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Presentation of Comment Resolution
NRC REGULATORY ISSUE SUMMARY 2016-##
EMBEDDED DIGITAL DEVICES IN SAFETY-RELATED SYSTEMS

April 06, 2016

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Webinar Agenda

- Objectives of this Webinar
- Background
- Introduction of Embedded Digital Device (EDD) Regulatory Issue Summary (RIS)
- Addressing Public Comments
- Path Forward and Summary

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Objectives of This Webinar

- Highlight how public comments were resolved in advance of issuing the EDD RIS
- Introduce what to expect in the EDD RIS, key points, and how public comments help structure the EDD RIS
- Not another formal public comment period but point out any inaccuracies
- Briefly explain relationship of EDD RIS to future digital I&C regulatory activities

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Where to find EDD RIS and Table of Public Comments and NRC Staff Response (TABLE)

- Documents are located in the NRC Agencywide Document Access and Management System (ADAMS); ADAMS Accession numbers below begin with **ML**

- Temporary EDD RIS
  - **ML16091A141** - Public Draft RIS 2016-XX to Support April 6, 2016 Public Meeting.

- Embedded Digital Device (EDD) RIS
  - RIS Location when officially issued: **ML15118A015**

- Public Comment Resolution
  - **ML15118A012 -** Table of Public Comments and NRC Staff Response on the draft Regulatory Issue Summary 2014-XX Embedded Digital Devices in Safety-Related Systems Issued June 05, 2014

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Background

- Nuclear facilities are increasing their use and reliance on digital technology
- RIS issued for public comment followed by a public meeting 2013
- RIS revised in response to public comments with and draft out for comment June 5, 2014
- Public Comments received and EDD RIS updated in late 2014
- Response to ALL the public comments received contained in a document titled: ***Table of Public Comments and NRC Staff Response*** (TABLE)
- EDD RIS influenced by several public meetings and desire to better reflect an understanding of industry concerns

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PURPOSE of EDD RIS

Clarify the NRC's technical position on existing regulatory requirements for the quality and reliability of safety-related equipment with embedded digital devices

Heighten awareness there may be potential safety issues from the use of equipment with EDD used in safety-related systems sometimes without the devices having been explicitly identified in procurement documentation

Acknowledge the benefits of the application of digital technology in nuclear facilities

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Scope of EDD RIS

- Scope limited to equipment, including instrumentation and controls (I&C), in safety-related systems
- No specific action or response required by this RIS
- Regulatory issues associated with equipment with EDDs related to common defense and security under
  - 10 CFR Part 73, "Physical Protection of Plants and Materials," and
  - 10 CFR Part 74, "Material Control and Accounting of Special Nuclear Material"
  - Are BEYOND THE SCOPE of this EDD RIS, and
  - Counterfeit and suspect parts beyond the scope of this RIS
- Two separate nuclear facility sectors used to address regulatory differences between these two sectors.
  - Nuclear reactor sector (subsection sectors for power and non-power reactors)
  - Fuel cycle facility sector.

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RIS Addresses Three Key Points

(1) The Need To Ensure Adequate Quality and Reliability of Embedded Digital Devices that Exist in Actuation Equipment

(2) The Need To Address Potential Plant Vulnerabilities to CCFs

(3) The Need To Ensure Sufficient Procurement Planning and Material Control To Identify, Review, Test, and Control Embedded Digital Devices

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RIS Discusses Three General Categories of I&C for Nuclear Reactors

- (1) The protection systems and control systems (sense and command features)
- (2) Data communications
- (3) Certain other nuclear facility equipment (actuated equipment or execute features)

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Public Comments Addressed by a Task Working Group (TWG)

- TWG members:
  - Number of years with NRC
  - Mainly from I&C disciplines
  - Have significant nuclear plant or nuclear industry experience

- TWG members represented different facilities and NRC offices:
  - New reactors – Office of New Reactors (NRO)
  - Operating nuclear power reactors – Office of Nuclear Reactor Regulation (NRR)
  - Non-power reactors - Office of Nuclear Reactor Regulation (NRR)
  - Fuel cycle facilities – Office of Nuclear Material Safety and Safeguards (NMSS)
  - Cyber and nuclear facility security – Office of Nuclear Security and Incident Response(NSIR)
  - NRC research – Office of Nuclear Research (RES)

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Public Comments in Response to June 5, 2014 Draft EDD RIS

- Received 10 sets of public comments
- Totaled of 100 comments from
  - NEI
  - EPRI
  - Utilities
  - Universities
  - Consultants
- Selected major similar comments have been grouped together, paraphrased, and summarized, and are discussed in the following slides

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Notable Public Comments (Ambiguous message in Safety/non-safety)

- INTENT Section narrows the scope of the RIS to safety-related equipment and then broadens the underlying concern to “important to safety” and non-safety equipment giving an ambiguous message.
  - *Majority of comments suggested deleting non-safety systems*
  - *Staff Removed reference to non-safety and important to safety*
  - *Staff acknowledges importance of CCF in non-safety systems*
  - *Non-safety would have added significant complexity to RIS*

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Notable Public Comments (EDD Definition)

- RIS attempting to define as "digital devices" a range of components not already defined in IEEE Standards and could broaden consideration of certain electronic components not intended to be EDDs
  - *RIS Definition emphasizes use of software, software-developed firmware, or software-developed programmable logic*
  - *Examples of EDDs provided (e.g., FPGAs, PLDs, CPLDs, ASICs, etc.)*

