



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

December 14, 1998

Mr. Nicholas J. Liparulo, Manager
Equipment Design and Regulatory Engineering
Westinghouse Electric Company
Post Office Box 355
Pittsburgh, Pennsylvania 15230-0355

SUBJECT: RESPONSE TO WESTINGHOUSE REPLY TO NOTICE OF VIOLATION
AND NOTICE OF NONCONFORMANCE NRC INSPECTION REPORT
99900404/98-02

Dear Mr. Liparulo:

Thank you for your letter dated August 28, 1998, which responds to our letter dated July 29, 1998, regarding our Notice of Violation (NOV) and Notice of Nonconformance (NON) identified in NRC Inspection Report 99900404/98-02. Your letter contests the issuance of the NOV, and with one exception the NON, and cites that neither of the examples identified by the inspection team represents a failure to comply with Westinghouse programs which satisfy 10 CFR Part 21 and 10 CFR Part 50, Appendix B, requirements. The enclosure to this letter provides a discussion of the staff's response to your letter for each of the NOV and NON and also requests additional information to address the issues identified.

Your letter states reliance on Westinghouse's technically qualified personnel and the application of reasoned engineering judgement used to assess issues that warrant evaluation for safety significance under Westinghouse's formal safety and quality programs and procedures. Additionally, you acknowledge the staff's concerns cited in the NOV and NON and identified additional actions taken by Westinghouse to strengthen the understanding of its personnel in the requirements for complying with Westinghouse programs and procedures for evaluating potential deviations and other conditions adverse to safety.

Although the staff recognizes the actions taken by Westinghouse to enhance organizational knowledge and awareness of implementing procedures and regulatory requirements, we conclude that, with one exception, the information presented does not change the findings identified by the staff in both the NOV and NON. However, as a result of additional information presented for the shunt trip plunger issue, the staff has retracted that part of the NOV. Notwithstanding the exceptions noted in the enclosure, the staff finds the corrective actions initiated by Westinghouse to be responsive to our concerns and, unless otherwise noted, no further response is required.

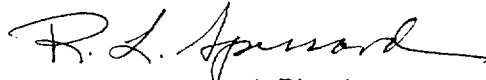
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Mr. N.J. Liparulo

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The staff appreciates the effort Westinghouse has expended to respond to the concerns identified in the NOV and NON. Please provide the information requested in the enclosure within 30 days of the date of this letter. Should you have any questions, please contact Robert L. Pettis, Jr. of my staff at (301) 415-3214.

Sincerely,

A handwritten signature in cursive script, appearing to read "R. L. Spessard", with a long horizontal flourish extending to the right.

R. Lee Spessard, Director
Division of Reactor Controls and Human Factors
Office of Nuclear Reactor Regulation

Enclosure: As stated

Enclosure

Violation 98-02-01 (Part 1)

Although Westinghouse cites the use of engineering judgement and states that cracks at the root of some screw threads should be expected during the quenching process, Westinghouse could not produce any written documentation to support the engineering judgements used to conclude that quench cracks were not a problem, or provide a documented basis for concluding that the condition was limited to a small percentage of screws per batch which would not affect the structural integrity or the load carrying capacity of the screws. Both the June 2 and June 19, 1995, Tennessee Valley Authority (TVA) TVA Central Laboratories Services (CLS) Technical Reports (95-1021), "Watts Bar Nuclear Plant, Ice Condenser Basket Screws," identified 12 in-service screws taken from ice baskets at the Watts Bar Nuclear Plant (WBNP) that were metallurgically tested and examined. The results indicated that at least 4 screws had intergranular cracks (not service induced) at the screw thread root. Based on this limited sample set, the intergranular cracks occurred with a higher incidence than what would be expected during manufacturing of the screws.

Westinghouse did not address the fact that the June 2, 1995, TVA CLS report identified measured core hardness values which exceeded the 32-40 Rockwell C scale range identified in Westinghouse Design Specification 678956. Because the report identified conditions potentially adverse to safety that represented a departure from the design specification, the team concluded that a review of these potential deviations to determine if a substantial safety hazard exists was required pursuant to 10 CFR Part 21 and Westinghouse Energy Systems Business Unit (ESBU) ESBU 21.

