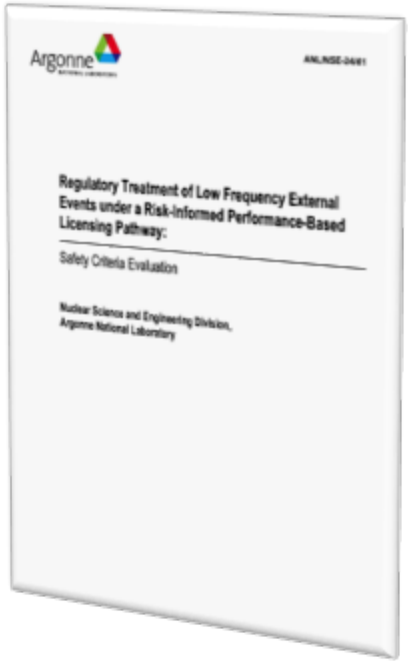
- Explored the underlying issues:
  - Uncertainty in both hazard severity and the response of the plant the result in large uncertainty in the estimated frequency and consequences of the events
- Held extensive discussions with stakeholders (industry, LMP developers, standard bodies, and the NRC and associated contractors) regarding the topic
- Preliminary findings captured in two reports

Method Development:

- Based on these analyses and collaborations, an approach was developed to address seismic events, as it was top external hazard concern for essentially all developers



ANL/NSE-21/56



ANL/NSE-24/41

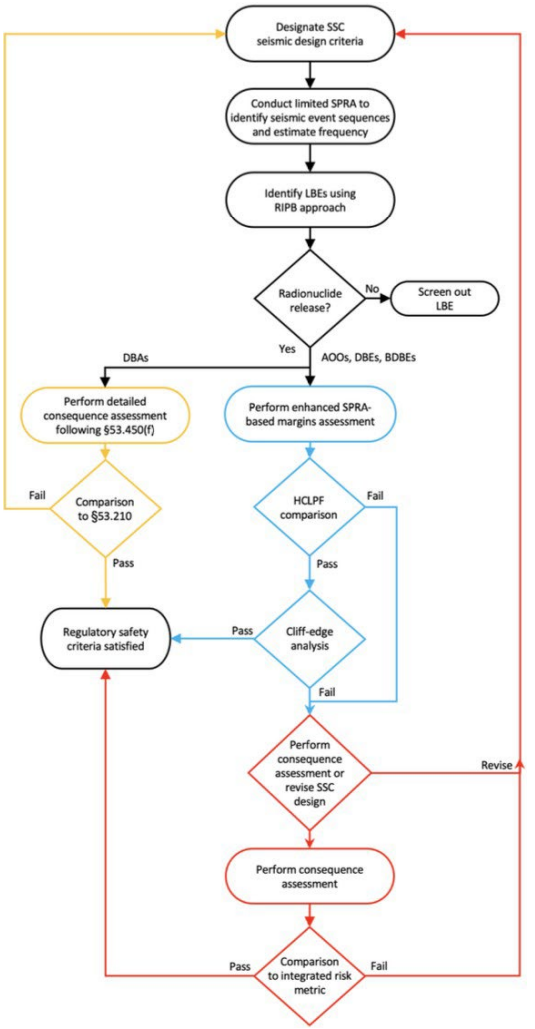
Progress

Enhanced Seismic PRA-Based Margins Approach:

- A risk-informed approach that simplifies seismic analyses
- Utilizes seismic event sequences and demonstrates either:
  - Sufficient margin to dose criteria
  - Sufficient margin to possible occurrence

Benefits:

- Reduce the impact of uncertainties related to the low frequency region of the hazard curve
- Alleviate the need to conduct detailed consequence assessment for highly uncertain, low frequency events
- Retains PRA insights and ability to “right size” SSC seismic design requirements
- Demonstrate adherence to the NRC safety goals, as currently contained in draft 10 CFR Part 53
- Builds on existing NRC guidance and precedent



Progress

Approach Development

- The approach has been documented, including examples, and shared with various stakeholders for review, including:
  - Preliminary NRC review
  - NEI ARRTF review
  - Review from numerous seismic and structural engineering experts

Challenges:

- Evolution of Part 53 wording has required repeated updates to the approach to ensure alignment with safety criteria, including changing draft NRC guidance docs
- Complexity of seismic assessments and the interrelation of several underlying issues
- Philosophical differences regarding external event analysis and determination of “safe enough”

Example Seismic Design Study Results

LBE (event sequence)	Acceptable Consequence[1]?	Optimal Design[2]
3	✓	Design 4
6	✓	
7	✓	
3	✓	Design 4
6	✓	
7	✗	
3	✓	Design 4
6	✗	
7	✗	
3	✗	Design 2
6	✗	
7	✗	

Next Steps

Current Efforts:

- Working with EPRI and NEI to ensure consensus before formal submittal to the NRC
- Updating selected criteria to provide increased clarity regarding their derivation and relation to safety criteria

Challenges and Opportunities:

- Part 53 wording continues to evolve and associated draft seismic design guidance has been delayed for years
- NRC is planning to issue an upcoming RG that provides a pathway for industry to propose new risk metrics and performance objectives

Work Package Title	Description/Milestone	Planned Date
	M4: Progress on NRC submittal and endorsement	3/28/25
	M3: Report on Results, Findings, and Lessons Learned from RIPB Emergency Preparedness and External Hazards Analysis Development and Endorsement Efforts	9/26/25

Questions?

U.S. DEPARTMENT *of* ENERGY | Office of Nuclear Energy

International Safety Standard Collaboration and Development

Regulatory Framework Modernization Review

Dave Grabaskas, *Manager, Licensing and Risk Assessments Group, Argonne*

March 2025

Work Package RD-25AN070303

International Safety Standard Collaboration & Development

Goals: Facilitate international collaboration regarding advanced reactor safety and regulatory development activities to support U.S. advanced reactor vendors on the international market

Benefits:

Promote U.S. perspective and approaches regarding licensing and safety analysis

Combat the influence of Russia, and increasingly China, in international organizations (such as the IAEA) by encouraging the participation of U.S. technical experts

Encouraging harmonization to expedite U.S. technology export

Work Package Title	Description/Milestone	Planned Date
	M4: FY25 International Safety Collaboration Activities	9/26/25

Background

- International organizations, such as the IAEA, routinely seek outside technical expertise to develop and guide projects and publications.
  - Organizations often provide funding for travel expenses
- In addition, opportunities arise to present on U.S. regulatory development progress at workshops and meetings held internationally
- This work package provides an important connection between such efforts and the DOE:NE regulatory modernization program to facilitate travel planning, while also providing a small amount of supplemental funding for preparations and effort

Aligned with NE-6 strategic priority

Outcomes and Next Steps

The work package has supported attendance (or future attendance) at the following events:

1. IAEA “Technical Meeting on Progress in Performance Assessment and Regulation of Passive Systems”
   - Traveler is a lead author of upcoming IAEA TECDOC
2. USDOE – India “Small Modular Reactor Technical Workshop”
   - Presented on SMR safety and licensing efforts
3. Korean Nuclear Society and Korean Hydro & Nuclear Power “Global SMR Technology Workshop”
   - Will present on the development of risk-informed licensing approaches and methods for SMRs and advanced reactors

UNITED STATES — INDIA

SMALL MODULAR REACTOR TECHNICAL WORKSHOP

March 25-26, 2025
Location: New Delhi, India

Under the auspices of the U.S. - India Civil Nuclear Energy Working Group (CNEWG)

한국원자력학회
Korean Nuclear Society

KHNP

Questions?

