WBN2Public Resource

From: Boyd, Desiree L [dlboyd@tva.gov]
Sent: Friday, September 30, 2011 9:40 AM
To: Epperson, Dan; Poole, Justin; Raghavan, Rags; Milano, Patrick; Campbell, Stephen
Cc: Arent, Gordon; Hamill, Carol L; Boyd, Desiree L
Subject: TVA letter to NRC_09-30-2011_IC RAI Response Letter
Attachments: 09-30-2011_IC RAI Response Letter_Final.pdf

Please see attached TVA letter that was sent to the NRC today.

The attachments are too large to send by e-mail. For those of you who receive a cc in the mail, the attachments will be included with your letter.

Thank You,

~*~*~*~*~*~*~*~*~*~*~*~*~

Désireé L. Boyd

WBN 2 Licensing Support
Sun Technical Services
dlboyd@tva.gov
423-365-8764

Hearing Identifier: Watts_Bar_2_Operating_LA_Public
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Subject: TVA letter to NRC_09-30-2011_IC RAI Response Letter
Sent Date: 9/30/2011 9:39:33 AM
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From: Boyd, Desiree L

Created By: dlboyd@tva.gov

Recipients:
"Arent, Gordon" <garent@tva.gov>
Tracking Status: None
"Hamill, Carol L" <clhamill@tva.gov>
Tracking Status: None
"Boyd, Desiree L" <dlboyd@tva.gov>
Tracking Status: None
"Epperson, Dan" <Dan.Epperson@nrc.gov>
Tracking Status: None
"Poole, Justin" <Justin.Poole@nrc.gov>
Tracking Status: None
"Raghavan, Rags" <Rags.Raghavan@nrc.gov>
Tracking Status: None
"Milano, Patrick" <Patrick.Milano@nrc.gov>
Tracking Status: None
"Campbell, Stephen" <Stephen.Campbell@nrc.gov>
Tracking Status: None

Post Office: TVANUCXVS2.main.tva.gov

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Attachments 1, 2, 5, 8, 10 and 13 are to be withheld from public disclosure under 10 CFR § 2.390. When separated from these attachments, this letter is decontrolled.

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

September 30, 2011

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

Watts Bar Nuclear Plant, Unit 2 — 10 CFR 50.4
NRC Docket No. 50-391

Subject: WATTS BAR NUCLEAR PLANT (WBN) UNIT 2 – INSTRUMENTATION AND CONTROLS STAFF INFORMATION REQUESTS

References: 1. Supplemental Safety Evaluation Report (SSER) 22, 23 and 24 Appendix HH Watts Bar Unit 2 Action Items Table

2. NRC to TVA letter dated September 21, 2011, "Watts Bar Nuclear Plant, Unit 2 - Request for Additional Information Regarding Supplemental Safety Evaluation Report Open Item 80 (TAC No. ME0853)," ML112590046

The purpose of this letter is to provide TVA's responses to NRC's information requests on:

- SSER 22, 23 and 24 Appendix HH "Watts Bar Unit 2 Action Items Table,"
- Items 2.ii through 2.ix of NRC to TVA letter dated September 21, 2011, "Watts Bar Nuclear Plant, Unit 2 - Request for Additional Information Regarding Supplemental Safety Evaluation Report Open Item 80 (TAC No. ME0853),"
- NRC staff comments on FSAR Amendment 105 received via telecom on September 6, 2011
- Correct a response contained in TVA to NRC letter dated May 6, 2011
- Various commitments.

Enclosure 1 to this letter provides TVA's response to the information requested by NRC. Enclosure 2 contains the supporting documents for TVA's responses to NRC's requests/questions provided in Enclosure 1. Enclosure 3 contains a list of references on which TVA's responses are based. Enclosure 4 contains a list of new regulatory commitments.

Attachments 1, 5, and 8 contain information proprietary to General Atomics-Electronic Systems, Inc. (GA-ESI). TVA requests that the GA-ESI proprietary information be withheld from public disclosure in accordance with 10 CFR § 2.390.

Attachments 2, 10, and 13 contain information proprietary to Westinghouse Electric Company LLC (WEC). TVA requests that the WEC proprietary information be withheld from public disclosure in accordance with 10 CFR § 2.390.

If you have any questions, please contact Gordon Arent at (423) 365-2004.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 30th day of September, 2011.

Respectfully,

David Stinson
Watts Bar Unit 2 Vice President

Enclosures:

1. TVA Responses to Instrumentation and Controls Staff Information Requests
2. List of Attachments
3. List of References
4. List of New Regulatory Commitments

cc (Enclosures):

U. S. Nuclear Regulatory Commission
Region II
Marquis One Tower
245 Peachtree Center Ave., NE Suite 1200
Atlanta, Georgia 30303-1257

NRC Resident Inspector Unit 2
Watts Bar Nuclear Plant
1260 Nuclear Plant Road
Spring City, Tennessee 37381

bcc (Enclosures):

Stephen Campbell
U.S. Nuclear Regulatory Commission
MS 08H4A
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852-2738

Patricia Holahan, Acting Deputy Regional Administrator for Construction
U. S. Nuclear Regulatory Commission
Region II
Marquis One Tower
245 Peachtree Center Ave., NE Suite 1200
Atlanta, Georgia 30303-1257

David Rahn
U.S. Nuclear Regulatory Commission
MS 09D2
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852-2738

George A. Wilson, Jr.
U.S. Nuclear Regulatory Commission
MS 09E3
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852-2738

Enclosure 1
TVA Letter Dated September 30, 2011
TVA Responses to Instrumentation and Controls Staff Information Requests

The following acronyms/abbreviations are used in this letter:

