

POLICY ISSUE
(Information)

October 25, 2017

SECY-17-0105

FOR: The Commissioners

FROM: Victor M. McCree
Executive Director for Operations

SUBJECT: UPDATE REGARDING THE INTEGRATED STRATEGY TO
MODERNIZE THE NUCLEAR REGULATORY COMMISSION'S DIGITAL
INSTRUMENTATION AND CONTROL REGULATORY
INFRASTRUCTURE

PURPOSE:

This paper provides the annual status update regarding the status of ongoing work on and planned future activities for Modernization Plans (MPs) 1 through 4 of the integrated action plan (IAP) to improve the U.S. Nuclear Regulatory Commission's (NRC's) digital instrumentation and control (I&C) regulatory infrastructure.

BACKGROUND:

In February 2016, the Commission directed the staff to develop an integrated strategy to modernize the NRC's digital I&C regulatory infrastructure. This direction appeared in the February 26, 2016, staff requirements memorandum (SRM) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16056A614) associated with SECY-15-0106, "Proposed Rule: Incorporation by Reference of Institute of Electrical and Electronics Engineers [IEEE] Standard 603-2009, 'IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations' (RIN 3150-AI98)" (ADAMS Accession No. ML113190983). Further, the Commission directed the staff to engage in public workshops

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and meetings with relevant standards setting committees, digital I&C vendors, licensees, and any other external stakeholders to reach a common understanding of the digital I&C regulatory challenges and priorities and to create an action plan to address them. The Commission also directed the staff to present any issues that are ripe for Commission consideration along with the plan. The staff submitted the IAP concept and initial revision to the Commission for approval in May 2016.¹

The Commission approved the staff's planned approach in October 2016,² and the staff has continued to update the plan to reflect current strategy and activities in modernizing the regulatory infrastructure. Revision 1 to the IAP³ was published in March 2017 with input from stakeholders. Revision 2 to the IAP⁴ is in development with a scheduled issue date of November 2017. The Commission also requested annual updates regarding the status of ongoing work on and planned future activities for MPs 1 through 4 of the IAP, as provided in this paper.

DISCUSSION:

As directed by the Commission, the IAP considers the broader context of digital I&C regulatory challenges and includes all related activities being pursued by the staff, including incorporation of IEEE Standard 603-2009⁵ into Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a, "Codes and standards"; updates to the policy on common-cause failure in SRM-SECY-93-087⁶; and development of guidance for evaluations of digital I&C modifications in accordance with 10 CFR 50.59, "Changes, tests and experiments."

The IAP is comprised of four MPs: (1) Protection Against Common Cause Failure (CCF); (2) Considering Digital I&C in Accordance with 10 CFR 50.59; (3) Acceptance of Digital Equipment; and (4) Assessment for Modernization of the I&C Regulatory Infrastructure. These activities are interrelated, and the Digital I&C Steering Committee of NRC Division Directors provides integration and coordination on common issues.

Key Updates to the Digital I&C Integrated Action Plan

The IAP is being updated to reflect changes and completed actions to date towards the digital I&C modernization effort and will continue to be reviewed and updated at least annually with approval of the Digital I&C Steering Committee.

MP 1: Protection Against CCF

MP 1 addresses developing guidance for using effective qualitative assessments of the

¹ SECY-16-0070, "Integrated Strategy to Modernize the Nuclear Regulatory Commission's Digital Instrumentation and Control Regulatory Infrastructure," dated May 31, 2016 (ADAMS Accession No. ML16126A137).

² SRM-SECY-16-0070, "Staff Requirements – SECY-16-0070 – Integrated Strategy to Modernize the Nuclear Regulatory Commission's Digital Instrumentation and Control Regulatory Infrastructure," dated October 25, 2016 (ADAMS Accession No. ML16299A157).

³ Integrated Action Plan to Modernize Digital Instrumentation and Controls Regulatory Infrastructure, Revision 1, dated March 31, 2017 (ADAMS Accession No. ML17102B307).

⁴ Integrated Action Plan to Modernize Digital Instrumentation and Controls Regulatory Infrastructure, Draft Revision 2 (ADAMS Accession No. ML17277B643).

⁵ IEEE Standard 603-2009, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations", dated January 26, 2016 (ADAMS Accession No. ML16026A007).

⁶ SRM-SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light Water Reactor (ALWR) Designs", dated July 21, 1993 (ADAMS Accession No. ML003708056).

likelihood of failures, along with coping and/or bounding analysis for addressing CCFs, use of defensive design measures for eliminating CCF from further consideration, and staff evaluation of the NRC's existing positions on defense against CCF. MP 1 has been divided into three sub-sections to allow for focused product development: (1A) development of near-term clarifying guidance for modifying lower risk-significant safety system auxiliary and/or support digital I&C systems under 10 CFR 50.59; (1B) evaluation of Nuclear Energy Institute's (NEI's) proposed guidance in NEI 16-16⁷ for assessing CCF in digital I&C systems; and (1C) evaluation of NRC's current position on protection of digital I&C systems and components against CCF.