U.S. DEPARTMENT *of* ENERGY | Office of Nuclear Energy

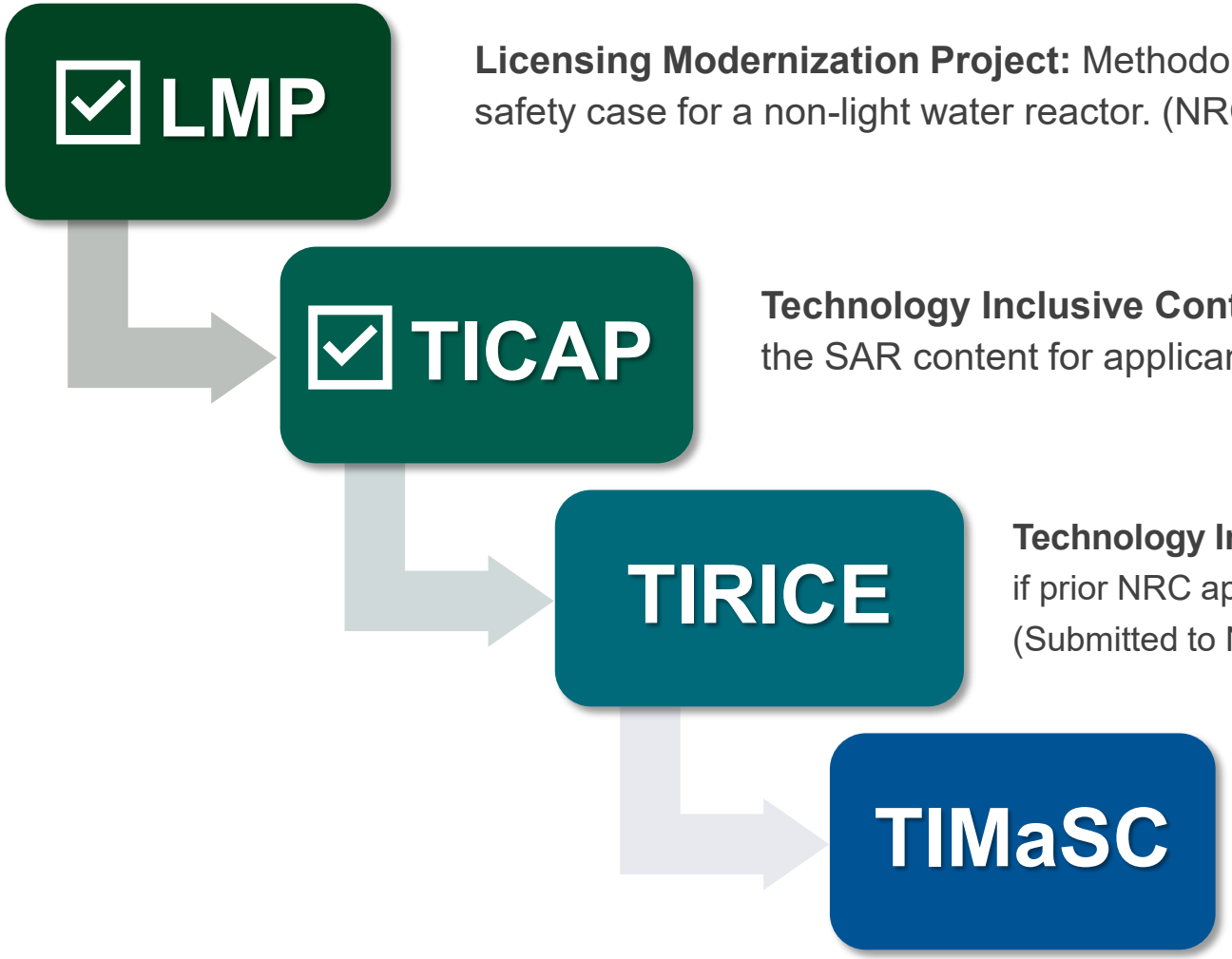
Technology Inclusive Plant and Safety Case Change Management (TIRICE and TIMaSC)

Regulatory Framework Modernization Program Review

Jason Andrus, *Deputy Director MFC Engineering, INL*

April 2025

Integrating Advanced Reactor Designs into the NRC Regulatory Framework



Licensing Modernization Project: Methodology for establishing a risk-informed, performance-based safety case for a non-light water reactor. (NRC Endorsement via RG1.233)

Technology Inclusive Content of Application Project: Documentation of portions of the SAR content for applicants using LMP. (NRC Approval via RG 1.253)

Technology Inclusive Risk-Informed Change Evaluation: Criteria for determining if prior NRC approval is required for changes for a licensee using LMP and TICAP. (Submitted to NRC under NEI 22-05, Pre-decisional Draft RG reviewed Dec 2024)

Technology Inclusive Management of Safety Case: Clarity on how to manage portions of the Safety Case (e.g. PRA change control, changes to understanding of plant states). [Ongoing FY25 Activity]

Key Objectives of TIMaSC

LMP-Based Safety Case (LMP/TICAP) is Risk-Informed: establish clarity on how changes (model updates or new operational information) propagate the licensing basis—this is expected to include:

1. New information that impact aspects of the facility safety case:
   - Type and magnitude of external hazards could affect PRA results or deterministic analyses
   - Operating experience indicating reliability or capability targets for SS SSCs are not met, etc.
2. Probabilistic Risk Assessment (PRA) Changes and program(s) to control the PRA:
   - Methodology updates,
   - Changes to SSC or Licensing Basis Event (LBE) risk significance,
   - Adjustments to LBE frequencies or consequences.
3. Changes to Plant Programs:
   - Play substantive role affecting the safety case (e.g., Defense in Depth, SSC Special Treatments).
   - Assuring other programs maintain efficacy through TIRICE or other control methods.

