Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

September 7, 2010

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 2
NRC Docket No. 50-391

Subject: **Watts Bar Nuclear Plant (WBN) Unit 2 - Denial of Notice of Violation (NOV) 05000391/2010603-08, Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers**

Reference: 1. NRC letter to TVA, "Watts Bar Nuclear Plant Unit 2 Construction - NRC Integrated Inspection Report 05000391/2010603 and Notice of Violation," dated August 5, 2010

By letter dated August 5, 2010 (Reference 1), the U.S. Nuclear Regulatory Commission (NRC) issued Inspection Report Number 05000391/2010603 concerning the April 6-30, 2010, inspection conducted at Tennessee Valley Authority's (TVA) WBN Unit 2.

The inspection report identified one Severity Level IV violation involving the suitability of molded case circuit breakers. The enclosure to this letter provides TVA's response denying the NOV.

There are no new commitments associated with this submittal. If you have any questions, please contact William Crouch at (423) 365-2004.

IE01
NRR

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 7th day of September 2010.

Respectfully,

M. Bajestani

Masoud Bajestani
Watts Bar Unit 2 Vice President

Enclosure:

1. WBN Unit 2 Reply to NOV 05000391/2010603-08

cc (w/enclosure):

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Description of NOV 05000391/2010603-08

10 CFR 50, Appendix B, Criterion III, "Design Control," states that measures shall be established for the review for suitability of application of materials, parts, and equipment that are essential to the safety-related functions of the structures, systems, and components (SSCs). The design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. Where a test program is used to verify the adequacy of a specific design feature in lieu of other verifying or checking processes, it shall include suitable qualifications testing of a prototype unit under the most adverse design conditions.

Contrary to the above, measures used to review the suitability of application of materials, parts, and equipment essential to the safety-related functions of molded case circuit breakers and measures to provide for the verification of checking the adequacy of design, such as, calculational methods, performing a suitable test program, including qualifications testing of a prototype unit under the most adverse design conditions, were not adequate in that:

1. *On October 5, 2009, the applicant installed molded case circuit breakers into the 120VAC vital instrument power boards; however, the test program used to seismically qualify a prototype circuit breaker failed to use a suitable mounting method that reflected the most adverse mounting condition.*

2. *On September 3, 2009, the applicant failed to perform an adequate review for suitability of application parts and material used to modify dimensional critical characteristics in molded case circuit breakers; further, the applicant failed to verify the adequacy of design for the modification and the effects on essential safety related functions of the circuit breakers.*

This is identified as violation (VIO) 005000391/2010603-08, Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers.

TVA Response

TVA denies the violation.

Basis for Denial of the Violation

This issue involves the 120 VAC Vital Instrument Power Board and its internally mounted Heinemann Model CF2-Z51-1 molded case circuit breakers. This assembly was seismically tested in 1974 and supplied as a unit by Westinghouse. Subsequent to the testing in 1974, the breaker was procured as a replacement from a third party, and the breaker (not the assembly) was seismically tested in 1992 as part of the commercial grade dedication process.

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The notice of violation (NOV) cited two examples of failure to adequately evaluate and qualify molded case circuit breakers currently in use.

Example 1 stated:

"On October 5, 2009, the applicant installed molded case circuit breakers into the 120VAC vital instrument power boards; however, the test program used to seismically qualify a prototype circuit breaker failed to use a suitable mounting method that reflected the most adverse mounting condition."

TVA disagrees that the 1992 qualification device test did not use a suitable mounting configuration. The seismic qualification of the replacement circuit breakers is described below.

- In 1974, Westinghouse seismically qualified the 120 VAC Vital Instrument Power Board (Westinghouse Seismic Test Report CO-33419-MKE, TVA Contract No. 74C4-85216, RIMS No. B07890914035) by testing a complete board assembly with Heinemann Model CF2-Z51-1 circuit breakers mounted in the board. The actual mounting of the breakers is shown on Westinghouse Drawing CO-33419-MKE-M3 in Section C-C. The tested board assembly duplicated the actual configuration. The mounting of the breakers consisted of a 36" front panel with two horizontal angle iron supports in the rear. The breakers were held in place solely by the clamping pressure applied by the front cover pushing the twelve breakers against the rear angle supports. There were no additional screws to secure the breaker to the frame. This configuration duplicated the actual configuration in the plant.

