

Draft Outline for Licensing Modernization Project
Advanced Reactor License Application

Activities identified in the NRC's implementation action plan for improving its regulatory readiness for non-light water reactor (non-LWR) designs include developing a regulatory framework that includes technology-inclusive, risk-informed, and performance-based approaches for reviewing advanced reactor applications (Strategy 3(b) of "NRC Non-Light Water Reactor Mid-Term and Long-Term Implementation Action Plans"). During its interactions with stakeholders, the NRC staff identified the need for additional guidance on the appropriate content of applications in terms of scope and level of detail. The proposed outline for a content of application is being released to support ongoing public discussions on this topic, including periodic stakeholder meetings, planned meetings on developing guidance on the content of applications, and planned meetings on a rulemaking to establish a technology-inclusive regulatory framework.

The proposed outline has not been subject to NRC management and legal reviews and approvals, and should not be interpreted as an official agency position.

Note: Sections 1 through 14 in the proposed outline below are similar in nature to a final safety analysis report (FSAR) type outline. In addition to soliciting comments on the draft outline provided in sections 1 through 14 below, the staff would like to discuss other material that would be expected to be provided in an application including the form and content of technical specifications. Regarding technical specifications, topics to be discussed during the stakeholder meeting include the need for adaption or interpretation of 10 CFR 50.36, "Technical specification," requirements. For example, 10 CFR 50.36 contains requirements associated with limited safety system settings (LSSS), and limiting conditions for operations (LCOs). While these terms are defined it is not clear how LSSS and LCOs would be established using a technology-inclusive, risk informed and performance-based approach.

1. General Information

- 1.1. General plant description
 - 1.1.1. Specific technology
 - 1.1.2. Power level
 - 1.1.3. General arrangement
- 1.2. Other Important Plant Features
 - 1.2.1. Materials
 - 1.2.2. Moderator
 - 1.2.3. Coolant
 - 1.2.4. Neutron energy spectrum
 - 1.2.5. Thermodynamic cycle including parameters of the cycle and energy balance
 - 1.2.6. Fuel system design
- 1.3. General site description
- 1.4. Overview of process used to develop safety analysis
 - 1.4.1. Selection and evaluation of licensing basis events
 - 1.4.2. Probabilistic Risk Assessment (PRA) development and technical adequacy
 - 1.4.3. Structures Systems and Components (SSC) safety classification and performance requirements
 - 1.4.4. Evaluation of defense-in-depth adequacy
 - 1.4.5. Role of the [Integrated Decision Panel (IDP)] or Expert Review Panel

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- 1.5. Identification and bases for the principal design criteria (PDC) of the facility
- 1.6. Overview of analytical codes and methods validation/verification
- 1.7. Referenced materials
- 1.8. Drawings and other detailed information
- 1.9. Combined licensee action items
- 1.10. Conformance with Regulatory Guides
- 1.11. Considerations for multi-unit sites
- 2. Site Information**
 - 2.1. Site characteristics
 - 2.2. Geography and Demography
 - 2.3. Nearby Industrial, Transportation, and Military Facilities
 - 2.4. Meteorology
 - 2.5. Hydrology
 - 2.6. Geology, Seismology, and Geotechnical Engineering
- 3. Licensing Basis Event (LBE) Analysis**
 - 3.1. LBE analysis process description
 - 3.2. Mechanistic source term
 - 3.3. Frequency – Consequence Criteria
 - 3.4. Anticipated Operational Occurrence (AOOs)
 - 3.4.1. Event Sequence Families
 - 3.4.2. PRA Safety Functions
 - 3.4.3. Required Safety Functions
 - 3.4.4. Safety-Significant Functions
 - 3.4.5. Required Functional Design Criteria
 - 3.5. Design Basis Events (DBEs)
 - 3.5.1. Event Sequence Families
 - 3.5.2. PRA Safety Functions
 - 3.5.3. Required Safety Functions
 - 3.5.4. Safety-Significant Functions
 - 3.5.5. Required Functional Design Criteria
 - 3.5.6. Adequacy of plant response to DBEs
 - 3.6. Beyond Design Basis Events (BDBEs)
 - 3.6.1. Event Sequence Families
 - 3.6.2. PRA Safety Functions
 - 3.6.3. Required Safety Functions
 - 3.6.4. Safety-Significant Functions
 - 3.6.5. Required Functional Design Criteria
 - 3.6.6. Adequacy of plant response to BDBEs
 - 3.7. Risk Significance Evaluations
 - 3.8. Aircraft Impact Analysis
- 4. Description and Classification of SSCs**
 - 4.1. SSC classification process description
 - 4.2. Overview of Primary Safety Functions
 - 4.2.1. Reactivity control

