

SCHEDULING NOTE

Title: **BRIEFING ON THE MITIGATION OF BEYOND DESIGN BASIS EVENTS (MBDBE) RULEMAKING (Public Meeting)**

Purpose: To provide the Commission with a discussion on the MBDBE proposed rule package and associated guidance. This activity stems from the lessons-learned from the Fukushima Dai-ichi accident.

Scheduled: **July 9, 2015**
9:00 a.m.

Duration: Approx. 3 hours

Location: Commissioners' Conference Room, 1st fl OWFN

Participants:	Presentation
<u>External Panel</u>	40 mins.*
Anthony Pietrangelo , Senior Vice President and Chief Nuclear Officer Nuclear Energy Institute <u>Topic:</u> <ul style="list-style-type: none"> • Industry Views of Proposed MBDBE Rule 	10 mins.*
Stuart Lewis , Program Manager, Electric Power Research Institute (EPRI) <u>Topic:</u> <ul style="list-style-type: none"> • Severe Accident Management Guidance Technical Basis Report 	10 mins.*
Jack Stringfellow , Chairman, Pressurized Water Reactor Owners Group (PWROG) <u>Topic:</u> <ul style="list-style-type: none"> • Generic Severe Accident Management Technical Guidance 	10 mins.*
David Lochbaum , Director, Nuclear Safety Project Union of Concerned Scientists (UCS) <u>Topic:</u> <ul style="list-style-type: none"> • UCS Views on Proposed MBDBE Rule 	10 mins.*
Commission Q & A	40 mins.
Break	5 mins.

NRC Staff Panel

50 mins.*

Mike Johnson, Deputy Executive Director for Reactor and Preparedness Programs and Fukushima Steering Committee Chairman

Bill Dean, Director, Office Nuclear Reactor Regulation (NRR)

Topic:

- Overview of MBDBE Rulemaking and Existing Orders

Timothy Reed, Senior Project Manager, Division of Policy and Rulemaking, NRR

Topic:

- Discussion of MBDBE proposed requirements and Cumulative Effects of Regulation considerations.

Eric Bowman, Special Advisor, Japan Lessons-Learned Division (JLD), NRR

Topic:

- Discussion of MBDBE supporting guidance.

John Monninger, Director, Division of Safety Systems and Risk Assessment, NRO

Topic:

- Mitigation Strategies Design Features for Future Reactor Designs

Commission Q & A

40 mins.

Discussion – Wrap-Up

5 mins.

*For presentation only and does not include time for Commission Q & A's



Proposed Rulemaking: Mitigation of Beyond Design Basis Events

Tony Pietrangelo

Senior Vice President and Chief Nuclear Officer

July 9, 2015



NUCLEAR ENERGY INSTITUTE

nuclear. clean air energy.

Importance of this Rule

- Centerpiece of the response to Fukushima
 - Establishes a regulatory framework for beyond design basis events
 - Integrates mitigating strategies with reevaluated hazards
 - Differentiates the treatment from design basis requirements
 - Improves the safety margin at every plant

Keep It Simple

- Provide diverse means to obtain power and water to perform key safety functions
- Risk-informed, performance-based approach
 - Absolutely necessary because sites, designs and hazards are different
- Need widespread understanding
 - Maintain clear differentiation between design basis and beyond design basis treatment

Implementation Dates

- Industry has met commitments on initial orders and requests for information thus far
- Rule must accommodate a spectrum of scenarios, methods and results
- Provide ample time based on realistic assumptions for completion of activities
- Minimize the need to seek exemptions for extensions of the deadline

Severe Accident Management Guidelines

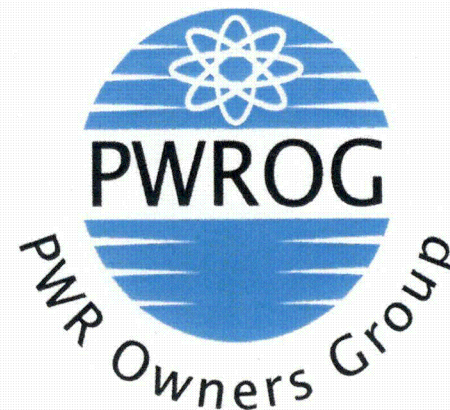
- Industry initiative approved in 1994
- No significant issues identified in 2011 NRC inspections
- Relevant quantitative factors are insufficient to impose the requirement
- Docketed commitments provide appropriate regulatory footprint

