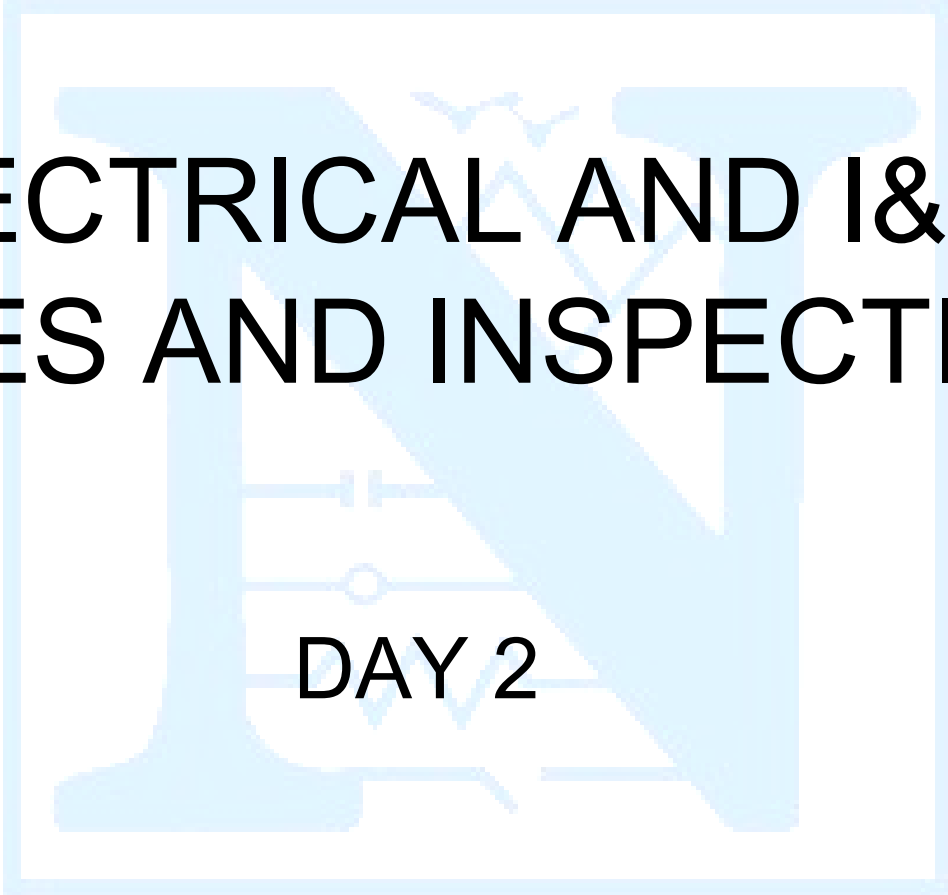




ELECTRICAL AND I&C CODES AND INSPECTION



DAY 2

DAY 2

Sessions:

4. Standard Review Plan and Generic Guides
5. Standards Overview

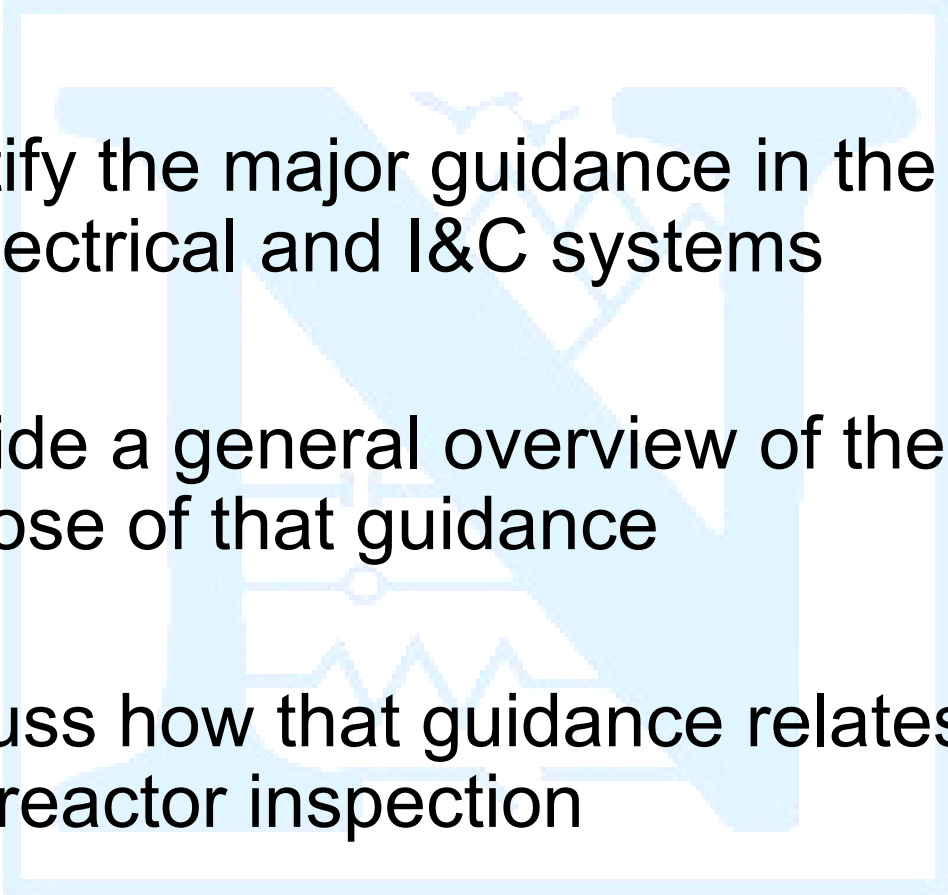


Session 4

Standard Review Plan and Generic Guides



4. SRP and Generic Guides Objectives

- 
- Identify the major guidance in the SRP for electrical and I&C systems
 - Provide a general overview of the purpose of that guidance
 - Discuss how that guidance relates to new reactor inspection

