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

BRIEFING ON RISK-INFORMED REGULATION

- Commission Meeting
- May 11, 2017

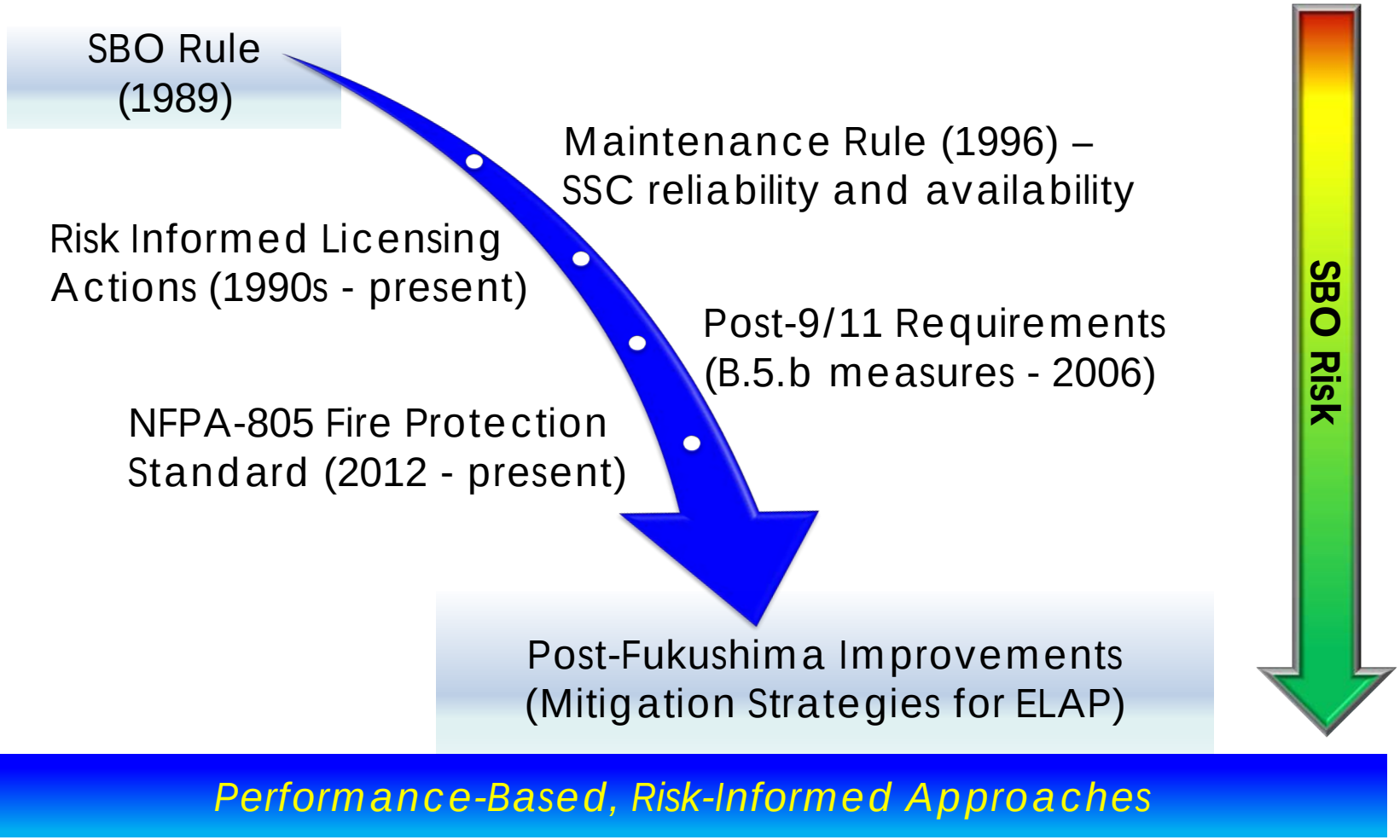
Key Messages

- Analytical improvements support more advanced risk-informed initiatives.
- Risk insights have enhanced reactor safety and improved decision-making.
- Investments in infrastructure, capacity, and methods are underway to address technical and cultural challenges.

