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

10 CFR Part 53
"Licensing and Regulation of Advanced Nuclear Reactors"

September 22, 2020

Agenda

12:00pm – 12:10pm	Welcome/Introductions
12:10pm – 1:00pm	Topic 1 - Defining appropriate safety criteria & risk metrics
1:00pm – 1:30pm	Topic 2 - Addressing the life cycle of a facility—from design through decommissioning
1:30pm – 2pm	Topic 3 - Quality Assurance requirements & related standards and certifications
2:00pm – 2:15pm	BREAK
2:15pm – 2:45pm	Topic 4 - Integration of various requirements & programs (e.g., environmental, security, EP)
2:45pm – 3:15pm	Topic 5 - Incorporation and use of performance-based requirements
3:15pm – 3:45pm	Topic 6 - Requirements & processing for initial licensing & maintaining licensing basis information throughout life cycle
3:45pm – 4:30pm	Additional Public Comments (including Union of Concerned Scientists), Questions, Suggestions, and Closing Remarks Adjourn

Welcome/Introductions

Welcome:
John Segala, NRR – Branch Chief of the Advanced Reactor Policy Branch

Speakers/Presenters:
Bob Beall, NMSS – Rulemaking PM & Meeting Facilitator
Bill Reckley, NRR – Technical Lead
Marc Nichol – Nuclear Energy Institute
Cyril Draffin/Jeff Merrifield – U.S. Nuclear Industry Council
Ed Lyman – Union of Concerned Scientists
Prasad Kadambi – Independent Consultant

Public Meeting Slides: ADAMS Accession No. ML20254A014

Purpose of Today's Meeting

- Discuss and exchange information on the Part 53 rulemaking.
  - This is the first of many public meetings the NRC staff will be hosting on the Part 53 rulemaking.
- Today's meeting is a Category 3 public meeting, which means that public participation is actively sought in the discussion of the regulatory issues during the meeting.
  - The meeting is being transcribed. The transcription will be publicly available with the meeting summary by October 22, 2020.
- No regulatory decisions will be made at today's meeting.

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Background

- Advance Notice of Proposed Rulemaking, “Approaches to Risk-Informed and Performance-Based Requirements for Nuclear Power Reactors,” dated May 4, 2006 (71 FR 26267)
- NRC’s Vision and Strategy report (12/16) for non-light-water reactors and related implementation action plans identified a potential rulemaking to establish a regulatory framework
- Nuclear Energy Innovation and Modernization Act (NEIMA; Public Law 115-439) signed into law in January 2019 requires the NRC to complete a rulemaking to establish a technology-inclusive, regulatory framework for optional use for commercial advanced nuclear reactors no later than December 2027

Background - NEIMA

(1) ADVANCED NUCLEAR REACTOR—The term “advanced nuclear reactor” means a nuclear fission or fusion reactor, including a prototype plant… with significant improvements compared to commercial nuclear reactors under construction as of the date of enactment of this Act, …

(9) REGULATORY FRAMEWORK—The term “regulatory framework” means the framework for reviewing requests for certifications, permits, approvals, and licenses for nuclear reactors.

(14) TECHNOLOGY-INCLUSIVE REGULATORY FRAMEWORK—The term “technology-inclusive regulatory framework” means a regulatory framework developed using methods of evaluation that are flexible and practicable for application to a variety of reactor technologies, including, where appropriate, the use of risk-informed and performance-based techniques and other tools and methods.

Regulation of Fusion Facilities

- Topic was initially visited in SECY-09-0064, “Regulation of Fusion-Based Power Generation Devices” (ADAMS ML092230171) and Related Staff Requirements Memorandum (ADAMS ML092230198)

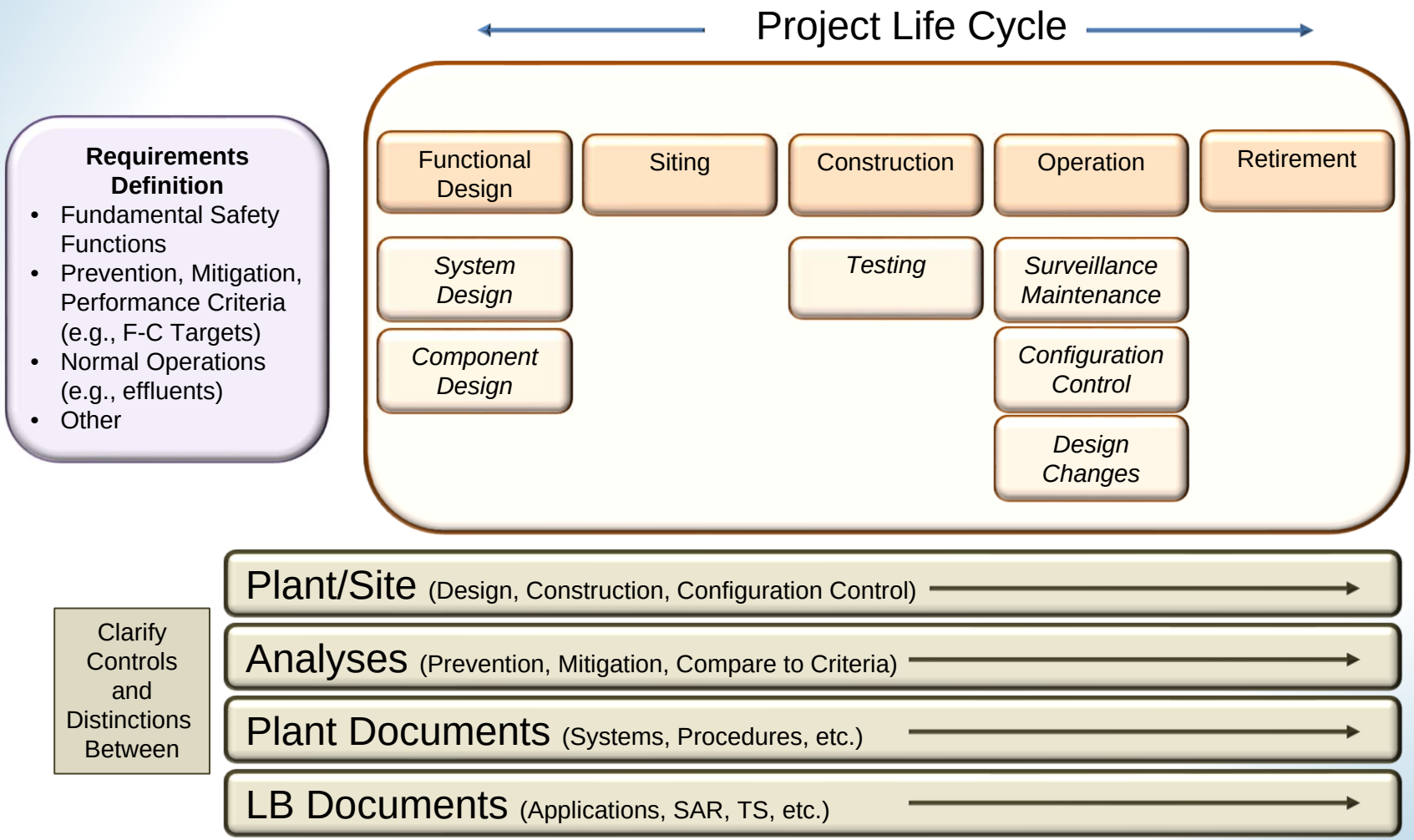
- Possible approaches for licensing and regulation of fusion facilities include:
  - Nuclear (fission) power plants
  - Materials (e.g., accelerator)
  - Hybrid or new approach

