



RIC 2015

Creating a Path Forward for Digital Instrumentation and Control Upgrades

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Agenda

- Background
- Approved Safety Systems DI&C Upgrades
- Challenges
- Topical Reports
- ISG-06 Licensing Process
- Diablo Canyon DI&C upgrade
- Path Forward



Background

- Current status of I&C systems in operating NPPs
- Transition to Digital I&C systems
- Regulatory environment



Approved Safety Systems DI&C Upgrades

- Duke Oconee RPS/ESFAS Enhancing Safety of a Three-Channel Safety System
- Wolf Creek Simple Safety Actuation Function Using FPGA Technology (for Main Feed & Steam isolation)
- CPLD-Based Solid State Protection System Card
- GE-H NUMAC Power Range Neutron Monitoring System (e.g., Columbia and Grand Gulf)
- Watts Bar Common Q – Post Accident Monitoring System (PAMS)



Challenges

- Enhancing regulatory transparency, predictability and efficiency through refined regulatory guidance
- Licensee implementation of 10 CFR 50.59 process through implementation of the guidance in NEI 01-01
- Regulatory treatment of the impact of potential software design errors on common cause failures



Challenges

- Impact of the continued introduction of (relatively) new technology on ability to keep guidance up to date
- Susceptibility of I&C (including digital) equipment, to Electromagnetic/Radio Frequency Interference (EMI/RFI), power surges, ambient temps, etc...
- Protection against digital system vulnerabilities and possible adverse interactions (either malicious or non-malicious)
- Hazards of communications paths which could challenge or compromise divisional separation requirements



Topical Reports and Software Tools

- **Approved Topical Reports**
 - Westinghouse Common Q
 - Invensys Tricon platform
 - AREVA Teleperm XS
 - Rolls Royce SPINLINE 3 platform
 - Doosan HFC-6000 platform
 - Westinghouse ALS platform
- **Topical Reports under review**
 - Lockheed Martin Digital Safety System Platform
 - Toshiba FPGA-based Power Range Monitoring System
 - Mitsubishi MELTAC
- ISG-06 has been used informally to facilitate preparation of TRs for DI&C platforms



ISG-06 Licensing Process

- ISG-06, "Licensing Process for Digital I&C Systems," augments the LIC-101 and LIC-109 licensing processes
- Specifically, ISG-06 clearly defines a consistent licensing PROCESS for digital safety systems by:
 - 1) Identifying the regulatory requirements, guidance, and acceptance criteria, that should be addressed in a license amendment or Topical Report
 - 2) Defining the level of detail and timing for the information and documentation to be submitted in a license amendment
 - 3) Defining the protocols for development of a license application and detailing how the staff review will be concluded



Diablo Canyon DI&C Upgrade

- **Diablo Canyon NPP proposed digital upgrade review**
 - Pilot Project for ISG-06
 - Replacement for Eagle 21 Digital Process Protection System
 - Uses two different digital platform technologies
 - References two approved licensing topical reports
 - Staff evaluated the Diversity and Defense in Depth Assessment for the Diablo Canyon system
 - Review coordination with cyber security program implementation
 - Technical review of the DCPD PPS LAR is in progress



Path Forward

- The regulatory guidance for licensing digital I&C systems has been improved and is being continuously evaluated to determine if more improvements are needed/ warranted to support digital I&C licensing efforts
- Several digital system and digital safety system upgrades have been successfully completed on operating reactors
- Benefits of digital upgrades can coexist with NRC's regulations
- The industry is proceeding cautiously with performing digital upgrades to the safety protection systems

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Path Forward

Because technology will continue to change, I&C will remain a challenging technical area deserving our continued strong attention

- Make liberal use of the Phase 0 meeting process
- Constant communications between NRR and the licensee is essential
- Finalize system requirements and if possible system documents prior to LAR submittal
- Verify compliance and completeness of the system to ensure safety requirements are met at all levels
- For 50.59 reviews – Implement improved guidance!

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Questions?

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Acronyms

- ALS – Advanced Logic System
- CPLD – Complex Programmable Logic Device
- DCCPP PPS – Diablo Canyon Power Plant Process Protection System
- DI&C – Digital Instrumentation and Control
- EMI/RFI – Electromagnetic/Radio Frequency Interference I&C – Instrumentation and Control
- FPGA – Field Programmable Gate Array
- GE-H – General Electric - Hitachi
- ISG – Interim Staff Guidance
- LAR – License Amendment Request
- LTR – Licensing Topical Report
- NEI – Nuclear Energy Institute
- NPP – Nuclear Power Plant
- NRR – Office of Nuclear Reactor Regulation
- PAMS – Post Accident Monitoring System RG – Regulatory Guides RPS/ESFAS – Reactor Protection System/Engineered Safety Features Actuation System
- SRP – Standard Review Plan
