

## **11.0 PLANT SYSTEMS**

### **11.12 SEISMIC QUALIFICATION OF EQUIPMENT, SYSTEMS, AND COMPONENTS**

#### **11.12.1 CONDUCT OF REVIEW**

This chapter of the revised draft Safety Evaluation Report (DSER) contains the staff's review of seismic qualification (SQ) described by the applicant in Chapter 11.12 of the revised Construction Authorization Request (CAR) (Reference 11.12.3.1). The objective of this review is to determine whether the SQ of electrical and mechanical equipment and their SQ design bases identified by the applicant provide reasonable assurance of protection against natural phenomena and the consequences of potential accidents. Seismic issues related to the ground motion are evaluated in revised DSER section 1.3.1.5. The staff evaluated the information provided by the applicant for SQ of electrical and mechanical equipment by reviewing Chapter 11 of the revised CAR, other sections of the revised CAR, supplementary information provided by the applicant, and relevant documents available at the applicant's offices but not submitted by the applicant. The review of the SQ of electrical and mechanical equipment design bases and strategies was closely coordinated with the review of the electrical, instrumentation and control, and mechanical aspects of accident sequences described in the Safety Assessment of the Design Basis (see Chapter 5 of this revised DSER), and the review of other plant systems.

The staff reviewed how the information in the revised CAR addresses the following regulations:

- Section 70.23(b) of 10 CFR states, as a prerequisite to construction approval, that the design bases of the PSSCs be found to provide reasonable assurance of protection against natural phenomena and the consequences of potential accidents.
- Section 70.64 of 10 CFR requires that baseline design criteria (BDC) and defense-in-depth practices be incorporated into the design of new facilities. With respect to natural phenomena hazards, 10 CFR 70.64(a)(2) requires that the MFFF design provide for adequate protection against such hazards, with consideration of the most severe documented historical events for the MFFF site.

The review for this construction approval focused on the design basis of the electrical and mechanical equipment that are related to the SQ requirement. The staff used Chapter 11 in NUREG-1718, "Standard Review Plan for the Review of an Application for a Mixed Oxide (MOX) Fuel Fabrication Facility," as guidance in performing the review.

##### **11.12.1.1 System Description**

The electrical and mechanical equipment evaluated in this section are PSSCs and are major components of systems (also PSSCs) such as the confinement systems (described in revised DSER Section 11.4), the electrical systems (described in revised DSER Section 11.5), the instrumentation and control systems (described in revised DSER Section 11.6), the material transport system (described in DSER Section 11.7), the fluid transport system (described in revised DSER Section 11.8), the fluid systems (described in revised DSER Section 11.9), and the heavy lift cranes (described in revised DSER Section 11.10).

### 11.12.1.2 Design Basis of the PSSCs and Applicable Baseline Design Criteria

The applicant's methodology for seismic classification of SSCs consists of seismic categories and seismic performance requirements. The seismic category classification contains seismic category I (SC-1) which applies to all PSSCs that must perform safety functions during and/or after the design basis earthquake to comply with the MFFF safety assessment as described in Chapter 5 of the revised CAR; and seismic category II (SC-2) which applies to systems which are not required after a design basis earthquake but whose failure could adversely impact the ability of a seismic category I system to perform its safety function. The seismic performance requirements segregate seismic category I and II by the safety functions they must perform during or after a seismic event such as remaining active during or after a seismic event, maintaining a pressure boundary or structural integrity, and not failing in a way that compromises a PSSC (seismic category II).

The analysis requirements provided in the revised CAR consist of seismic design parameters that were developed with the determination of the design basis earthquake and procedures for the use of seismic inertial response techniques. For the seismic parameters, in-structure response spectra will be generated in accordance with one of the methods cited in the American Society of Civil Engineers, "Standard Seismic Analysis of Safety Related Nuclear Structures" (ASCE 4-98), Section 3.4. The applicant's qualification methodology allows the inertial response of PSSCs to be determined using dynamic analysis or equivalent static analysis for elements that can be represented by a single-degree-of-freedom or a simple multiple-degree-of-freedom model.

The seismic qualification requirements as specified in the revised CAR allows either analysis or "shake table testing" for most seismic performance categories. Shake table testing is required for components where analysis alone is insufficient to ensure operability after a seismic event (e.g., electrical components).

In Reference 11.12.3.1 and Reference 11.12.3.2 DCS stated that electrical and mechanical equipment will be seismically qualified using:

- Institute of Electrical and Electronics Engineers (IEEE). IEEE Std 344-1987, "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Generating Stations."
- Nuclear Regulatory Commission (U.S.)(NRC). Regulatory Guide 1.100, Revision 2, "Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants." NRC: Washington, D.C. June 1988.

In Reference 11.12.3.2, DCS stated that mechanical equipment will be qualified to IEEE 344-1987, including NRC additions to the 1987 IEEE standard stated in Regulatory Guide 1.100. Therefore, mechanical equipment qualification will consider attached piping loads, thermal loads, and live loads such as fluid sloshing. In addition, applied loads will meet or exceed accelerations corresponding to their installed locations.

The staff finds that these commitments satisfy the requirements of 10 CFR 70.64 (a)(2), and notes that this approach is consistent with how SQ requirements are applied at nuclear power plants.

### **11.12.2 EVALUATION FINDINGS**

Based on the staff's review of the revised CAR, the supporting information provided by the applicant, and the applicant's commitments to the guidance referenced above, the staff finds, pursuant to 10 CFR 70.64(a)(2), that for seismic qualification of equipment, the design basis of the proposed facility provides for adequate protection against seismic hazards, and that the applicant has adequately taken into consideration the most severe documented historical seismic events for the MFFF site. The staff concludes, pursuant to 10 CFR 70.23(b), that the design basis of the PSSCs relevant to seismic qualification of electrical and mechanical equipment will provide reasonable assurance of protection against natural phenomena and the consequences of potential accidents.

### **11.12.3 REFERENCES**

- 11.12.3.1 Ihde, R.H., Duke Cogema Stone & Webster, letter to U.S. Nuclear Regulatory Commission, RE Mixed Oxide Fuel Fabrication Facility Construction Authorization Request Revision, October 31, 2002.
- 11.12.3.2 Hastings, P.S., Duke Cogema Stone & Webster, letter to U.S. Nuclear Regulatory Commission, RE Construction Authorization Request: Clarification of Responses to NRC Request for Additional Information, February 11, 2002.

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