



**ACRS MEETING WITH  
THE U.S. NUCLEAR  
REGULATORY  
COMMISSION**

**June 11, 2015**



# **Overview**

**John W. Stetkar**

# **Accomplishments**

- **Since our last meeting with the Commission on October 2, 2014, we issued 13 Reports**
- **Topics:**
  - **Draft SECY Paper, “Proposed Rulemaking: Mitigation of Beyond-Design-Basis Events”**
  - **Draft SECY Paper, “Cumulative Effects of Regulation Process Enhancements and Risk Prioritization Initiative: Response to Commission Direction and Recommendations”**

- **Topics (cont.):**
  - **Interim Staff Guidance JLD-ISG-2015-01, “Compliance with Phase 2 of Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions”**
  - **Assessment of the Quality of Selected NRC Research Projects – FY 2014**

- **Topics (cont.):**
  - **Watts Bar Unit 2 Operating License**
  - **Report on the Safety Aspects of the Nuclear Innovation North America, LLC Combined License Application for South Texas Project Nuclear Station, Units 3 and 4**
  - **Report of the Safety Aspects of the License Renewal Application of the Callaway Plant, Unit 1**
  - **Report on the Safety Aspects of the License Renewal Application of the Sequoyah Nuclear Plant, Units 1 and 2**

- **Topics (cont.):**
  - **Commission Paper, “Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards”**
  - **Draft Generic Letter 20XX-XX, “Treatment of Natural Phenomena Hazards in Fuel Cycle Facilities”**
  - **Draft Branch Technical Position 8-9 on Open Phase Conditions in Electric Power Systems**
  - **Standard Review Plan Chapter 19 and Section 17.4**

- **Topics (cont.):**
  - **Topical Report NEDC-33766P, “GEH Simplified Stability Solution (GS3)”**

# Ongoing / Future Reviews

- **New Plants**
  - **Subsequent COLAs for AP1000 (Levy) and ESBWR (North Anna)**
- **Small Modular Reactors (NuScale)**
- **PSEG Early Site Permit**
- **SHINE Medical Radioisotope Production Facility**



# Ongoing / Future Reviews

- **License Renewal**
  - **Byron / Braidwood**
  - **Indian Point**
  - **Davis-Besse**
  - **Seabrook**
- **Technical Issues for Subsequent License Renewal**
  - **Concrete Structures**
  - **Reactor Vessel and Internals**
  - **Electrical Cables**
  - **Others as Identified**

# **Ongoing / Future Reviews**

- **Grand Gulf Maximum Extended Load Line Limit Analysis Plus (MELLLA+)**
- **Nine Mile Point Unit 2 MELLLA+**
- **Risk-Informed Resolution of GSI-191, “Assessment of Debris Accumulation on PWR Sump Performance”**

# **Ongoing / Future Reviews**

- **Fukushima Proposed Rulemaking**
  - **Containment Protection and Release Reduction (CPRR) for BWRs with Mark I and Mark II Containments**
  - **Mitigation Strategies for Beyond-Design-Basis External Events**
- **Updated Regulatory Analysis Guidance**
- **Westinghouse Realistic Full Spectrum LOCA Methodology**

# Ongoing / Future Reviews

- **Risk Prioritization Initiative / Cumulative Effects of Regulation**
- **Risk Management Regulatory Framework**
- **Level 3 PRA**
- **Human Reliability Analysis Methods**
- **Biennial Report on NRC Safety Research Program (NUREG-1635)**



# **Proposed Rulemaking: Mitigation of Beyond- Design-Basis Events**

**John W. Stetkar**

# Background

**The draft proposed rule consolidates the following activities:**

- **Order requirements for mitigation of beyond-design-basis external events**
- **Order requirements for monitoring spent fuel pools**
- **Station Blackout Mitigation Strategies**
- **Onsite Emergency Response Capabilities**

# Background (cont.)

## **Draft proposed rule also addresses:**

- **Requirement for Severe Accident Management Guidelines (SAMGs)**
- **Integrated response capability and mitigation strategies**
- **Emergency plan requirements for station blackout and multi-unit events**
- **Items currently being implemented by industry (e.g., FLEX guidance NEI 12-06)**

