



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

November 23, 1998

Dr. William D. Travers
Executive Director for Operations
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Dr. Travers:

SUBJECT: REPRIORITIZATION AND PROPOSED RESOLUTION OF GENERIC SAFETY
ISSUE-171, "ENGINEERED SAFETY FEATURES FAILURE FROM LOSS-OF-
OFFSITE-POWER SUBSEQUENT TO A LOSS-OF-COOLANT ACCIDENT"

During the 457th meeting of the Advisory Committee on Reactor Safeguards, November 4-7, 1998, we completed our review of the reprioritization and proposed resolution of the Generic Safety Issue (GSI)-171. During our review, we had the benefit of discussions with representatives of the NRC staff and the documents referenced.

DISCUSSION

The GSI-171 deals with the ability of the nuclear power plant to respond to a loss-of-coolant accident (LOCA) followed by a delayed loss-of-offsite power (LOOP). The scope of this GSI was later broadened to include a LOOP followed by a LOCA. The primary concern of this GSI is the possible overloading of the emergency diesel generators (EDGs) resulting from simultaneous starting of all pumps and motors actuated by engineered safety features (ESFs) signals if a LOCA occurred followed by a LOOP prior to resetting the safety injection system.

The initial GSI-171 prioritization analysis reported in NUREG-0933 was based on conservative assumptions that resulted in estimated core damage frequency (CDF) contributions as high as 5.5×10^{-3} /reactor-yr. Consequently, the staff assigned a HIGH priority ranking to this GSI. Results of this analysis also revealed that nonrecoverable damage to EDGs and emergency core cooling system (ECCS) motors due to surge current created by out-of-phase connection was unlikely. Subsequently, the NRC staff assessed (Ref. 7) the assumptions used in the initial analysis and concluded that the estimated contribution to the CDF decreased by up to two orders of magnitude. To obtain an independent estimate of the range of the CDF contributions for various plant configurations, a further analysis was conducted by Brookhaven National Laboratory (BNL).

The BNL probabilistic risk analysis results, which are documented in NUREG/CR-6538, revealed that the CDF contribution varied by up to two orders of magnitude, depending on

postulated plant-specific electrical configurations. The CDF contribution values were found to be lower than those obtained from the initial GSI-171 prioritization analysis; but, for some configurations, the CDF contribution value was sufficiently large to support a HIGH priority ranking for GSI-171.

The staff conducted a survey and also performed an independent evaluation to determine whether any plant configurations were comparable with the high-risk configurations identified in NUREG-6538. The results of a telephone survey of a limited number of plants performed by the Office of Nuclear Reactor Regulation (NRR) indicated adequate electrical load sequencing or load shedding capability at these plants. In addition, the Office of Nuclear Regulatory Research (RES) reviewed the Updated Final Safety Analysis Reports for 20 plants to determine the adequacy of their electrical load shedding and sequencing capability. The results of this review showed that the safety concerns of GSI-171 were adequately addressed in the design of ESF systems at these plants.

Based on the above, the staff has concluded that GSI-171 should be placed in a DROP category, and that it should be considered resolved.

The difficulties of prioritizing GSI-171 revealed one of the reasons the NRC's process for prioritizing GSIs can be time consuming. Two analyses (Refs. 1 & 2) and two independent assessments (Refs. 3 & 6) were needed to arrive at a final priority for GSI-171. As stated in our October 16, 1998 letter (Ref. 8), there is a need for the staff to ensure the quality and appropriateness of the assumptions used in the analysis supporting the priority ranking of a particular GSI. This effort may require the development of procedures or analytical tools. An important mission of research at NRC should be the development of such tools to aid the staff in performing these analyses.

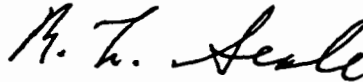
Although we concur with the decision of the staff to drop GSI-171, we are disappointed with the quality of the assessments performed by the staff. Further, even though the CDF contribution for a number of plants may be sufficiently low, the staff should take steps to ensure that no plant has an electrical configuration that would place the plant in a higher-risk category.

