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MEMORANDUM FOR: James E. Dyer, Director
Project Directorate III-2
Division of Reactor Projects
Office of Nuclear Reactor Regulation

FROM: Carl H. Berlinger, Chief
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Office of Nuclear Reactor Regulation

SUBJECT: STAFF ACTIONS RESULTING FROM THE DIAGNOSTIC EVALUATION AT
QUAD CITIES NUCLEAR POWER STATION (TAC NOS. M88667/M88668)

In a memorandum to Thomas E. Murley, Director NRR, et al., dated December 29, 1993, James M. Taylor, the Executive Director for Operations, assigned responsibilities for generic and plant-specific actions resulting from the Diagnostic Evaluation Team (DET) Report for Quad Cities Nuclear Power Station. Among other items, the team observed that the licensee may not remain in compliance with emergency core cooling system (ECCS) regulations given a single failure of the degraded voltage relay during degraded grid condition. Such a condition may cause the loss of both low pressure coolant injection trains and one train of core spray. The remaining ECCS will not be sufficient to mitigate a design-basis loss-of-coolant-accident (DBLOCA). The Electrical Engineering Branch (EELB) was asked to determine whether current regulations require licensees to mitigate the consequences of a DBLOCA during degraded voltage conditions and in conjunction with a single failure. In addition, the EELB was asked to determine the need for further generic action on this matter.

The issue of degraded voltage conditions was raised after an event at Millstone Unit 2 in 1976. The NRC staff sent generic letters requesting that plants propose modifications to address postulated degraded grid conditions. Subsequently, the information in the generic letters was documented in a Branch Technical Position (BTP) PSB 1, "Adequacy of Station Electric Distribution System." The voltage-sensing protection of the BTP is to conform to a number of requirements of IEEE Std. 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations;" however, the single-failure criterion is not explicitly cited. Although the requirements do not explicitly include the single-failure criterion for the sensing portion of the design, independent sensing is to be provided for each electrical division.

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Since most plant designs have two independent 100-percent divisions of electrical power for all analyzed events, the overall single-failure criterion has been met by providing independent sensing for each division.

Conforming to the single-failure criterion is not as straightforward at a plant such as Quad Cities which has a "swing" bus design. It has been recognized that the swing bus design can compromise the independence of the electrical divisions, and some scenarios involve such single-failure vulnerabilities as the loss of a dc power source. In some cases, explicit exemptions have been given to the single-failure criterion. The scenario postulated by the DET could be interpreted as another scenario involving such a single-failure vulnerability.

Although designs could be implemented that would withstand a single failure in the degraded voltage sensing, the EELB has concluded that plants such as Quad Cities were not explicitly required to meet the single-failure criterion with regard to the degraded grid voltage relays during LOCA conditions. Furthermore, considering the EELB's perception of the low probability of the scenario described, we do not believe that it would be cost beneficial to pursue such an issue on a generic basis.

To gain added assurance that this perception is valid, we asked the Probabilistic Safety Assessment Branch (SPSB) of the Division of Systems Safety and Analysis (DSSA) to investigate aspects of typical core-damage frequency (CDF) estimates associated with a scenario of a DBLOCA during degraded voltage conditions with a failure of voltage sensing device. In a memorandum from Edward J. Butcher to Carl H. Berlinger dated June 8, 1994, SPSB concluded that CDF for such an event is acceptably low. Therefore, the EELB has concluded that further generic action on this issue is not warranted.

We are forwarding this issue to the Office of Nuclear Regulatory Research, recommending its inclusion in NUREG-0933, "A Prioritization of Generic Safety Issues."

Original signed by

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