



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

July 17, 2012

10 CFR 2.201

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

Watts Bar Nuclear Plant, Unit 2
Construction Permit No. CPPR-92
NRC Docket No. 50-391

Watts Bar Nuclear Plant, Unit 1
Facility Operating License No. NPF-90
NRC Docket No. 50-390

Sequoyah Nuclear Plant, Units 1 and 2
Facility Operating License Nos. DPR-77 and DPR-79
NRC Docket Nos. 50-327 and 50-328

Subject: Reply to Notice of Violation 05000391/2010603-08 - Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers - Revised Response

- References:**
- 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 (ML102170465)
 - 2) TVA letter to NRC, "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," dated September 7, 2010 (ML102520435)
 - 3) TVA letter to NRC, "Watts Bar Nuclear Plant Unit 2 - Denial of Notice of Violation (NOV) 05000391/2010603-08, Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers - Additional Information," dated October 15, 2010 (ML102880493)
 - 4) NRC letter to TVA, "Response to Disputed Notice of Violation (NOV) 05000391/2010603-08," dated October 19, 2010 (ML102920665)

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- 5) TVA letter to NRC, "Watts Bar Nuclear Plant Unit 2 - Reply to Notice of Violation 05000391/2010603-08 - Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers," dated November 24, 2010 (ML103300217)
- 6) NRC letter to TVA, "Watts Bar Nuclear Plant - NRC Integrated Inspection Report 05000390/201005," dated January 28, 2011 (ML110280456)
- 7) NRC letter to TVA, "Response to Corrective Actions for Notice of Violation (NOV) 05000391/2010603-08," dated March 4, 2011 (ML102920665)
- 8) NRC letter to TVA, "Sequoyah Nuclear Plant - NRC Integrated Inspection Report 05000327/2011002, 05000328/2011002," dated May 12, 2011 (ML111320467)
- 9) TVA letter to NRC, "Watts Bar Nuclear Plant Unit 2 - Reply to Notice of Violation 05000391/2010603-08 - Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers - Revised Response," dated June 9, 2011 (ML11164A141)
- 10) Letter from NRC (Charles R. Ogle) to TVA (M. Skaggs), "Response to Corrective Actions for Watts Bar Unit 2 Notice of Violation (NOV) 05000391/2010603-08," dated May 18, 2012 (ML12139A052)
- 11) TVA letter to NRC, "Reply to Notice of Violation 05000391/2010603-08 - Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers - Revised Response," dated June 18, 2012 (ML12172A412).
- 12) NRC letter to TVA, "Watts Bar Nuclear Plant Unit 2 - Acknowledgement to Reply to Notice of Violation 05000391/2010603-08 - Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers - Revised Response," dated June 22, 2012 (ML12174A139)

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) Watts Bar Nuclear Plant (WBN) Unit 2. Based on the results of the inspection, one violation was cited. Tennessee Valley Authority denied the violation in a letter dated September 7, 2010 (Reference 2), and provided additional information in a letter dated October 15, 2010 (Reference 3).

By letter dated October 19, 2010 (Reference 4), the NRC informed TVA that after review and consideration of TVA's response, the NRC had concluded that the violation had occurred as stated in NOV 05000391/2010603-08 and that TVA was required to provide an additional response. In a letter dated November 24, 2010 (Reference 5), TVA admitted that the violation occurred and described associated corrective actions to achieve compliance.

By letter dated January 28, 2011 (Reference 6), the NRC informed TVA that a green non-cited violation of 10 CFR 50, Appendix B, Criterion III, Design Control, at Watts Bar Unit 1, was identified for the failure to assure that appropriate quality standards were specified and included in design documents and that deviations from such standards were controlled. Specifically, TVA failed to ensure that the Heinemann Circuit Breakers utilized in the station 120VAC vital instrument power boards were properly seismically qualified for their application.

By letter dated March 4, 2011 (Reference 7), the NRC informed TVA that the corrective actions prescribed in Reference 5 did not appear adequate to achieve full compliance and requested an amended response to the violation describing corrective actions that are sufficient to achieve full compliance. In a letter dated June 9, 2011 (Reference 9), TVA provided a revised response.

By letter dated May 12, 2011 (Reference 8), the NRC informed TVA that a green non-cited violation of 10 CFR 50, Appendix B, Criterion III, Design Control, at Sequoyah Nuclear Plant (SQN), was identified for failure to assure that appropriate quality standards were specified and included in design documents and that deviations from such standards were controlled. Specifically, TVA failed to ensure that the molded case circuit breakers utilized in the station 120VAC vital instrument power boards were properly seismically qualified for their application.

By letter dated May 18, 2012 (Reference 10), the NRC informed TVA that the corrective actions for the violation described in Reference 9 response are inadequate to achieve full compliance and that TVA is required to submit a supplemental response to the subject NOV within 30 days of June 18, 2012. In a letter dated June 18, 2012, (Reference 11) TVA requested an extension for the required submittal of the supplemental response to the NOV until July 20, 2012.