AAF	Acceptable As Found
[1]BEACON™	Best Estimate Analyzer for Core Operations Nuclear
BDP	Beacon Data Processing
CET	Core Exit Thermocouple
CFR	Code of Federal Regulations
CISPR	Comité Internationale Spécial des Perturbations Radioelectrotechnique
dBpT	decibels relative to one picoTesla
dBµA	decibels relative to one microampere
dBµV	decibels relative to one microvolt
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
[2]EPRI®	Electric Power Research Institute®
EQ	Environmental Qualification
FMEA	Failure Modes and Effects Analysis
FSAR	Final Safety Analysis Report
GA	General Atomics
GA-ESI	General Atomics-Electronic Systems, Inc.
Hz	Hertz (cycles per second)
IEC	International Electrotechnical Commission
[3]IEEE™	Institute of Electrical and Electronics Engineers
IIS	Incore Instrument System
IITA	Incore Instrument Thimble Assembly
kA	one thousand Amperes
kHz	kilo-Hertz (one thousand cycles per second)
kV	one thousand Volts
MI	Mineral Insulated
MIL-STD	Military Standard
MOV	Metal Oxide Varistor
NRC	Nuclear Regulatory Commission
PAMS	Post Accident Monitoring System
RAI	Request for Additional Information
RFI	Radio Frequency Interference
RG	Regulatory Guide
SPD	Self Powered Detector
SPM	Software Program Manual
SPND	Self Powered Neutron Detector
SPS	Signal Processing System
SQN	Sequoyah Nuclear Plant
SSER	Supplemental Safety Evaluation Report
TVA	Tennessee Valley Authority
V	Volt
Vrms	Volts root-mean-square
WBN	Watts Bar Nuclear Plant
WEC	Westinghouse Electric Corporation
[4]WINCISE™	Westinghouse In-Core Information Surveillance & Engineering

[1] BEACON is a registered trademark of the Westinghouse Electric Corporation LLC
[2] EPRI and Electric Power Research Institute are registered service marks of the Electric Power Research Institute Inc.
[3] IEEE is a registered trademark of the Institute of Electrical and Electronics Engineers Inc.
[4] WINCISE is a registered trademark of the Westinghouse Electric Corporation LLC

Enclosure 1
TVA Letter Dated September 30, 2011
TVA Responses to Instrumentation and Controls Staff Information Requests

1. NRC Request (SSER 23 Appendix HH Item Number 81)

The extent to which TVA's supplier, General Atomics (GA), complies with EPRI TR-106439 and the methods that GA used for its commercial dedication process should be provided by TVA to the NRC staff for review. (SSER 23, Section 7.5.2.3, pg 7-117)

TVA Partial Response to NRC Request

Compliance with EPRI TR-106439 and the methods GA uses for its commercial dedication process are documented in GA procedure OP-7.3-240. Attachment 1 contains proprietary GA procedure OP-7.3-240, Revision K, "Safety-Related Commercial Grade Item Parts Acceptance." Attachment 16 contains responses to the NRC comments on the previous procedure revision. The non-proprietary version and affidavit for withholding will be submitted by December 1, 2011.

A white paper describing the GA commercial grade dedication program and how it conforms to current regulatory requirements is being prepared and will be submitted after it is received from GA.

2. NRC Request (SSER 24 Appendix HH Item Number 118)

Note: In several questions and responses the NRC uses the term Self Powered Neutron Detectors (SPND) while Westinghouse and TVA use the term Self Powered Detectors (SPD). The terms SPD and SPND are interchangeable and refer to the vanadium neutron detectors contained in the Incore Instrument Thimble Assemblies (IITA).

TVA should provide to the NRC staff a description of how the other vanadium detectors within the IITA would be operable following the failure of a SPND. (SSER 24, Section 7.7.1.9.2)

TVA Response

Each self powered detector (SPD) element is contained inside its own mineral insulated (MI) cable that physically and electrically isolates each detector element from all the other elements inside the IITA. There is no direct link between the measured signals from individual detectors inside an IITA. Consequently, there is no reason for the failure of one detector element to affect the operability of any of the other elements inside the IITA.

The core monitoring system uses information from all available sensors. The uncertainty methodology used to establish the number and distribution of required SPD sensors is described in detail in NRC approved WCAP-12472, "BEACON Core Monitoring and Operation Support System," Addendums 1 (ML003678190) and 2 (ML021270086). Specifically, the uncertainty methodology is described in Section 5 of Addendum 1, and the basis for the requirements on the number and distribution of sensors is provided in Section 6 of Addendum 2.

Based on the above, failure of one or more SPDs within an IITA does not render the remaining SPDs in the IITA inoperable.

3. NRC Request (SSER 24 Appendix HH Item Number 123)

TVA should provide an explanation to the NRC staff of how the system will assign a data quality value to notify the power distribution calculation software to disregard data from a failed SPND. (SSER 24, Section 7.7.1.9.5)

TVA Response

The presentation provided to the staff during the public meeting in April 2011 contained the following information about data validation performed by the WBN Unit 2 In-core Instrumentation System Best Estimate Analyzer for Core Operations Nuclear (BEACON) Data Processing (BDP) application software running on the redundant Application Servers:

The following are design features of the BDP application:

- Time compensation correction applied for Vanadium detectors
- Data integrity checks
    - Rate-of-change
    - High/low self powered detector (SPD) current limits
    - Cable leakage resistance limits
- Accepts "on-demand" signal to initiate leakage calculation
- Provides quality assignment for SPD BEACON inputs

The BDP application continuously reviews detector signal measurements; performs on-demand checks of signal cable leakage resistance; and performs validity checks of this information relative to defined maximum change in measured signal between two measurement intervals, high and low current limits, and minimum acceptable cable leakage resistance measurement limits. If any of these criteria are violated, the BDP application sets a data quality bit contained in the digital representation of the current value to “BAD.” The BEACON System Plant Interface function automatically disregards the BAD data.

4. NRC Request (SSER 24 Appendix HH Item Number 125)

TVA should provide clarification to the NRC staff of the type of connector used with the MI cable in Unit 2, and which environmental qualification (EQ) test is applicable. (SSER 24, Section 7.7.1.9.5)

TVA Response

The applicable Environmental Qualification Report is Westinghouse Proprietary Report DAR-ME-09-10, “Qualification Summary Report for the WINCISE Cable and Connector

Upgrade at Watts Bar Unit 2," submitted in TVA to NRC letter dated May 6, 2011 (Reference 5).