New Plant Design Requirement

- Imposes new design basis requirements
 - Hazards are not beyond design basis for new plants
 - Complicates/confuses intent of proposed rule
- Fundamentally different from aircraft impact
- Unknown risk reduction benefit

Conclusions

- The timing is right for this rulemaking
 - We all know a lot more now
 - We have a better understanding of what's needed to complete the response
- While challenging, the rule provides the right framework for resolution of remaining issues



Generic Severe Accident Management Guidance

Jack Stringfellow

Chairman, PWR Owners Group

July 9, 2015

P R E S S U R I Z E D W A T E R R E A C T O R O W N E R S G R O U P

Introduction



- Both Owners Groups are heavily invested in assisting their members with the implementation of many of the initiatives resulting from the event at Fukushima Daiichi.
 - Emergency Operating Procedures (EOPs)
 - FLEX Support Guidelines
 - Severe Accident Management Guidelines
- Maintaining close coordination between the two Owners Groups, NEI, and EPRI.



EPRI TBR Update



- Both Owners Groups participated in the most recent update of the EPRI Technical Basis Report (TBR).
 - Ensured broad understanding of the operating experience and lessons learned.
 - Resulted in consistent considerations and approaches for updating Severe Accident guidance.
- Recognize that industry will continue to gain knowledge from the Fukushima accident and are committed to incorporate this knowledge into future materials.



PWROG SAMG Update



- Phase 1 (completed January 2013)
 - Revised severe accident management guidance for each NSSS technology to address near-term lessons learned (Westinghouse, CE and B&W)
 - Based on updated EPRI TBR, the changes included new/revised guidance for:
 - Spent Fuel Pool cooling
 - Ex-containment hydrogen
 - Use of raw water
 - Containment leak behavior
 - Instrumentation:
 - SAMGs contain guidance to validate instrumentation indications using available alternative information



PWROG SAMG Update



- Phase 2 (in progress)
 - Develop a common PWR Severe Accident Management Guideline (SAMG) document
 - Address lesson learned from implementation of original SAMG programs
 - Incorporate best practices and enhancements from individual NSSS SAMGs
 - Continue monitoring of Fukushima lessons learned
 - All US PWR sites have committed to implement the Phase 2 update:
 - Facilitates continuous improvement and future updates through the use a single generic SAMG for all PWRs (similar to current BWR approach)



P R E S S U R I Z E D W A T E R R E A C T O R O W N E R S G R O U P

PWROG SAMG Update



Schedule

Project Deliverables	Schedule
NSSS-Specific SAMG Update	January 2013
PWROG Generic SAMG, Revision 0a (pre-validation)	February 2015
PWROG Generic SAMG Validation Report	September 2015
PWROG Generic SAMG, Revision 0 (post-validation)	January 2016
PWROG SAMG Generic Training Material	October 2016
PWROG Generic SAMG Drill Scenario Templates	July 2016
Site-specific Generic SAMG Implementation	July 2018
SAMG Maintenance	Continuing



BWROG EPG/SAG Update

- Issued Feb 2013 incorporated early insights:
 - Preservation of steam-driven reactor injection systems by limiting depressurization if needed for adequate core cooling
 - Anticipatory containment venting to remove decay heat and reduce suppression pool temperature as suction source
 - Integration of portable equipment in EOP and SAMG guideline steps
 - SAMG changes reflect a reduced emphasis on containment flooding and guidance to preserve the wet well vent as appropriate
 - Instrumentation:
 - SAGs contain guidance to validate instrumentation indications using available alternative information

BWROG EPG/SAG Ongoing Actions



- Resolution of EPG/SAG Revision 3 implementation topics identified by member utilities through the Emergency Procedure Committee
- Severe Accident Water Addition/Severe Accident Water Management (SAWA/SAWM) strategies being incorporated into the SAGs
- Planned issuance EPG/SAG Rev 4 anticipated in 2017



Boiling Water Reactors Owners Group

P R E S S U R I Z E D W A T E R R E A C T O R O W N E R S G R O U P

BWROG EPG/SAG



Schedule

Project Deliverables	Schedule
Critique Fukushima Accident and make interim EOP/SAG Changes	2012
Formally issue Rev 3 EOP/SAG and conducted international training	2013
Address implementation issues from Rev 3 and FLEX guidance with approved interim changes	2014
Order 109 and other FLEX implementation lessons approved interim actions	2015
Issuance of Rev 4, MS Rule active driving 3-4year implementation timeline	Anticipated 2017
US BWRs implement Rev 4	~2021



Closing Remarks

- Both Owners Groups working closely in the area of Onsite Emergency Response Procedures/SAMGs
 - Coordinating with NEI and EPRI
 - Incorporating insights from each others SAMG validation exercises
- OG activities have supported the MBDBE Rulemaking (including guidance documents)
 - Will provide safety benefit without undue burden.
- Both Owners Groups have strong ownership of the SAG/SAMGs and are committed to a rigorous process in their development as well as continuous improvement.