Overview

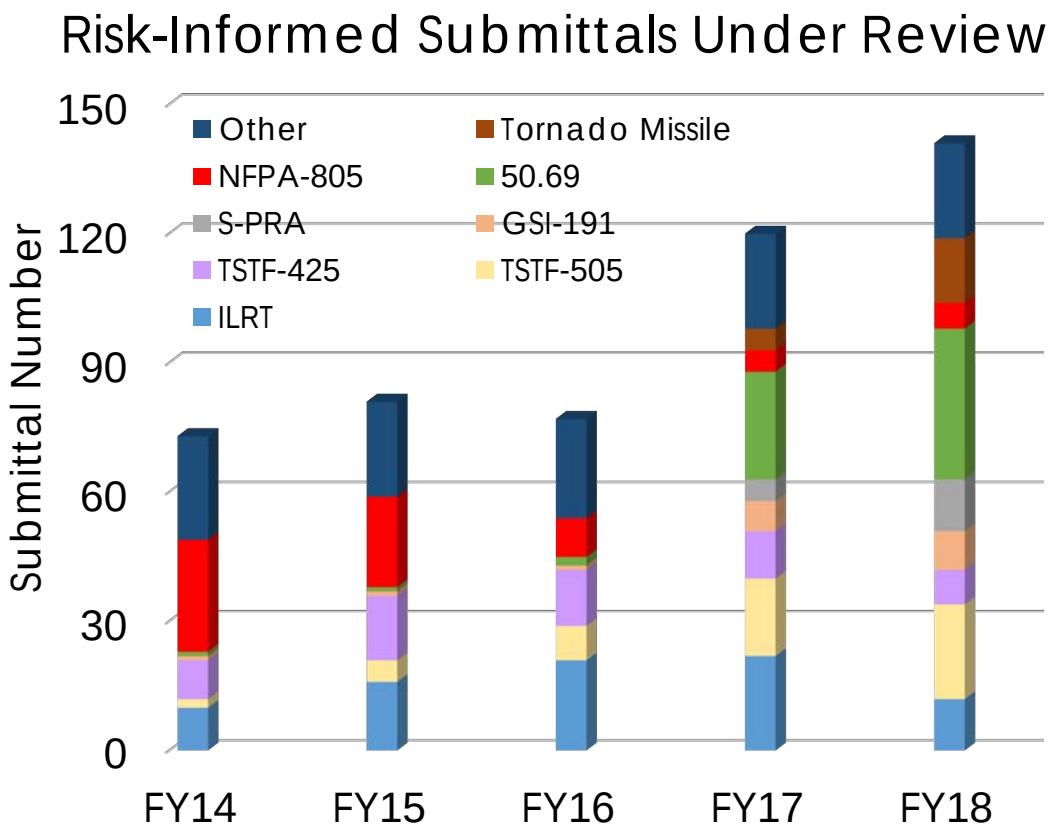
- Our risk-informed journey - *Bill Dean, NRR*
- Improving safety, informed by risk insights - *CJ Fong, NRR*
- Ensuring appropriate oversight of new risk-informed initiatives - *Alejandro Alen, Region 2*
- Improving integrated risk-informed decisionmaking (RIDM) and probabilistic risk assessment (PRA) realism - *Anders Gilbertson, RES*
- Creating a culture of risk-informed regulation - *Joe Giitter, NRR*

Station Blackout Risk Reduced for a Spectrum of Hazards



Risk-Informed Applications Can Afford Greater Operational Flexibility and Improved Safety

- Risk-informed licensing is trending upward.
- FLEX is being incorporated into RIDM.



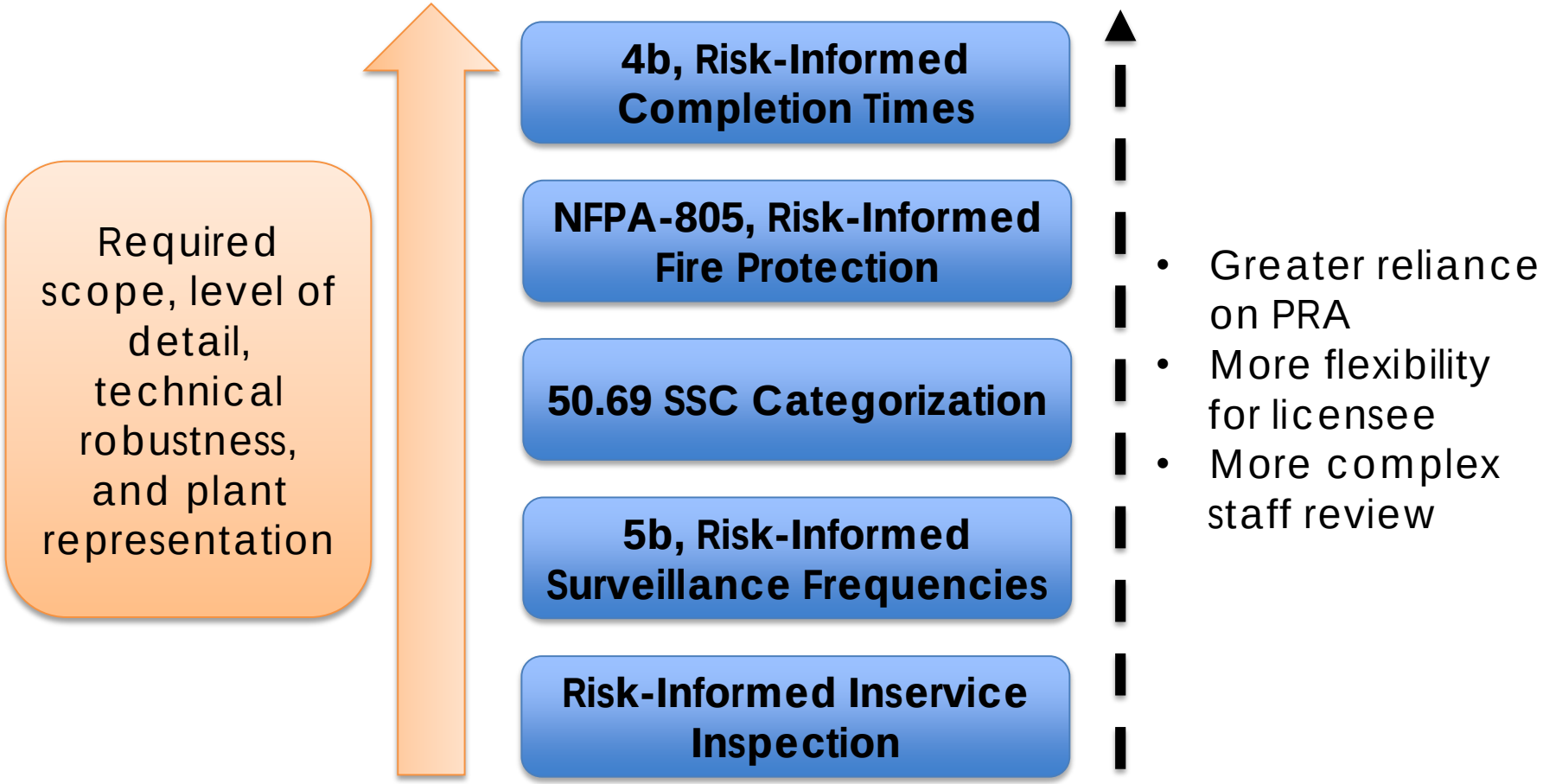
Progress in RIDM Continues but Challenges Remain

