ELECTRICAL AND I&C CODES AND INSPECTION

DAY 8

DAY 8

Session:

18. Non-IEEE Standards

Student Activity:

ElectricalComponent vs. Non-IEEE Standards Matrix

19. ITAAC

18. Non-IEEE Standards Objectives

- Identify the major non-IEEE electrical and I&C standards
- Provide a general overview of the purpose of these standards
- Discuss how these standards relate to new reactor inspection

18. Non-IEEE Standards

- ANSI
- ASME
- ICEA
- ISA
- NEMA
- NFPA
- UL

18. Non-IEEE Standards

Component vs Non-IEEE Standard

18. Non-IEEE Standards

- Transformers ANSI C57 Series
- Switchgear
  - MV ANSI C37 Series
  - LV ANSI C37 Series

18. Non-IEEE Standards

- MCC NEMA/UL
- Power Panels NEMA/UL

18. Non-IEEE Standards

- Motors and Generators
  - NEMA MG-1
  - ANSI C50.41
  - ANSI C37.106

18. Non-IEEE Standards

- Cables
  - ICEA Series on Cable Functional Standards
  - ICEA Standards on Ampacity of Cables

18. Non-IEEE Standards

- Bus Duct
  - ANSI C37.23, Metal-Enclosed Bus
  - ANSI/UL 857, Busways

18. Non-IEEE Standards

- Switchyard Bus AA, ASCE, ASTM
- Electrical Penetration Assemblies ASME Section III

18. Non-IEEE Standards

- Battery Racks ANSI/AISC N690

18. Non-IEEE Standards

- Power Conversion Components
  - Chargers — NEMA PE-5
  - Inverters/UPS — NEMA PE-1
  - Static Transfer Switches — NEMA ICS-10
  - Adjustable Speed Drives — NEMA ICS 7

18. Non-IEEE Standards

- Instruments
  - ASME Research Report
  - ANSI/ISA 67.02.01

18. Non-IEEE Standards

- Electromagnetic Compatibility
  - IEC 61000
  - MIL-STD 461
  - MIL-STD 462

Student Activity

- **Electrical Components vs. Non-IEEE Standards Matrix**

18. Non-IEEE Standards Objectives Review

- Identified the major non-IEEE electrical and I&C standards
- Provided a general overview of the purpose of these standards
- Discussed how these standards relate to new reactor inspection

19. ITAAC

Inspections

Tests

Analyses

Acceptance Criteria

19. ITAAC Objectives

- Identify the major I&C and electrical ITAACs
- Provide a general overview of the purpose of these ITAACs
- Discuss how these ITAACs relate to new reactor inspection

19. ITAAC

- NUREG-0800, Standard Review Plan
  - Section 14.3.5, Instrumentation and Controls
  - Section 14.3.6, Electrical Systems

Sample ITAAC Format

Design Commitment	Inspections Tests Analyses	Acceptance Criteria
1. The basic configuration of the system is as shown in Figure x .	1. Inspections of the as-built system will be conducted.	1. The as-built system conforms with the basic configuration shown in Figure x.

Design Commitment

- Identifies the design requirement and/or commitment to be verified
- Uses the specific text of the design commitment contained in the COL application

Inspections, Tests, Analyses

- Identifies the proposed method which will verify the design requirement/ commitment described in column 1
- Inspection, testing, analysis, or some combination of the three

Acceptance Criteria

- Identifies the proposed specific acceptance criteria for the inspections, tests, or analyses described in column 2
- That will demonstrate that the design requirement/commitment in column 1 has been met

RG 1.206

- RG 1.206, Section C.II.1.2.5, ITAAC for Instrumentation and Controls,
- Refers to SRP Section 14.3.5

Section 14.3.5
Instrumentation and Controls

- IEEE Std 603-1991
- Appendix A to 10 CFR Part 50
- SRP BTP 7-14, Software Lifecycle

IEEE Std 603-1991

Sections:

4. Safety System Design Criteria
5. Safety System Criteria
6. Sense and Command
7. Execute Features
8. Power Source Requirements

