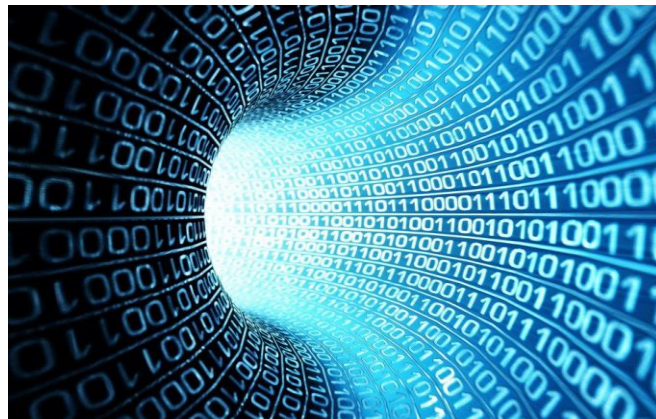




# BRIEFING ON DIGITAL INSTRUMENTATION AND CONTROL

Commission Meeting  
October 25, 2018



# Speakers

- Margaret Doane, Executive Director for Operations
- Ho Nieh, Director, Office of Nuclear Reactor Regulation (NRR)
- Eric Benner, Director, Division of Engineering (DE), NRR
- Rossnyev Alvarado, Electronics Engineer, Instrumentation and Control Branch B, NRR/DE
- Michael Waters, Chief, Instrumentation and Control Branch B, NRR/DE
- Dinesh Taneja, Sr. Electronics Engineer, Instrumentation and Control Branch A, NRR/DE

# Significantly Modernizing our Digital I&C Infrastructure

- Making real progress, in terms of flexibility and external engagement
- Considering experiences, internal and external to NRC
- Embracing a vision that safely enables new technologies and innovation



Shippingport Control Room ~ 1957



NuScale Control Room Simulator

# Focused on the Most Significant Regulatory Challenges

- Addressing near-term challenges identified by external stakeholders
  - Clarify common cause failure (CCF) expectations
  - Clarify and expand use of 10 CFR 50.59
  - Improve licensing and certification processes
  - Clarify commercial grade dedication expectations
- Identifying broader improvements to modernize the regulatory infrastructure
  - Leverage international and non-nuclear approaches
  - Expand use of risk information

# **The IAP Implements Commission Direction and Stakeholder Priorities**

- Enable performance-based and technology neutral approaches
- Use same regulations for new and operating reactors, with tailored guidance if necessary
- Ensure common understanding with stakeholders on challenges, priorities, and potential solutions

# Recent Accomplishments Enabled by Changes in our Approach

- Self-critical assessment of NRC practices:
  - Implementation of Commission policy on CCF
- Creating support networks to ensure effective implementation of new guidance:
  - RIS 2002-22, Supplement 1
- Revisiting what information is necessary to make a regulatory decision:
  - Operating Reactor License Amendments (ISG-06)
  - New Reactor Design Certification (NuScale DSRS)

# Clarifying CCF Expectations

- Evaluated:
  - Policy in SRM-SECY-93-087
  - Feedback from industry
  - Lessons learned from regulatory reviews
- Concluded:
  - Current policy adequate and supports near-term improvements (i.e., graded approach, alternative standards, alternative methods of diverse actuation)
  - Implementation has been inconsistent and, in specific cases, overly restrictive
- SECY 18-0090:
  - Documents staff evaluation and identifies guiding principles to improve policy implementation

# SECY 18-0090 Guiding Principles

- Continue to address CCF
- Diversity and Defense-in-Depth analysis typically warranted, but can be:
  - Best estimate or design basis
  - Graded commensurate with safety significance & may not be necessary for low safety significance
- Alternate means to accomplish safety function acceptable:
  - Non-safety or safety-related
  - Manual or automatic
  - Mitigation of consequences through other means
- Justification for defensive measures can be commensurate with safety significance



# Clarifying and Expanding the use of 10 CFR 50.59

- Operating reactors seek to implement majority of upgrades under 10 CFR 50.59
- RIS 2002-22, Supplement 1
  - Focused on lower safety significance I&C systems
  - Clarifies appropriate use of qualitative factors when performing 10 CFR 50.59 evaluations
- Appendix D to NEI 96-07
  - Addresses all I&C systems
  - Includes improved 50.59 screening guidance

# Demonstrated Improvement in Recent Licensing and Certification Actions

- Hope Creek PRNMS
- NuScale Design Certification
- APR-1400 Design Approval
- Vogtle Unit 3&4 Amendments
- MIT Nuclear Safety System
- Purdue I&C System Upgrade



Purdue-1 Digital I&C System

# Improving the Licensing Process

- Operating reactor licensees seek to obtain regulatory approval before making significant capital investment
- Revising ISG-06 to:
  - Provide alternate review process for earlier approval of digital systems
  - Clarify information needed to initiate regulatory review
  - Incorporate other lessons learned from operating and new reactor reviews

# Licensing Processes Comparison

Timeline (*not to scale*) →

## Traditional Process

**LAR Submitted** →  
(Phase 1 Information)

NRC Review and Audits

← NRC Decision on LAR

NRC Regional Inspection  
Processes

Phase 2 Supplemental  
Information

## Licensee Activities

Concepts  
and Pre-application  
Meetings

Initial System  
Design,  
Planning

Detailed HW & SW Design  
and Fabrication

Implementation,  
Software V&V, and  
Factory Testing

Installation and  
Site Acceptance Testing

## Alternate Review Process

**LAR Submitted** →  
All Information

NRC Review and Audits

← NRC Decision on LAR

NRC Vendor  
Inspection Processes

NRC Regional Inspection  
Processes

# Clarifying Commercial Grade Dedication Expectations

- Vendors seek to demonstrate achievement of domestic nuclear safety standards through international safety certification
- Will expand the number of systems and components available for use by domestic licensees
- EPRI currently developing process which NEI will submit for NRC review

# Continuing to Identify Broader Improvements to Modernize the Regulatory Infrastructure

- Evaluating international and non-nuclear approaches to identify best practices
- Expanding use of higher level design principles applied in NuScale to improve advanced reactor reviews
- Engaging industry to identify alternative standards they are most interested in using
- Evaluating broader use of risk-information in licensing, certification and oversight

# **Making Progress on Achieving an Efficient and Effective Digital I&C Framework**

- Continue our efforts to modernize our decision making in the use of DI&C systems
- Continue to effectively communicate with all stakeholders to understand their challenges, priorities, and potential solutions
- Continue to transform with risk-informed and innovative approaches

# Acronyms

- APR – Advanced Power Reactor
- BTP – Branch Technical Position
- CCF – Common Cause Failure
- CFR – Code of Federal Regulations
- D3 – Diversity and Defense-in-Depth
- DI&C – Digital Instrumentation and Control
- DSRS – Design Specific Review Standard
- ESFAS – Engineered Safety Actuation System
- FPGA – Field Programmable Gate Array
- HW - Hardware
- IAP – Integrated Action Plan
- I&C – Instrumentation and Control
- IEEE – Institute of Electrical and Electronics Engineers
- IEC – International Electrotechnical Commission
- ISG – Interim Staff Guidance
- LA – License Amendment
- LAR – License Amendment Request
- MIT – Massachusetts Institute of Technology
- NEI – Nuclear Energy Institute
- PRNMS – Power Range Neutron Monitoring System
- QA – Quality Assurance
- RIS – Regulatory Issue Summary
- RPS – Reactor Protections System
- SIL – Safety Integrity Level
- SW – Software
- V&V – Verification and Validation