By letter dated June 22, 2012 (Reference 12), the NRC agreed to extend the date for the TVA response an additional 30 days from the original due date, to July 17, 2012.

Enclosure 1 to this letter contains TVA's revised response to the subject NOV. The revised response includes the reason for the violation, corrective steps that have been taken and the results achieved, the corrective steps that will be taken, and the date when full compliance will be achieved.

Enclosure 2 provides TVA's response regarding short-term operability and long-term corrective actions taken at WBN Unit 1, including how configuration control has been verified for these components and how applicable Institute of Electrical and Electronic

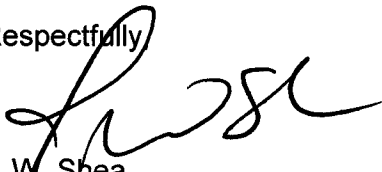
Engineers (IEEE) standards are being met for all Heinemann molded case circuit breaker configurations in safety-related applications.

Enclosure 3 provides TVA's response regarding short-term operability and long-term corrective actions taken at SQN Units 1 and 2, including how configuration control has been verified for these components and how applicable IEEE Standards are being met for all Heinemann molded case circuit breaker configurations in safety-related applications.

If you have any questions in this matter, please contact John Laffrey at 423-751-3262.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 17th day of July, 2012.

Respectfully



J. W. Shea
Vice President, Nuclear Licensing

Enclosures

1. Reply to Notice of Violation 391/2010603-08 - Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers - Revised Response
2. Short-Term Operability and Long-Term Corrective Actions Taken at WBN Units 1
3. Short-Term Operability and Long-Term Corrective Actions Taken at SQN Units 1 and 2

cc: (Enclosures)

Regional Administrator - Region II
NRC Senior Resident Inspector - Sequoyah Nuclear Plant
NRC Senior Resident Inspector - Watts Bar Nuclear Plant, Unit 1
NRC Senior Resident Inspector - Watts Bar Nuclear Plant, Unit 2

Enclosure 1

Reply to Notice of Violation 05000391/2010603-08 - Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers - Revised Response

Description of Violation

"10 CFR 50, Appendix B, Criterion III, "Design Control," states that measures shall be established for the review of 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 by 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 conditions.
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."

1. Tennessee Valley Authority (TVA) Response to October 5, 2009, Violation:

Tennessee Valley Authority admits that the violation occurred.

Reason for the Violation:

This violation occurred due to insufficient details on Westinghouse and TVA drawings for the 120 Volt Alternating Current (VAC) Vital Instrument Power (VIP) Boards. Due to the lack of detail, TVA did not completely understand and adequately control the unique mounting configuration of the Heinemann CF2-Z51-1 circuit breakers in those boards.

Due to insufficient detail, the exact mounting configuration for these breakers was not adequately translated, evaluated, and documented when Southern Testing Services (STS) performed seismic tests for commercial grade dedication of replacement Heinemann CF2-Z51-1 original configuration circuit breakers in 1992.

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Corrective Steps That Have Been Taken and the Results Achieved:

The applicable Equipment Seismic/Structural Qualification (ESQ) design criteria for floor-mounted Seismic Category I equipment assemblies at Watts Bar Nuclear Plant (WBN) Units 1 and 2 is identified in General Design Criteria Document WB-DC-40-31.2, "Seismic/Structural Qualification of Seismic Category I Electrical and Mechanical Equipment". The applicable ESQ design criteria for Sequoyah Nuclear Plant (SQN) Units 1 and 2 is identified in General Design Criteria Document SQN-DC-V-40.0, "Seismic/Structural Qualification of Seismic Category I Electrical and Mechanical Equipment".

The Watts Bar and Sequoyah ESQ programs are consistent with the guidance provided by NRC Standard Review Plan (SRP), NUREG-0800, Revision 2, July 1981, Section 3.10, acceptance criteria for plants with Construction Permit applications docketed before October 27, 1972. As described in the ESQ design criteria, the equipment shall be qualified either in direct compliance with Institute of Electrical and Electronic Engineers (IEEE) Standard 344-1975, "Recommended Practice for Seismic Qualification of Class IE Equipment for Nuclear Power Generating Stations," and Regulatory Guide 1.100, "Seismic Qualification of Electrical and Mechanical Equipment for Nuclear Power Plants," (equipment procured after September 1, 1974) or in accordance with a program which provides as a minimum, qualification to the requirements of IEEE 344-1971 and in addition addresses the guidelines of SRP 3.10.

