Approaches to Certified Designs without Design Acceptance Criteria

Session T2

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Session Presenters

- **Theresa Clark**, Branch Chief / Executive Technical Assistant (NRC)
  A Graded Approach to Piping Level of Detail
- **Terry Jackson**, Branch Chief (NRC/NRO)
  Digital Instrumentation and Control (I&C) DAC
- **Paul Pieringer**, Senior Human Factors Engineer (NRC/NRO/DCIP)
  Application of DAC to Human Factors – Lessons Learned
- **Steve Mannon**, Director of Nuclear Licensing (KHNP/AECOM)
  Application of Design Acceptance Criteria in the APR1400 DCA
- **Marc Nichol**, Senior Project Manager (NEI)
  Factors for Consideration in Applicants' Decision on the Use of DAC

Overview

- DAC were used since first design certifications to address challenges at the time.
  - Areas where information only available during construction or procurement
  - Areas with quickly evolving technology
- NRC staff review focused on detailed methodology rather than full FSAR-level design and analysis.
- Given review, design, and construction experience, more holistic approach may now be possible.

Historical References

- SECY-90-377, "Requirements for Design Certification under 10 CFR Part 52," dated November 8, 1990 (ML003707889)
  - SRM dated February 15, 1991 (ML003707892)
- SECY-92-053, "Use of Design Acceptance Criteria during 10 CFR Part 52 Design Certification Reviews," dated February 19, 1992 (ML003707942)
- SECY-92-196, "Development of Design Acceptance Criteria for the Advanced Boiling Water Reactor (ABWR)," dated May 28, 1992 (Accession # 9206040228)

A Graded Approach to Piping Level of Detail

Theresa Clark

Justification for Piping DAC

- As-built or as-procured information needed (e.g., specific component types and locations)
- Level of detail generally unavailable at time of design certification

Approach to Piping DAC

- DC applicants provide sufficient information to make a final safety determination on all piping issues
  - Methodologies
  - Design processes
  - Acceptance criteria
- SRP Section 3.12 guides staff review (ML14042A513)
  - Follows ABWR review topics
- Final analyses result in a design that continues to address all safety issues
  - Verified through ITAAC; FSAR also updated as appropriate

Review Experience

- Piping DAC used for:
  - Certified designs
    - ABWR (see SECY-92-196)
    - System 80+
    - AP1000
    - ESBWR
  - DC applications
    - U.S. EPR
    - US-APWR
- Piping DAC not used for AP600
  - Significantly fewer safety-related piping systems
  - Few active safety-related components

But Can We Do it Better?

- What if we could do piping without DAC?
  - Facilitate resolution of safety issues (e.g., for novel designs)
  - Enhance standardization (safety benefit)
  - Increase transparency through licensing review
  - Reduce resources and complexity of construction-stage inspections
  - Reduce scope of potential ITAAC hearing
- Are there down sides?
  - Increase scope and resources of DC review
- Try when it makes sense…
  - Detailed design and construction experience
  - Reduced number of safety-related piping systems

The Graded Approach

1. Essentially complete designs for the overall systems (regardless of the use of DAC)
2. ITAAC for verification of detailed design (including reconciliation), fabrication, installation, inspection, and testing for all ASME BPV Code Class 1, 2, and 3 components and piping
3. Overall methodology to be employed in completing the detailed piping design for all systems
4. NRC review of piping design detail graded based on safety significance

Defining #4

- Highest level of detail for Class 1 RCPB piping and Class 2 main steam and feedwater piping (vessel to first anchor beyond isolation valves)
- Less detail for other portions of Class 2 and 3 piping, as well as for small-bore piping (nominal pipe size of 2" or less)
- Precedent in piping packages needed to close AP1000 DAC (DCD Tier 2, Table 3.9-20, ML11171A432)

Piloting the Graded Approach

- Proposed as a white paper in March 2014 (ML14065A067)
  - Examples of level of detail (subject to design-specific considerations)
    - Design criteria, system descriptions, methodologies for all piping
    - Detailed diagrams, parameters, layouts, and stress and pipe rupture hazards analysis results for selected piping systems
- Discussed with mPower, KHNP, and NuScale
- Incorporated in KHNP's APR1400 DC application (under review)

Looking Forward

- APR1400 review
- NuScale pre-application discussions and future application
- Considering update to general DAC discussion in Regulatory Guide 1.206 (public meeting in October 2015)
  - DAC are still a viable option if original rationale applies
  - No-DAC approach may have advantages for certain designs
- Potential update to SRP Section 3.12 to clarify review criteria for DAC and no-DAC options

Abbreviations

- ABWR – Advanced Boiling-Water Reactor
- AP – Advanced Passive (600, 1000)
- APR – Advanced Pressurized Reactor (1400)
- APWR – Advanced Pressurized-Water Reactor
- ASME – American Society of Mechanical Engineers
- BPV – *Boiler and Pressure Vessel* (Code)
- CFR – *Code of Federal Regulations*
- DAC – design acceptance criteria
- DC – design certification
- DCD – design control document
- DCIP – Division of Construction Inspection and Operational Programs
- DEIA – Division of Engineering, Infrastructure, and Advanced Reactors
- EPR – Evolutionary Power Reactor
- ESBWR – Economic Simplified Boiling-Water Reactor
- FSAR – final safety analysis report
- ITAAC – inspections, tests, analyses, and acceptance criteria
- KHNP – Korea Hydro and Nuclear Power
- NRC – Nuclear Regulatory Commission
- NRO – Office of New Reactors
- RCPB – reactor coolant pressure boundary
- SER – safety evaluation report
- SRM – Staff Requirements Memorandum
- SRP – Standard Review Plan (NUREG-0800)