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U.S. NUCLEAR REGULATORY COMMISSION

Director, Office of Nuclear Reactor Regulation
Attention: D. M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket No. 50-206
SEP Topic III-6
Seismic Design Considerations
San Onofre Nuclear Generating Station
Unit 1

As you are aware, SCE is currently in the process of reevaluating the San Onofre Unit 1 structures to determine their capability to withstand higher seismic loadings. As discussed with the NRC staff, the results of this evaluation to date indicate that the fuel storage building will require modifications to meet the reevaluation criteria. However, it is concluded that this structure does meet the original design basis seismic criteria for the plant. The purpose of this letter is to provide our basis for that conclusion.

Section 9.2.2 of the San Onofre Unit 1 Final Safety Analysis (FSA) describes the original seismic design criteria applicable to the design of safety related (Category A) structures, systems and components. The methods of analysis are described in Section 9.2.4. The design criteria limits the stresses due to the 0.25g operating basis earthquake (OBE) to working stress limits. The criteria places no specific limitation on stresses due to the 0.5g Design Basis Earthquake (DBE). It merely requires that the stresses be such that "the function of the component, system or structure is not impaired, and a safe and orderly shutdown of the plant is assured". Section 9.2.4 states that the natural period of the structure, component or system was determined and that the acceleration responses at the appropriate periods were taken from figure 9.2. That is, one response curve was used regardless of the location of the structure, component or system.

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We have reviewed the existing Fuel Storage Building calculations which were performed in 1964 and 1965, and have concluded that they probably represent an incomplete record of the actual design process since no requirement for complete documentation or retention of records then existed. However, no deviations from the guidelines of sections 9.2.2 and 9.2.4 were identified. In addition, the following specific information has been extracted from these calculations:

1. Since the fuel pool structural walls were governed by shielding requirements (thickness), they are more than adequate to fulfill the seismic requirements of the San Onofre Unit 1 FSA.

2. The structural steel framing was designed to provide vertical support for floor slabs and the roof system. Since dead load stresses in these members are generally quite low, these members clearly satisfy the requirements for seismic design capacity as presented in the San Onofre Unit 1 FSA.

3. The in-plane shear stresses in the reinforced masonry walls were calculated based upon a lateral acceleration of 0.25g. The applied seismic in-plane stresses were found to be approximately one third of the allowable working stress limits. Since the peak acceleration from Figure 9.2 of the FSA associated with 7 percent damping (in accordance with table 9.1 of the FSA) is .35g, the computed stress would be less than half the working stress allowable regardless of the computed period of the walls. Therefore, the masonry walls were adequately designed to withstand in-plane shear, in accordance with the FSA.

4. Transverse loadings in the masonry walls were evaluated for a wind loading of 20 psf. This loading is equivalent to a transverse seismic loading of .35g. As previously indicated, this is the peak acceleration associated with the masonry walls under the design provisions of the San Onofre Unit 1 FSA. Additionally, the reinforcing provided exceeded by almost 40 percent that which was called for by the actual design calculations.

Based on this information and a general review of the original design calculations, it is concluded that the Fuel Storage Building meets and in some cases substantially exceeds the requirements for seismic design as delineated in the San Onofre Unit 1 FSA.

In addition, we have attempted to determine the seismic withstand capability of the Fuel Storage Building in accordance with current criteria. It is concluded that the fuel pool walls and basemat are sufficient to withstand seismic forces in excess of those associated with a 0.67g Housner ground motion spectrum. This conclusion is based on the fact that the pool walls were sized to provide shielding and, therefore, the seismic capacity did not govern the design. Similar conclusions have been reached for other structures in which shielding requirements governed the design.

The seismic capacity of the structure on top of the fuel pool is governed by the ability of the masonry walls to resist and transfer lateral loads. The capacity of these walls is governed by their ability to respond inelastically and by the ability of the roof diaphragm and wall-to-roof connection details to perform their function. Analysis of similar masonry walls in other structures has shown that these walls have significant inelastic capacity. This has also been demonstrated in tests of masonry walls conducted by various research organizations. However, the analysis of the Fuel Storage Building to date has incorporated assumed modifications. These modifications were made to ensure that they would remain within elastic stress limits when subjected to seismic input of a .67g Housner response spectrum. The inclusion of the assumed modifications in the current analysis greatly changes both the mass and stiffness characteristics of the building above the fuel pool level. As a result, the information obtained to this point from this analysis cannot be employed with confidence to evaluate the withstand capability of the existing building configuration. This is particularly true since the assumed modifications were implemented to change the wall responses from inelastic to elastic.

Based upon the considerations described above it is concluded that there currently does not exist a calculational basis which would allow the seismic withstand capacity of the fuel building masonry walls to be determined with a high degree of confidence. Based upon a comparison to tests of masonry walls, analysis of similar walls and evaluation of existing calculations it is our opinion that the Fuel Storage Building walls have a substantial capacity to resist earthquake loadings.

If you have any questions or require additional information, please let me know.

Very truly yours,

K P Bashan