WBN2Public Resource

From: Hamill, Carol L [clhamill@tva.gov]
Sent: Friday, September 17, 2010 2:05 PM
To: Wiebe, Joel; Raghavan, Rags; Milano, Patrick; Campbell, Stephen
Cc: Crouch, William D; Arent, Gordon; Stockton, Rickey A; Boyd, Desiree L
Subject: 9-17-10_Integrated Safeguards Testing letter to NRC
Attachments: image001.jpg; 9-17-10_Integrated Safeguards Testing letter to NRC_FINAL.pdf

Please see attached TVA letter to NRC sent to the Document Control Desk today.

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U.S. Nuclear Regulatory Commission
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Washington, D.C. 20555-0001

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

Subject: **WATTS BAR NUCLEAR PLANT (WBN) UNIT 2 – INTEGRATED SAFEGUARDS TESTING INFORMATION**

Reference: NRC Letter dated August 11, 2010, "Summary of August 3, 2010, Meeting with Tennessee Valley Authority regarding Watts Bar Nuclear Plant, Unit 2, Final Safety Analysis Report"

The purpose of this letter is to provide follow-up information related to Unit 2 Integrated Safeguards Testing Plan discussed at a meeting between NRC and TVA held at NRC Headquarters in Rockville, Maryland, on August 3, 2010 (Reference). Enclosure 1 provides this additional information regarding TVA's planned approach to perform this testing for Unit 2. Since this planned approach will be used for test scheduling, TVA requests NRC feedback by October 15, 2010. In addition, responses to specific items which pertain to testing contained in the Reference cover letter are addressed in Enclosure 2.

No new commitments are made by this submittal. If you have any questions, please contact William Crouch at (423) 365-2004.

I declare under the penalty of perjury that the foregoing is true and correct. Executed on the 17th day of September 2010.

Sincerely,

M. Bajestani

Masoud Bajestani
Watts Bar Unit 2 Vice President

Enclosures:

1. Integrated Safeguards Testing Information
2. NRC Items in August 11, 2010, Letter Related to Testing

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ENCLOSURE 1
WATTS BAR NUCLEAR PLANT (WBN) UNIT 2
INTEGRATED SAFEGUARDS TESTING INFORMATION

Summary

As part of the Unit 2 preoperational testing program, WBN Unit 2 must demonstrate that Unit 2 has satisfied the test requirements of Regulatory Guide 1.41, "Preoperational Testing of Redundant Onsite Electric Power Systems to Verify Proper Load Group Assignments," and in accordance with the WBN Final Safety Analysis Report (FSAR) Table 14.2-1. Specifically, the regulatory guide requirements are as follows:

- Regulatory Guide 1.41, Section B, states: "As a minimum, a suitable test should assure that each redundant onsite power source and its load group can function without any dependence upon any other redundant load group or portion thereof."

- Regulatory Guide 1.41, Section C, paragraph 3 states: "During each test, the d-c and onsite a-c busses and related loads not under test should be monitored to verify absence of voltage at these busses and loads."

The independence of the electrical distribution system from each of the emergency diesel generators (EDGs) to its respective 6.9-kV shutdown board and from the 6.9-kV shutdown boards to the Unit 1 and common respective loads required for Unit 1 operation was verified as part of the Unit 1 pre-operational testing. Accordingly, the Unit 2 testing will only need to test those Unit 2 loads neither previously connected nor tested to demonstrate functional independence during simulated accident conditions. Further details of how TVA has previously satisfied these requirements of Regulatory Guide 1.41 for Unit 2 are discussed below:

System Description

The plant's safety-related loads are arranged electrically into four power trains, two for each nuclear unit. The four trains are grouped into two load groups, A and B. These load groups are further divided into Unit 1 loads (A and B) and Unit 2 loads (A and B) which are strictly independent of one another.

Unit	Power Train	Load Groups
1	1A	A
	1B	B
2	2A	A
	2B	B

A power train includes an EDG, a 6.9-kV shutdown board, and the lower voltage load and distribution system. Two EDGs and one load group (1A and 2A or 1B and 2B) can provide safety-related functions to mitigate a loss-of-coolant accident in one unit and safely shut down the other unit. Each power train of each unit has access to a diesel generator (DG) (standby source) and has access to each of the two preferred offsite sources.

The 125 VDC distribution system is a safety-related system which receives power from four independent battery chargers and four 125V dc batteries and distributes it to safety-related loads and non-safety-related loads of both units. The 120 VAC distribution system receives power from eight independent inverters and distributes it to the safety-related loads of both units. These systems are described in FSAR Sections 8.2 and 8.3.