Staff Review of Westinghouse Corrective Actions (10 CFR Part 21 Evaluation)

On September 29, 1998, NRC staff performed a limited review of documentation related to Westinghouse's 10 CFR Part 21 evaluation (Potential Issue (PI) PI98-016, dated June 17, 1998). The review, performed by Westinghouse in response to NOV 98-02-01, was initiated to investigate the possibility that broken and cracked ice condenser sheet metal screws could represent a defect and that a substantial safety hazard may exist. The review, performed in the Rockville, Maryland office of Westinghouse, concluded that based on metallurgical examination of 50 screws removed from in-service ice baskets at the DC Cook Nuclear Plant, 6.1 percent of the screws within the sample contained intergranular cracks at the screw thread root. The evaluation postulated hydrogen induced cracking associated with the manufacturing process as the cause.

Additionally, since the heat treating process may not produce uniform results between batches of screws and the fact that the WBNP has experienced significant screw cracking, the staff has a concern that the actual percentage of cracked screws at the WBNP may exceed the 33 percent limit bounded by the Westinghouse evaluation based on static pull tests of actual ice

baskets fastened together with screws supplied by DC Cook. Therefore, the staff has a concern that the percentage of in-service cracked screws at the WBNP may be higher than had been demonstrated acceptable by static pull testing.

Staff Review of Recent Testing Performed by TVA

The staff reviewed TVA Supplement to Problem Evaluation Report (PER) Closure Package (T42961219833), "Reconciliation of Watts Bar Nuclear Plant Ice Condenser Basket Screws Report," dated October 26, 1998 (including Attachments A and B), which supplemented TVA PER950246 for the WBNP. The report reconciled technical differences between the June 2 and June 19, 1995, versions of TVA CLS Technical Report No. 95-1021, and reaffirmed that the conclusions reached in those reports are still valid and that the overall metallurgical core properties of the screws are adequate for their intended application.

The staff reviewed Attachment A, TVA CLS Technical Report 98-1612, "Westinghouse Carbon Steel Sheet Metal Screws, TIIC #BXV-254X, Contract 9500006758, 54114-1," dated October 21, 1998, which tested 72 ice condenser sheet metal screws currently in stock at the WBNP. The objective of the testing was to verify the composition, hardness, and microstructure of the screws based on the Westinghouse requirements. The report concluded that the chemistry of the screws met the requirements of the American Iron and Steel Institute 1022 carbon steel, were zinc phosphate coated and surface hardened. Cracks and laps, developed during the forming process of the screw, were found in the transverse view of the screws and appeared to be limited to the case region while secondary cracks appeared to follow along the case.

The staff also reviewed TVA report, "Metallurgical Evaluation of Replacement Ice Condenser Basket Screws," dated October 26, 1998. The report concluded that the overall metallurgical properties of the screws at the WBNP are adequate based on core hardness, microstructure, and extrapolated tensile properties and that although some of the screws did not meet the minimum surface hardness requirement stated in the design specification, the load carrying capacity of the screws are not compromised.

Based on the staff review of the above, the following observations were identified:

- The cracking observed in the current WBNP replacement screws appear to have a different morphology (e.g. cracks are contained to the case region) than cracking identified in the thread root areas in the 1995 test on 12 in-service ice basket screws at the WBNP or that reported for the DC Cook screws tested by Westinghouse in 1998.
- The October 26, 1998, TVA metallurgical evaluation referenced above states the evaluation was based on fracture mechanics. However, the staff did not identify this to be the case. Additionally, the evaluation does not provide the calculated shear or tensile strength of the screws with "case cracks." It appears that if the cracks are shallow and within the hardened outer case, then the cracked screw shear and tensile load carrying capacity can be compared with that assumed in the Westinghouse design specification for the WBNP.

- The reports do not quantify or bound the extent of cracking as was done for the DC Cook screws, e.g. 6.1 percent of screws have thread root cracking at DC Cook, nor does it relate the screws tested to in-service screws at the WBNP by material heat, batch or lot.

