Docket Nos. 50-269, 50-270
and 50-287

March 11, 1994

Mr. J. W. Hampton
Vice President, Oconee Site
Duke Power Company
P. O. Box 1439
Seneca, South Carolina 29679

Dear Mr. Hampton:

SUBJECT: RESOLUTION OF COMMENTS ON 1992 ACCIDENT SEQUENCE PRECURSOR (ASP) ANALYSES FOR OCONEE NUCLEAR STATION

Enclosed is information concerning resolution of comments you provided on the draft 1992 ASP analyses concerning the Oconee Nuclear units. The responses were prepared by Oak Ridge National Laboratory, our ASP contractor. The information summarizes your comments, indicates how the comments were addressed and resolved, and provides rationale for their resolution.

The NRC appreciates the assistance you have provided by answering our questions and furnishing additional information for the analyses. The subject analyses are included in NUREG/CR-4674, Volumes 17 and 18. Your comments are included in Appendix G of Volume 18 of the NUREG report.

If you have questions regarding this matter, contact me at (301) 504-1495.

Sincerely,

Original signed by:
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Enclosure:
As stated

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ASP Analysis of LER 269/92-004,005

Reference 1: Letter from J. W. Hampton, Duke Power to the U.S. Nuclear Regulatory Commission, dated June 24, 1993.

Comment 1: The comment indicates that there are two typographical errors in the event description. It also notes that a previous event (LER 287/91-007, 269/91-009) involving the failure of FDW-315 was analyzed by the ASP program for the 1991 report.

Response 1: The two typographical errors have been corrected.

Comment 2: The second comment indicates that the licensee analysis of the event and the ASP analysis of the event resulted in similar dominant sequences.

Response 2: No response required.

Comment 3: The comment indicates that in a previous analysis of a similar event, the ASP analysis used a nonrecovery factor of 0.04 for the EFW system instead of the 0.12 used in the draft report.

Response 3: The previous analysis referred to by the licensee is for LERs 287/91-007, 269/91-009 found on pages B-157 through B-162 of Volume 16 of NUREG/CR-4674. The valve failure which occurred in this event in unit 1 is identical to the failure which occurred in 1991 in unit 3. The previous analysis inappropriately used a nonrecovery factor of 0.04 for the EFW valve (the standard ASP value of 0.26 was used for the EFW pumps). The current calculation should use nonrecovery factors of 0.26 for both the EFW valves and pumps. The current calculation has been revised to correct this error.

Comment 4: The comment indicates that the SSF is another source of feedwater and would have been available during this event. This should be included in the modeling for the event.

Response 4: The feedwater function of the SSF has been added to the modeling for this event.

ASP Analysis of LER 269/92-008

Reference 1: Letter from J. W. Hampton, Duke Power to the U.S. Nuclear Regulatory Commission, dated June 24, 1993.

Comment 1: The sequence of concern, the operator actions required for recovery, and the time involved are described. The licensee concluded that the probability of operator failure to recover emergency power was $\sim 1.0 \times 10^{-3}$.

Response 1: The event was modeled with an effective failure to recover probability for Keowee of 0.43, based on the situation which was observed subsequent to the October 19, 1992 Oconee 2 LOOP (an on-call technician had to be called to the site to recover Keowee). For plant-centered and grid-related LOOPs, the potential for ac power recovery from the Central Switchyard and the Lee combustion turbines was also considered, using the structured approach to estimating nonrecovery probabilities described in Appendix A to the yearly precursor reports. The potential recovery of the Oconee switchyard was also addressed in the analysis. For plant-centered LOOPs, the overall nonrecovery probability for ac power assumed in the analysis (exclusive of Keowee) is less than 0.001. The probability values used in the analysis are considered appropriate.

Comment 2: The licensee noted (last sentence in paragraph 3 of their letter) that their analysis assumes the Central Switchyard is lost along with the grid during a LOOP.

Response 2: This statement is correct for non-plant-centered LOOPs. The analysis and discussion of this event, LER 269/92-008, and LER 270/92-004 have been revised to separate plant-centered, grid-related, and severe weather-related LOOPs to address this condition. For plant-centered LOOPs, the Central Switchyard is assumed to be available for short-term recovery of ac power. For grid-related LOOPs, the Central Switchyard is assumed to be unavailable; however, power is assumed to be recoverable in ~1h from the Lee combustion turbines.

ASP Analysis of LER 269/92-018

Reference 1: Letter from J. W. Hampton, Duke Power, to the U.S. Nuclear Regulatory Commission, dated August 30, 1993.

