Digital I&C Integrated Action Plan Revision 3

Status & Update Plans

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IAP Public Meeting

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Agenda

- Introductions/Opening
- Status & Proposed Updates to Integrated Action Plan (IAP) Modernization Plans (MPs) #1 - #4A
- NRC Staff Considerations for Possible Broader Modernization Efforts under MP #4B
- Input from Stakeholders on Needs and Priorities
- Comments from the Public
- Action Item Summary/Next Steps

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Commission Direction Informing the IAP

(From Staff Requirements Memoranda [SRM] for SECY-15-0106 & SECY-16-0070)

- Develop an integrated strategy under the oversight of a senior management steering committee to modernize the DI&C regulatory infrastructure
- Engage stakeholders to identify common priorities, problems, and potential solutions to address them
- New or revised requirements should be performance-based, rather than prescriptive
- Focus on acceptable approaches to comply with the requirements
- Requirements should be technology-neutral; Guidance for specific technologies should be tailored if necessary
- Same requirements should apply for operating and new reactors
- Evaluate potential policy issues; present any issues that are ripe for consideration to Commission prior to any rulemaking

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Premise for NRC Digital I&C Activities

In general, implementation of digital I&C technology can provide dependability and safety benefits. Notably, digital technology can be designed to provide continuous diagnostic information to plant operators on the integrity of its internal systems operation and its availability. However, implementation of digital I&C technology may introduce potential hazards such as software common cause failure (CCF) or failures introduced as result of interconnectivity.

NRC Focus

- Issuance of regulatory products which support near-term upgrade and initial licensing needs identified by industry:
  - Clear expectations for regulatory acceptability of modifications performed under 10 CFR 50.59
  - Clear guidance and expedited approval of license amendment requests
  - Clear expectations for applicants for new reactor licenses and new digital I&C platforms

Status & Plans for IAP Revision 3

MP	Status	Path Forward to be documented in IAP Rev. 3
MP#1A (RIS 2002-22, Supplement 1)	RIS issued on May 31, 2018.	Staff will continue to support workshops and develop training materials for inspection staff (See MP#1D below). MP#1A will be relocated into a new Appendix in the IAP titled, "Completed Work."
MP#1B (NEI 16-16)	This activity is ongoing.	Awaiting industry submittal of revised NEI 16-16 regarding design attributes for addressing CCF, expected late Fall or Winter, 2018. This guidance is an NRC priority and NRC may initiate it's own guidance if revised NEI 16-16 is not timely submitted.

Status & Plans for IAP Revision 3

MP	Status	Path Forward to be documented in IAP Rev. 3
MP#1C	CCF Info SECY Paper to be issued by September 2018	Staff work is nearing completion on SECY paper for ensuring consistent application of policy in SRM/SECY 93-087. MP#1C will be relocated into a new Appendix in the IAP titled, "Completed Work"
MP#1D	Follow-up activities from the issuance of RIS-2002-22, Supplement 1	Relocate the workshop and training activities from MP#1A into a new sub-MP titled, "MP#1D: RIS Workshops"
MP#2 (NEI 96-07 Appendix D)	This activity is ongoing.	NRC Staff and NEI have resumed work after issuance of RIS 2002-22 Supp. 1. Concepts from the RIS to be incorporated and other issues addressed.

Status & Plans for IAP Revision 3

MP	Status	Path Forward to be documented in IAP Rev. 3
MP#3	This activity is ongoing.	Staff/NEI/EPRI work to continue work to identify appropriate, effective, and consistent certification process.
MP#4A-1 (ISG-06)	This activity is ongoing.	Draft ISG Rev 2 to be issued by July 31, 2018, and targeted for issuance as final at end of 2018.
MP#4A-2 (BTP 7-19 Update) **(New)**	Not Started	Add new sub-MP under MP#4A. The activities of BTP 7-19 (same as Appendix A, Item (xi)) will be transitioned here.
MP#4A-3 (50.59 Inspection Training and Guidance) **(New)**	Not Started	Add new sub-MP under MP#4A. This activity will be started after the completion of MP#2.

