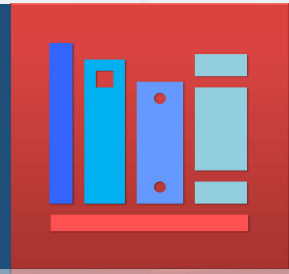
Regulatory Guidance Framework for IEEE Standards



- **Moderator:** Tania Martinez Navedo, Acting Deputy Division Director, NRR/DEX

- **Panelists/Speakers:**
  - Sheila Ray (NRC)
  - Robert Konnik (IEEE)
  - Ismael Garcia (NRC)
  - Rufino Ayala (IEEE)
  - Gabe Taylor (NRC)

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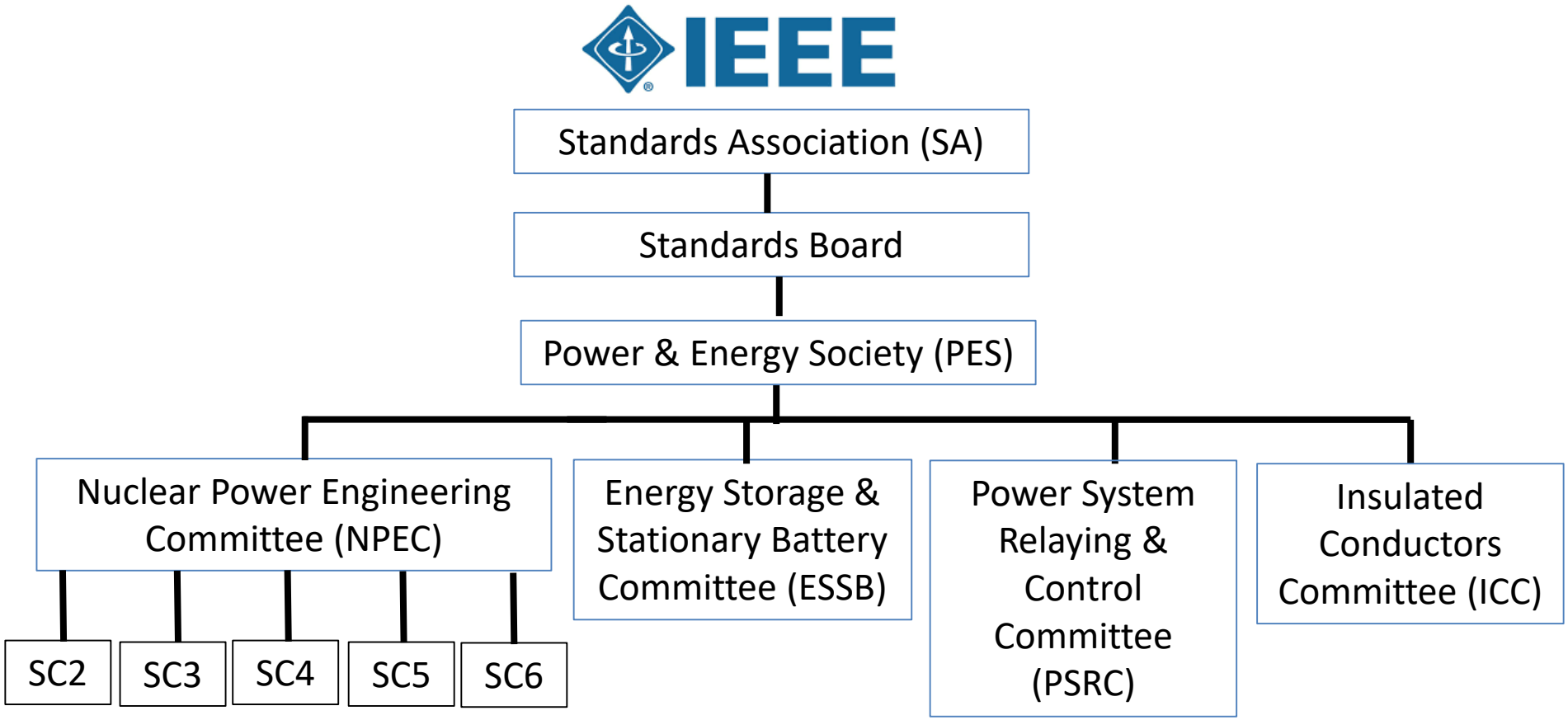
United States Nuclear Regulatory Commission
Protecting People and the Environment

