LILCO LONG ISLAND LIGHTING

LONG ISLAND LIGHTING COMPANY

SHOREHAM NUCLEAR POWER STATION

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JOHN D. LEONARD, JR.
VICE PRESIDENT - NUCLEAR OPERATIONS

February 25, 1985 SNRC-1149

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

LILCO Comments on Preliminary Review of Shoreham PRA Study
Shoreham Nuclear Power Station
Docket No. 50-322

Reference: Letter from A. Schwencer (NRC) to J. D. Leonard, Jr. (LILCO) dated January 24, 1985

Dear Mr. Denton:

Attached please find LILCO's comments on NUREG/CR-4050, "A Review of the Shoreham Nuclear Power Station Probabilistic Risk Assessment", dated November 1984. At this time, additional effort by LILCO is deemed necessary in order to prepare detailed comments on the Brookhaven review. To expedite this process, a meeting between Brookhaven and LILCO at the working level is recommended to resolve differences in the analyses.

We trust this letter addresses in part Brookhaven's review of the PRA study, and we look forward to discussing the outstanding comments with their staff. If you require additional information, please contact this office.

Very truly yours,

Jeffrey L. Smith for
John D. Leonard, Jr.
Vice President - Nuclear Operations

NRL:ck

Attachment

cc: P. Eselgroth
K. Shiu, Department of Nuclear Energy
Brookhaven National Laboratory

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ATTACHMENT I
SNRC-1149

SUMMARY

The BNL review indicates a core vulnerable frequency of 1.5E-4yr. while the SNPS PRA calculated a value of 5.5E-5yr. This difference is not large, but it is judged that the BNL value is not a best estimate analysis and has incorporated the following conservative biases:

- o The initiator frequencies are increased by utilizing the "Bayesian Two Stage" analyzer.
- o The initiator frequencies are biased by including the first year of data directly. It is a well known fact that the first year data is not characteristic of mature plant operation. The unweighted inclusion of first year data results in conservative values.
- o The initiators are not discriminated due to initial power level for the ATWS evaluation. This is an important conservative bias introduced by BNL.
- o The LOOP initiator frequency is conservatively assessed by ignoring LILCO grid-specific information, and by conservatively assessing the data presented in NSAC/80.
- o The present on-site power capability of LILCO is not included.
- o The reactor water level instrumentation analysis neglects the changes made by LILCO which include:
  - analog trip system, and
  - additional level instrumentation.
- o The postulated common mode failure of the HPCI and RCIC batteries is included in the Shoreham analysis. BNL increased this probability without substantiation.

Removal of the conservative elements cited in this summary will result in reducing the BNL calculated core and containment vulnerable frequency from 1.5E-4/yr. to approximately 8E-5/yr.

OVERVIEW

1. Within the context of PRA evaluations and their inherent uncertainties and limitations, there does not appear to be any substantial disagreement in the evaluation of what sequences are important.

2. It is judged that the BNL numerical estimates are conservative and therefore, the use of the BNL study point estimates should be used with caution.

3. The BNL point estimates are referred to as core damage frequencies. However, the SNPS PRA frequencies that are cited are not core damage frequencies, rather they are end-states referred to as core or containment vulnerable conditions. This distinction is important if the purpose of the BNL evaluation is to compare to the proposed secondary safety goal of core melt frequency. The SNPS PRA values cited by BNL do not correspond with core melt, and it can only be assumed that the BNL values are meant also to be consistent with the SNPS intent and are therefore not core melt. BNL review needs to clarify the end-states since they currently appear to be inconsistent.

4. The BNL review provides a good sensitivity study to demonstrate what types of variations in accident sequence frequency can be obtained through changes in input parameters. Most of the BNL changes may be referred to as sensitivities since there is not always a technical justification which would support the BNL value as a best estimate value.

5. The differences in numerical values cited by BNL are generally due to differences in generic input data values.

6. For initiators, the use of EPRI NP-2230 would make a small increase in the turbine trip initiator frequency.

7. There appears to be agreement that the modeling of the plant has been performed accurately and that generally only the point estimate input values are in question.

8. The BNL document identifies some areas in which their analyses are conservative. These conservatisms should be considered if the BNL quantification is to be used for anything other than sensitivity study. Examples include:

   p3: MSIV initiator frequency is high due to LILCO committed plant-specific design modification not reflected in data from older plants. (Level 1 isolation).

   p7: The LOOP sequences are conservative due to the lack of modeling of the actual plant electrical configuration which includes:

   - two independent switchyards
   - black-start gas turbine onsite
   - additional diesels onsite
   - extensive black-start gas turbine capability offsite

p50-5: The ATWS initiator frequency is conservative due to the inclusion of startup initiated events. Approximately one-third of transient initiators are at low power.

9. The BNL assertion on page xi that there are large changes in the ranking of dominant sequences as a result of the BNL quantitative estimates. This, however, is misleading since the rearrangement of sequences as a result of the BNL assumptions does not change the basic set of sequences identified in the SNPS PRA.

