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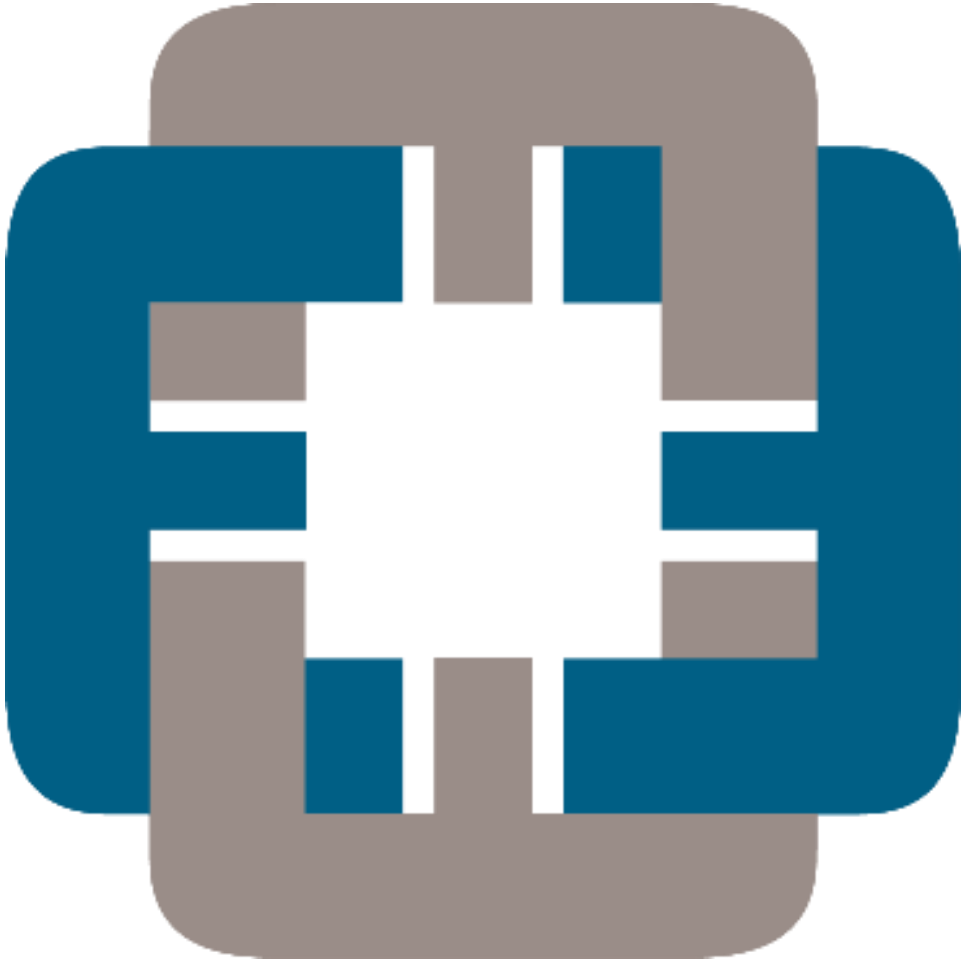


10 CFR 50.69 RMS Implementation Case Study

By: Jason Gasque

Design I&C Manager

Topics for discussion:

- Background Information
- 10 CFR 50.69
- Changing the RMS from RISC 1 & 2 to RISC 3
- Procurement
- Digital Requirements
- Issuing Engineering Change Package (ECP)

Background Information

Replace the following RMS:

