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October 28, 1996

Mr. Satish Aggarwal  
U.S. Nuclear Regulatory Commission  
Mail Stop T-10 E8  
North Bethesda, MD 20852

**Subject: Review of Draft NUREG/CR-6412, "Aging and Loss-of-Coolant Accident Testing of Electrical Connections," Sandia National Laboratory, July 1996.**

Dear Satish:

Thank you for the opportunity to review the subject document. In general, the report was found to be well written and presents a good scoping study of electrical connectors. BNL's comments are attached for your use.

If you have any questions on this or wish to discuss these comments further, please contact me.

Sincerely,

Robert J. Lofaro, Group Leader  
Engineering and Testing Group  
Engineering Technology Division

RJL/pvg

Attachment: BNL Comments on Draft NUREG/CR-6412

cc: w/out attachment  
R. Bari  
R. Hall  
J. Taylor  
J. Vora, NRC/RES

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I&P-11 Guides/Manuals 1/1

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**Brookhaven National Laboratory  
Comments on Draft NUREG/CR-6412  
October 28, 1996**

BNL has reviewed draft NUREG/CR-6412 entitled "Aging and Loss-of-Coolant Testing of Electrical Connections." The following comments were generated from this review.

1. The report provides a good scoping study on electrical connections. Based on the conclusions drawn in this report, additional testing should be considered to better understand why the failures occurred.
2. It would be helpful if pictures of the test specimens before and after the steam chamber tests were included in the report.
3. This study had the following two objectives: 1) to assess the accident performance of electrical connections aged more slowly than in typical industry qualification tests and under simultaneous conditions, and 2) to investigate the performance of connections aged to a 60-year life to determine their suitability for life extension beyond the current nominal 40-year qualified life. The second objective may justify the manner in which the experiments were conducted. However, it is unclear how the study was to accomplish the first objective. All of the connections were aged to simulate 60-years of operation, which precludes a comparison to typical industry tests which simulate 40-years of operation. In fact, no discussions were provided to compare the 60-year results with 40-year results. It is recommended that this discussion be provided, or the objectives of the study be modified to be consistent with the results obtained.
4. Additional justification is needed for the 60-year radiation dose of 20 MRads and accident dose of 100 MRads since these numbers are much lower than those recommended by IEEE qualification standards, and are even lower than those used by Sandia in earlier studies. The report states that these doses are more representative of actual power plant conditions, however, no basis is provided for this statement. Also, no discussion is provided on how the results of this study can be compared to previous qualification results. It is recommended that this be clarified in the report.
5. In light of the failures noted in this study for some of the connections, which were preaged using lower radiation doses than the original qualification tests, a question that should be addressed is how these connections passed the original qualification tests, and why they failed during these tests. It is recommended that a discussion be provided to address this question.
6. The report does not provide any discussion of the correlation between different test results, or whether this was even investigated. This is an important tool which could potentially provide useful insights into the effectiveness of the techniques being studied. For example, IR and post-LOCA submerged dielectric test results could be compared with TDR results to see if there is any correlation between the findings. It is recommended that this be considered for inclusion in the report.
7. The results of the TDR tests are included in the Appendix while other test results are in the main body of the report. It is recommended that all test data be presented in a consistent manner.
8. In the Summary and Conclusions, many of the bullet items do not appear to be consistent with the stated first objective of the study; namely to assess the accident performance of connectors using slow aging versus typical industry aging. It is recommended that the bullet items and/or the first objective be reviewed and revised to be consistent.