

NRR-PMDAPEm Resource

From: Lingam, Siva
Sent: Thursday, February 27, 2014 3:15 PM
To: garent@tva.gov; rhbryan@tva.gov
Cc: Quichocho, Jessie; Poole, Justin; Regner, Lisa; Mathew, Roy; Matharu, Gurcharan; Dion, Jeanne; Zimmerman, Jacob
Subject: RE: Watts Bar 2 - Open Phase and Open Item 30 RAIs (DVR Setpoint)
Attachments: Watts Bar 2 - open phase and Open item 30 RAI RKM comments incorporated.....docx

Attached please find the final RAIs from our Electrical Engineering Branch on the subject matter. Please provide your responses within 30 days.

From: Lingam, Siva
Sent: Monday, February 24, 2014 11:20 AM
To: garent@tva.gov; rhbryan@tva.gov
Cc: Quichocho, Jessie; Poole, Justin; Regner, Lisa; Mathew, Roy; Matharu, Gurcharan
Subject: FW: Watts Bar 2 - open phase and Open item 30 RAI (DVR Setpoint) - DRAFT ONLY

Attached please find the draft RAIs from our Electrical Engineering Branch on the subject matter. These RAIs are not checked, however, I am sending these draft RAIs to buy you more time for the responses. Official RAIs will follow later.

Hearing Identifier: NRR_PMDA
Email Number: 1131

Mail Envelope Properties (Siva.Lingam@nrc.gov20140227151500)

Subject: RE: Watts Bar 2 - Open Phase and Open Item 30 RAIs (DVR Setpoint)
Sent Date: 2/27/2014 3:15:22 PM
Received Date: 2/27/2014 3:15:00 PM
From: Lingam, Siva

Created By: Siva.Lingam@nrc.gov

Recipients:

"Quichocho, Jessie" <Jessie.Quichocho@nrc.gov>
Tracking Status: None
"Poole, Justin" <Justin.Poole@nrc.gov>
Tracking Status: None
"Regner, Lisa" <Lisa.Regner@nrc.gov>
Tracking Status: None
"Mathew, Roy" <Roy.Mathew@nrc.gov>
Tracking Status: None
"Matharu, Gurcharan" <Gurcharan.Matharu@nrc.gov>
Tracking Status: None
"Dion, Jeanne" <Jeanne.Dion@nrc.gov>
Tracking Status: None
"Zimmerman, Jacob" <Jacob.Zimmerman@nrc.gov>
Tracking Status: None
"garent@tva.gov" <garent@tva.gov>
Tracking Status: None
"rhbryan@tva.gov" <rhbryan@tva.gov>
Tracking Status: None

Post Office:

Files	Size	Date & Time
MESSAGE	679	2/27/2014 3:15:00 PM
Watts Bar 2 - open phase and Open item 30 RAI RKM comments incorporated.....docx		
28837		

Options

Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

WATTS BAR NUCLEAR PLANT UNIT 2 (WBN-2) ELECTRICAL OPEN ITEMS
REQUEST FOR ADDITIONAL INFORMATION FOR FSAR SECTION 8.3
NRR/DE/EEEB (TAC NO. ME2731)

The staff of the Electrical Engineering Branch (EEEB) of the Division of Engineering has previously requested information on open items associated with NUREG-0847 Supplemental Safety Evaluation Report (SSER) Related to the Operation of Watts Bar Nuclear Plant, Unit 2. In order to complete the review and close these items, the staff requests additional information from the licensee, as described below:

BACKGROUND

In letter dated June 7, 2012, Tennessee Valley Authority (TVA) provided response to Open Item 30 (Power System Degraded Voltage) with respect to SSER Appendix HH

The response states that the methodology used in this study was developed to meet the intent of Regulatory Issue Summary (RIS) 2011-12, "Adequacy of Station Electrical Distribution System Voltages".

The RIS states "The licensee's voltage calculations should provide the basis for proper operation of the plant safety-related electrical distribution system, *when supplied from the offsite circuit(s) (from the transmission network) (emphasis added)*. These calculations should demonstrate that the voltage requirements (both starting and running voltages) of all plant safety-related systems and components are satisfied based on operation of the transmission system (including the bounding transmission system single contingency in terms of voltage drop) and the plant onsite electric power system during all operating configurations of transmission network and plant systems.

The TVA response further states that to perform the analysis, the 6.9 kV shutdown boards were *disconnected* from all offsite power source(s) and a dedicated fixed voltage source was added to each 6.9 kV shutdown board (6.9 kV shutdown board was used as a swing bus). The source voltage was set to the DVR analytical dropout limit of 6555 V.

QUESTION 1

Based on the above statements:

- a) Please explain how disconnecting the shutdown boards from offsite power source(s) meets the intent of guidance provided in the RIS section cited above.
- b) Please explain how the voltage drop through station services transformers (CSST A, B, C and D) is accounted for during block starting or sequential starting of emergency loads in the analyses provided?
- c) If the shutdown bus is considered a 'dedicated fixed voltage source' or a swing bus, then please confirm that the calculation process assumes the swing bus to be an

infinite source of real and reactive power. If not, provide basis for the assumption used.