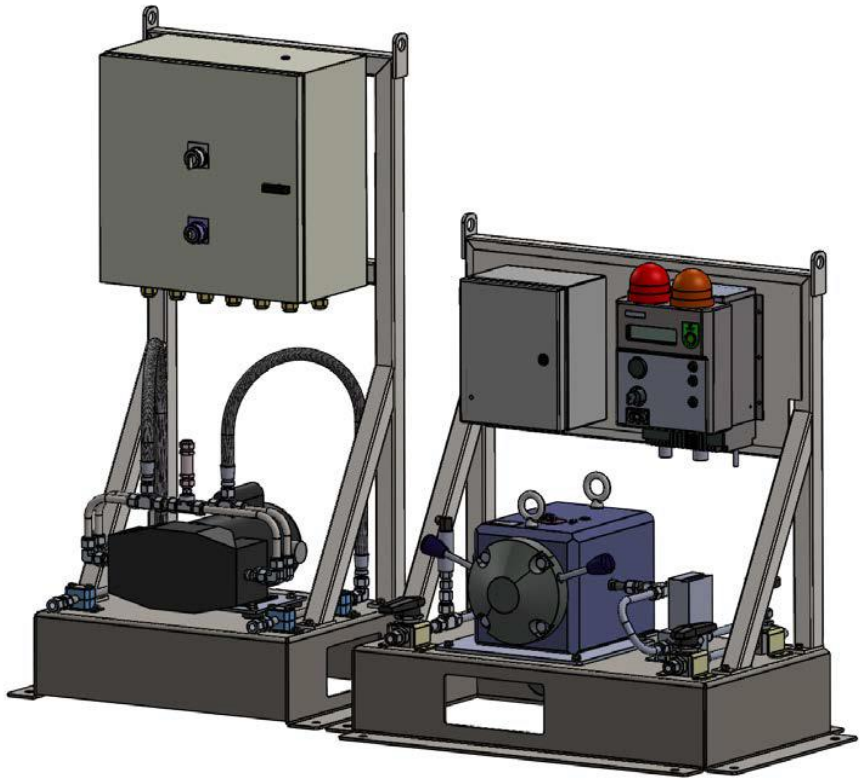
- Containment Purge Air Exhaust Monitors
  - The primary safety function is the mitigation of the off-site dose consequences for the small loss of coolant accident.
  - Safety-Related
  - Redundant Trains
- Main Control Emergency Intake Monitor
  - The safety function will limit the exposure of personnel in the Control Room to satisfy the dose limits.
  - Safety-Related Monitors
  - Redundant Trains
- Main Control Room Normal Air Intake Monitors
  - The monitors shall perform real-time detection of the radioactivity in the inlet air.
  - Safety-Related Monitors
  - Redundant Trains

Background Information

Challenges:

- Modular Build (Detection and Pump Skids)
- Different Sample Pump
- Safety-Related Digital Modification
- Redundant Trains
- First Of A Kind (FOAK) 10 CFR 50.69 Modification for the Utility on any system/ component