Comment 1: The ASP analysis makes the assumption that, due to the "X" relay modification, the closing coils to the Keowee auxiliary bus feeder breakers would not close the breakers automatically if required. The identified problem was an insufficient voltage to the breaker closing coils that was not affected by the "X" relay modification. Both Keowee units had been black-start tested before November 24, 1992, and had never experienced the problem identified in the LER.

Response 1: The ASP analysis noted that, under the reduced dc voltage conditions that existed during the emergency start test (and would presumably exist during an actual LOOP), certain modified breakers did not close. The LER described these failures in terms of the "X" relay modification and noted that the problem was corrected by increasing the time that the closing coils were energized. In a discussion with Duke Power (L. Kachnik and G. Cruzan) on September 22, 1993, Duke noted that the auxiliary power breaker problems on Keowee 1 observed during the October 19, 1992 LOOP were potentially attributable to low dc voltage problems. The assumption that these problems existed since the "X" relay modification was completed or were made visible by the modification appears reasonable.

Comment 2: Keowee 1 was functionally tested by the October 19, 1992 LOOP. This event occurred after the "X" relay modification associated with Keowee 1. ... It is also noteworthy that, during the emergency start test, the auxiliary power breakers for Keowee 1, and the field breakers for both Keowee units, did not indicate any problems. The assumption is being made that Keowee 1 was inoperable in spite of two successful trials after the "X" relay modification.

Response 2: It is acknowledged that Keowee 1 operated correctly during the emergency start test. However, problems with Keowee 1 auxiliary power breaker ACB-7 and with the field breakers on both units were subsequently found. This type of event, in which component inoperability is potentially a function of specific voltage levels, is very difficult to address in PRA. In lieu of a component-specific assessment, which would not have been practical, a potentially conservative bounding analysis was performed in which it was assumed that both Keowee units would be unavailable following a postulated LOOP. See the response to comment 1a regarding Keowee 1 performance during the October 19, 1992 LOOP.

Comment 3: For the above reasons, the period of unavailability for both Keowee units assumed in the (preliminary) ASP evaluation (360 h) is too large. This period should have been about 22 h.

Response 3: The unavailability period assumed in the analysis is considered appropriate, considering the nature of the observed failures. Both Keowee units were clearly inoperable during the 22 h period discussed in the comment. However, during most of this period, the standby buses were energized from the Lee steam station. As noted in Modeling Assumptions, this period of time was not of concern in the ASP analysis, since the risk was believed to be relatively small once Lee was powering the standby buses.

Comment 4: LER 269/92-018 does describe a period when both Keowee units were functionally inoperable.... This is a period of 21 h 35 min. ...

Response 4: As noted in the response to comment 1c, the 21 h 35 min period is less of a concern to the ASP program since the standby buses were energized from the Lee steam station during most of this period. Both the Keowee and Oconee operators were aware of the problems with Keowee during this time period. The period of concern is when the potential inoperability was unknown.

ASP Analysis of LER 269/92-018, cont.

Comment 5: The preliminary ASP evaluation says that "the use of CT-5 is described in procedures but the need for manual load shedding is not addressed," however, main feeder buses would automatically load shed....

Response 5: The description of the potential use of the Central Switchyard and the Lee gas turbines for recovery of offsite power via transformer CT-5 has been revised to better characterize, from an ASP standpoint, the issues involved.

Comment 6: The backup emergency power through CT-5 (for the plant-centered case) should be considered more reliable than assumed in this analysis.... A value of 1.0×10^{-03}, ... would be appropriate.

Response 6: The nonrecovery probability for this action is still assumed to be 0.12, based on the criteria included in Appendix A to the yearly precursor reports. However, the ASP model also addresses LOOP recovery in the short term via the Oconee switchyard and in the long term (prior to battery depletion). The overall probability assumed in the analysis of not recovering ac power for the plant-centered LOOP case is approximately 0.001 (exclusive of Keowee).

Comment 7: Improvements made since the October 19, 1992 LOOP, the implementation of procedure AP/0/A/2000/002, "Keowee Hydro Station - Emergency Start," and enhanced communications systems make the action to restore power to the Keowee auxiliary buses more reliable. A value of 0.05 for the failure to recover Keowee power in the short term can be justified.

Response 7: As noted in Modeling Assumptions, the revised analysis is a bounding analysis that addresses the potential impact if multiple breakers were to concurrently fail during a postulated LOOP. As a result of the multiple postulated breaker failures, it was assumed that the on-call technician would be required to recover Keowee except during the day shift. During the vulnerability period associated with this event, the on-call technicians were contacted by phone and would then have to drive to Keowee to address the problem, unless it could be handled by phone or radio (telephone conversation with L. Kachnik and G. Cruzan, Duke Power, September 22, 1993). While it is possible that the breaker problems could have been corrected by a phone call, this was not assumed in the analysis.