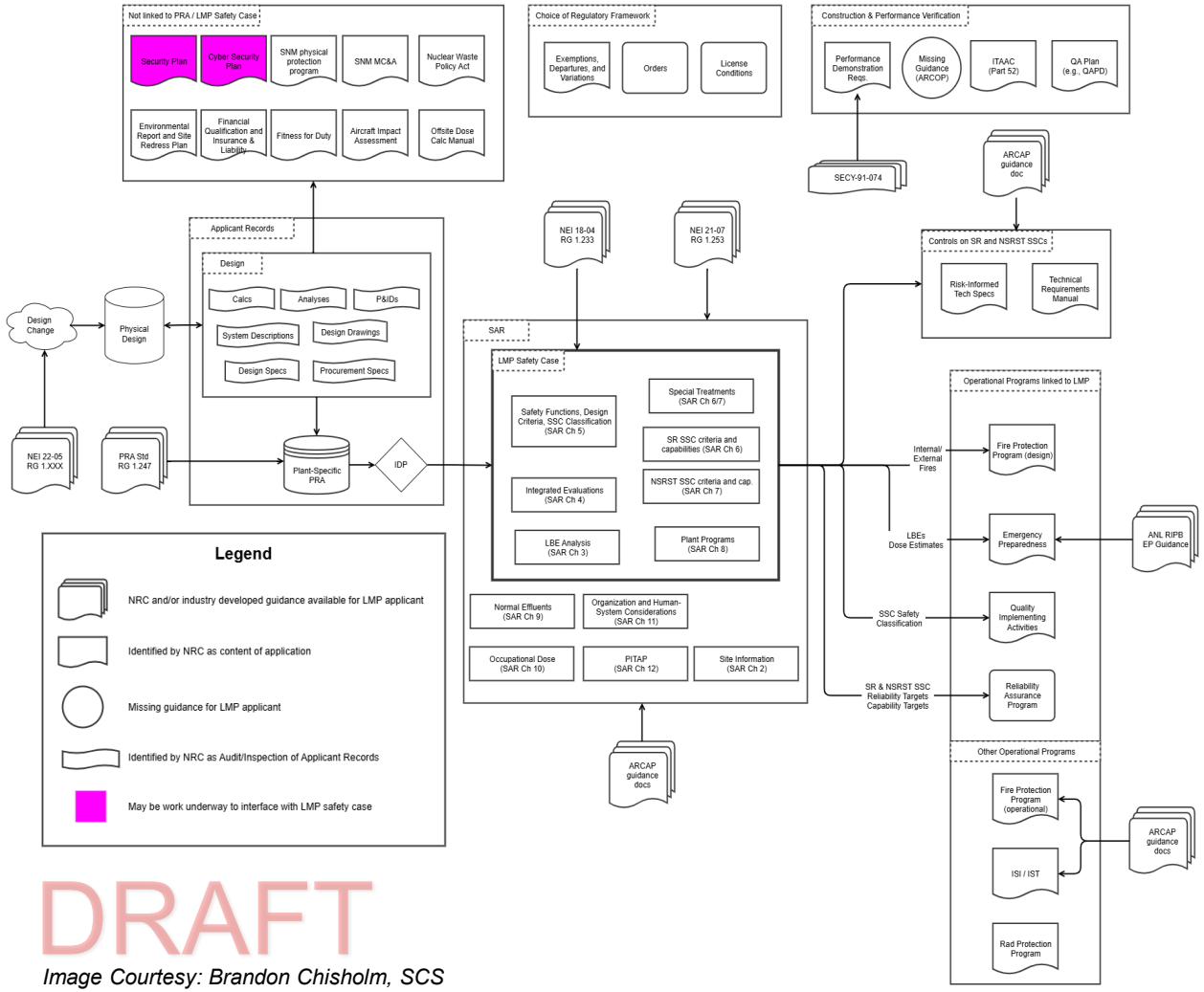
Project Outputs

Endorsable regulatory guidance that can ***reasonably be implemented*** to address change management gaps identified in NEI 22-05 (TIRICE) review:

- Development of a white paper identifying the elements needing addressed with proposed approaches and details for resolution.
- Increase Industry and NRC awareness through stakeholder meetings and review of white paper.
- Use the white paper to develop a guidance annotated outline, which will then evolve into formal draft guidance for submittal, supported by tabletop activities.

LMP-based Safety Case Network Diagram and Gap Assessment

- Provide a visual means for understanding the interrelation of the elements of the LMP-based Safety Case.
- Assess completed, ongoing, and proposed work to identify and address potential gaps or inconsistences.
- Communicate results to Industry, NEI, DOE, and NRC to support prioritization of future regulatory framework activities.



DRAFT

Image Courtesy: Brandon Chisholm, SCS

FY25 Key Activities and Progress

Technology Inclusive Risk-Informed Change Evaluation (TIRICE):

- Provided feedback on NRC Pre-decisional Draft Guide for approval (December 2024).
- Identified items needing to be addressed in TIMaSC.

Technology Inclusive Management of Safety Case (TIMaSC):

- Develop a draft White Paper for NEI Advanced Reactor Regulatory Task Force review.
- Technical team led by Southern Company Services, supported by NEI, Westinghouse, GE-Hitachi, Terrapower, X-Energy, Industry Consultants, Aalo Atomics, INL, and ANL.
- Kickoff Meeting held in March 2025.
- Targeting presentation at next NRC Advanced Reactor Stakeholder public meeting (Tentative 4/28/25).
- White Paper Draft to be reviewed by industry by end of FY25.

Questions?

Backup Material

Motivation for TIMaSC

Why TIMaSC?

- **LMP and TICAP**: Establish the foundation for creating and documenting a safety case for advanced reactors facilities in the Safety Analysis Report (SAR).
- **Post-Acceptance**: Upon NRC approval and operating license issuance, TIRICE provides a methodology for managing facility changes (e.g., 10 CFR 50.59) within a risk-informed, performance-based framework.
- **Regulatory Framework**: Suitable for prescriptive frameworks like RG 1.70 used for Large LWRs. Changes in risk analysis/models differ from plant changes and still affect the safety case, requiring evaluation.
- **Development Insight**: During LMP-TICAP-TIRICE development, additional guidance for maintaining the safety case was identified as beneficial.
- **Implementation**: TIMaSC, though developed later, aims to address gaps and document potential challenges for smoother operations.
- **Early Guidance**: Ensures a smooth transition from applicant to licensee.

Scope

- **New Information**: Addresses impacts on the safety case, such as changes in external hazards (affecting PRA results or deterministic analyses) and operating experience indicating that reliability or capability targets for safety-significant SSCs are not met.
- **PRA Changes**: Controls programs for Probabilistic Risk Assessment (PRA), including methodology updates, changes to SSC or Licensing Basis Event (LBE) risk significance, and adjustments to LBE frequencies or consequences.
- **Plant Programs**: Maintains efficacy of programs crucial to the safety case, including defense in depth, ensuring they are controlled by TIRICE or other appropriate means.

U.S. DEPARTMENT *of* ENERGY | Office of Nuclear Energy

Performance-Based Physical Security Framework – FY25

Regulatory Framework Modernization Program Review (Mid-Year)

Advanced Reactor Safeguards and Security Program

Chris Chwasz, Robby Christian, Amanda Rynes – *INL*, Alan Evans – *SNL*

March 2025

U.S. DEPARTMENT of ENERGY | Office of Nuclear Energy

Performance-Based Physical Security Framework

Background

- NRC has initiated 3 performance-based physical security rulemakings for Advanced Reactors:
  - Alternative Physical Security Requirements for Advanced Reactors (NRC-2017-0227).
  - 10 CFR Part 53: Risk-Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors (NRC-2019-0062).
  - Law Enforcement Response in Power Reactor Physical Protection Programs (NRC-2024-0167).
- Rulemakings allow reactor applicants and licensees to use performance-based modeling to justify physical security system design vs. traditional prescriptive program minimum requirements.
- Guidance is needed to support applicant submission format and content for regulatory decision-making consistency.

Part 53 Feedback

Proposed § 73.100 (as part of the Part 53 Rulemaking package)

Technology-Inclusive Requirements for Physical Protection

- Focuses on physical protection of licensed activities at commercial nuclear plants against radiological sabotage.
- A performance-based regulatory framework for physical security of a commercial nuclear plant.

Supporting Guidance

- **DG-5076 (Draft RG 5.97)**: Guidance for technology-inclusive requirements for physical protection of licensed activities at commercial nuclear plants.

Feedback on DG-5072 Examples

- **Performance Element Expectations**: Revise specific performance element expectations (e.g., 90% probability of detection in Intrusion Detection System (IDS)) to functional performance-based compliance (e.g., 90% probability of detection before critical detection point based on response strategy).
- **Redundancy and Diversity Expectations**: Revise expectations to demonstrate defense-in-depth for function.
- **Prescriptive Expectations**: Revise prescriptive expectations to performance-based functional compliance.