Severe Accident Management Guidelines

Technical Basis Report

Stuart Lewis

Sr. Program Manager
EPRI Risk & Safety Management

**Commission Briefing on the Mitigation
of Beyond Design-Basis Events**

July 9, 2015



Severe-Accident Management Guidelines (SAMGs)

Background

- Context for severe-accident management
 - Set of actions to limit effects of an accident that results in significant damage to fuel
 - Focused on stopping progression of fuel damage and limiting releases to the environment
- Nature of severe-accident management guidelines
 - Delineate strategies for response to symptoms of a severe accident
 - Traditionally, rely on use of
 - Existing equipment
 - Existing instrumentation – with alternatives or compensatory measures as necessary

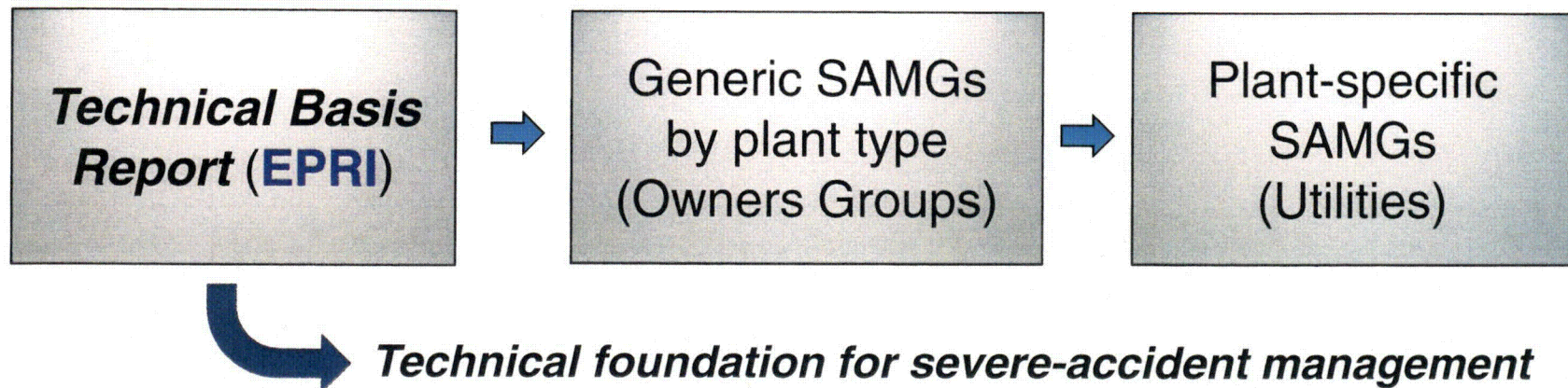
SAMGs – Background

■ Nature of SAMGs (continued)