For MP 1A, the staff will issue a supplement to Regulatory Issue Summary (RIS) 2002-22⁸ in November 2017. This supplement will clarify the staff's endorsement of industry guidance for preparing and documenting qualitative assessments when determining under 10 CFR 50.59 whether a change requires a license amendment. SECY-17-0096⁹ was recently provided to the Commission to provide an overview of the supplement to RIS 2002-22. The staff anticipates that licensees will use this information to facilitate near-term digital upgrades and replacements to I&C systems, and will focus initially on nonsafety-related systems and auxiliary support safety systems for new and operating power reactors and non-power production or utilization facilities.

For MP 1B, the staff is continuing to evaluate NEI's proposed guidance in NEI 16-16 for addressing CCF. This guidance is based on applying defensive design measures and determining CCF likelihood. The results of this assessment could, in part, dictate the scope of further defense-in-depth and diversity (D3) assessments of potential CCFs. The staff provided informal comments to NEI on the most recent draft of NEI 16-16 on July 14, 2017. The staff is currently evaluating the technical basis for making appropriate CCF safety findings, and examining how the draft guidance would be used to make technical conclusions in support of future 10 CFR 50.59 evaluations or license amendment requests.

For MP 1C, the staff is evaluating and will propose modifications to the NRC's current position on the protection of digital I&C systems and components against CCFs, including the scope and applicability of D3 analysis for safety-related systems. The staff intends to provide a policy paper on this topic to the Commission by June 2018 (see further discussion below).

MP 2: Considering Digital I&C in Accordance with 10 CFR 50.59

MP 2 addresses the need for clarity regarding 10 CFR 50.59 evaluations of proposed digital I&C plant modifications. MP 2 outlines the staff's evaluation of NEI's proposed guidance for performing 10 CFR 50.59 evaluations of digital I&C plant modifications. NEI submitted the current draft of NEI 96-07, Appendix D,¹⁰ in April 2016 to clarify the approach for addressing unique digital I&C issues.

⁷ Draft NEI 16-16, "Guidance for Addressing Digital Common Cause Failure", dated May 2017 (ADAMS Accession No. ML17135A253).

⁸ RIS 2002-22, "Use of EPRI [Electric Power Research Institute]/NEI Joint Task Force Report, 'Guideline on Licensing Digital Upgrades: EPRI TR-102348, Revision 1, NEI 01 01: A Revision of EPRI TR-102348 to Reflect Changes to the 10 CFR 50.59 Rule,'" dated November 25, 2002 (ADAMS Accession No. ML020860169).

⁹ SECY-17-0096, "Status of Guidance Development for Digital Instrumentation and Control Upgrades under Title 10 of the *Code of Federal Regulations*, Section 50.59, 'Changes, Tests and Experiments,'" dated September 21, 2017 (ADAMS Accession No. ML17213A774).

¹⁰ Draft NEI 96-07, Appendix D, "Guidelines for 10 CFR 50.59 Evaluations," Appendix D, "Supplemental Guidance for Application of 10 CFR 50.59 to Digital Modifications", dated December 20, 2016 (ADAMS Accession No. ML17075A371).

The staff is providing comments and insights to inform NEI's final development of the guidance. There is general alignment and agreement on definitions, screening criteria, treatment of human-system interface, treatment of CCF likelihood, and the application of Criteria (i)-(v) and (vii) of 10 CFR 50.59(c)(2). The staff plans to complete its technical review of NEI 96-07, Appendix D by the end of January 2018, with a formal endorsement process by regulatory guide planned by June 2018. NEI has requested an early "acceptable for use" determination from the staff regarding NEI 96-07, Appendix D prior to the NRC's completion of a regulatory guide.

MP 3: Acceptance of Digital Equipment

MP 3 is aimed at improving guidance for the acceptance of commercial grade digital equipment. The staff issued RIS 2016-05¹¹ to address embedded digital devices, and issued draft Regulatory Guide 1.164¹² to address dedication of commercial grade items. The third-party Safety Integrity Level (SIL) certification¹³ process for digital equipment used in safety applications is currently being independently evaluated by the Electric Power Research Institute (EPRI) as agreed to by staff and industry. Results of the EPRI evaluation are anticipated by the end of March 2018.