- Major risk-informed licensing reviews have proved challenging
  - National Fire Protection Association (NFPA) Standard 805
  - Risk-Informed Technical Specifications (RITS) Initiative 4b
- Not all staff have embraced RIDM
- Inconsistent levels of PRA acceptability

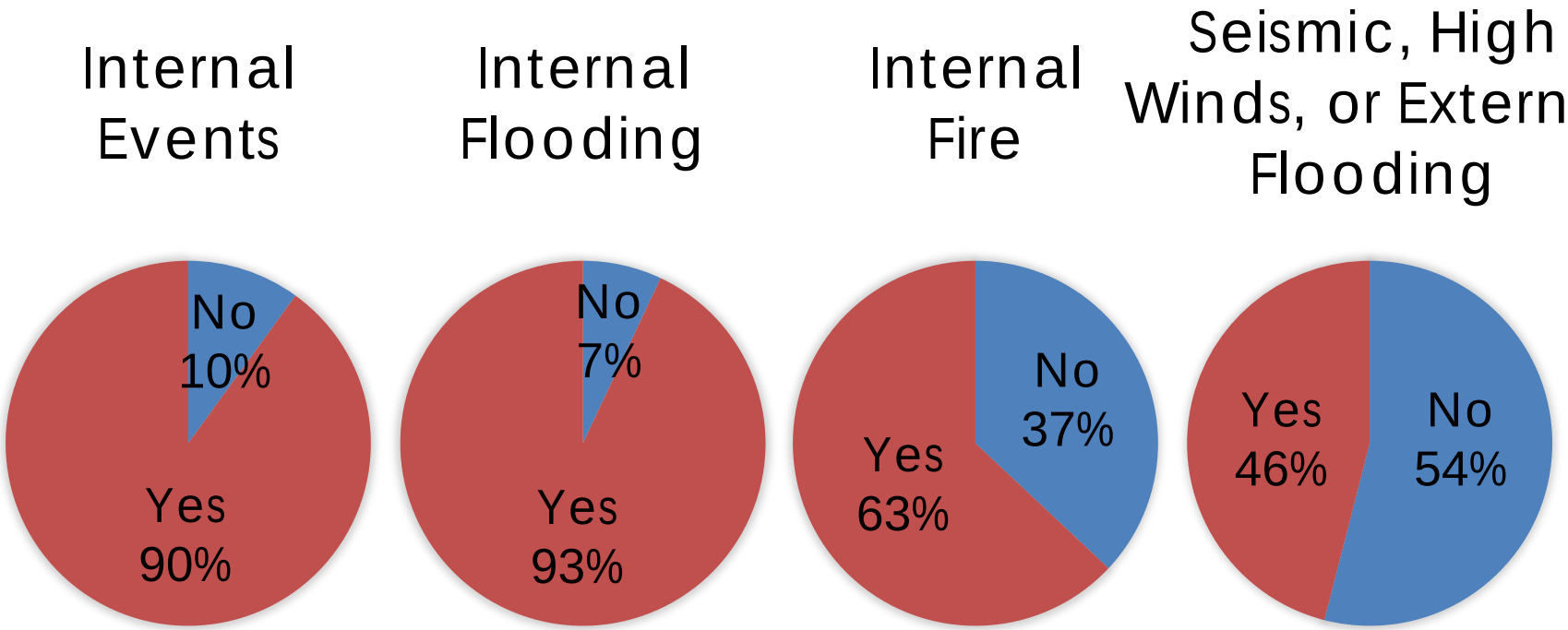
Several Major Risk-Informed Initiatives Are under Review

- Technical Specifications Task Force (TSTF) 505: risk-informed completion times ("4b")
- TSTF-425: risk-informed surveillance frequencies ("5b")
- Risk-informed Generic Safety Issue (GSI)-191
- 50.69: risk-informed structure, system, or component (SSC) categorization
- Seismic PRA (NTTF 2.1)