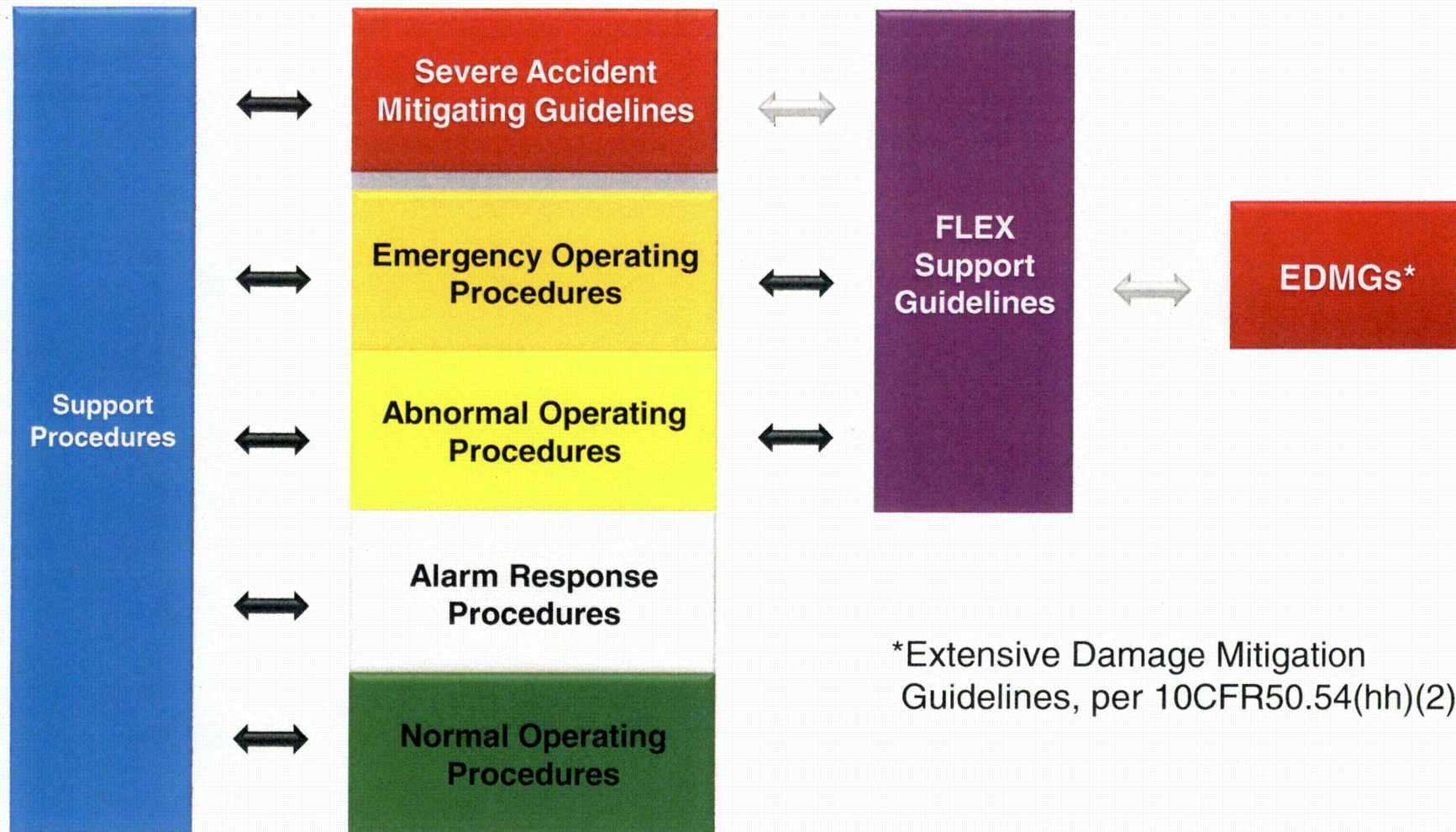
- Emphasis is on use by Technical Support Center to advise control room staff
- Guidelines (rather than step-by-step procedures) to provide flexibility to address a broad range of possible condition

■ Origin of the SAMGs

- Originally developed as part of long-term response to TMI-2 accident
- Overall process:



Where do SAMGs Fit Relative to Plant Procedures?



*Extensive Damage Mitigation Guidelines, per 10CFR50.54(hh)(2)

Updating of Technical Basis Report (TBR)

Objectives

- Address major insights from Fukushima Dai-ichi accidents
- Review other information from severe-accident research and analysis and incorporate as necessary

Milestones

- Technical revisions completed Summer 2012
 - Extensive interaction with Owners Groups throughout development to facilitate updates to SAMGs
- Publication (EPRI 1025295) October 2012

Update of Technical Basis Report

Organization/content of the TBR

- **Volume 1:** Candidate High-Level Actions (CHLAs) and Their Effects
- **Volume 2:** The Physics of Accident Progression

Nature of revision to TBR

- Minor updating of many sections
- Major updates to some sections
- New sections to address additional phenomena or accident considerations



Update of the TBR – Volume 1

- Enhanced discussion of existing candidate high-level actions
 - Expanded description of relevant accident signatures
 - Identified thresholds for taking action
- Additional (new) candidate high-level actions
 - Operation of isolation condenser (BWRs)
 - Makeup and cooling of spent fuel pool
 - Venting/ventilation of the reactor or auxiliary building
- Candidate high-level actions address
 - General insights, including
 - Implications of accidents initiated by external events
 - Consideration of shutdown states
 - Challenges and priorities for multi-unit accidents
 - New and expanded treatment of phenomena in Volume 2