Regulatory Guidance Framework for IEEE Electrical Standards

Sheila Ray, P.E.
NRR/DEX/EEEB
October 13, 2020

Topics of Discussion

- Status of Significant Regulatory Guides
- Regulatory Framework for ICC Standards
- Feedback on Framework of Regulatory Guides for electrical standards
  - Are there any inconsistencies?
  - Are there any improvements that can be made?


IEEE
Standards Association (SA)
Standards Board
Power & Energy Society (PES)
Nuclear Power Engineering Committee (NPEC)
SC2
SC3
SC4
SC5
SC6
Energy Storage & Stationary Battery Committee (ESSB)
Power System Relaying & Control Committee (PSRC)
Insulated Conductors Committee (ICC)

Status of Significant Regulatory Guides

- RG 1.89 (60780-323) – expected to have draft out for public comment by the end of the 1st quarter of FY2021
- Status of RG to endorse IEEE Std. 741 – expected to have draft out for public comment before end of Jan. 2021
- RG 1.9 (IEEE Stds. 387 & 2420) – expected to have draft out for public comment before end of calendar year 2020
- RG to endorse IEEE 1205 – expected to have draft out for public comment by the end of FY2021
- RG to endorse IEEE Std. 1819 – expected to have draft out for public comment by the end of FY2021
- RG to endorse IEEE 352 & 577 on reliability – expected to have draft out for public comment mid-2021

IEC/IEEE Condition Monitoring Standards

- Revise existing RG 1.218 (Condition Monitoring Techniques for Electric Cables Used in Nuclear Power Plants) to endorse IEC 62582 series on condition monitoring methods (Parts 1-6) & 1186 (evaluation of installed cable systems)

Vision & Strategy of IEEE Electrical Standards - ROADMAP

- Focus on the agency mission and regulatory requirements when determining a RG is needed or requires updating.
- Represents a technically viable approach for allowing licensees, manufacturers, vendors, and NRC staff to effectively navigate and use regulatory guidance.
- Prevents the ad hoc approach of generating additional regulatory guidance documents.
- Combine related standards on a technical topic into one RG.
  - Reduced staff hours as compared to updating and maintaining several RGs
  - Reduced costs as compared to updating and maintaining several RGs
  - Technical Efficacy - Generates efficiencies such that industry/users have a one-stop shop on NRC positions on a particular topic
  - Process Efficiency – review process is streamlined for one RG on a technical topic (i.e. one public comment period on a technical topic)
  - Updates to a combined RG endorsing several standards would only be considered when there are significant changes that impact the staff's position or provide additional clarifications
  - Examples:
    - RG. 1.100 (seismic qualification) includes both 60980-344 & C37.98
    - One RG on the design of DC systems to include 946 (design), 1189 (selection of batteries), 1375 (protection), & 2405 (battery chargers), all of which are critical to a DC system design.
- For standards in the early stages of development, NRC action will be determined once early drafts are available to ascertain how the standard fulfills the agency's mission and provides methods to meet regulatory requirements.