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- 4.2.2. Remove core heat
 - 4.2.3. Maintain control of radionuclide release
 - 4.3. Safety-Related SSCs
 - 4.3.1. Design requirements, applicable codes, and relationship to PDCs
 - 4.3.2. External hazard levels
 - 4.3.3. Reliability and capability performance requirements
 - 4.3.4. Design features
 - 4.3.5. Required supporting functions
 - 4.3.5.1. Instrumentation for control and monitoring
 - 4.3.5.2. Structural
 - 4.3.5.3. Power
 - 4.3.6. Evaluation of adequacy of special treatment
 - 4.3.7. Associated testing/validation
 - 4.3.7.1. Equipment qualification
 - 4.3.7.2. Seismic qualification
 - 4.3.7.3. Materials qualification
 - 4.3.7.4. Pre-service and risk-informed in-service inspections
 - 4.3.7.5. Pre-service and in-service testing
 - 4.3.7.6. Surveillance testing
 - 4.4. Non-Safety-Related SSCs with Special Treatment
 - 4.4.1. Design requirements, applicable codes, and relationship to PDCs
 - 4.4.2. External hazard levels
 - 4.4.3. Performance requirements
 - 4.4.4. Design features
 - 4.4.5. Required supporting functions
 - 4.4.5.1. Instrumentation for control and monitoring
 - 4.4.5.2. Structural
 - 4.4.5.3. Power
 - 4.4.6. Evaluation of adequacy of special treatment
 - 4.4.7. Associated testing/validation
 - 4.4.7.1. Equipment qualification
 - 4.4.7.2. Seismic qualification
 - 4.4.7.3. Materials qualification
 - 4.4.7.4. Pre-service and risk-informed in-service inspections
 - 4.4.7.5. Pre-service and in-service testing
 - 4.4.7.6. Surveillance testing
 - 4.5. Non-Safety-Related SSCs with No Special Treatment (General Info only)
5. **Design Basis Accidents Analysis (10 CFR 50.34)**
- 5.1. DBA analysis process description
 - 5.2. Deterministic accident analysis
 - 5.2.1. Acceptance criteria for postulated accidents
 - 5.2.2. Event X evaluation
 - 5.2.2.1. Plant characteristics considered/assumed
 - 5.2.2.2. Assumed protection and safety system actions
 - 5.2.2.3. Identification of causes and frequency classification
 - 5.2.2.4. Sequence of events and Systems Operation

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- 5.2.2.5. Core, system, and barrier performance
- 5.2.2.6. Results
- 5.2.3. Event Y Evaluation
 - 5.2.3.1. Plant characteristics considered/assumed
 - 5.2.3.2. Assumed protection and safety systems actions
 - 5.2.3.3. Identification of causes and frequency classification
 - 5.2.3.4. Sequence of events and systems operation
 - 5.2.3.5. Core, system, and barrier performance
 - 5.2.3.6. Results

6. Integrated Plant Analysis

- 6.1. NRC safety goal Quantitative Health Objectives (QHOs) for both early and latent health effects
 - 6.1.1. Cumulative Early Fatality Risk
 - 6.1.2. Cumulative Latent Fatality Risk
- 6.2. Analysis to show compliance with Part 20 requirements
 - 6.2.1. Cumulative Dose Exceedance Frequency

7. Defense in Depth (DID)

- 7.1. DID process description
- 7.2. Programmatic Defense-in-Depth
 - 7.2.1. Performance targets for SSC reliability and capability
 - 7.2.2. Design, testing, manufacturing, construction, operations, and maintenance programs to meet performance targets
 - 7.2.3. Tests, inspections, and monitoring of SSC performance and corrective actions
 - 7.2.4. Operational procedures and training to compensate for human errors, equipment failures, and uncertainties
 - 7.2.5. Technical specifications to bound uncertainties
 - 7.2.5.1. Risk-significant LBE limiting condition for operation reflected in plant Operating Technical Specifications
 - 7.2.5.2. Allowable Outage Times in Technical Specifications consistent with assumed functional reliability levels for risk-significant LBEs
 - 7.2.6. Capabilities for emergency plan protective actions
- 7.3. Plant Capability Defense-in-Depth
 - 7.3.1. Inherent reactor, facility, and site characteristics
 - 7.3.2. Radionuclide physical and functional barriers
 - 7.3.3. Passive and active SSCs in performance of safety functions
 - 7.3.4. SSC reliability in prevention of accidents
 - 7.3.5. SSC capability in mitigation of accidents
 - 7.3.6. SSC redundancy and diversity
 - 7.3.7. Defenses against common cause failures
 - 7.3.8. Conservative design margins in SSC performance

8. Control of Routine Plant Radioactive Effluents and Solid Waste

- 8.1. Liquid effluents
- 8.2. Gaseous effluents
- 8.3. Solid radioactive waste

9. Control of Occupational Dose

- 9.1. Maintaining ALARA
- 9.2. Radiation Sources

10. Human Factors Analysis

- 10.1. Insights from the Human Factors Engineering program been included in the PRA
- 10.2. Plant system control designs minimized the reliance on human performance as part of risk-significant LBE scenarios

11. Physical Security

- 11.1. Physical barriers
- 11.2. Vital areas
- 11.3. Detections aids
- 11.4. Communication
- 11.5. Access controls
- 11.6. Security lighting

12. Overview of PRA

13. Administrative Control Programs (* combined license application (COLA) only)

- 13.1. Organization*
- 13.2. Training of personnel*
- 13.3. Conduct of operations*
- 13.4. Reliability Assurance Program
- 13.5. Maintenance Program*
- 13.6. Change control process to monitor performance and manage SSC categorization changes

14. Initial Startup Programs

- 14.1. As-built verification program (ITAAC?)
- 14.2. Preoperational testing program
- 14.3. Initial startup testing/operations program

Separate Licensing Documents

Design Certification (DC) and COL Application (if not referencing a DC)

- Technical Specifications
- Technical Requirements Manual
- Quality Assurance Plan (design)
- Fire Protection Program (design)
- PRA
- Fuel qualification report
- Exemptions

COL Application only

- Quality Assurance Plan (construction and operations)

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- Emergency Plan
- Physical Security Plan
- SNM (special nuclear materials) physical protection program
- SNM material control and accounting plan
- Cyber Security Plan
- New fuel shipping plan
- Fire Protection Program (operational)
- Radiation Protection Program
- Offsite Dose Calculation Manual
- Inservice inspection/Inservice testing (ISI/IST) Program
- Environmental Report
- Site Redress Plan
- Exemptions, Departures, and Variances

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