Update of the TBR – Volume 2

- Goals for the Volume 2 update:
 - Address phenomenological insights from the Fukushima Dai-ichi accidents
 - Include additional insights gained from experiments performed since the initial TBR version was completed
 - Include insights gained from plant-specific analyses developed using the initial TBR
- Phenomena of interest from Fukushima Dai-ichi include
 - Influence of using seawater to cool the reactor core
 - Multi-unit effects
 - Possible influence of the venting configuration
 - Effects of potential accident conditions on the spent fuel pool
 - Effects of radiolysis and corrosion with respect to formation of hydrogen

Summary & Conclusions

- Guidance in original Technical Basis Report remains valid and useful
- Updated TBR was valuable in developing enhanced SAMGs
 - Both the PWROG and BWROG engaged throughout updating of the TBR
 - For timely revision of the SAMGs, technical information from TBR was factored into owners groups' updates as TBR evolved
- Future revisions to TBR
 - Currently tracking relevant developments (e.g., extensive investigation of mitigating strategies to limit serious releases)
 - Expect next version after further forensic examination of Fukushima Dai-ichi reactors



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Proposed Rulemaking: Mitigation of Beyond-Design-Basis Events

David Lochbaum

Director, Nuclear Safety Project

www.ucsusa.org

July 9, 2015

Scope of Our Comments

UCS confines our comments to the proposed rulemaking process.

When the proposed rule is opened for public comment, UCS may provide comments on what is in, and what else should be in, the final rule.

Up Front Pluses

- **A 75-day comment period seems appropriate for this rulemaking**
- **A DPO raised a good question and the rulemaking seems the best way to answer it**
- **Packaging draft regulatory guidance and the draft regulatory analysis with the proposed rule is invaluable and much appreciated**