PRA Must Be Suitable for the Application



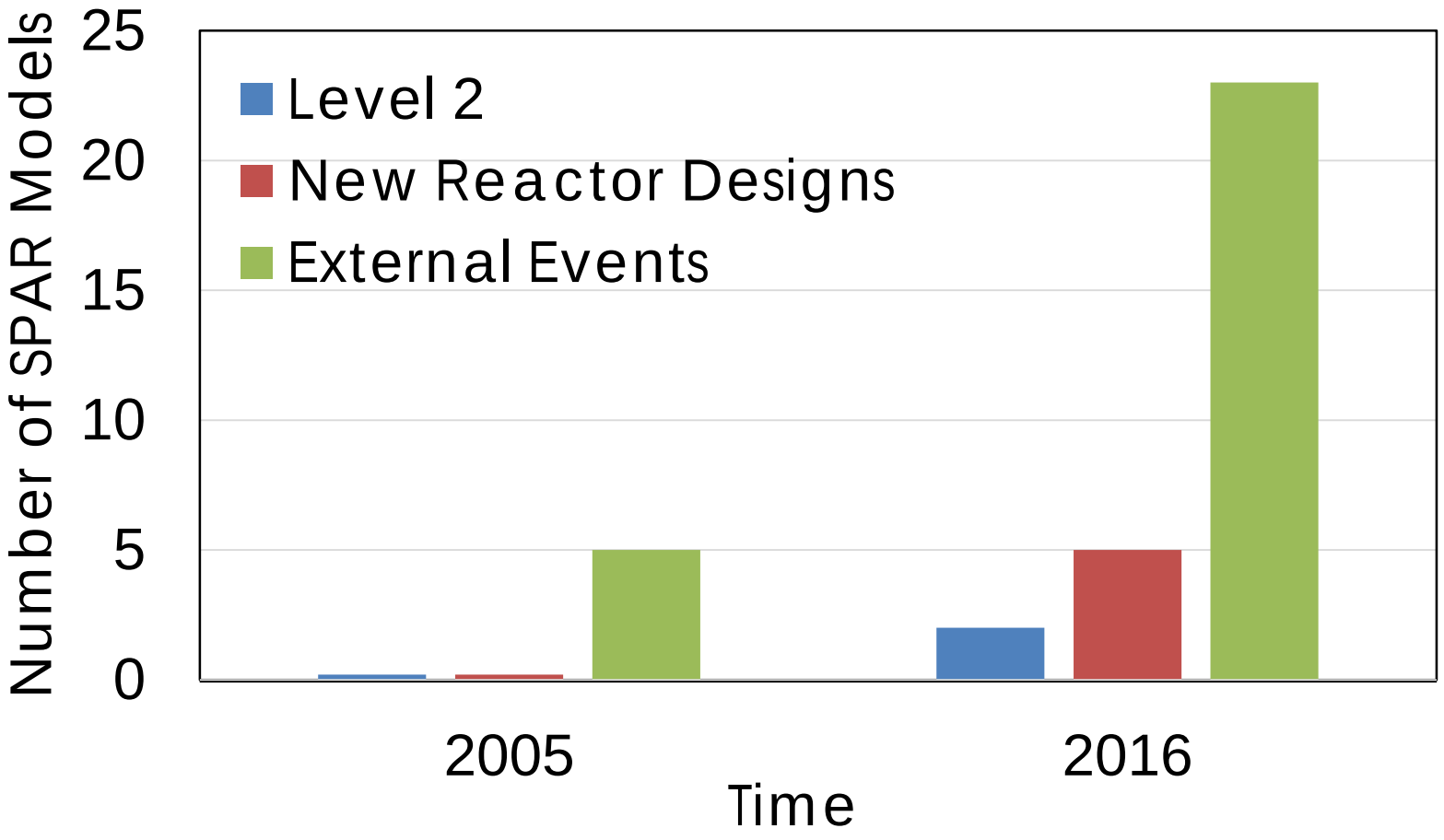
Industry PRA Models Have Improved Greatly Over the Last Decade



Are models across the fleet peer-reviewed?

Source: 2013 letter from Nuclear Energy Institute (NEI) to NRC (ML13354B997)

NRC SPAR Models Have Improved Greatly over the Last Decade



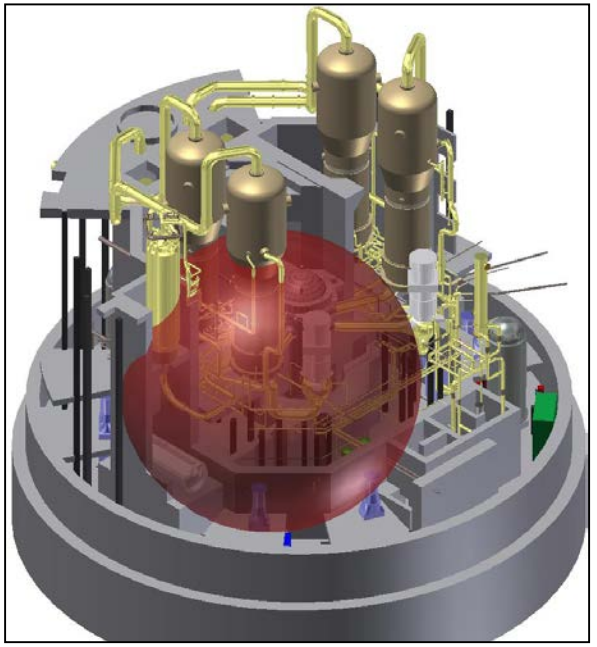
Risk Insights Gained from Fire PRA Are Driving Safety Improvements

- Reactor Coolant Pump (RCP) seals
- Additional feed water pumps
- Alternate RCP seal injection
- New diesel generators
- Improved batteries
- Traditional fire protection equipment (shielding, detection, etc.)

