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COMPARISON OF DETERMINISTIC (APPENDIX R) AND PERFORMANCE-BASED (NFPA 805) COMPLIANCE STRATEGIES

FIT - 04

BROOKHAVEN NATIONAL LABORATORY
U.S.NRC UNITED STATES NUCLEAR REGULATORY COMMISSION Protecting People and the Environment
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Objectives

- Recognize differences between deterministic (Appendix R) and risk-informed performance-based (NFPA 805) compliance strategies:
  - Methodologies
  - Terminology
  - Goals and Objectives
  - Other Differences

Outline

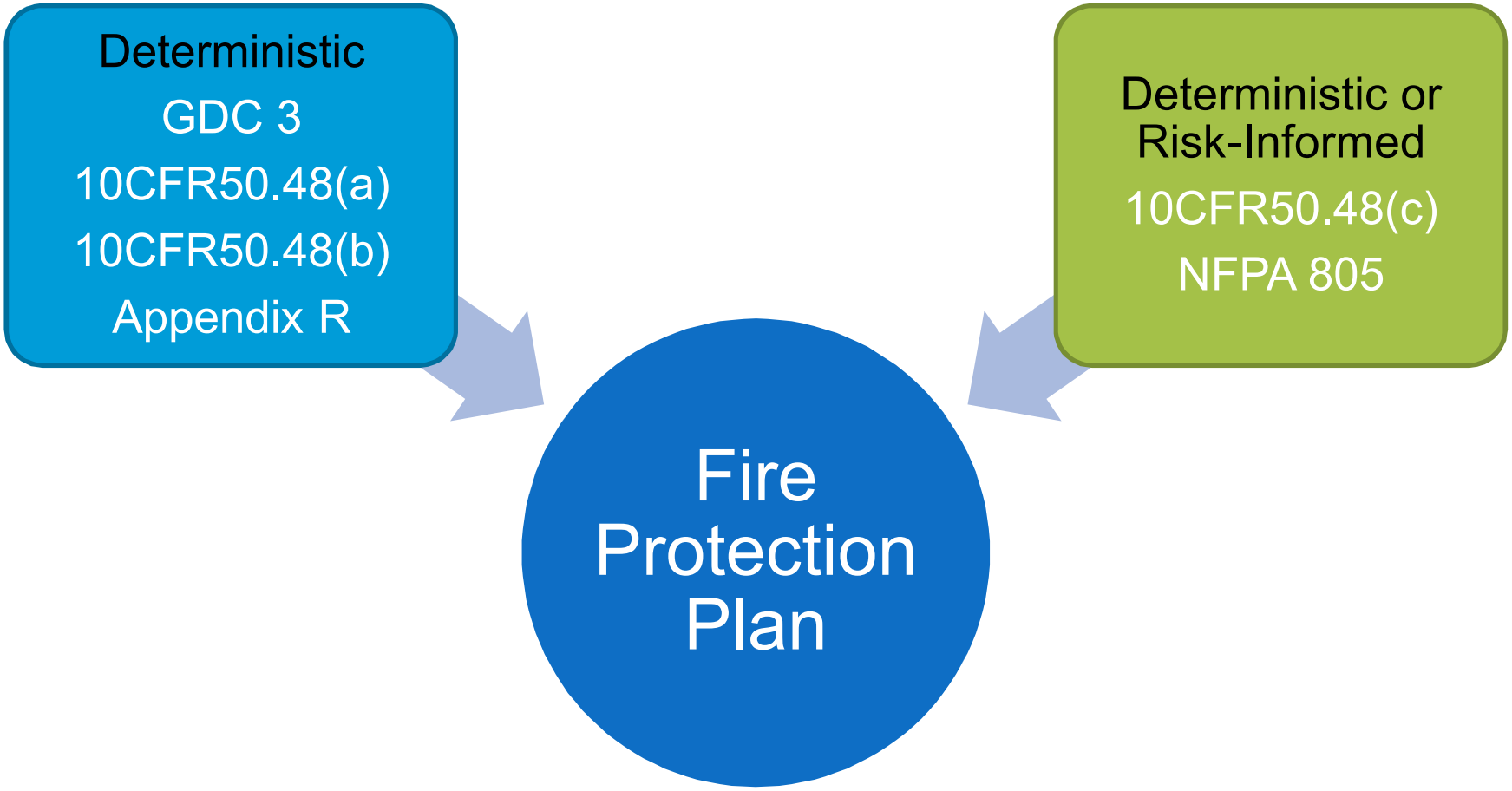
- Methodologies
- Terminology
- NFPA 805 Risk-Informed Performance-Based (RI/PB) Methodology
  - Goals
  - Objectives
  - Performance Criteria
- Nuclear Safety Capability Assessment
- Other differences