# **ACRS Conclusion and Recommendations**

**The draft proposed rule should be published for public comment subject to the following:**

- **The public comment period should be extended beyond the proposed 75 days**
- **Draft Regulatory Guide DG-1301, Section 6, should be completed**
- **Staff confirms that NEI 12-06, Revision 1, is published in final form and guidance is acceptable**



# **Severe Accident Management** **Guidelines**

- **Staff conclusion that SAMGs cannot be justified by backfit criteria, based on limited analysis for BWR Mark I and Mark II venting**
- **SAMGs enhance defense-in-depth for accident mitigation, containment, and emergency planning**

# **Severe Accident Management** **Guidelines (cont.)**

- **Staff, industry, public stakeholders agree on SAMG benefits**
- **Owners Groups completed updates to generic SAMGs in 2014**
- **Issue is not whether SAMGs should be developed and implemented**

# **Severe Accident Management Guidelines (cont.)**

- **Confidence needed that SAMGs will be updated and maintained current throughout plant lifetime**
- **Licensee formal commitments to develop, implement, maintain, and train on SAMGs**
- **Subject to staff oversight**

# **Integrated Response Capability**

## **Draft Rule: Integrate with Emergency Operating Procedures (EOPs):**

- **Mitigation Strategies for Beyond-Design-Basis External Events (FLEX)**
- **Extensive Damage Mitigation Guidelines (EDMGs)**
- **Severe Accident Management Guidelines (SAMGs)**

# **ACRS Observations - EOPs**

- **Symptom-based EOPs focus on plant safety functions**
- **Enhance operator performance and improve safety**
- **Symptom-based EOP framework should not be altered by proposed rule**

# **ACRS Concerns - Integration**

- **Guidance beyond EOPs has been developed over time in response to specific regulatory issues**
- **Often applies for a particular set of event-based conditions**
- **Overlap, duplication of strategies**
- **Requires operators to determine which guidance is most appropriate for evolving plant conditions**

# **ACRS Concerns - Integration**

## **(cont.)**

- **Event-based decision prescriptions are contrary to symptom-based focus**
- **Actual events may not match guidance criteria or assumptions**
- **Adds complexity to decision-making during a challenging situation**
- **Could cause confusion or delays in timely response**

# **Additional ACRS Recommendation**

**A more comprehensive symptom-based and function-oriented framework should be developed for integration of response capabilities that extend beyond the EOPs**



# **Additional** **ACRS Recommendation (cont.)**

**The framework should coordinate strategies and guidance currently distributed among the following:**

- **Fire response procedures**
- **Flooding response procedures**
- **FLEX Support Guidelines**
- **Extensive Damage Mitigation Guidelines**
- **Severe Accident Management Guidelines**



**Containment Hardened Vents  
Interim Staff Guidance  
JLD-ISG-2015-01**

**Michael Corradini**

# **NRC Orders on Mark I and Mark II BWRs Containment Venting Systems**

- **Order EA-12-050, requires licensees to install reliable hardened vents capable of removing heat and lowering pressure within containment.**
- **A new Order, EA-13-109, included additional requirements to ensure that venting functions be available during severe accident conditions.**

# **NRC Orders on Mark I and Mark II BWRs Containment Venting Systems** **(cont.)**

- **Phased approach was recommended to ensure implementation with minimal delays.**
  - **Phase 1 – Wetwell venting system**
    - **ACRS reviewed Phase 1 ISG and issued a letter to the EDO on October 18, 2013.**
  - **Phase 2 – Drywell venting system or alternative approaches.**

# **Phase 2 Interim Staff Guidance**

## **JLD-ISG-2015-01**

- **ISG endorsed industry guidance NEI 13-02 with exceptions and clarifications to assure that all Phase 2 objectives are met.**
- **Extended the Phase 1 ISG approach and the revised NEI document includes the guidance for implementation of both phases of the Order.**
- **Revisions also addressed ACRS concerns and recommendations from the Phase 1 review.**

# **ACRS on ISG Reviews and Discussion**

- **The guidance proposed three possible approaches for Phase 2**
  - **The first method would directly use a drywell venting system.**
  - **Two alternative approaches would rely on Severe Accident Water Addition as a common element.**

# **ACRS on ISG Reviews and Discussion (cont.)**

- **The guidance proposed three possible approaches for Phase 2 (cont.)**
  - **One alternative method uses the wetwell vent as long as available with water addition to the containment. When the wetwell vent floods, venting is transferred to a severe accident capable drywell venting system.**