Example auxiliary feedwater NFPA-805 modification (Arkansas Nuclear One)

Risk Insights Have Resulted in GSI-191 Enhancements

- Targeted removal of problematic insulation
- Strainer modifications (not just size) that focus on risk-significant scenarios
- Improved procedures informed by more realistic analyses



Source: South Texas Project GSI-191 license amendment request (LAR)

NRC Is Upgrading the Infrastructure Needed to Support RIDM

- Facts and Observations (F&O) independent assessment process
- Improved guidance (e.g., Regulatory Guide (RG) 1.174 update)
- Interactions with industry to improve LAR consistency and quality

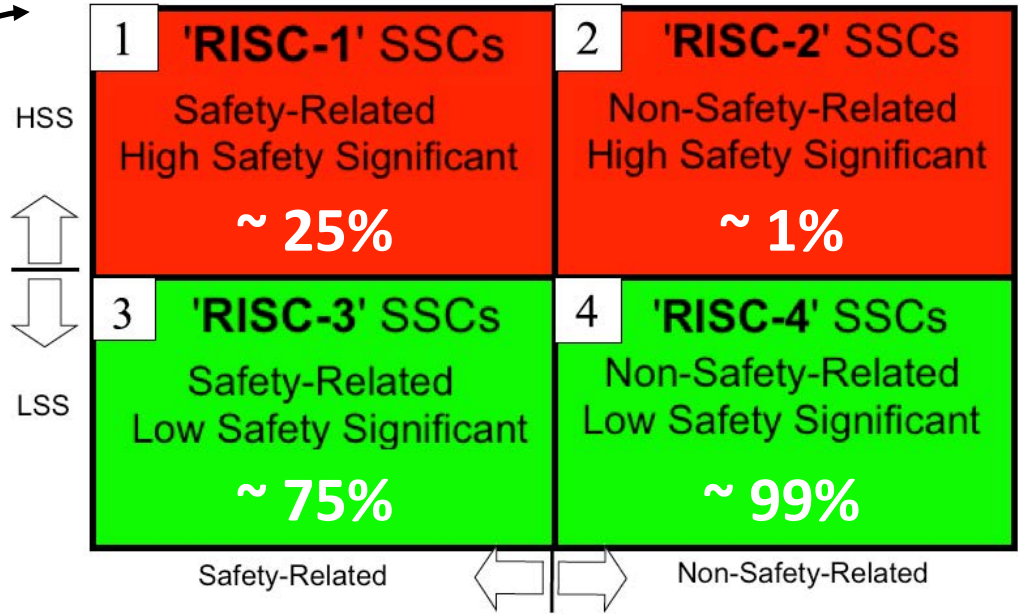
NRC Is Overseeing New Risk-Informed Initiatives

- **10 CFR 50.69** – categorization and treatment of SSCs
- Risk-informed technical specification initiatives
  - **4b**: risk-informed completion times
  - **5b**: relocation of surveillance requirement frequencies to licensee-controlled program

50.69 Allows Treatment of SSCs According to Safety Significance

- Adjust scope of SSCs subject to "special treatment" controls
- Rule consists of three major elements

1. Categorization Process
2. Alternate Treatment
3. Feedback and Process Adjustments



50.69 Demonstrated through Vogtle Pilot Application

- Pilot Plant: Vogtle Units 1 and 2
- 2012 – 2014: LAR review and approval
- 2016: Inspection per Inspection Procedure (IP) 37060
- Program and implementation
  - 4 systems categorized
  - 1 alternate treatment (limited)
- Program consistent with safety evaluation and 50.69 requirements
- IP 37060 supports additional inspection

NRC Is Prepared to Inspect Implementation of 4b

R - Risk

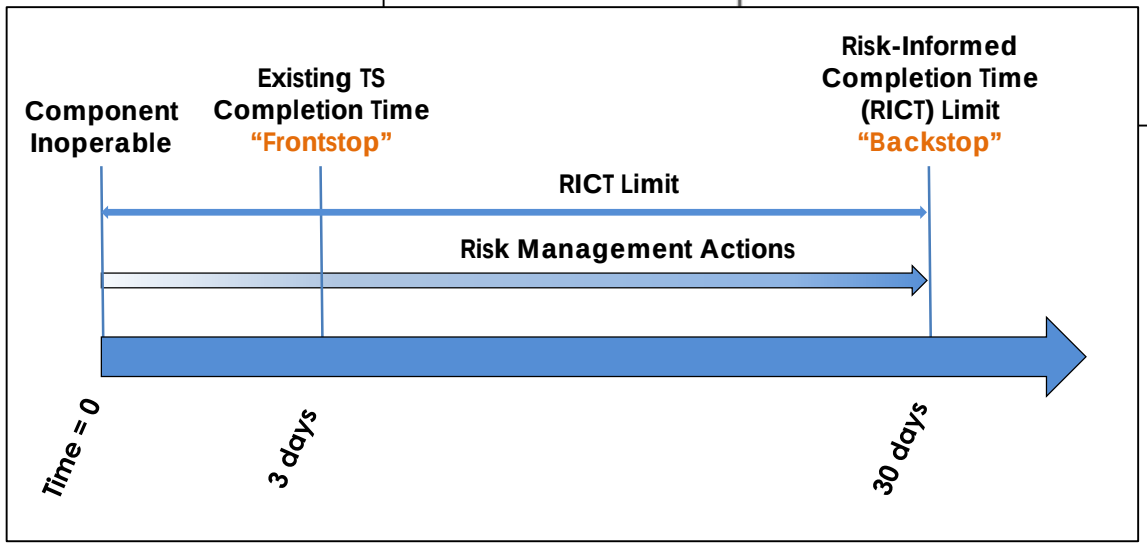
I - Informed

C - Completion

T - Times

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One subsystem inoperable.	A.1 Restore subsystem to OPERABLE status.	3 days OR In accordance with the Risk Informed Completion Time Program