Background Information



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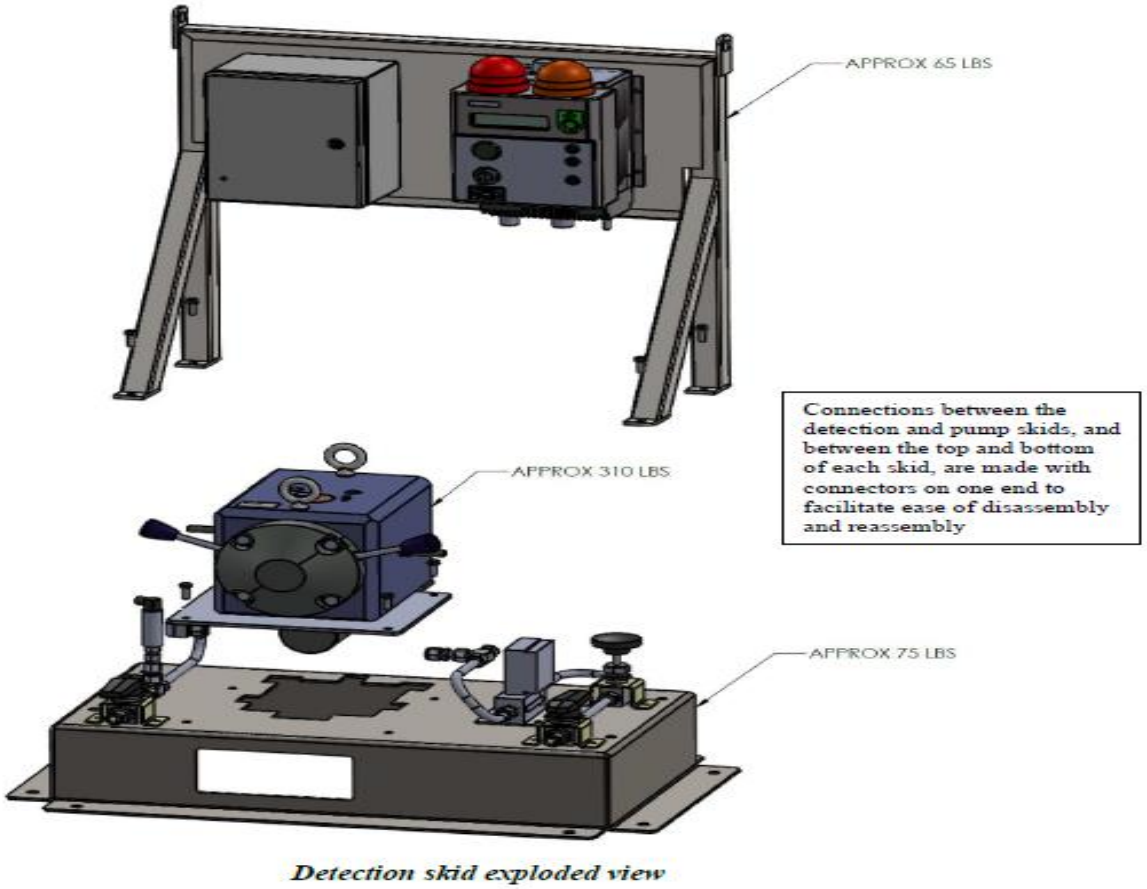
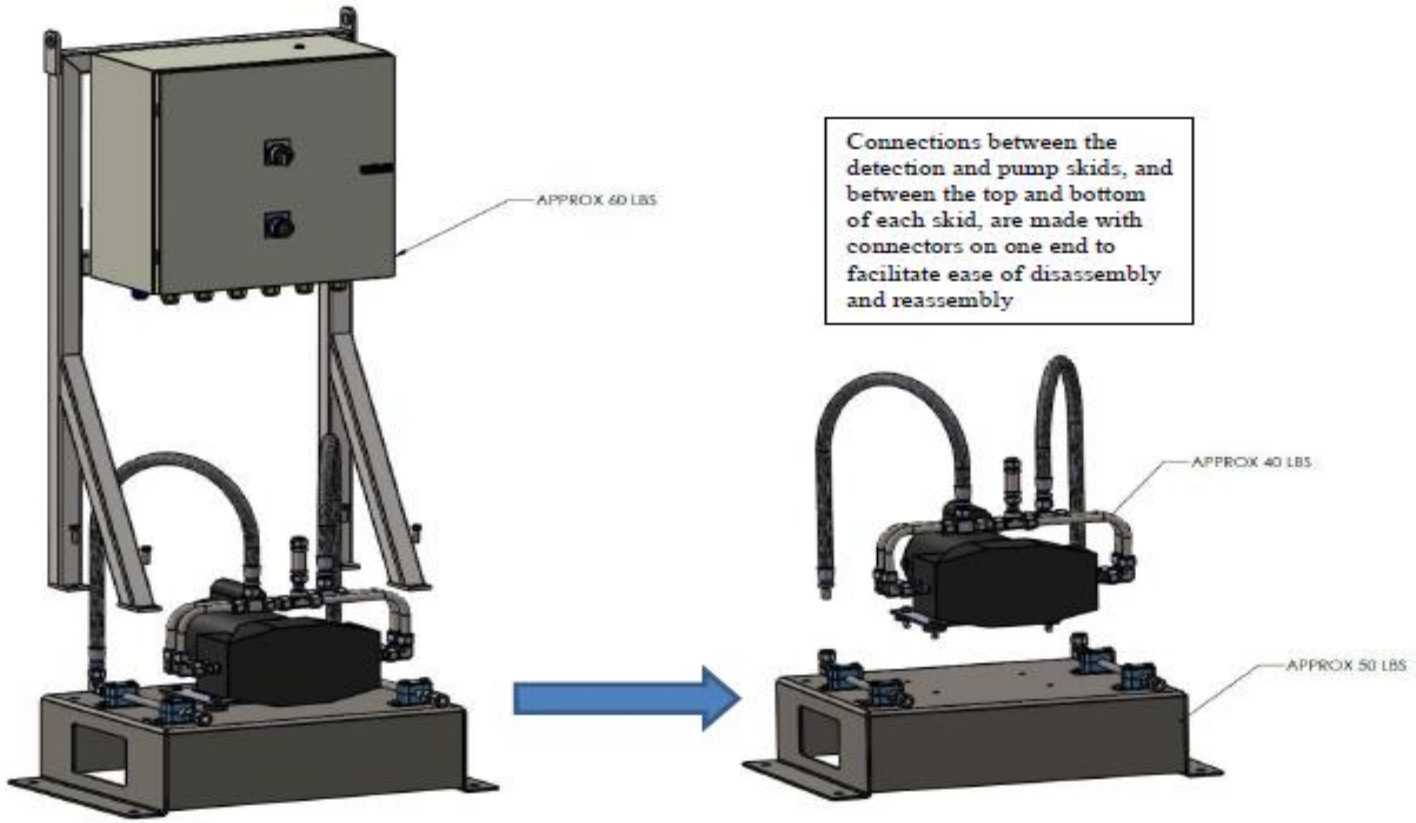