- DOE/NRC Public Forum on a Regulatory Framework for Fusion Planned for October 6, 2020

SECY-20-0032, Rulemaking Plan

- SECY-20-0032, “Rulemaking Plan on “Risk-Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors,” dated April 13, 2020 (ADAMS ML19340A056)
- Proposing a new 10 CFR part that could address performance requirements, design features, and programmatic controls for a wide variety of advanced nuclear reactors throughout the life of a facility.
- Focus the rulemaking on risk-informed functional requirements, building on existing NRC requirements, Commission policy statements, and recent activities (e.g., SECY-19-0117)
- Expect extensive interactions with external stakeholders and the Advisory Committee on Reactor Safeguards (ACRS) on the content of the rule.

Technology Inclusive Regulatory Framework



Example – **Possible** Layout

- General Provisions
- Technology-Inclusive Safety Objectives
  - Regulatory limits, safety goals
- Design Requirements
- Siting
- Construction and Manufacturing Requirements
- Requirements for Operation
- Decommissioning Requirements
- Applications for Licenses, Certifications and Approvals
- Maintaining and Revising Licensing Basis Information
- Reporting and Administrative Requirements

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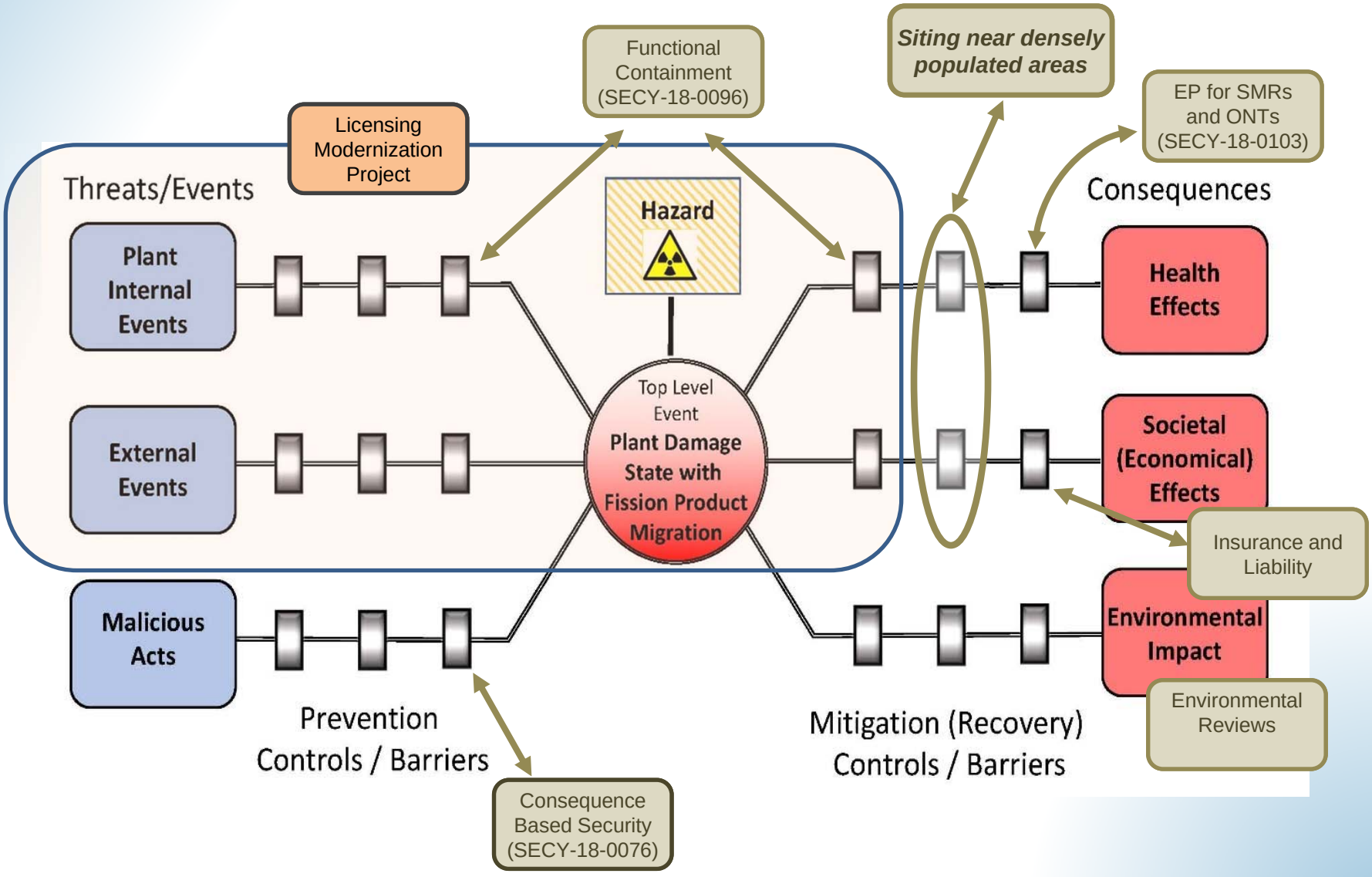
Integrated Approach