In response to Watts Bar Unit 2 Notice of Violation (NOV) 05000391/2010603-08, Watts Bar Unit 1 Non-Cited Violation (NCV) 05000390/2010005-01, and Sequoyah Unit 1 and Unit 2 NCV 05000327-328/2011002-01, TVAs has:

- Defined the limiting case (i.e., highest level) Required Response Spectra (RRS) for evaluation and seismic testing of Heinemann CF2-Z51-1 circuit breaker configurations at Watts Bar and Sequoyah Nuclear Plants.
- Documented seismic test fixture and test specimen configurations.
- Performed seismic tests of Watts Bar and Sequoyah Nuclear Plant Heinemann CF2-Z51-1 original and new configuration breakers.
- Issued Watts Bar Unit 1 and 2 Design Change Notice (DCN) 59132A to identify new and existing hardware used in mounting and replacing Heinemann CF2-Z51-1 breakers and define associated assembly instructions.
- Performed a Watts Bar Unit 1 and 2 Seismic Technical Evaluation of Replacement Items (STERI) Evaluation that supports DCN 59132A.
- Performed evaluations that verify the operability of Heinemann CF2-Z51-1 circuit breakers for Watts Bar Unit 1 and Sequoyah Units 1 and 2. (See Enclosures 2 and 3 for Short-Term operability and long-term corrective actions taken at WBN Unit 1 and Sequoyah Units 1 and 2, respectively.)

These actions and results achieved are further described below.

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In-Cabinet Required Response Spectra (RRS) [WBN and SQN]

Calculation WCGACQ0587 defines the limiting case (i.e., highest level) in-cabinet RRS for the Heinemann CF2-Z51-1 circuit breakers located in the 120 Volt Alternating Current (VAC) Vital Instrument Power (VIP) boards at WBN Units 1 and 2. This calculation was initially issued in June 2011 and then revised in July 2012, to provide additional comparisons to the 1974 Westinghouse sine beat test results. (The First Seismic Test Series description below summarizes the comparison.) It utilizes TVA Nuclear Engineering standard methodology for development of in-cabinet RRS in accordance with WB-DC-40-31.2 section 4.2.2. New design and modification (Set B+C) WBN Auxiliary / Control Building floor response spectra and dynamic properties of the boards determined by the 1974 Westinghouse seismic tests for qualification of the 120 VAC VIP Boards were applied to develop the in-cabinet RRS at the limiting location in accordance with WB-DC-40-31.2 and IEEE 344-1975. Thus, appropriate in-cabinet RRS were developed for use in the new seismic tests for WBN.

Calculation SCG4M01136 defines the limiting case (i.e., highest level) in-cabinet RRS for the Heinemann CF2-Z51-1 circuit breakers located in the 120 VAC VIP Boards at SQN Units 1 and 2. This calculation was prepared and reviewed in August 2011 and issued in October 2011. It utilizes TVA Nuclear Engineering standard methodology for development of in-cabinet RRS in accordance with SQN-DC-V-40.0 section 4.2.2. SQN Auxiliary/Control Building floor response spectra and dynamic properties of the boards determined by the 1974 Westinghouse seismic tests for qualification of the 120 VAC VIP Boards were applied to develop the in-cabinet RRS at the limiting location in accordance with SQN-DC-V-40.0 and IEEE 344-1975. Thus, appropriate in-cabinet RRS were developed for use in the new seismic tests for SQN.

In-cabinet RRS for WBN are higher than for SQN due to differences in the applicable floor response spectra.

The 1974 Westinghouse tests for SQN and WBN 120 VAC VIP Boards are documented in a report dated December 16, 1974. This is the seismic qualification test report described in WBN-1 UFSAR Table 3.10-3 sheet 28 and WBN-2 FSAR Table 3.10-3 sheet 22. The SQN and WBN 120 VAC VIP Boards were procured in July 1974. Per the WBN and SQN ESQ licensing basis, Seismic Category I equipment procured prior to September 1, 1974, was seismically qualified in accordance with IEEE 344-1971 and the guidelines of NRC Standard Review Plant section 3.10, for plants with construction permit applications docketed before October 27, 1972.

No bolt loosening was noted in the 1974 Westinghouse board assembly test report. As demonstrated in calculation WCGACQ587, the new WBN test was conservative relative to the 1974 Westinghouse test. The maximum input acceleration (i.e., Zero Period Acceleration (ZPA)) for the in-cabinet test response spectra exceeded the maximum comparable accelerations measured in the 1974 Westinghouse sine beat tests by large margins. For example, the maximum input acceleration in the side-to-side direction for the new Safe Shutdown Earthquake test (5.93 G ZPA at 100 Hertz and 8.0 G at 33 Hertz), exceeded the comparable maximum acceleration measured in the 1974

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Westinghouse sine beat test (2.72 G).

IEEE 344-1975 and associated NRC Regulatory Guide 1.100, have been used for procurement of new Seismic Category I equipment and modification of existing Seismic Category I equipment at WBN and SQN, since September 1, 1974. Thus, in accordance with WB-DC-40-31.2 and SQN-DC-V-40.0, Seismic Category I equipment at WBN and SQN are now seismically tested in accordance with IEEE 344-1975.

