

May 26, 2005

MEMORANDUM TO: Farouk Eltawila, Director
Division of Systems Analysis and Regulatory Assessments
Office of Nuclear Regulatory Research

FROM: Michael Mayfield, Director **/RA/**
Division of Engineering
Office of Nuclear Reactor Regulation

SUBJECT: IDENTIFICATION OF A GENERIC SEISMIC ISSUE

REFERENCE: GI-194, "Implications of Updated Probabilistic seismic hazard estimates."
ADAMS Accession No.: ML032680979

BACKGROUND:

In the above reference document, RES staff addressed the concern related to the adequacy of existing deterministic seismic design criteria for the licensing basis of plants in the Eastern Tennessee Seismic Zone, and concluded that the concerns in GI-194 had been addressed through previous programs. Subsequent to the closure GI-194, the Division of Engineering (DE) staff has been reviewing seismic hazard analyses for several sites in the Central and Eastern United States (CEUS) for early site permit applications (ESP) under 10 CFR Part 52, Subpart A and associated siting evaluation criteria from 10 CFR Part 100.23, "Geologic and seismic siting criteria." Regulatory guidance for the implementation of 10 CFR Part 100.23 is provided in RG 1.165, "Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion (ML003740084)."

Regulatory Guide 1.165, developed in the early 1990s, specifies a reference probability for exceedance of the safe shutdown earthquake (SSE) ground motion, i.e., seismic hazard, at a median annual value of 10^{-5} . This reference probability value is based on the annual probability of exceeding the SSEs for 29 CEUS nuclear power plant sites and is used to establish the SSEs for future nuclear facilities. Preliminary results from a recent (2004) letter report from the United States Geological Survey (USGS) indicates that the reference probability for the 29 CEUS sites is now about 6 to 7 x 10^{-5} . This increase in the reference probability value is primarily due to recent developments in the modeling of earthquake ground motion in the CEUS.

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No new plants have applied for a Construction Permit or ESP since Part 100 was revised and Reg. Guide 1.165 was issued in 1997. Therefore, the impact of the revised regulation and the regulatory guide as they relate to future plants and operating reactors was not realized until the staff started its review of the ESP applications.

PRELIMINARY OBSERVATION

It is apparent from staff's review of the ESP applications with support from the USGS letter report that the perception of seismic hazard for operating plants in the CEUS region has increased. It should be noted that a complete assessment and review of the operating plants were conducted in response to the Individual Plant Examination for External Events (IPEEE) Program under GL 88-20, Supplement 4. A review level earthquake (RLE) of 0.3g peak ground acceleration (NUREG/CR 0098 spectrum shape anchored at 0.3g) was used for the CEUS sites. In NUREG-1407, "Procedural and Submittal Guidance for the Individual Plant Examination of External Events for Severe Accident Vulnerabilities," Section A.2.5, Spectral shape, it has been pointed out that the use of a somewhat higher spectrum (Seismic Qualification Utility Group bounding spectrum) would make little or no difference. Staff perspective on its evaluation of IPEEE reports is documented in NUREG-1742, "Perspectives Gained From the Individual Plant Examination of External Events Program."

The staff has reviewed the implementation of RG 1.165 criteria of probabilistic seismic hazard analysis (PSHA) for selected CEUS sites where current understanding of seismogenic sources and CEUS ground motion attenuation models were used. Based on this review, the staff has determined that compared to the spectra derived from RG 1.165 methods, RLE spectra have higher spectral ordinates in the vibration frequency range of 1 to about 6 Hz and lower spectral ordinates in vibration frequencies higher than 6 Hz. It is expected that new ground motion spectra from a current PSHA would have lower spectral ordinates compared to the RLE spectrum ordinates in the 1 to 6 Hz range for most currently operating facilities in the CEUS. The dominant natural frequencies for most structures lie within the 1 to 6 Hz range. Therefore, the RLE spectrum is conservative for the examination and evaluation of the capacities of structures. Equipment in the high frequency range, 6 to 20 Hz generally are rugged and have margins substantially beyond the design basis SSE.

The staff has determined, based on the evaluations of the IPEEE Program, that seismic designs of operating plants in the CEUS still provide an adequate level of protection. At the same time, the staff also recognizes that the probability of exceeding the SSE at some of the currently operating sites in the CEUS is higher than previously understood.

RECOMMENDATION

We recommend that this generic seismic issue (GI-194), and the impact of higher seismic hazard on current nuclear power plants in the CEUS region, be examined under your generic issue identification and resolution process. The DE staff will maintain interaction with your staff, as needed, during the resolution process, and initiate appropriate action in accordance with the findings from the final resolution of this generic issue.

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