The electrical connectors used with the WBN Unit 2 WINCISE MI Cable Assemblies are glass-to-metal seal technology connectors fabricated for Westinghouse by Meggitt Safety Systems.

The electrical connectors used for the WBN Unit 2 MI Cable are the same family of electrical connectors that have been installed in numerous plants since the 1980s for Class 1E Environmentally Qualified Core Exit Thermocouple (CET) applications. This experience list includes the WBN Unit 1 CET MI Cable installed in 2006 and the SQN Units 1 and 2 CET MI Cable installed in the late 1980s.

5. NRC Request (SSER 24 Appendix HH Item Number 126)

TVA should provide the summary report of the EQ for the IITA. (SSER 24, Section 7.7.1.9.5)

TVA Response

Qualification of the excore portion of the IITA is documented in Westinghouse Qualification Report DAR-ME-11-4-P, "Qualification Summary Report for the Ex-Vessel Portion of the WINCISE In-Core Instrumentation Thimble Assembly (IITA) for Watts Bar Unit 2," Revision 0.

Attachment 2 contains the proprietary Westinghouse Report DAR-ME-11-4-P, Revision 0, "Qualification Summary Report for the Ex-Vessel Portion of the WINCISE In-Core Instrumentation Thimble Assembly (IITA) for Watts Bar Unit 2." Attachment 17 contains non-proprietary Westinghouse Report DAR-ME-11-4-NP, Revision 0, "Qualification Summary Report for the Ex-Vessel Portion of the WINCISE In-Core Instrumentation Thimble Assembly (IITA) for Watts Bar Unit 2." Attachment 18 contains Westinghouse document CAW-11-3253 "Application For Withholding Proprietary Information From Public Disclosure, DAR-ME-11-4-P, Rev. 0, Qualification Summary Report for the Ex-Vessel Portion of the WINCISE Incore Instrumentation Thimble Assembly (UTA) for Watts Bar Unit 2 (proprietary)."

A qualification report for the incore portion of the IITA will be submitted to the NRC within two weeks of receipt from Westinghouse.

6. NRC Request (SSER 24 Appendix HH Item Number 127)

TVA should provide a summary to the NRC staff of the electro-magnetic interference/radio-frequency interference (EMI/RFI) testing for the MI cable electro-magnetic compatibility (EMC) qualification test results. (SSER 24, Section 7.7.1.9.5)

TVA Response

The MI Cable Assemblies supplied for the WBN Unit 2 Incore Instrumentation System (IIS) were not subjected to a product specific EMI/EMC test program.

The construction of MI Cable Assemblies provided by Westinghouse for the WBN Unit 2 IIS includes the use of stainless steel material tubing for the MI Cable sheaths that are factory installed into a supplemental flexible stainless steel conduit to form the IIS Cable Assemblies. The electrical connectors are factory seal welded to the MI Cable.

The combination of the stainless steel sheath material joined to the stainless steel connectors provides for 100% shielding coverage. The exterior surfaces of the IIS MI Cable Assemblies are post accident qualified, and as such, are required to be 100% hermetic. This hermeticity of the MI Cable Assembly design and construction also demonstrates the absence of any apertures or seams that would compromise the shielding effectiveness of the assemblies.

As an additional layer of protection, the IIS MI Cable Assemblies for WBN Unit 2 include an interlocked stainless steel material hose assembly that is brazed and seal welded to the electrical connector backshell at each end of the cable assemblies. This hose assembly was originally added to provide additional mechanical protection for the underlying MI cable, but also provides supplemental EMC shielding protection for the signals. The addition of interlocked metal hose as shielding, also known as “fingerstock” in the cable industry, is a common design practice used to increase shielding to effectively mitigate EMC issues.

To provide the necessary grounding of the cable assembly shielding, the installation parameters for the WBN Unit 2 IIS MI Cable Assemblies specify that the cable assemblies are to be secured to seismically qualified in-containment cable supports at regular intervals along the length of the cable run. The frequency of this support arrangement provides multiple low impedance paths to ground for the cable assemblies to effectively divert EMI.

MI Cable as supplied by Westinghouse has been installed in numerous plants since the early 1980s for Class 1E CET applications without any reported EMC issues. This experience list includes the Watts Bar 1 CET MI Cable installed in 2006 and the Sequoyah Unit 1 and 2 CET MI Cable installed in the late 1980's.

Based on the above, it is concluded that:

(a) There is reasonable assurance that the IIS MI Cable Assemblies, as supplied for WBN Unit 2, are protected from a disruptive noise signal related to EMI/EMC;

(b) A product-specific EMI/EMC characterization test is not required to demonstrate qualification.

7. <u>NRC Request (SSER 24 Appendix HH Item Number 129)</u>

TVA should verify to the NRC staff resolution of the open item in WNA-CN-00157-WBT for the power supply (to be installed in the SPS cabinet) to undergo EMC testing of 4 kV to validate the assumptions made in the Westinghouse analysis. (SSER 24, Section 7.7.1.9.5)

TVA Response

Item 5 in Table 2.2-1 of EQ-QR-39-WBT-P (Attachment 10) is identified as the WBN Unit 2 WINCISE Power Supply Assembly Mounting Kit, 10004D04G01 which is Group 1 in drawing 10004D04. Attachment 11 contains Westinghouse Electric Company EQ-QR-39-WBT-NP, Revision 1, "Equipment Qualification Summary Report for WINCISE Signal Processing System," (Non-Proprietary). Attachment 12 contains Westinghouse Electric Company CAW-11-3243 Application For Withholding Proprietary Information From Public Disclosure EQ-QR-39-WBT-P, Rev. 1, "Equipment Qualification Summary Report for WINCISE Signal Processing System (Proprietary)," dated September 7, 2011.

The following documentation trail leads to the identification of the power supplies for the WBN2 WINCISE cited in WNA-CN-00157-WBT (submitted in TVA to NRC letter dated September 1, 2011 (Reference 2):

1. 10004D04G01 refers to the BOM kit (10000A297) and calls out the WINCISE power supply assembly 10004D05G01, which is Group 1 in drawing 10004D05.

