

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
EVALUATION OF ELECTRICAL CIRCUIT BREAKER COORDINATION  
DEFICIENCY AT CATAWBA NUCLEAR STATION  
DOCKET NOS. 50-413 AND 50-414

BACKGROUND

The Electrical Distribution System Functional Inspection (EDSFI) at Catawba Nuclear Station Units 1 and 2 (CNS), from January 13 to February 14, 1992 identified a safety significant deviation from the following written commitment: "NUREG-0800, Standard Review Plan, states on page 8.3.2-5 that acceptance [of a design] is based on meeting the specific guidelines in Regulatory Guide 1.32, which endorses the Institute of Electrical and Electronics Engineers (IEEE) Standard 308. IEEE Std. 308, says in section 5.3.1 that protective devices shall be provided to limit the degradation of Class 1E power systems." The licensee's Final Safety Analysis Report (FSAR) states on page 8-75 that the system meets the requirements of this standard. And the FSAR, in Section 8.3.1.1.2.2 states that protective devices on the 600-Vac essential power system (EPS) are set to achieve a selective tripping scheme so that a minimal amount of equipment is isolated by an adverse condition such as a fault.

Contrary to the above, the licensee deviated from the commitment because the protective devices may not limit the degradation of the 125-Vdc Vital Instrumentation and Control Power System (EPL) distribution center and other main feeder circuit breakers. The licensee's analysis showed that coordination did not exist for currents above 3500 Amperes (A) to the maximum fault current of 9,500 A. A fault on the battery charger feeder cable could isolate both the charger and battery from the remainder of the distribution system and loads.

Also contrary to the above, all 600-Vac motor control centers (MCC) outgoing circuit breakers had thermal elements but the incoming circuit breaker to each MCC had an instantaneous element. Hence, the incoming and outgoing MCC breakers are not coordinated for currents near the maximum short circuit current. A fault on any outgoing feeder could trip the MCC incoming breaker, resulting in the loss of all MCC loads on that bus.

DPC does not dispute that the subject breakers are not coordinated, but argues instead that the consequences of the breakers not being coordinated are small enough to be ignored and do not justify the cost of changing the MCC breakers so that they are coordinated.

EVALUATION

The DPC reply consisting of enclosures 1 and 2 to the E. Merschoff letter of May 12, 1993 to G. Lainas, cited above, stated:

LICENSEE RESPONSE 1:

The EPL system for each unit comprises two completely redundant and separate trains each consisting of two load channels. Therefore, a postulated fault would, at worst, disable two load channels of the same train, yet the redundant train would remain unaffected.

STAFF COMMENT ON LICENSEE RESPONSE 1:

The staff's position is that redundant parallel safety trains are provided to compensate for random operational failures and the redundancy of these trains cannot be used to compensate for known design errors. Further, it is an impermissible design error to use instantaneous trip elements in a circuit breaker feeding load breakers that have only slower thermal magnetic tripping elements if, as in this case, the circuit breakers cannot be coordinated. Circuit breakers which are not coordinated violate the intent of General Design Criterion 1 which says, "Structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed." The PSAR, CNS cited IEE Std. 308 which requires that circuit breakers be coordinated. Further, it is inconceivable that even usual good engineering practice would allow circuit breakers that are not coordinated. There would be no point in having branch circuit breakers if the circuit breaker feeding the bus were not coordinated with them.

It is scarcely credible that the electrical engineers who designed the EPL failed to discover the mistake before CNS became operational. It is much more likely that the error was found only after the MCC assembly had been installed, or had been ordered, at which time correction would have entailed the same costs that CNS now faces when it installs coordinated breakers. If the staff were to accept the CNS argument that because a redundant safety train could perform the function of a failed safety train, the design or construction defects of a safety train need not be corrected, then any safety train could be allowed to degrade, as long as a redundant safety train were operable. This is unacceptable to the staff.

LICENSEE RESPONSE 2:

Selected loads such as the diesel load sequencer, essential switchgear and load center controls, and auxiliary feedwater pump turbine controls are not only fed by the EPL system, but are auctioneered with the 125-Vdc diesel auxiliary power (EPQ) system. Consequently, should the EPQ system become unable to feed these loads, the EPQ system will supply them without interruption. A fault on the EPL System will not affect the EPQ System and vice versa.

STAFF COMMENT ON LICENSEE RESPONSE 2:

Redundant power supplies like other redundant elements are part of the defense against single failures disabling a safety function. Redundant power supplies are also part of the plant's defense-in-depth. On both these grounds, the presence of a redundant power supply, like a redundant safety train, may not be used to compensate for a discovered design or construction error, which instead must be removed in a timely fashion. Defense-in-depth and resistance to single failures are reserved for random operational failures and undiscovered design or equipment failures.