NRC Staff White Paper

- The NRC staff developed a white paper (ADAMS ML20195A270) to support discussions with ACRS and other stakeholders

- Soliciting information that:
  1) Defines the scope of stakeholder interest in a rulemaking to develop a technology inclusive framework for advanced nuclear reactors,
  2) Identifies major issues and challenges related to technology-inclusive approaches to licensing and regulating a wide variety of advanced nuclear reactor designs,
  3) Supports prioritizing and developing plans to resolve identified issues within the rulemaking for the wide variety of advanced nuclear reactor designs, and
  4) Supports the development of the proposed rule and related guidance.

- Staff receptive to feedback on any aspect of developing a technology-inclusive regulatory framework to support the regulatory objective, whether or not in response to a question listed in this white paper or future solicitations.

Part 53 Rulemaking Objectives

1) Provide reasonable assurance of adequate protection of the public health and safety and common defense and security at reactor sites at which advanced nuclear reactor designs are deployed, to at least the same degree of protection as required for current-generation light water reactors;
2) Protect health and minimize danger to life or property to at least the same degree of protection as required for current-generation light water reactors;
3) Provide greater operational flexibilities where supported by enhanced margins of safety that may be provided in advanced nuclear reactor designs;
4) Ensure that the requirements for licensing and regulating advanced nuclear reactors are clear and appropriate; and
5) Identify, define, and resolve additional areas of concern related to the licensing and regulation of advanced nuclear reactors.

Discussion Topics

1) Defining appropriate safety criteria & risk metrics
2) Addressing the life cycle of a facility—from design through decommissioning
3) Quality Assurance requirements & related standards and certifications
4) Integration of various requirements & programs (e.g., environmental, security, EP)
5) Incorporation and use of performance-based requirements
6) Requirements & processing for initial licensing & maintaining licensing basis information throughout life cycle

- **Note that other topics are expected to be discussed as part of the above items or to be addressed in future meetings**

Topic 1 – Safety Criteria & Risk Metrics

4) Performance Criteria
   - o Technology-inclusive performance criteria?

5) Risk Metrics
   - o Include risk metrics in the regulations?

9) Identifying Levels of Protection
   - o Differentiate requirements for adequate protection and safety improvements?

11) Consistency with Historical Standards
   - o Use of existing standards (e.g., safety goals)?

Safety/Risk Criteria Examples

- Normal Operations
  - Total effective dose equivalent (TEDE) to individual members of the public from normal plant operation does not exceed 0.1 rem (1 mSv) in a year.
  - Total effective dose equivalent to individual members of the public from effluents resulting from normal plant operation are as low as is reasonably achievable

- Transients and Postulated Accidents
  - An individual located at any point on the outer boundary of the low population zone, who is exposed to the radioactive cloud resulting from the postulated fission product release (during the entire period of its passage) would not receive a radiation dose in excess of 25 rem (250 mSv) TEDE.
  - The estimated frequency of a member of the public receiving a radiation dose with the potential for immediate health effects remains below five in 10 million years or a radiation dose with the potential to cause latent health effects remains below two in 1 million years.

Safety Criteria and Risk Metrics

- Goal to meet adequate protection standards, but in a way that focuses on public health and safety
- Criteria should be focused on information that is essential to demonstrating the safety case with a level of detail that is commensurate with its contribution to the safety case arguments– and add additional requirements only when necessary to support the safety case
- Reduced source term for advanced reactors and high-level performance-based requirements bring significant opportunities to reduce requirements to just those necessary to assure adequate safety protection
- NRC should be careful to ensure that the development of this rule does not result in unnecessarily ratcheting requirements