    - The 1974 Westinghouse qualification testing subjected the assembly to the required seismic motion. The test demonstrated the response of the assembly and the individual breakers. The test procedure included instrumentation to collect acceleration data at the locations of the individual breakers.

    - The Westinghouse qualification testing determined the natural frequencies of the test specimen simulating the boards at WBN. Sine beat tests were then performed at the natural frequencies of the panel as determined by the resonance search and at 1/2 octave intervals over the range from 1 to 33 Hertz. The tests were a conservative simulation of the actual earthquake motion at upper building elevations at WBN. The ten-cycle sine beat test accelerations measured at the breaker locations are conservative in-cabinet inputs (seismic demand) for testing the breakers as devices. The highest measured acceleration at the device locations in the board test was 2.72g.

- IEEE-344-1975, Section 6.4 Device Testing, states, "Devices shall be tested simulating operating conditions to either the levels dictated by expected service requirements or to their ultimate capability..... If a device is intended to be mounted on a panel, the panel should be included in the test mounting, or the response at the device mounting location should be monitored in the assembly test (see Section 6.5), in which case the device may be mounted directly to the shake table if the in-service excitation can be simulated."

- In 1992, TVA WBN purchased Heinemann Model CF2-Z51-1 circuit breakers from Southern Testing Services as replacement items for the original Model CF2-Z51-1 circuit breakers in the Westinghouse 120VAC Vital Instrument Power Boards. The 1992 test was performed by Southern Testing Services as part of the commercial grade dedication for the breakers, not the overall assembly. The testing was performed, and the breaker configuration was the same as was tested in 1974. Southern Testing Services chose to perform a test of the breaker (since that was the part they were supplying) and did not intend the test to address the entire assembly. The assembly qualification from 1974 was deemed by TVA to remain valid. In the 1992 test, an individual breaker was attached directly to the vibratory source with bolting. A 3g input motion (which exceeded the 2.72g highest measured acceleration [seismic demand] in the 1974 test) was applied. This 1992 test simulated the in-service excitation as required by IEEE-344-1975 because the 3g input motion exceeded the highest measured acceleration in the 1974 test. Therefore, the 1992 test confirmed that the breaker was seismically qualified.

- The mounting configuration used in the 1992 test was appropriate for device testing of replacement breakers. The retention of breakers in the board assembly was by a clamping arrangement provided by two rear retaining angle iron members and the front cover panel. The calculated natural frequencies of the front cover panel in the three directions were also in excess of 33 Hz and rigid. Therefore, the rigid clamping arrangement of rear retaining angles and front cover panel did not introduce any additional localized flexibility that would require replication in device testing of replacement breakers. Since there is no additional flexibility, the measured maximum in-cabinet acceleration of 2.72g was confirmed to be the minimum seismic input for testing of replacement breakers (the actual test used 3g). This also confirms that the appropriate configuration for testing of replacement breakers is by rigid mounting to a test fixture. This rigid mounting is provided in the 1992 testing by bolting the breakers to a rigid test fixture.

- Rigid attachment of the breaker was done in the 1992 test by bolting the breaker to the test fixture using the rear tab slotted holes, which resulted in the entire weight of the breaker cantilevered from the test fixture. Device testing in this manner maximizes the input of test motion into the test specimen.

Thus, TVA believes that the 1974 and 1992 tests meet the provisions of IEEE-344-1975 and demonstrates that the original board and the breakers remain seismically

qualified. The 1992 test used to qualify a replacement breaker used a suitable mounting method for single breaker testing, i.e., a rigid mounting arrangement that reflects the rigidity of the clamping arrangement in the board assembly. The seismic qualification of the overall assembly is demonstrated by the 1974 test.

Example 2 stated:

"On September 3, 2009, the applicant failed to perform an adequate review for suitability of application parts and material used to modify dimensional critical characteristics in molded case circuit breakers; further, the applicant failed to verify the adequacy of design for the modification and the effects on essential safety related functions of the circuit breakers."

TVA disagrees that that the impact of the modification to the method of retaining the auxiliary contact switch was not accounted for in the seismic qualification of the circuit breakers and overall assembly.

- The original Heinemann Circuit Breaker, CF2-Z51-1, was altered by the manufacturer by changing the auxiliary contact switch retainer that attaches to the main body of the breaker. This change was a result of new tooling that removed the ¼" thick retaining plate for the Auxiliary Contact Assembly mounted on the rear of the breaker. It was replaced by a small molded retainer bracket which secures the auxiliary contact switch in the same position without adding to the entire depth of the pole containing it. This alleviated the difference in the depth of one pole that contained the retainer plate versus the depth of the other pole on the two pole breaker. Thus, the back of the new breaker is flat.