Detailed Comments

1. Initiator Frequency

   - Use of the weighted average of years is appropriate for the evaluation of risk associated with Shoreham during mature plant operation. Calculation of risk associated with initial years of plant operation or end-of-life is a separate problem. This use of the data by BNL causes a conservative bias in the calculation of risk for mature plant operation.

   - Bayesian two-stage analysis tends to increase calculated values.

   - IORV frequency is biased high since it does not reflect the plant specific Shoreham design (Target Rock two-stage SRVs).

   The LOOP frequency is biased high because:

   - NSAC/80 data including BNL modifications to data (pg 4-9) is not appropriate to the LILCO specific grid.

   - The plant-specific Shoreham design is not included in LOOP recovery; i.e., black-start gas turbines, backup diesels, independent switchyards.

2. The contributions to Class II and IV events are referred to as core damage sequences. In fact, these sequences are containment vulnerable conditions which may not necessarily lead to core damage.

3. By placing the ATWS Class I sequences in Class IV, BNL has not fully considered the logical possibility of sequences which cause core melt prior to containment challenge. This is judged to be a conservative bias in the public risk evaluation.

4. There are a number of additional failure probabilities inserted into the Shoreham analysis which seem to double count the failure probabilities already included in the Shoreham analysis. For example, time-phased functional event trees on power conversion system appears to double count feedwater failure.

COMMENTS BY SEQUENCE

ATWS:

- The initiator frequencies are high as identified above.
- The failure to discriminate between high power and low power initiated transients leads to approximately a 30% increase in the ATWS sequence frequencies.
- p5D-22 - the table is misleading by including only high power initiators from Shoreham while including all power level initiators from BNL evaluation.

LOOP:

- The BNL initiator frequency is conservative and is not characteristic of the LILCO grid.
- The Shoreham dual switchyard configuration is not included in the quantification.
- Table 5B-1 - the evaluation of the reactor water level indication during LOOP does not recognize the scenario which is postulated (i.e., DC buses and the third diesel available) and does not reflect the emergency procedure actions which would occur. It does not reflect the likelihood of continued operation of a working water level indication system.
- Table 5B-1 - the justification for a Class II accident scenario during station blackout is not correct (T_EI IV W). The data referenced for recovery of offsite power indicates that all observed failures have been recovered within ten hours. The relatively high probability for failure to recover that BNL assumes and the fact that BNL only allows 15 hours to recover offsite power before calling it a Class II sequence is very conservative. AC power recovery from Table 4-7 indicates that there are no observed LOOP events longer than 10 hours. The crucial time before containment vulnerable conditions would be on the order of 30 to 40 hours, not 15 hours as assumed by BNL.

INTERFACING LOCA

- The BNL review represents a good sensitivity study to identify potential variations.
- There appears to be a neglect of the valve interlocks which would be violated to cause such an event.
- There appears to be a lack of credit for the required inservice testing of the valves.

- o The mathematics used to combine failure rates (.02/yr. and 10^{-3}/d) seems questionable.

- o The 10^{-3}d (MOV spurious opening) seems arbitrary and is useful only as a sensitivity. Spurious MOV opening is not a failure mode generally seen in the data, especially for an interlocked valve.

- o The neglect of the operator probability to reclose the valves is an important omission in light of the successful performance by the operator in the LER data.

- o When the above changes are included in the analysis, the point estimate should be reduced by several orders of magnitude.

Reactor Water Level Reference Leg

- o BNL conservatively neglected two major design changes:

    - Analog Trip System: This eliminates the need for on-line testing involving the reference legs.

    - additional HPCI level transmitters.

- o BNL's reference to LERs where more than two reference legs have been affected is not supported. Such LERs have not occurred to our knowledge or been verified by S. Levy in reports SLI 8218 or SLI 8221.

- o The assertion that miscalibration is the same as the loss of a DC bus is a conservative assumption which introduces conservative bias into the quantification.

REVIEW OF FLOOD EVENTS

Overview:

The increase in frequency of floods estimated by BNL is in large part due to conservatism within their modeling process. The BNL analysis description contained insufficient information to track in detail their quantification process, only summary tables were provided. The use of Markov models did not enhance the traceability of the results, and did not allow for straight-forward indication of plant states. In light of the conservatisms included in the BNL study, an appropriate reanalysis should reduce the estimated frequency of core vulnerable conditions developed by BNL.

Specific Comments:

The following describes some, but not all, of the problems encountered in the review:

1. Inclusion of the Brown's Ferry Event in the analysis is very conservative due to the fact that the Brown's Ferry flood resulted from failure of aluminum pipe while Shoreham has stainless steel.

2. The initiator frequency for MSIV closure of 4.42/y used in the flooding analysis by BNL is very conservative with respect to the value used in the PRA review - .67/Rx year.

3. Hourly failure rates derived for motor driven and turbine driven pumps, and major maintenance are conservative. All failures of these devices do not result in disassembly of these devices.

4. It appears that maximum allowable outage times were used in the Markov models for maintenance induced floods. Mean time to repair should be used.

5. The BNL time-phased event tree calculations were not traceable.

6. The conclusion that HPCI and RCIC are disabled in Phase II is incorrect. Equipment between 1'3" and 1'10" is not necessary for successful operation of those systems.