NRC Is Prepared to Inspect Implementation of 4b

- 2012 – Vogtle submitted LAR
  - SER expected later in 2017
- IP 71111.13, Maintenance Risk Assessment
- Under review to include RICT inspection
- 2007 – South Texas Project first to adopt
- Temporary Instruction 2515/170

NRC Continues to Review Implementation of the Surveillance Frequency Control Program 5b

- TSTF-425 and NEI-04-10
- Adopted by ~ 75% of industry (Vogtle 2012)
- IP 71111.22, Surveillance Testing – Appendix A

Battery Parameters
3.8.6

SURVEILLANCE REQUIREMENTS (continued)

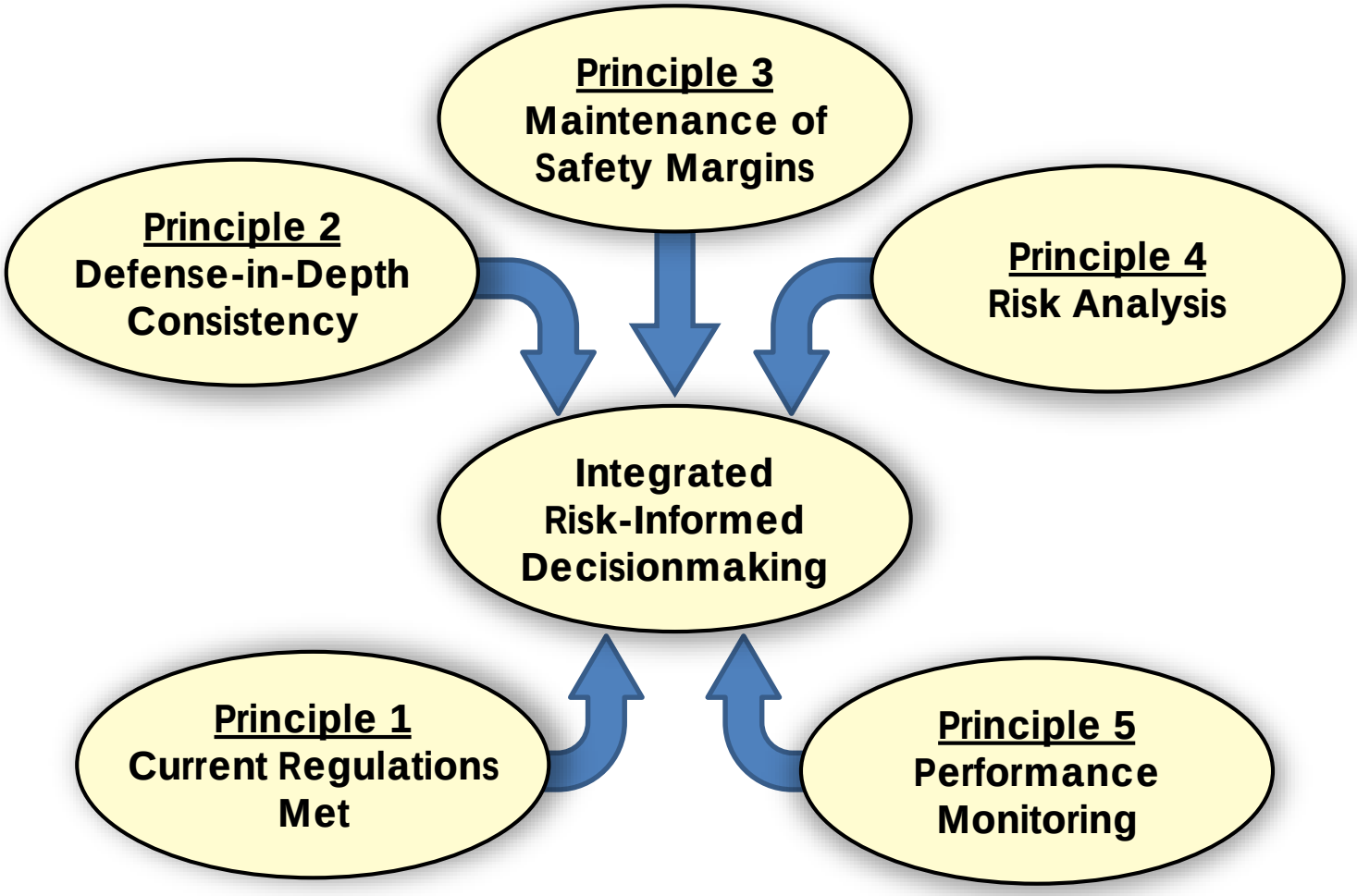
SURVEILLANCE		FREQUENCY
SR 3.8.6.2	Verify each battery pilot cell float voltage is ≥ [2.07] V.	In accordance with the Surveillance Frequency Control Program → ~~31 days~~

24	Hrs
3	Days
7	Days
31	Days
92	Days
6	Months
18	Months

NRC Is Improving Integrated Risk-Informed Decisionmaking

- Guidance on RIDM
- Improved PRA realism

Risk Analysis Is One Principle of the Integrated RIDM Process



Staff Revised Defense-in-Depth (DID) Guidance in RG 1.174 Based on Commission Direction

