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

March 27, 1985

Docket No.: 50-206
LS05-85-03-029

Mr. Kenneth P. Baskin, Vice President
Nuclear Engineering
Safety and Licensing Department
Southern California Edison Company
Post Office Box 800
2244 Walnut Grove Avenue
Rosemead, California 91770

Dear Mr. Baskin:

SUBJECT: SEISMIC CRITERIA AND METHODOLOGY - SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1

In meetings held on February 12 and 27, 1985, and in the submittal dated March 12, 1985, the Southern California Edison Company (SCE) described the analysis methods and acceptance criteria that would be used to complete the seismic reevaluation and design of any remaining plant modifications for San Onofre Unit 1. We understand that the earliest possible staff evaluation of the proposed plan is desired so that SCE can implement this plan and design any required plant modifications, allowing sufficient time to install them during the next scheduled refueling outage in accordance with the provisions of the November 21, 1984 Contingent Recission of Suspension.

To that end, we have performed a preliminary review of the proposed plan. As discussed during the meetings, there are a number of techniques proposed by which SCE would rely on state-of-the-art methods that will more clearly establish where adequate seismic margins clearly do not exist so that they may be corrected. While we agree with this approach, in principle, the lack of precedents establishing the applicability of some of these techniques will require substantial staff review to establish their acceptability on a generic basis. In such cases, therefore, we believe it may be more appropriate to evaluate either the specific applications for such methods or the analysis results to determine whether they provide sufficient margin to accommodate the uncertainties of the parameters involved.

Based on our preliminary review, we have identified all of the issues which we believe need to be resolved, both with respect to the plan and its implementation, and categorized these issues as follows: (1) the methods or criteria appear reasonable and should only require minor clarifications and a confirmatory audit to verify that they have been properly implemented; (2) the methods or criteria may be acceptable, provided that applicable restrictions and appropriately conservative assumptions will be applied with their use; and (3) the methods or criteria represent advancements in the state-of-the-art, or do not appear to be applicable, such that we have no firm basis, at this time, to

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judge their suitability for the proposed application or they may be very sensitive to modelling assumptions and parameter variations. The specific issues identified during our preliminary review are listed in the enclosure for each of the categories described above. In addition to these issues, we would intend to audit the overall implementation of this plan as a part of our evaluation.

Despite the issues identified, we believe that you should continue with the implementation of this plan because of the schedule constraints. We have already begun our detailed review and will arrange periodic meetings to discuss the findings of our review as they evolve; the categorization of the preliminary issues described above should identify the relative strengths and weaknesses of the various elements of the plan for contingency planning purposes.

In order to assure an efficient and effective staff review, we request that you prepare a table identifying all of the structures, systems and components within the scope of this evaluation and the alternative methods and criteria you would intend to apply to the specific elements of each structure, system or component, in the order of their preference. We recognize that these applications may change with time and, therefore, would expect you to update this table during the course of your evaluation.

If you have any questions concerning this matter, please contact Christopher Grimes (301) 492-8414.

Sincerely,

ORIGINAL SIGNED BY DENNIS M. CRUTCHFIELD

Dennis M. Crutchfield, Assistant Director
for Safety Assessment
Division of Licensing

Enclosure:
As stated

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See next page

Mr. Kenneth P. Baskin

cc
Charles R. Kocher, Assistant
General Counsel
James Beoletto, Esquire
Southern California Edison Company
Post Office Box 800
Rosemead, California 91770

David R. Pigott
Orrick, Herrington & Sutcliffe
600 Montgomery Street
San Francisco, California 94111

Dr. Lou Bernath
San Diego Gas & Electric Company
P. O. Box 1831
San Diego, California 92112

Resident Inspector/San Onofre NPS
c/o U.S. NRC
P. O. Box 4329
San Clemente, California 92672

