UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 17, 1996

MEMORANDUM TO: Frank J. Miraglia, Acting Director
Office of Nuclear Reactor Regulation

FROM: Brian W. Sheron, Chairperson
Ad hoc NRR DPV Review Panel

SUBJECT: DIFFERING PROFESSIONAL VIEW CONCERNING DYNAMIC TESTING OF INSTRUMENTATION CHANNELS AT BRAIDWOOD

In a memorandum to you dated October 17, 1996, Dale Thatcher forwarded a differing professional view (DPV) from Fred Burrows, an electrical engineer in the Electrical Engineering Branch, regarding the Office of Nuclear Reactor Regulation's (NRR) acceptance of dynamic testing of instrumentation channels at Braidwood. In the view of Mr. Burrows, in performing dynamic tests in lieu of static tests, the licensee had not properly addressed the impact of dynamic component setpoint uncertainties upon the setpoint methodology, technical specification setpoints and allowable values, and final safety analyses report chapter 15 analyses. The concern was that the dynamic component setpoint uncertainties, if not properly accounted for in safety analysis, could result in the plant tripping in a non conservative manner with respect to the safety analyses, and produce unreviewed results.

The members of the ad hoc NRR DPV Review Panel were Brian Sheron as Chairperson, Tim Martin as a management member, and Virgil Beaston as recommended by Mr. Burrows. Ms. Sheri Peterson served as technical assistant to the panel. The panel commenced a review of the DPV that included a review of the documents provided by Mr. Burrows and HICB, and discussions with Jerry Wermiel, chief of the Instrumentation and Controls Branch (HICB), Mike Waterman, HICB technical reviewer, and Fred Burrows.

Background

While working in the Instrumentation and Controls Branch in 1987, Mr. Burrows was requested to review a new automatic test system (MESAC) being used at Braidwood Station for periodic, functional testing of the safety-related instrumentation channels. Historically, the staff has reviewed and accepted a static setpoint testing methodology in which all dynamic components are jumpered out, the input signal slowly varied and recorded, and the measured bistable trip setpoint compared to the setpoint contained in the technical specifications. It was assumed the dynamic component time constants were accurately set or confirmed by the technicians in accordance with technical specification requirements. The Braidwood automatic test system performed a simultaneous dynamic test of both static and dynamic components. However, the original Westinghouse setpoint methodology referenced by Braidwood as the bases for its setpoint development did not address dynamic component setpoint uncertainties.

After visiting the Braidwood site in November 1987, Mr. Burrows wrote a request for additional information (RAI) dated January 14, 1988, that was intended to have the licensee address the assumptions used to calculate acceptable dynamic testing results such as the impact of dynamic component calibration errors upon the setpoint methodology, technical specifications and the accident safety analysis. While the RAI was forwarded to the NRR Project Director, it was not forwarded to the licensee. In the meantime, Mr. Burrows was reassigned to the Electrical Engineering Branch in NRR.

Mr. Burrows' concerns about dynamic testing surfaced again during a personal grievance meeting with Bill Russell in October 1992, subsequent to Mr. Burrows receiving second-hand information that dynamic testing could be marketed to other plants. As a result, Mike Waterman from HICB was tasked to study this issue. Several discussions between Mr. Burrows and HICB staff members were held, but his concerns were not resolved. In a memorandum to Jerry Wermiel dated October 3, 1995, Mr. Burrows maintained that uncertainties associated with dynamic component setpoints (i.e., lead-lag time constants) were apparently never addressed in Final Safety Analysis Report (FSAR) Chapter 15 accident analyses and that approved surveillances assumed them to be jumpered out during testing.

On October 11, 1995, Jerry Wermiel responded to Mr. Burrows' concerns regarding MESAC implementation at Braidwood and provided a staff response to issues identified in the January 14, 1988, request for additional information. On October 18, 1995, Mr. Burrows replied to Mr. Wermiel's memorandum and stated that he felt the responses should have come from the licensee and not the staff. While Mr. Burrows' concerns regarding the exclusion of calibration error for the gain adjustment of the lead-lag card, and test equipment inaccuracy of the MESAC test system had been addressed by the licensee, the overall tolerances for the lead-lag adjustments or response times and the sum of the calibration errors for individual associated circuits was not addressed by the licensee but rather by the staff. Mr. Burrows also was concerned that while Braidwood does perform dynamic testing and Byron does not, Braidwood and Byron share the same technical specifications.

