



Regulatory Perspectives on the Use of External Hazards Probabilistic Risk Assessments

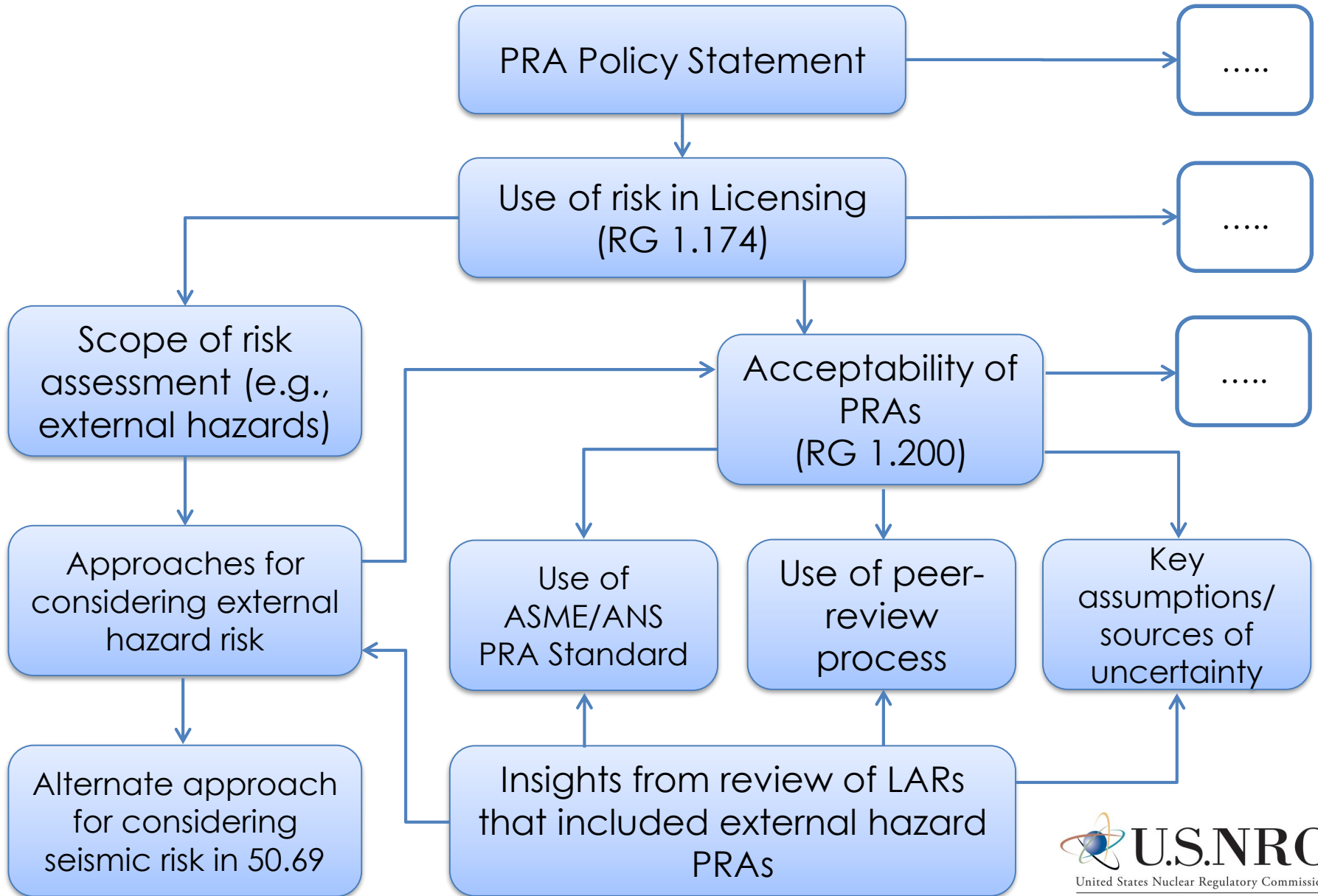
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Objectives

- Introduce the NRC's Policy for use of PRA
- Explain the regulatory framework for reviewing the use of PRAs in licensing applications
- Discuss the insights/lessons-learned from reviewing external hazards PRAs