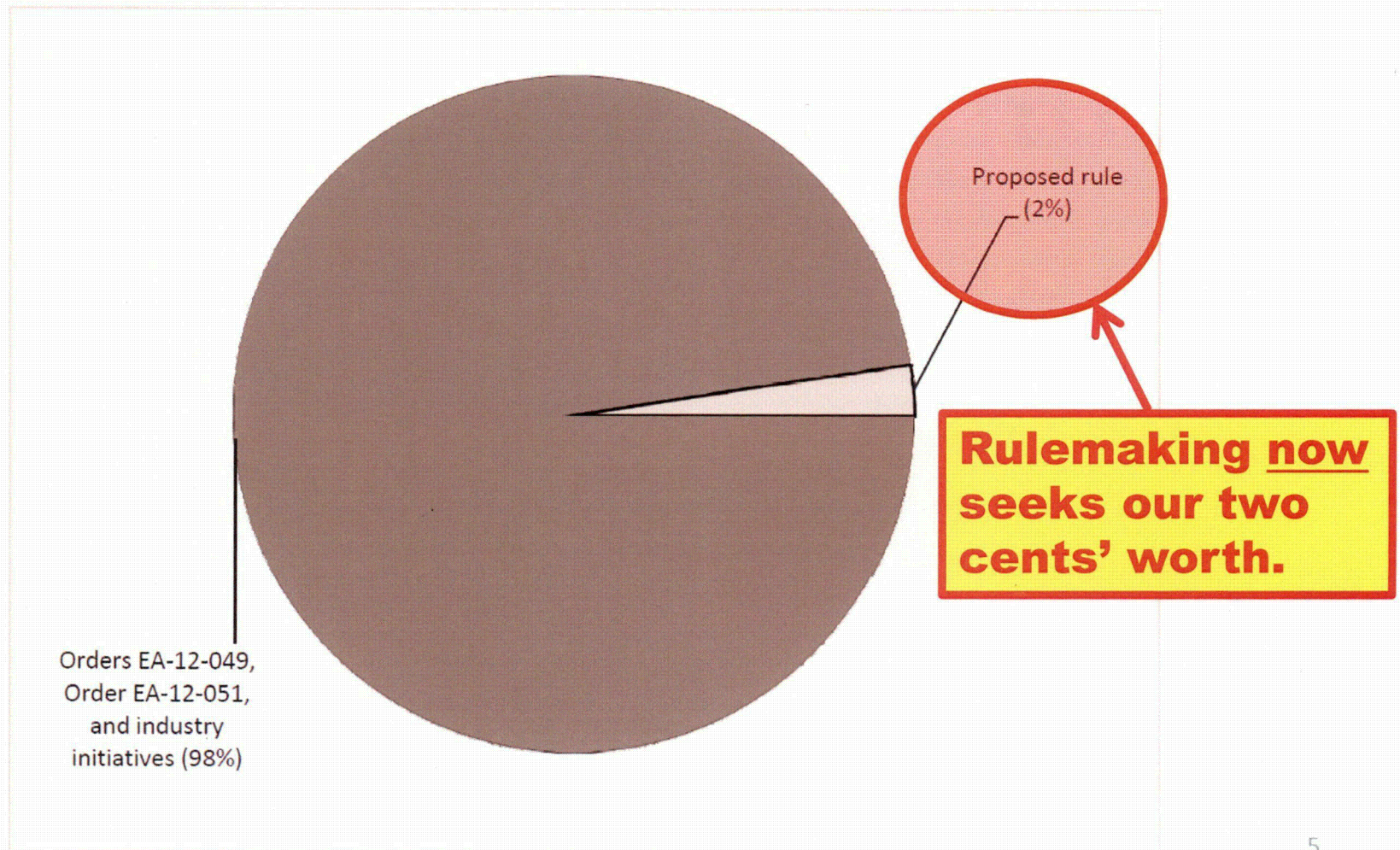
Undue Process

The proposed rulemaking seeks to codify requirements previously imposed by the NRC via orders in 2012.

Stakeholders lacked meaningful input to those requirements and inertia means the requirements are not likely to be significantly changed during the pending rulemaking.

Undue Process

Figure ES-1. Estimated Industry Cost of the Proposed Rule, Order EA-12-049, Order EA-12-051, and Industry Initiatives (Present Value, 7%)



Due Process

The NRC skipped rulemaking to “rush” out upgraded requirements.

Instead of locking out stakeholders when security and safety upgrades are urgently needed, the NRC must figure out how to conduct expedited rulemaking and use it in these cases.

Undue Burden



Source: Liza on flickr

Burden Reduction

The proposed rulemaking has many pieces. The NRC should include a concise, plain-English brochure in the rulemaking package to help stakeholders assemble the pieces and see the overall picture.

Unsubstantiated Assertion

**Page 5 of the SECY-15-0065 states
“*the proposed SAMG requirements
would not include new
instrumentation requirements.
The SAMGs were developed and
implemented based on a
philosophy that makes use of
available instrumentation,
includes backup or alternative
means for determining plant
conditions...*”.**

Substantiating the Assertion

NRC's Office of Research should examine the dependence of SAMGs on reliable plant parameter information to successfully mitigate beyond design basis events to transform this unsubstantiated rumor into hard reality.

Ready for Prime Time?

Is the proposed rulemaking package ready for public comment?

Yes^{*}

- * Provided a plain-English brochure is developed and included in the package noticed in the *Federal Register* and the Office of Research is tasked with evaluating information needs and instrumentation reliability during beyond-design-basis events.**

Extra: Questions UCS Will Address During Review of Proposed Rule

- **Does pending Rev. 2 to NUREG-0654/FEMA-REP-1 affect this proposed rule?**
- **If “majority of requirements have been previously implemented,” how can proposed compliance schedule allow four more years (i.e., perhaps delaying even beyond 10-year anniversary)?**

Extra: Questions UCS Will Address During Review of Proposed Rule

- **How can equipment intended to mitigate a beyond design basis event be stored in a structure designed to design basis hazards, or less?**
- **Would/should 50.155(c)(3) permit licensees to use FLEX equipment during outages and operation on guise of demonstrating operability and training workers?**

Extra: Questions UCS Will Address During Review of Proposed Rule

- **Should 50.155(f)(3) really permit beyond design basis event scenarios to be drilled less often than 7-year locusts appear?**
- **Does 50-155(g)(4) adequately cover cases where design basis changes (e.g., extended power uprates and increased decay heat levels) might undermine MBDBE capability?**

Extra: Questions UCS Will Address During Review of Proposed Rule

- **Without 50.155(b)(4) [SAMG link], would 50.155(b)(5) [staffing] and 50.155(e) [training] be too vague/abstract to be useful?**
- **Does the Systems Approach to Training process ensure adequate training?**

Extra: Questions UCS Will Address During Review of Proposed Rule

- **Would/should deficiencies in FLEX equipment and MBDBE strategies be covered by App. B corrective action programs?**
- **Would/should deficiencies in FLEX equipment and MBDBE strategies be reportable under 10 CFR 50.72/50.73?**