2. Item 1 for 10004D05G01 specifies the standard safety assembly 10043D28G03, which is Group 3 in drawing 10043D28.

3. Items 54 and 55 for 10043D28G03 specify the power supplies used for the WBN2 WINCISE as 2A10655G01 and 2A10655G02 which are Groups 1 and 2 in drawing 2A10655.

4. 2A10655G01 and 2A10655G02 specify the WBN2 WINCISE power supplies identified in Open Item #2 in WNA-CN-00157-WBT and whose data sheets were provided in the Appendix of the calc note.

The preceding demonstrates that the power supplies for WINCISE were in the scope of the equipment tested documented in EQ-QR-39-WBT-P. EQ-QR-39-WBT-P, section 3.2.4, "Test Results," documents the open item for testing of the power supplies in WNA-CN-00157-WBT was closed by the testing.

NOTE:
Letter items 8 through 15, below, are from NRC RAI letter to TVA dated September 21, 2011 (Reference 8). Responses are included for NRC items 2.ii through 2.ix. Responses to NRC items 1 and 2.i will be provided within two weeks of receipt from GA-ESI.

The following information from the NRC letter applies to the items included in this letter:

As noted in the Safety Evaluation for the high range radiation monitors it was not clear how they meet the electromagnetic interference and radio frequency interface (EMI/RFI) requirement. After reviewing TVA standard specification SS-E18-14.1 staff requested actual test information pertaining to EMI/RFI. TVA provided EMI/RFI test reports by April 15, 2011 submittal. Attachment 1 of this report contained the test data with two sets of test reports; one by Nemko and the other by TUV. Nemko report is 89 pages and it addresses the updated RM1000 monitors whereas the TUV report tested the older RM1000 and I/F converter models. After review, Staff requests the following clarifications and additional information.

2. The following clarifications apply to Nemko test report 04509050 (89 pages):

8. NRC Requests related to SSER 23 Appendix HH Item Number 80 (Item 2.ii)

Low Frequency Conducted Susceptibility Test: Please note that the Current revision of Regulatory Guide (RG) 1.180 (Rev 1), Figure 4.1 requires frequency range from 30 Hz to 150 kHz. Since the tested range for this test is from 30 Hz to 50 kHz, TVA is requested to justify the lower range or provide additional test data to cover the entire range. TVA to note that MIL-Std-461E also shows a range of 30 Hz to 150 kHz.

TVA Response

1. The Nemko report test frequency is 30Hz to 50kHz. The 30Hz to 150kHz was performed as part of TUV test report S7439-03, (page 18 of 20).

2. This is a test on the power leads. The effect of adjacent equipment on the same power supply is the mechanism that is being verified. TVA, at SQN and the industry at many sites have significant history that shows successful operation of this instrument. If there were issues with noise on the power system, it would have been revealed over the years that the RM1000 has been in service.

9. NRC Requests related to SSER 23 Appendix HH Item Number 80 (Item 2.iii)

High Frequency Conducted Susceptibility Test: IEC 1000-4-6 has been used. ***[1]*** *TVA to justify the equivalency between IEC 1000-4-6 and other approved test methods noted in RG 1.180 or EPRI TR-102323 (e.g. IEC 61000-4-6).* ***[2]*** *TVA also to explain how this test meets EPRI TR-102323, Rev 2 or RG 1.180, Rev 1. TVA to note that Nemko report (page 65 of 89) does not provide the test curves nor does it explain how the 10 Vrms is equivalent to the test levels required by EPRI 102323.* ***[3]*** *TVA to clarify the range limits and provide test curves/data.*

TVA Response

1. IEC 1000-4-6 and IEC 61000-4-6, “Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields,” are revisions of the same document. There is no difference in the test levels or the test methods between these revisions.

2. The test standard in RG 1.108, “Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems,” Revision 1, stipulates a test level of 140 decibels relative to one microvolt (dBμV) over the required frequency range. The test was run at 10V. 10V is the same value as 140 dBμV.

3. Since the test level is held constant at 10V for the entire frequency range (10kHz to 200MHz), there is no need for test curves.

10. NRC Requests related to SSER 23 Appendix HH Item Number 80 (Item 2.iv)

Low Frequency Radiated Susceptibility Tests: According to Nemko test description (page 30 of 89 of the Nemko report) this test is to be conducted per RS101 with frequency

ranges from 30 Hz to 100 kHz. Nemko test results (page 53 of 89) for RS 101 test indicate frequency from 3 Hz to 10 kHz. Test data results on page 31 of 89 state that the test results were in compliance with RS101 requirements of MIL-STD-461E. ***[1]*** *TVA to explain why the test data shown on Nemko report (page 53 of 89) shows a range from 3 to 10000 Hz as opposed to the required range of 30 Hz to 100 kHz (see test description on page 30 of 89). In addition the test should be conducted to the ranges specified in RG 1.180 or EPRI TR-102323 but the test data (page 53 of 89) shows test range 18 to 11 decibels relative to one pico Tesla (dBpT).* ***[2]*** *Please clarify how this test limit meets RG 1.180, Rev1 or EPRI TR-102323 (Rev 2) for range of 180 to 110 dBpT.*

TVA Response

1. The table is mislabeled. The listed frequencies are off by a factor of 10. This is documented in section 5.5.2 on page 31 of 89 which states: "The frequency range of 30Hz - 100kHz was swept while monitoring for susceptibility."

2. Again, the difference is a units labeling issue. The test levels are 180 to 110 dBpT. This is documented in section 5.5.2 on page 31 of 89 which states: "The field strength was calibrated to the EPRI Limit using the 9229-1 Loop Sensor. The frequency range of 30Hz - 100kHz was swept while monitoring for susceptibility. The signal generator was connected and the output adjusted until the field strength reached the required level."