- d) From bus voltage perspective, discuss how this simulation depicts the dynamic response capabilities of the shutdown boards compared to the real and reactive power demand of motor starts postulated during accident conditions with offsite source(s) supplying power through CSST A, B, C and D including all worst-case operating and loading configurations.

QUESTION 2:

The analyses states that for contactors, relays and solenoid valves, adequacy of pickup voltage was performed as part of the Control Circuit Voltage Drop (CCVD) analysis. This analysis was performed considering a steady state minimum voltage of 432V at the motor control center (MCC) bus. Please confirm that 432V is the minimum voltage required for operability of all equipment (minimum voltage required at component terminal) with nominal operating voltage of 480V and lower (230/120V) voltage systems supplied from the 480V system.

QUESTION 3

The analyses states that the MCC transient bus voltage under degraded voltage conditions (at DVR dropout voltage of 6555V) drops below 432V due to starting of large motors on the 480V switchgear and recovers to a value of >432V within 4 seconds. Please confirm that the duration and magnitude of voltage drop and recovery during block starting of all safety related loads and sequenced start of loads remains within the acceptable range without actuating any protective devices (accident analyses perspective) if the 6.9kV busses remain connected to the 161kV offsite power source through the CSSTs.

QUESTION 4

Calculation Number WBN-EEB-EDQ000-999-2007-0002 1 submitted in response to preliminary request for additional information regarding Unit 2 licensing process states the following:

“One 161 kV transmission line and CSSTs A and D, or the other transmission line and CSSTs B and C, shall be capable of starting and running all required safety-related loads and powering all running BOP loads for a design basis accident in one unit and orderly shutdown of the other unit. The analysis for the Class 1 E power system shall evaluate all equipment that is started by a safety injection signal (SIS) as starting at the same time unless the load's control circuitry has sequential time delay, and that all continuous loads that could be operating as required by the process, whether safety-related or not, are running. The analyses in this calculation evaluate the starting of the equipment required to mitigate an accident in accordance with the above requirements for one Unit and simultaneous orderly shutdown of the other unit. The worst case bases for this evaluation is assuming a 161 kV grid pre-event voltage of 164KV and a subsequent 161 kV grid drop of 9kV at event initiation resulting in a post event 161kV

grid voltage of 153kV. The analyses shows that all equipment required to start to mitigate an accident receive adequate starting voltage within the time period (5 seconds) of Reference 2.16 for the cases when both CSST C and D are available and also when only one CSST (either C or D) is available.”

Enclosure 1 attached to TVA letter dated July 31, 2010, provided similar information (reference pages E1-63 and 64) regarding the capability of the electrical power system described in FSAR Section 8.1. Please clarify that the impact of the voltage drop in the 161kV system coupled with the voltage drop in CSSTs during block loading of accident loads is accounted for in the degraded voltage relay setpoint calculation performed in accordance with the recommendations of RIS 2011-12.

QUESTION 5

- 1) In response to NRC letter dated December 20, 2013, for resolving open phase condition (OPC) design vulnerability within electric system at Watts Bar 2, TVA stated that:

Vulnerability studies of the OPC faults have been completed for WBN and additional operator meetings are being scheduled to communicate the results. For the analyzed configurations, the vulnerability studies showed existing protection automatically actuates and provides protection to the Class-1E system for grounded open phase conditions. Vulnerability to an ungrounded open phase condition has been identified for some analyzed configurations.

The TVA nuclear fleet has endorsed the generic schedule provided in the Industry OPC Initiative.

To resolve the OPC design vulnerability at Watts Bar 2, staff requests that TVA provide design features and analyses information in the Final Safety Analysis Report to automatically detect and alarm in the main control room for OPC with and without a high impedance ground condition including two open phase condition on the high voltage side of a transformer connecting a credited GDC-17 offsite power circuit to the transmission system. For OPC, automatic detection and actuation circuits will transfer loads required to mitigate postulated accidents to an alternate power source and ensure that safety functions are preserved, as required by the current licensing bases. The OPC should be sensitive enough to identify an open phase condition under all operating electrical system configurations and loading conditions for which they are required to be operable and should minimize misoperation, maloperation, and spurious actuation. In addition, the staff requests TVA to address the limiting conditions of operation and surveillance requirements that must be added to the plant Technical Specifications to meet the provisions of 10CFR50.36 (c) (2) and c(3).

The above information is required from TVA for staff to reach the necessary safety conclusion that the electrical power system for Watts Bar Unit 2 design meets the 10 CFR Part 50, Appendix A, GDC 17, 10 CFR 50.55a(h)(2), and 10 CFR 50.36 requirements with respect to

addressing electric power system design vulnerability due to OPC which could affect the safety functions of both onsite and offsite power systems.