MP 4: Assessment for Modernization of the I&C Regulatory Infrastructure

The objective of MP 4 is to perform a comprehensive modernization assessment to identify further improvements to the regulatory infrastructure (regulations and guidance) and develop plans for accomplishing such improvements. MP 4 is divided into two subsections: (4A) includes tactical activities to support improvements to the regulatory infrastructure that will benefit near-term licensing activities, and (4B) includes broader strategic activities to address long-term improvements to the regulatory infrastructure.

For MP 4A, the staff is currently developing a draft revision to digital I&C (DI&C) interim staff guidance (ISG) DI&C-ISG-06, "Licensing Process"¹⁴ to support planned digital upgrades requiring license amendments such as reactor protection system and engineered safety features actuation system (ESFAS). The staff plans to complete this draft revision in January 2018. In developing the draft revision to ISG-06, the staff has requested and considered stakeholder views (including those from NEI). The industry has indicated that a lead utility plans to start working on an application using the revised draft guidance with an anticipated submission of a license amendment request. The staff will apply lessons-learned from this lead plant application before updating the permanent guidance in NUREG-0800, "Standard Review Plan [SRP] for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," and retiring DI&C-ISG-06, Revision 1.

In addition, the staff continues to participate in development activities for the IEEE 603 standard, as previously directed by the Commission. IEEE is currently evaluating and resolving balloted comments from its members on the proposed revision. An updated standard is expected to be issued by IEEE in the summer or fall of 2018. As the standard gets closer to completion, the

¹¹ NRC Regulatory Issue Summary 2016-05, "Embedded Digital Devices in Safety-Related Systems", dated April 29, 2016 (ADAMS Accession No. ML15118A015).

¹² Regulatory Guide 1.164, Revision 0, "Dedication of Commercial-Grade Items for use in Nuclear Power Plants" dated June 2017 (ADAMS Accession No. ML17041A206).

¹³ International Electrotechnical Commission (IEC) 61508, "Functional Safety," Safety Integrity Level (SIL) certification.

¹⁴ Digital I&C Interim Staff Guidance (ISG)-06, "Licensing Process", dated January 19, 2011 (ADAMS Accession No. ML110140103).

staff will begin to evaluate the 2018 version for incorporation by reference into our regulations under 10 CFR 50.55a. The staff will continue to engage the Commission as appropriate.

For MP 4B, consistent with SRM-SECY-15-0106 and the IAP, the staff has recently begun broader strategic activities for long-term improvements to the regulatory infrastructure. The staff plans to identify the issues, and implement plans and activities aimed at resolving the issues. Examples of some issues include identification of improvements in the technical basis and regulatory criteria used in evaluation of digital systems, assessment of the basis for a safety assurance determination in a licensing submission, and adequacy of the regulatory infrastructure. The staff expects to develop additional detailed modernization plans by the end of Summer 2018.

Policy Issues for Commission Consideration

The staff has determined that there is one potential policy issue regarding CCF that warrants Commission consideration.

Potential Policy Issue on CCF

The NRC's current position on CCF in licensing is guided by SRM-SECY-93-087 and Branch Technical Position (BTP) 7-19.¹⁵ The position provides a means to ensure adequate defense in depth against potential CCF for safety-related digital systems (in both new and operating reactors). In 2009, the staff examined the technical literature, knowledge of digital I&C failure modes, and reliability data, and made the determination in SECY-09-0061¹⁶ that CCF should still be considered a credible failure source in digital systems. For the reviews of licensing applications, the current staff position in BTP 7-19 allows the use of sufficient internal diversity in the design or complete testing of systems to eliminate software CCF from further consideration. Alternately, an applicant can perform a defense-in-depth and diversity analysis for a beyond-design basis CCF event in digital systems, concurrent with an accident, to demonstrate adequate coping of the plant (using best estimates) within accident design limits. This analysis can credit operator actions and/or the use of diverse instrumentation and controls to maintain protection of the plant.

As part of its current policy review, the staff will evaluate up-to-date information and evaluation techniques regarding the credibility and likelihood of CCF and will examine potential graded approaches for demonstrating sufficient defense-in-depth against potential CCFs in safety-related digital systems. The staff intends to provide a policy paper on this issue to the Commission by June 2018.

External Stakeholder Interaction

In the development of the strategy and associated action plan revisions, the staff engaged with external stakeholders via public meetings and workshops. Participants included members of relevant IEEE standards setting committees, digital I&C vendors, licensees, and other external stakeholders. The staff issued a draft revision of the integrated action plan for external

¹⁵ SRP-BTP-7-19, "Guidance for Evaluation of Diversity and Defense-in-Depth in Digital Computer-Based Instrumentation and Control Systems" dated March 2007 (ADAMS Accession No. ML070550072).