11. NRC Requests related to SSER 23 Appendix HH Item Number 80 (Item 2.v)

Surge Withstand Capability: RG 1.180 and EPRI TR-102323 provide the guidance for surge withstand capability tests. Both permit use of IEC 61000-4-5, Level 3 for this test. Nemko test report indicates that tests were conducted to IEC 1000-4-5 (page 64 of 89). Tests were performed to criterion B for 2kV common mode and 1kV differential mode surges in the AC power supply configuration using the combination wave method. RG 1.180, table 22 for combination wave for Category B, Low Exposure notes that the surge level is 2 kV / 1 kA. Nemko test report states compliant testing between neutral and ground for common mode at 2 kV, between line and ground for common mode at 2 kV, and between neutral and line for differential mode at 1 kV. ***[1]*** *TVA to explain the equivalency between IEC 1000-4-5 and other approved test methods noted in RG 1.180 or EPRI TR-102323 (i.e. IEC 61000-4-5).* ***[2]*** *Further TVA to clarify how both parts of the combination wave form tests were conducted. RG 1.180, Rev1 requires an open circuit voltage and a short circuit test with surge current of 1 kA (see Figures 5.2 and 5.3). The test data (page 64 of 89) reflects that only voltage test was conducted.*

TVA Response

1. IEC 1000-4-5 and IEC 61000-4-5, "Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test," are revisions of the same document. There is no change in the test levels or the test methods between these revisions.

2. The combination wave definition requires both a voltage and a current to be stated. With these both stated the impedance of the test generator is defined. So, there are not two tests defined but one.

There are metal oxide varistors (MOVs) and a filter on the power input required per this testing. This is significant protection to surge waveforms.

12. NRC Requests related to SSER 23 Appendix HH Item Number 80 (Item 2.vi)

Electrical fast Transients Tests: RG 1.180 and EPRI TR-102323 provide the guidance for electrical fast transient tests. Both permit use of IEC 61000-4-4, Level 3 for this test. Nemko test report states that the guidance of test method IEC 1000-4-4 was used (page 40 of 89). The equipment was tested as Category B, low exposure power line. Nemko test results (page 63 of 89) for electrical fast transients state that the basic standard is EN-61000-4-4. ***[1]*** *Is TVA taking any credit for this test for WBN2?* ***[2]*** *If so then please explain the equivalency between the actual test method used (i.e. IEC 1000-4-4 or EN 61000-4-4) and other approved test methods noted in RG 1.180 or EPRI TR-102323 (i.e. IEC 61000-4-4).*

TVA Response

1. Yes, TVA is taking credit for this test.

2. IEC 1000-4-4 and IEC/EN 61000-4-4, "Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test," are revisions of the same document. There are no changes to the test method or levels between these revisions.

13. NRC Requests related to SSER 23 Appendix HH Item Number 80 (Item 2.vii)

Low Frequency Conducted Emissions Tests: Purpose of CE-101 test is to prove that the low frequency conducted emissions do not exceed the specified limits. EPRI TR-102323, Figure 5-4 for AC and DC source voltages above 28 volts specify a range of 110 decibels relative to one microampere (dBμA) from 30 Hz to 1 kHz and then linearly decreasing to 90 dBμA at 10 kHz. Nemko test results (page 45 of 89) show very similar test requirements. However, the Nemko test data (page 45 of 89) starts from about 120 Hz as opposed to 30 Hz. TVA to justify why the test data did not start from lower limit of 30 Hz.

TVA Response

Testing starts at the 1st harmonic of the power supply. In this case, a 60Hz AC power supply has a first harmonic of 120Hz. If it were a DC system, it would start at 30Hz.

14. NRC Requests related to SSER 23 Appendix HH Item Number 80 (Item 2.viii)

Low Frequency Radiated Emissions Tests: Per Nemko report (page 52 of 89) this test was conducted per MIL STD-461E RE101 method. RG 1.180 also agrees with RE101 method and shows test requirements which are very similar to the Nemko test. The test passed with respect to the requirements. However, the margin at 64180 Hz is only 3.1 dBpT. This margin is very small. NRC safety evaluation for EPRI TR-102323, dated

April 17, 1996 suggested a safety margin of 8 dB which was eventually incorporated in Rev 1 of EPRI TR-102323. TVA is requested to justify why this small margin of 3.1 dBpT is acceptable for WBN2.

TVA Response

RE101 is only a recommended test in lieu of separations from adjacent equipment. TVA's installation practices are consistent with EPRI TR-102323, "Guidelines for Electromagnetic Interference Testing in Power Plants," recommendations as documented in TVA Electrical Engineering General Engineering Specifications:

- G-38, "Installation, Modification, And Maintenance Of Insulated Cables Rated Up To 15,000 Volts"

- G-40 "Installation, Modification And Maintenance Of Electrical Conduit, Cable Trays, Boxes, Containment Electrical Penetrations, Electric Conductor Seal Assemblies, Lighting And Miscellaneous Systems"

- G-47 "Installation, Modification, And Maintenance Of Electrical Grounding Systems And Lightning Protection Systems"

As previously committed to in Enclosure 4 of TVA to NRC letter dated April 15, 2011 (Reference 10) an EMI survey of the RM-1000 radiation monitors will be performed after installation and the results will be provided to the NRC within two weeks of the survey being completed.

The recommended safety margin in the RG was between the susceptibility test limit and the emissions test limit--not the difference between a specific emission test value and an emissions test limit value.

Based on the preceding, the value of 3.1 dBpT is acceptable.