Topic 1 – Safety Criteria & Risk Metrics

Discussion

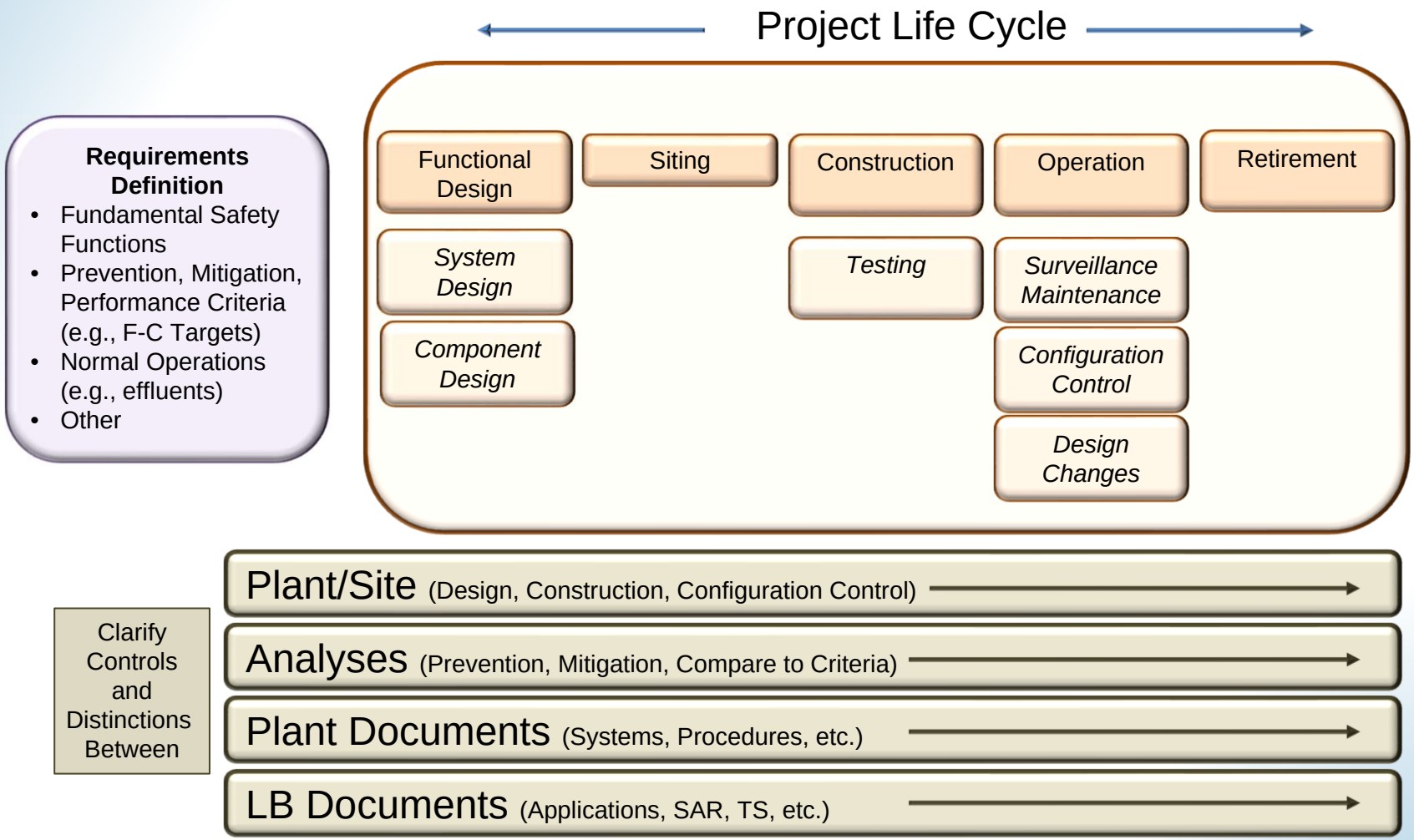
Topic 2 – Facility Life Cycle

6) Facility Life Cycle
   - How could new Part 53 align with facility life cycle?

Possible Layout

- General Provisions
- *Technology-Inclusive Safety Objectives*
  - *Regulatory limits, safety goals*
- Design Requirements
- Siting
- Construction and Manufacturing Requirements
- Requirements for Operation
- Decommissioning Requirements
- Applications for Licenses, Certifications and Approvals
- Maintaining and Revising Licensing Basis Information
- Reporting and Administrative Requirements

Technology Inclusive Regulatory Framework



Life Cycle of a Facility from design through decommissioning

- Scope should be inclusive of all future applications and technologies. Do not want segmentation into subsets or categories. To the extent technology-specific information is needed, it should be provided in guidance, not in the regulations themselves.
- Part 53 should allow one-step construction permit and operating license approach (similar to Part 52 combined license) without need for initial Design Certification Application (DCA) for FOAK deployment
- Part 53 should address licensing, administrative, procedural, and reporting matters for Advanced Reactor applications
- Part 53 should clarify how regulatory oversight and inspection will be done (e.g. should regulatory oversight process be left to policy and guidance documents)
- Alternative ways of meeting decommissioning should be provided– recognizing some advanced microreactors will only operate for 10 years and require replacement or refueling, while others may be sealed and operate for 40-60 years and then trucked offsite

Topic 2 – Facility Life Cycle

Discussion

Topic 3 – Quality Standards

12) Quality Standards:
    - Recognize alternatives to Appendix B?

- Background
    - SECY-03-0117, "Approaches for Adopting More Widely Accepted International Quality Standards"
- Possible Structure

Quality Assurance requirements and related standards and certifications

- Part 53 provides opportunity for NRC to take a fresh look at Appendix B and NQA-1 Program, and consider alternatives
- Level of quality of commercially available components may meet and exceed prior “nuclear standards” without the need for the overly burdensome reporting requirements
- Alternative approach should set the requirements for an approved quality assurance program and use guidance to establish the acceptable means of demonstrating what is needed. A less prescriptive program would allow the use of alternative approaches, such as the ISO 9000 series.
- Commercial dedication programs should be an acceptable approach for meeting Part 53 as this would facilitate licensing of US reactors in Canada, Europe, Asia, and other parts of the world