LICENSEE RESPONSE 3:

MCC incoming breakers were provided although only switches were needed because switches that would fit the available MCC enclosures were not available with high enough peak current ratings.

STAFF COMMENT ON LICENSEE RESPONSE 3:

The fact that only a switch and not a breaker was needed where the breaker was installed on the input to a MCC bus with multiple loads is not a basis for continuing to operate with an input breaker which is not coordinated with the MCC load breakers because the switch, had it been installed, would not trip the entire bus if a load circuit on the bus were to experience a fault. Instead, the load breaker would trip and the other loads on the bus would remain operable. The faulted circuit would also be the more easily restored since the location of the fault would be more easily located than would be the case if the entire bus were lost.

LICENSEE RESPONSE 4:

The probability is low that a three-phase fault will occur on the 600 V essential system, since it would have to occur in an MCC compartment or in an armored cable. Each compartment circuit and

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cable was inspected and tested before initial operation, and post-modification/maintenance testing verifies that no detrimental conditions have been induced before returning the equipment to operation.

STAFF COMMENT ON LICENSEE RESPONSE 4:

The staff cannot accept the licensee's argument that the initiating event is so improbable that remedies are not justified, because DPC in their reply to the NRC Notice of Deviation of March 18, 1992, provided no justification beyond: "The probability that a three phase bolted fault will occur on the 600 volt essential system...is low since it would have to occur in a motor control center compartment or be the result of a failure of an armored cable." This is an insufficient basis.

General Design Criterion 1 says: "Structures, systems, and components important to safety shall be designed, fabricated, ...to quality standards commensurate with the importance of the safety functions to be performed." Coordinating circuit breakers is universal so that no electrical distribution system that fails to coordinate all its circuit breakers can be considered to meet even usual engineering standards much less the exacting standards of nuclear safety systems.

LICENSEE RESPONSE 5:

Three-phase bolted faults at many locations in the EPL would not result in upstream breakers tripping before the branch circuit breakers, if the battery and main circuit breakers were replaced with Westinghouse MA 800A or NB 1200A magnetic-only breakers. But replacement would require extensive modifications to main EPL distribution centers. And the substantial engineering and design time and material costs associated with the modifications are not justified by the increased freedom from improper circuit breaker trips.

STAFF COMMENT ON LICENSEE RESPONSE 5:

Reducing the number of locations at which faults could cause breaker trips that are not coordinated is desirable but not sufficient. All examples of circuit breakers in safety systems which are uncoordinated must be corrected, and a point-by-point analysis of both the EPL and the 600-Vac EPS must be made to discover and remove any other cases of circuit breakers which are not coordinated.

LICENSEE RESPONSE 6:

A fault on the auctioneered distribution center bus will not cause the battery or main circuit breakers in the EPL to trip before the branch circuit breakers. The conclusion that the battery or main circuit breakers would trip first was based on an erroneous worst-case fault current calculation.

STAFF COMMENT ON LICENSEE RESPONSE 6:

The staff agrees that a fault on an EPQ Auctioneered bus will not cause a trip of the associated main or battery breaker if the latest fault current been correctly calculated.

CONCLUSION

DPC should fulfill its PSAR commitments and coordinate the subject EPL and EPS circuit breakers. The schedule for doing this is the responsibility of Region II, as is determining the need for an interim justification for continued operation with so many safety system circuit breakers not coordinated.

SALP INPUT

FACILITY NAME: Catawba Nuclear Station Units 1 and 2

SUMMARY OF REVIEW:

Catawba Nuclear Station, Units 1 and 2, in response to an Electrical Distribution System Functional Inspection (EDSFI) Finding and Notice of Deviation of March 18, 1992, proposed to the NRC that nothing be done to correct admitted deficiencies in circuit breaker coordination in two safety systems. The basis of the licensee's position is that the initiating events are rare and the consequences of the deficiencies are small. Further, the cost of correcting the circuit breaker deficiencies are substantial and the benefits of the required modifications could not justify them.

The staff's position in the safety evaluation by EELB does not agree that such egregious violations of good engineering standards and practice, let alone NRC requirements for safety systems, can be allowed to continue. The staff has not accepted the licensee's assertion that the frequency of the initiating faults is small because the licensee offered no basis for that finding. Nor has the staff accepted the philosophy that prior licensee commitments need not be performed if the costs are too great. Neither can the staff accept the licensee's position that discovered defects in a safety system need not be corrected because a fully redundant operable safety train may be available to perform the requisite safety function.