15. NRC Requests related to SSER 23 Appendix HH Item Number 80 (Item 2.ix)

High Frequency Radiated Emissions Tests: Per Nemko report (page 48 of 89) this test requirement is to perform this test from 30 MHz to 230 MHz at 40 dBµV/meter with frequency range from 230 MHz to 1 GHz at level varying linearly from 40 dBµV/meter to 47 dBµV/meter using EN 55022, Class A method with an antenna distance of 10 meters for open area test site. The test data graph shows actual tests from 30 MHz to 320 MHz with acceptable results. However, EPRI recommended curve in Figure 5-7 of EPRI TR-102323 shows limit values varying from 95 dBµV/meter to 66 dBµV/meter. It also states that EN 55022 Class A or B is acceptable if the highest clock frequency is 200 MHz. EPRI TR-102323 also states that this test should be performed up to 1 GHz or 5 times the highest internal generated frequency within the test unit. Further RG 1.180 in section 3.6 states, Figure 3.5 shows all of the acceptable testing programs and notes that the alternative programs are acceptable only when the conditions for exemption are satisfied. Thus, when the identified conditions for exempting low frequency emissions testing are met, any of the three alternative emissions testing programs may be selected. However, regardless of the emissions testing program selected, it is intended that each be applied in

its entirety, without selective application of individual methods (i.e., no mixing and matching of test methods) for emissions testing. The baseline group in Figure 3.5 lists CE101, CE102, RE 101, and RE102 as test methods. TVA uses CE101, CE102, and RE 101 but not RE102. RG 1.180, as noted above, states that mixing and matching of these methods should not be used. ***[1]*** *TVA to justify why RE102 has not been used for this test.* ***[2]*** *TVA also to explain why the EN 55022 test is acceptable and how it meets the guidance of EPRI TR-102323 or RG 1.180.*

TVA Response

1. RE 102, "radiated emissions, electric field, 10 kHz to 18 GHz" or any other radiated susceptibility test uses the same monitoring equipment. The only difference in methodology is the distance of the test and the detector type when the test limit is approached. As described below, EN 55022 is more restrictive than RE102 and therefore bounds the RE102 requirements.

2. EN 55022, "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement," is an industry standard test citing Comité Internationale Spécial des Perturbations Radioelectrotechnique (CISPR) 22, "Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement," for limits and is more restrictive than that required by either RG 1.180 or EPRI TR 102323. Meeting this limit is more than satisfactory to comply with either RG 1.180 or EPRI TR 102323.

16. NRC Request for FSAR Change

During NRC Staff review of FSAR Amendment 105, Table 7.1-1, Note 17 was found to conflict with the requirements of Regulatory Guide 1.152 Revision 3. The reviewer questioned why the note had been included.(Telecom between N. Carte and S. Clark held on September 6, 2011)

TVA Response

In the process of preparing the September 1, 2011 TVA to NRC response letter, a decision was made to change the project commitment from RG 1.152 Revision 2 to Revision 3. This required the project to create new analysis documents to show compliance with Revision 3. However, in the process of changing the commitment from Revision 2 to Revision 3, the previously submitted change to the FSAR (i.e., Note 17) for conformance with Revision 2 cyber security requirements was not withdrawn. Since the cyber security requirements were removed from Revision 3, a note explaining TVA's position on cyber security was no longer required. As a result Note 17 was erroneously included in Amendment 105. Note 17 was removed in FSAR Amendment 106.

17. NRC Request for FSAR Change

During NRC Staff review of FSAR Amendment 105, Table 7.1-1, Note 18 was found to be confusing and the reviewer questioned if the note was necessary. (Telecom between N. Carte and S. Clark held on September 6, 2011)

TVA Response

The inclusion of Note 18 was caused by a misinterpretation of the requirements of RG 1.152 Revision 3 as it applied to IEEE 7-4.3.2 2003 by the TVA reviewer. Discussion with the NRC reviewer determined that the note was not required. Note 18 was removed in FSAR Amendment 106.

18. TVA Correction to Response in May 6, 2011 Letter Item 11 NRC Request Number 370

The following request, partial response, and commitment were included in TVA to NRC letter dated May 6, 2011 (Reference 5). Subsequently a typographical error was found in the request and partial response. The correct document number is IEEE 1028-1997. Both the request and response incorrectly use IEEE 1020-1997. The corrections to the May 6th text are shown in **bold underline**. FSAR Amendment 105 correctly refers to IEEE 1028-1997.

On 5/6/2010 (See Open Item No. 81) the NRC Staff requested an evaluation of the Common Q PAMS against the current staff position.

By letter dated 2/25/11 (ML110620219), TVA docketed a response.

*The WBN2 FSAR (Amendment 103) does not reference RG 1.168, IEEE 1012, or IEEE 1028. IEEE Std 7-4.3.2-2003 identifies IEEE Std 1012-1998 as normative. RG 1.168 Rev. 1 endorses, with clarifications, IEEE 1012-1998. The current staff positions are documented in RG 1.168 Rev. 1, IEEE 1012-1998, and IEEE 102**8**-1997. Based upon the review of this item, the staff finds the following open item:*

1. *WBN2 to update FSAR Table 7.1-1 to reference RG 1.168 Rev. 1, IEEE 1012-1998, and IEEE 102**8**-1997 as being applicable to WBN2 Common Q PAMS and the Sorrento Containment High Radiation monitor.*

TVA Partial Response to NRC Request:

Common Q PAMS is designed in accordance with RG 1.168, Revision 1, IEEE 1012-1998 and IEEE 102**8**-1997. These references will be added to FSAR Table 7.1-1.

19. TVA Commitment

Provide non-proprietary version and affidavit for withholding for Weed Instrument Qualification report 16690-QTR, Revision 0.

Commitment Closure

As committed to in Item 6 of Enclosure 2 of TVA to NRC letter dated July 31, 2010 (Reference 1), Attachment 3 contains the non-proprietary version of Weed Instrument qualification report 16690-QTR, “Qualification Test Report For Environmental and Seismic Qualification of Weed Instrument Model DTN2010 Pressure Transmitters,” Revision 0. Attachment 4 contains Ultra Electronics “Application for Withholding Proprietary Information from Public Disclosure - Document No.: Qualification Test Report No.: 16690-

QTR Rev 0, Qualification Test Report For Environmental And Seismic Qualification Of Weed Instrument Model DTN2010 Pressure Transmitters."

20. TVA Commitment

Provide non-proprietary version and affidavit for withholding for GA-ESI test report 04508903-1TR, Revision B.