- In order to accommodate the shorter depth of the case, a Micarta plate is secured to the back face of the breaker. The thickness of the Micarta plate is chosen such that the total depth of the breaker and the Micarta plate is identical to the depth of the original breaker and thus the clamping configuration of the frame remains unchanged. The Micarta plate is placed over the entire back surface of the breaker, thus creating a larger contact surface between the breaker and the rear angle irons which makes it more stable when secured by the front cover.

- The Micarta plate is rigidly secured to the breaker using four screws and thus becomes an integral part of the breaker. The change in weight due to deletion of the previously used retainer plate and substitution of the Micarta plate adds approximately 1.5 oz. to the weight of the breaker. The mounting of the breaker with the Micarta plate provides an equivalent fit to that shown on Westinghouse Drawing No. CO-33419-MKE-M3 in Section C-C and exposes the bus bar to minimum additional loading.

- The functionality of the breaker has not changed and the basic components (molded case frame, operating mechanism, contacts and arc extinguisher, trip

elements, Auxiliary contact switch, and thermal connectors) have not changed. Note that the auxiliary contact switch does not provide a safety function. The change in the method of retaining the auxiliary contact switch on the Heinemann breaker and the addition of the Micarta plate spacer for installation in the board does not impact the seismic qualification of the reconfigured breakers. Therefore, even with the failure of the non-safety-related auxiliary contact switch to function, the safety-related function of the circuit breaker would not be affected.

Some confusion during the NRC's inspection was created by information contained in the 1992 qualification report. The 1992 qualification report indicated a Z dimension of 3.75" and the manufacturer's catalog now indicates 2.609" for the critical characteristic. There is an explanation for the difference.

- Vendor schematics show the Z dimension of 3.75" given in the 1992 qualification report includes the depth of the main body of the breaker of 2.609" plus the dimension from the rear body of the breaker to the end of the auxiliary contacts (0.510") plus the dimension from the front body of the breaker to the end of the lever (0.656") (reference Attachment 1 and 2 in this Enclosure). The total dimension is 3.775" at the maximum arc of the breaker arm and is less than 3.775" in the closed or open position. The clamping depth of the breaker as installed in the power board is 2.8509" (2.609" + 0.25"). The depth (2.609") of the main body of the breaker is the same for the original and the reconfigured breaker. Therefore, the purpose of the 0.25" thick Micarta plate is to maintain the required clamping depth for the reconfigured breaker.

- In calculation WCG-ACQ-1004 the change in mounting depth of the breaker was recognized and the change with the addition of the Micarta plate was evaluated.

NRC stated that the breaker was modified by attaching a Micarta plate to the rear of the breaker using 4 nuts and bolts to fit them in the power boards, as described in Example 1, without updating the qualification package. However, the qualification package includes calculation WCG-ACQ-1004, which addresses the qualification of the circuit breakers with the Micarta plate and concludes that the component (i.e., circuit breaker) remains seismically qualified under like for like conditions per the 1992 seismic qualification device test. Since breaker clamping configuration was improved by creating a larger contact surface between the breaker and the rear angle irons which makes it more stable when secured by the front cover and the change in breaker weight was minor, the seismic qualification of the overall board was not affected.

Calculation WCG-ACQ-1004 analyzed the effects that were introduced by the modification, demonstrated an adequate review for suitability of application, and analyzed the impact on other components.

- Calculation WCG-ACQ-1004 was prepared to qualify the new Heinemann breakers that will replace existing breakers located in the 120 VAC Vital

Instrument Power Boards. The methodology of the calculation was to address maintaining the seismic qualification of host equipment with the replacement of existing components.

- Specifically, calculation WCG-ACQ-1004 addressed the following:
    - Qualification of the breaker by identifying the changes to the breaker as minor changes to the physical shape and the breaker was seismically qualified under like for like conditions.
    - Attachment of the breakers to the panel by stating that the breaker attaching to the panel contains many similar parts with similar weights, all of which have qualified connections. The breaker will attach in the same fashion as the existing breakers and is thus qualified under like for like conditions.
    - Panel remains qualified by recognizing that the impact of the small change in weight has a negligible impact on shifting the frequency response of the panel.
    - Qualification of the anchorage of the panel remains unchanged due to the small change in design weight.