Based on the staff's review of the information supplied by Westinghouse, including recent testing and metallurgical report reconciliation by TVA of ice condenser sheet metal screws installed at the WBNP, the staff requests that Westinghouse provide additional information to address the staff concerns noted above and to demonstrate that the test results, compiled for screws at DC Cook, adequately bound the conditions which exist for screws currently installed at the WBNP. As a result, this part of the violation will remain open.

Violation 98-02-01 (Part 2)

The Westinghouse response to this item stated that a documented assessment exists to support the position that further evaluation of the issue was not warranted and that inclusion of the issue in Westinghouse's 10 CFR Part 21 program was not required. However during the June 1998 NRC inspection, the team was provided with only an electronic record of the notification of the issue to Westinghouse and not an evaluation or assessment as indicated in Westinghouse's response. An NRC inspection team reviewed additional information on this issue during an inspection of the Cheswick facility on October 28-29, 1998. Based on that review, and the Westinghouse response to this issue, the staff concluded that sufficient information now exists to satisfy the team's concerns regarding the evaluation and documentation of potential deviations and other conditions adverse to safety which are brought to the attention of Westinghouse. After the review of the additional information at Cheswick, the staff agrees with Westinghouse that the issue did not rise to the threshold of a violation and as such, the staff has retracted this part of the NOV. As a result, the staff has closed this issue.

Nonconformance 98-02-02

As stated previously, the June 2, 1995, TVA report (provided to Westinghouse by fax on June 8, 1995) identified screws at the WBNP with manufacturing induced quench cracks and core hardness values in excess of Westinghouse design specification values. However the June 22, 1995 Westinghouse report, submitted to TVA for the WBNP, provided only a statistical analysis to support the structural integrity of the ice baskets with 2 of the 12 screws missing per basket and did not address the potential impact that quench cracks may have on the remaining in-service ice basket screws. Since Westinghouse and TVA have recently provided additional testing and related information to the staff on this issue, this part of the nonconformance will remain open pending completion of the staff's review of this information.

With respect to the second part of the nonconformance regarding possible damage to Air Handling Units (AHUs) and the release of glycol products into the containment sump following an ejected ice basket accident during a loss-of-cooling-accident (LOCA), the staff reviewed a September 28, 1998, letter to TVA in which Westinghouse stated that "the consequences of a potential ejecting ice basket column during a LOCA coming up out of the ice bed and hitting an AHU was assessed during the initial evaluation of broken screws at Watts Bar in 1995." During

the inspection, the team was provided with only a 1993 evaluation, performed for the Sequoyah Nuclear Plant, which concluded that the release of ethylene glycol into the sump and Reactor Coolant System was not considered to be an issue for Sequoyah. Westinghouse could not produce documentation to demonstrate that the potential for glycol release had been considered for inclusion into its June 1995 report prepared for the WBNP. However based on the staff's review of the September 28, 1998 letter to TVA which discusses in more detail the sequence of events leading up to containment isolation of the glycol piping penetration valves during the initial phase of a LOCA, the staff has closed this part of the nonconformance.

Nonconformance 98-02-03

The staff acknowledges the actions taken by Westinghouse to correct the affected drawings. However, the response is inadequate in that it does not provide actions necessary to verify that screws of the correct material type and strength level were installed in operating ice condenser plants during the period when the affected drawing did not reflect critical design information relative to procurement of the screws. The staff requests that Westinghouse provide additional information which demonstrates that ice basket sheet metal screws, of the appropriate material type and strength level, were installed in Westinghouse designed domestic nuclear power plants. As a result, this issue will remain open.

Nonconformance 98-02-04

The staff review of the Gelles report concluded that it contained metallurgical failure information for cracked screws at DC Cook which was similar to that identified in the 1995 CLS reports prepared by TVA to address broken and cracked screws identified at the WBNP. Therefore, in light of the NOV cited for Westinghouse's failure to evaluate the June 2, 1995, CLS report, it was the opinion of the team that sufficient information existed to warrant referral to the ESBU Safety Review Committee for evaluation, in accordance with Westinghouse procedures. Since Westinghouse has recently completed testing and evaluations that demonstrate that the issues related to ice condenser sheet metal screws do not represent a defect pursuant to 10 CFR 21, this issue is considered closed.

*Closing of
Inspection Finding*