Status & Plans for IAP Revision 3

MP	Status	Path Forward to be documented in IAP Rev. 3
MP#4B	This activity is ongoing	Divide MP#4B into three new sub-MPs: • Licensing (MP#4B-1), • Inspection, (MP#4B-2) • Research (MP#4B-3) Appendix A Items (i), and (iii)-(ix) will be incorporated into the scope of MP#4B1 through MP#4B3.

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MP#4B IAP Description Summary

Identify actions needed to implement a streamlined, and agile I&C regulatory infrastructure that will ensure safety and security while effectively addressing larger scale digital I&C upgrades to operating reactors and the I&C designs for new and advanced reactors. The outcome will also improve clarity regarding the interrelationships between the regulatory issues, the priorities and sequencing of further improvements, and the supporting research that is needed to accomplish such improvements to meet both objectives.
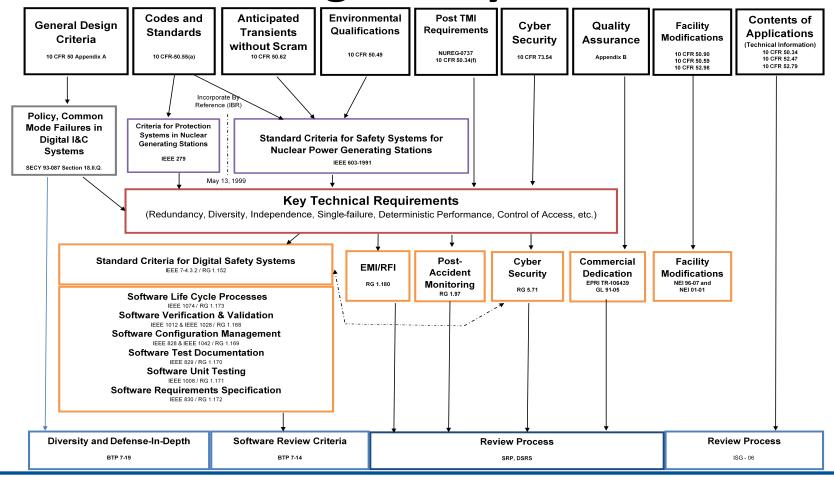
Objectives of MP#4B

An improved regulatory infrastructure that integrates performance-based and technology-neutral safety engineering concepts, to assist stakeholders in demonstrating the safety and security of I&C systems, and to assist the NRC staff in performing regulatory reviews and I&C system inspections in an efficient, effective, consistent, and risk-informed manner.

Starting Point:
Baseline Regulatory Framework

General Design Criteria	Codes and Standards	Anticipated Transients without Scram	Environmental Qualifications	Post TMI Requirements	Cyber Security	Quality Assurance	Facility Modifications	Contents of Applications (Technical Information)
10 CFR 50 Appendix A	10 CFR-50.55(a)	10 CFR 50.62	10 CFR 50.49	NUREG-0737 10 CFR 50.34(f)	10 CFR 73.54	Appendix B	10 CFR 50.90 10 CFR 50.59 10 CFR 52.98	10 CFR 50.34 10 CFR 52.47 10 CFR 52.79

Incorporate By Reference (IBR)

Policy, Common Mode Failures in Digital I&C Systems
SECY 93-087 Section 18.II.Q.

Criteria for Protection Systems in Nuclear Generating Stations
IEEE 279

Standard Criteria for Safety Systems for Nuclear Power Generating Stations
IEEE 603-1991

May 13, 1999

Key Technical Requirements
(Redundancy, Diversity, Independence, Single-failure, Deterministic Performance, Control of Access, etc.)

Standard Criteria for Digital Safety Systems
IEEE 7-4.3.2 / RG 1.152

Software Life Cycle Processes
IEEE 1074 / RG 1.173
Software Verification & Validation
IEEE 1012 & IEEE 1028 / RG 1.168
Software Configuration Management
IEEE 828 & IEEE 1042 / RG 1.169
Software Test Documentation
IEEE 829 / RG 1.170
Software Unit Testing
IEEE 1008 / RG 1.171
Software Requirements Specification
IEEE 830 / RG 1.172

EMI/RFI	Post-Accident Monitoring	Cyber Security	Commercial Dedication	Facility Modifications
RG 1.180	RG 1.97	RG 5.71	EPRI TR-106439 GL 91-05	NEI 96-07 and NEI 01-01