NARRATIVE DISCUSSION OF LICENSEE PERFORMANCEFUNCTIONAL AREA: ENGINEERING/FUNCTIONAL SUPPORT:

The licensee's staff did an outstanding job defending what ultimately cannot be defended: that discovered deficiencies in licensee performance to safety analysis commitments need not be corrected (1) when another safety train could perform the safety function that would have been disabled by a discovered but uncorrected defect in the first, and (2) because the modifications required to remove the deficiency would cost too much. Since the safety evaluation is based on the licensee's and not on any other contacts, that submittal is the sole basis of this SALP.

Author: C. Morris

Date: 16+ August 1993



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

September 17, 1993

MEMORANDUM FOR: NRR Technical Staff

FROM: Thomas E. Murley, Director  
Office of Nuclear Reactor Regulation

SUBJECT: COST BENEFICIAL LICENSING ACTIONS

As licensees begin to come to grips with the significant rise in plant operational and maintenance (O&M) costs, they frequently express concern that some regulatory requirements provide little or no safety benefit but incur significant implementation costs. Furthermore, licensees believe that in some instances they have "overcommitted" to meet regulatory requirements and that revisions to these commitments could result in cost savings. The purpose of this memorandum is to explain the NRR position on the review of such licensee requests, called cost beneficial licensing actions (CBLAs), that in the past have had a low priority for review.

Licensees have described both direct and indirect safety benefits if allowed to be relieved from requirements or commitments that they view to be marginal to safety. A direct benefit is one in which the costs averted could be directly applied to safety enhancements in other areas. For example, a licensee described how \$11 million not spent on low safety enhancements to the control room would be spent on improving its independent plant examination (IPE) and on flooding prevention measures. An indirect benefit is one in which the costs averted would result in a reduction of O&M costs and a more efficient organization.

In the past, licensees' requests for relief from regulatory requirements or for changes in their commitments have, absent any significant safety issues, received a low priority (level 4) and were scheduled on an "as available" basis. This resulted in many requests not being expeditiously worked, with a resultant loss or delay in realizing any direct or indirect safety benefits. As an initial step to recognize the connection between costs averted and plant safety, I raised the priority of such licensing actions to level 3 in my memorandum of June 6, 1993, on priority determination for NRR review efforts.

I established the CBLA task force to study how the NRR staff are currently handling high-cost/low-safety-significant issues and what changes, if any, should be made to the NRR review process to provide a more timely and efficient review of all licensing issues, including the CBLAs. In addition, the task force will ensure that the CBLAs are given the appropriate staff attention.

The CBLA task force is considering several options to improve this process and will report its recommendations in the fall of 1993. This report will be made available to the project directorates (PDs) and technical branches for their review and comment. Until the report is issued and any process-oriented improvements or clarifications are implemented, the current procedures for assigning work are not being changed.

Project managers (PMs) should work with licensees to ensure that CBLAs are clearly identified and prioritized within the overall licensee agenda and that only significant CBLAs that actually need NRC review are submitted. Each CBLA

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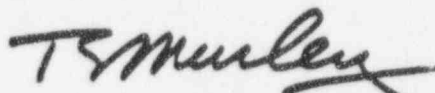
should be considered on a case-by-case basis on its technical merits. Cost information should be used only as a basis for prioritization, not as a basis for either approving or disapproving the licensee's proposal. Also, the staff should identify issues that are generic and that should be worked in a generic manner to further improve our efficiency. These issues should be brought to the attention of either the PD organization or to the CBLA task force.

The CBLA task force does not, in any way, replace the PM in working with the licensee to manage proposed work or replace or augment the technical staff or PM as a technical review path. The current procedures for assigning work to the technical branches or PMs and the criteria that the licensees' requests are evaluated against are not being changed by this memorandum.

Where licensees determine that significant resources may be saved by changing the manner in which their facilities are licensed to operate, the NRR staff should be receptive to reviewing the proposed changes. This NRR position may result in improved safety for the operating plants by (1) reducing the application of significant licensee resources to low safety significant issues (i.e., allowing licensees to effect direct and indirect benefits) and (2) more efficiently using NRR staff resources on the important licensing issues, including those with significant economic impact to the licensees.

There are other efforts also underway that may affect what is finally decided about CBLAs. These include, for example, the Regulatory Review Group report recommendations and the current licensing basis task force. Since many CBLAs are licensees' requests to change their commitments, questions have arisen about the need for staff to review these changes; the results of these efforts will be carefully weighed and factored into the CBLA work, where appropriate.

If you have any recommendations concerning CBLAs, please contact Tad Marsh at 504-1340, MS 13D18.



Thomas E. Murley, Director  
Office of Nuclear Reactor Regulation

cc: J. Taylor  
J. Sniezek  
Regional Administrators