Commitment Closure

As committed to in Enclosure 4 of TVA to NRC letter dated March 31, 2011 (Reference 3), Attachment 5 contains the demarcated proprietary version of GA-ESI test report 04508903-1TR, "Seismic Qualification Test Results RM-1000 and Current-to Frequency (I/F) Converter," original release, dated April 1999. Attachment 6 contains the non-proprietary version of GA-ESI test report 04508903-1TR, "Seismic Qualification Test Results RM-1000 and Current-to Frequency (I/F) Converter," original release, dated April 1999. Attachment 7 contains GA-ESI letter 4488, "Request by General Atomics Electronic Systems, Inc. to Withhold Certain Information from Public Disclosure under 10CFR2.390," dated September 19, 2011.

21. TVA Commitment

Provide non-proprietary version and affidavit for withholding for GA-ESI test report 04508905-QR, Revision B.

Commitment Closure

As committed to in TVA to NRC letter dated March 12, 2010 (Reference 7) and Enclosure 4 of TVA to NRC letter dated February 25, 2011 (Reference 6), Attachment 8 contains the demarcated proprietary version of GA-ESI test report 04508905-QR, "Qualification Test Report for RM-1000 Processor Module and Current-To-Frequency Converter," Revision A. Attachment 9 contains the non-proprietary version of GA-ESI test report 04508905-QR, "Qualification Test Report for RM-1000 Processor Module and Current-To-Frequency Converter," Revision A. Attachment 7 contains GA-ESI letter 4488, "Request by General Atomics Electronic Systems, Inc. to Withhold Certain Information from Public Disclosure under 10CFR2.390," dated September 19, 2011.

22. TVA Commitment

Provide non-proprietary version and affidavit for withholding for Westinghouse EQ-QR-39-WBT-P, Revision 0.

Commitment Closure

As committed to in Enclosure 4 of TVA to NRC letter dated September 1, 2011 (Reference 2), Attachment 10 contains Westinghouse EQ-QR-39-WBT-P, Revision 1, "Equipment Qualification Summary Report for WINCISE Signal Processing System," (Proprietary). This is an update to the Revision 0 document submitted on September 1, 2011. The revision description states:

"Revision 1 is Revision 0 with proprietary markings identified. Minor editorial and formatting changes were also made; revision bars are provided in the left hand margin for these changes."

Engineering review of the changes found no changes to the test methodology, results or conclusions of the report.

Attachment 11 contains Westinghouse EQ-QR-39-WBT-NP, Revision 1, "Equipment Qualification Summary Report for WINCISE Signal Processing System," (Non-Proprietary). Attachment 12 contains Westinghouse CAW-11-3243 Application For Withholding Proprietary Information From Public Disclosure EQ-QR-39-WBT-P, Rev. 1, "Equipment Qualification Summary Report for WINCISE Signal Processing System (Proprietary)," dated September 7, 2011.

23. TVA Commitment

Provide corrected version of Westinghouse WNA-AR-00180-WBT-P, Revision 1.

Commitment Closure

As committed to in Enclosure 4 of TVA to NRC letter dated December 22, 2010 (Reference 4), Attachment 13 contains the corrected Westinghouse WNA-AR-00180-WBT-P, Revision 2, "Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System," (Proprietary). Attachment 14 contains Westinghouse WNA-AR-00180-WBT-NP, Revision 2, "Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System," (Non-Proprietary). Attachment 15 contains Westinghouse CAW-11-3117, Application For Withholding Proprietary Information From Public Disclosure WNA-AR-00180-WBT-P, Rev. 2, "Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System," (Proprietary), dated February 25, 2011.

24. TVA Commitment

The AAF calculation for Westinghouse setpoint methodology calculations in EEB-TI-28 for TSTF 493, will be revised to use the Square Root Sum of the Squares (SRSS) method.

Commitment Closure

As committed to in Enclosure 4 to TVA to NRC letter dated October 29, 2010 (Reference 9), EEB-TI-28, "Branch Technical Instruction, Setpoint Calculations," Appendix A, "Preparation of Setpoint and Scaling Documents," section 3.1.21, "Use of Westinghouse Methodology," was changed in Revision 8 as shown below:

For implementation of TSTF-493, the following calculation must be used for Acceptable as Found tolerances:

$$A_{nf}(\text{sensor}) = \sqrt{SD^2 + SCA^2 + SMTE^2}$$

$$A_{nf}(\text{rack}) = \sqrt{RD^2 + RCA^2 + RMTE^2 + RCSA^2}$$

Enclosure 2
TVA Letter Dated September 30, 2011
List of Attachments

Note: While project coversheets have not been included, all attachments have been reviewed and approved by Engineering prior to submittal.

1. Proprietary GA-ESI procedure OP-7.3-240, Revision K, “Safety-Related Commercial Grade Item Parts Acceptance” (Letter Item 1, SSER 23 Appendix HH Item 81)

2. Proprietary Westinghouse Electric Company Report DAR-ME-11-4-P, Revision 0, “Qualification Summary Report for the Ex-Vessel Portion of the WINCISE In-Core Instrumentation Thimble Assembly (IITA) for Watts Bar Unit 2.” (Letter Item 5, SSER 24 Proposed Appendix HH Item Number 126)

3. Non-proprietary Weed Instrument Qualification Report 16690-QTR, “Qualification Test Report For Environmental and Seismic Qualification of Weed Instrument Model DTN2010 Pressure Transmitters,” Revision 0 (Letter Item 19)

4. Ultra Electronics “Application for Withholding Proprietary Information from Public Disclosure - Document No.: Qualification Test Report No.: 16690-QTR Rev 0, Qualification Test Report For Environmental And Seismic Qualification Of Weed Instrument Model DTN2010 Pressure Transmitters” (Letter Item 19)

5. Demarcated proprietary version of GA-ESI test report 04508903-1TR, “Seismic Qualification Test Results RM-1000 and Current-to Frequency (I/F) Converter,” original release, dated April 1999 (Letter Item 20)

6. Non-proprietary version of GA-ESI test report 04508903-1TR, “Seismic Qualification Test Results RM-1000 and Current-to Frequency (I/F) Converter,” original release, dated April 1999 (Letter Item 20)