Diversity and Defense-In-Depth	Software Review Criteria	Review Process	Review Process
BTP 7-19	BTP 7-14	SRP, DSRS	ISG - 06

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Planned Scope of MP#4B Assessment

- Three standards IBR in 10 CFR 50.55a(h):
  - ➢ IEEE Std 279-1968, IEEE Std 279-1971, and IEEE Std 603-1991
- SRP Chapter 7
  - ➢ 27 RGs referenced in SRP Chapter 7 that endorses 32 standards
  - ➢ 17 BTPs referenced in SRP Chapter 7
  - ➢ 3 Generic Communications referenced in SRP Chapter 7
  - ➢ 14 NUREGs referenced in SRP Chapter 7
  - ➢ 52 other documents referenced in SRP Chapter 7 (e.g., EPRI Reports, IEEE, and ISO stds not endorsed)

- NuScale DSRS Chapter 7
  - ➢ 19 RGs in DSRS Chapter 7 that endorses 17 standards
  - ➢ 3 Generic Communications referenced in DSRS Chapter 7
  - ➢ 7 NUREGs referenced in DSRS Chapter 7

- Other Relevant Documents
  - ➢ 7 ISGs (most of them superseded)
  - ➢ 27 NUREGs
  - ➢ 11 SECY Papers
  - ➢ 14 Topical Reports
  - ➢ 3 RILs

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Previously Proposed IAP Appendix A Items for Longer-term Modernization

App. A Item	Add/Drop/ Relocate	Path Forward
Item (i): Improved Licensing Review Guidance for Digital I&C Systems	Drop part/ Relocate part	<u>Drop</u>: This tactical activity was addressed by MP#4A-1 (i.e. ISG-06, Rev 2). The strategic portion for how ISG-06 will be transitioned to durable guidance would be covered under MP#4B-1. <u>Relocate</u>: The "Cyber Security Evaluation in Design Reviews," will be relocated to a new activity under MP#4B titled, "Guidance on Architecture Measures"

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Previously Proposed IAP Appendix A Items for Longer-term Modernization

App. A Item	Add/Drop /Relocate	Path Forward
Item (ii): Improvement in Regulatory Consistency from Licensing to Inspection	Relocate	Relocate this item into new MP#4A-3, "50.59 Inspection Training and Guidance."
Item (iii): IBR of IEEE Std 603-2018	Relocate	Pending the outcome of SRM to SECY-18-0060 (Transformation Team Paper) Relocate this item into MP#4B-1.
Item (iv): Approval of Endorsement of IEEE Standard 7-4.3.2 into an RG	Relocate	Relocate this item into MP#4B-3. This item will be led by RES's Regulatory Guide Branch.

Previously Proposed IAP Appendix A Items for Longer-term Modernization

App. A Item	Add/Drop/ Relocate	Path Forward
Item (v): Embedded Digital Devices (EDDs)	Relocate	This item will be transitioned into MP#4B-3. This item was started by a UNR on EDDs. (See Slide 20 below)
Item (vi): Holistic Review of the Regulatory Infrastructure	Relocate	This item will be transitioned into MP#4B1-MP#4B-3.
Item (vii): Improved Guidance for Evaluation of Highly-Integrated Digital Technologies	Relocate	This item will be transitioned into MP#4B-1 and MP#4B-3.

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Previously Proposed IAP Appendix A Items for Longer-term Modernization

App. A Item	Add/Drop/Relocate	Path Forward
Item (viii): Consistency and Integration of Multiple Regulatory Guidance Documents	Relocate	This item will be transitioned into MP#4B-1.
Item (ix): Improved Guidance for Evaluation of Proposed Alternatives to Regulatory Guides and Standards	Relocate	This item will be transitioned into MP#4B-1.
Item (x): Improved Process for Digital I&C Topical Report Evaluations	Drop	This item will be dropped from the IAP.