Detection skid exploded view

Background Information



Pump skid exploded view

10 CFR 50.69

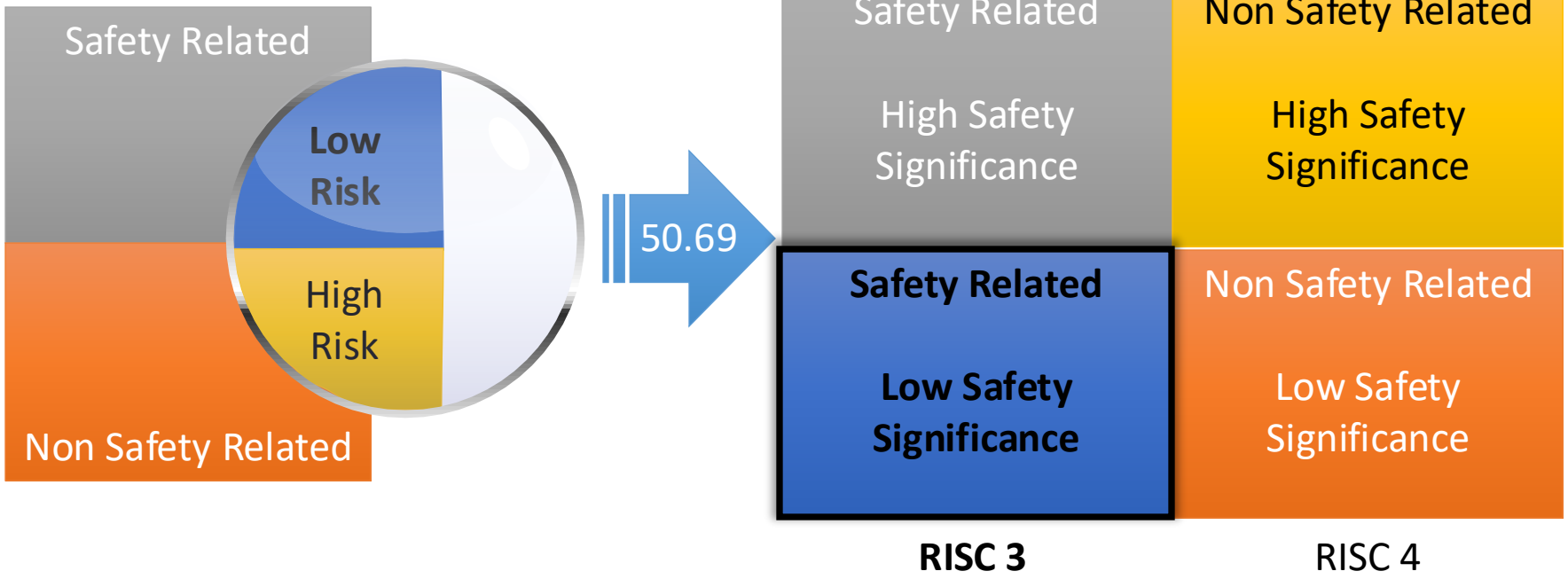
What is 10 CFR 50.69?