Previously Performed Unit 1 Testing

The testing performed during Unit 1 startup successfully verified independence of the four power trains from the EDGs to their respective 6.9-kV shutdown boards. The testing did not include Unit 2 loads which had been isolated at their respective interface points. When TVA made the decision to delay the completion of Unit 2, the Unit 2 Class 1E busses and onsite standby power sources (EDG 2A and 2B), determined to be required for Unit 1 operation, were included in the Unit 1 Technical Specifications. Examples of common loads powered from the Unit 2 boards are the Essential Raw Cooling Water pumps (two per board), and other loads on the Unit 2 480V Shutdown Boards which are powered from the Unit 2 6.9-kV Shutdown boards. These lower 480V boards also have loads required for Unit 1 operation, such as Component Cooling Water pumps and 125V Vital Battery Chargers.

As stated previously, the Unit 1 preoperational testing program satisfied (train) independence test requirements of Regulatory Guide 1.41, "Preoperational Testing of Redundant Onsite Electric Power Systems to Verify Proper Load Group Assignments," Paragraph B and C, and in accordance with the WBN FSAR Table 14.2-1. Specifically, this testing was performed under preoperational test instruction 1-PTI-262-01, "Unit 1 Integrated Safeguards Test," which satisfied the same regulatory guide requirements as described below:

- Regulatory Guide 1.41, Section B, states: "As a minimum, a suitable test should assure that each redundant onsite power source and its load group can function without any dependence upon any other redundant load group or portion thereof."

- Regulatory Guide 1.41, Section C, paragraph 3 states: "During each test, the d-c and onsite a-c busses and related loads not under test should be monitored to verify absence of voltage at these busses and loads."

During the Unit 1 testing, one train of power and associated equipment (pumps, fans, etc.) were left functional. For the purpose of discussion, this train will be referred to as the "tested train." At the same time, the other train of power is disabled. This second train will be referred to as the "non-tested" train. Once the tested train is demonstrated to operate independent of the non-tested train, the role of each train is reversed and the test repeated.

The Unit 1 pre-test alignments consisted of:

- Disabling all non-tested onsite standby DGs such that no normal or emergency start signal would start that train of DGs;

- Disabling output of the non-tested train of Solid State Protection System to prevent any inadvertent repositioning of a component on the non-tested train;

- De-energizing all Unit 1, Unit 2, and Common non-Class 1E AC and DC power supplied from the auxiliary station service;

- De-energizing all non-tested Load Group Class 1E AC and DC distribution boards;

- Conducting a voltage survey to verify all Class 1E boards not under test are de-energized prior to actuation of loss of offsite power or an accident signal to the tested distribution train to ensure all busses were de-energized appropriately.

As each test configuration was established for the load group being tested, the components being tested were verified to be in their normal "operational" position. A manual Safety Injection (SI) signal coincident with a Loss of Offsite Power (LOOP) was then initiated for the Load Group under test. Components for the load group under test were then verified to go to or be in the required safeguards state (e.g., pumps running, fans running, associated DG running, valves open or closed as required, etc.). Support equipment was verified to be running. Each train's associated accident signals generated from the manual SI actuation (Auxiliary Building Isolation, Containment Ventilation Isolation, Control Room Isolation, Hi-Hi Containment Pressure, Main Feedwater Isolation) were verified for proper indication and actuation of associated train components. In addition, starting sequences and required response times for the accident loads were checked and logged for proper position/running. In the case of the onsite standby DG, the starting sequence, loading times, and verification of proper voltage and frequency were verified on recording devices established to provide for permanent record of test acceptance criteria.

During the test of each load group, the non-test load group was also surveyed to verify that no electrical board was energized from the load group under test. Load group independence was verified by the absence of voltage on the non-tested group for both the AC and DC busses of the Class 1E distribution systems as required by Regulatory Guide 1.41. Both load groups were successfully tested and met acceptance criteria without exception. Noted deficiencies were investigated and resolved with follow-up testing as required to meet acceptance criteria. At no time did any noted deficiency cause load group independence to be questioned.

In addition, busses having a potential to be energized from the offsite transmission network were isolated prior to the test. These busses were verified to remain de-energized during each load group test, only being reenergized in accordance with the test instruction at the times planned for in the test sequence. Preoperational testing of the Class 1E distribution systems and the Onsite Standby power sources complied with Unit 1 FSAR Amendment 91, Section 14.2, "Test Program," for the Integrated Engineered Safety Features Actuation System (Sheet 26 and 27 of 90) and DGs (Sheet 44 and 45 of 90).

Based on the previously performed Unit 1 testing, it is TVA's position that the only Unit 2 equipment to be tested will be those Unit 2 loads neither previously connected nor tested in order to demonstrate functional independence during simulated accident conditions to satisfy the Regulatory Guide 1.41 requirements.

Previous Unit 1 Testing Remains Valid

The following provides a basis for TVA's position that the previous Unit 1 testing performed prior to Unit 1 licensing remains valid to support the independence of the Unit 2 electrical system.

