RAS 5586 72-22-ISFSI - State Exhibit 127-Rec'd 5/17/02

CNWRA 98-007

SEISMIC GROUND MOTION AT THREE MILE ISLAND UNIT 2 INDEPENDENT SPENT FUEL STORAGE INSTALLATION SITE IN IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY—FINAL REPORT

DOCKETED
USNRC

2003 JAN 29 PM 3: 17

OFFICE OF THE SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

Prepared for

Nuclear Regulatory Commission
Contract NRC-02-97-009

NUCLEAR REGULATORY COMMISSION
Docket No. ___ Official Exh. No. 127
In the matter of PFS
Staff ✓ IDENTIFIED ✓
Applicant ___ RECEIVED ✓
Intervenor ✓ REJECTED ___
Other ___ WITHDRAWN ___
DATE 5-17-02 Witness ___
Clerk D. Kent

Prepared by

Rui Chen
Asadul H. Chowdhury

Center for Nuclear Waste Regulatory Analyses
San Antonio, Texas

June 1998

NRC-00551 Template=SECY-028

State's
Exhibit 127
SECY-02

It is interesting to note that the DOE's current 0.36-g horizontal design value for the proposed TMI-2 ISFSI soil site bounds the 2,000-yr return period probabilistic event (0.30 g, table 3-2). However, it does not bound the 10,000-yr return period event (0.47 g, table 3-2).

3.5 DEVELOPMENT OF DESIGN BASIS EARTHQUAKE PARAMETERS

To comply with DOE Standards 1020-94 and 1023-94 and to be consistent with NRC regulations, WCFS (1996b) developed DBE ground motion parameters for the proposed ISFSI site based on the WCFS (1996a) PSHA. These parameters were developed according to procedures described in DOE Standards 1023-94 and are in the form of acceleration response spectra and time histories as reviewed in more detail in section 2.5 and illustrated in figures 2-19 through 2-21 and tables 2-6.

4 DISCUSSION AND RECOMMENDATION

4.1 DISCUSSION

Seismic issues that are important to siting the proposed TMI-2 storage facility include identification of potential seismic sources, source characteristics, and associated uncertainties; deterministic and probabilistic seismic hazard assessment using state-of-the-art knowledge and techniques, including ground motion attenuation predictions and spectral analyses; and development of design basis parameters in compliance with applicable regulations and regulatory guidance. These issues have been discussed in detail in chapters 2 and 3.

In the TMI-2 SAR, the DOE-ID (1996b) has proposed a seismic design horizontal acceleration of 0.36 g. This is based on seismic design criteria contained within the INEEL AE standards (U.S. Department of Energy, 1992) that provide technical direction and guidance to architects and engineers in the development of designs for construction-type work performed for DOE-ID at INEEL. The PHAs for rock in the AE standards are based on deterministic studies conducted in the 1970s (Woodward-Lungren and Associates, 1971; Woodward-Clyde Consultants, 1975; Allied Chemical Corporation, 1975; Agbabian Associates, 1977) and supported by the results of a further deterministic analysis conducted by WCC (1990). In the AE standards related to a reactor or similar higher risk facility, the peak design basis horizontal acceleration for the ICPP is 0.36 g, including effects of soil amplification. This corresponds to the 84th percentile of the 1970s DSHA studies. This acceleration was used as the design basis SSE for the chemical processing plant, and it is intended to serve as the design basis SSE for the proposed TMI-2 ISFSI at the ICPP.

However, DOE-ID continued DSHA to develop site-specific seismic design criteria for the proposed TMI-2 ISFSI site. This analysis was based in part on the results of the 1990 deterministic evaluation for INEEL (Woodward-Clyde Consultants, 1990) and recent fault-trenching studies conducted along the Lemhi and Lost River faults (Woodward-Clyde Consultants, 1992b; 1995). The Lemhi fault is the closest Basin and Range normal fault to the proposed TMI-2 ISFSI site and controls the deterministic seismic hazard. The resulting 50th- and 84th-percentile deterministic values of PHAs at the proposed TMI-2 ISFSI site are 0.34 g and 0.56 g, respectively.