Framework of IEEE PES ICC Standards

REGULATIONS

10 CFR Part 50:
GDC 3, GDC 4, GDC 17, GDC 18, 10 CFR 50.34, 10 CFR 50.48, 10 CFR 50.49 , 10 CFR 50.65, 10 CFR 50.69, 10 CFR 50.71, Appendix B, Appendix R

10 CFR Part 52 (New Rx)

Proposed 10 CFR Part 53 (Advanced Rx)

10 CFR Part 54 (License Renewal)

NRC Participation in ICC	
ICC D08W	IEEE 634 – IEEE Standard Cable-Penetration Fire Stop Qualification Test
ICC D05W	IEEE 1185 - IEEE Recommended Practice for Cable Installation in Generating Stations and Industrial Facilities
ICC D06W	IEEE 1428 - IEEE Guide for Installation Methods for Fiber Optic Cables in Electric Power Generating Stations and in Industrial Facilities
ICC D07W	IEEE 1186 - Evaluation of Installed Cable Systems in Nuclear Generating Facilities
ICC D10W & NPEC SC2	IEEE 383 – IEEE Standard for Qualifying Electric Cables and Splices for Nuclear Facilities
ICC D14W	IEEE 422 – IEEE Guide for the Design of Cable Raceway Systems for Electric Generating Facilities/Guide for the Design of Cable Systems
ICC D15W	IEEE 1202 – IEEE Standard for Flame-Propagation Testing of Wire and Cable
ICC D16W & NPEC SC2	IEEE 1682 – IEEE Standard for Qualifying Fiber Optic Cables, Connections, and Optical Fiber Splices for Use in Safety Systems in Nuclear Power Generating Stations
ICC D19W	IEEE 1844 – IEEE Standard Test Procedure for Determining Circuit Integrity Performance of Fire Resistive Cables in Nuclear Facilities
ICC D20W	IEEE 2776 – IEEE Guide for Specifying and Selecting Cables for Nuclear Facilities
ICC F01W	IEEE 400 - IEEE Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems Rated 5 kV and Above
ICC F02W	IEEE 400.1 - IEEE Guide for Field Testing of Laminated Dielectric, Shielded AC Power Cable Systems Rated 5 kV to 500 kV Using High Voltage Direct Current
ICC F03W	IEEE 400.2 - IEEE Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (less than 1 Hz)
ICC F04W	IEEE 400.3 - IEEE Guide for Partial Discharge Testing of Shielded Power Cable Systems in a Field Environment
ICC F05W	IEEE 400.4 - IEEE Guide for Field Testing of Shielded Power Cable Systems Rated 5 kV and Above with Damped Alternating Current (DAC) Voltage
ICC F06W	IEEE 400.5 - IEEE DC Field Testing of Extruded Cable Systems
ICC F12W	IEEE 1234 – Guide for Fault Locating on Shielded Power Cables
ICC A06D	Discussion group on Accelerated Electrical Aging
ICC A14D	Discussion group on Power Cable Standards
ICC D12D	Discussion group on plant life extension
ICC F10D	Discussion Group on Diagnostic Testing of Cable Joints and Terminations

INSULATED CONDUCTORS – ICC

17 documents & 4 discussion groups, 2 existing RGs, 3 proposed RG.

- IEEE 383 (qualification of cables) & IEEE 1682 (qualification of fiber optic cables) are also in IEEE PES NPEC SC2 as joint collaboration amongst IEEE groups. IEEE 690 (design & installation of cable systems for Class 1E circuits) are in IEEE PES NPEC SC4. IEC 62582 series are in IEEE PES NPEC SC2.
- Existing RG 1.189 on fire protection that references 634 (cable penetration fire stop qualification test), 1844 (circuit integrity performance of fire-resistive cables), 1202 (flame-propagation testing) & 383 (qualification of cables) - RG 1.189 revision in progress
- Existing RG 1.211 to endorse IEEE 383 (qualification of cables) – update RG to endorse 383-2015
- Propose 1 RG for IEEE 400 series on fault location & test methods (7 stds – 1234, 400, 400.1, 400.2, 400.3, 400.4, & 400.5)
- Propose 1 new RG on fiber optic cables to endorse 1428 (installation) & 1682 (qualification)
- Propose 1 new RG on design, selection and installation of cables to endorse 422 (design of cable systems), 1185 (cable installation), 690 (design & installation of Cable Systems for Class 1E Circuits), and 2776 (selecting cables)
- Revise existing RG 1.218 (Condition Monitoring Techniques for Electric Cables Used in Nuclear Power Plants) to endorse IEC 62582 series on condition monitoring methods (Parts 1-6) & 1186 (evaluation of installed cable systems)
- Participation in discussion groups for awareness