Performance-Based Physical Security Framework

Objective: Develop a performance-based framework for the licensing of a physical protection system (PPS) that meets the proposed 73.100 requirements. This framework will allow reactor applicants and licensees to use performance-based approaches rather than traditional prescriptive methods to ensure physical security at commercial nuclear plants.

Key Components of the Framework:

- **Offsite Response**: Credit private or local law enforcement response.
- **Security Bounding Time**: Adversary interference preclusion time / Reasonable assurance of protection time.
- **Operator Actions**: Allowed operator recovery and mitigating actions.
- **Advanced Security Technologies**: Incorporate cutting-edge security technologies.
- **Security by Design**: Integrate security by design methods and alternative protective strategies, consistent with advanced and small modular reactors.

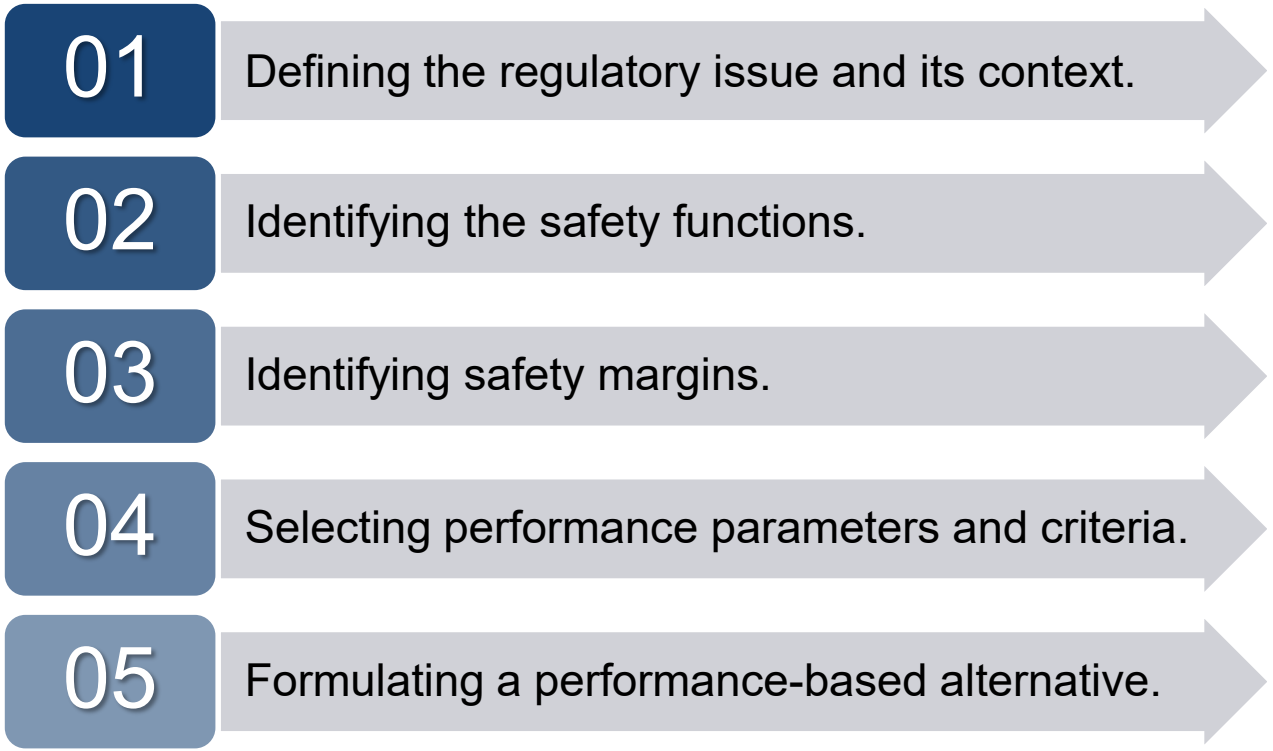
- Method for using performance-based elements within a 73.55 licensed physical protection system.

Performance-Based Regulation

NUREG/BR-0303, Guidance for Performance-Based Regulation

- "…provides guidance on a process for developing a performance-based alternative for consideration, along with other more prescriptive alternatives, in regulatory decision making."
- Benefits of performance-based regulation provides enhanced flexibility, encourages innovation, focuses on achieving safety outcomes, and improves risk management.

Steps for Developing a Performance-Based Regulation



Performance-Based Regulation – Physical Security

Using the NUREG/BR-0303 Five Steps

01 Defining the Regulatory Issue and Context

Physical Security Licensing: Reactor safety and security.

02 Identifying the Safety Functions

Physical Security Functions: Detect, Delay, Respond.

03 Identifying Safety Margins

Defense-in-Depth Analysis: Multiple layers of protection.

Timeline Analysis: Response times and delays.

04 Selecting Performance Parameters and Criteria

To Follow…: Define measurable parameters and criteria for assessing performance.

05 Formulating a Performance-Based Alternative

Flexible performance-based framework: Develop framework that allows flexibility in achieving safety and security objectives.

Performance-Based Regulation – Physical Security

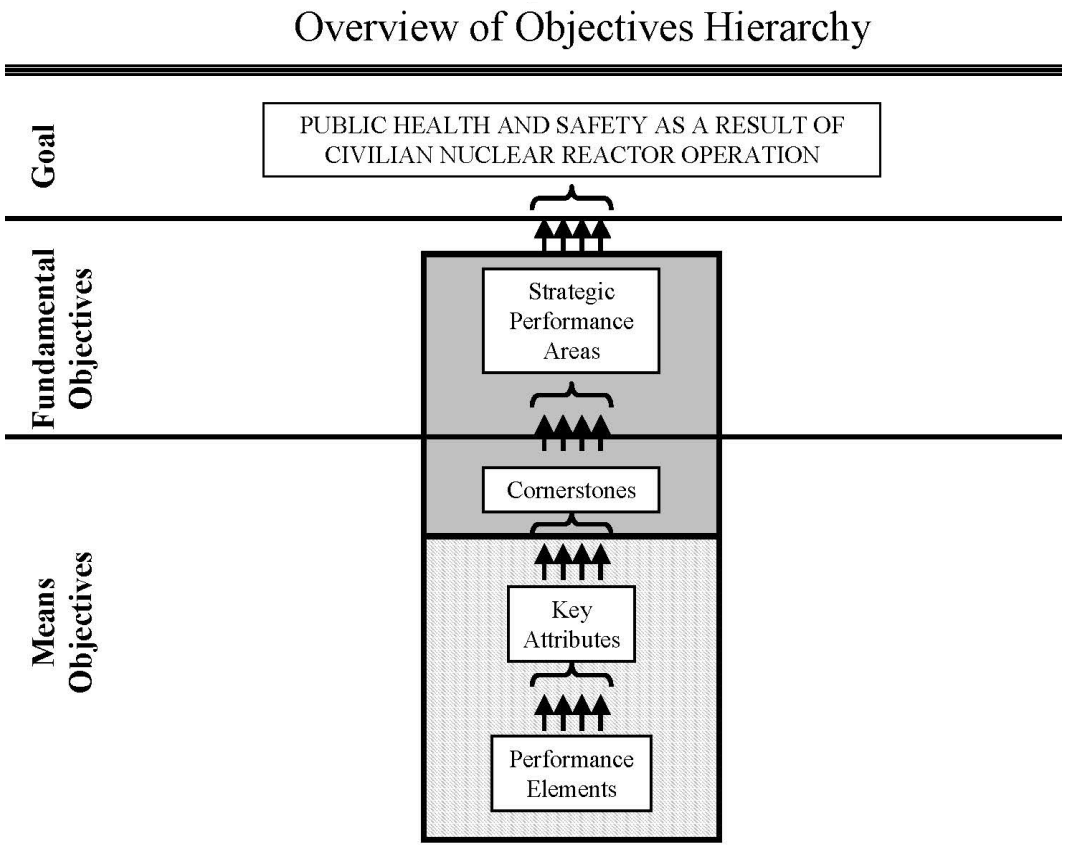
Selecting performance parameters and criteria