Previously Proposed IAP Appendix A Items for Longer-term Modernization

App. A Item	Add/Drop/Relocate	Path Forward
Item (xi): Improvements to SRP BTP 7-19	Relocate	This activity will be transitioned into MP#4A-3

New Research Activities

Item	Description	Path Forward
Risk-Informed Reviews of I&C	The objective of this research is to provide support in developing the technical basis for integrating risk insights into the regulatory framework for I&C systems and components.	This activity will be incorporated into MP#4B-3. A UNR was created to initiate this effort.
Technical Basis and Recommendations to Address CCF	The objective of this research is to develop a technical basis for acceptance criteria for evaluating the CCFs in DI&C systems and components.	This activity will be incorporated into MP#4B-3. A UNR was created to initiate this effort.

New Research Activities

Item	Description	Path Forward
Embedded Digital Devices and Emerging Technology	The objective of this research is to develop a technical basis to support guidance to review (and/or dedicate) EDDs and emerging technologies	This activity will be incorporated into MP#4B-3. A UNR was created to initiate this effort.

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Proposed New Activity to be Considered

Item	Description	Path Forward
Guidance on Architecture Measures	Develop guidance that includes review areas at the overall I&C architecture level, and leverage MDEP DICWG-09, "Common Position on Safety Design Principles and Supporting information for the Overall I&C Architecture."	This activity will be incorporated into MP#4B-3. The "Cyber Security Evaluation in Design Reviews," from IAP Appendix A Item (i) will be relocated into this activity.

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NRC Transformation Team

Maintain an Awareness of SECY 18-0060 Recommendations

- Rulemaking: High-level performance-based I&C safety design principles

- Address future versions of IEEE Std. 603 into regulatory guidance

- Development Processes reviewed under Quality Assurance Program

IAP Schedule

- Issue Revision 3 to IAP: October 2018

- Annual Commission Paper: October 2018

- Commission Meeting: October 2018

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Questions?

Input from Stakeholders on Needs and Priorities

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Backup Slides

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Status Summary

- Making progress on Integrated Action Plan (IAP) activities

- Focused so far on developing regulatory products to support near-term upgrade needs identified by industry

- First implementable result targets lower safety-significant safety-related upgrades under 10 CFR 50.59 (i.e., RIS supplement) and work on NEI 96-07, Appendix D

- Next priorities – revise licensing process (ISG-06, Rev. 2) and issuance CCF Info SECY Paper

- Continue work on CCF Guidance and Digital Equipment Acceptance to support CGD process

- Staff is increasing its efforts under MP#4B to identify and pursue broader modernization of the regulatory infrastructure (initiated in October 2017)

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MP#1C Implementing Commission Policy on CCF in DI&C

- Staff will update guidance documents to ensure the Commission policy in SRM to SECY-93-087 continues to be consistently applied and address evolving DI&C technologies by better articulating the following principles:
  - Licensees and applicants should continue to address CCFs due to software
  - A D3 analysis for RTS and ESFAS to address CCF concerns continues to be required. This analysis can be either a best estimate (i.e., using realistic assumptions) or a design basis analysis
  - Clarify the use of a graded approach for a D3 analysis for less safety critical systems
  - Clarify the use of alternate means to address CCF concerns
  - Clarify the use of certain design attributes to address CCF concerns

Acronyms

ACRS: Advisory Committee on Reactor Safeguards

APR1400: Advanced Power Reactor 1400

ARS: advanced review standard

BTP: branch technical position

CCF: common cause failure

CGD: commercial grade dedication

DI&C: digital instrumentation and control

DRS: design review standard

DSRS: design-specific review standard

IEC: International Electrotechnical Commission

EDD: embedded digital device

ET: emerging technology

EPRI: Electric Power Research Institute

ESFAS: engineered safety features actuation system

FAT: factory acceptance test

GDC: general design criteria

HW: hardware

IAP: integrated action plan

I&C: instrumentation and control

IBR: incorporated by reference

IEEE: Institute of Electrical and Electronics Engineers

Acronyms

ISG: interim staff guidance

ISO: International Organization For Standardization

LAR: licensee amendment request

MP: modernization plan

NEI: Nuclear Energy Institute

NRC: U.S. Nuclear Regulatory Commission

QA: quality assurance

RG: regulatory guides

RIL: research information letter

RIS: Regulatory Information Summary

RPS: reactor protection system

SAT: site acceptance test

SIL: safety integrity level

SRM: Staff Requirements Memorandum

Std: standard

SW: software

TR: technical report

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