The Key Documents

- *Title 10 Code of Federal Regulations (CFR) 50.48(c)*
  - Regulatory endorsement for 2001 NFPA 805 as alternative to Appendix R deterministic requirements (10CFR50.48(b))
    - With seven "exemptions, modifications, and supplementation" to NFPA 805

- NFPA 805, *Performance-Based Standard for Fire Protection for Light-Water Reactor Electric Generating Plants*
  - Endorsed version: 2001 (original)
  - 2006, 2010 and 2015 updates have not been endorsed by NRC

Fire Protection Plan – Compliance Strategies



NFPA 805 Methodology

Deterministic
(based on Appendix R)

Risk-Informed
(new)

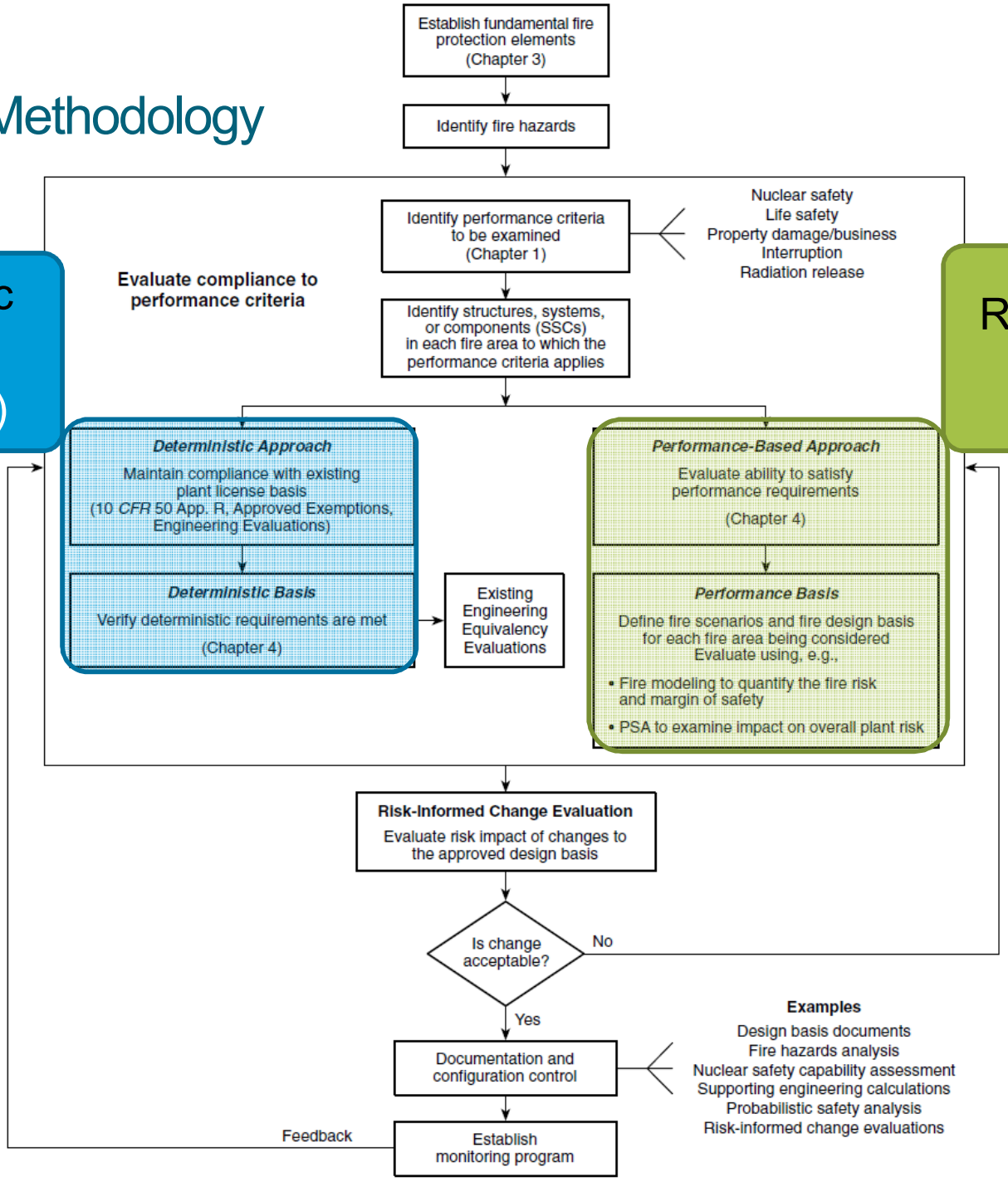


Figure 2.2
of NFPA 805

Exemptions, Modifications and Supplements to NFPA 805

Life Safety Goal, Objectives & Criteria not endorsed

Plant Damage/Business Interruption Goal, Objectives & Criteria are not endorsed

Use of feed-and-bleed to demonstrate compliance is not permitted

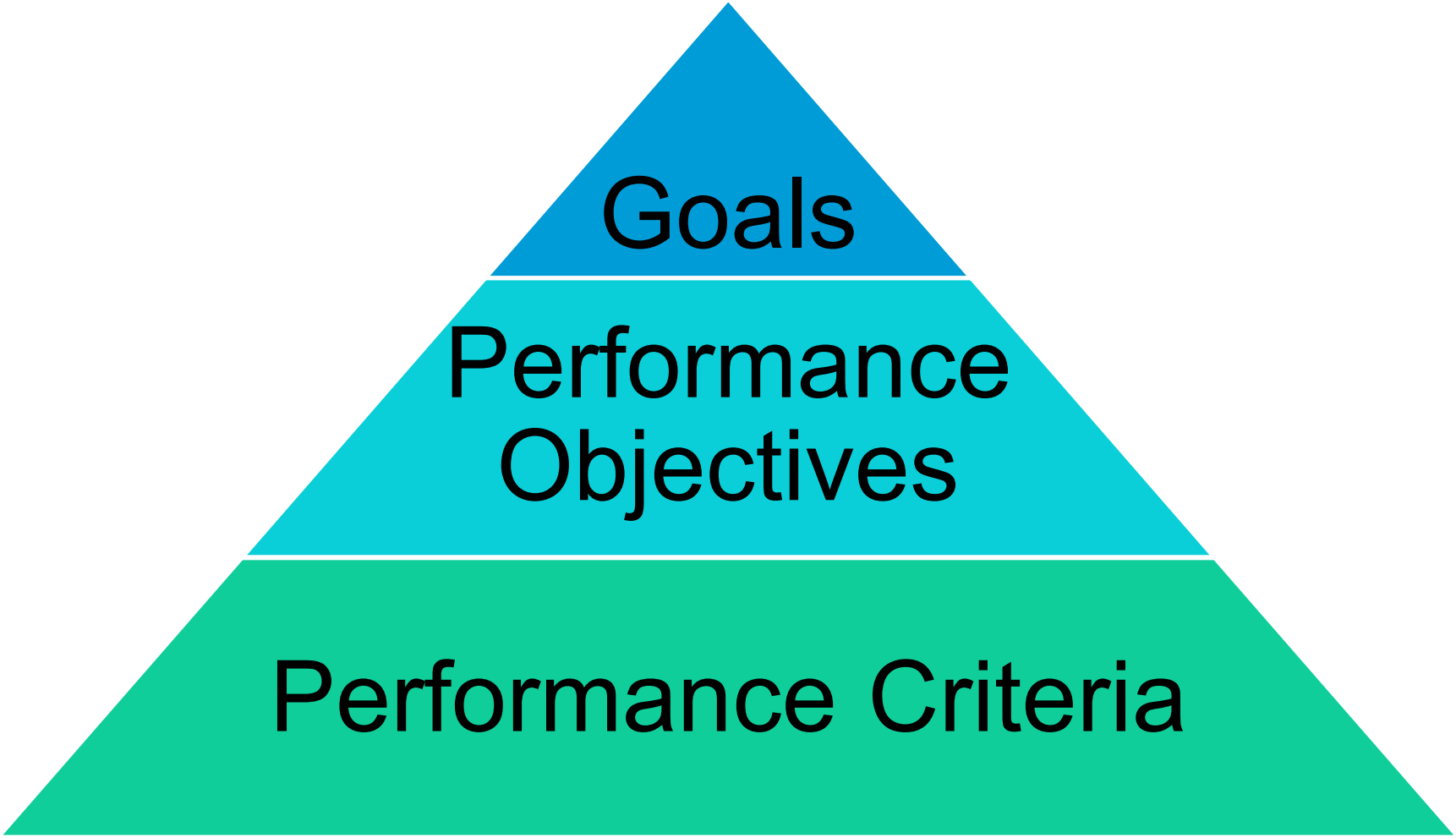
Uncertainty analysis (Section 2.7.3.5) is not required to support deterministic approach calculations