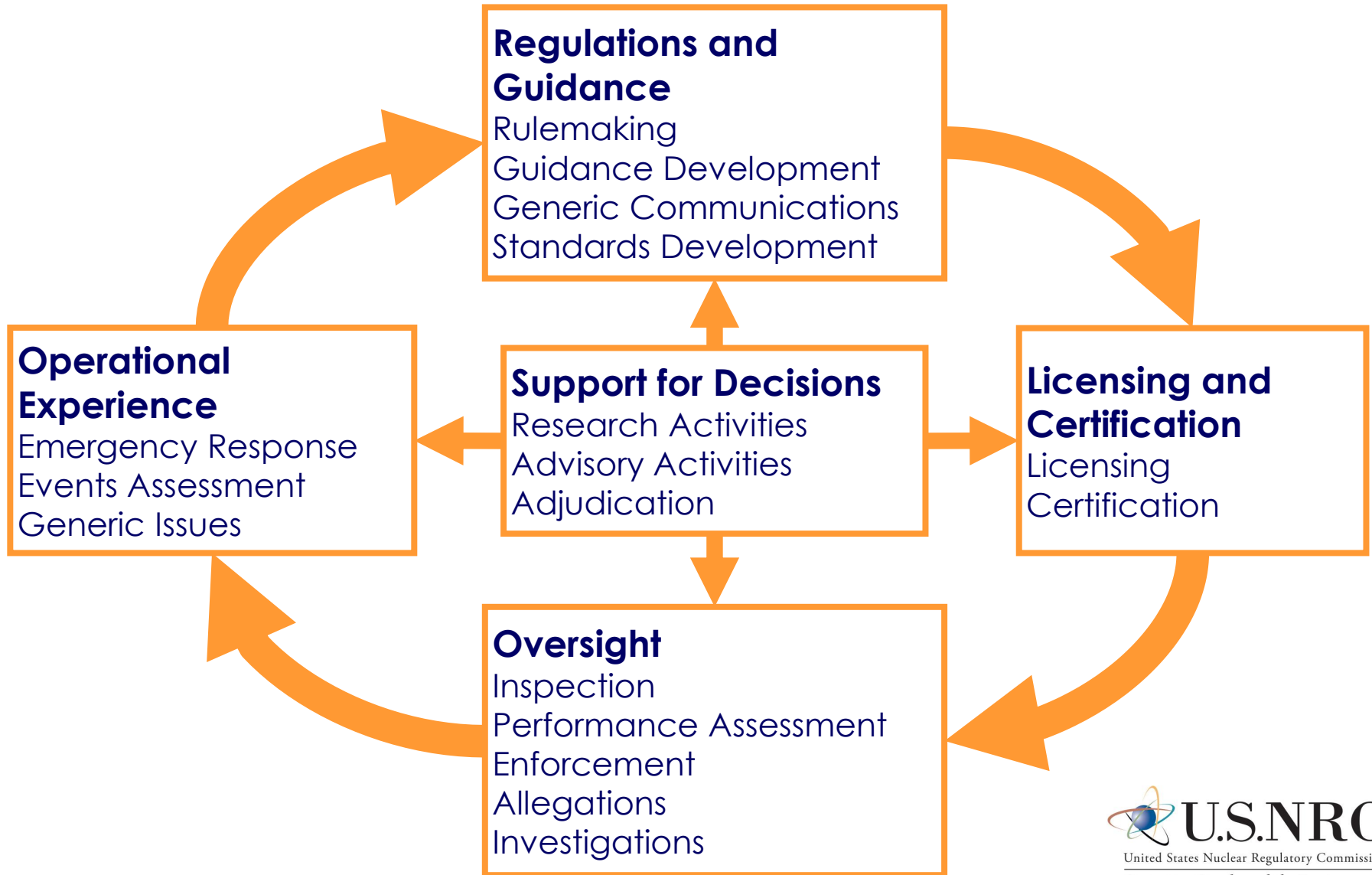
Outline



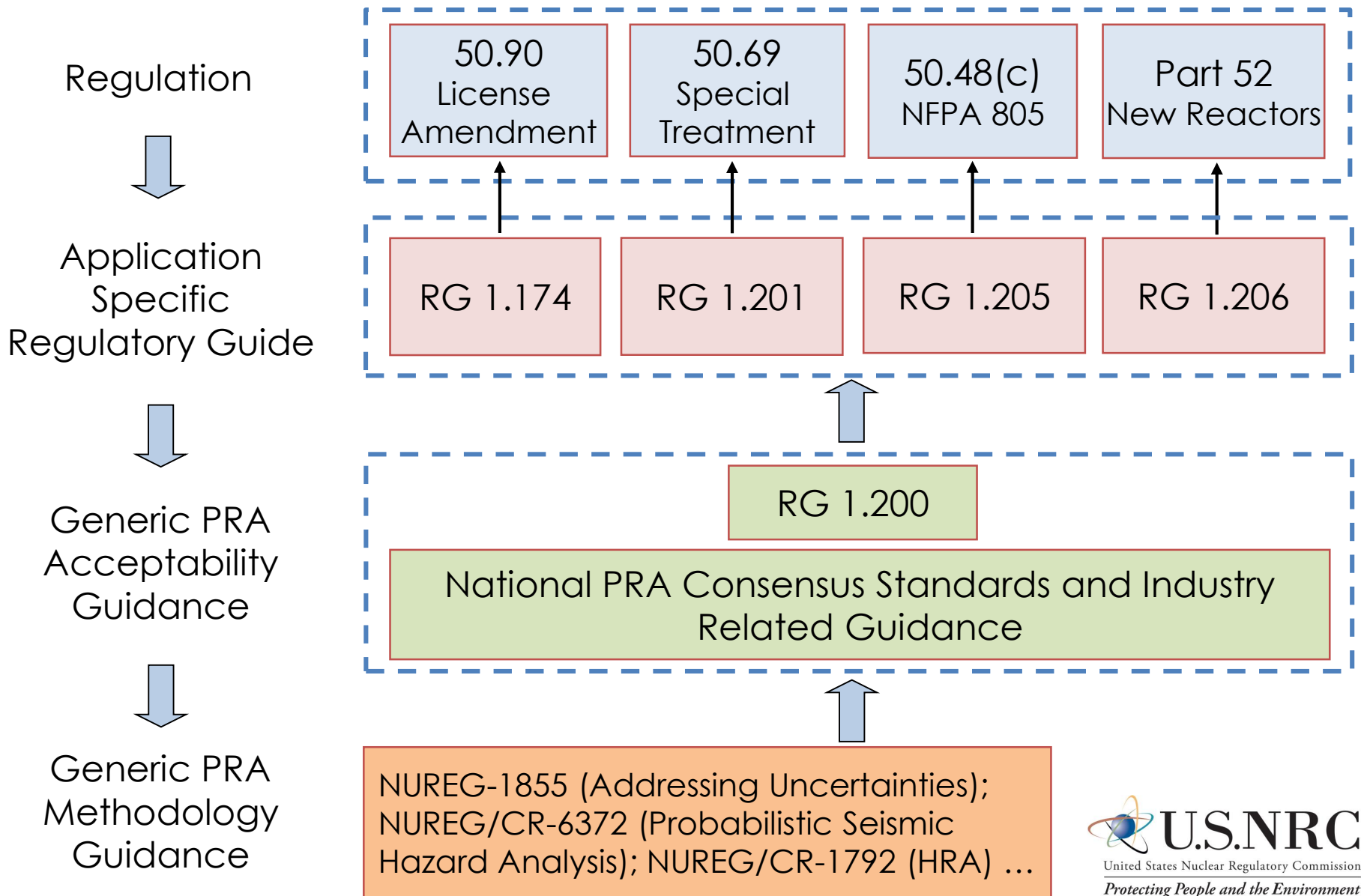
NRC PRA Policy Statement

- “Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities,”
August 16, 1995
 - Increase use of PRA technology in all regulatory matters [...] in a way that complements the deterministic approach and supports the traditional defense-in-depth philosophy
 - PRAs used in regulatory decisions should be as realistic as practicable [...]