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Notable Public Comments (Increase of Critical Digital Assets)

- Broad EDD definition could lead the licensee to scope more components as Critical Digital Assets (CDA) than is necessary
  - *Simplified RIS to state cyber security issues are beyond the scope of this RIS*
  - *Does the equipment with EDD pose a potential threat? Then equipment is a Critical Digital Asset (CDA)*
  - *RIS notes merely classifying components as "digital" would not likely force licensees to classify components as CDAs*

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Notable Public Comments (Over-Emphasis on Diversity)

- An over-emphasis on diversity as only prevention or mitigation against a potential CCF
  - *RIS reflects our current position such as GDC 22 and BTP 7-19*
  - *Comment resolution discusses points of BTP 7-19*

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Notable Public Comments (CCF Causes)

- Software CCF is only a programmer error and NRC ignoring other causes as inadequate specifications.
  - *EDD RIS states that EDD defects include more than just programmer errors.*
  - *Also include specifications errors and omissions that cause the hardware and software in some way to not accurately reflect the environment and process.*

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Notable Public Comments (Provide Additional CCF Guidance)

- Public comments recommended additional guidance on various CCF related topics (e.g., more details on defensive measures, procurement,)
  - *EDD RIS based on current NRC regulations, policy, and guidance*
  - *It is not the function of a Regulatory Issue Summary to develop new guidance*

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Notable Public Comments (Non-Power Reactor Guidance)

- Is NRC trying to apply power regulations and guidance to non-power reactors (research and test reactors)?
  - *RIS subdivides Reactor Sector subsections to separately address regulations and guidance specifically for non-power reactors*
  - *Where appropriate, RIS pointed out some references not directly applicable to non-power reactors that could be still be helpful*

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Notable Public Comments (Fuel Cycle Facilities)

- Recommendation to expand the scope of the RIS by adding cyber-security related components
  - *RIS is applicable to safety-related systems (as defined in the RIS)*
  - *Common defense and security applications are beyond the scope*

- Concerns that NRC has set new expectations for the10 CFR 70.72 change process as applied to EDDs
  - *The RIS is not setting any new expectations*
  - *Raising awareness that the process may be used to make changes in safety-related systems with EDDs in a facility*
  - *Reminding addresses of the need to adequately address any impact EDDs have on the quality and reliability of safety-related systems*

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Notable Public Comments (Many Helpful Recommendations)

- Public comments pointed out specific text for further clarification, suggested additional references, added general phrasing improvements, and provided other helpful recommendations
  - *These were incorporated into the EDD RIS*
  - *THANKS*

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Path Forward

- Hold webinar (April 6, 2016) to highlight how public comments were resolved in advance of issuing the EDD RIS
- Use Federal Register Notice to officially Issue the EDD RIS and TABLE as public documents in April, 2016
- RIS can be updated if warranted by future changes in NRC regulations, policy, and guidance

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Summary

- Again, the objective of this Webinar has been to highlight how the NRC staff resolved public comments
- Can adjust EDD RIS for any factual inaccuracies
- Will try to answer any clarifying questions at this time

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Acronym List

- Application specific integrated circuits (ASIC)
- Branch technical position (BTP)
- Common cause failure (CCF)
- Critical digital asset (CDA)
- Complex programmable logic device (CPLD)
- Embedded digital Device (EDD)
- Electrical Power Research Institute (EPRI)
- Electromagnetic Interference (EMI)
- Field programmable gate array (FPGA)
- Instrumentation and Controls (I&C)
- Interim Staff Guidance (ISG)
- Nuclear Energy Institute (NEI)
- Nuclear Regulatory Commission (NRC)
- Programmable logic device (PLD)
- Regulatory Issue Summary (RIS)
- Task working group (TWG)

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Time for Public Questions and Comments

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Additional Slides If Needed for Q&A

(Not part of regular Webinar program)

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EDD Definition as used in this RIS

- *For the purposes of this RIS, an embedded digital device is defined as a component consisting of one or more digital electronic parts that use software, software-developed firmware, or software-developed programmable logic and that is integrated into equipment to implement one or more system requirements*
- The NRC does not accept EDDs as strictly hardware components.
- Examples of EDDs provided (e.g., FPGAs, PLDs, CPLDs, ASICs, etc.)

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Benefits of Digital Technology in Nuclear Facilities

The NRC understands that licensees may use digital technology, including equipment and components containing EDDs, with the intent to:

- increase accuracy, speed, and quantity of transmitted data
- reduce operating and maintenance cost, and help with obsolescence issues
- improve equipment reliability, fault detection, and procurement
- add new or additional functionality, especially in the human-machine interface

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RIS States Potential Safety Concerns

- Use of safety-related equipment with EDDs may:
  - Potentially increase a facility's vulnerability to hazards from undetected EDD defects [e.g., common-cause failure (CCF)]
  - Potentially increase susceptibility to electromagnetic interference (EMI)
  - Create other potential hazards from the in-service environment.

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Key Statement

- It is important for licensees and applicants to ensure that the digital technology introduced in nuclear facility safety-related equipment is identified, reviewed, controlled, and evaluated for the potential effects of hardware and software defects in accordance with regulations and guidance applicable for the specific nuclear facility