4. Standard Review Plan and Generic Application Guides

- NUREG-0800 Overview
- Content of Applications

NUREG-0800 Overview



Chapter 7	Instrumentation and Control
Chapter 8	Electric Power Systems
Chapter 9	Auxiliary Support Systems

Chapter 7

Instrumentation and Control

- 7.1 Introduction
- 7.2 Reactor Trip System
- 7.3 Engineered Safety Features
- 7.4 Safe Shutdown

Chapter 7

Instrumentation and Control

- 7.5 Information Systems Important to Safety
- 7.6 Interlock Systems Important to Safety
- 7.7 Control Systems
- 7.8 Diverse I&C Systems
- 7.9 Data Communication Systems

7.2 Reactor Trip System

- Sense, command, & actuate functions that trip the reactor
- Trip logic, hardware, software, & firmware
- IEEE 603, IEEE 7-4.3.2

7.3 Engineered Safety Features

- Sense, command, & actuate functions that initiate engineered safety features (ESF) to mitigate design basis accidents
- ESF initiation logic, hardware, software, & firmware
- IEEE 603, IEEE 7-4.3.2

7.4 Safe Shutdown

- Safe shutdown functions that do not involve accident mitigation
- I&C required to achieve and maintain a safe shutdown condition
- Capability to achieve safe shutdown independent of the control room
- IEEE 603, IEEE 7-4.3.2

7.5 Information Systems

- Accident monitoring
- Bypassed or inoperable status
- Alarm systems
- Safety parameter display system
- Emergency response facility

7.6 Interlock Systems

Examples:

- Prevent overpressure of low-pressure system connected to high pressure system (e.g., RHR/RCS valve interlocks)
- Assure availability of ECCS accumulators
- Isolate safety/non-safety systems (e.g., service water system interfaces)

7.7 Control Systems

- Control systems are not credited in the accident analysis
- Controlled variables are to be maintained within prescribed operating ranges
- Effects of operation or failure of control systems must be bounded by the accident analysis
- The protection system (SRP 7.2, 7.3) must be independent of the control system

7.8 Diverse I&C Systems

- ATWS (anticipated transients without scram) mitigation system
- For digital safety systems, controls and displays in the control room that are independent and diverse from the associated digital systems

7.9 Data Communication

- Supports communication between and among safety divisions, and to control and information systems
- Key review attributes for digital communications include vulnerability to CCF, real-time performance, software quality, reliability, electromagnetic compatibility

Chapter 8

Electric Power Systems

- 
- 8.1 Introduction
 - 8.2 Offsite Power System
 - 8.3 Onsite Power System
 - 8.4 Station Blackout

8.2 Offsite Power System

- The preferred power supply
- Two independent connections between the transmission system and the power plant

8.3 Onsite Power System

- Minimum of two independent onsite power systems
- Each system includes independent generation and distribution
- AC and DC power sources

8.4 Station Blackout

- Alternate AC supplies
- Calculated coping time

Chapter 9

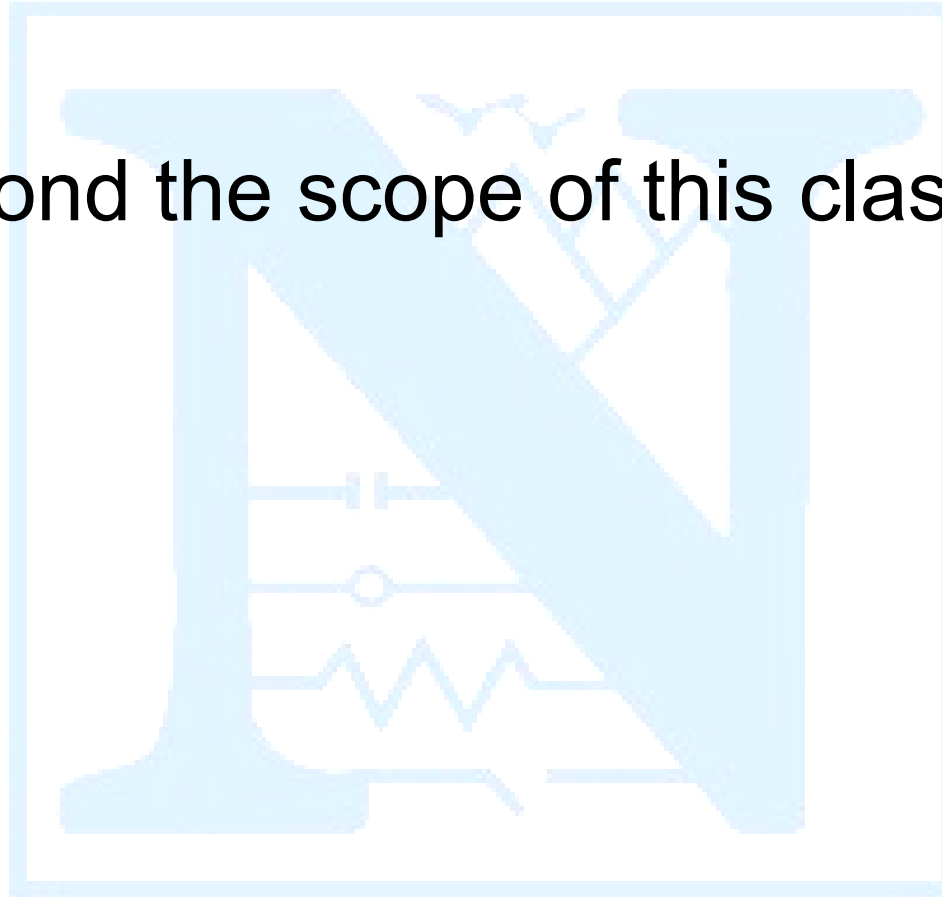
Auxiliary Support Systems

9.5 Other Auxiliary Systems

- 9.5.1 Fire Protection
- 9.5.2 Communication Systems
- 9.5.3 Lighting Systems
- 9.5.4-.8 DG Support Systems