Topic 3 – Quality Standards

Discussion

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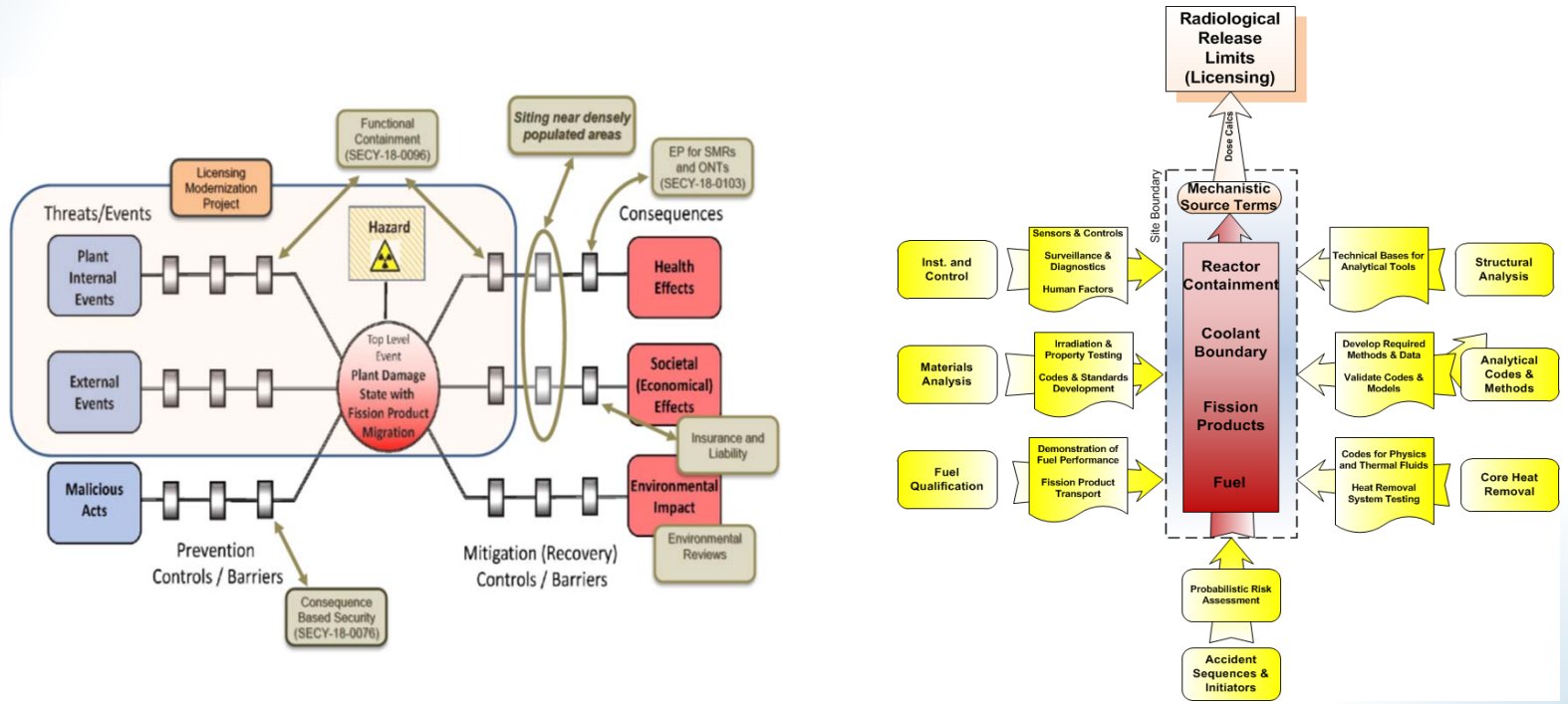
MEETING BREAK

Meeting to resume in 15 minutes

Topic 4 – Integrated Approach

10) Integrated Approach to Rulemaking
    - How to integrate safety, security, emergency preparedness?



Representations of integrated approaches (event/barrier models)

Topic 4 – Integrated Approach

❖ Varied Reactor Technologies

- Routine Operations
- Plant Upsets
  - Internal Hazards
  - External Hazards

- General Provisions
- **Technology-Inclusive Safety Objectives**
  - **Regulatory limits, safety goals**
- Design Requirements
- Siting
- Construction and Manufacturing Requirements
- Requirements for Operation
- Decommissioning Requirements
- Applications for Licenses, Certifications and Approvals
- Maintaining and Revising Licensing Basis Information
- Reporting and Administrative Requirements

➢ Emergency Preparedness
➢ Security

➢ Quality Assurance

➢ Operators, Staffing

➢ Financial Matters

➢ Environmental Assessments

➢ NRC oversight

❖ Trade-offs – Performance-based approaches (e.g., - design vs EP, design vs staffing)

Integration of various Requirements and Programs (e.g. environmental , security, EP)

- Desirable to apply risk informed approaches to safety & security– as well as emergency preparedness
- Although it is not necessary to incorporate Part 20, Part 30, Part 40, Part 70, and Part 100 in Part 53, there are potential efficiencies in those other Parts that could be achieved separately (e.g. addressing unnecessary constraints and aspects that are not working optimally to achieve needed benefits). For instance, Part 20 and 100 might be used for performance metrics.

Topic 4 – Integrated Approach

Discussion

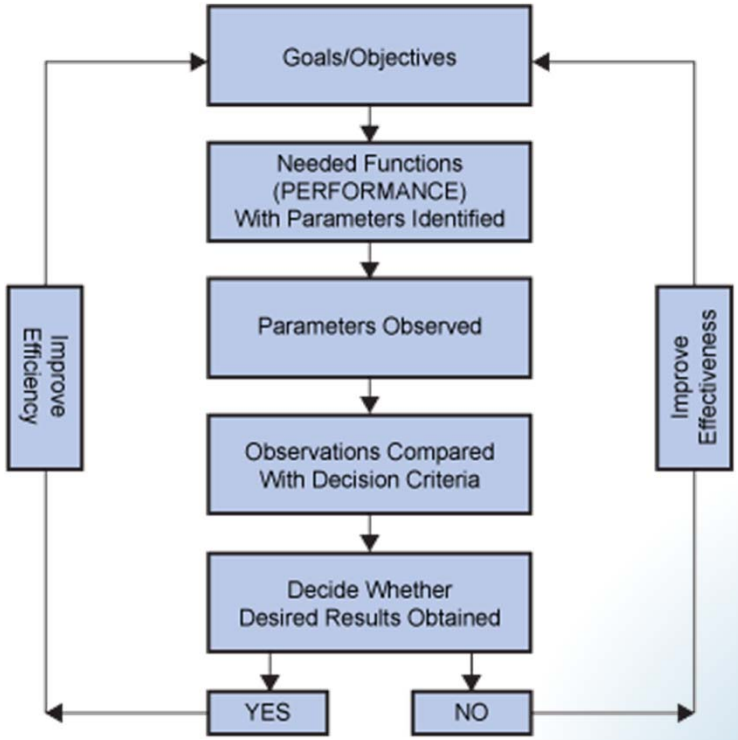
Topic 5 – Performance-based approach

8) Performance-Based Regulation
   - o How to incorporate performance-based concepts?