NRC Staff Representation

- 1 staff member from RES
- 2 staff members from NRR
- 1 staff member from RES to participate in fire protection activities

IEEE SA
STANDARDS ASSOCIATION

IEEE ICC & NPEC NUCLEAR STANDARDS

ROBERT KONNIK

ROBERT KONNIK: CONSULTANT

HTTPS://WWW.LINKEDIN.COM/IN/ROBERT-KONNIK/

Past IEEE ICC Subcommittee D Chair

Incoming Secretary IEEE NPEC

Past Chair NPEC SC2

IEEE 383 Chair

IEEE 60780-323 Vice Chair & Joint Project Team Leader

IEEE 690 Chair

IEEE Senior Member and on Many IEEE Standards WGs

Member of NPEC Conformity Assessment Group

IEEE ICC MISSION STATEMENT

INSULATED CONDUCTORS COMMITTEE

Established 1947

The Insulated Conductors Committee's mission is to continuously improve the fundamental technological understanding, practical application, and safe use of conductors having applied insulation or coverings.

Subcommittee D – Generating Station and Industrial Cable: *Scope*

Subcommittee D is tasked with cable systems for power, control, signal, data, communication, and Fiber optic applications for use in generating stations, substations, industrial facilities, shipboards, military installations, submarines, mining, and transit/locomotive cars. These cables are direct buried, pulled in duct banks, conduits, ducts or wire ways, or installed in trays, air handling plenums, cabinets, enclosures and other non-T&D applications of insulated conductors. Testing and installation guidance for these applications is also within the scope of this group. The group develops standards and guidelines and provides opportunity for technical discussion. Specifically excluded are T&D cables for use on land applications.

IEEE ICC STANDARDS OF INTEREST

D5W – Station Cable Installation Criteria (IEEE1185)

D6W – Installation Methods for Fiber Optic Cables (IEEE 1428)

D7W – Applicability of Method For The Evaluation of Installed Cable Systems (P1186)

D8W – Cable Penetration Fire Stop Qualification Test (IEEE 634)

D10W – Class 1E Cables for Nuclear Plants (IEEE 383) [Joint with SC2]

D11W – Guide on Shielding Practice for Low Voltage Cables (IEEE 1143)

D12D – Plant Life Extension: White Paper to Address EMDA Vol. 5 Cable Issues

D14W – Guide for the Design of Cable Systems (P422)

IEEE ICC STANDARDS OF INTEREST

D15 W - Vertical Tray Flame Test Protocol (IEEE 1202)

D19W – Standard for Testing Fire Resistive Cables (IEEE 1844)

D20W – Guide for Specifying and Selecting Cables (P2776)

F01- 06W – Guide for Field Testing and Evaluation of Shielded Cables, IEEE 400 Series

A16D – Characteristics of EPR Cables

Discussion Group That Frequently Talks About Wet Aging of EPR

IEEE CERTIFICATION OF NUCLEAR EQUIPMENT

The IEEE Conformity Assessment Program (ICAP) is a process designed to ensure high quality; certified parts are used for nuclear applications.

This has been developed to support qualification to IEEE/IEC 6078-323, IEEE/IEC 60980-344 and other related standards.