Seismic Test Fixture and Test Specimens [WBN and SQN]

Consistent with IEEE 344-1975, Section 6.4, the seismic test fixture for the new WBN and SQN tests directly simulates an entire 39 inch by 13 inch local panel with 12 Heinemann CF2-Z51-1 circuit breakers clamped in position by backer angles and with electrical bus bars attached to the Heinemann breaker terminals. The local connections to the board frames are directly simulated. As-built dimensions and construction details for fabrication of the test fixture were obtained from all available sources, since the existing Westinghouse drawings of the 120 VAC VIP Boards did not contain sufficient details for fabrication of the test fixture.

This approach assured that the backer angle mounting arrangement, local panel/board frame interface, and electrical buss bar/breaker interface for the limiting case location would be directly simulated for all 12 breakers on the local panels at WBN and SQN. Minor differences in the as-built WBN and SQN backer angle configurations were identified and included in the fixture details.

Detailed drawings were issued and utilized for fabrication of the test fixture by a local contractor on TVA's approved supplier list. The fabricated seismic test fixture and Heinemann CF2-Z51-1 original configuration circuit breaker test specimens were then shipped to QualTech NP in Cincinnati for new seismic tests.

The Heinemann CF2-Z51-1 circuit breaker test specimens for these new seismic tests had been supplied to TVA by Southern Testing Services (STS) as commercially dedicated breakers. They are original configuration Heinemann CF2-Z51-1 breakers which are identical to the CF2-Z51-1 circuit breakers tested by STS in 1992. Original configuration CF2-Z51-1 breakers were also tested in the 1974 Westinghouse board assembly test.

First Seismic Test Series - September 2011 [WBN and SQN]

The September 2011 tests verified the seismic adequacy of 12 original configuration replacement CF2-Z51-1 Heinemann breakers and their mountings on local panels in Unit 1 boards.

QualTech NP prepared and the TVA approved Electric Power Research Institute / Seismic Qualification Reporting and Testing Standardization (EPRI/SQURTS) Test Procedure S1123.0 Revision 1, on September 2, 2011. The test procedure invokes the practices in IEEE 344-1975. The test procedure includes the limiting case in-cabinet RRS and the detailed drawings of the test fixture for both WBN and SQN.

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Consistent with IEEE 344-1975, Section 6.4, the WBN and SQN test configurations directly simulated existing as-built Heinemann circuit breaker installations in the WBN Unit 1 and the SQN Unit 1 and 2 120 VAC VIP Boards.

The WBN and SQN tests were performed with 12 original configuration Heinemann CF2-Z51-1 circuit breakers powered through the attached electrical bus bar so that each breaker was at approximately 90 percent of its 15 amp rating. All 12 breakers were monitored for tripping, contact chatter, and electrical continuity with the breaker closed, simulating normal plant operation. No tripping, chatter, loss of electrical continuity, or structural damage was observed for any of the 12 breakers. Pre and post seismic functional tests verified breaker functionality. (These are the same functional tests currently performed by TVA for commercial grade dedication of the breakers.)

However, the mounting bolts between the backer angles and the board frame started to loosen during the WBN Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE) test sequence. Mounting bolts did not loosen during the SQN OBE and SSE test sequence. The OBE and SSE test sequence was completed and Heinemann breaker ruggedness was confirmed (as described above) for both SQN and WBN.

No bolt loosening was noted in the 1974 Westinghouse board assembly test report. As demonstrated in calculation WCGACQ587, the new WBN test was conservative relative to the 1974 Westinghouse test. The maximum input acceleration (i.e., Zero Period Acceleration (ZPA)) for the in-cabinet test response spectra exceeded the maximum comparable accelerations measured in the 1974 Westinghouse sine beat tests by large margins. For example, the maximum input acceleration in the side-to-side direction for the new Safe Shutdown Earthquake test (5.93 G ZPA at 100 Hertz and 8.0 G at 33 Hertz), exceeded the comparable maximum acceleration measured in the 1974 Westinghouse sine beat test (2.72 G).

The limiting case RRSs, test fixtures, breaker configurations, Test Response Spectra, and triaxial input motion combined to conservatively account for the dynamic properties of the 120 VAC VIP Board assemblies at WBN and SQN. This comparison accounts for any non-linear effects such as impacts, rattling, chatter, or banging which may have occurred during the 1974 Westinghouse tests.

The EPRI-SQURTS Test Report S1123.0 R1 was approved by the TVA test representative on October 11, 2011.

The TVA WBN NEDP-9 review/approval memorandum for the first seismic test series procedure and report was issued on January 26, 2012. The Comments and Recommendations for TVA Use Only" section of this memorandum indicate an Engineering Documentation Change (EDC) will be issued. The anticipated EDC later became DCN 59132A (described below). Also, anticipated Problem Evaluation Report (PER) 335459 corrective actions were updated and the PER 335459 Functional Evaluation was revised to establish compensatory measures described in Enclosure 2, after completion of the second seismic test series (also described below).

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This first test series confirmed the operability of existing original configuration Heinemann CF2-Z51-1 breaker configurations on the WBN Unit 1 and SQN Units 1 and 2 120 VAC VIP Boards.