- <u>Background</u>

- o NUREG/BR-0303, “Guidance for Performance-Based Regulation”

- o Staff Requirements—SECY-98-144—White Paper on Risk-Informed and Performance-Based Regulation



“Guidance for Performance-Based Regulation” NUREG/BR-0303

Presentation to 10 CFR Part 53 Stakeholders

N. Prasad Kadambi

Retired NRC Staff

Kadambi Engineering Consultants

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

- What NUREG/BR-0303 Set Out to Do
- Expected Products of NUREG/BR-0303 Implementation
- Expected Outcomes from Applying Outputs of NUREG/BR-0303
- Relevance of Formal Performance-Based outcomes to 10 CFR Part 53
- Current State-of-Play of NUREG/BR-0303
- Future Promise of Application of NUREG/BR-0303

SRM-SECY-98-0144
"White Paper On RIPB Regulation"

- "White Paper" is central to formal basis for Commission's direction on initiatives for regulatory reform in late 1990s
- The Commission's expectations expressed in "White Paper" are valid today
- NRC staff has not sought to formally fulfill Commission's expectations
- NUREG/BR-0303 sought to formally fulfill Commission's expectations on performance-based safety
- Products from formal implementation NUREG/BR-0303 could enable an applicant to assert conformity with Commission expectations
- This is the basis for the formal application of NUREG/BR-0303 to American Nuclear Society's standards program
- Industry does not appear to find value in formal application of "White Paper" definitions.

"White Paper" As Basis for Performance-Based Safety

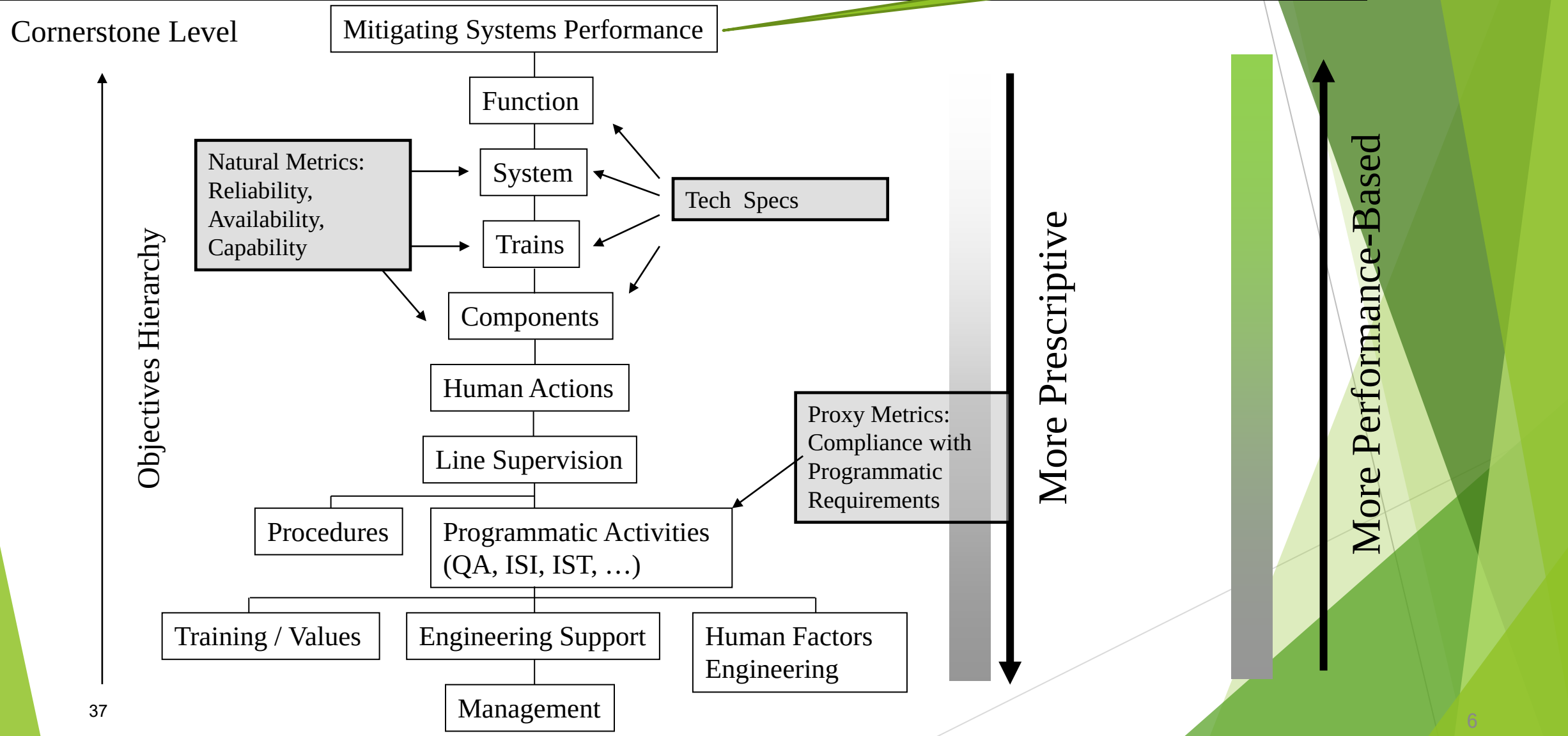
- Four formal attributes of implementing a performance-based approach are evident
  - Measurable parameters
  - Decision criteria associated with the parameters
  - Licensee flexibility (conditional on monitoring selected parameters)
  - Framework for margin requirements (physical and temporal)
- NUREG/BR-0303 formally set out to achieve Commission's expectations from the "White Paper" for all NRC activities (reactors, materials, waste)
- Given the wide variety of activities involving radiation, radioactive materials, and fissionable materials, NUREG/BR-0303 was set up for two levels of application:
  - Simple scenarios
  - Complex scenarios