On January 17, 1996, Mr. Wermiel responded to Mr. Burrows' October 18, 1995 memorandum. HICB had concluded that the licensee had implemented the necessary controls to ensure that their setpoint methodology and instrument channel testing meets current staff criteria and the Byron/Braidwood technical specifications. This conclusion was based on a member of HICB staff visiting the Braidwood station and the licensee's headquarters to review setpoint analyses and supporting scaling analyses. Mr. Burrows responded on January 31, 1996, and stated that he had reviewed HICB's replies to his concerns and that they did not resolve his concerns. Mr. Burrows felt that HICB had taken an informal approach to resolving what he considers to be a significant regulatory and technical issue. Mr. Burrows requested that the licensee formally respond to his concerns regarding dynamic testing. As a result, on February 9, 1996, HICB forwarded to Projects a request for information to be sent to the licensee for Braidwood that contained a staff analysis demonstrating that setpoint uncertainties in dynamic components were conservatively accounted for in the licensee's analysis, and requested the licensee to confirm the staff's conclusions. The request for information was

forwarded to the licensee on May 22, 1996, requesting a prompt response to a "concerned staff member's concerns" and presenting the HICB staff analysis for the licensee to confirm. Subsequent conference calls were also held between the licensee, HICB, Mr. Burrows and Projects to discuss the dynamic testing concerns. Due to inherent instrument errors, the licensee for Braidwood (Byron) identifies $\pm 3 (\pm 10)$ percent deviations in the lead/lag time constants as being acceptable. The main concern Mr. Burrows expressed was whether or not these percent deviations in the lead/lag time constants associated with the thermal overtemperature delta-T reactor trip setpoint at Braidwood(Byron) were bounded by the Updated FSAR Chapter 15 accident analysis. Mr. Burrows told the panel that the licensee's original FSAR analysis he reviewed did not account for any dynamic component setpoint uncertainties, consistent with the Westinghouse setpoint methodology, upon which it was based.

On November 12, 1996, the licensee for Braidwood responded to the May 22, 1996 request for information. The licensee agreed with the HICB analysis contained in the RAI and explained how the dynamic component setpoint uncertainties are bounded by the FSAR Chapter 15 accident analyses in the specific case of the overtemperature delta-T reactor trip function.

Discussion

The NRR DPV Review Panel initially met amongst themselves on November 15, 1996, to discuss the documentation provided to the panel. Virgil Beaston gave the panel an overview of the dynamic testing issue and discussed the circumstances leading up to the DPV.

On November 19, 1996, the panel first met with Mr. Burrows to gain a better understanding of his concerns regarding dynamic testing of instrument channels at Braidwood. Mr. Burrows went through the background information. He noted that while dynamic testing is a desirable feature, it should be appropriately tied to the plant's Chapter 15 analyses, setpoint methodology and approved Technical Specifications (TS); or followed by required static testing. Mr. Burrows believes that the licensees cannot replace static testing with dynamic testing under 10 CFR 50.59 without prior staff review and approval since he also believes FSAR Chapter 15 accident analyses, TS, and setpoint methodology are directly impacted. He believes that more errors are being introduced with dynamic testing and that the technical specification values were approved based on the use of static testing. Therefore, he believes dynamic testing does not confirm the technical specification values. Mr. Burrows also noted that some plant technical specifications specify the response time values such that they are adjusted exactly and implied that this was because the setpoint uncertainties, such as caused by calibration errors, are not accounted for elsewhere.

On November 19, 1996, the panel also met with Messrs. Wermiel and Waterman to gain a better understanding of HICB's involvement and what was reviewed by the staff. Messrs. Wermiel and Waterman first stated that they had just received a copy of the Braidwood licensee's response to the May 22, 1996 staff request for additional information. The licensee's response was distributed to the panel and Mr. Burrows. Messrs. Wermiel and Waterman stated that the setpoint

values are independent of the timing issue. Mr. Waterman stated that the licensee for Braidwood performed static testing of individual circuit cards in addition to the dynamic test. Mr. Waterman also stated that the dynamic component setpoint uncertainties were accounted for in the FSAR Chapter 15 accident analyses and that the licensee confirmed this in their response. The panel raised the concern of setpoint uncertainties resulting in the lag time constants exceeding the lead time constants and the potential for operating outside design basis. Mr. Waterman pointed out that the lead time constants will always be a few times greater than the lag time constants, such that the lead-lag circuits will always conservatively anticipate the trip rather than delay the trip.

