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Update on Initiative for the Licensing Review of Instrumentation and Controls (I&C) applied to mPower Design-Specific Review Standard

Public Meeting on June 21, 2012

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Agenda

- Introduction
- Discussion
- Challenges
- Schedule

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Introduction

- Design-Specific Review Standards (DSRSs) being developed for review of advanced reactors
- Chapter 7 DSRS intended to incorporate the lessons learned
- Key goals to ensure staff review is more safety-focused while promoting more efficient licensing process

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Discussion: Structure

- Existing Guidance
  - 7.0 Overall Review Process
  - 7.1 Introduction
  - 7.2 Reactor Trip System
  - 7.3 ESF Systems
  - 7.4 Safe Shutdown Systems
  - 7.5 Information Systems
  - 7.6 Interlock Systems
  - 7.7 Control Systems
  - 7.8 Diverse Systems
  - 7.9 Data Communication Systems
  - BTPs (7-1 to 7-21 & 8-5)
  - ISGs

- DSRS Chapter 7
  - 7.0 Overview of Review Process
  - 7.1 Fundamental Design Principles
    - Independence
    - Redundancy
    - Determinism
    - Defense-in-Depth and Diversity
  - 7.2 System Characteristics
  - 7.3 System Design
  - 7.4 Conformance to regulations
  - 7.5 ITAAC

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Discussion: Current Public Draft

- Draft Section 7.1 (Fundamental Design Principles) made available for informal review and comment
- Draft Appendices made available for informal review and comment
  - *Hazards Analysis [under development]*
  - I&C Architecture
  - Simplicity
- Appendices supplement reviews of fundamental design principles

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Discussion:
Fundamental Design Principles

- Subsection 7.1.1, "Independence"
- Subsection 7.1.2, "Redundancy"
- Subsection 7.1.3, "Determinism"
- Subsection 7.1.4, "Diversity and Defense-In-Depth"

Note: These principles must be addressed separately but also in an integrated systems approach and reviewed with the Appendices.

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Discussion: Hazard Analysis

- Appendix A, "Hazard Analysis"
  - Internal draft under staff review
  - Review areas
    - Overall hazard analysis process
    - Evaluation elements and categories of hazards
    - Contributory hazards
    - Inspections, Tests, Analyses and Acceptance Criteria (ITAAC)

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Discussion: I&C Architecture

- Appendix B, "I&C Architecture"
  - Architecture description will support review of fundamental design principles
  - Review concurrent with each fundamental design principles
  - Review areas
    - Description of all I&C functions that are part of the design basis
    - Interfaces between I&C safety systems
    - Safety to nonsafety interfaces
    - Signal flows and descriptions
    - Simplified/functional logic diagrams

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Discussion: Simplicity

- Appendix C, "Simplicity"
  - Evaluate whether simplicity has been considered in the design of the digital I&C systems
  - Review concurrent with each fundamental design principles
  - Key factors for simplicity
    - Logical, modular description of interactions, signal flows, definition of interfaces
    - Separation or segregation among I&C functions
    - Safety systems designed for only the minimal required functions
    - Simplified communications and system integration

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Challenges

- Leveraging NRC staff cross-organizational expertise during QA, Software Development, and EQ reviews related to I&C
- Leveraging CMMI in programmatic requirements
- Ensuring clear line-of-sight from regulatory requirements to new guidance
- Leveraging existing guidance to support DSRS development

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Schedule

- Interactions with stakeholders ongoing and frequent
- Draft Sections 7.2-7.5 to be publicly available for informal review and comment as completed
- ACRS meeting on the subject planned for September 2012
- DSRS Chapter 7 for formal public comment in November 2012