# **ACRS on ISG Reviews and Discussion (cont.)**

- **The guidance proposed three possible approaches for Phase 2 (cont.)**
  - **The other alternative method uses the wetwell vent with water addition to containment and monitors and controls water addition rate using Severe Accident Water Management.**
    - **This method does not require a drywell vent.**
    - **The ACRS agrees with the staff's analysis that these approaches satisfy the Order.**



# **ACRS on ISG Reviews and Discussion (cont.)**

- **The staff and industry performed MELCOR and MAAP analyses which demonstrated that water addition is necessary to maintain acceptable drywell temperatures during venting.**
- **As further information becomes available from the damaged reactors at Fukushima, this information can help assure that models used for these analyses prove valid.**

# **ACRS Conclusion & Recommendations**

- **The staff should address our comments, achieve reasonable closure to the open items identified for discussion with the industry, and answer the public comments before issuing ISG JLD-ISG-2015-01.**
- **We would like the opportunity to review the final version of ISG JLD-ISG-2015-01 and its supporting documents.**

# **ACRS Conclusion & Recommendations (cont.)**

- **The draft ISG and NEI 13-02, Revision 0E2, we have reviewed provide reasonable guidance on system design and implementation on a generic basis. Substantial work remains to evaluate, justify, and implement the plant-specific designs.**

# **ACRS Conclusion & Recommendations (cont.)**

- **The staff has taken steps to address our recommendations and concerns from the Phase 1 program review that also apply to Phase 2. Each of these will require additional attention from the staff during their review of plant-specific hardened containment venting systems designs.**

# **ACRS Conclusion & Recommendations (cont.)**

- **Because of inherent severe accident model uncertainties, especially for Mark II BWRs, all methods of water addition during a severe accident should be considered, including drywell sprays, to take full advantage of reductions in radioactive source terms during wetwell venting.**



# **Cumulative Effects of Regulation Process Enhancements and Risk Prioritization Initiative**

**Dennis Bley**

# **Background for SECY-15-0050**

- **Decades of Commission guidance on the use of risk information**
- **Loss of risk-informed focus**
- **Risk Prioritization Initiative: regulatory and plant-identified issues according to safety impact**
- **SRM combining RPI and CER**
- **SECY: four options: 2, 3, and 4 extend the initiative progressively**

# Discussion

## **Option 2:**

- **Augment existing regulatory processes for power reactors with the proposed practices to address CER and RPI**
  - **Minor inspection findings excluded**
  - **Can be used when licensee schedule established through a docketed commitment**



# Discussion

## **Option 3:**

- **Establish voluntary alternative plant-specific implementation schedules in new rules**
  - **Subtle extension of Option 2**
  - **May introduce additional complexity in the rulemaking process**

# Discussion

## **Option 4:**

- **Initiate rulemaking to allow risk-prioritized scheduling flexibility**
  - **Without requesting prior NRC approval**
  - **Licensee would need to have and maintain an adequate PRA**

# **ACRS Conclusion and Recommendations**

- **We endorse implementation of Option 2 and proceeding with a trial application of Option 3**
- **The staff should explicitly include risk information as an input to decisions and priorities for proposed regulatory actions regardless of the Commission's decisions about specific options or approaches presented in SECY-15-0050**

# **ACRS Conclusion and Recommendations (cont.)**

- **A challenging aspect of the proposed risk-informed prioritization process involves the methods by which risk information and other metrics will be used to develop consistent measures of the significance of issues that affect plant safety, security, emergency preparedness, radiation protection, and equipment reliability**

# **ACRS Conclusion and Recommendations (cont.)**

- **If the Commission endorses a prioritization process, the staff should expedite development of regulatory guidance for its use and reviews**



# **Assessment of the Quality of NRC Research Projects**

**Joy L. Rempe**

# Background

- **Throughout its history, an essential ACRS activity is reviewing NRC-sponsored research**
- **These activities include:**
  - **Research reviews conducted in support of specific regulatory activities**
  - **Episodic reviews of important ongoing research**
  - **Biennial review of the overall reactor safety research program**
  - **Research Quality Reviews**

# **Motivation for Quality Review**

- **Independent evaluation of the quality and utility of research programs**
- **Government Performance and Results Act of 1993 requirement**