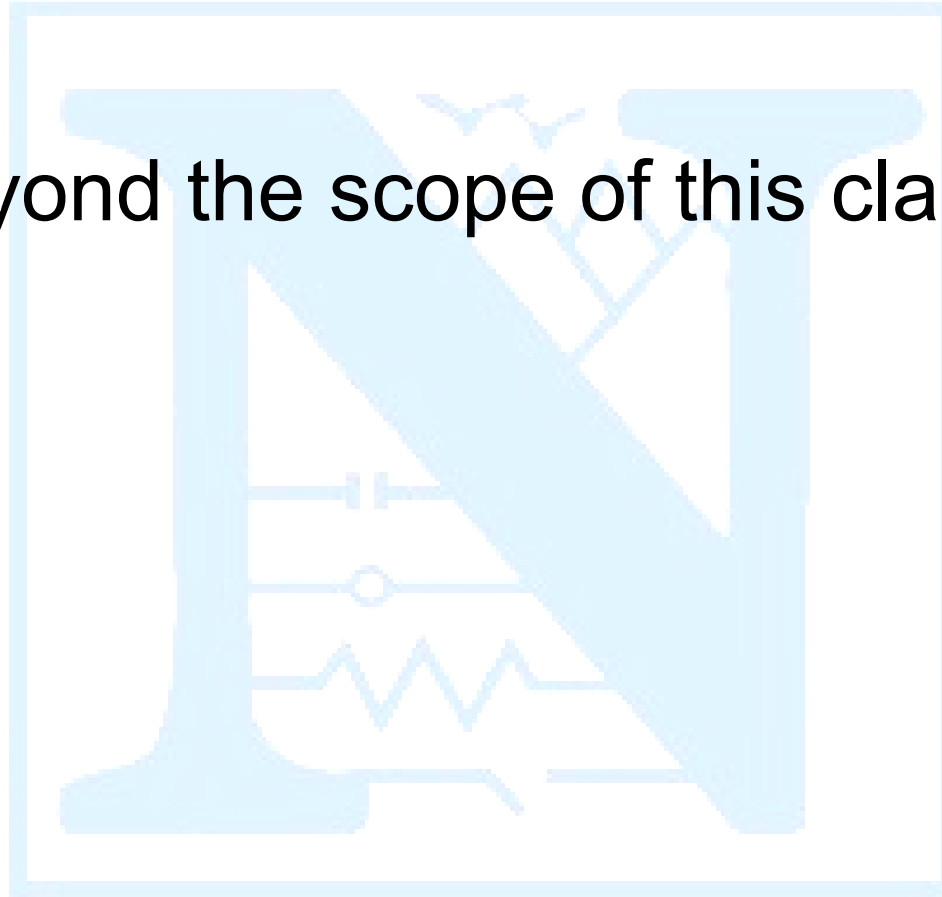
9.5.1 Fire Protection

- Beyond the scope of this class



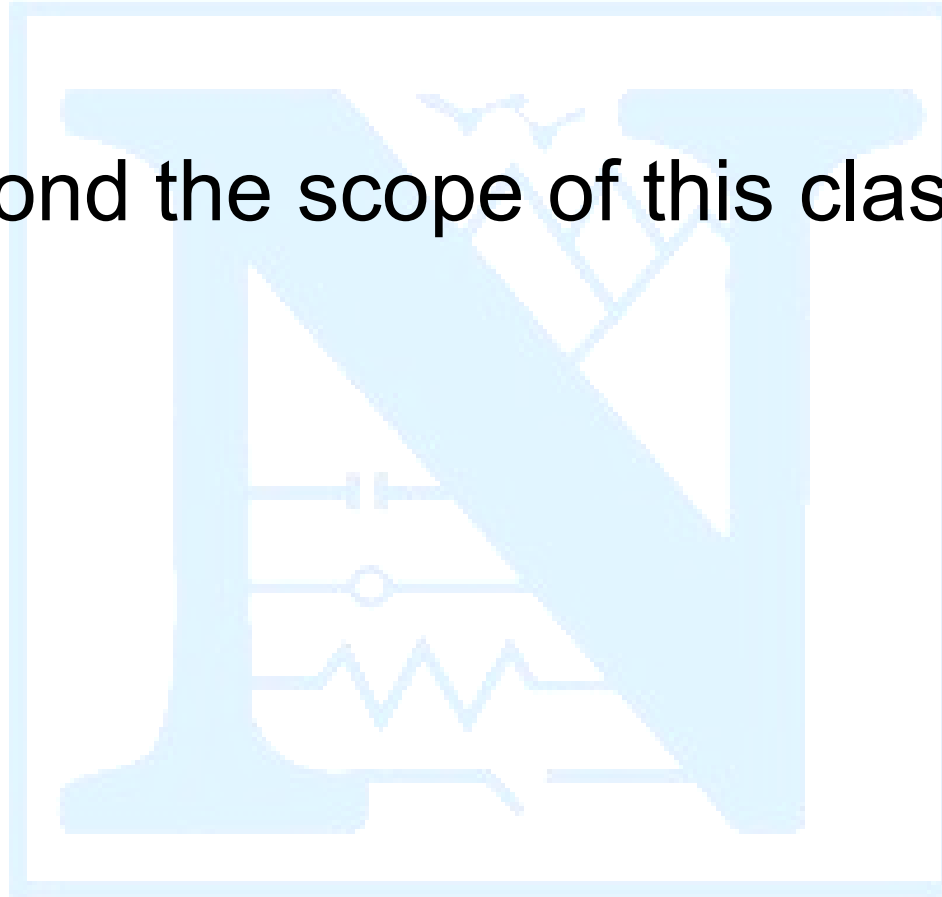
9.5.2 Communication Systems

- Beyond the scope of this class



9.5.3 Lighting Systems

- Beyond the scope of this class



9.5.4-.8 DG Support Systems

- 9.5.4 Fuel Oil
- 9.5.5 Engine Cooling
- 9.5.6 Starting
- 9.5.7 Lube Oil System
- 9.5.8 Combustion Air