The EQ Navigator Software (built by Endevor) will allow people to find qualified labs and certified products as well as standardize test plans, reports and site EQ packages that will improve efficiency and overall quality of EQ documentation

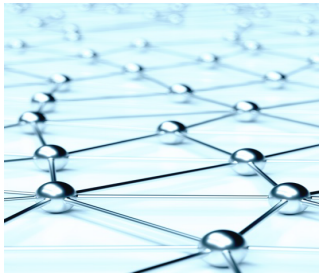
IEEE will audit labs and suppliers to maintain quality

GOALS OF NPEC CONFORMITY PROGRAM

- Class 1E devices used by end users in nuclear power facilities should conform to IEC/IEEE 60780-323 and other related IEEE standards
- Class 1E device conformity should be certified
- Utilize standardized test plan & report templates
- Conformance should be assessed by third party authorized independent experts and/or authorized test laboratories
- Certified devices may bear an IEEE certification mark and listed on a public registry managed by IEEE
- Consolidated software solution to assist in managing qualification process

BENEFITS OF IEEE NUCLEAR STANDARDS CERTIFICATION PROGRAM

Mitigate the uncertainties in 1E electrical equipment procurement



Cost savings on source verification and audits

Limit fraudulent product issues

Independent assessment on compliance to the IEEE/IEC standards

DISCUSSION

IEEE Conformity Assessment Program is a process designed to ensure high quality; certified parts are used for nuclear applications. NRC is encouraged to support and endorse this effort.

I do not know if IEEE ICC has a priority list. I would suggest:

IEEE 1844 As Allowed Method to Wrap Systems For Appendix R (RG 1.189)

IEEE P1186 on Applicability of Methods for the Evaluation of Installed Cable

May be out in one or two years

IEEE 1202 is supposed to be revised within 2 years

DRAFT APPROACH FOR A NEW REGULATORY GUIDANCE INFRASTRUCTURE FOR DIGITAL INSTRUMENTATION AND CONTROL (I&C)

Ismael Garcia

NRC Standards Forum

October 13, 2020

U.S.NRC
United States Nuclear Regulatory Commission
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Background

- NRC continues to strive to improve the clarity and cohesiveness of the I&C regulatory infrastructure.
- While the NRC staff has focused to date on tactical improvements, it is now transitioning to modernizing and streamlining the overall I&C regulatory infrastructure.
- As a first step, the NRC staff developed a draft approach for streamlining the I&C Regulatory Guide (RG) infrastructure framework that was discussed during a public meeting held on April 28, 2020.

Approach for a New I&C Regulatory Guide Infrastructure Framework

Figure 1, “DRAFT Approach for a New I&C Regulatory Guide Infrastructure Framework” - See attachment to meeting notice

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Highest NRC Priority Areas

- **RG 1.153 – I&C Safety Criteria**
  - Update to endorse IEEE 603-2018
- **RG 1.152 – Criteria for Computers**
  - Update to endorse IEEE 7-4.3.2-2016 and retire ISG-04 for digital communication systems
- **RG 1.168 – Software V&V**
  - Assess graded-approach alternatives for the specified software integrity level guidance in IEEE-1012-2016
  - Assess the feasibility of consolidating criteria in RGs 1.168 through 1.173 for a more efficient demonstration of software quality