Since the 1980s, the DOE-ID also conducted PSHA for INEEL. TERA Corporation (1984) performed a PSHA for the ANL—West Facility. The site-specific seismic hazard curves developed by TERA Corporation have been used by LLNL (Coats and Murrary, 1984) to calculate peak horizontal ground surface accelerations for the INEEL for various return periods. The PHAs for INEEL are 0.14, 0.21, and 0.24 g for return periods of 1,000, 5,000, and 10,000 yr. However, recently the DOE-ID has completed another probabilistic seismic hazard evaluation for facility areas of INEEL, including the ICPP (Woodward-Clyde Federal Services, 1996a). The methodology used in the new probabilistic study provides for explicit inclusion of the range of seismologic and tectonic interpretations including seismic source characterization and ground motion estimation consistent with approaches contained in NRC Guide 1.165 (Draft was DG-1032, Nuclear Regulatory Commission, 1997a). Based on this study, the PHAs for the proposed TMI-2 ISFSI site are 0.23, 0.30, and 0.47 g for return periods of 1,000, 2,000, and 10,000 yr, respectively.

In the light of new deterministic and probabilistic hazard assessment data, the DOE-ID has proposed to the NRC (U.S. Department of Energy-Idaho Operations Office, 1996b) for NRC acceptance of the DOE-ID SAR a DE value of 0.36 g that will envelope the 50th-percentile deterministic value of 0.34 g and 2,000-yr return period probabilistic value of 0.30 g.

The literature survey conducted herein indicates that the majority of the pertinent literature was produced by the DOE and its contractors or subcontractors. It is important to recognize that the DOE has sufficiently identified, utilized, and referenced previous as well as the state-of-the-art knowledge and information that exist in the literature in its site characterization efforts. Seismotectonic characteristics that are significant for seismic hazard evaluation at INEEL have been analyzed and potential seismic sources have been identified. Various studies, especially the recent probabilistic and deterministic seismic hazard analyses conducted by a DOE subcontractor, the WCFS (1996a,b), have also taken sufficient considerations of uncertainties associated with seismic source characteristics using the state-of-the-art investigation and analysis techniques. This study by WCFS (1996a,b) also included sophisticated sensitivity analyses that isolated the contributions to the total ground motion hazard produced by various potential seismic sources and the evaluated relative importance of various uncertainties associated with characterization of those seismic sources. Those analyses are consistent with recommendations in Appendix A of 10 CFR Part 100. In summary, the DOE seismic hazard analysis approach for the proposed TMI-2 ISFSI appears to be technically sound, and resultant ground motion values represent the best estimates. However, the DOE-proposed design PHA of 0.36 g does not bound the most recent 84th-percentile deterministic value of 0.56 g and 10,000-yr return period probabilistic value of 0.47 g. Therefore, a judgment of whether the DOE-design approach is acceptable depends on whether there are regulatory and technical bases to accept an ISFSI-design value that bounds the 50th-percentile deterministic value and the 2,000-yr return period probabilistic value.

Section 2.5.2.6 of NUREG-0800 (Nuclear Regulatory Commission, 1997b) provides guidance on assessing the SSE ground motion. Substantial uncertainties are inherent in deriving spectra for seismic ground motions, and the guidance states NRC preference that the 84th-percentile (median plus one standard deviation) response spectra be used for both spectral shape and ground motion amplitude estimates. Although a strict interpretation of 72.102(f)(1) may lead one to conclude that 0.56 g is the requisite DE value for the proposed TMI-2 ISFSI site, there is a regulatory basis for a different design value that may be adequate. In 1980, when 10 CFR Part 72 was first promulgated, ISFSIs were largely envisioned to be spent fuel pools or massive dry-storage structures. Moreover, ISFSIs were expected to be built at existing power plant sites where SSE values are already determined. In the Statements of Consideration (SOC) accompanying the initial rulemaking, the NRC recognized that the design PHA for dry casks and canisters need not be as high as a power reactor SSE: "For ISFSIs which do not involve massive structures, such as dry-storage casks and canisters (*sic*), the required design earthquake will be determined on a case-by-case basis until more experience is gained with licensing these types of units." With over 10 yr of experience licensing dry-cask storage, and robust analyses demonstrating cask behavior in accident scenarios, the NRC staff now have a reasonable technical basis to consider a different design PHA that is adequate for licensing dry storage ISFSIs.

The NRC selected the 84th-percentile DE for power reactors to provide an extra level of conservatism for those higher risk facilities. An operating ISFSI is inherently less hazardous and less vulnerable to earthquake-initiated accidents than is an operating nuclear power reactor (Hossain et al., 1997). Unlike a nuclear power plant, an ISFSI does not have an active nuclear reaction, and hence does not need to meet requirements for active cooling and safe shutdown systems in order to ensure the integrity of the high-pressure reactor coolant boundary and for shutting down the reactor in the event of a very large earthquake. Operations in an ISFSI facility need not be continuous but can be shut down,