Content of Applications

- Part 50 RG 1.70
- Part 52 RG 1.206

RG 1.70

- Standard format and content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)

RG 1.70

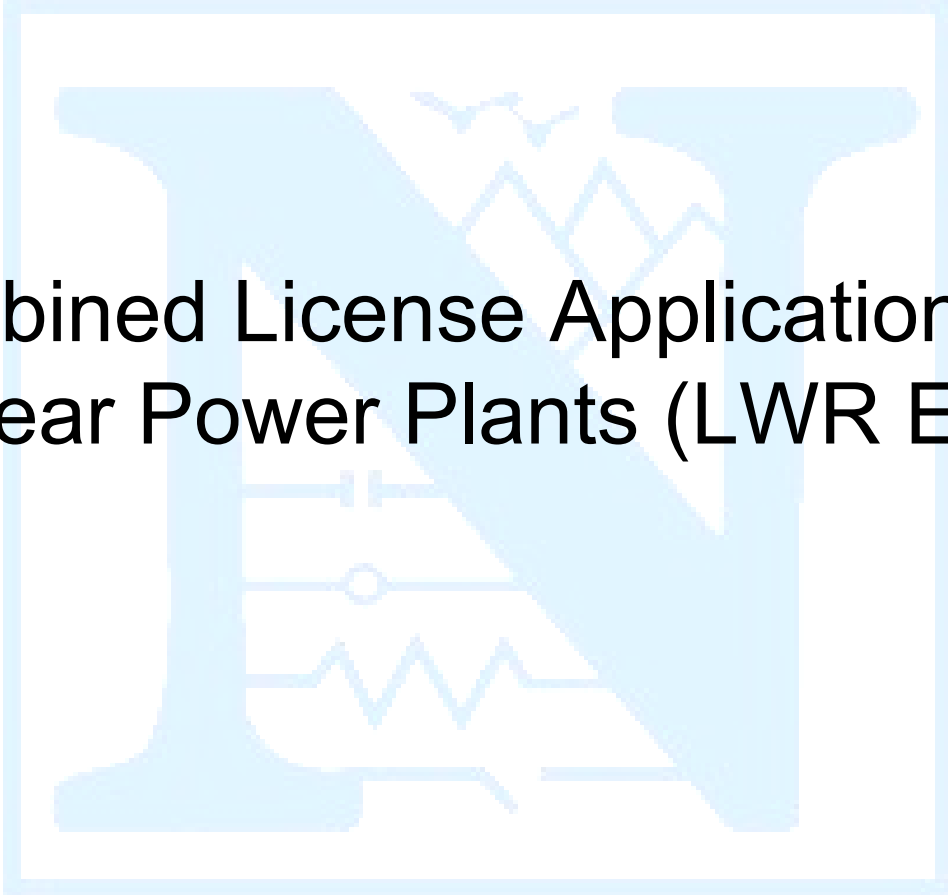
Chapter 7

I&C

Chapter 8

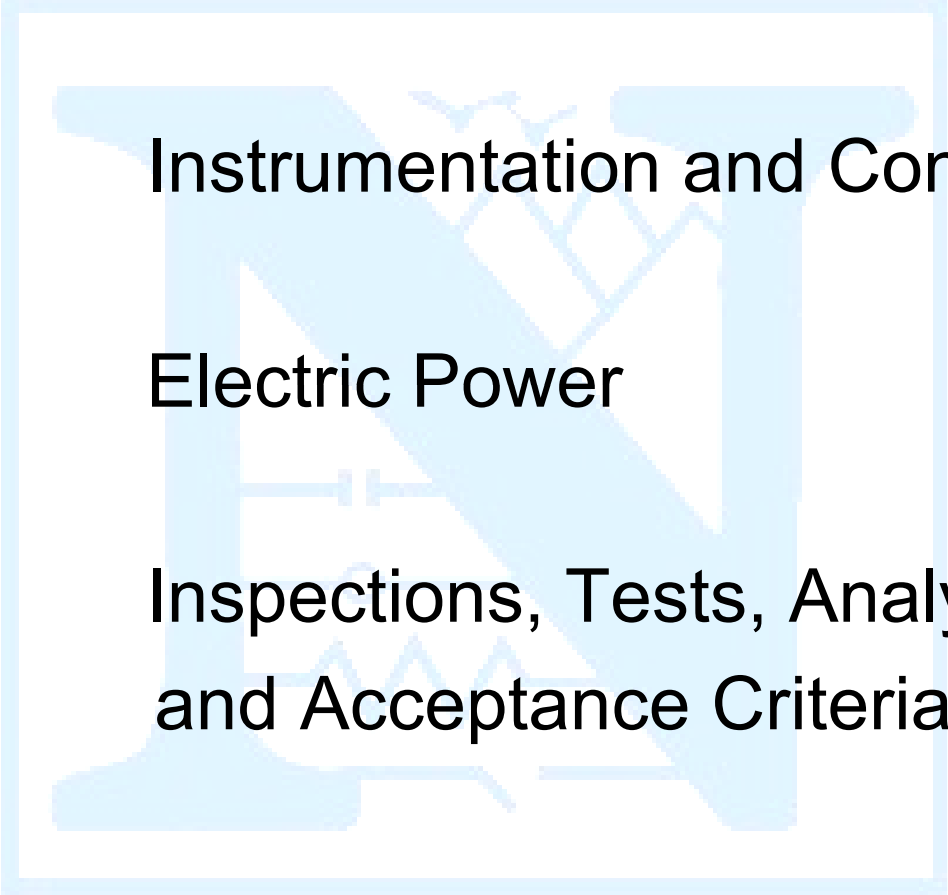
Electric Power

RG 1.206



Combined License Applications for Nuclear Power Plants (LWR Edition)

