UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO PROCEDURE FOR DEVELOPING

IN-STRUCTURE RESPONSE SPECTRA FOR RESOLUTION OF USI A-46

COMMONWEALTH EDISON COMPANY

AND

IOWA-ILLINOIS GAS AND ELECTRIC COMPANY

DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3

QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2

DOCKET NOS. 50-237, 50-249, 50-254, AND 50-265

1.0 BACKGROUND

In a letter dated November 20, 1993 (Reference 1), the NRC staff indicated to the licensee that the information provided in the 120-day response (Reference 2) to supplement No. 1 to Generic Letter 87-02 was not adequate to assess the adequacy of the in-structure response spectra for the resolution of USI A-46. The licensee provided the additional information in its letter dated January 15, 1993 (Reference 3). This evaluation addresses the adequacy of the procedure used in the development of the in-structure response spectra (IRS).

2.0 EVALUATION

Dresden, Unit 2, is a Systematic Evaluation Plan (SEP) plant. Its peak ground acceleration (PGA) corresponding to the Safe Shutdown Earthquake (SSE) is 0.2g. As indicated in Reference 1, the licensee had a choice of using either the spectra approved for use during the SEP review or the design response spectra (DRS) with the SSE-PGA of 0.2g. The licensee plans to use the DRS for the resolution of USI A-46. The DRS for Dresden are smoothed Housner Spectra. The licensee plans to use the normalized N-S component of El. Centro 1940 earthquake as the input time-history for generating the IRS. The response spectra developed from the normalized raw records envelopes the DRS by 20 to 60% between the frequencies of 1 to 10 Hz.; except between the frequencies of 3.5 to 5.0 Hz. where the enveloping margin is between -5 to 20%. The current SRP (Reference 4) acceptance criteria allows up to five such dips below the DRS. However, the current provision also requires the checking of adequate energy levels at all frequencies of interest; by comparing the DRS-power spectral density (PSD) with a target PSD. However, considering a general conservatism that exists in the input time-history, the staff finds the input to be acceptable.

The original IRS were developed utilizing this input for Operating Basis Earthquake (OBE) at 1/2% oscillation damping. The IRS for SSE were obtained by doubling the OBE-IRS. Subsequently, the horizontal DRS for additional damping values of 1%, 2% and 5% for both, the OBE and the SSE, were generated. Synthetic time histories consistent with the 1/2% damped original unwidened IRS were obtained for each floor elevation by iteration with the El. Centro time record as the starting point. These synthetic time histories were then utilized to generate SSE-IRS at various damping values. The staff reviewed a comparison demonstrating the adequacy of a synthetic time history. The staff finds the procedure for developing the synthetic time histories acceptable.

The staff also reviewed the structural modelling parameters and the IRS provided by the licensee at various floor levels of the reactor building. At approximately, 40 ft. above the grade, the broadened peaks of a 5% damped IRS have the amplifications of 3.5, 13, and 8 times the SSE-PGA between the frequencies of 1.8 and 2.5 Hz, 5 to 6.8 Hz, and 15 to 20 Hz, respectively. At 96 ft. above the grade, only the mid frequency (5 to 8 Hz) peaks are further amplified to about 21 times the SSE-PGA. The staff finds the amplifications and broadening of the peaks sufficiently conservative.

Quad Cities, Units 1 and 2, was designed as sister units to Dresden, Units 2 and 3, by the same NSSS supplier, using the same architect/engineer. Each of the units in both the plants is a Boiling Water Reactor with Mark I containment with essentially identical features. The licensee confirmed that the structural parameters of the buildings that can affect the seismic analysis are similar for both the plants. The licensee believes that, from the standpoint of seismic risk, both plants should have the same SSE-PGA (i.e., 0.2g). However, because of the FSAR commitment, for Quad Cities, the licensee plans to scale up the Dresden IRS by 0.24/0.2 = 1.2. The staff finds the licensee's approach acceptable for the resolution of USI A-46.

3.0 CONCLUSION

Based on the review of the information submitted by the licensee, the information available in the UFSAR, and responses to the staff's RAI, the staff concludes that the in-structure response spectra developed by the indicated procedure are acceptable as "conservative, design" for the purpose of verifying the adequacy of equipment. This conclusion is applicable to Dresden, Units 2 and 3, and Quad Cities, Units 1 and 2.

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4.0 REFERENCES

1. Letter from C. Patel (NRC) to T. Kovach (CECo), "Evaluation of Dresden and Quad Cities 120 Day Response to Supplement 1 to Generic Letter 87-02", dated November 20, 1992.

2. Letter from M. Jackson (CECo) to T. Murley (NRC), "Response to Supplement 1 to Generic Letter 87-02", dated September 21, 1992.

3. Letter from M. Jackson (CECo) to T. Murley (NRC), "NRC Evaluation of the Commonwealth Edison Response to Generic Letter 87-02, Supplement 1", dated January 15, 1993.

4. Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, Section 3.7.1, Revision 2, dated August 1989.