Second Seismic Test Series - March 2012 [WBN Only]

Tests performed in March 2012 verified the seismic adequacy of new configuration replacement CF2-Z51-1 Heinemann breakers (with insulator boards on the back of breakers) and their future mountings on local front panels of the Unit 1 and Unit 2 boards. These tests simulated all new configuration breakers on a local panel and a mixture of original and new configuration breakers on a local panel for anticipated arrangements of original and new configuration Heinemann CF2-Z51-1 breakers on WBN Unit 1 and 2 120 VAC VIP Boards and proposed design enhancements to ensure no loosening of the backer angle mounting bolts.

Three separate breaker arrangements, chosen to bound potential future arrangements, were tested. The first arrangement consisted of six original configuration breakers and six new configuration breakers; all 12 breakers had 1/4 inch thick Micarta boards attached. The second arrangement consisted of six original configuration breakers and six new configuration breakers; only the new configuration breakers had Micarta boards attached. The third arrangement consisted of 12 original configuration breakers without Micarta boards attached.

In the future, original configuration Heinemann CF2-Z51-1 circuit breakers will be replaced by new configuration Heinemann CF2-Z51-1 circuit breakers, because the original configuration breakers are no longer made. Most of the original configuration breakers on the Unit 2 120 VAC VIP Boards have already been replaced with new configuration breakers.

QualTech NP prepared and TVA approved EPRI/SQURTS Test Procedure S1209.0, Revision 1, on March 13, 2012. The test procedure invokes the practices in IEEE 344-1975. The same WBN test fixture was used in these additional tests, with the exception of the proposed design enhancements (e.g., self-locking mounting bolts for the backer angles). The same limiting case in-cabinet RRS were also applied in these additional tests.

All three arrangements, described above, were successfully tested with no breaker tripping, no contact chatter, no loss of electrical continuity, no structural damage, and no loosening of the backer angle self-locking mounting bolts. Pre and post seismic functional tests verified breaker functionality. The EPRI/SQURTS Test Report S1209.0 R0 was approved by TVA on April 18, 2012.

All original and new configuration Heinemann CF2-Z51-1 replacement circuit breakers were verified to be seismically adequate, as mounted in the 120 VAC VIP Boards.

The September 2011 and March 2012 seismic tests complied with WB-DC-40-31.2 section 4.2.2 and with IEEE 344-1975 in all aspects, including IEEE 344-1975 section

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6.4, "Device Testing". State-of-the-art proof testing was performed using broad-band, multi-frequency, tri-axial input motion. The applied in-cabinet RRS and the test technique together constituted conservative tests in comparison to the original 1974 qualification test of the 120 VAC VIP Board assemblies, as discussed above. These new tests provided the primary technical basis for the STERI Evaluation, revised Functional Evaluation, and DCN 59132A.

Seismic Technical Evaluation of Replacement Items (STERI) Evaluation [WBN Units 1 and 2 Only]

TVA Calculation WCGACQ0588 documents STERI evaluations for original and new configuration CF2-Z51-1 Heinemann breakers and associated mounting hardware in WBN Unit 1 and Unit 2 120 VAC Vital Instrument Power Boards, in support of DCN 59132A. The evaluation demonstrates that alternate replacement items described in DCN 59132A are equivalent to the items they replace, from a Seismic/Structural Qualification (S/SQ) standpoint. Original configuration CF2-Z51-1 replacement breakers, new configuration Heinemann CF2-Z51-1 replacement breakers, and the replacement mounting hardware are addressed in accordance with TVA Nuclear Engineering Design Standard DS-C1.2.11 "Maintaining S/SQ - Replacement Items", which is based on industry consensus EPRI STERI documents, as described therein. The justification for S/SQ equivalency is based on the September 2011 and March 2012 seismic tests.

Design Change Notice (DCN) 59132, Revision A [WBN Units 1 and 2 Only]

Watts Bar DCN 59132, Revision A, was issued on June 4, 2012, to provide design output which will ensure Heinemann circuit breakers on the WBN Unit 1 and 2 120 VAC Vital Instrument Power Boards are installed and maintained in a seismically qualified configuration, as verified by the seismic testing described above. The DCN accounts for the results of the September 2011 and March 2012 seismic tests and is scheduled for implementation during the U1R11 outage in the fall of 2012. It includes Design Change Authorizations (DCAs) with instructions for replacement of the original Heinemann CF2-Z51-1 breakers and mounting hardware with equivalent replacement items, as justified by the September 2011 and March 2012 seismic tests and the STERI evaluations documented in STERI evaluation calculation WCG-ACQ-0588.

Seismic tests performed by Curtiss Wright - QualTech NP in September 2011 and March 2012 have verified the seismic adequacy of the original and new configuration Heinemann replacement breakers and their mountings in the WBN Unit 1 and Unit 2 120 VAC Vital Instrumentation Power Boards, when installed and maintained per DCN 59132 and other applicable requirements.