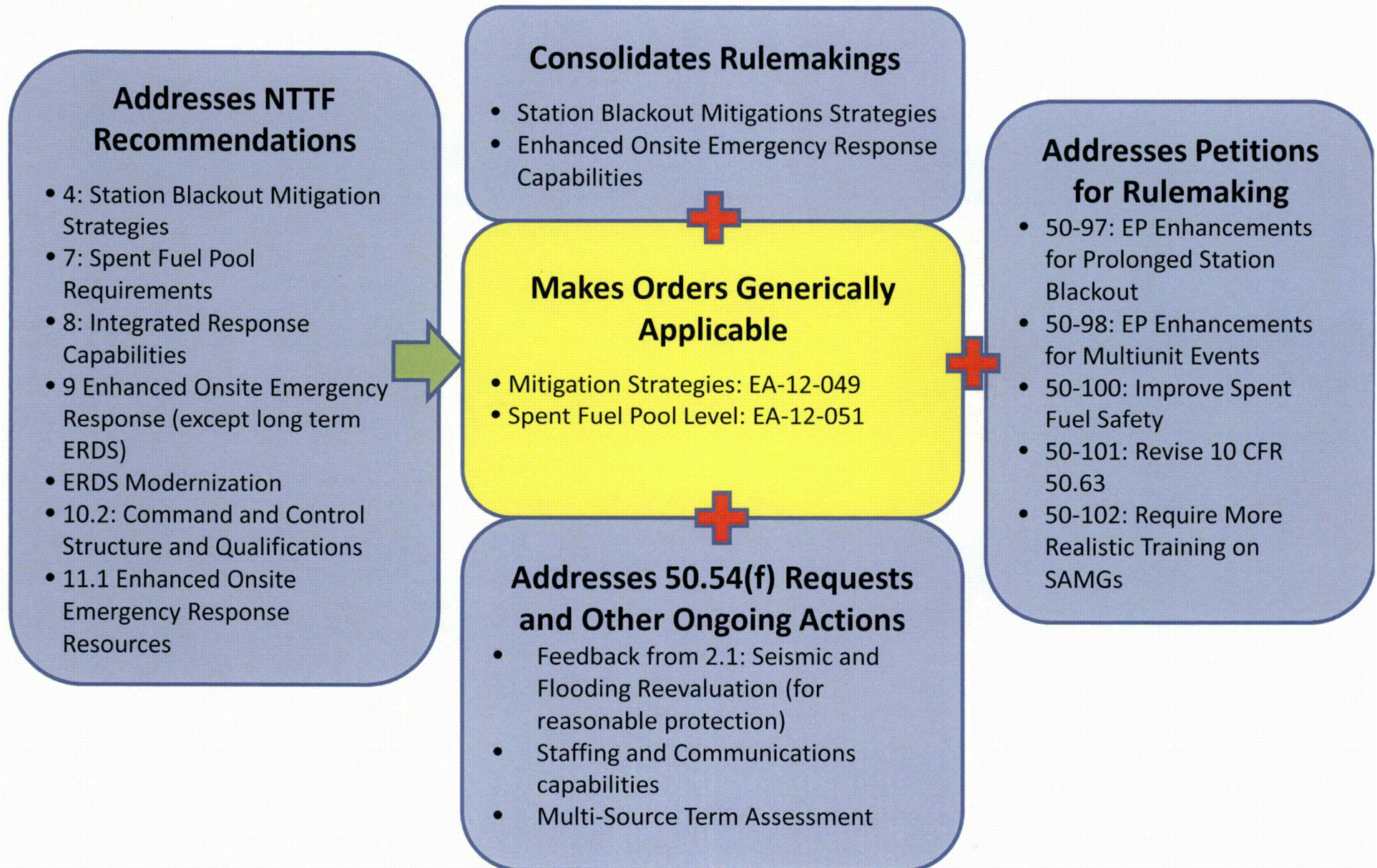
Proposed Rule: Mitigation of Beyond-Design-Basis Events

Michael Johnson
**Deputy Executive Director for Reactor
and Preparedness Programs**
July 9, 2015

Speakers

- **William Dean, Director, Office of Nuclear Reactor Regulation**
- **Timothy Reed, Senior Project Manager, Division of Policy and Rulemaking**
- **John Monninger, Director, Division of Safety Systems and Risk Assessment, Office of New Reactors**
- **Eric Bowman, Special Advisor, Japan Lessons-Learned Division**

