

DG-1145: Combined License Applications for Nuclear Power Plants (LWR Edition)



Office of Nuclear Reactor Regulation
July 10, 2006

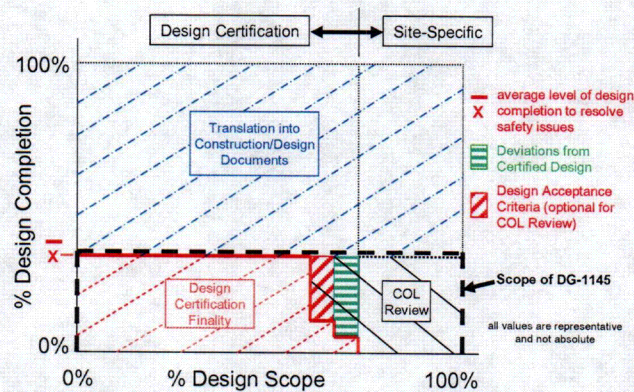


Figure 1: Combined License Application Referencing a Certified Design

DG 1145 – Section C.I.3 (3.7 – 3.13)
**Design of Structures, Systems,
Components, and Equipment**



10 July 2006
New Reactor Infrastructure Guidance Development
Branch

Overview

- Section Outlines
- Content Highlights
- Section References
- Pre-Workshop Comments
- Questions

ml061360276

C.I.3 Design of Structures, Components, Equipment, and Systems

- Chapter 3 of the final safety analysis report (FSAR) should identify, describe, and discuss the principal architectural and engineering design of those structures, components, equipment, and systems important to safety.

Section C.I.3 (3.7 – 3.13) Design of Structures, Systems, Components, and Equipment

COL Applications Referencing a Certified Design (CD) or a Certified Design and an Early Site Permit (ESP)

- Section C.III.1, Chapter 3: Application Referencing a CD
Note: COL applicants do not need to provide additional information on some sections discussed in C.I.3.
- Section C.III.2, Chapter 3: Application Referencing a CD and an ESP
Note: COL applicants need to provide information identical to the information in Chapter 3 of C.III.1, with exception of Section 3.5.1.6, Aircraft Hazards. Unless it is covered in the ESP.

Section Outline

- **C.I.3.7 Seismic Design**
 - C.I.3.7.1 Seismic Design Parameters
 - C.I.3.7.2 Seismic System Analysis
 - C.I.3.7.3 Seismic Subsystem Analysis
 - C.I.3.7.4 Seismic Instrumentation

Referencing a Certified Design

- **C.III.1.3.7 Seismic Design**
 - For example, if a certified design is referenced, the applicant does not need to include additional information in the COL of:
 - 3.7.1 Seismic Design Parameters
 - 3.7.1.2 Percentage Critical Damping Value
 - 3.7.2 Seismic System Analysis
 - 3.7.2.1 Seismic Analysis Methods
 - 3.7.2.3 Procedures Used for Analytical Modeling
 - 3.7.2.6 Three Components of Earthquake Motion
 - 3.7.2.7 Combination Modal Responses
 - 3.7.2.10 Use of Constant Vertical Static Factors
 - 3.7.2.11 Method Used to Account for Torsional Effects
 - 3.7.2.15 Analysis Procedures for Damping

Referencing a Certified Design

- **C.III.1.3.7 Seismic Design (cont'd)**
 - For example, if a certified design is referenced, the applicant does not need to include additional information in the COL of:
 - **3.7.3 Seismic Subsystem Analysis**
 - 3.7.3.1 Seismic Analysis Methods
 - 3.7.3.2 Procedures Used for Analytical Modeling
 - 3.7.3.3 Analysis Procedure for Damping
 - 3.7.3.4 Three Components of Earthquake Motion
 - 3.7.3.5 Combination of Modal Responses
 - 3.7.3.6 Use of Constant Vertical Static Factors

Section Outline (cont'd)

- **C.I.3.8 Design of Category I Structures**
 - C.I.3.8.1 Concrete Containment
 - C.I.3.8.2 Steel Containment
 - C.I.3.8.3 Concrete and Steel Internal Structures of Steel or Concrete Containment
 - C.I.3.8.4 Other Seismic Category I Structures
 - C.I.3.8.5 Foundations (see C.I.3.8.1)

Referencing a Certified Design

- **C.III.1.3.8 Design of Category I Structures**
 - For example, if a certified design is referenced, the applicant does not need to include additional information in the COL of:
 - 3.8.1 Concrete Containmentment
 - 3.8.2 Steel Containmentment
 - 3.8.3 Concrete and Steel Internal Structures of Steel or Concrete Containments
 - 3.8.5 Foundations
- Note: Section C.I.3.8.4, Other Seismic Category I Structures, will still be required.