Use of PRA in Regulatory Matters

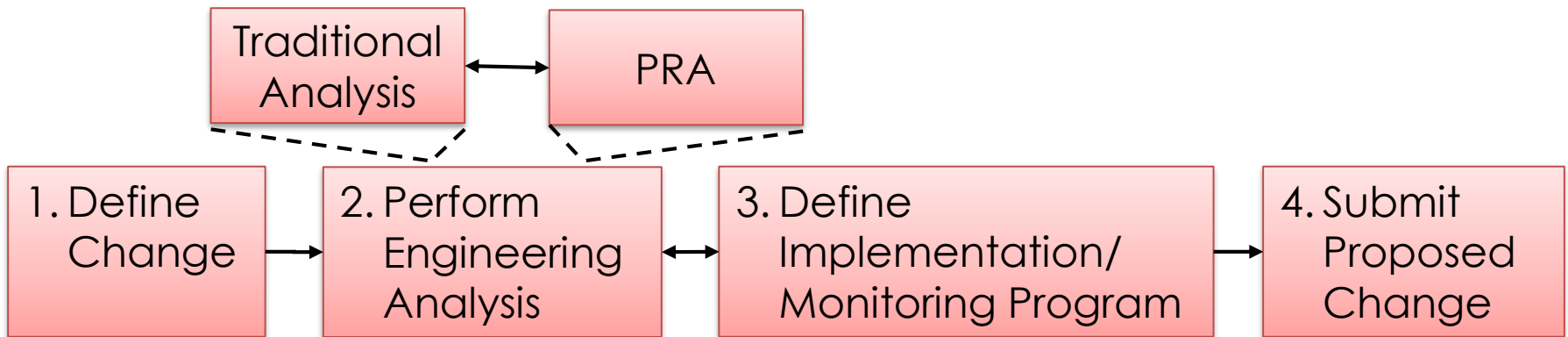


Risk-Informed Licensing Regulatory Framework



Risk-Informed Licensing Changes

- RG 1.174 describes an approach for developing risk-informed applications for licensing basis change
- Licensing basis changes use integrated decisionmaking
 - expected to meet five principles of risk-informed decision-making: meeting **regulation**, **defense-in-depth**, **safety margin**, small increase in **risk**, **performance monitoring**
- Integrated decisionmaking is applied in non-licensing activities



RG 1.174: PRA Scope for Applications

- “when the risk associated with a particular **hazard group** or operating mode would **affect the decision** being made, [...] then the risk should be assessed using a **PRA that meets that standard**”
- “A **qualitative treatment** of the missing [...] hazard groups may be sufficient when the licensee can demonstrate that those **risk contributions** would **not affect the decision**”

Acceptable PRAs

- PRA used to support an application is measured in terms of appropriateness with respect to **scope**, **level of detail**, conformance with **technical elements**, and **plant representation**
 - Typical hazard groups considered include, in part, internal events, seismic events, internal fires, high winds, and external flooding
- RG 1.200 describes one acceptable approach for determining whether base PRA is acceptable

Acceptable PRAs (Continued)

- RG 1.200 endorses **ASME/ANS PRA standard** that addresses **base PRA** for **internal** and **external hazard** groups at-power as well as **industry peer-review** program documents
- Peer-review process identifies and assesses where the technical requirements of the standard are not met
- RG 1.200 “will obviate the need for an in-depth review of the base PRA by NRC reviewers, allowing them to **focus their review** on **key assumptions** and **areas identified by peer reviewers** as being of concern and relevant to the application”

Use of PRA Standard in Licensing Applications

- RG 1.200 endorsed 2009 ASME/ANS PRA Standard (Addendum A) including Parts 5 (seismic), 7 (high winds), and 8 (external flooding)
- NRC staff accepted Code Case to Part 5 of Addendum B with comments (ADAMS ML18017A964)
- NRC staff endorsed EPRI report 1025287, known as SPID, for use in developing SPRAs to respond to the 10 CFR 50.54(f) letter
 - Cites Part 5 of 2013 ASME/ANS PRA Standard (Addendum B)
 - Addendum B has not been endorsed for use in licensing activities
- “Gap” assessment of differences between SPRA SRs in Addenda A and B needed

Insights on Acceptability of IEPRAs

- External hazards PRAs are usually built using IEPRA as the base
 - Finding may not impact certain applications of IEPRA, but may impact external hazards
 - Resolutions may not have been propagated to SPRAs
 - Resolution of finding in IEPRA may be different from what was propagated to SPRA at time of development
- Beneficial to explicitly consider IEPRA acceptability in self-assessment as well as peer review for external hazards PRAs
- Refinements to the Part 5 of the PRA Standard and peer-review guidance expected to address this issue for SPRAs