Corrective Steps That Will Be Taken [WBN Units 1 and 2 Only]:

DCN 59132A implementation will install equivalent replacement items and design enhancements in all eight Unit 1 and 2 120 VAC VIP Boards as follows:

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- Replace the original backer angle bolts with self locking bolts.
Basis: Design enhancement justified by the tests.
- Replace the original spacers between the top backer angles and the board frame on Unit 1 boards with new machined spacers and install new spacers on the Unit 2 boards.
Basis: Design enhancement justified by the tests.
- Add new machined spacers between the bottom backer angles and the board frame.
Basis: Design enhancement to improve mounting and supported by tests.
- Replace the existing backer angles with new angles of the same size.
Basis: Done solely to expedite replacement of existing foam tape and ethylene propylene diene monomer (EPDM) shims with EPDM foam tape.
- Replace the existing foam tape and EPDM shims on the Unit 1 and 2 board backer angles with new EPDM foam tape.
Basis: Equivalent EPDM foam tape was used in tests.
- Add Micarta boards to selected original configuration breakers.
(Basis: Design enhancement justified by the tests. Done to make future breaker test/replacement activities easier and preclude potential misalignment.

Design Change Authorizations (DCAs) in DCN 59132A identify new and existing hardware used in mounting and replacing the Heinemann CF2-Z51-1 breakers. The DCAs also provide assembly/installation instructions. Thus, the design control and configuration management issues described in NCV 05000390/2010005-02 and NOV 05000391-2100603-08 are fully addressed and resolved by DCN 59132A. Seismic margin is also improved by the equivalent replacement items and design enhancements described above. The inclusion of assembly/installation instructions on these DCAs satisfies the WBN-2 commitment to provide instructions governing future maintenance activity on these circuit breakers.

After implementation of DCN 59132A, Heinemann CF2-Z51-1 circuit breaker testing / replacement requirements and maintenance activities will be the same for all eight Unit 1 and 2 120 VAC VIP Boards.

New configuration replacement CF2-Z51-1 Heinemann circuit breakers will continue to be procured and dedicated by TVA, with functional acceptance tests as defined in Procurement Engineering Group (PEG) Package CQQ548K. Micarta boards will be attached to the replacement Heinemann CF2-Z51-1 circuit breakers prior to installation, in accordance with DCAs in DCN 59132A and consistent with the September 2011 and March 2012 seismic tests.

See Enclosure 3 for remaining SQN corrective actions.

Date When Full Compliance Will Be Achieved:

Full compliance for WBN Units 1 and 2 will be achieved on or before the last day of the WBN Unit 1 refueling outage (U1R11), in the fall of 2012.

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2. Tennessee Valley Authority Response to September 3, 2009, Violation:

Tennessee Valley Authority admits that the violation occurred.

Reason for the Violation:

The reason for this violation is that the manufacturer made a production change to the breaker configuration but did not revise the model number or publish schematics to reflect a component change. As a result, TVA failed to identify a change in a critical characteristic (i.e., the required mounting depth between the front face and the rear angles) and, therefore, did not address the resulting impact on device seismic qualification and functionality.

Corrective Steps That Have Been Taken and the Results Achieved [WBN and SQN]:

As described under the corrective steps taken in response to the October 5, 2009, violation, TVA has performed additional qualification testing of both original and replacement Heinemann CF2-Z51-1 circuit breakers.

In addition to the corrective steps described under the October 5, 2009 violation, TVA has also taken the following corrective step, which impacts all new procurements for WBN and SQN:

- Since the breakers cannot be distinguished by the manufacturer's model number, they have to be distinguished by unique TVA inventory numbers called CATIDs. The original breakers have a CATID number of CEW199V. The replacement breakers have a CATID number of CQQ548K. A note has been placed in the tracking data base for CEW199V, which says: "For future procurement use CATID CQQ548K. The CATID CEW199V breaker contains a configuration change in the auxiliary switch mounting and is now obsolete."

Corrective Steps That Will Be Taken [WBN Units 1 and 2 Only]:

The remaining corrective steps are related to DCN 59132A, that will install equivalent replacement items and design enhancements in all eight Unit 1 and 2 120 VAC VIP Boards as discussed in greater detail under the corrective steps related to the October 5, 2009, violation.

See Enclosure 3 for remaining corrective steps for SQN.

Date When Full Compliance Will Be Achieved [WBN Units 1 and 2 Only]:

Full compliance for WBN Units 1 and 2 will be achieved on or before the last day of the WBN Unit 1 refueling outage (U1R11), in the fall of 2012.

Enclosure 2

Reply to Notice of Violation 05000391/2010603-08 - Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers - Revised Response

Short-Term Operability and Long-Term Corrective Actions Taken at Watt Bar Nuclear Plant Units 1

An operability determination (i.e., Watts Bar Nuclear Plant (WBN) Functional Evaluation (FE) to address Problem Evaluation Report (PER) 335459 and 369782) was performed for the Heinemann CF2-Z51-1 circuit breakers in WBN Units 1 and 2 120 Volt Alternating Current (VAC) Vital Instrument Power (VIP) Boards at the close of the WBN U1R10 outage in May 2011. The operability determination needed to address both Units 1 and 2 120 VAC VIP Boards because there are a few Heinemann CF2-Z51-1 breakers on Unit 2 boards serving instruments required for Unit 1 operation.