RG 1.206

- 
- 
- C.I.7 Instrumentation and Controls
 - C.I.8 Electric Power
 - C.II.1 Inspections, Tests, Analyses,
and Acceptance Criteria



Session 5

Standards Overview

5. Standards Overview Objectives

- Identify the major source organizations for industry electrical and I&C standards
- Provide a general overview of the type of standards from these organizations
- Discuss how these standards organizations relate to new reactor inspection

5. Standards Overview

- Industry Standards Organizations
- IEEE Power and Energy Society
- IEEE Non-Nuclear Standards
- IEEE Color Book Series Overview

Industry Standards Organizations

- American National Standards Institute (ANSI)
- American Society of Mechanical Engrs. (ASME)
- Insulated Conductor Engineers Assoc. (ICEA)
- Institute of Electrical and Electronics Engrs. (IEEE)

Industry Standards Organizations

- International Society of Automation (ISA)
(formerly Instrument Society of America)
- National Electrical Manufacturers Assoc.
(NEMA)
- National Fire Protection Association
(NFPA)
- Underwriter Laboratories (UL)

American National Standards Institute

- C37 Switchgear
- C57 Transformers
- C62 Surge Protection



American Society of Mechanical Engineers

- ASME Section III, Division I,

Type MC components
(containment electric penetration
assemblies)

Insulated Conductor Engineers Association



- Cables

Low voltage cables

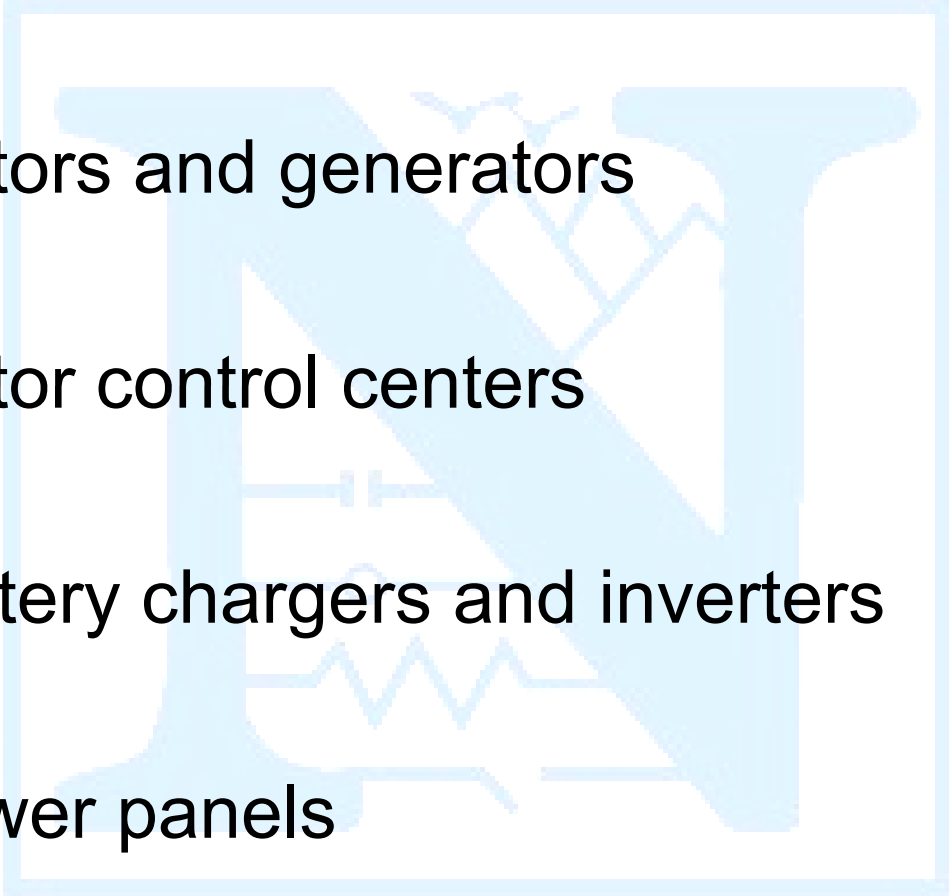
Medium voltage cables

International Society of Automation (ISA)

- Setpoints for Nuclear Safety-Related Instrumentation (ANSI/ISA 67.04.01)
- Nuclear Safety-Related Instrument Sensing Line Piping and Tubing Standard (ANSI/ISA 67.02.01)