Insights on Use of Peer-Review Process

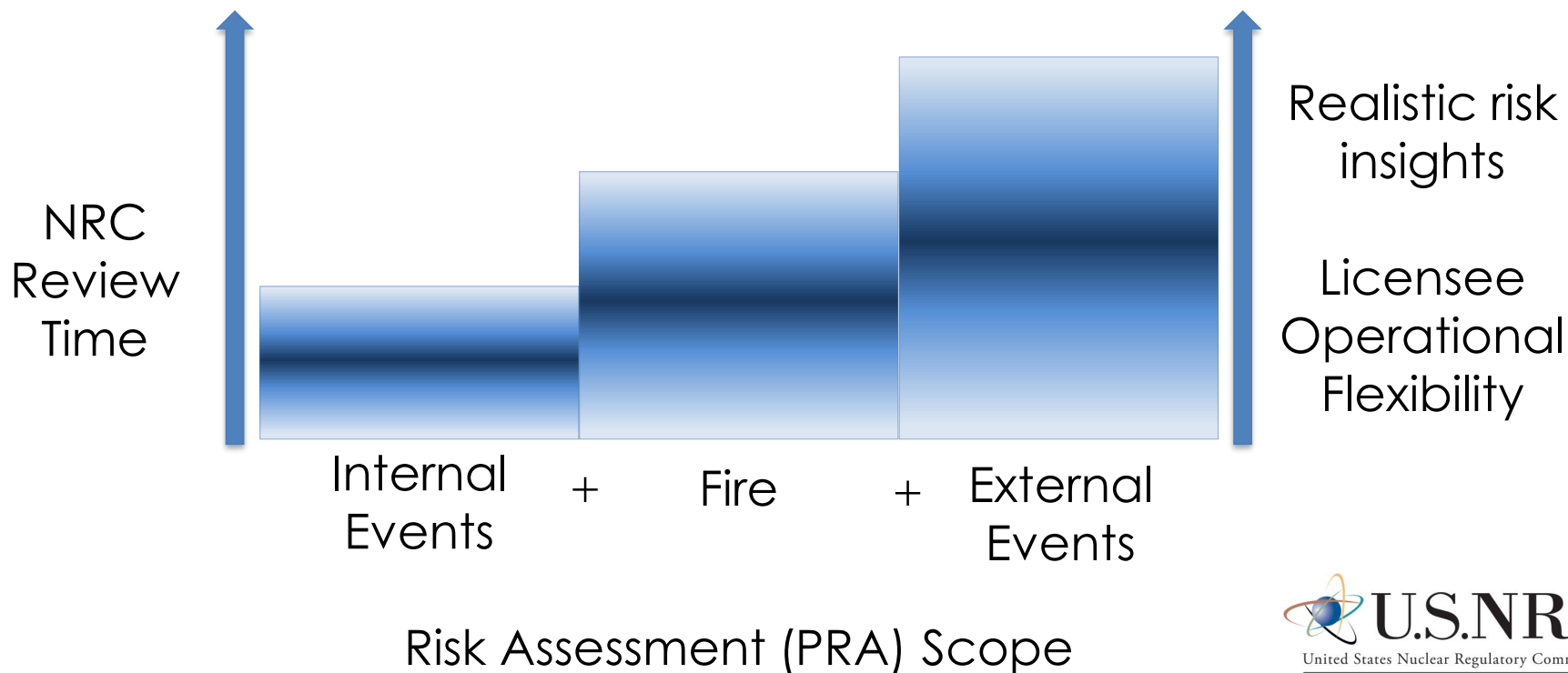
- NRC accepted NEI 12-13 (ML18025C025) with exceptions; Prominent comments included:
 - Identification of review of “newly developed methods”
 - Performing “in-process” peer review (i.e., separate peer review for each external hazard technical element)
- Beneficial to include explicit discussion of consideration of staff comments during performance of peer-review
- Reviews showed that walkdowns performed as part of PRA peer-reviews are crucial to process

Key Assumptions and Sources of Uncertainty

- RG 1.200: “the applicant identifies the key assumptions [...] relevant to that application. This will be used to identify sensitivity studies...”
- An effective approach for identification and disposition of key assumptions and sources of uncertainty includes
 - compilation all assumptions used across technical elements
 - use definition in RG 1.200 and NUREG-1855 to identify key assumptions and sources of uncertainty
 - disposition of the identified key assumptions (qualitatively or quantitatively) on an application-specific basis

Insights from Recent LAR Reviews

- LARs of increased scope require more NRC review hours but afford increased operational flexibility