7. GA-ESI letter 4488, “Request by General Atomics Electronic Systems, Inc. to Withhold Certain Information from Public Disclosure under 10CFR2.390,” dated September 19, 2011 (Letter Items 20 and 21)

8. Demarcated proprietary version of GA-ESI test report 04508905-QR, “Qualification Test Report for RM-1000 Processor Module and Current-To-Frequency Converter,” Revision A (Letter Item 21)

9. Non-proprietary version of GA-ESI test report 04508905-QR, “Qualification Test Report for RM-1000 Processor Module and Current-To-Frequency Converter,” Revision A (Letter Item 21)

10. Westinghouse Electric Company EQ-QR-39-WBT-P, Revision 1, “Equipment Qualification Summary Report for WINCISE Signal Processing System,” (Proprietary) (Letter Items 7 and 22)

11. Westinghouse Electric Company EQ-QR-39-WBT-NP, Revision 1, “Equipment Qualification Summary Report for WINCISE Signal Processing System,” (Non-Proprietary) (Letter Item 22)

Enclosure 2
TVA Letter Dated September 30, 2011
List of Attachments

12. Westinghouse Electric Company CAW-11-3243 Application For Withholding Proprietary Information From Public Disclosure EQ-QR-39-WBT-P, Revision 1, “Equipment Qualification Summary Report for WINCISE Signal Processing System (Proprietary),” dated September 7, 2011 (Letter Item 22)

13. Westinghouse Electric Company WNA-AR-00180-WBT-P, Revision 2, “Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System,” (Proprietary) (Letter Item 23)

14. Westinghouse Electric Company WNA-AR-00180-WBT-NP, Revision 2, “Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System,” (Non-Proprietary) (Letter Item 23)

15. Westinghouse Electric Company CAW-11-3117 Application For Withholding Proprietary Information From Public Disclosure WNA-AR-00180-WBT-P, Rev. 2, “Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System,” (Proprietary),” dated February 25, 2011(Letter Item 23)

16. GA-ESI Responses to NRC Comments on General Atomics Procedure OP-7.3-240 (Letter Item 1)

17. Non-proprietary Westinghouse Electric Company DAR-ME-11-4-P, Revision 0, “Qualification Summary Report for the Ex-Vessel Portion of the WINCISE In-Core Instrumentation Thimble Assembly (IITA) for Watts Bar Unit 2.” (Letter Item 5)

18. Westinghouse Electric Company CAW-11-3253 “Application For Withholding Proprietary Information From Public Disclosure, DAR-ME-11-4-P, Rev. 0, Qualification Summary Report for the Ex-Vessel Portion of the WINCISE Incore Instrumentation Thimble Assembly (UTA) for Watts Bar Unit 2 (proprietary).” (Letter Item 5)

Enclosure 3
TVA Letter Dated September 30, 2011
List of References

1. TVA to NRC letter dated July 31, 2010, “Watts Bar Nuclear Plant (WBN) Unit 2 – Final Safety Analysis Report (FSAR) – Response to Preliminary Requests for Additional Information and Requests For Additional Information” (Letter Item 19)

2. TVA to NRC letter dated September 1, 2011, “Watts Bar Nuclear Plant (WBN) Unit 2 – Instrumentation and Controls Staff Information Requests” (Letter Items 7 and 22)

3. TVA to NRC letter dated March 31, 2011, “Watts Bar Nuclear Plant (WBN) Unit 2 – Instrumentation and Controls Staff Information Requests” (Letter Item 20)

4. TVA to NRC letter dated December 22, 2010, “Watts Bar Nuclear Plant (WBN) Unit 2 – Instrumentation and Controls Staff Information Requests” (Letter Item 23)

5. TVA to NRC letter dated May 6, 2011, “Watts Bar Nuclear Plant (WBN) Unit 2 – Instrumentation and Controls Staff Information Requests” (Letter Item 4 SSER 24 Proposed Appendix HH Item Number 125)

6. TVA to NRC letter dated February 25, 2011, “Watts Bar Nuclear Plant (WBN) Unit 2 – Instrumentation and Controls Staff Information Requests” (Letter Item 21)

7. TVA to NRC letter dated March 12, 2010, “Watts Bar Nuclear Plant (WBN) Unit 2 - Additional Information Regarding Final Safety Analysis Report (FSAR), Chapter 7, ‘Instrumentation and Controls’ Review” (Letter Item 21)

8. NRC to TVA letter dated September 21, 2011, “Watts Bar Nuclear Plant, Unit 2 - Request for Additional Information Regarding Supplemental Safety Evaluation Report Open Item 80 (TAC No. ME0853),” ML112590046 (Letter Items 8 through 15)

9. TVA to NRC letter dated October 29, 2010 “Watts Bar Nuclear Plant (WBN) Unit 2 – Instrumentation and Controls Staff Information Requests” (Letter Item 24)

10. TVA to NRC letter dated April 15, 2011 “Watts Bar Nuclear Plant (WBN) Unit 2 – Instrumentation and Controls Staff Information Requests” (Letter Item 14)

Enclosure 4
TVA Letter Dated September 30, 2011
List of New Regulatory Commitments

1. The non-proprietary version and affidavit for withholding for GA procedure OP-7.3-240, Revision K, “Safety-Related Commercial Grade Item Parts Acceptance,” will be submitted by December 1, 2011. (Letter Item 1, SSER 23 Appendix HH Item 81)

2. A white paper describing the GA commercial grade dedication program and how it conforms to current regulatory requirements is being prepared and will be submitted after it is received from GA. (Letter Item 1, SSER 23 Appendix HH Item 81)

3. A qualification report for the incore portion of the IITA will be submitted within two weeks of receipt from Westinghouse. (Letter Item 5, SSER 24 Proposed Appendix HH Item Number 126)

4. Responses to NRC items 1 and 2.i of NRC RAI letter to TVA dated September 21, 2011 (Reference 8) will be provided within two weeks of receipt from GA-ESI. (NOTE prior to Letter Item 7)