Addresses Multiple Ongoing Post-Fukushima Actions



Proposes New Requirements

- **Holders of operating and combined licenses**
 - **SAMGs**
 - **Multi-source term requirements**
- **Unique provisions for new reactor designs**
 - **Applied during the design stage**

Centers on Integrated Response Capability

- **Applicability to Power Reactors**
 - **Not applicable to RTRs or ISFSIs**
 - **Decommissioning provisions**
- **Integrate guideline sets with EOPs**
 - **Mitigating strategies (FLEX)**
 - **Extended Damage Mitigation Guidelines (EDMGs)**
 - **Severe Accident Management Guidelines (SAMGs)**
- **Supporting Equipment Requirements**

Ensures continued integrated response capabilities

- **Supporting requirements assure continued capability:**
 - **Training requirements**
 - **Drills or Exercises**
 - **Change control**

Implementation is currently in progress

- **Requirements of orders currently being implemented**
- **4-years following effective date unless otherwise specified**
- **Reevaluated hazard requirement would have a 2-year implementation period**

Enhances onsite emergency response capabilities

- **Located in Part 50, Appendix E**
- **Multi-source term capabilities**
- **Staffing and communications capabilities**

Proposes new SAMG requirements

- **Currently a voluntary industry initiative**
- **Improve effectiveness of SAMGs and address implementation inconsistencies**
- **Backfit justification 50.109(a)(3)**
 - **Combination of quantitative risk-insights and qualitative factors**

Opportunities Exist for New Reactors

- **Proposed requirements apply to new reactors**
- **Advanced Reactors Policy**
 - **Simplify means to accomplish safety functions**
 - **Extend time constants**
 - **Reduce required operator actions**

Leverages the Design Stage

- **Added design requirements (50.155(d))**
- **Accomplish the same safety functions, with an upfront focus on installed capabilities**
- **Established expectations for capabilities**

Considering Implications for New Reactors

- **Applying new reactor provisions in parallel with rulemaking**
- **Stakeholder outreach and potential impacts**
- **Diverse views including non-concurrence**

DG-1301 would endorse industry guidance

- **Alternatives/lessons learned**
- **NEI 12-06 Appendices for
reevaluated hazards**
- **Appendix A for New Reactor
Design Features**

Reasonable protection

- **Appendix G – Flooding**
- **Appendix H – Seismic**
- **Targeted Hazard Mitigating Strategies**
- **Alternative Mitigating Strategies**
- **Interim Staff Guidance Update**

DG-1317 and DG-1319

- **NEI 12-02 – SFP Instrumentation**
- **NEI 12-01 – staffing & communications**
- **NEI 13-06 – on-site emergency response enhancements**
- **NEI 14-01 – integration, SAMGs, and command and control**

Summary

- **Proposed rule makes previously issued orders generically applicable**
- **Safety benefits being realized from order implementation**
- **New requirements justified by comprehensive and transparent rationale**

Acronyms

ACRS – Advisory Committee on Reactor Safeguards

ANPR – Advance Notice of Proposed Rulemaking

CER – Cumulative Effects of Regulation

CFR – Code of Federal Regulations

CPRR – Containment Protection and Release Reduction

DG – Draft Regulatory Guide

DID – Defense-in-Depth

EDMGs – Extensive Damage Mitigation Guidelines

EOPs – Emergency Operating Procedures

EP – Emergency Preparedness

ESBWR – Economic Simplified Boiling Water Reactor

FSGs – FLEX Support Guidelines

ISFSI – Independent Spent Fuel Storage Installation

ISG – Interim Staff Guidance

JLD – Japan Lessons Learned Division

MBDBE – Mitigation of Beyond-Design-Basis Events

NEI – Nuclear Energy Institute

Acronyms (continued)

NEI – Nuclear Energy Institute

NRC – Nuclear Regulatory Commission

NRO – Office of New Reactors

NRR – Office of Nuclear Reactor Regulation

NTTF – Near-Term Task Force

RFI – Request for Information

RG – Regulatory Guide

RTR – Research and Test Reactor

SAMG – Severe Accident Management Guidelines

SFP – Spent Fuel Pool

SOARCA – State-of-the-Art Reactor Consequence Analysis

SRM – Staff Requirements Memorandum

TI – Temporary Instruction