Section Outline (cont'd)

- **C.I.3.9 Mechanical Systems and Components**
 - C.I.3.9.1 Special Topics for Mechanical Components
 - C.I.3.9.2 Dynamic Testing and Analysis of Systems, Components, and Equipment
 - C.I.3.9.3 ASME Code Class 1, 2, and 3 Components and Component Supports, and Support Structures
 - C.I.3.9.4 Control Rod Drive Systems

Section Outline (cont'd)

- **C.I.3.9 Mechanical Systems and Components (cont'd)**
 - C.I.3.9.5 Reactor Pressure Vessel Internals
 - C.I.3.9.6 Functional Design, Qualification, and In-service Testing Programs for Pumps, valves, and Dynamic Restraints
 - C.I.3.9.7 Risk Informed In-service Testing (Later)
 - C.I.3.9.8 Risk Informed In-service Inspection of Piping (Later)

Referencing a Certified Design

- **C.III.1.3.9 Mechanical Systems and Components (cont'd)**
 - For example, if a certified design is referenced, the applicant does not need to include additional information in the COL of:
 - **3.9.2 Dynamic Testing and Analysis of Systems, Components, and Equipment**
 - 3.9.2.2 Seismic Analysis and Qualification of Seismic Category I Mechanical Equipment
 - 3.9.2.3 Dynamic Response Analysis of Reactor Internals (Transient and Steady State)
 - 3.9.2.5 Dynamic Response Analysis of Reactor Internals Under Faulted Conditions
 - 3.9.2.6 Correlations of Reactor Internals Vibration Tests with the Analytical Results

Referencing a Certified Design

- **C.III.1.3.9 Mechanical Systems and Components (cont'd)**
 - For example, if a certified design is referenced, the applicant does not need to include additional information in the COL of:
 - 3.9.3 ASME Code Class 1, 2, and 3 Components and Component Supports, and Support Structures
 - 3.9.3.4 Component Supports
 - 3.9.4 Control Rod Drives Systems
 - 3.9.5. Reactor Pressure Vessel Internals
 - 3.9.5.1 Design Arrangements
 - 3.9.5.2 Loading Conditions
 - 3.9.5.3 Design Bases

Section Outline (cont'd)

- **C.I.3.10 Seismic and Dynamic Qualification of Mechanical and Electrical Equipment**
 - C.I.3.10.1 Seismic Qualification Criteria
 - C.I.3.10.2 Methods and Procedures for Qualifying Mechanical and Electrical Equipment and Instrumentation
 - C.I.3.10.3 Methods and Procedures for testing and Supports of Mechanical and Electrical Equipment and Instrumentation
 - C.I.3.10.4 Tests and Analyses results

Section Outline (cont'd)

- **C.I.3.11 Environmental Qualification of Mechanical and Electrical Equipment**
 - C.I.3.11.1 Equipment Location and Environmental Conditions
 - C.I.3.11.2 Qualification Tests and Analyses
 - C.I.3.11.3 Qualification Tests Results
 - C.I.3.11.4 Loss of Ventilation
 - C.I.3.11.5 Estimated Chemical and Radiation Environment
 - C.I.3.11.6 Qualification of Mechanical Equipment
- **C.I.3.12 Piping Design Review (Later)**

Section Outline (cont'd)

- **C.I.3.13 Threaded fasteners – ASME Code Class 1, 2, and 3**
 - C.I.3.13.1 Design Considerations
 - C.I.3.13.2 In-service Inspection Requirements

Referencing a Certified Design

- **C.III.1.3.13 Threaded fasteners – ASME Code Class 1, 2, and 3**
 - For example, if a certified design is referenced, the applicant does not need to include additional information in the COL of:
 - 3.13.1 Design Considerations
 - 3.13.1.4 Pre-Service Inspection Requirements
 - 3.13.1.5 Certified Materials Reports