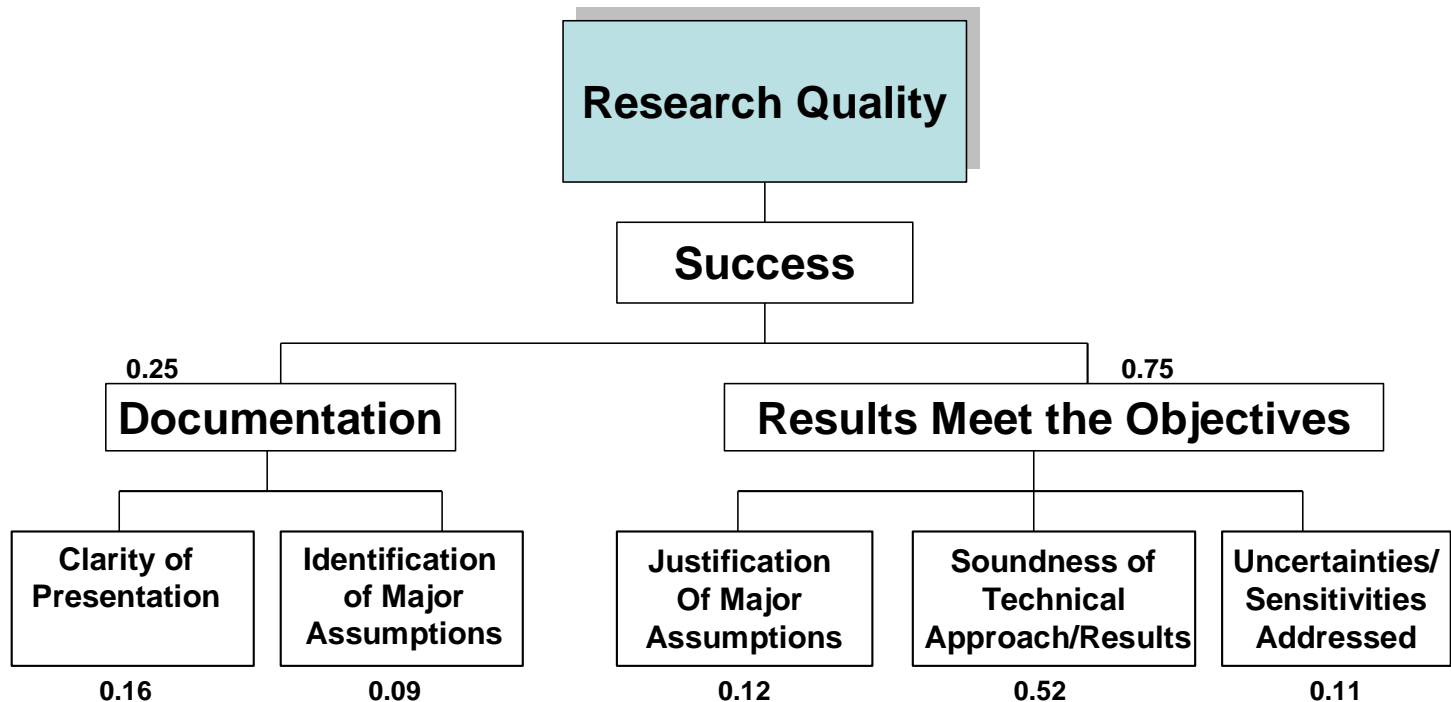
# Quality Review Process

- **Review criteria originally developed by ACRS and RES**
- **ACRS typically selects two or three projects from list proposed by RES**
- **A panel of three ACRS members assigned to each project to complete an in-depth review**

# **Quality Review Process (cont.)**

- **ACRS three-member panel**
  - **Meets with RES and sponsoring program offices to better understand project scope and user need**
  - **Presents oral and written report to entire committee for peer review**
- **Quality rating finalized by whole committee**
- **Annual report submitted to RES director**

# Value Tree Evaluation Criteria and Weights



# Scoring System

<b>SCORE</b>	<b>RANKING</b>	<b>INTERPRETATION</b>
<b>10</b>	<b>Outstanding</b>	<b>Creative and uniformly excellent</b>
<b>8</b>	<b>Excellent</b>	<b>Important elements of innovation or insight</b>
<b>5</b>	<b>Satisfactory</b>	<b>Professional work that satisfies research objectives</b>
<b>3</b>	<b>Marginal</b>	<b>Some deficiencies identified; marginally satisfies research objectives</b>
<b>0</b>	<b>Unacceptable</b>	<b>Results do not satisfy the objectives or are not reliable</b>