- Draft Revision 3 of RG 1.174 completed in response to SRM on SECY-15-0168
- Enhanced guidance on the agency's interpretation and implementation of the DID philosophy
- Overseen by the agency's Risk-Informed Steering Committee

Key Enhancements to DID Guidance in RG 1.174 Revision 3

- Expanded introductory and background discussions on the DID philosophy
- Defined each DID evaluation factor
- Provided guidance on how to address the DID evaluation factors individually and in an integrated fashion

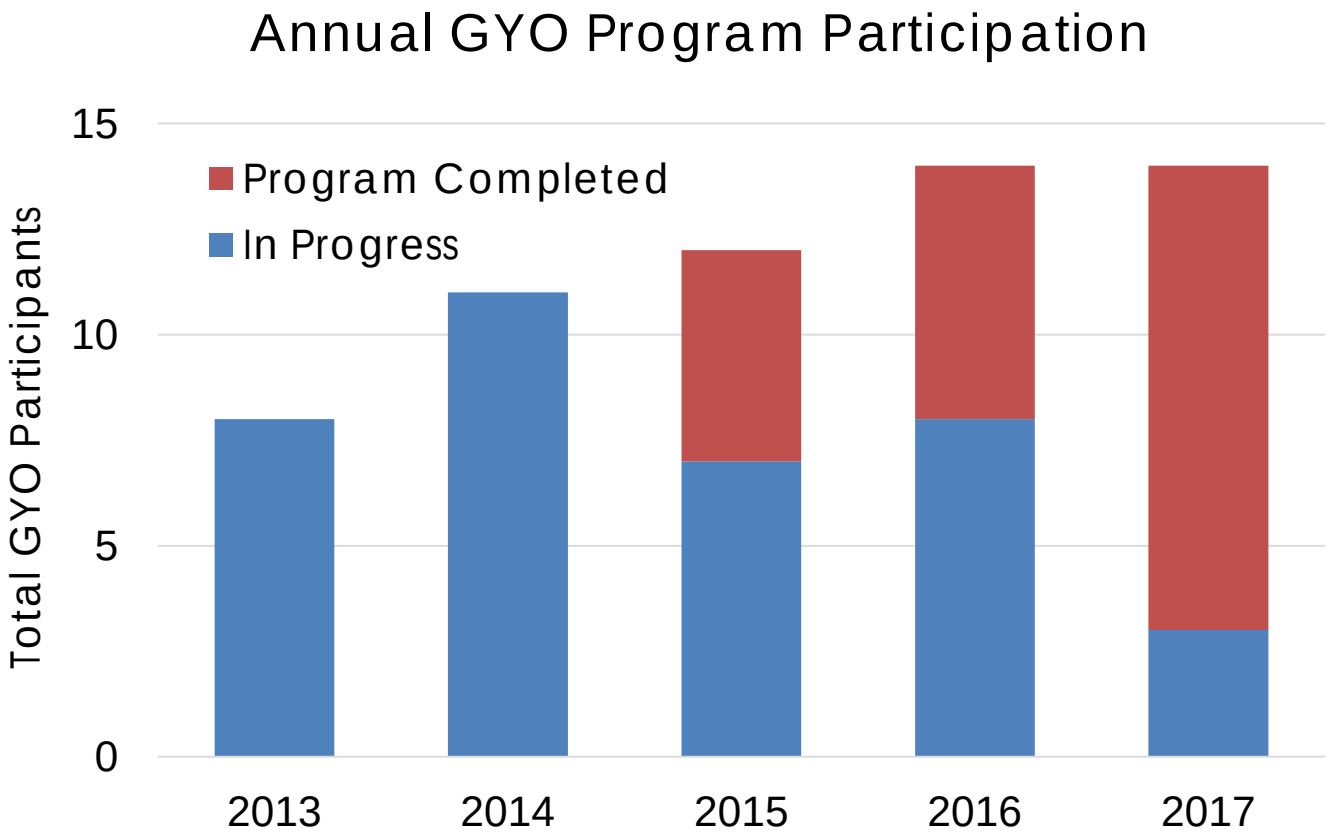
Additional Enhancements to RG 1.174 Revision 3

- Discussion on aggregation of risk
- Acceptance guideline transitions
- Provides stronger connection to guidance on treatment of uncertainty (NUREG-1855)
- Transitioning from large release frequency (LRF) and conditional containment failure probability (CCFP) to large early release frequency (LERF) and containment performance expectations for new reactors