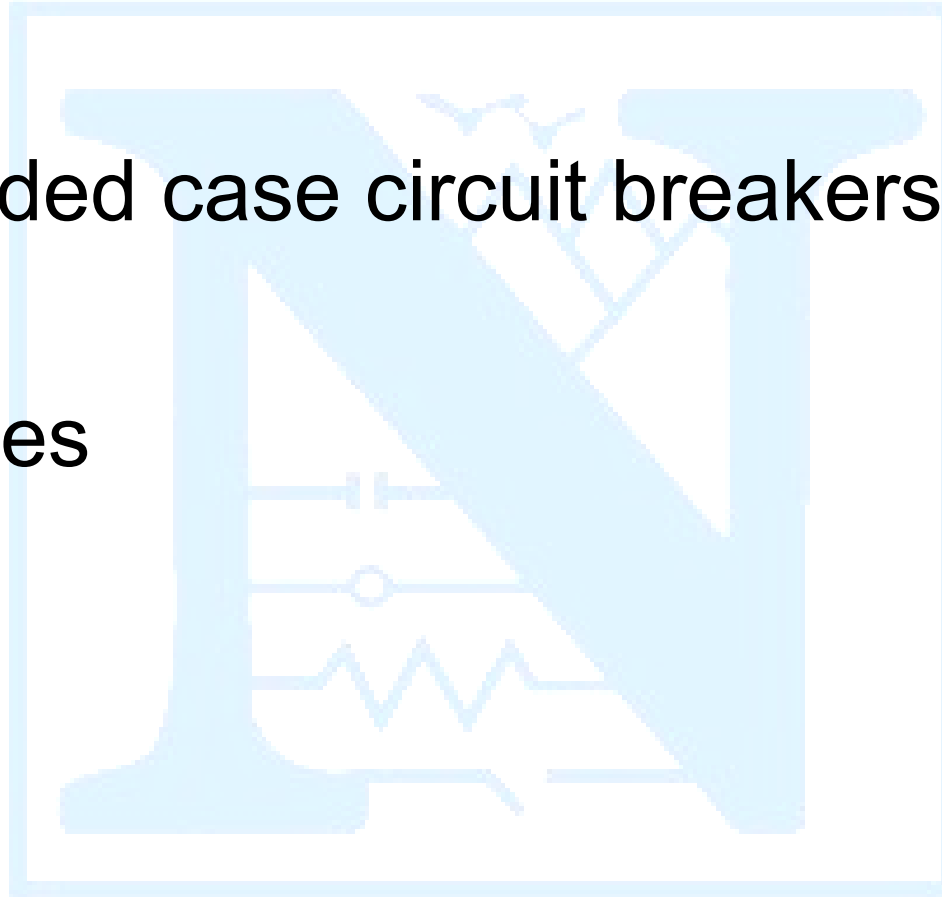


National Electrical Manufacturers Association

- 
- Motors and generators
 - Motor control centers
 - Battery chargers and inverters
 - Power panels

Underwriter Laboratories, Inc.

- Molded case circuit breakers
- Fuses



Institute of Electrical and Electronics Engineers



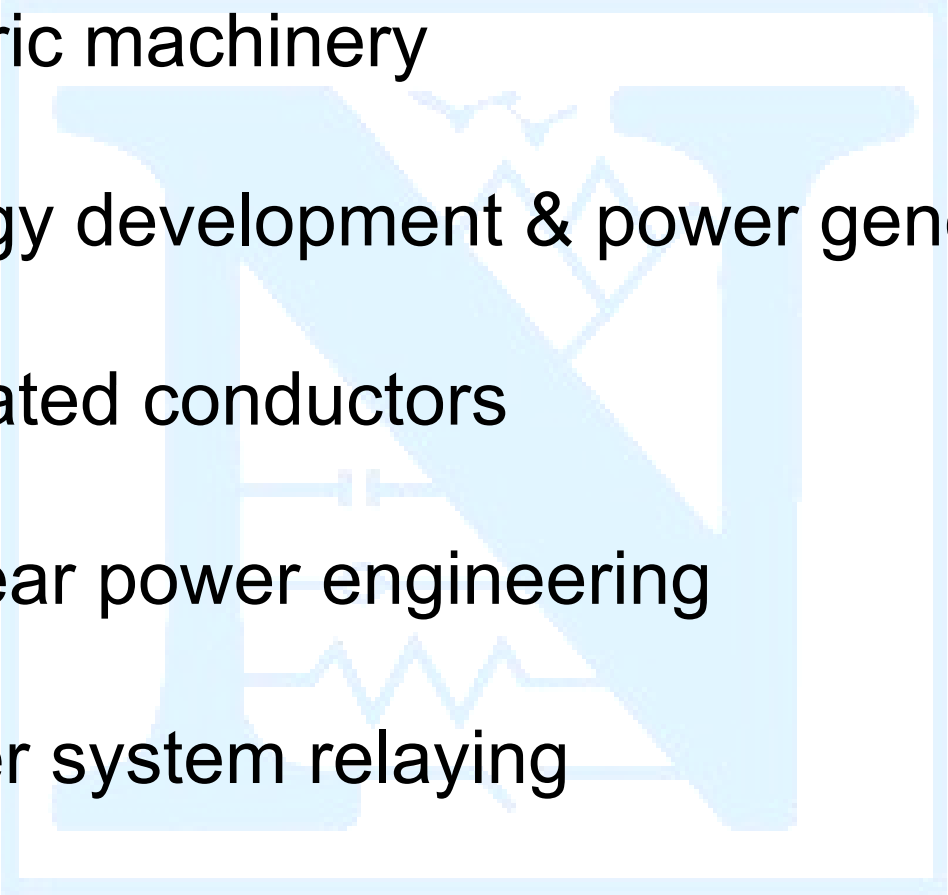
- Standards, Recommended Practices, and Guides for:

