Embedded Digital Devices
U.S. NRC RIC, March 12, 2014

Classification of Important to Safety/Items Relied Upon for Safety

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LTR-RC-14-15

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Embedded Digital Devices
Draft Regulatory Issue Summary (RIS)

- The draft RIS defines an embedded digital device as a digital component consisting of one or more digital electronic parts that uses :
  - Software
  - Software-developed firmware
  - Software-developed logic that is integrated into equipment
- The draft RIS addresses not only safety-related systems, but also will include both
  - Systems Important to Safety
  - Items Relied on for Safety

Would apply to most commercially available electronic-based equipment currently available for use

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Examples of Embedded Digital Devices

- Replacement modules for currently installed analog systems
- Smart Motor Control Center (MCC) w/communicating electronic overload relays
- Molded case circuit breakers (especially larger frame models)
- Current generation of battery chargers, inverters, and uninterruptible power supplies (UPS)
- Time-delay/multifunction relays
- Communication interfaces (e.g., RS-485 or Ethernet links connected to remote I/O modules

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NRC/Industry Safety Classification

- Current U.S. guidance for electrical and instrumentation & control (I&C) basic components (structure, system, or component; SSC):
  - ANSI/ANS-51.1 (PWR) Safety Class 3 (SC-3), Special non-nuclear safety (NNS), and NNS
  - 10 CFR 50.2 → Safety related and Non-Safety related
  - IEEE Standards → Class 1E and Non-Class 1E
  - 10 CFR 50.69 → Risk-informed safety class (RISC)
    - RISC-1; Safety-Related, Safety-Significant
    - RISC-2; Non-Safety-Related, Safety-Significant
    - RISC-3; Safety-Related, Low-Safety-Significant
    - RISC-4; Non-Safety-Related, Low-Safety Significant

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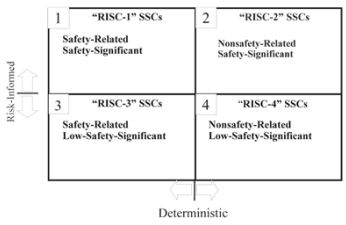
RISC vs Deterministic Approach



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International Electrotechnical Commission (IEC) Safety Classification by Function

- IEC 61513
  - Class 1
  - Class 2
  - Class 3
  - Not Categorized
- IEC 61226
  - Category A
  - Category B
  - Category C
  - Not Categorized

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Correspondence of Various SSC Classifications

ANS Safety Class	10 CFR 50.2	IEEE Std 603-1998	IAEA NS-G-1.3		IEC 61513/ IEC 61226	10 CFR 50.69 RG-1.201 (Trial Use)	Software
SC-1	Safety Related	--	Important to Safety	Safety System	--	--	--
SC-2		--			--	--	--
SC-3		Class 1E			Class 1/ Category A	RISC-1	Protection (Safety Critical)
						RISC-3	Important to Safety
Special NNS	Non-safety related	Non-Class 1E		Safety-related	Class 2/ Category B	RISC-2	
							Important to Availability
NNS					Class 3/ Category C	RISC-4	
							General Purpose
			Not important to safety		Not categorized		

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Conclusion – RIS Key Issues

- Once properly classified, embedded digital devices (EDD) can be procured, configured, dedicated, qualified, and tested to the applicable regulations, guidance, and industry standards
  - Help to ensure adequate quality (graded, NOT relaxed) and reliability of EDDs exist in actuation equipment
  - Highlights the need to also address plant vulnerabilities to new failure modes and potential common cause failures (CCF's)
  - Will help ensure that sufficient procurement planning and material control exists to identify, review, test, and control EDD consistent with quality, regulatory, and industry standards

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