In addition, NRR has raised concerns that degraded switchyard voltage events at Salem and Palo Verde nuclear plants indicate it is possible that plants have either not implemented under-voltage protection properly or conditions have changed that invalidate original design basis capability. The sensitivity study performed by BNL showed that the dominant contributors to risk from a LOCA/LOOP accident are overloading of the EDG, lockout of anti-pumping circuits, and plant-specific vulnerabilities, such as switchyard under-voltage effects, which may increase the probability of a delayed LOOP and overloading of pumps. However, a degraded voltage condition following a LOCA is not specifically addressed in the BNL report and sufficient information on operating experience is not available to calculate the conditional probability of a LOOP following a LOCA due to design implementation flaws. The staff should evaluate and resolve this issue through the regulatory process.

RECOMMENDATIONS

- We agree with the staff's conclusion that GSI-171 should be placed into a DROP priority category, and that it should be considered resolved.
- Although the contribution to the CDF associating with load shedding or load sequencing may be sufficiently low for a number of plants, the staff should use an appropriate regulatory process to ensure that no plant has an electrical configuration that would result in an unacceptable CDF.
- NRR's concerns relating to the functional capability of ECCS under degraded-voltage conditions should be pursued and addressed through the regulatory process.
- RES should develop appropriate tools for conducting risk-informed analysis for efficient prioritization of GSIs.

Sincerely,



R. L. Seale
Chairman

References:

1. U. S. Nuclear Regulatory Commission, NUREG/CR-6538, "Evaluation of LOCA With Delayed Loop and Loop With Delayed LOCA Accident Scenarios," July 1997.
2. U. S. Nuclear Regulatory Commission, NUREG-0933, "A Prioritization of Generic Safety Issues," November 1985.
3. Memorandum dated August 18, 1998, from Charles E. Rossi, Office for Analysis and Evaluation of Operational Data, NRC, to John W. Craig, Office of Nuclear Regulatory Research, NRC, Subject: Request for Review of the Re-Prioritization of GSI-171, "Engineered Safety Features Failure From a Loss of Offsite Power Subsequent to a Loss-of-Coolant Accident."
4. Note dated July 8, 1998, from José A. Calvo, Office of Nuclear Reactor Regulation, NRC, to Brian W. Sheron and Gus C. Lainas, Office of Nuclear Reactor Regulation, NRC, Subject: EELB's [Electrical Engineering Branch, NRR] Determinations Relative to GSI-171. **[Predecisional]**.
5. Memorandum dated June 19, 1998, from John W. Craig, Office of Nuclear Regulatory Research, NRC, to Brian W. Sheron, Office of Nuclear Reactor Regulation, NRC, et al., Subject: Generic Safety Issue-171, "ESF Failure From LOOP Subsequent to LOCA."
6. Memorandum dated October 13, 1998, from Jose A. Calvo, Office of Nuclear Reactor Regulation, NRC, to Thomas O. Martin, Office of Nuclear Regulatory Research, NRC, Subject: GSI-171, "Engineered Safety Features (ESF) Failure from a Loss-Of-Offsite Power (LOOP) Subsequent to a Loss-Of-Coolant Accident (LOCA)."

7. Memorandum dated October 18, 1995, from Mark Cunningham, Office of Nuclear Regulatory Research, NRC, to C. Z. Serpan, Office of Nuclear Regulatory Research, NRC, Subject: Evaluation of Assumptions Used in Generic Issue 171 Prioritization.
8. Letter dated October 16, 1998, from R. L. Seale, Advisory Committee on Reactor Safeguards, Chairman, to L. Joseph Callan, Executive Director for Operations, NRC, Subject: Proposed Priority Rankings of Generic Safety Issues: Tenth Group.