# **Research Quality Reviews** **Completed in FY 2014**

- **NUREG/CR-7143: Characterization of Thermal-Hydraulic and Ignition Phenomena in Prototypic, Full-Length Boiling Water Reactor Spent Fuel Pool Assemblies After a Postulated Complete Loss-of-Coolant Accident**
- **NUREG/CR-7148: Confirmatory Battery Testing: The Use of Float Current Monitoring to Determine Battery State-of-Charge**

# **Biennial Review of Research Program**

- **ACRS already initiated its next biennial review of NRC Safety Research Program**
  - **Considers programmatic justification for research as well as technical approaches and progress of the work**
  - **Identifies research crucial to NRC missions**
- **Will report to Commission in March 2016**
- **Final report will be issued as NUREG-1635, Vol. 12**

# **Biennial Review of Research Program**

- **General Observations and Recommendations**
- **Special Topic of Current Interest**
- **Advanced Reactor Designs**
- **Digital Instrumentation and Control Systems**
- **Fire Safety**
- **Reactor Fuel**
- **Human Factors and Human Reliability**
- **Materials and Metallurgy**
- **Neutronics and Criticality Safety**
- **Operational Experience**
- **Probabilistic Risk Assessment**
- **Radiation Protection**
- **Nuclear Materials and Waste**
- **Seismic and Structural Engineering**
- **Severe Accidents and Source Term**
- **Thermal Hydraulics**

# Abbreviations

<b>ACRS</b>	<b>Advisory Committee on Reactor Safeguards</b>	<b>MAAP</b>	<b>modular accident analysis program</b>
<b>AP1000</b>	<b>Advanced Passive 1000</b>	<b>MELCOR</b>	<b>Methods for Estimations of Leakages and Consequences of Releases</b>
<b>BWR</b>	<b>Boiling Water Reactor</b>	<b>MELLLA+</b>	<b>Maximum Extended Load Line Limit Analysis</b>
<b>CER</b>	<b>cumulative effects of regulation</b>	<b>NEDC</b>	<b>GE Nuclear Energy Licensing Topical Report</b>
<b>COLA</b>	<b>Combined License Application</b>	<b>NEI</b>	<b>Nuclear Energy Institute</b>
<b>CPRR</b>	<b>Containment Protection and Release Reduction</b>	<b>NRC</b>	<b>Nuclear Regulatory Commission</b>
<b>EA</b>	<b>enforcement action</b>	<b>NUREG/CR</b>	<b>NRC technical report designation/contractor report</b>
<b>EDO</b>	<b>Executive Director for Operations</b>	<b>PRA</b>	<b>Probabilistic Risk Assessment</b>
<b>EDMGs</b>	<b>Extensive Damage Mitigation Guidelines</b>	<b>PSEG</b>	<b>Public Service Electric &amp; Gas Company</b>
<b>EOPs</b>	<b>Emergency Operating Plans</b>	<b>RES</b>	<b>Office on Nuclear Reactor Research</b>
<b>ESBWR</b>	<b>Economic Simplified Boiling Water Reactor</b>	<b>RPI</b>	<b>Risk Priorization Initiative</b>
<b>DG</b>	<b>Draft Guide</b>	<b>PWR</b>	<b>Pressurized Water Reactor</b>
<b>FLEX</b>	<b>Diverse and Flexible Coping Strategies</b>	<b>SAMGs</b>	<b>Severe Accident Management Guidelines</b>
<b>FY</b>	<b>Fiscal Year</b>	<b>SECY</b>	<b>Office of the Secretary of the Commission (NRC)</b>
<b>GEH</b>	<b>General Electric Hitachi</b>	<b>SHINE</b>	<b>SHINE Medical Technologies, Inc.</b>
<b>GSI</b>	<b>Generic Safety Issue</b>		
<b>GS3</b>	<b>GEH Simplified Stability Solution</b>		
<b>JLD</b>	<b>Japan Lessons Learned Division</b>		
<b>ISG</b>	<b>Interim Staff Guidance</b>		
<b>LOCA</b>	<b>loss-of-coolant accident</b>		