The discussion above demonstrates that the design control process was followed to ensure that replacement breakers, including the reconfigured breakers, as well as the board assembly, are seismically qualified to appropriate design criteria. Thus, the replacement breakers are seismically qualified as like for like replacements using the 1974 and 1992 tests as baseline qualification tests. Calculation WCG-ACQ-1004, as explained above, provides the engineering analysis that supports the conclusion that the breakers are qualified.

Conclusion

Testing performed to qualify both the 120VAC Vital Instrument Power Boards as an assembly and the replacement circuit breakers as individual components met the requirements of IEEE-344-1975 and was suitable for seismic qualification. TVA evaluated the modification to the molded case circuit breakers for safety-related 120VAC power applications and confirmed that the reconfigured circuit breakers are qualified for application in the 120VAC Vital Instrument Power Boards. Accordingly, TVA denies the violation.

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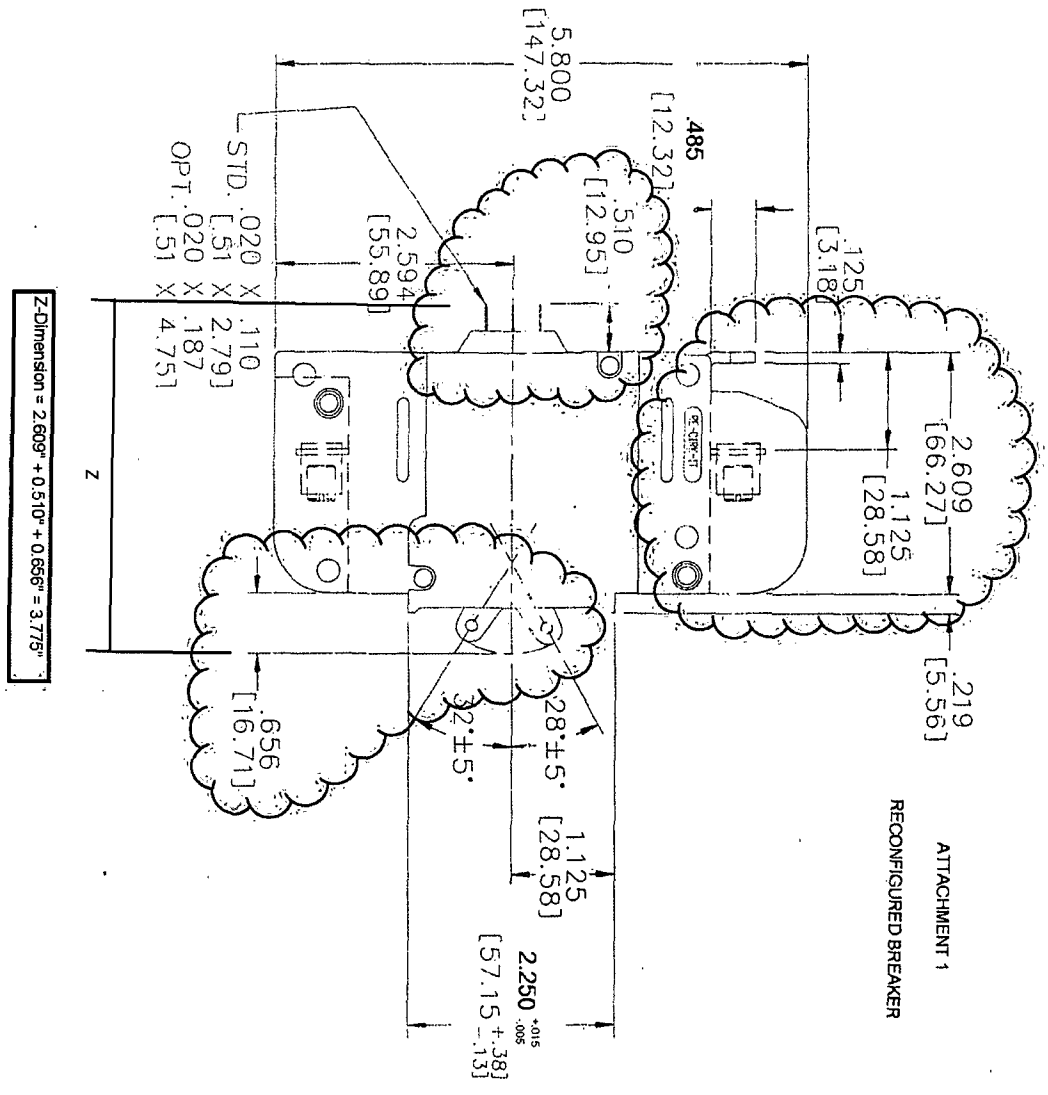