Nuclear Power Plants

Industrial and Commercial
Facilities

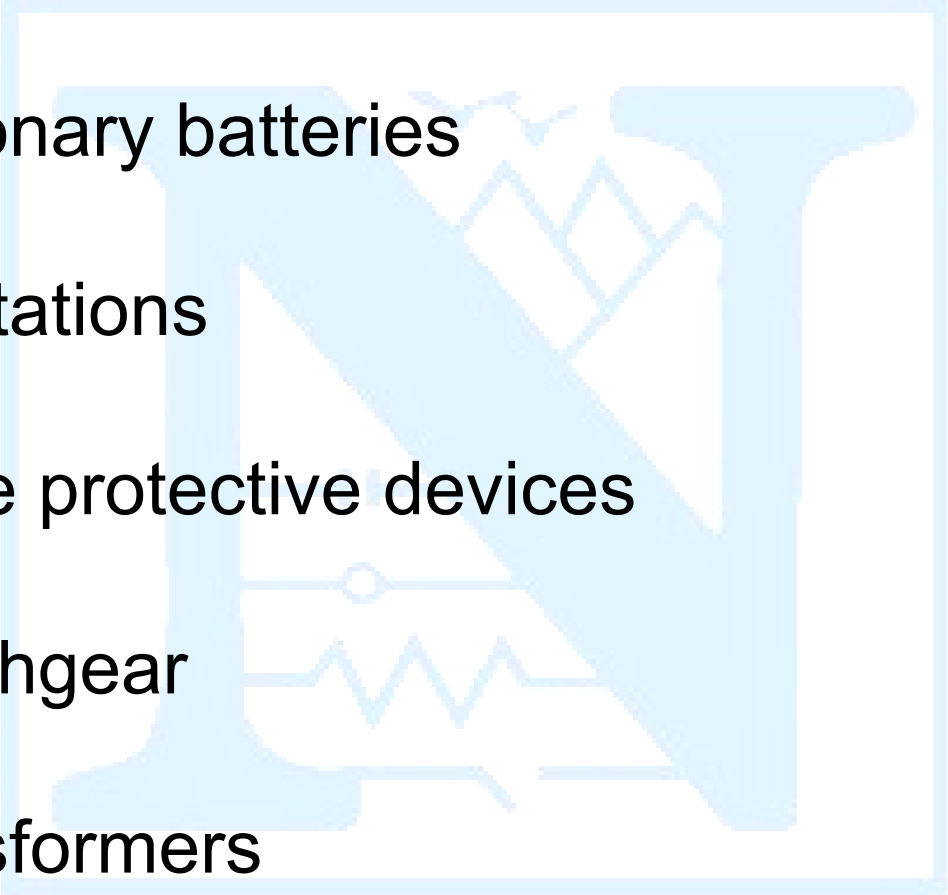


IEEE Power and Energy Society

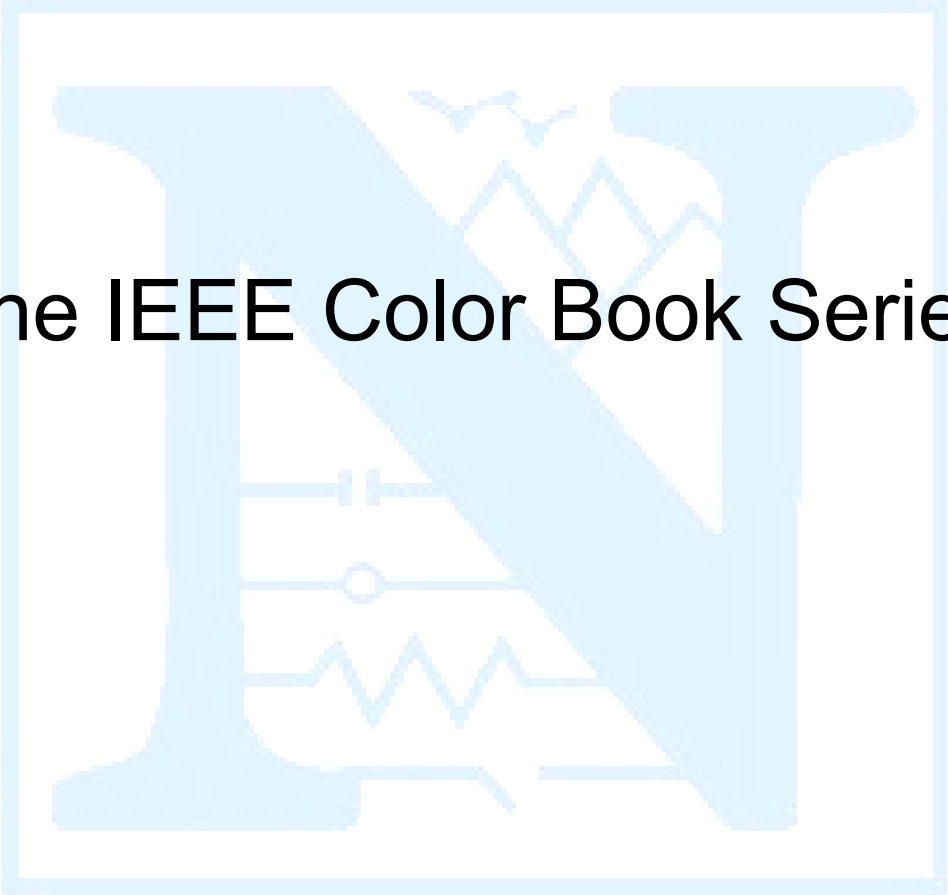
- Electric machinery
 - Energy development & power generation
 - Insulated conductors
 - Nuclear power engineering
 - Power system relaying
- 

IEEE Power and Energy Society



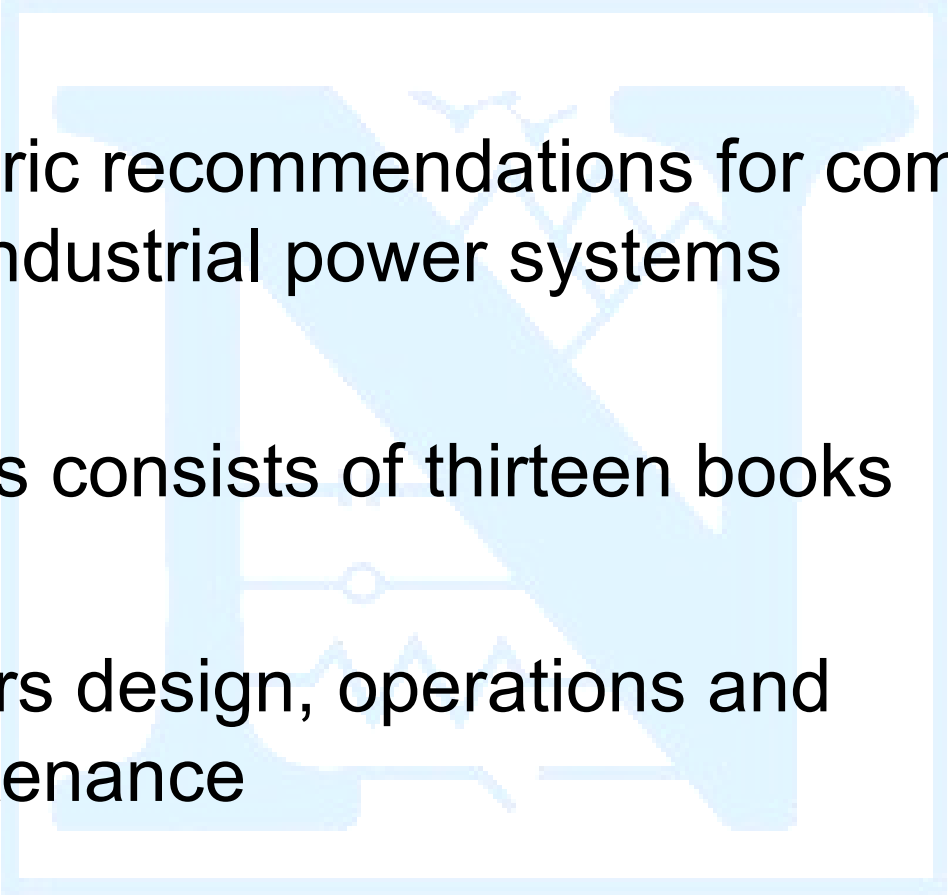
- Stationary batteries
 - Substations
 - Surge protective devices
 - Switchgear
 - Transformers
- 