Mayor
City of San Clemente
San Clemente, California 92672

Chairman
Board of Supervisors
County of San Diego
San Diego, California 92101

Director
Energy Facilities Siting Division
Energy Resources Conservation &
Development Commission
1516 - 9th Street
Sacramento, California 95814

U.S. Environmental Protection Agency
Region IX Office
ATTN: Regional Radiation Representative
215 Freemont Street
San Francisco, California 94105

John B. Martin, Regional Administrator
Nuclear Regulatory Commission, Region V
1450 Maria Lane
Walnut Creek, California 94596

Joseph O. Ward, Chief
Radiological Health Branch
State Department of Health
Services
714 P Street, Office Bldg. 8
Sacramento, California 95814

ENCLOSURE

PRELIMINARY REVIEW RESULTS RELATED TO THE "LONG TERM SERVICE" SEISMIC REEVALUATION FOR SAN ONOFRE UNIT 1

Category 1: Methods or criteria appear resonable.		LTS Section
1.1	For large-bore piping, the seismic/non-seismic decoupling criteria, support stiffness criteria, and envelope response spectrum method appear to be acceptable.	3.1
1.2	The method for generating new artificial ground motion time histories is acceptable, provided that the results satisfy the criteria in Sections 3.7.1 and 3.7.3-3 of the Standard Review Plan (SRP., NUREG-0800).	4.1.1
1.3	The methods and criteria for small-bore piping (and tubing) are acceptable, provided that they are verified by confirmatory analyses and engineering evaluations, as described in the staff's February 8, 1984 evaluation for the Return to Service (RTS) plan.	3.2 4.3
1.4	The methods and criteria for the evaluation of mechanical equipment appear to be acceptable.	3.5 4.6
1.5	The criteria for penetrations appear to be acceptable, provided that the associated piping criteria intended are found acceptable.	3.8
1.6	The multiple-level response spectrum method is acceptable provided that the computer code used for this analysis is appropriately "bench-marked" for the intended applications.	4.2.1.2
1.7	The time history method for linear system analysis appears to be acceptable.	4.2.1.3
1.8	Floor response spectra peak shifting is acceptable for use with the envelope response spectrum method; for the multiple-level response spectra method, detailed analysis procedures should be described and justified.	4.2.1
1.9	The damping ratios recommended by PVRC are acceptable for use with the envelope response spectrum method; for the multiple-level response spectra method, detailed analysis procedures should be described and justified.	4.2.1
1.10	The procedure for considering seismic anchor motion appears to be acceptable.	4.2.1

Category 2: Methods or criteria may be acceptable under certain conditions.	LTS Section
2.1 A stress criterion of 2.0 Sy for large-bore piping is reasonable when the stress indices values (B1 & B2) in the ASME Code are used; any other values for the stress indices must be justified in detail.	3.1
2.2 The branch-line decoupling criteria for large-bore piping are reasonable provided that: (a) the moment of inertia ratio is greater than or equal to 25 for a pipe diameter ratio greater than or equal to 3; (b) decoupling would not be allowed if there is an anchor or another branch-line in close proximity; and (c) decoupling would not be allowed if the pipe segment includes a termination which defines a reaction load. The latter two exclusions were addressed in the staff's February 8, 1984 RTS evaluation.	3.1
2.3 A one percent strain criterion for carbon steel is acceptable. The staff is currently reviewing the proposed justification for a two percent strain criterion for stainless steel; it is not clear at this time whether that justification is soundly based.	3.1
2.4 The use of the manufacturer's "catalog" criteria for new pipe supports appears to be reasonable. However, the use of a factor-of-safety (FOS) greater than or equal to two, for existing pipe supports, would only be appropriate when the analysis method or test data, used to establish the FOS, are justified in detail. It would be useful to explain the analysis methods and test data to be applied as part of the criteria.	3.3.3
2.5 The use of Level "D" stress criteria (ASME Section III, 1980 Winter Addenda) for pipe support welds appears to be reasonable; we may need to audit a range of fabrication, material testing, and non-destructive examination design specifications to support this stress criteria. The material strength may have to be based on the lesser value between the weld and the base-metal, unless the licensee can determine that the welding procedures applied would assure that the weld strength is always greater than or equal to the base-metal.	3.3.4
2.6 The criteria and methods proposed for "secondary steel structures" are reasonable provided that (a) whenever the ductility criterion is applied, a system response evaluation is presented to justify the inelastic behavior; (b) whenever the ½ uniform strain criterion is applied, the member response is correlated to a ductility ratio (we would prefer that the ductility criterion be used instead); and (c) appropriate criteria for geometric buckling is applied (the Level "D" stress only addresses the material strength).	3.4 3.3.1