- A risk-informed regulation that allows for the re-categorization of many safety-related Structures, Systems and Components (SSCs) into a “safety-related, but low risk” category

- Go from “Reasonable Assurance” to “Reasonable Confidence”

- Note: RISC stands for Risk-Informed Safety Class

50.69 SSC Categorization



RISC = Risk Informed Safety Class

RISC 3 gets simplified programs;

RISC 2 subject to additional programmatic controls

10 CFR 50.69

What is 10 CFR 50.69?

- SSCs categorized as RISC 3 can have various special treatment requirements relaxed:
  - Nuclear Quality Assurance Manual (NQAM)
  - Environmental Qualification (EQ)
  - Seismic Qualification
  - Digital (NEI-24-01 guidance)
  - Maintenance Rule
  - Electromagnetic Compatibility (EMC) “Questionable”

10 CFR 50.69 Implementation

- Identify Candidate Systems for 10CFR50.69 implementation
- Develop LAR per industry template
  - PRA related attachments can credit previous Risk Informed submittals with updated Facts & Observations (F&O) information
  - Minimize open F&O by performing NRC endorsed Appendix X closure reviews
- Perform RISC categorization using PRA and qualitative ranking measures
- Identify and implement alternative treatments for RISC-3 SSCs
- Implement long-term monitoring plan to ensure no adverse risk impacts

10 CFR 50.69 Benefits

Several immediate procurement benefits (SR vs. NSR) have been already identified by utilities:

Component	Savings	Information Source (Utility)
Containment Spray Pump Motors	$150k / motor	Xcel Energy
Main Control Room Chillers	$900k / chiller	TVA
Radiation Monitors	**$9mil / system**	**TVA** **(15% savings on SR vs SR, all monitors to be replaced)**

Changing RMS From RISC 1 & 2 to RISC 3 by Utility

- Utility performed its on Engineering Change Package (ECP) for RMS to categorize to RISC 3
- Created new fields in Maximo for RISC Categories
- ECP Included Basis for 10 CFR 50.69 for the RMS
  - Document categorization process
  - Document Results

Procurement

- ENERCON supported the utility with a Systems/ Procurement Specification
- Specification included the following:
  - Existing Systems Description
  - Seismic/ Environmental Specifications and Requirements
  - Digital Requirements
    - SQA Documentation per utilities design standard
    - Critical Digital Review (CDR)
  - Cyber Requirements
  - How the new system shall operate
  - EMC
  - Etc…

Additional Procurement Activities

- Utility had special requirements for Mirion to perform:
  - Different Sample Pump
  - Modular Design (Both Skids)
  - Perform EMC Testing (Pump)

Digital Requirements

- Utility specification was written prior to NEI-24-01 “Digital I&C Considerations for 50.69 RISC-3 Structures, Systems or Components”.
- Mirion had to provide SQA documents to the utility to support their Safety-Related standard design process.
- Mirion provides the Safety-Related deliverables with a 50.69 specification.
- Utility and ENERCON performed a Critical Digital Review (CDR)
  - Support utility’s design process
  - ENERCON wrote a Qualitative Assessment to support 50.59 evaluation for software common cause failure (SCCF).