Short-Term Operability Corrective Actions:

Tennessee Valley Authority (TVA) has since proceeded with new seismic testing to verify operability of the Heinemann CF2-Z51-1 circuit breakers in the existing 120 VAC VIP Board installations at WBN Unit 1 and has revised the operability determination (FE for PER 335459) accordingly.

If a WBN design basis Operating Basis Earthquake (OBE) exceedance occurs (as determined by WBN seismic monitoring instrumentation) before implementation of Design Change Notice (DCN) 59132A, push tests using the process previously used for Minor Maintenance Work Order 112281644 will be conducted on limiting case WBN Unit 1 Heinemann CF2-Z51-1 circuit breakers in WBN Units 1 and 2 120 VAC vital instrument power boards. These push tests will verify no looseness of the breaker mounting, before restart of the Unit. This compensatory measure will be controlled by a temporary appendix in WBN Technical Instruction 0-TI-52.001, which will remain in place until DCN 59132A is implemented. Implementation of DCN 59132A is planned for the U1 R11 refueling outage.

Long-Term Corrective Actions:

As described in Enclosure 1, WBN DCN 59132, Revision A, was issued on June 4, 2012, to provide design output which will ensure Heinemann circuit breakers on the WBN Units 1 and 2 120 VAC VIP Boards are installed and maintained in a seismically qualified configuration, as verified by the seismic testing described above. The DCN accounts for the results of the September 2011 and March 2012 seismic tests and is scheduled for implementation during the U1R11 outage in the fall of 2012. It includes Design Change Authorizations (DCAs) with instructions for replacement of the original Heinemann CF2-Z51-1 breakers and mounting hardware with equivalent replacement items, as justified by the September 2011 and March 2012 seismic tests and the STERI evaluations documented in STERI evaluation calculation WCG-ACQ-0588.

Seismic qualification has been verified by using as-built data in the September 2011 and March 2012 seismic tests described in Enclosure 1. Configuration control has been improved by issuance of DCN 59132A. DCN 59132A establishes configuration and design control measures, including assembly/installation instructions for future maintenance activities, to prevent recurrence of these violations.

Enclosure 2

Reply to Notice of Violation 05000391/2010603-08 - Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers - Revised Response

Short-Term Operability and Long-Term Corrective Actions Taken at Watt Bar Nuclear Plant Units 1

The applicable Institute of Electrical and Electronic Engineers (IEEE) standard is IEEE 344-1975 or IEEE 344-1971 (for equipment procured before September 1, 1974) as described in WBN Unit 1 and 2 Safety Analysis Report (SAR) sections 3.7.3.6.3, 3.7.3.16, 3.10, and 3.10.1. Compliance with the Units 1 and 2 SARs for floor-mounted safety-related equipment assemblies and devices mounted on those assemblies is controlled by WB-DC-40.31.2, as described in Enclosure 1.

Safety related Heinemann circuit breakers for WBN Units 1 and 2 are only located on the 120 VAC VIP Boards. Therefore, the clamped mounting arrangement, which is the subject of WBN Unit 1 NCV 0500390-211005-02, is unique to the 120 VAC VIP Boards supplied by Westinghouse for WBN and SQN.

Date When Full Compliance Will Be Achieved:

Full compliance for WBN Units 1 and 2 will be achieved on or before the last day of the WBN Unit 1 fall 2012 U1R11 refueling outage.

Enclosure 3

Reply to Notice of Violation 05000391/2010603-08 - Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers - Revised Response

Short-Term Operability and Long-Term Corrective Actions Taken at Sequoyah Units 1 and 2

An operability determination (i.e., Sequoyah Nuclear Plant (SQN) Functional Evaluation (FE) to address Problem Evaluation Report (PER) 264271) was performed for the Heinemann CF2-Z51-1 circuit breakers in the SQN Unit 1 and 2 120 Volt Alternating Current (VAC) Vital Instrument Power (VIP) Boards. In certain cases, the breaker did not sit flush in the front panel opening. This condition does not conform to the as-tested configuration.

The operability determination concluded that this condition would not prevent the breakers from performing their intended function. This conclusion was based on the following:

1. A field survey was conducted and breakers were determined to be adequately restrained and structural integrity not compromised.
2. The original seismic qualification for the boards and breakers utilized accelerations almost twice the SQN requirement.
3. Industry seismic technical evaluation data shows molded case circuit breakers of this type are seismically rugged and generally not subject to chatter or spurious action during an earthquake.
4. Industry seismic experience data shows this type of board possesses characteristics which generally preclude damage in earthquakes.
5. A seismic margin assessment utilizing Electric Power Research Institute (EPRI) margins methodology obtained "High Confidence Low Probability of Failure" (HCLPF) seismic margin value of greater than 0.51g for this board. [Note: This value may be reduced to 0.38g, considering NRC concerns about the SQN assessment]. An HCLPF greater than 0.30g is good.
6. More than 90% of the breakers are bolted to leads from a copper bus structure which is robust and is adequate to support the breaker.

