U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

SRM-SECY-22-0076
Digital I&C Guidance Development

Public Meeting
July 11, 2023

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Presentation Outline

- Background
  - SRM-SECY-22-0076 and Enclosure
  - Direction and Challenges
- Staff's Approach to Develop Guidance
- Major Milestones and Next Steps
- Closing Remarks

SRM-SECY-22-0076

- "The Commission has approved the staff's recommendation to expand the existing policy for digital instrumentation and control (I&C) common-cause failures to allow the use of risk-informed approaches to demonstrate the appropriate level of defense-in-depth, subject to the enclosed edits. The staff should clarify in the implementing guidance that the new policy is independent of the licensing pathway selected by reactor licensees and applicants. Given the regulatory importance of this issue, the staff should complete the final implementing guidance within a year from the date of this Staff Requirements Memorandum." (emphasis added)

ML23145A181

SRM-SECY-22-0076 Enclosure

The Commission approved the staff's proposed four points from SECY-22-0076 with the following edits:

- **Point 1**: Added the option of using "both" a best-estimate method and a risk-informed approach
- **Point 2**: Added reference to RG 1.233, *Guidance for a Technology-inclusive, Risk-informed, and Performance-based Methodology to Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light-Water Reactors*
- **Point 3**: Added "postulated" before "CCF"
- **Point 4**: Added "risk-informed" before "critical safety functions"

  Added "The applicant may alternatively propose a different approach to this point in the policy if the plant design has a commensurate level of safety."

ML23145A182

SRM-SECY-22-0076 Point 1

The applicant must assess the defense in depth and diversity of the facility incorporating the proposed digital I&C system to demonstrate that vulnerabilities to digital CCFs have been adequately identified and addressed.

The defense-in-depth and diversity assessment must be commensurate with the risk significance of the proposed digital I&C system.

SRM-SECY-22-0076 Point 2

In performing the defense-in-depth and diversity assessment, the applicant must analyze each postulated CCF using either best-estimate methods or a risk-informed approach or both.

When using best-estimate methods, the applicant must demonstrate adequate defense in depth and diversity within the facility's design for each event evaluated in the accident analysis section of the safety analysis report.

When using a risk-informed approach, the applicant must include an evaluation of the approach against the Commission's policy and guidance, including any applicable regulations, for risk-informed decision-making. The NRC staff will review applications that use risk-informed approaches for consistency with established NRC policy and guidance on risk-informed decision-making (e.g., Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," RG 1.233, "Guidance for a Technology-inclusive, Risk-informed, and Performance-based Methodology to Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light-Water Reactors").

SRM-SECY-22-0076 Point 3

The defense-in-depth and diversity assessment must demonstrate that a postulated CCF can be reasonably prevented or mitigated or is not risk significant. The applicant must demonstrate the adequacy of any design techniques, prevention measures, or mitigation measures, other than diversity, that are credited in the assessment. The level of technical justification demonstrating the adequacy of these techniques or measures, other than diversity, to address potential CCFs must be commensurate with the risk significance of each postulated CCF.

A diverse means that performs either the same function or a different function is acceptable to address a postulated CCF, provided that the assessment includes a documented basis showing that the diverse means is unlikely to be subject to the same CCF. The diverse means may be performed by a system that is not safety-related if the system is of sufficient quality to reliably perform the necessary function under the associated event conditions. Either automatic or manual actuation within an acceptable timeframe is an acceptable means of diverse actuation.

If a postulated CCF is risk significant and the assessment does not demonstrate the adequacy of other design techniques, prevention measures, or mitigation measures, then a diverse means must be provided.

SRM-SECY-22-0076 Point 4

Main control room displays and controls that are independent and diverse from the proposed digital I&C system (i.e., unlikely to be subject to the same CCF) must be provided for manual, system-level actuation of risk-informed critical safety functions and monitoring of parameters that support the safety functions. These main control room displays and controls may be used to address point 3, above. The applicant may alternatively propose a different approach to this point in the policy if the plant design has a commensurate level of safety.