What is NEI-24-01?

- Issued June 2024 by NEI
- NEI Digital Task Force which included ENERCON and led by Alan Campbell
- Alternate Digital I&C Considerations for 50.69 RISC-3 Structures, Systems or Components
- Allows the industry to procure RISC 3 SR components without all the SQA documents and following ISG-06

Critical Digital Review

- Critical Digital Review (CDR) is a focused technical review applied to a specific digital systems project to investigate the potential for unforeseen events, and to recommend mitigation strategies.
  - Assess the vendor's development processes for both strengths and weaknesses.
  - Verify if the vendor is providing what you ask for and if their expectations align with.
  - Utility expectations such as level of detail, focus, and formal documentation.
  - Verify if the vendor is following their design processes and procedures.
  - What is the operating performance of the system/component based upon internal metrics?
  - Evaluate the system/ component critical operating characteristics by software and hardware reviews.
  - Evaluate operating history looking for specific failures applicable to your application.
  - Establish if the product and application is a good candidate for implementation under 50.59 process and does not require a Licensing Amendment Request (LAR).

What is Qualitative Assessment?

- RIS 2002-22 Supplement 1, “Clarification on Endorsement of Nuclear Energy Institute Guidance in Designing Digital Upgrades in Instrumentation and Control Systems”

- Currently the only industry guidance endorsed by the NRC as providing an acceptable technical basis to determine digital equipment failure likelihood and software common cause failure (SCCF) likelihood for use in 10 CFR 50.59 Evaluations.

- This is only used to support a 50.59 Evaluation to show the Digital Component has a “sufficiently low” likelihood of a software common cause failure.

Mirion's Qualitative Assessment

- Activity Description
  - Existing System Description
  - New System Upgrade
- Failure Mode Comparison
  - Internal Defect
  - Loss of Power
  - Environmental Factors
- Failure Results

Mirion's Qualitative Assessment

- Assertions
  - Design Attributes
    - Absence of Concurrent Triggers
    - Watchdog Timer
    - Diverse Indication of Failure
    - Self-Diagnostics and Self-Testing
    - Use of Interrupts
    - Extensive Testing

Mirion's Qualitative Assessment

- Assertions
  - Quality Design Process
    - Procuring Uder 50.69
    - Safety-Related SQA Process
    - Operating Experience
  - Conclusion
    - To show that the digital components have a "sufficiently Low Likelihood of a SCCF.

Engineering Change Package (ECP)

- Utility follows IP-EN-001 “Standard Design Process”
- NISP-EN-04 “Standard Digital Engineering Process”
- Separate ECP to support the RIS 1 & 2 to Risc 3 in parallel to modification package
- EMC Test Plan and EMC Test Report
- Testing Performed
  - Factory Acceptance Testing (FAT)
  - Post Modification Testing (PMT)

Engineering Change Package (ECP)

- Uncertainty Calculations (Start Early)
- Reviewed all Mirion deliverables
  - ENERCON performed 1 - 2 week turnarounds
  - Mirion provided quick comment incorporation if needed
- 50.59 Screening/ Evaluation
  - Screening
    - Screened into an Evaluation
  - Evaluation
    - Redundant Safety-Related Trains
    - Issued Qualitative Assessment to support SCCF

Engineering Change Package (ECP)

- Package was issued in 2024
- Currently being installed at the site
- Installation is by multiple child packages
- No major modification issues or interferences during installation

Questions?

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