- NUREG/BR-0303 Appendix B provides information for the application of performance-based regulation to complex issues:

  "Generally, a performance based regulatory alternative needs to:

  1. allocate performance across relevant functions, systems, or barriers, in order to assess whether the target safety objectives are satisfied
  2. then implement that allocation of performance which entails identifying the steps to be taken by licensees and/or NRC to make the performance allocation "come true" in practice

  Part of implementation is confirmation of ongoing performance."



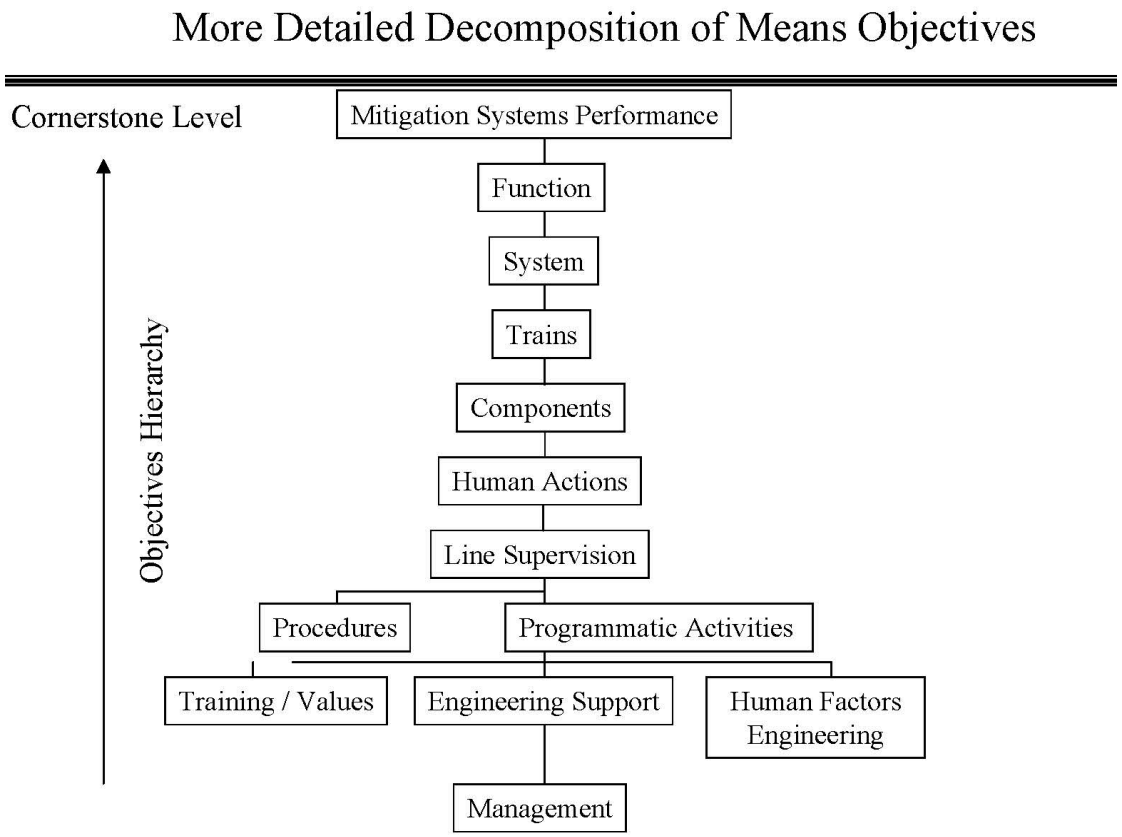
NUREG/BR-0303 Appendix B. Figure B-1.

Performance-Based Regulation – Physical Security

Selecting performance parameters and criteria

- NUREG/BR-0303 Appendix B.3, Allocation of Performance provides the following point:

  "Generally, it is desirable to specify and monitor performance targets as high on the objectives hierarchy as possible, consistent with the viability guidelines. Allocating performance too far down on the hierarchy reduces licensee flexibility. Arriving at an implementation that maintains safety, while appropriately balancing licensee flexibility with the need for regulatory assurance of ongoing performance, will require some iteration with the allocation step."

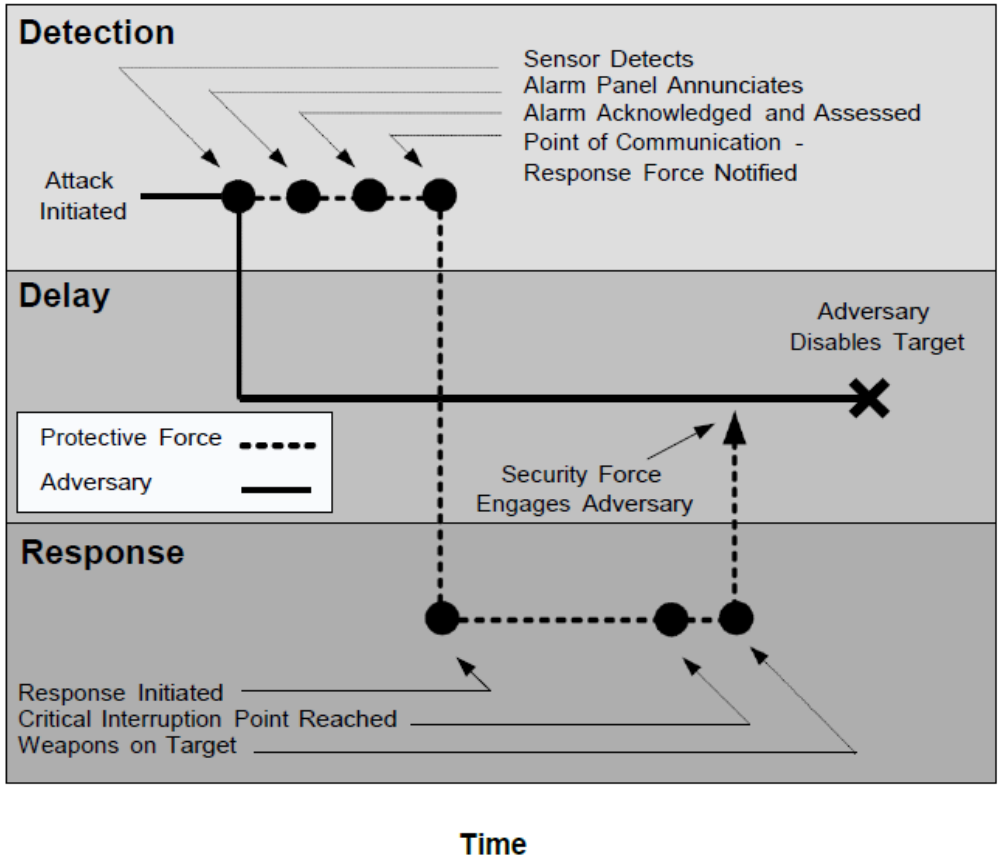


NUREG/BR-0303 Appendix B. Figure B-3.