SRM Direction

1. Complete the final implementing guidance within a year from the date of the SRM (i.e., May 24, 2024)
   - Time to complete the guidance is challenging to accommodate the developing process and the issuance process

2. Clarify that the new policy is independent of the licensing pathway

Staff's Approach to Develop Guidance

- Issue final implementing guidance within one year to meet SRM direction
  - To do this, the staff is considering what revisions are necessary for the following existing staff review guidance:
    - Standard Review Plan (SRP) Branch Technical Position (BTP) 7-19
    - Guidance for Non-Light-Water (LWR) Reactors
  - The draft revisions are to be completed by 3rd quarter 2023 and the final revisions issued in 2nd quarter 2024
  - The revised staff guidance will allow the staff to review proposed risk-informed approaches to address DI&C CCF

- Note: The staff considered development of a RG and review of industry guidance/standard
  - These activities cannot be completed within the required one-year schedule
  - The staff plans to continue engagement with industry on NEI 20-07

BTP 7-19 Revision

- BTP 7-19 guidance explicitly addresses the CCF policy (in SRM-SECY-93-087)
- As such, it is appropriate to update the BTP to reflect the expanded policy in SRM-SECY-22-0076:
  - The direction to make the guidance “independent of the licensing pathway” creates the need to provide further clarification in the BTP
  - The addition of “risk-informed approach” to perform a D3 assessment (see SECY Point 2) creates the need for guidance in this area
  - The addition of “or both” (see SRM Point 2) creates the need to accommodate in the BTP the ability to implement this option in various ways
  - The addition of “design techniques … credited in the assessment” (see SECY Point 3) creates the need to accommodate in the BTP the evaluation of design techniques other than diversity to address CCF
  - The addition of “a different approach” (see SRM Point 4) creates the need for guidance in this area

BTP 7-19 Revision (continued)

- The following types of edits are being considered:
  - Targeted edits to incorporate the expanded policy (instead of a whole re-write of the BTP)
  - Inclusion of communication independence language to address a prior commitment to ACRS

- The staff's goal is to keep the I&C review guidance separate from the PRA review guidance
  - Staff's goal is to apply the existing risk-informed decisionmaking paradigm to digital I&C for high safety significance systems
  - The acceptance criteria for risk-informed approaches for digital I&C CCFs will be consistent with the NRC's broader (i.e., not specific to digital I&C) practices and guidance for risk-informed decision making (e.g., RG 1.174 and RG 1.233)

- The staff is considering including guidance for risk-significance determination to:
  - Determine the risk significance of the remaining CCFs using a bounding sensitivity analysis
  - Calculate the change in risk assuming the CCF will occur
  - Map the change in risk to the regions in RG 1.174

Guidance for Non-Light-Water Reactors (Non-LWRs)

- Staff and licensee guidance being developed for non-LWRs is risk-informed and performance-based for the plant
  - Includes specific acceptance criteria on risk significance, frequency-consequence targets, defense-in-depth as part of the systematic risk-informed and performance-based approach
  - NRC staff review of I&C design is performed in a risk-informed and performance-based manner using DRG

- The NRC staff is evaluating if and what additional guidance is needed to meet the SRM

Major Milestones and Next Steps

- SRM Issued – May 25, 2023 ✔
- First Public Meeting – July 11, 2023 ✔
- Develop Draft Guidance – 3rd quarter, 2023
- Public Meeting – 3rd quarter, 2023
- ACRS Briefings on Draft Guidance – TBD
- Public Comment Period Starts – 4th quarter, 2023
- Public Meeting – 4th quarter, 2023
- Public Comment Period Ends – 4th quarter, 2023
- ACRS Briefings on Final Guidance – TBD
- Issue Final Implementing Guidance – 2nd quarter, 2024

Closing Remarks

Acronyms

ACRS	Advisory Committee on Reactor Safeguards
BTP	Branch Technical Position
CCF	Common Cause Failure
CDF	
D3	Defense-in-Depth and Diversity
DAS	Diverse Actuation System
DI&C	Digital Instrumentation and Control
DRG	Design Review Guide
ESFAS	Engineered Safety Features Actuation System
GDC	General Design Criteria
I&C	Instrumentation and control
LERF	
LMP	Licensing Modernization Project
LWR	Light-Water Reactor
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
PRA	Probabilistic Risk Assessment
RG	Regulatory Guide
RPS	Reactor Protection System
SECY	Commission Paper
SRM	Staff Requirements Memorandum
SRP	Standard Review Plan