

4.0 REACTOR

4.1 Introduction

This chapter describes the mechanical components of the Economic Simplified Boiling-Water Reactor (ESBWR) and the reactor core including the reactor internals, control rod drive, and core support structural materials, fuel system design (fuel rods and assemblies), the nuclear design, and the thermal-hydraulic design. It provides an evaluation and the supporting information necessary to establish the capability of the reactor to perform its safety functions throughout its design lifetime under all normal operational modes and transient, steady-state, and accident conditions. This chapter also includes information to support the accident analyses.

4.2 Summary of Application

Chapter 4 of the Fermi 3 Combined License (COL) Final Safety Analysis Report (FSAR), Revision 7 incorporates by reference, with no departures, Chapter 4 of the certified ESBWR Design Control Document (DCD), Revision 10. In addition, in FSAR Chapter 4, the applicant provides the following:

COL items

- STD COL 4.3-1-A Variances from Certified Design

The applicant shall address changes to the reference design of the fuel, control rod, or core design.

- STD COL 4A-1-A Variances from Certified Design

The applicant shall address changes to the reference design of the fuel, control rod, or core design.

For both items, the applicant states that there are no changes to the fuel, control rod, or core design from the referenced certified design.

4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG-1966, "Final Safety Evaluation Report Related to the Certification of the Economic Simplified Boiling-Water Reactor." In addition, the relevant requirements of the Commission regulations for the reactor, and the associated acceptance criteria, are in Chapter 4 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, (LWR Edition)," the Standard Review Plan (SRP).

4.4 Technical Evaluation

As documented in NUREG-1966, U.S. Nuclear Regulatory Commission (NRC) staff reviewed and approved Chapter 4 of the certified ESBWR DCD. The staff reviewed Chapter 4 of the Fermi 3 COL FSAR and checked the referenced ESBWR DCD to ensure that the combination

of the information in the COL FSAR and the information in the ESBWR DCD represents the complete scope of information relating to this review topic.¹ The staff's review confirmed that the information in the application and the information incorporated by reference address the required information relating to this chapter.

Chapter 4 of the Fermi 3 COL FSAR contains the following sections:

- 4.1 Summary Description
- 4.2 Fuel System Design
- 4.3 Nuclear Design
- 4.4 Thermal and Hydraulic Design
- 4.5 Reactor Materials
- 4.6 Functional Design of Reactivity Control System

Appendix 4A Typical Control Rod Patterns and Associated Power Distribution for ESBWR
Appendix 4B Fuel Licensing Acceptance Criteria
Appendix 4C Control Rod Licensing Acceptance Criteria
Appendix 4D Stability Evaluation

The staff reviewed the following information in the COL FSAR:

COL items

- STD COL 4.3-1-A Variances from Certified Design
- STD COL 4A-1-A Variances from Certified Design

For COL Items STD COL 4.3-1-A and STD COL 4A-1-A, the applicant states that there are no changes to the fuel, control rod, or core design from the referenced certified design. The staff reviewed the information in the COL FSAR and concluded that the information provided to address these COL items is adequate and therefore acceptable.

4.5 Post Combined License Activities

There are no post COL activities related to this chapter.

4.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG-1966. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirms that the applicant addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this chapter. Pursuant to 10 CFR 52.63(a)(5) and 10 CFR Part 52, Appendix E, Section VI.B.1, all nuclear safety issues relating to this section that were incorporated by reference are resolved. The staff's review confirms that the applicant adequately addressed COL Items STD COL 4.3-1-A and STD COL 4A-1-A.

¹ See "Finality of Referenced NRC Approvals" in SER Section 1.2.2 for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.