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

Gentlemen:

The purpose of this letter is to describe the methodology proposed for resolution of the High Energy Line Break (HELB) issue for San Onofre Unit 1. SCE is planning to apply a Probablistic Risk Assessment (PRA) approach to the evaluation of non-structural HELB target interactions. The methodology for evaluation of the structural HELB interactions is currently under review and will be discussed in a letter planned for July 31, 1990.

BACKGROUND

The HELB issue remains to be resolved from the Integrated Plant Safety Assessment Report (IPSAR) (Reference C). Reference B transmitted a scoping analysis of the effects of high energy line breaks. In our October 2, 1989 letter (Reference A), we asked the NRC to halt their review of the study to allow us to develop new criteria and methodology for resolution of the issue.

In our efforts to resolve the HELB issue we have performed three studies. The first study, performed in 1973, was superseded by new criteria requiring the analysis of additional lines. The second study, in 1983, left 102 lines unresolved, and was later invalidated by changes in the plant configuration due to Appendix R (Fire Protection), and seismic upgrading requirements. The third study was initiated in 1985, but did not resolve all of the lines. As an alternative to continuing the conventional deterministic approach, we have decided to evaluate the risk from HELB interactions with plant systems. We will also develop HELB design criteria to ensure future plant modifications will be within the boundaries of the PRA results.

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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 impact structures. During 1985-1986 data was taken from plant walkdowns and drawings to determine the target interactions. The data for the systems related interactions was recently used to conduct a feasibility study for the resolution of the interactions using PRA techniques. A summary of the HELB PRA feasibility study is contained in the enclosure.

The results of the feasibility study indicated the core melt risk from a HELB event at SONGS 1 is on the order of 4.7E-7/year. Comparable levels of risk have been used to resolve other SEP topics. Based on the favorable results of the initial HELB PRA study, we plan to perform a more detailed PRA of the systems-related interactions. We will examine a selection of lines representative of all of the systems-related interactions. The total risk from HELB will be obtained by adding the risk from these interactions and combining it with the risk of a failure which leads to a core melt. The results will identify the high risk lines, and determine the overall contribution to the core damage frequency from HELB. Any modifications which may be recommended as a result of either the PRA study, or structural review, would be implemented after the Cycle 12 refueling outage.

SCE plans to submit the results of the PRA study and structural evaluation by July 31, 1991. 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

Probablistic Risk Assessment for High Energy Line Breaks

Background

A scoping PRA analysis was performed to determine whether PRA techniques could be used to evaluate the risk due to HELB. The analysis was based on the fault trees and work currently being performed for the Unit 1 PRA. For the study, the worst case HELB interactions were selected from the data compiled during walkdowns conducted in 1985-1986. The walkdowns were performed to collect data for the most recent deterministic scoping analysis[1]. Modifications which have been installed since 1985 have followed Appendix R separation criteria and therefore, it is believed the component separation has been maintained or improved since the HELB data was compiled. A conservatively wide margin was used to determine the size of the HELB impact areas used to identify the interactions.

Evaluation

The HELB data was reviewed and divided into four categories representative of the overall types of HELB interactions which may occur at Unit 1. For purposes of the study, a sample of 46 interactions identified as leading to failure of safe shutdown systems were analyzed. The following categories were considered to represent the worst cases and were used for the scoping study:

1. High Pressure Line Inside Containment (LOCA)

2. High Pressure Secondary Line with Multiple Impacts

3. High Pressure Secondary Line with Few Impacts

4. Low Pressure Secondary Line with Multiple Ruptures

The event and fault trees used for the preparation of the Unit 1 PRA were reviewed to select those events which would be similar to the selected HELB interactions. Each fault tree was modified at the system level to be initiated by a HELB event and follow the appropriate system failure leading to a core melt.

The initiating event frequency for the HELB was determined by consulting standard reference sources[2,3] to determine the pipe segment failure rates. For this, three typical pipe segment failure frequencies, using the Thomas methodology[4], were selected:

Case	HELB Initiating Frequency
10′ line segment with single weld	1.8E-6/yr
100′ line segment with two welds	3.6E-6/yr
100′ line segment with no welds	1.7E-7/yr

Results

The risk from each category was multiplied by the number of represented HELB events in the category to yield a number for the overall contribution to risk.

The core damage frequencies for each category of HELB were determined as follows:

Category	Core Damage Frequency	Total Risk for Case
1	8.5E-10/yr	7.6E-9/yr
2	2.8E-10/yr	1.4E-9/yr
3	1.2E-10/yr	1.2E-9/yr
4	2.1E-10/yr	4.6E-7/yr

Conclusions

The total overall core damage frequency due to HELB for Unit 1 was determined in the scoping study to be on the order of 4.7E-7/yr. This is comparable to the lower significance range of risk used to resolve other SEP topics[5]. A more complete study is expected to return results of a similar magnitude.

References

(1) Letter, F.R. Nandy to NRC, dated January 31, 1989

(2) Reactor Safety Study, WASH-1400, October 1975

(3) S.H. Bush "Reliability of Piping in Light-water Reactors," Nuclear Safety, Vol. 17, NO. 5, September-October 1976

(4) B.A. Thomas er.al., Failure History, 1968-1972 (as discussed in WASH-1400, Appendix III)

(5) Integrated Plant Safety Assessment, NUREG-0829, "Risk Based Categorization of San Onofre SEP Issues", December 1986