In lieu of installing cables meeting flame propagation tests, a flame-retardant coating or fire suppression system will provide an equivalent level of protection

Water supply and distribution Section 3.6.5 italicized exception is not endorsed

Fire protection program elements and minimum design requirements of Chapter 3 may be subject to the performance-based methods permitted if approved by NRC

NFPA 805 Performance-Based Methodology



NFPA 805 Performance Criteria

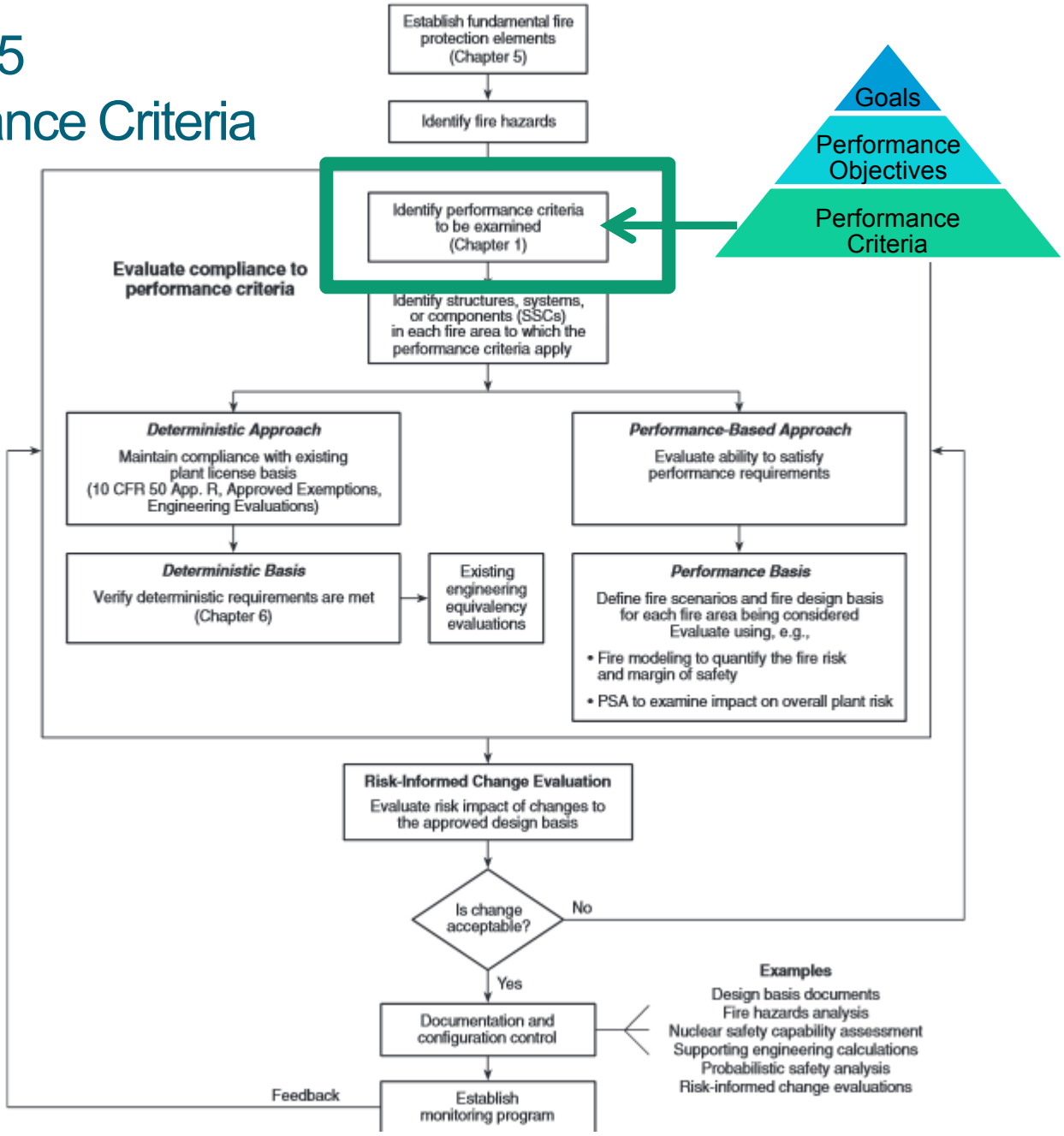


Figure 2.2
of NFPA 805

Terminology Differences

Appendix R	NFPA 805
One *train* free from fire damage	One *success path* free from fire damage
Fire Areas, Fire Zones	Fire Areas, Fire Compartments
Hot and Cold Shutdown	Fuel in a Safe and Stable Condition
Operator Manual Actions (OMAs)	Recovery Actions
Dedicated or Alternate Shutdown Panels	Primary Control Station (PCS)*
Assume fire area lost (full burn-out)	Fire Modeling determines losses
Defense-in-Depth	Defense-in-Depth and Safety Margin

*The alternate shutdown panel may be considered the PCS with additional criteria per RG 1.205

FHA and NSCA

Fire Hazard Analysis (FHA) – Appendix R

- Consider potential in-situ and transient fire hazards.
- Determine the consequences of fire in any location in the plant on the ability to safety shut down the reactor or on the ability to minimize and control the release of radioactivity to the environment.
- Specify measures for fire prevention, fire detection, fire suppression, and fire containment and alternative shutdown capability as required for each fire area containing structures, systems, and components important to safety in accordance with NRC guidelines and regulations.

Nuclear Safety Capability Assessment (NSCA) – NFPA 805

- Tool to determine compliance to NSPC
- Identification of systems, equipment, and equipment location and their interrelationships necessary to achieve the nuclear safety performance criteria.
- Identification and location of cables necessary to achieve the nuclear safety performance criteria.
- Assessment of the ability to achieve the nuclear safety performance criteria given a fire in each fire area.

Applicability

Deterministic Approach of Appendix R

- Applicable at power

Performance-Based Approach of NFPA 805, 2001 Ed.

- Specifies the minimum fire protection requirements during ***all phases*** of plant operation, including shutdown, degraded conditions, and decommissioning.

Operator Manual Actions (OMAs) and Recovery Actions

Deterministic Approach of Appendix R

- No OMA for III.G.2, unless approved by NRC

Performance-Based Approach of NFPA 805, 2001 Ed.

