Southern California Edison Company

23 PARKER STREET

IRVINE, CALIFORNIA 92718

F. R. NANDY
MANAGER, NUCLEAR LICENSING

TELEPHONE
(714) 587-5400

July 30, 1990

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Gentlemen:

Subject: **Docket No. 50-206**
San Onofre Nuclear Generating Station, Unit 1
SEP Topics III-5.A, Effects of Pipe Break on Structures, Systems and Components Inside Containment;
III-5.B, Pipe Break Outside Containment

References:
A. Letter, F. R. Nandy, SCE, to NRC, dated April 3, 1990
B. Letter, Harold B. Ray, SCE, to NRC, dated October 2, 1989
C. Letter, F. R. Nandy, SCE, to NRC, dated January 31, 1989
D. Integrated Plant Safety Assessment Report (IPSAR), SEP, San Onofre Nuclear Generating Station, Unit 1, Final Report, NUREG-0829, dated December, 1986

This letter describes the methodology proposed for resolution of the structural interactions for the High Energy Line Break (HELB) issue for San Onofre Unit 1. Reference A provided our methodology for the resolution of the systems interactions. We are planning to complete the structural evaluation following the methodology described in the Enclosure. The results of our evaluation for both the systems and structural interactions will be submitted by July 31, 1991.

BACKGROUND

The HELB issue is an open item from the Integrated Plant Safety Assessment Report (IPSAR) (Reference D). As part of the Systematic Evaluation Program, we submitted an evaluation of HELBs (Reference C). This was a scoping study, intended to determine the extent of HELB interactions by applying conservative criteria. In late 1989, we asked that NRC review be halted while we developed new criteria and methodology for final resolution of the issue (Reference B). Our letter of April 3, 1990, described our approach for resolving the HELB interactions with plant systems.

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DISCUSSION

The jet impingement and pipe whip interactions due to HELB can be divided into two types of target interactions: those which impact target components in systems needed for safe shutdown (systems related), and those which directly impact structures. The systems related interactions are being addressed by a Probablistic Risk Assessment approach as described in our April 3, 1990 letter. The structural interactions will be evaluated using the acceptance criteria described in the Enclosure.

The data which is being used in the evaluation was compiled during 1985-1986 from plant walkdowns and drawings to determine the HELB interactions. The data was collected using conservative screening criteria, and formed the basis for the scoping study. Conservative assumptions were made regarding the break locations and area affected by the jet impingement such that the data would determine the overall extent of the HELB interactions. The assumptions used in collecting the data are described in additional detail in the study (Reference C). The data will be reviewed and revised as necessary to account for any recent design changes which may have relocated or installed high energy lines that could affect the structural interactions.

The scoping study identified numerous potential interactions. These were reviewed and many were resolved. However, since we could not resolve all of the structural interactions using the conservative assumptions of the report, we are performing a more extensive analysis of the unresolved structural interactions. The structural interactions will be evaluated for resistance to HELB loads using the criteria described in the enclosure. If necessary, additional analysis will be performed on the piping to determine more precisely the location of breaks and jet impingement or pipe whip on a particular structure. The acceptance criteria for analysis of the structure will be based on the enclosure and may include plastic analysis, dynamic analysis, or time history analysis, as necessary.

If you have any questions or require additional information concerning the methodology being applied, please contact me.

Very truly yours,

cc: J. B. Martin, Regional Administrator, NRC Region V
C. Caldwell, NRC Senior Resident Inspector, San Onofre Units 1, 2 and 3

ENCLOSURE

Criteria for the Analysis of Structural Interaction Due to High Energy Line Breaks

SONGS 1

Objective

This enclosure defines the acceptance criteria for structural members affected by High Energy Line Break (HELB) loads.

Approach

Load combinations will include dead loads, live loads, normal operating loads and HELB loads. Potential seismic loads are not considered to occur simultaneously with HELB loads. Jet impingement loads of less than 5 psi, or further than 10 diameters of the pipe are assumed not to have sufficient force to cause structural damage. Items which are initially impacted by the high energy line break forces are not considered to cause secondary missiles.

Acceptance Criteria

The acceptance criteria will follow the guidance of NUREG-0800, Section 3.5.3, for overall damage prediction with the following deviations when a ductility ratio greater than one is determined:

* 1. Ductilities for reinforced concrete will be as indicated below which is per BC-TOP-9A and supplemented by ACI 349.

a. Flexure:

Beams and one-way slabs	$[0.10/(p-p')] \leq 10$ or 30*
Slabs with two-way reinforcing	$[0.10/(p-p')] \leq 10$ or 30*

* Ductility ratio limit of up to 30 can be used when the angular rotation is limited to $0.0065\ (d/c) \leq 0.07$ radians.

where,

p and p′ are the tension and compression reinforcing steel ratios respectively
d - effective depth of sections
c - distance from extreme compression fiber to neutral axis at ultimate strength

b. Beams and slabs where shear controls design:

Shear carried by concrete only	1.3
Shear carried by concrete and stirrups	1.6

2. Structural steel ductility ratios for secondary members. Secondary members are defined as members not required to support slabs, or maintain the integrity of a structure.

a.	Compression due to flexure	20
b.	Tension due to flexure	20
c.	Shear	20
d.	Compression members not required for stability of building structures	20

References

1. Bechtel Topical Report, "Design of Structures for Missile Impact," BC-TOP-9A, Revision 2, Bechtel Power Corporation, September 1974.

2. ACI 349-86, "Code Requirements for Nuclear Safety Related Concrete Structures."