IEEE Industry and Applications Society



The IEEE Color Book Series

IEEE Color Book Series Overview

- 
- Generic recommendations for commercial and industrial power systems
 - Series consists of thirteen books
 - Covers design, operations and maintenance
- 



IEEE Color Book Series

- Basic analysis of electrical systems
- Design, construction, and continuity
- Safety of life and preservation of property
- Reliability and simplicity of operation



IEEE Color Book Series

- Red Book (IEEE-141) - Electric Power Distribution
- Green Book (IEEE-142) - Grounding of Power Systems
- Gray Book (IEEE-241) - Electric Power Systems in Commercial Buildings

IEEE Color Book Series

- Buff Book (IEEE-242) - Protection and Coordination of Power Systems
- Brown Book (IEEE-399) – Power Systems Analysis
- Yellow Book (IEEE-902) – Maintenance, Operation, and Safety

Red Book (IEEE-141)

Electric Power Distribution

- system planning
- voltage considerations, surge voltage protection
- system protective devices
- fault calculations
- grounding
- power switching

Red Book (IEEE-141)

Electric Power Distribution

- transformation, and motor-control apparatus
- instruments and meters
- cable systems
- busways
- electrical energy conservation
- cost estimation

Green Book (IEEE-142)

Grounding of Power Systems

- The problems of system grounding
- Advantages and disadvantages of grounded vs. ungrounded systems
- How and where to ground the system, and how to select equipment for the ground of the neutral circuits
- Connecting the frames and enclosures of electric apparatus to a ground system

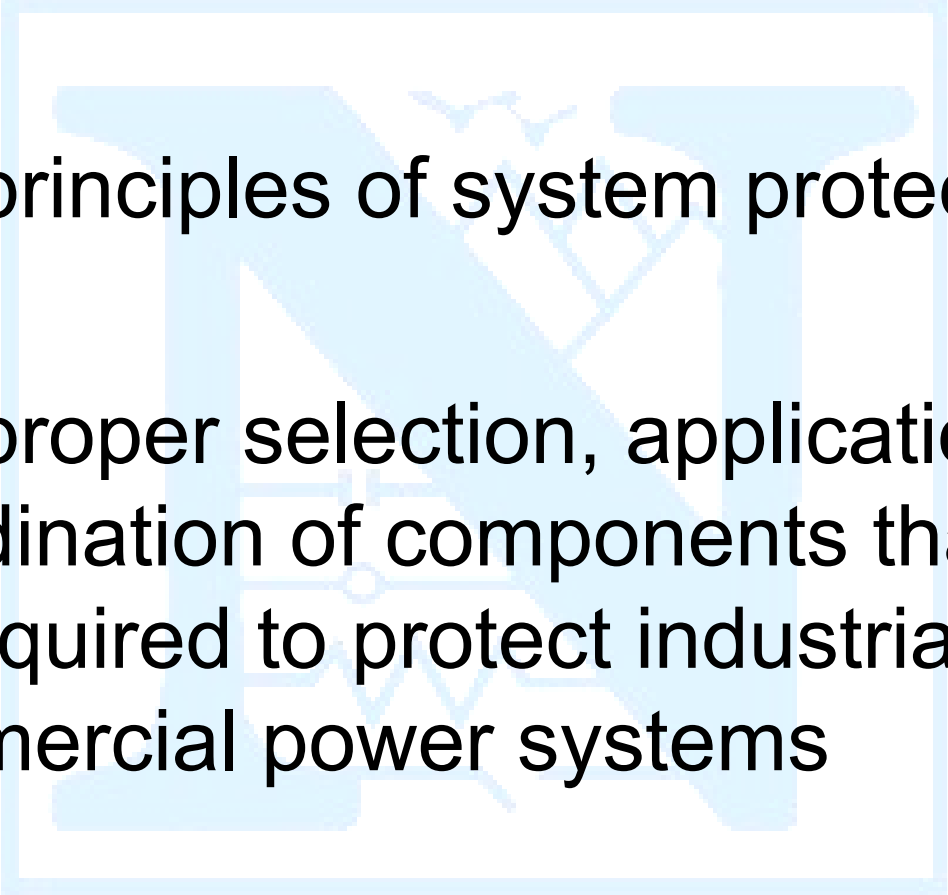
Gray Book (IEEE-241) - Electric Power Systems in Commercial Buildings

- 
- The guide provides an introduction to commercial building load characteristics, voltage considerations, power sources and distribution systems.



Buff Book (IEEE-242)

Protection and Coordination of Power Systems

- 
- The principles of system protection
 - The proper selection, application, and coordination of components that may be required to protect industrial and commercial power systems

Brown Book (IEEE 399)

Power Systems Analysis

- Includes load flow, short-circuit, stability, motor starting, harmonic analysis, switching transients, reliability, cable ampacity, ground mat, coordination, and dc auxiliary studies

Yellow Book (IEEE 902)

Maintenance, Operation, and Safety

- 
- Fundamentals of safe and reliable maintenance and operation of electric power distribution systems
 - Also discusses record-keeping, testing, and inspection methods