¹⁶ SECY-09-0061, "Status of the Nuclear Regulatory Commission Staff Efforts to Improve the Predictability and Effectiveness of Digital Instrumentation and Control Reviews," dated April 14, 2009 (ADAMS Accession No. ML090790409).

stakeholder review and comment. Additionally, the Digital I&C Steering Committee met with the NEI-led industry digital I&C working group to discuss the action plan. A summary listing the specific interactions with stakeholders can be found in the Enclosure.

CONCLUSION:

Implementation of the IAP has resulted in development of several guidance documents which will support future digital I&C upgrades. The staff has internally coordinated the positions in the IAP. The staff is also routinely communicating with external stakeholders to ensure NRC requirements and guidance do not pose an unnecessary impediment to advancement in nuclear applications of digital technology. Consistent with Commission direction, future staff updates on the status of the IAP will be provided to the Commission annually.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objections.

/RA/

Victor M. McCree
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for Operations

Enclosure:
As stated

SUBJECT: UPDATE REGARDING THE INTEGRATED STRATEGY TO MODERNIZE THE
NUCLEAR REGULATORY COMMISSION'S DIGITAL INSTRUMENTATION AND
CONTROL REGULATORY INFRASTRUCTURE DATED: OCTOBER 25, 2017.

SRM-S16-0070-1

ADAMS Accession No.: ML17277B542

*via e-mail

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Overview of Public and Stakeholder Interactions

Action	Date
SECY-15-0106 Request for incorporation of IEEE 603-2009 submitted to Commission	August 2015
Commission Briefing	December 2015
SRM-SECY-15-0106 Incorporation of IEEE 603-2009 (not approved)	February 2016
Public Meeting - Common Cause Failure	March 2016
Draft NEI 96-07 Appendix D submitted to NRC for review (50.59)	April 2016
Public Meeting - 10 CFR 50.59	April 2016
SECY-16-0070 Integrated Action Plan submitted to Commission	May 2016
Commission Assistant Brief	June 2016
Public Meeting - Common Cause Failure	June 2016
Public Meeting - 10 CFR 50.59	June 2016
Common Cause Failure NEI Table Top	July 2016
Common Cause Failure NEI Table Top	August 2016
Public Meeting - 10 CFR 50.59	August 2016
Public Meeting - Common Cause Failure	September 2016
SRM-SECY-16-0070 Integrated Action Plan approved	October 2016
Public Meeting - 10 CFR 50.59	November 2016
NEI 16-16 Draft 1 submission to NRC for review (CCF)	December 2016
Public Meeting - Common Cause Failure	December 2016
Public Meeting - 10 CFR 50.59	December 2016
Public Meeting - 10 CFR 50.59	January 2017
Commission Assistant Brief	January 2017
Public Meeting - Common Cause Failure	February 2017
Public Meeting - Commercial Grade Dedication	February 2017
Public Meeting - IAP Revision 1	February 2017
Public Meeting - Regulatory Infrastructure: Tactical Modernization	February 2017
Public Meeting - 10 CFR 50.59	March 2017
Public Meeting - Common Cause Failure	March 2017
Public Meeting - Draft Regulatory Issue Summary	March 2017
Public Meeting - Common Cause Failure	April 2017
Public Meeting - Regulatory Infrastructure: Tactical Modernization	April 2017
Public Meeting - 10 CFR 50.59	April 2017
Public Meeting - Draft Regulatory Issue Summary	April 2017
NEI 16-16 Draft 2 submission to NRC for review (CCF)	May 2017
Public Meeting - ACRS Subcommittee Briefing	May 2017
Public Meeting - Draft Regulatory Issue Summary (Tabletop Exercise)	May 2017
Public Meeting - Commercial Grade Dedication / Regulatory Infrastructure	June 2017

ENCLOSURE

Action	Date
Public Meeting - Regulatory Infrastructure: Tactical Modernization	June 2017
All NRC Instrumentation and Controls Stakeholders Meeting	June 2017
NEI Digital Instrumentation and Controls Working Group Meeting (Management Exchange)	June 2017
Public Meeting - 10 CFR 50.59	June 2017
ANS NPIC-HMIT and ISA-POWID Annual Meetings	June 2017
Issued for Public Comment: Draft Regulatory Issue Summary	June 2017
Public Meeting - Regulatory Infrastructure: Tactical Modernization	July 2017
Public Meeting - 10 CFR 50.59	August 2017
Public Meeting - Draft Regulatory Issue Summary	August 2017
Public Meeting - Regulatory Infrastructure: Tactical Modernization	August 2017
Public Meeting - 10 CFR 50.59	September 2017
Public Meeting - Regulatory Infrastructure: Tactical Modernization	September 2017