Performance-Based Regulation – Physical Security

Selecting performance parameters and criteria

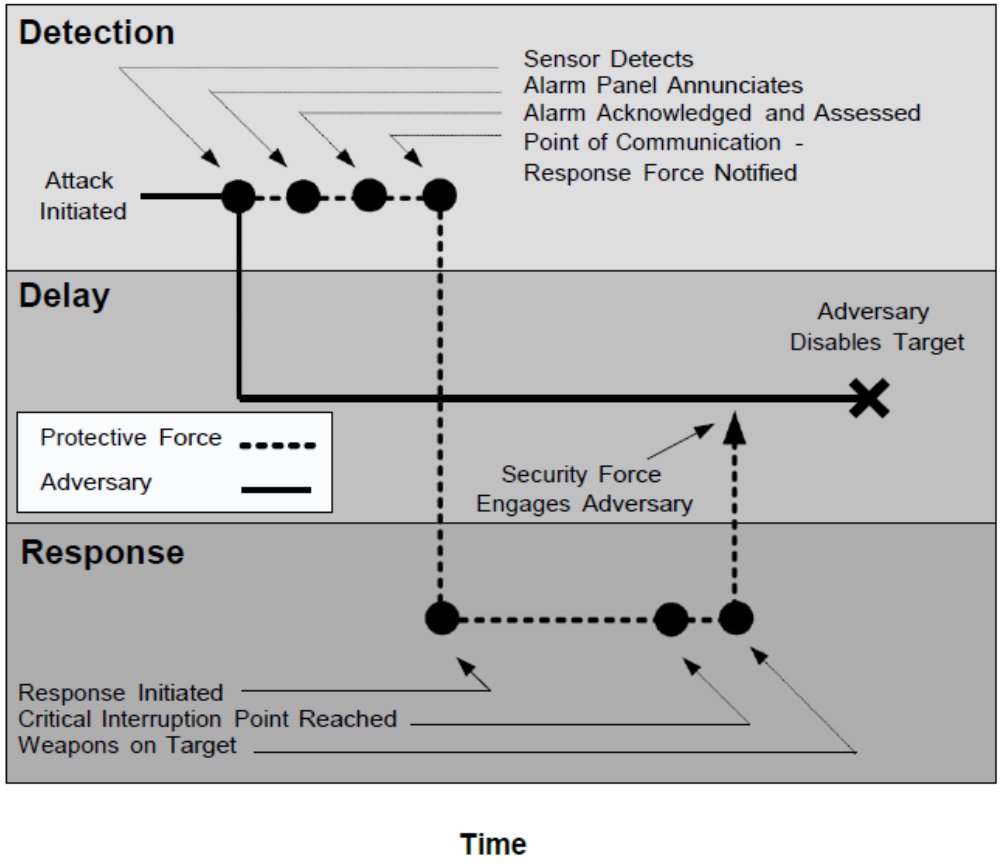
- The ultimate performance parameter for the performance-based licensing of a physical protection program for a nuclear power reactor is the timing of neutralization (response force) or off-site response (Adversary Interference Preclusion Time / Security Bounding Time / Reasonable Assurance of Protection Time).



Performance-Based Regulation – Physical Security

Selecting performance parameters and criteria

- Physical protection system must prevent radiological sabotage (significant release of radionuclides from any source).
- Non-recoverable release of radioactive material that would exceed the determined sabotage dose value* determines the time at which the PPS has failed to prevent radiological sabotage.
- The parameters are governed by the consequence analysis timing associated with offsite release.

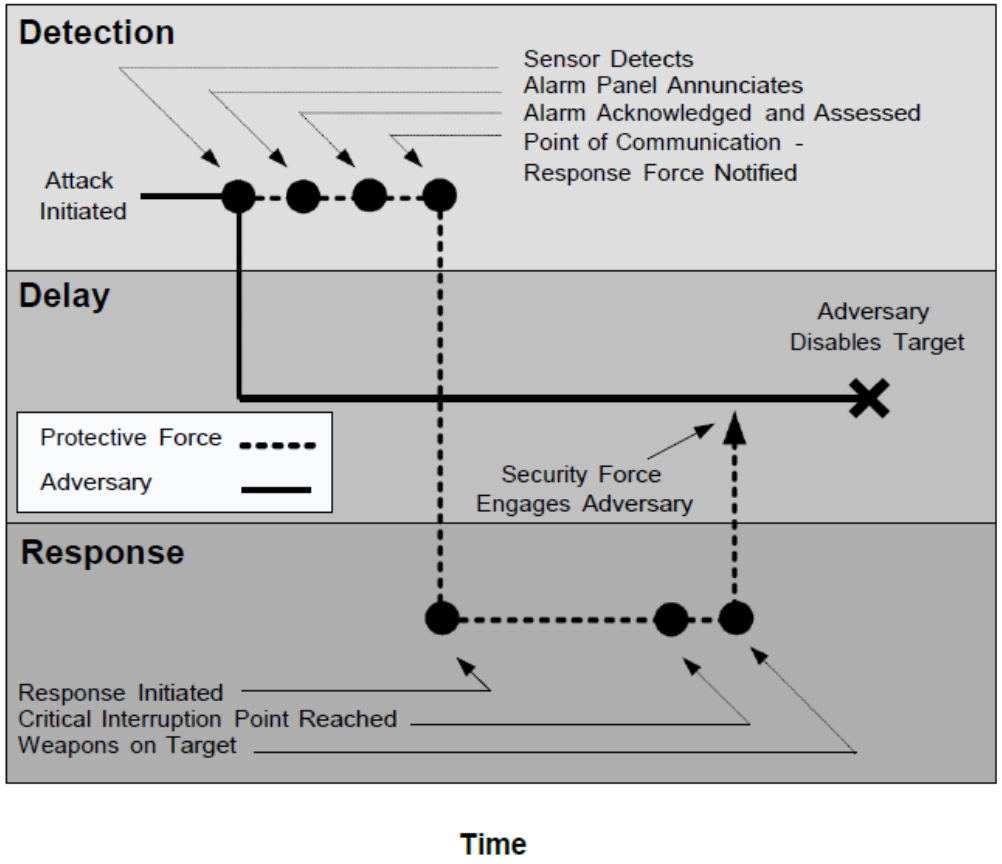


* Proposed guidance suggests doses consistent with site design-basis accidents.