IEEE Std 603 - Section 4

4.1 Identification of the DBEs

4.4 Identification of monitored variables

4.5 Minimum criteria for manual initiation and control of protective actions subsequent to initiation

4.6 Identification of the minimum number and locations of sensors

IEEE Std 603 - Section 4

4.7 Range of transient and steady-state conditions

4.8 Identification of conditions having the potential to cause functional degradation of safety system performance

4.9 Identification of the methods used to assess the reliability of the safety system design

IEEE Std 603 - Section 5

5.1 Single-failure criterion

5.2 Completion of protective action

5.3 Quality

5.4 Equipment qualification

5.5 System integrity

IEEE Std 603 - Section 5

5.6 Independence

5.7 Capability for test and calibration

5.8 Information displays

5.9 Control of access

5.10 Repair

IEEE Std 603 - Section 5

5.11 Identification

5.12 Auxiliary features

5.13 Multi-unit stations

5.14 Human factors considerations

5.15 Reliability

IEEE Std 603 - Section 6

6.1 Automatic control

6.2 Manual control

6.3 Interaction between the sense and command features and other systems

6.4 Derivation of system inputs

IEEE Std 603 - Section 6

6.5 Capability for testing and calibration

6.6 Operating bypasses

6.7 Maintenance bypass

6.8 Setpoints

IEEE Std 603 - Sections 7 and 8

7.3 Completion of protective action for executive features

8 Power Source Requirements

Appendix A to 10 CFR Part 50

- GDC 1, Quality standards for design, fabrication, erection, and testing
- GDC 2, Protection against natural phenomena
- GDC 4, Environmental and dynamic effects
- GDC 13, Instrumentation and control

Appendix A

- GDC 19, Control room requirements
- GDC 20, Protection system functions
- GDC 21, Protection system reliability and testability
- GDC 22, Protection system independence

Appendix A

- GDC 23, Protection system failure modes
- GDC 24, Protection systems separated from control systems
- GDC 25, Protection system requirements for reactivity control malfunctions
- GDC 29, Protection against anticipated operational occurrences

SRP BTP 7-14

- Documentation of a High-Quality Software Design Process

Software Life-Cycle Phases

- Requirements
- Design
- Implementation
- Integration
- Validation
- Installation
- Operations
- Maintenance

SRP BTP 7-14

- Management
- Implementation
- Design Output

U.S. EPR ITAACs

- AREVA ITAACs in Tier 1
- COL site specific ITAACs

Tier 1, Section 2.4
Instrumentation and Control

- Protection System
- Safety Information and Control System
- Severe Accident I&C
- Safety Automation System
- Priority and Actuator Control System
- Plant Fire Alarm System

Tier 1, Section 2.4
Instrumentation and Control

- Seismic Monitoring System
- Process Automation System
- Process Information and Control System
- Boron Concentration Measurement System
- Control Rod Drive Control System
- Hydrogen Monitoring System

Tier 1, Section 2.4
Instrumentation and Control

- Reactor Control, Surveillance, and Limitation System
- Reactor Pressure Vessel Level Measurement System
- Excore Instrumentation System
- Incore Instrumentation
- Communication Equipment
- Radiation Monitoring System

COL Section 2.4
Instrumentation and Controls

Site Specific
Instrumentation and Controls
ITAACs

RG 1.206

- RG 1.206, Section C.II.1.2.6, ITAAC for Electrical Systems
- Refers to SRP Section 14.3.6

Section 14.3.6 Electrical Systems

A. Arrangement/Configuration
   - General functional arrangement
   - Qualification of systems and components

B. Independence

C. Capacity and Capability
   (Sizing of Sources and Distribution Equipment)
   - Loading
   - Voltage

Section 14.3.6 Electrical Systems

D. Equipment Protective Features
- Short-circuit capability
- Breaker coordination
- Diesel generator protective trips

E. Sensing Instrumentation and Logic

F. Controls, Displays, and Alarms

Section 14.3.6 Electrical Systems

G. Test Features

H. Connection of Non-Class 1E Loads on Class 1E Buses

I. Location of Equipment

U.S. EPR ITAACs

- AREVA ITAACs in Tier 1
- COL Site Specific ITAACs

Tier 1 Section 2.4
Electric Power Systems

- Class 1 E Emergency Power Supply System
- Class 1E Uninterruptible Power Supply System
- Station Blackout Alternate AC Source
- Emergency Diesel Generator
- Preferred (Offsite) Power Supply System
- Power Transmission System

Tier 1 Section 2.4
Electric Power Systems

- Non-Class 1E Uninterruptible Power Supply System
- Lightning Protection and Grounding System
- Lighting System
- Normal Power Supply System
- 12-Hour Uninterruptible Power Supply System

COL Section 2.4
Electric Power Systems

Site Specific
Electric Power Systems
ITAACs

19. ITAAC Objectives Review

- Identified the major I&C and electrical ITAACs
- Provided a general overview of the purpose of these ITAACs
- Discussed how these ITAACs relate to new reactor inspection

Student Activity
Sample EPR/COL ITAACs

- **EPR ITAACs**
  - **Table 2.4.1-9 Protection System ITAACs**
  - **Table 2.5.5-1 Offsite Power System ITAACs**

- **BBNPP ITAACS**
  - **Table 2.4-24 Offsite Power System ITAACs**

QUESTIONS?