Safety Focused Review of Instrumentation and Control Systems

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Discussion Topics

• Background
• NuScale Enhance Safety Review
• NuScale Chapter 7 DCA Review
• Conclusion
Background

The staff embarked on an innovative approach for reviewing FSAR Chapter 7, “Instrumentation & Controls” for mPower (and beyond)

• Improve the safety focus of the review
• Adherence to fundamental safety design principles; independence, redundancy, deterministic performance, and D3
• Improve the efficiency of the review
NuScale Enhanced Safety Focus Review

- Safety-Significance
- Regulatory Compliance
- Novel Design
- Shared SSCs
- Licensing Approach
- Safety Margin
- Defense-in-Depth
- Operational Programs
- Adverse Interactions
- Additional Risk Insights
- Other Considerations
Review Considerations

Safety-Significance

• NUREG-0800, Introduction - Part 2 defines safety-significance of an SSC or its associated function(s) using the A1, B1, A2, B2 safety classifications:
  A1 – Safety-related and risk-significant
  B1 – Nonsafety-related and risk-significant
  A2 – Safety-related and not risk-significant
  B2 – Nonsafety-related and not risk-significant
Review Considerations

Regulatory Compliance

- Adequate review will always be conducted for compliance with applicable regulations with making findings of reasonable assurance of safety.

Novel Design

- Identify any novel design features proposed by NuScale and associated importance to safety issues (e.g., passive safety design features)
Review Considerations (cont.)

Sharing of SSCs across modules
• Identify extent of SSC sharing between modules and associated importance to safety issues (e.g., multi-module trip)

Licensing approach
• Identify any unique licensing approaches and associated importance to safety issues

Defense-in-Depth
• Identify any significant defense-in-depth considerations (e.g., active injection back up for passive emergency core cooling system)
Pre-Application Activities

Early Interactions with the applicant

• Audits of conceptual designs and regulatory gaps
• Public Meetings
• Training

Through these interactions, the staff was able to learn about:

• Safety considerations
• Plant-Level I&C Architecture
• Safety-Related I&C Platform
Highly Integrated Protection Platform

- Module & plant protection systems architectures
- Software common-cause failures
- Anticipated transients without scram

System Interfaces

- Nonsafety to safety systems interactions
- Human-machine interface

First-of-a-Kind Sensor Applications
Conclusion

Challenges using a graded approach:
  • Approach review focus on safety significance with risk insights, without compromising safety
  • Implementation

Benefits of using a graded approach:
  • Holistic plant safety review
  • Early resolution of safety design concerns
  • Increased effectiveness & efficiency
Acronyms

• CFR: code of federal regulations
• DCA: design certification application
• IEEE: Institute of Electrical and Electronics Engineer
• I&C: instrumentation and controls
• PE: professional engineer
• NPIC&HMIT: Nuclear Plant Instrumentation, Control and Human Machine Interface Technologies
• NRC: Nuclear Regulatory Commission
• NuScale: NuScale Power, LLC
• SSC: structures, systems, and components