Performance-Based Regulation – Physical Security

Selecting performance parameters and criteria

- Parameters:
  - Unrecoverable release timing (per security scenario, or on a sitewide basis)
    - With no operator actions
    - With allowed operator actions
  - Detection (Assessment) + Delay + Response time
    - Delay
      - Active or Passive
    - Response
      - Neutralization
      - Offsite response agencies (SBT /RAPT / AIPT)
  - Detection Probability and Confidence
  - Probability of Neutralization



Performance-Based Regulation – Physical Security

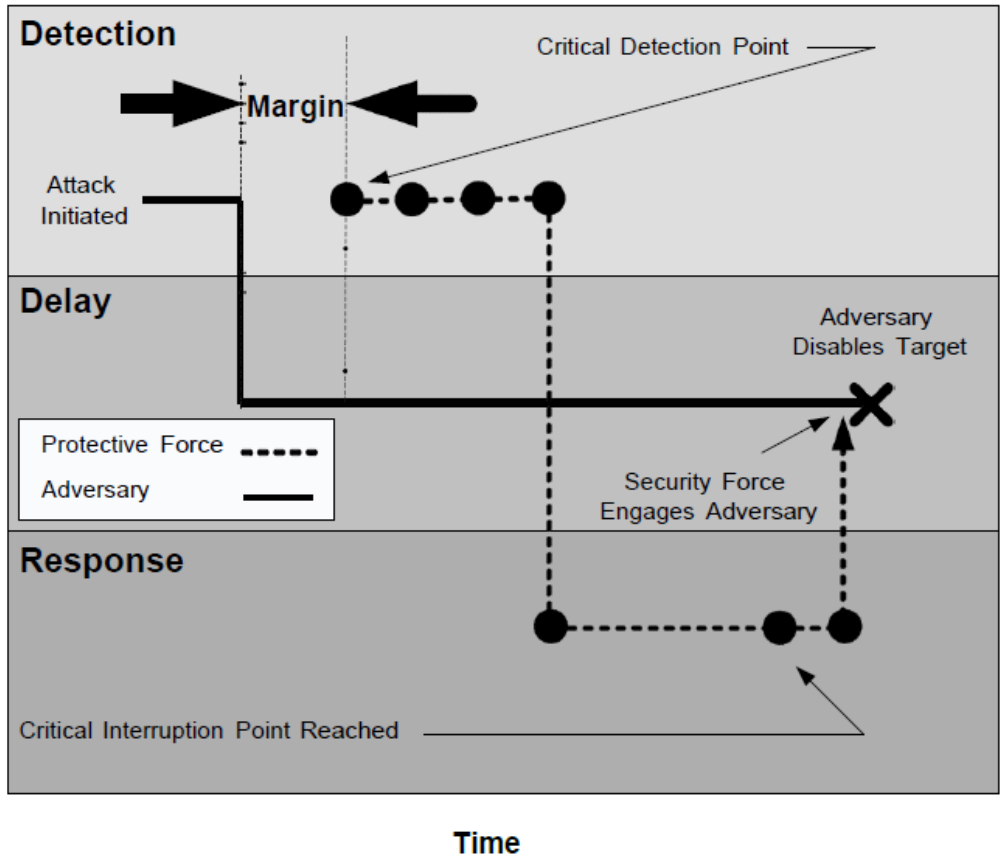
Performance parameters and criteria

- **Unrecoverable Release Timing:** From Target Set analysis (impacted by design of reactor systems and allowed operator actions).
- **Detection:**
  - Detection probability and confidence should be consistent with existing licensees: RG 5.44.
  - Detection should be evaluated along a path of adversary travel, before the Critical Detection Point (the point on the adversary's path where path delay exceeds response force interruption time).
- **Assessment:** Capability and timing should be consistent with the protective strategy.
- **Delay:** Capability and timing should be consistent with the protective strategy.
- **Response:** Capability (probability of neutralization) and timing should be consistent with the protective strategy.

Performance-Based Regulation – Physical Security

Identifying Safety (Security) Margin - TBD

- Security Margin (timing)
  - Margin within the Assessment + Delay + Response parameter before unrecoverable release.
- Defense-In-Depth
  - Analysis may be similar to existing sites to normalize against regulatory expectations and proven success.



Performance-Based Regulation – Physical Security

Validation of Model Parameters - TBD

- Tabletop Exercise
  - Method to establish tabletop exercise scope (number and breadth of scenarios).
- Performance Testing
  - Component testing of sensors can provide confirmation of 90% probability of detection for sensors in the PPS (Probability of Detection).
  - Subsystem testing can be conducted to ensure times for alarm assessment and alarm communication (Timelines).
  - Limited scope performance tests and enhanced limited scope performance tests can be conducted to evaluate the effectiveness against specific adversary attack scenarios (Detection, Delay, and Response Timelines).
  - Whole system performance tests (force-on-force) exercises can be completed to validate or evaluate the overall physical protection system effectiveness (Detection, Delay, Adversary Timelines, and Response Timelines).
- Exercises

Performance-Based Regulation – Physical Security

Confirmation of Ongoing Performance – TBD

NUREG/BR-303: “Can objective criteria be developed that are indicative of performance and that permit corrective action?”

- Unrecoverable Release Timing
- Detection
- Assessment
- Delay
- Response

Questions?

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Regulatory Coordination and Integration Group

Regulatory Framework Modernization Program Review

Jason Christensen, *Sr. Regulatory Engineer, INL*

April 2025

Work Package Overview

RD-25IN070202: Regulatory Framework Coordination and Integration-INL

- Establish and maintain a focus group of national laboratory senior staff for the coordination and integration of technical advice focused within the Regulatory Framework Modernization sub-program.
- Group elicits and coordinates the engagement of national laboratory technology experts with advanced reactor stakeholder organizations or groups on licensing- and regulatory-related topics, issues, and concerns.
- Focus is to review items used in the establishment of licensing technical requirements affects multiple stakeholders.
- Stakeholders include NRC staff and industry working groups for various advanced reactor technologies on issues with broad or generic applicability to the advanced reactor community.
- Technology experts in this group will engage in stakeholder meetings and other opportunities to solicit stakeholder input to sub-program activities.

Listing of Work Package Milestones

M4RD-25IN0702022

- Summary Memo for the FY25 Regulatory Framework Development Coordination and Integration
- Due Sept. 19, 2025
- Will provide a summary of the FY25 Regulatory Framework Development Coordination and Integration Group activities.
- ANL, ORNL, and PNNL have similar summaries due by the end of FY24.

Alternative Physical Security Rulemaking

NRC-2017-0227-0038, Alternative Physical Security Requirements for Advanced Reactors

- **Public Comment Deadline:** 10/23/24
- **Submission:** Comments submitted via the Federal Register and the NRC Rulemaking Website.
- **Main Comment:** "Proposed rulemaking has the potential for significant positive impact on future SMRs and non-LWRs…"
- **Benefits:** Provides a performance-based licensing approach to physical security, including thorough and complete guidance.

Next Steps

- **Final Rulemaking:** Expected September 2025.

10 CFR Part 53 Rulemaking

Recently Completed: NRC-2019-0062, Risk-Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors (RIN-3150-AK31)

Timeline

March 1, 2023: NRC Staff provided the draft Part 53 rulemaking package SECY-23-0021, Proposed Rule: Risk-Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors, to the Commission for approval.

March 4, 2024: The Commission issued Staff Requirements Memorandum SRM-SECY-23-0021.

NOTE: This approved the proposed rulemaking, in part, with exceptions and clarifications to be addressed prior to publishing to the Federal Register for public comment.

Oct. 31, 2024: Staff released the revised proposed rule and published to the Federal Register with a 60-day comment period.

NOTE: Initial 60-day comment period (Dec. 31, 2024) and was extended an additional 60-days to address stakeholder request.

Feb. 28, 2025: Extended comment period closed.

