UNITED STATES NUCLEAR REGULATORY COMMISSION WASHINGTON, D.C. 20665-0001

February 22, 1993

PDR

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Mr. Joseph Santucci, Project Director Advanced Reactor Corporation 3340 Hillview Avenue Palo Alto, California 94304

SUBJECT: ALWR FIRST-OF-A-KIND ENGINEERING - PROPOSED CRITERIA FOR PIPING DESIGN AND EQUIPMENT SEISMIC QUALIFICATION

Dear Mr. Santucci:

In your letter to me dated January 26, 1993, you provided information that the NRC staff requested during the November 10, 1992 public meeting held in the NRC offices in Rockville, Maryland. Your information included (1) a status of the first-of-a-kind engineering (FOAKE) project on seismic qualification of equipment, (2) a copy of an ASME paper on proposed dynamic stress criteria for piping, and (3) comments on the NR. staff's criteria for the ABWR.

We have reviewed the ASME paper on proposed dynamic stress criteria for piping (also referred to as the EPRI-GE criteria). It is our understanding that this paper will be used as the basis for developing the ARC technical criteria for piping in the ALWR FOAKE. As you noted in your letter, the ARC's proposal will be a refinement and repackaging of the EPRI-GE criteria. You stated that the ARC's technical proposal will be submitted to the ASME in early 1993. Although not explicitly addressed in your letter, we assume your plans are to seek an expedited ASME approval of the ARC technical criteria.

We have also reviewed the initial draft comments from the ARC Technical Core Group on the NRC staff's criteria for the ABWR. It appears that the "NRC staff criteria" you evaluated are only proposed criteria for eliminating the operating basis earthquake (OBE) from design. The criteria do not represent the total package of piping design criteria for the ABWR in which certain relaxation from today's criteria have been approved. Recognizing this, it is partially understandable that your overall conclusion found that the NRC staff criteria "do not address the appropriate mode of failure for piping subjected to earthquake loading, thereby resulting in a highly conservative piping system design." However, it was not the intent of the staff's criteria to address a mode of failure different than collapse. Because it was wellrecognized that the OBE controlled the piping design in currently operating nuclear plants. the "trf's goal was to develop seismic criteria that would allow the elin the OBE from the ALWR plant design and, thus, establish the design based on a single earthquake - the safe-shutdown earthquake. In coing so, and in approving other relaxations in the piping design criteria for the ABWR, the staff believes it has achieved a reasonably balanced set of seismic design criteria that results in m conservative and yet cost-effective design for piping systems without decreasing the safety margin from that of currently operating nuclear plants. Our preliminary information indicates that in using the piping design criteria approved for the ABWR, the number of seismic soubbers and postulated oipe break locations can be substantially reduced. 300073

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The staff's criteria for a single-earthquake design do not preclude the use of a design based on a fatigue or fatigue-ratcheting failure mode if such methods are approved by the ASME and endorsed by NRC regulations. To date, however, the ARC has not provided the technical justification for such an approach or the benefits in terms of safety, cost, or ALARA factors. Also, there needs to be a careful examination of the piping design resulting from your proposed criteria, a review against operating experience (e.g., earthquake or dynamic loadings), and the development of appropriate fragility estimates to determine the high confidence of low probability of failure (HCLPF) of piping. As you are aware, the staff has proposed a factor of two between design and the overall HCLPF to resolve uncertainties associated with seismic hazard analyses.

You stated in your letter that you plan to submit final comments from the ARC Technical Core Group together with the results of the sample piping problems (which compare the results of various piping design criteria) to the NRC staff. After the staff has received and reviewed these naterials, a followup meeting would be appropriate. While the staff is interested in your proposed approach for piping design, the staff does not plan to approve such methods except through rulemaking, which endorses the ASME Boiler and Pressure Vessel Code.

Original signed by

James E. Richardson, Director Division of Engineering Office of Nuclear Reactor Regulation

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