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## ISG-04 Conformance Analysis



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[Not Export Controlled]

## Agenda

- Purpose and Outcome
- Licensing Strategy
- I&C Design Principles
  - ✓ Independence
    - Communication Independence
- ISG-04
- Conformance of the SMR-160 design to ISG-04

## Purpose and Outcome

- The purpose of the meeting is to
  - ✔ Familiarize NRC staff with I&C architecture of the SMR-160, focusing on the communication interfaces
  - ✔ Review the regulatory approach related to Digital I&C communications
  - ✔ Understand future NRC work on in this area
  
- The outcome is to obtain feedback from the NRC staff on
  - ✔ The approach for complying with regulations in this area
  - ✔ The specific ways the SMR-160 I&C complies with available guidance and regulations
  - ✔ Future revisions to NRC guidance or regulation in this area

# Licensing Strategy for SMR-160 I&C



- Following Part 50 Process
- DNRL-ISG-2022-01, provides guidance for I&C content related to Part 50
  - ✓ Points to guidance in the design-specific review standard (DSRS) for NuScale
    - Generic for I&C focused on Digital I&C systems
    - Incorporated some of the lessons learned from review of large LWR designs.
    - The guidance emphasizes fundamental instrumentation and control (I&C) design principles of independence, redundancy, predictability and repeatability, and diversity and defense in depth.

# DNRL-ISG-2022-01



- In evaluating a CP application, the NRC staff should focus on the following elements of the I&C design:
  - ✓ An overall I&C architecture that demonstrates adherence to the fundamental I&C design principles.
    - *Architecture overview presented October 2022 (Public Meeting ML22263A014)*
  - ✓ Plant safety functions allocated to each of the safety-related I&C systems.
  - ✓ Proposed communications between safety-related and non-safety-related I&C systems.
    - *Covered in this presentation*
  - ✓ Regulations that the applicant intends to comply with for the I&C design.
  - ✓ Regulations that the applicant intends to take exemption from or deems not applicable to its design.
  - ✓ Topical reports incorporated by reference in the application.

## I&C Fundamental Design Principles

- independence
- redundancy
- predictability and repeatability
- diversity and defense-in-depth (D3)

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## Independence

- Required to demonstrate independence of the I&C systems
  - ✓ between redundant portions of a safety system
  - ✓ between safety systems and the effects of a DBE
  - ✓ between safety systems and other systems
- Concepts to address are:
  - ✓ physical independence
  - ✓ electrical independence
  - ✓ communications independence
  - ✓ functional independence



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  - ✓ physical independence
  - ✓ electrical independence
  - ✓ communications independence
  - ✓ functional independence

## Communications Independence

- Communication independence must exhibit adequate independence
  - ✓ among redundant portions of the safety system
  - ✓ between safety and nonsafety systems
- The design of the data communication system
  - ✓ meets IEEE Std 603-1991, Section 5.6
  - ✓ conforms to the guidance for the separation and isolation of the data processing functions of interconnected computers in IEEE Std 7-4.3.2, Section 5.6, as endorsed by RG 1.152.

## DI&C-ISG-04 Highly-Integrated Control Rooms - Communications Issues (HICRc)



- This Interim Staff Guidance addresses the design and review of digital systems proposed for safety-related service in nuclear power plants.
  - ✓ Address only selected digital aspects of such systems.
- Specifically addresses issues related to
  - ✓ interactions among safety divisions
  - ✓ between safety-related equipment and equipment that is not safety-related.

## DI&C-ISG-04 Areas of Interest

1. interdivisional communications - communications among different safety divisions or between a safety division and a non-safety entity
  2. command prioritization - selection of a particular command to send to an actuator when multiple and conflicting commands exist
  3. multidivisional control and display stations - use of operator workstations or displays that are associated with multiple safety divisions and/or with both safety and nonsafety functions
  4. digital system network configuration - the network or other interconnection of digital systems that might affect plant safety or conformance to plant safety analysis assumptions
- Areas of Interest #1 through 3 are each addressed in a separate section of ISG-04.
    - ✓ Area of Interest #4 has implications concerning each of the first three and is incorporated into those sections as needed

## Questions for Staff

- Does the staff see issue in utilizing ISG-04 guidance in complying with regulations related to digital I&C and conforming to guidance in the NuScale DSRS?
- Are there any plans to consolidate ISG-04 guidance into a BTP or revision to Chapter 7 NUREG 0800 guidance?
  - ✓ If so is there a timeline?
- Are there any gaps the NRC staff feels are in ISG-04 that would need to be addressed by a licensee?

## Summary of Closed Meeting Materials

- Overview of the I&C architecture focusing on communication
  - ✓ between redundant portions of a safety system
  - ✓ between safety systems and other systems
- Summary of how the SMR-160 I&C architecture complies with staff positions associated with the three focus areas of ISG-04
  - ✓ interdivisional communications
  - ✓ command prioritization
  - ✓ multidivisional control and display stations

**\*\*\*Transition to CLOSED portion of the meeting at this time\*\*\***

# Closed Portion Agenda

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# Scope

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# SMR-160 I&C Architecture

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# SMR-160 I&C Architecture

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# SMR-160 I&C Architecture

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# Interdivisional Communications

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# Command Prioritization

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# Command Prioritization

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# Multidivisional Control and Display Stations

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# Multidivisional Control and Display Stations

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# Conclusion

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## Questions or Comments?

- Are there any aspects of evaluation that are lacking in the current Whitepaper?