Content Highlights

- **Mechanical Systems and Components**
 - DG-1145 will include Section 3.9.5.4 in C.I.3 to ask to perform a detail analysis of flow effects (as applicable) to the BWR Reactor :
 - Pressure vessel internal components
 - Other main steam components

Section References

- **Regulations**
 - 10 CFR Part 50
 - 10 CFR Part 52
- **Regulatory Guide 1.70**
- **Other Applicable Regulatory Guides**
 - e.g., 1.12, 1.18, 1.20, 1.30, 1.35, 1.40, 1.55, 1.57, 1.60, 1.61, 1.63, 1.73, 1.89, 1.90, 1.92, 1.97, 1.122, 1.131, 1.151, 1.156, 1.158, and 1.166
- **NUREGs**
 - NUREG/CR-6372; NUREG/CR- 6728

Pre-Workshop Comments

Questions



Section C.II.2, Inspections, Test, Analyses, and Acceptance Criteria (ITAAC)

- Requirements for including ITAAC in an application are contained in the regulations
 - COLs - *proposed* Part 52.80(b)
 - DCs - *proposed* Part 52.47(b)(2)
 - ESPs - *proposed* Part 52.17(b)(3)

Section C.II.2, ITAAC

- Successful completion of all ITAAC is necessary to ensure that the facility has been constructed and will operate in conformity with its combined license
- Successful completion of all ITAAC and a Commission finding that the acceptance criteria in the COL are met are prerequisites for fuel load and operation of the facility

Section C.II.2, ITAAC

- DG-1145, Section C.II.2, provides guidance for the development of ITAAC for a COL applicant that does not reference a DC
 - ITAAC must be for entire facility
 - same level of detail and verification efforts
 - format and content should be similar
- Section C.II.2 interfaces with Sections C.III.7, C.I.13.3 and C.I.13.6

Section C.II.2, ITAAC

- Development of Section C.II.2 guidance
 - NRC experience with ITAAC for certified designs (ABWR, AP600, System 80+, AP1000)
 - draft SRP 14.3 and associated draft SRPs 14.3.1 – 14.3.11
 - draft NEI-04-01, Rev. E

Section C.II.2, ITAAC

- ITAAC format – system based focus (does not preclude alternative basis)
- ITAAC format – 3 columns
 - Design requirement/commitment
 - Inspections, Tests, or Analyses
 - Acceptance Criteria

Section C.II.2, ITAAC

- ITAAC for DCs – Tier 1 information
 - design descriptions included tables and figures
- COL application that does not reference a DC does not have Tier 1 information
 - maintained concept of design descriptions as an option for COL applicants to include tables and figures specifically for reference by ITAAC

Section C.II.2, ITAAC

- Selection methodology for SSCs to be included in ITAAC should consider:
 - safety related/important to safety
 - provide defense-in-depth functions
 - NSR functions credited for mitigating DBEs
 - NSR requiring additional regulatory oversight
 - risk significant (PRA insights)
 - features/functions to satisfy Parts 20, 50, 52, 73 and 100
 - severe accident prevention or mitigation
 - features/functions credited in integrated analyses

Section C.II.2, ITAAC

- ITAAC are not all created equal – range of verification methods and acceptance criteria
 - Simple tests to complicated tests
 - Simple visual verifications
 - Simple reports to detailed engineering analyses
 - ASME Code reports
 - Use definitions consistent with those provided
 - Acceptance criteria should reflect values credited in safety analyses rather than design values

Section C.II.2, ITAAC

- Specific guidance provided for developing ITAAC
 - SRP 14.3.1, Site Parameters
 - SRP 14.3.2, Structures and Systems
 - SRP 14.3.3, Piping Systems and Components
 - SRP 14.3.4, Reactor Systems
 - SRP 14.3.5, Instrumentation and Controls
 - SRP 14.3.6, Electrical Systems
 - SRP 14.3.7, Plant Systems

Section C.II.2, ITAAC

- Specific guidance provided for developing ITAAC
 - SRP 14.3.8, Radiation Protection
 - SRP 14.3.9, Human Factors Engineering
 - SRP 14.3.10, Emergency Planning
 - SRP 14.3.11, Containment Systems and Severe Accidents
 - SRP 14.3.12, Physical Security Hardware

Section C.II.2, ITAAC

- Sample ITAAC format provided
- ITAAC General Development guidance
 - Fluid Systems
 - Instrumentation and Control Systems
 - Electrical Systems
 - Building Structures