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Next Steps

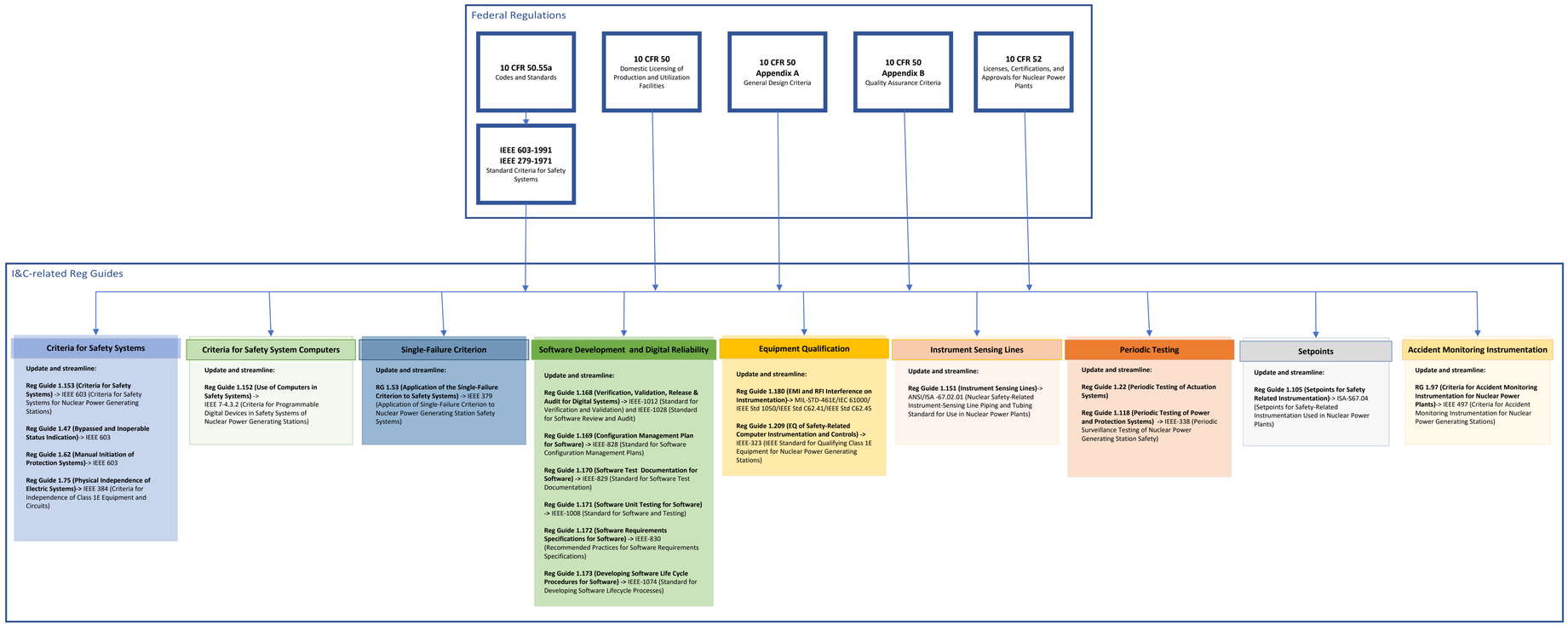
- Finalize the new I&C RG infrastructure framework.

- Implement plans for updating I&C regulatory guidance.

References

- [1] U.S. NRC, "Summary of the April 28th, 2020, Category 2, Public Meeting via Skype to Discuss the Draft Approach for a New Regulatory Guidance Infrastructure for Digital Instrumentation and Control (I&C)," May 2020, (ADAMS Accession No. ML20125A344).
- [2] U.S. NRC, SECY 19-0112, "Annual Update on the Integrated Strategy to Modernize the U.S. Nuclear Regulatory Commission's Digital Instrument and Control Regulatory Infrastructure," November 2019, (ADAMS Accession No. ML19261B629).
- [3] U.S. NRC, "Final Report for the Strategic Assessment of the Digital Instrumentation and Control Regulatory Infrastructure," December 2019, (ADAMS Accession No. ML19351D933).
- [4] U.S. NRC, Figure 1 "DRAFT Approach for a New I&C Regulatory Guidance Infrastructure" (ADAMS Accession No. ML20100J219).
- [5] U.S. NRC, Regulatory Guidance documents available via: https://www.nrc.gov/reading-rm/doc-collections/#reg.

Figure 1 DRAFT Approach for a New I&C Regulatory Guidance Infrastructure



Notes:

(1) An evaluation would be required to assess the technical feasibility of updating/streamlining the regulatory guides shown in the figure, including the potential consolidation of guidance documents sharing a common topic.

(2) While not shown in the figure, the draft approach for a new I&C regulatory guidance infrastructure allows for incorporating, as appropriate, the current set of digital I&C interim guidance into durable I&C regulatory guidance. For example, DI&C-ISG-04 (Highly Integrated Control Rooms & Digital Communication Systems) could be retired by revising Reg Guide 1.152 to endorse IEEE 7-4.3.2-2016, which captures the information from this interim staff guidance document.