Overview of Proposed Rule

From NRC:

The NRC proposes to establish an optional technology-inclusive regulatory framework for use by applicants for new commercial advanced nuclear reactors. The regulatory requirements developed in this rulemaking would use methods of evaluation, including risk-informed and performance-based methods, that are flexible and practicable for application to a variety of advanced reactor technologies. The proposed rule accommodates all reactor technologies and includes self-contained licensing framework featuring a probabilistic risk assessment (PRA)-led approach that aligns with the U.S. Department of Energy cost-shared, industry-led Licensing Modernization Project (LMP) methodology.

10 CFR Part 53 Rulemaking

Regulatory C&I Staff Activities

- Reviewed the revised proposed rule and developed initial comments.
- Met regularly to discuss comments and created an initial list.
- Attended NRC public meetings to discuss the proposed rule.

Key Meetings

November 19-21, 2024:	Public meeting to provide an overview of the proposed rule, address stakeholder questions, and discuss methods for public comment submission.
January 8, 2025:	Discussion of the NRC staff's regulatory approach to the proposed rule.
January 16, 2025:	Discussion on the path forward with the previous Framework B.

Industry Interactions on 10 CFR Part 53

Overview

- Staff attended numerous industry meetings and workshops to provide input on the revised proposed rule.

NEI Involvement

- Nuclear Energy Institute (NEI) staff reviewed Part 53 and provided a significant comments package for discussion and submission.
- Held numerous meetings and interactions to discuss this comments package and provide input to NEI.

Breakthrough Institute Workshop

- Regulatory C&I staff attended the Breakthrough Institute Part 53 Comments Workshop in February 2025.

Comment Development and Submission

Overview:

- Regulatory Coordination and Integration Group Activities:
- Compiled a list of comments on the revised proposed Part 53 rule.
- Reviewed NEI comments package and determined group comments were addressed within it.

Decision to Endorse NEI Comments:

- To avoid duplication and increased workload for NRC staff, the group provided a letter of endorsement of the NEI comment package with selected clarifications and additions.
- Additions focused on safeguards and security.

Submission:

- Letter of endorsement and additional comments were submitted to NRC on February 28, 2025.

Path Forward

Future Focus

- The Regulatory Coordination and Integration Group will continue reviewing new reports, rulemakings, and documents related to advanced reactor licensing.

NRC Rulemakings and Guidance

- NRC will develop numerous rulemakings, guidance documents, and other documentation to support the licensing of non-LWRs and SMRs.
- The group will provide comments and recommendations on these documents as they become available for review.

Questions?

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Regulatory Development for AMMT Program

Regulatory Framework Modernization Program Review

Jason Christensen, *Sr. Regulatory Engineer, INL*

April 2025

Work Package Overview

RD-25IN070204: Assess Regulatory Approach for Selected AMMT Program Topics - INL

Scope:

- Support the future deployment of Advanced Materials and Manufacturing Technologies (AMMT)
- Identification of current and anticipated regulatory framework challenges or uncertainties for selected technologies.
- Technologies and areas of work may include:
  - Advanced materials and manufacturing
  - Rapid qualification
  - Analysis of environmental effects
  - Technology demonstrations
- Possible interactions with codes and standards organizations.

Listing of Work Package Milestones

M3RD-25IN0702041

- **Complete Report Summary:**
  - Summarize the activities performed in FY25.
  - Provide recommendations for collaborations between the AMMT Program and the Regulatory Development Program.
  - Due 06/27/2025.
- Milestone will provide a summary of the scoping activities performed by the Regulatory Development Program and will summarize the recommendations for regulatory support in the AMMT Program in FY26 and beyond.

Intended Outcome of Work Package

Intended Outcome

- **Regulatory Development Plan:** Establish regulatory development plan for the AMMT program for FY26 and beyond.
  - Identify actions necessary to establish a formal NRC endorsement of selected AMMT qualification approaches.
  - Regulatory strategies proposed will support the timely and efficient deployment of AMMT program technical outcomes.
  - Regulatory strategies are intended to directly support development and licensing of advanced reactors, microreactors, and SMRs.

Meeting with AMMT Staff

Participants:

- Regulatory Development staff, AMMT National Technical Director, Technical Area Lead for Technology Maturation (Michael McMurtrey, TAL)

Discussion Points:

- Work package objectives were relayed and discussed.
- Areas of potential regulatory development need were discussed.

Upcoming Engagement, AMMT Program Review:

- Regulatory Development staff will attend the review from July 15-17, 2025, in Washington D.C.
- Key areas of interaction: Technology Maturation (Michael McMurtrey, TAL)
  - Component Testing
  - Codes and Standards
  - Regulatory Acceptance and Licensing

Areas of Potential Regulatory Need

Regulatory Acceptance of Commercial Codes and Standards:

- ISO-9001 and other commercial QA codes and standards (in lieu of NQA-1/10 CFR Part 50 App. B).

Codes and Standards Endorsement:

- Material codes have extensive testing hours requirements.
- Consider allowing an accelerated pathway to materials deployment.

Utilization of Digital Information:

- AMMT processes generate significant amounts of digital information.
- Explore how AMMT program and NRC can collaborate to utilize this data for approval/qualification.

Rapid Qualification Programs: Expedite the qualification process for new materials and technologies.

Reliability and Integrity Management Programs (RIM): Can provide a pathway to help AMMT deployment.

Potential Area of Development

The Regulatory Development Program developed the basis for an accelerated materials deployment (AMD) process in FY23.

Accelerated Materials Deployment Process:

- Potentially be used to qualify new materials (such as high temperature materials and graphite) more quickly for use in advanced reactors.
- Utilizes 10 CFR 50.43(e) to provide an accelerated pathway to use of new, unendorsed materials in new reactors.
- Utilizes a RIM-type approach to materials deployment.
- Allow the applicant/licensee to take on the risk of utilizing the unqualified material prior to reaching the required number of testing hours.
  - Applicant/licensee would implement a monitoring system that would monitor the material properties and ensure that the material continues to be safe for use in the reactor. If it has unacceptable properties, adjustments would be made to operational parameters of the plant.
  - All data from this testing could be used to support material qualification.

Path Forward

- INL Regulatory Development staff will attend the AMMT Program Review to be held the week of May 19, 2025, in Washington D.C.
- Staff will continue meeting with AMMT staff and identifying areas of regulatory development need.
  - These areas will be investigated to develop a full work scope for proposal in FY26.
  - Previously identified areas of need will be developed into full work scopes.
  - Work scopes will be proposed in the FY25 Regulatory Development IPL (as well as the AMMT IPL, if it is a co-funded activity).
- Staff will also facilitate discussions between AMMT staff and NRC staff to determine ongoing NRC activities in the identified areas.

Questions?

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FY-26 Priorities Input & Closing Remarks

Regulatory Framework Modernization Program Review

Scott, *National Technical Area Lead DOE Regulatory Development &*
Division Director (acting), Nuclear Safety and Regulatory Research, INL

April 2025

Potential Areas of Interest for DOE RFM Projects in FY-26

Artificial Intelligence in the Regulatory Space

- AR License Applications – Generation and Review

SMR and Micro Reactor Regulatory Development

- Transportation / Factory Fueling / Factory Testing
- NEPA and EPZ Right Sizing
- Aircraft Impact Rule

License Transitions

- Part 50/52 transitions to Part 53 – ESPs
- Design Certifications to Part 53
- DOE Authorization to NRC License
- NRC Test Reactor to Commercial

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