High-Level Guidelines and Objectives Hierarchy

- "High-Level Guidelines (HLG)" are sufficiently effective for materials and waste issues where safety functions and margins are evaluated easily
  - Occupational exposure (Part 20) and industrial sources (Part 34)
- HLG consider viability of PB approach and assessment of alternatives
- HLG may be insufficient for PB approach if where and how performance is measured become critically important
- "Objectives Hierarchy (OH)" shows context for performance measurement in structured objectives with formally defined relationships and dependencies
- OH is well suited for making integrated safety decisions that involve adequacy of protection and levels of undue risk
  - Reactor Oversight Process (ROP) is a prime example (Parts 50 and 52)

Means Objectives Hierarchy

Performance *Goal*



Desired Outcomes of NUREG/BR-0303

- The decision-making framework from NUREG/BR-0303 envisions development of alternatives with selection based on optimization
  - Prescriptive Vs. Performance-Based (More Margin => Less Prescriptive)
  - Deterministic Vs. Risk-Informed (Magnitude of and Confidence in Margin)
- Transparent assessment of costs and benefits
  - Structured objectives are more suited for life-cycle costs and systems engineering
- Realize the benefits from the flexibility afforded by the US regulatory framework
  - NRC staff only recently seems to have become motivated toward PB
- Realize the outcomes from Yellow Announcement COMSAJ-97-008, “Discussion on Safety and Compliance”

Performance-Based Safety through Proposed Part 53

- It is an opportunity to integrate risk management on a life-cycle basis
  - We know enough about the flaws in compartmentalizing of design, construction, operation, maintenance, and decommissioning to seek alternatives
- NRC staff progress on some current initiatives can be significantly enhanced
  - "Enhanced Safety Focused Review Approach" needs to be generalized and formalized to correspond with NUREG/BR-0303
- Part 53 should formally define Model Based Systems Engineering uniquely for nuclear technology
  - Requirements Management should be incorporated with goal that there should be no unnecessary requirements
- Regulatory Analysis should incorporate cost-benefit analysis in a way to have resource allocation commensurate with risk-managed requirements.

State-of-Play for NUREG/BR-0303 With Its Derivatives

- The performance-based decision-making framework of NUREG/BR-0303 was supported by two other documents:
  - Elements of an Approach to Performance-Based Regulatory Oversight. NUREG/CR-5392
  - Formal Methods of Decision Analysis Applied to Prioritization of Research and Other Topics, NUREG/CR-6833.
- The Licensing Modernization Project produced the following document that is being used for ANS standards:
  - "Introduction to Implementation and Assessment of Safety for Risk-Informed and Performance-Based Technical Requirements in Non-Light Water Reactors," Draft Report (Rev. 1), U.S. Department of Energy, Idaho Operations Office, Contract DE-AC07-05ID14517.
- NUREG/BR-0303 is being referenced in ANS and ASME standards

The Promise of NUREG/BR-0303

- The promise of NUREG/BR-0303 lies in the far-sightedness of the Commission's vision relative to performance-based safety
  - Flexibility without enforceability would be a regulatory non-starter
  - Unique in monitoring of margins (physical and temporal) appropriately
- Offers blending of structuralist and rationalist perspectives
- Offers a way to introduce and improve MBSE for current innovations
  - Provides for enhanced use of "digital twin" concepts
- Offers a way to handle uncertainty and ambiguity in decision-making
- Offers a way for NRC to address public health and safety objectives simultaneously with common defense and security
- Offers a way for the current Commission to be accountable to outcomes envisioned two decades ago.

Incorporation and Use of Performance-Based Requirements

- Ensure requirements for licensing and regulating advanced nuclear reactors are clear, appropriate, and focused on the protection of public health and safety
- Avoid regulations not needed to provide reasonable assurance of adequate protection of health and safety-- eliminating or streamlining requirements that are overly prescriptive or not relevant will reduce the need for future exemptions

Topic 5 – Performance-based approach

Discussion

Topic 6 – Licensing-related processes

3) Technical Requirements versus Licensing Process
   - o Limit to regulations related to technical standards?
   - o Alternative licensing processes?