- Recovery actions allowed under performance-based design

Emergency Lighting Differences

Deterministic Approach of Appendix R

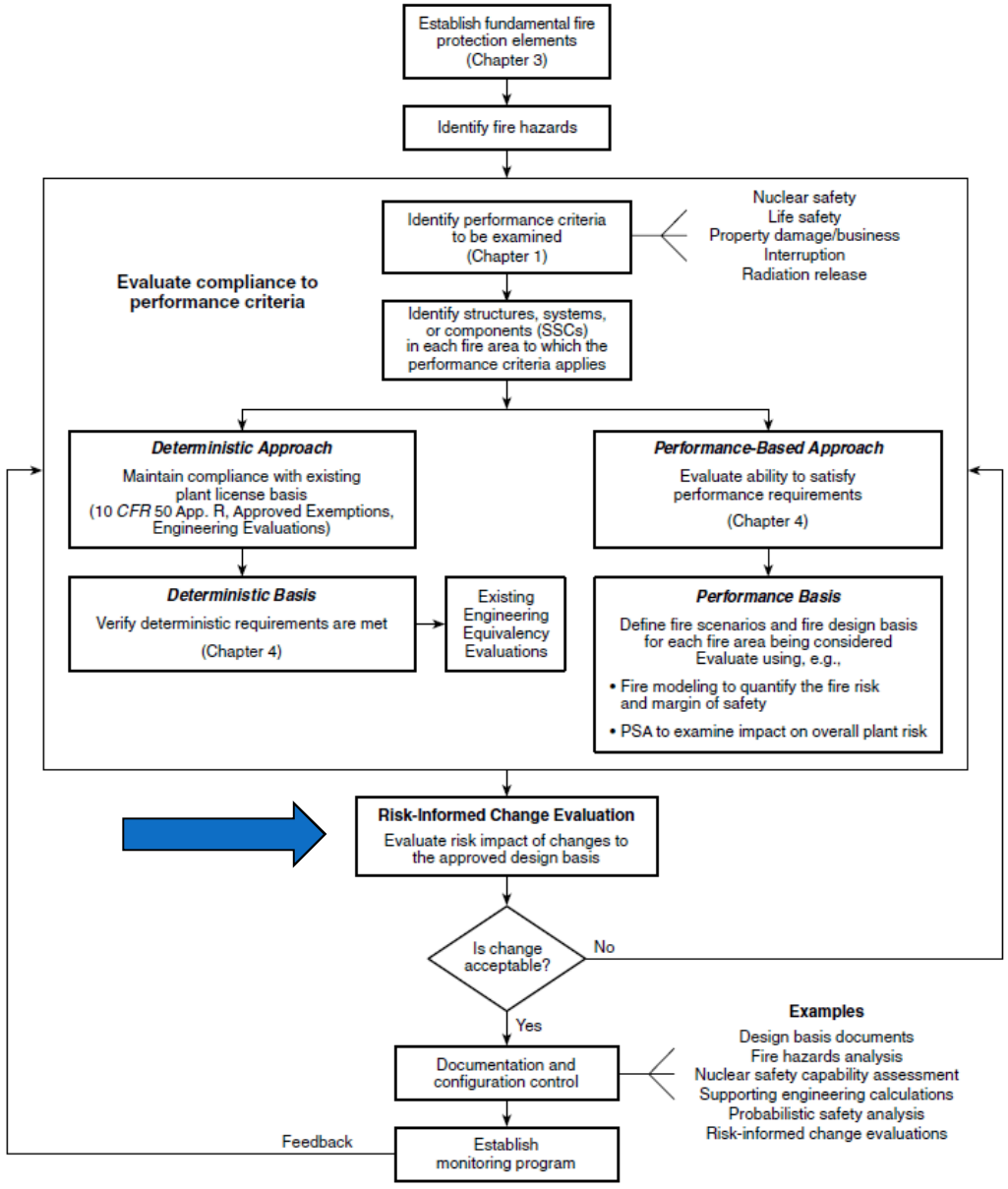
- Eight hour battery power supply in all areas needed for operation of safe shutdown equipment and in access and egress routes.

Performance-Based Approach of NFPA 805, 2001 Ed.

- Lighting evaluated to ensure sufficient lighting is available to perform necessary safety functions as a result of a fire event.

Plant Change Evaluation Process

- All changes—even changes that comply with deterministic requirements—must evaluate risk impact of changes!
- More will be discussed on this in later presentations.



Summary

- 10CFR50.48(a),(b) provides deterministic requirements
- 10CFR50.48(c) NFPA 805 provides compliance through deterministic or performance-based requirements
  - 2001 Edition endorsed by 10CFR50.48 with seven exceptions, modifications and supplementations
- NFPA 805 performance-based methodology defines goals, objectives and performance criteria to show compliance
- Nuclear Safety Capability Assessment tool to meet Nuclear Safety Performance Criteria

- Differences exist—check references!

QUESTIONS?

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