Staff Continues to Work with Stakeholders to Improve PRA Realism

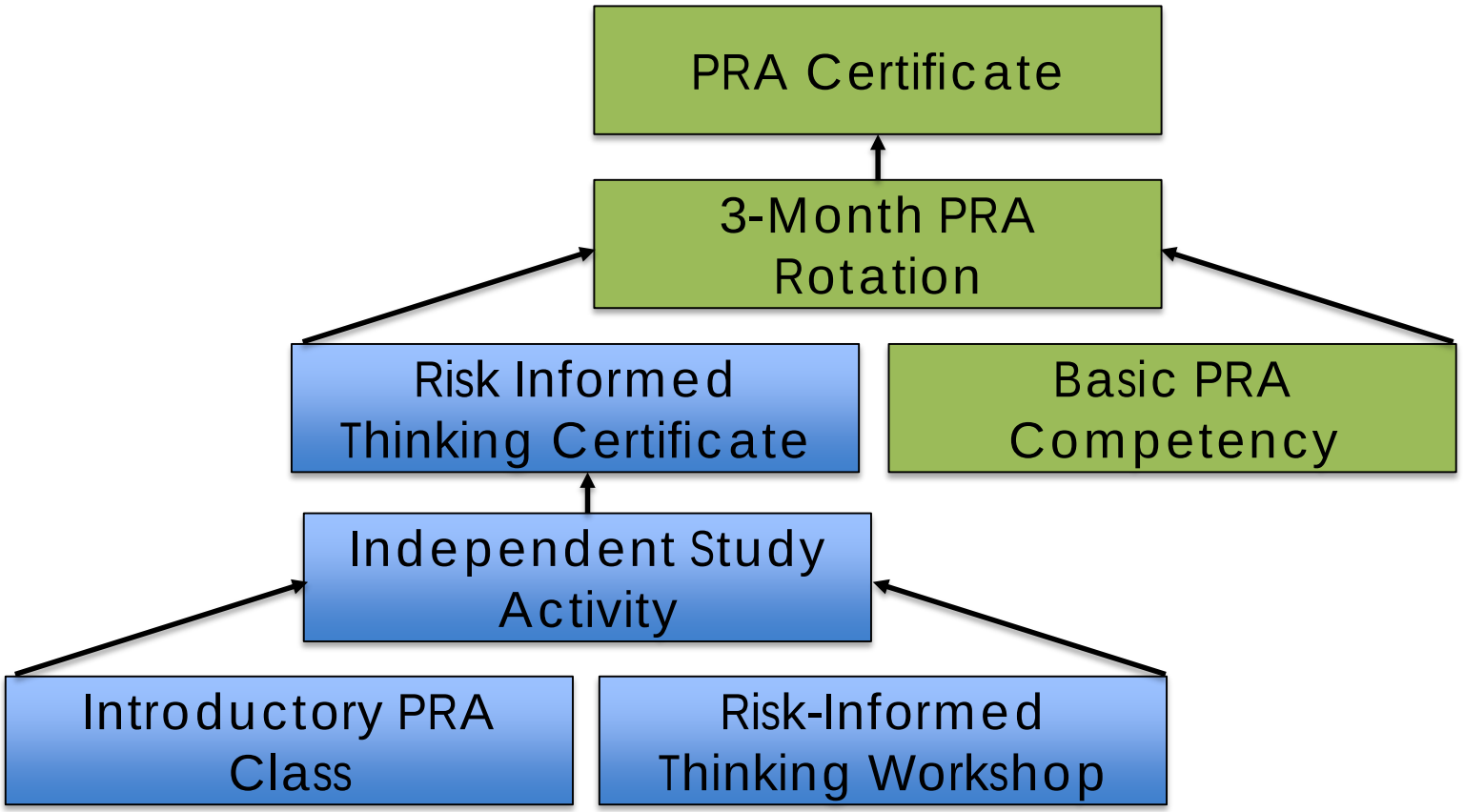
- Improving fire PRA methods
- Seeking stakeholder input on human error probability estimates and common-cause failure modeling
- Potential methods for modeling credit of FLEX equipment and RCP seals
- Enhancing probabilistic flooding hazard analyses

The NRC Grow Your Own (GYO) Program Has Created an Effective Pipeline for PRA Expertise



Risk-Informed Thinking Workshops Provide Staff Hands-on Experience with RIDM

Certificate Programs Promote Risk-Informed Thinking Beyond PRA Organizations



Process Updates Will Support Risk-Informed Culture

- Enhanced review guidance and office procedures place greater emphasis on using risk insights
- Greater collaboration between PRA specialists and traditional reviewers
- Focusing on risk significance can result in more streamlined and efficient licensing reviews

Key Messages

- Analytical improvements support more advanced risk-informed initiatives.
- Risk insights have enhanced reactor safety and improved decision-making.
- Investments in infrastructure, capacity, and methods are underway to address technical and cultural challenges.

Acronyms (A-N)

- CCFP: Conditional Containment Failure Probability
- CDF: Core Damage Frequency
- CFR: Code of Federal Regulations
- DID: Defense-In-Depth
- ELAP: Extended Loss of AC Power
- F&O: Fact/Finding and Observation
- GSI: Generic Safety Issue
- GYO: Grow Your Own
- IP: Inspection Procedure
- LAR: License Amendment Request
- LERF: Large Early Release Frequency
- LRF: Large Release Frequency
- LOCA: Loss-of-Coolant-Accident
- NEI: Nuclear Energy Institute
- NFPA: National Fire Protection Association
- NTTF: Near Term Task Force

Acronyms (O-Z)

- PRA: Probabilistic Risk Assessment
- RCP: Reactor Coolant Pump
- RG: Regulatory Guide
- RICT: Risk-Informed Completion Time
- RISC : Risk-Informed Steering Committee Risk-Informed Safety Class
- RITS: Risk-Informed Technical Specifications
- RG: Regulatory Guide
- SFCP: Surveillance Frequency Control Program
- SSC: Structure, System, or Component
- SR: Surveillance Requirement
- SRM: Staff Requirements Memorandum
- TS: Technical Specification
- TSTF: Technical Specification Task Force