		LTS Section
2.7	The methods and criteria for valves appear reasonable, provided that the Level "C" stress criteria for active valves are used in conjunction with the elastic limit.	3.6 4.7
2.8	The staff is currently reviewing the details of the criteria and methods for electrical raceways; at this point, they appear to be reasonable.	3.9 4.10
2.9	The envelope response spectrum methods for large-bore piping related to (a) mode/direction combinations (CQC), (b) coupled pipe-structure analysis, and (c) mode/direction combination for multiple levels are currently under review and appear to be reasonable; however, the coupled pipe-structure method does not appear at this time to be soundly based.	4.2.1 4.5
2.10	The penetration analysis methods would rely on (a) idealized textbook techniques, (b) Bijlaard techniques, and (c) axisymmetric finite-element techniques. While these methods may be appropriate, modelling and procedural details should be submitted for the staff's review.	4.9

Category 3: Methods or criteria are state-of-the-art or do not appear to be applicable.

3.1	The alternative for structural steel strength (yield stress) assumes an 18% increase for actual material properties and a 10% increase for strain-rate effects. We believe that the combination will overestimate the actual material strength: (a) it does not appear that the material test data are applicable to San Onofre 1 and a sample of material tests from San Onofre suggests that this value may be less than 10%; and (b) the strain-rate data do not appear to be representative for seismic loading conditions. Lacking more appropriate justification, the structural steel strength will have to be evaluated on a case-by-case basis.	3.3.1 3.4
3.2	The criteria proposed for concrete expansion bolts (FOS greater or equal to 2 for two out of four anchors or equivalent) does not appear to allow sufficient margin for observed variations in workmanship and installation practices. While we agree that it may be appropriate to establish the overall integrity of the associated support, such instances may have to be evaluated on a case-by-case basis.	3.3.2
3.3	The methods proposed for soil-structure interaction and floor response spectra direct generation are currently under review, it is not apparent that appropriate procedures have been established for modelling and parameters sensitivities.	4.1.2 4.1.3

		LTS Section
3.4	The similarity analysis method for large-bore piping does not appear to include a requisite procedure to establish complete similarity.	4.2.1.4
3.5	The non-linear time history analysis method for large-bore piping would rely on a single "artificial" time history. Studies performed in conjunction with Unresolved Safety Issue A-40 suggest that at least seven "real" time histories are necessary to adequately assess the phase relationships and, moreover, the "artificial" time histories should not be used for non-linear analyses.	4.2.2.1
3.6	The energy balance method for large-bore piping should be supported by a confirmatory analysis, as described in the staff's February 8, 1984 RTS evaluation, and should not be applied in system segments containing elbows, tees or valves.	4.2.2.2
3.7	The secant stiffness method has not been presented in sufficient detail for the staff to review.	4.2.2.3
3.8	For pipe support analyses where a snubber is located in close proximity to a rigid support, the analysis should assume that the snubber fails to lock.	4.4
3.9	The square-root-of-the-sum-of-the-squares (SRSS) load combination technique is proposed for pipe supports bearing multiple pipes (e.g., beams). Independent motion of the pipes has not been demonstrated. Moreover, we would expect such pipe configurations would have dependent motion, such that an absolute sum (ABS) load combination method should be used.	4.4