Short-Term Operability Corrective Actions:

Corrective actions have been completed for PER 286156 to correct all but 26 of the misaligned Heinemann breaker installations and to revise Maintenance Instruction 0-MI-EBR-317-010.A, "Testing of Molded Case Circuit Breakers on 120 VAC Vital Instrument Power BD's and 125 VDC Vital Battery BD's," regarding Heinemann circuit breaker mounting and positioning. There are 384 Heinemann CF2-Z51-1 circuit breakers on the eight SQN 120 VAC VIP boards.

In-cabinet required response spectra (RRS) have also been developed and Seismic Qualification Reporting and Testing Standardization (SQURTS) tests have confirmed operability of existing SQN Heinemann breaker configurations in 120 VAC VIP Boards, as described in Enclosure 1.

The existing operability determination (FE for 264271) will be revised to address each of the remaining misaligned breakers and to account for the new seismic tests performed in September 2011 and March 2012 (described in Enclosure 1).

Enclosure 3

Reply to Notice of Violation 05000391/2010603-08 - Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers - Revised Response

Short-Term Operability and Long-Term Corrective Actions Taken at Sequoyah Units 1 and 2

Long-Term Corrective Actions:

SQN will perform additional corrective actions for PER 286156 which are similar to those completed and planned for WBN. Those corrective actions will include:

1. Issue an Engineering Documentation Change (EDC) to allow replacement of original configuration Heinemann CF2-Z51-1 circuit breakers with new configuration Heinemann CF2-Z51-1 circuit breakers (CATID CQQ548K) with Micarta boards attached, when performing testing and maintenance activities.
2. Correct the remaining misaligned Heinemann CF2-Z51-1 circuit breakers on Unit 1 and 2 120 VAC VIP Boards during the fall 2012 Unit 2 Refuel 18 (U2R18) outage.
3. Issue an NEDP-9 approval memo documenting approval of the September 2011 and March 2012 SQRSTS test reports for original and new configuration replacement Heinemann CF2-Z51-1 circuit breakers in 120 VAC VIP Boards at SQN Unit 1 and 2.
4. Perform a Seismic Technical Evaluation of Replacement Items (STERI) evaluation calculation (similar to WCGACQ588) in support of SQN Unit 1 and Unit 2 Design Change Notices (DCNs) or Equivalency Changes (action 5).
5. Prepare and issue SQN Unit 1 and Unit 2 DCNs or Equivalency Changes which include similar (not identical) equivalent replacement items and design enhancements to those in Watts Bar Nuclear Plant (WBN) DCN 59132A. These changes will make the SQN installations similar to those at WBN with regard to seismic capacity and maintenance provisions.
6. Implement the SQN Unit 1 and Unit 2 DCNs or Equivalency Changes (action 5), in a timely manner consistent with completion of supporting engineering documents and proper planning of outage work.

Seismic qualification has been verified by using as-built data in the September 2011 and March 2012 seismic tests described in Enclosure 1. The EDC will allow an alternate mounting arrangement for the new configuration Heinemann CF2-Z51-1 circuit breakers for implementation during the U2R18 outage. Design Change Notices (DCNs) for SQN will establish configuration and design control measures, including assembly/installation instructions for future maintenance activities, to prevent recurrence of these violations.

The applicable Institute of Electrical and Electronic Engineers (IEEE) standard is IEEE 344-1974 or IEEE 344-1971 (for equipment procured before September 1, 1974) as described in SQN Updated Final Safety Analysis Report (UFSAR) sections 3.2, 3.7, and 3.10. Compliance with the Unit 1 and 2 UFSAR for floor-mounted safety-related equipment assemblies and devices mounted on those assemblies is controlled by SQN-DC-V-40.0 as described in Enclosure 1.

Enclosure 3

Reply to Notice of Violation 05000391/2010603-08 - Failure to Adequately Evaluate and Qualify Molded Case Circuit Breakers - Revised Response

Short-Term Operability and Long-Term Corrective Actions Taken at Sequoyah Units 1 and 2

Safety-related Heinemann circuit breakers for SQN Unit 1 and 2 are only located on the 120 VAC VIP Boards. Therefore, the clamped mounting arrangement which is the subject of Unit 1 NCV 05000327/2011002-01 and Unit 2 NCV 05000328/2011002-01 is unique to the 120 VAC VIP Boards supplied by Westinghouse for WBN and SQN.

Date When Full Compliance Will Be Achieved:

Full compliance for SQN Unit 1 will be achieved on or before the last day of the fall 2013 U1R19 refueling outage.

Full compliance for SQN Unit 2 will be achieved on or before the last day of the spring 2014 U2R19 refueling outage.