On November 21, 1996, the panel met to discuss the information obtained, including the inconsistencies regarding whether or not Braidwood conducts static testing and whether or not dynamic component setpoint uncertainties were accounted for in the accident analyses. The panel also met with Mr. Burrows to try to gain a better understanding of these inconsistencies and to obtain his feedback on the licensee's November 12, 1996, response that the staff received on November 19, 1996. Mr. Burrows did not think the licensee's response fully addressed his concerns. In particular, the licensee had only addressed the overtemperature delta-T reactor trip and did not state that all dynamic component setpoint uncertainties in other reactor protection circuits were bounded by the accident analyses. Mr. Burrows also noted that the licensee did not confirm that static testing was performed at Braidwood.

On November 26, 1996, the panel met briefly with Mr. Howard Richings of the Reactor Systems Branch (SRXB) to determine if the SRXB staff's review of the UFSAR Chapter 15 accident analyses included the review of protection system dynamic component setpoint uncertainties to ensure they were properly accounted for. Mr. Richings indicated that his branch typically relied upon HICB's review of the setpoint methodologies, including how dynamic component setpoint uncertainties are accounted for, and that SRXB focused on the values presented in the technical specifications. The panel discussed the staff's acceptance of such margins, however, because a technical review was not documented, the rationale for the staff's acceptance could not easily be reconstructed.

Conclusions

(1) Based on the licensee's current FSAR analysis including margin for dynamic component setpoint uncertainties, the licensee's use of dynamic testing at Braidwood is probably acceptable. However, it has not been formally reviewed and approved by the staff. HICB has informally reviewed the licensee's use of dynamic testing and concluded that it does not raise a safety concern.

(2) The licensee responded on November 12, 1996, to a staff RAI regarding the use of dynamic testing at Braidwood. The licensee stated that dynamic component setpoint (i.e, response time) uncertainties for the overtemperature delta-T reactor trip function are accounted for in the UFSAR Chapter 15 analyses. The licensee's response, however, did not

explicitly state how the accident analyses accounted for dynamic component setpoint uncertainties in other reactor instrument channels. No documentation was found to indicate that the staff had previously reviewed and accepted the licensee's method of accounting for dynamic component setpoint uncertainties in Braidwood's accident analyses.

(3) There were apparent discrepancies in the facts presented to the panel regarding whether or not Braidwood performed static tests. The staff member that visited the site and reviewed the licensee's test procedure indicated that the licensee does perform static tests. However, the licensee did not confirm this in its November 12, 1996, response. The RAI specifically asked the licensee to confirm that it performs static tests.

(4) The staff has not conducted a review to determine how the licensee combines dynamic component setpoint uncertainties to establish its TS acceptance criteria. The standard Westinghouse TS format and acceptance criteria for reactor trip setpoints were developed assuming that lead-lag circuits are jumpered-out during testing. The Westinghouse setpoint methodology, which the staff has accepted and is used by licensees, does not specify an allowance for dynamic component setpoint uncertainties.

(5) Mr. Burrows has played a positive role in identifying the dynamic testing and response time uncertainty issues at Braidwood. His DPV highlights the need for the staff to formally document its findings in safety evaluations.

(6) While not directly related to the DPV issue, the panel notes that it appears inappropriate for the staff to have stated in its request for additional information to the licensee that the request was being made solely based on one staff member's concerns.

Recommendations

Based on the conclusions above, the NRR DPV Review Panel recommends that:

(1) The staff formally review and document the acceptability of dynamic testing. The staff should review and approve Braidwood's method of accounting for dynamic component setpoint uncertainties in its accident analyses, including dynamic components in channels other than the overtemperature delta-T trip, and the staff should verify that Braidwood's use of dynamic testing and its acceptance criteria are bounded by its accident analyses.

(2) After completing its review for Braidwood, the staff should document its position, including the technical basis, regarding how much uncertainty is acceptable when setting dynamic components in instrument channels (e.g., ± 10% is acceptable to the staff) for all licensees.

(3) In completing the generic review, the staff should reexamine the acceptability of technical specifications that currently do not specify tolerances for dynamic component setpoints (i.e., time constants) and, if necessary, provide staff guidance on an acceptable licensee method to ensure the technical specification setpoints are being satisfied.

Attachments:

1. DPV memo to F. Miraglia dated October 17, 1996