(3) For the development of new standards, as well as the need to endorse IEC standards, an evaluation would be required to determine if these can be endorsed via existing regulatory guides thus avoiding the need for developing new ones.

Perspectives on Regulatory Guidance Framework

Rufino Ayala
IEEE NPEC SC-6 Chair

Outline

- Short Version
- Feedback on Draft Approach
- Timelines
- NRC Participation

Short Version

- Updating and streamlining regulatory guides is a good approach
- Decisions on IEEE 1012 should rise to the top
- NRC lags too far behind in endorsement in certain areas.
- NRC Periodic Reviews are helpful but need something in between
- The Regulatory Guide website could be enhanced
- Excellent NRC participation within SC-6 and hope their efforts continue to be supported

Feedback on Draft Approach

- Support NRC's effort and approach [1]
  - Current draft approach looks good
  - Consider adding joint-logo standard on spent fuel pool instrumentation to "Accident Monitoring Instrumentation" bucket
- Highest Value in NRC's Highest Priority Areas
  - Software V&V
  - IEEE 1012

Timeline

- Based on IEEE process, standards continuously incorporate needed changes or enhancements from participating vendors, utilities, and regulators.
- Delays in-between Regulatory Guide revisions
  - Periodic Reviews very useful
  - Enhance RG website to provide NRC status on consideration of new standard:
    - Under Review
    - Considered with No Further Actions
    - Considered with Further Actions

Timeline (continued)

Guide Number	Title	Revision Number	Issue Date	Periodic Review	Current Status
1.89	Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants **+ HISTORY**	1	06/1984	Reviewed in 2018 – Revise	In internal agency review. Release for Public Comments mid-2020.

NRC Participation

- NRC participation within SC-6 has been excellent
- Encourage the NRC to continue to support these individuals in their efforts.

References

[1] Figure 1 “DRAFT Approach for a New I&C Regulatory Guidance Infrastructure” (ADAMS Accession No. ML20100J219)

[2] U.S. NRC, Letter to Daryl Harmon, Chair, Dated December 26, 2019 (ADAMS Accession No. ML19352E115)

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NPEC SLIDES FOR REFERENCE

ROBERT KONNIK

IEEE NPEC

Nuclear Power

NPEC is one of the Technical Committees of the IEEE Power & Energy Society (PES).

NPEC scope covers all nuclear power related technical and standards writing activities within the IEEE. NPEC's principal subcommittees cover:

- Equipment Qualification
- Operating, Aging, Maintenance, Testing and Reliability
- Auxiliary Power
- Human Factors and Control Facilities
- Safety Related Systems
- There is also an Administrative Committee

IEEE NPEC STANDARDS OF INTEREST: SC2

2.1 IEEE/IEC 60780-323 Equipment Qualification: RG 1.89 & RG 1.209

2.2 IEEE 334 Type Testing of Motors: RG 1.4

2.3 IEEE 382 Qualification of Actuators: RG 1.73

2.4 IEEE 383 Qualification of Cables and Splices: RG 1.211

2.5 IEEE/IEC 60980-344 Seismic Qualification: RG 1.100

2.6 IEEE C37.98 & C37.105 Seismic Qualification of Relays

2.10 IEEE 627 Qualification of Equipment

IEEE NPEC STANDARDS OF INTEREST: SC2

2.11 IEEE 572 Qualification of Connection Assemblies: RG 1.156

2.13 IEEE 650 Qualification of Battery Chargers and Inverters: RG 1.20

2.14 IEEE 649 Qualification of Motor Control Centers

2.15 IEEE 1682 Qualification of Fiber Optic Cables, et al

2.16 IEEE P2425 EMC Testing

IEEE/IEC 62582 Series on Condition Monitoring (-1 to -6)