ASP Analysis of LER 270/92-004

Reference 1: Letter from J. W. Hampton, Duke Power to the U.S. Nuclear Regulatory Commission, dated March 10, 1993.

(Duke Power comments have been paraphrased.)

Comment 1: The purpose of the ASP evaluation is to estimate the core melt probability margin of operational events of significance. The analysis appears to utilize conservative and pessimistic assumptions concerning manually operated equipment. The Duke Power estimate of the conditional probability for the event is $\sim 1.0 \times 10^{-5}$, compared with the (preliminary) ASP estimate of 3.0×10^{-3}. While both the ASP program and Duke Power consider the event to be a precursor, there is considerable difference in the numerical results and corresponding significance.

Response 1: The analysis has been revised to incorporate information provided in comments from a number of organizations. The analysis now recognizes the potential for short-term recovery of ac power via the Central Switchyard following a plant-centered LOOP, consistent with the analyses of LER 269/92-008 and LER 269/92-018. The approach used to assign a nonrecovery probability for this action is described in Appendix A to the yearly precursor reports. The assumptions concerning the likelihood of recovering Keowee are considered valid, considering the recovery actions required during the event.

Comment 2: The sixth paragraph of the ASP event description inaccurately describes the Keowee auxiliary power supplies (specific concerns were not identified). This paragraph should be revised to be consistent with the Augmented Inspection Team (AIT) report on the event.

Response 2: The paragraph has been revised to reflect information on the Keowee auxiliary power supplies included in the AIT report.

Comments contained in the attachment to the reference letter

Comment 1a: Recovery of Keowee auxiliary power is not dependent on operation of Oconee 1, as described in the preliminary ASP event description. Alternate sources of auxiliary power are identified.

Response 1a: The analysis was revised to remove the requirement for Oconee 1 operation for Keowee auxiliary power recovery.

Comment 1b: The Central Switchyard was available during the event and could have been used to energize transformer CT-5. This action is considered highly reliable.

Response 1b: The analysis has been revised to address the potential for short-term recovery of ac power from the Central Switchyard.

Comment 1c: The potential existed for short-term recovery of ac power through restoration of the switchyard and startup buses.

Response 1c: This was addressed in the analysis (LOOP nonrecovery).

Comment 2: The use of a generic failure probability for the turbine-driven emergency feedwater pump (TDEFWP) results in conservative sequence probabilities compared to those which would be calculated using the much lower Oconee-specific EFW failure probability. These sequence probabilities are also conservative because of the safe shutdown facility (SSF) was not addressed as an alternate source of secondary side cooling.

Response 2: Considering other associated basic events addressed in the licensee's analysis results in an overall EFW pump failure probability consistent with that used in the ASP analysis. The EFW pump failure probability used in the ASP analysis is considered appropriate. The use of the SSF has been addressed in the revised analysis.

Comment 3: The assumption in the (preliminary) ASP analysis that the loss of instrument air (IA) pressure came close to tripping Unit 1 is speculative.

Response 3: The primary IA compressor was lost when 230 kV switchyard isolated. The diesel-driven air compressor was manually started to recover IA pressure. It is acknowledged that estimating a probability of Unit 1 trip due to loss of IA following the LOOP is difficult and involves substantial uncertainty. It is also acknowledged that a possible Unit 1 trip had little impact on the core damage probability estimated for Unit 2, based on the preliminary ASP analysis. Because of this, the potential for Unit 1 trip has been removed from the base analysis. It is still considered as a sensitivity analysis, however.

Comment 4: The ASP analysis did not consider the SSF.

Response 4: The potential for use of the SSF has been addressed in the revised analysis.

Comment 5: It is believed that the major difference between the conditional core damage probability in the ORNL/ASP evaluation and the Duke analysis arises from the lack of credit for SSF capability and the conservatively low reliability assumed for the 100 kV standby source of power in the ORNL/ASP evaluation.

Response 5: Analysis differences regarding recovery of ac power from the 100 kV standby source and the potential use of the SSF have a large impact on the core damage probability estimated for the event. Consideration of the potential for short-term ac power recovery via the Central Switchyard and the potential use of the SSF in the revised ASP analysis resulted in a reduction in the difference between it and the Duke Power analysis by about an order of magnitude.