Scope of External Hazards Risk Evaluations

Licensing Action	TSTF-505 (4b)	TSTF-425 (5b)	10 CFR 50.69	ILRT
Guidance for External Hazard Risk Evaluation	<p>Demonstration of insignificant impact</p> <p>Bounding or conservative estimate</p> <p>PRA (RG 1.200 CC-II)</p>	<p>Demonstration of insignificant impact</p> <p>Bounding or conservative estimate</p> <p>PRA (RG 1.200 CC-II)</p>	<p>Demonstrate if <1% of IEPRA risk</p> <p>PRA (RG 1.200 CC-II)</p> <p>SMA</p> <p>Qualitative treatment following guidance</p>	<p>PRA (RG 1.200 CC-I)</p> <p>Assessment to provide order of magnitude estimate</p>
Approaches Reviewed by Staff	<p>SPRA; “Penalty” factors for seismic/high winds risk; Insignificant impact bases</p>	<p>SPRA; High Winds PRA; External Flooding PRA; Insignificant impact bases</p>	<p>SPRA; High Winds PRA; External Flooding PRA; Qualitative treatment</p>	<p>SPRA; External hazards multiplier</p>

Proposed Alternative Seismic Approach

- Current approaches for addressing seismic risk:
 - Seismic PRA
 - Seismic Margin Analysis
 - Screen from consideration if seismic risk is a small fraction (<1%) of internal events risk
- Subset of plants do not have SPRA or SMA
- A three-tiered approach has been proposed for plants with low, medium and high seismic hazard/margin (EPRI Report 3002012988)

Proposed Alternative Seismic Approach (Continued)

- To support the approach, EPRI Report uses four SPRAs to identify insights related to seismic risk
 - identifies limited unique seismic insights and failure modes
 - claims that most seismic risk significant SSCs are identified by internal events and/or fire PRAs
- A lead site submitted Tier 1 of the approach
 - important revisions made to plant-specific LAR during LAR review to explicitly consider unique seismic insights
- Another site expected to submit Tier 2

Key Messages

- Evaluation of external hazard risk is an important element of the scope and review of risk-informed LARs based on RG 1.200 and RG 1.174
- External hazard risk can be non-trivial contribution to the baseline risk
- More realistic evaluation of external hazard risk allows increased operational flexibility from RI applications
- Recent advancements in the knowledge and understanding of external hazard risk resulted in refinement/update of related risk insights

References

- 60 FR 42622, "Use of Probabilistic Risk Assessment Methods in Nuclear Activities: Final Policy Statement," Federal Register, Volume 60, Number 42622, August 16, 1995
- U.S. NRC, Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 3, January 2018 (ADAMS Accession No. ML17317A256)
- U.S. NRC, Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk Informed Activities," Revision 2, dated March 2009 (ADAMS Accession No. ML090410014)
- ASME/ANS RA Sa 2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," February 2009
- EPRI Report 1025287, "Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," November 2012 (ADAMS Accession No. ML 12333A170)
- NEI 12-13, "External Hazards PRA Peer Review Process Guidelines," August 2012 (ADAMS Package Accession No. ML122400044)
- Franovich, M., U.S. NRC, letter to Kruger, G., Nuclear Energy Institute, "U.S. Nuclear Regulatory Commission Acceptance of Nuclear Energy Institute (NEI) Guidance NEI 12-13, "External Hazards PRA Peer Review Process Guidelines, (August 2012)," March 7, 2018 (ADAMS Accession No. ML18025C025)
- EPRI Report 3002012988, "Alternative Approaches for Addressing Seismic Risk in 10 CFR 50.69 Risk-Informed Categorization," July 2018

Acronyms

- ADAMS – Agencywide Documents Access and Management System
- ANS – American Nuclear Society
- ASME – American Society of Mechanical Engineers
- CC – Capability Category
- EPRI – Electric Power Research Institute
- HRA – Human Reliability Analysis
- IEPRA – Internal Events PRA
- ILRT – Integrated Leakage Rate Testing
- LAR – License Amendment Request
- NEI – Nuclear Energy Institute
- NFPA-805 – National Fire Protection Association Standard 805
- PRA – Probabilistic Risk Assessment
- RG – Regulatory Guide
- RI – Risk-informed
- SMA – Seismic Margin Analysis
- SPID – Screening, Prioritization and Implementation Details (EPRI 1025287)
- SPRA – Seismic PRA
- SR – Supporting Requirement