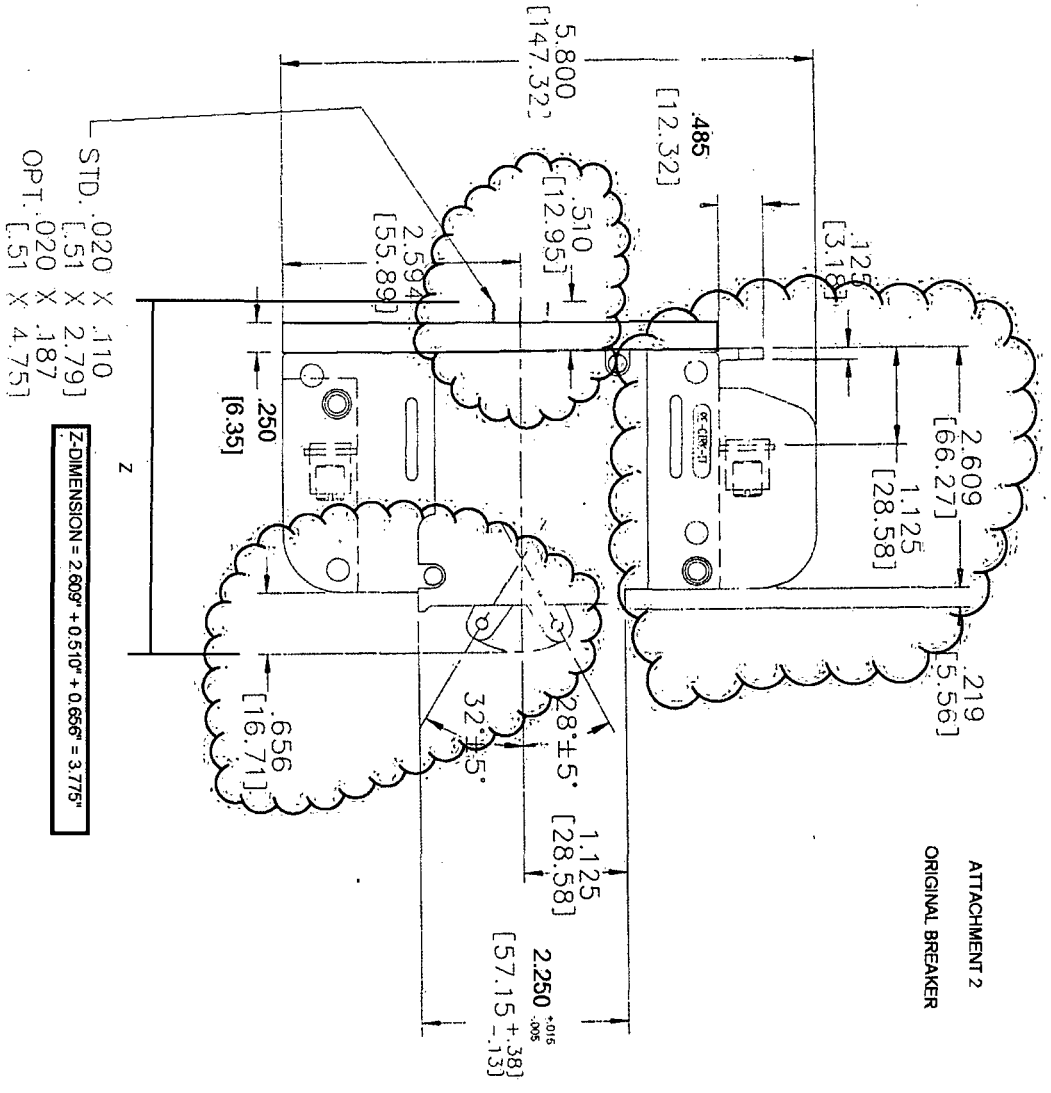
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ATTACHMENT 2
ORIGINAL BREAKER