IEEE NPEC STANDARDS OF INTEREST: SC3

3.1 IEEE 336 Installation, Inspection, and Testing Requirements: RG 1.30

3.1 IEEE 338 Criteria for Periodic Testing: RG 1.118

3.1 IEEE 1819 Risk-Informed Categorization and Treatment

3.2 IEEE 692 Criteria for Security Systems

3.3 IEEE 352 General Principles of Reliability Analysis

3.3 IEEE 577 Requirements for Reliability Analysis

3.3 IEEE 933 Definition of Reliability Program Plans

3.4 IEEE 1205 Assessing, Monitoring, and Mitigating Aging Effects: RG 1.218

IEEE NPEC STANDARDS OF INTEREST: SC4

IEEE 308 Criteria for Class 1E Power Systems: RG 1.32 & 1.41

IEEE 317 Electric Penetration Assemblies: RG 1.63

IEEE 387 Diesel-Generator Units Applied as Standby Power Supplies: RG 1.9

IEEE 628 Design, Installation, and Qualification of Raceway Systems

IEEE 690 Design and Installation of Cable Systems

IEEE 741 Criteria for the Protection of Class 1E Power Systems and Equipment: RG 1.63

IEEE 742 Bus Voltage Monitoring of the Class 1E Power Systems

IEEE 765 Preferred Power Supply (PPS)

IEEE 833 Protection of Electric Equipment from Water Hazards

IEEE 1290 Motor-Operated Valve (MOV) Motor Application, Protection, Control, and Testing

IEEE 1792 Preferred Power Supply

IEEE 2420 Criteria for Combustion Turbine Generator Units Applied as Standby Power Supplies

IEEE NPEC STANDARDS OF INTEREST: SC5

IEEE 845 Evaluation of Human-System Performance

IEEE 1023 Application of Human Factors Engineering to Systems, Equipment, and Facilities

IEEE 1082 Incorporating Human Action Reliability Analysis

IEEE 1289 Application of Human Factors Engineering in the Design of Computer-Based Monitoring and Control Displays

IEEE 1707 Investigation of Events

IEEE 1786 Human Factors Applications of Computerized Operating Procedure Systems (COPS)

IEEE 2411 Human Factors Engineering Guide for the Validation of System Designs and Integrated Systems Operations

IEEE 2421 Designing and Developing Computer-Based Displays for Monitoring and Control

IEEE NPEC STANDARDS OF INTEREST: SC6

IEEE 7-4.3.2 Criteria for Programmable Digital Devices in Safety Systems: RG 1.62, 1.152, 1.153, 1.209

IEEE 379 Application of the Single-Failure Criterion Safety Systems: RG 1.53

IEEE 384 Criteria for Independence of Class 1E Equipment and Circuits: RG 1.62 & 1.75

IEEE 420 Design and Qualification of Class 1E Control Boards, Panels, and Racks

IEEE 497 Criteria for Accident Monitoring Instrumentation: RG 1.97

IEEE 603 Criteria for Safety Systems: RG 1.47, 1.52, 1.53, 1.62, 1.153

IEEE 622 Design and Installation of Electric Heat Tracing Systems

IEEE 1891 Criteria for Application Intelligent Digital Devices

IEEE/IEC P61226 Standard for categorization and classification of I&C and electrical systems

IEEE/IEC P63113 Spent Fuel Pool Instrumentation

IEEE P2809 Common Cause Failure Systems Analysis and Diversity

DISCUSSION

NPEC Priority (NRC Response ML19352E115)

IEEE 60780-323-2016 Equipment Qualification: RG 1.89

IEEE 60980-344-2013 Seismic Qualification: RG 1.100

IEEE 1819-2016 Risk-Informed Categorization: Possible New RG

IEEE 741-2017 Criteria for Protection of 1E Power Systems and Equipment: New RG

IEEE 387-2017 Criteria for Diesel-Generator Units as Standby Power Supplies: RG 1.9

IEEE 1786-2011 Human Factors Guide for Application of Computerized Operating Procedure Systems: New RG

IEEE 7-4.3.2-2016 Criteria for Programmable Digital Devices: RG 1.152

IEEE 379-2014 Application of Single-Failure Criterion to Safety Systems: RG 1.53