6) Facility Life Cycle
   - o How could new Part 53 align with facility life cycle

Requirements and processing for initial licensing and maintain licensing base information throughout life cycle

- Part 53 should address, in a technology inclusive manner, the licensing, administrative, procedural, and reporting matters for Advanced Reactor applications
- Some advanced reactors plan for a 60+ year life cycle that needs to be considered by the licensing framework, and should plan on a streamlined process for relicensing after the first 40 years. The licensing period could be technology dependent with appropriate documentation supporting the design life requested
- Part 53 should consider on-going inspection requirements, and record retention– and limit on-site inspections not needed to assure safety

Topic 6 – Licensing-related processes

Discussion

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General and Open Discussion on Part 53

Closing Remarks: Perspective

- USNIC welcomes opportunity to engage with NRC to develop Part 53
- Part 53 should be flexible technology-inclusive voluntary process available to all Advanced Reactors technologies and have clear advantages over Part 50 and Part 52
- Advanced Reactor developers should not be compelled to use Part 53 -- and should be allowed to use Part 50 or Part 52 if they wished
- USNIC provided NRC with 50 comments addressing each of the 14 issues that the NRC raised in their July 2020 NRC Staff White Paper
  - Available at: https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML20244A229

Closing Remarks: Scope

- To avoid misalignment between industry and the NRC on what Part 53 will include, the scope should be clarified:
  - Scope includes advanced nuclear reactors and fusion reactors ("advanced" plants as defined and directed by NEIMA)
  - Does NRC plan for Part 53 to include any nuclear plant, even if it's another AP1000 (which isn't covered by NEIMA explicitly) or a plant using even older technology?
  - Does NRC plan to include subcritical reactors?
- May be possible to write Part 53 so that it's generic enough that it can handle all plants, but doesn't necessarily call out older technology

Closing Remarks: Regulatory Objectives

- NRC regulatory objectives presented to ARCS should be augmented to provide clearly defined outcomes that result in substantial improvements in the regulatory process, rather than incremental improvements
- NRC may want to develop metrics for success, perhaps a page limit
- Objectives should be technology inclusive, risk-informed, and performance-based
- Objectives should include applying lessons-learned from 50 years of light water reactor regulatory experience to make the licensing process as efficient and streamlined as possible and focused on providing reasonable assurance of adequate protection of public health and safety

Closing Remarks: Regulatory Objectives (continued)

- Advanced nuclear reactors may be used for other applications than power generation and for this reason Part 53 needs to be built to be more flexible and efficient than Parts 50 or 52. The rule should address how far NRC regulatory authority should reach when process heat applications are involved (e.g. site boundary or just a part of the plant). Several designs employ a bi-furcated facility where the Nuclear island is physically separated from the energy storage or electrical generating processes.
- Develop a regulation that includes only the necessary legal and statuary requirements (e.g. from the Atomic Energy Act) and includes only regulatory requirements necessary for adequate protection of health and safety
- The Affirmative Safety Case approach used in TICAP deserves strong consideration by the NRC

Closing Remarks: Part 53 Process

- Timely development and implementation of Part 53 is crucial in providing greater certainty for future advanced reactor applicants
- Current regulatory approval process should continue, including appropriate licensing modernization efforts, so no momentum is lost
- Part 53 development should not interfere with ongoing reviews by establishing new requirements that applications under review would not meet – recognizing the years it will take to implement the rule

Closing Remarks: Part 53 Process (continued)

- Every element of the licensing process, including technical, administrative and procedural requirements (including the role of Advisory Committee on Reactor Safeguards (ACRS) and Atomic Safety and Licensing Board (ASLB)) should be subject to a fresh look
- Consider role of state and local permits in meeting safety requirements— the agency should avoid regulatory duplication of requirements already established under state and local law
- Consider international regulatory agency approaches, as appropriate, so Part 53 enables efficient international licensing of NRC approved designs
- Where innovative approaches to licensing cannot be achieved under existing statutory authority, the Commission and its staff should seek legislative changes that make sense and are consistent with achieving adequate protection

Closing Remarks: Next Steps

- USNIC believes today is first step on detailed interactive approach to developing an effective and useful Part 53
- When available, we look forward to understanding timeline for the Commission to implement Part 53 (including whether desire is to complete rulemaking in 2024 or 2027)
- USNIC welcomes opportunity to continue the dialog with NRC staff to achieve a rule that is fully effective in meeting the Adequate Protection Standard-- but does in a way that allows Advanced Reactors to be developed, licensed, and deployed efficiently and effectively, thus allowing them to serve as important contributors to avoiding carbon emissions

United States NIC Nuclear Industry Council

Part 53 Rulemaking

Final Discussion and Questions

Future Public Meetings

- The NRC staff plans to host a public meeting every 4 to 6 weeks to discuss and receive feedback on various regulatory topics and preliminary rule text.
  - The next Part 53 public meeting will be scheduled for November 2020
  - Any preliminary rule text will be posted on regulations.gov under docket ID NRC-2019-0062 before the public meeting.
- The NRC staff will be meeting with the ACRS Future Plants subcommittee every two months starting in January 2021.

Closing Remarks

Rulemaking Contacts

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Regulations.gov docket ID: **NRC-2019-0062**

Please provide feedback on this public meeting using this link:
https://www.nrc.gov/public-involve/public-meetings/contactus.html

Acronyms and Abbreviations

ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Documents Access and Management System
ANS	American Nuclear Society
ASLB	Atomic Safety and Licensing Board
ASME	American Society of Mechanical Engineers
CFR	Code of Federal Regulations
DCA	Design Certification Application
DOE	Department of Energy
EP	Emergency preparedness
F-C	Frequency – Consequence
FOAK	First-of-a-kind
FRN	Federal Register notice
HLG	High-level guidelines
ISI	Inservice inspection
ISO	International Organization for Standardization
IST	Inservice testing
LAR	License amendment request
LB	Licensing Basis
LWR	Light water reactor
MBSE	Model-based system engineering

Acronyms and Abbreviations (cont.)

mSv	millisieverts
NEIMA	Nuclear Energy Innovation and Modernization Act
NMSS	Office of Nuclear Material Safety and Safeguards
Non-LWR	Non-light water reactor
NQA	Nuclear quality assurance
NRC	U.S. Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
OH	Objectives hierarchy
PB	Performance based

PRA	Probabilistic risk assessment
QA	Quality assurance
RIPB	Risk-informed and performance-based
rem	roentgen-equivalent man
ROP	Reactor oversight process
SMR	Small modular reactor
TEDE	Total effective dose equivalent
TICAP	Technology Inclusive Content of Application Project