<u>System Maintenance</u>

To ensure the previous preoperational testing remains valid, a review was performed of the following documents/surveillances:

- 1-PTI-262-01, “Unit 1 Integrated Safeguards Test”
- System Description, N3-82-4002, “Standby Diesel Generator System”
- FSAR Chapter 8, “Electric Power”
- Surveillance Instruction, 0-SI-82-3, “18 Month Loss of Offsite Power with Safety Injection - DG 1A-A”
- Surveillance Instruction, 0-SI-82-4, “18 Month Loss of Offsite Power with Safety Injection - DG 1B-B”
- Surveillance Instruction, 0-SI-82-5, “18 Month Loss of Offsite Power with Safety Injection - DG 2A-A”
- Surveillance Instruction, 0-SI-82-6, “18 Month Loss of Offsite Power with Safety Injection - DG 2B-B”

Since the initial preoperational testing performed by Unit 1, the four trains (Unit 1 and Unit 2) of Class 1E busses and the four onsite standby DG systems have been maintained and tested to the surveillance requirements established in accordance with Unit 1 Technical Specifications, Section 3.8., Electrical Power Systems, and System Description N3-82-4002, Standby Diesel Generator System. The four onsite standby power sources are in compliance with Regulatory Guide 1.9, Application and Testing of Safety-Related Diesel Generators in Nuclear Power Plants, as noted in the System Description.

An additional assurance that each train remains independent is that over the life of the plant to this date, periodic maintenance has been performed on the trains and standby power sources. During each Unit 1 refueling outage, each train of Class 1E distribution boards, with the associated standby power source, has successfully completed required surveillance testing. These outage surveillances perform “Blackout” tests which de-energize the train 6.9-kV bus, initiate accident signals, verify proper load stripping, standby power source starting, loads sequencing on, verification of required component responses and indications. These verifications provide assurance that each train is capable of providing the engineered safety features functionality as required for a single train. The test for each train also assures that systems that are common to both Unit 1 and Unit 2 will actuate and reposition to the required safeguards state regardless of the source of power to the common system (e.g., Auxiliary Building Gas Treatment system).

For the purpose of maintaining the trained Class 1E distribution boards and standby power sources, periodic maintenance requires the busses and DGs be removed from service. The method for removing the component busses and DGs is to apply clearances (hold orders) which de-energize, isolate, and otherwise make inoperable and unavailable the trained equipment. The standby power sources may be removed from service with the unit at power adhering to Unit 1 Technical Specifications. The Class 1E distribution boards are removed from service during planned outages inside refueling outage periods. Independence is further illustrated by these planned outages having no impact on the remaining Class 1E distribution systems and onsite power sources.

Design Changes

Since the preoperational testing of the Class 1E busses and onsite standby power sources for Unit 1, design changes to the power system have been limited to a series of changes to the Class 1E 120 VAC vital inverters resulting in the addition of a spare inverter. The vital inverter configuration at the time of integrated safeguards testing of Unit 1 consisted of one vital inverter feeding each 120 Vital Instrument Power Board with four inverters for Unit 1, 1-I, 1-II, 1-III, and 1-IV, and four Inverters for U2, 2-I, 2-II, 2-III, and 2-IV. This configuration was tested according to Regulatory Guide 1.41, and all acceptance criteria were met. The 120 VAC and 125 VDC electrical boards were de-energized except the train/channel under test. Each electrical board remaining energized was successfully tested and performed its safety function.

Since that time, there have been an additional series of related design changes made to the 120 VAC vital power system. The original inverters have been replaced with more reliable inverters, incorporating static switches. Additionally, each channel of the Unit 1 and Unit 2 inverters originally shared the same feeder from a common electrical disconnect; now each inverter is fed separately from a separate cable and a separate disconnect. This configuration provides the ability to completely isolate or "spare out," if required, each channel's inverter without disturbing the opposite unit inverter.

The current plant configuration also allows placing in service a spare inverter for either unit on any channel. There are four spare inverters, 0-I, 0-II, 0-III, and 0-IV, which provides the ability to remove from service one of the normal channel inverters for each channel or unit. For example, Spare Inverter 0-I may be placed in service for either 120 VAC Vital Inverter 1-I or 2-I, but not both inverters at one time.

The process used to implement changes to the 120 VAC Vital Power system is an approved design change process, SPP-9.3, "Plant Modifications and Engineering Change Control." This design change process required license amendment requests to the site Technical Specifications prior to implementation (subsequently approved by Amendments 45 [September 8, 2003] and 76 [March 24, 2009]) and changes to Safety Analysis Report after implementation of each of the design change made to the plant configuration.

The channel alignment of the 125 VAC Vital Busses and inverters is in the same configuration that was present during the Unit 1 preoperational testing, with each inverter supplying an individual channel for each unit. The postmodification testing verified the various transfers and load carrying capabilities by channel. This testing provides assurance that the channels are configured to the proper channel for each unit and assures that they are independent and in the same alignment as was present during Unit 1 preoperational testing.

Today, except as discussed above, the design of the station onsite standby power sources and the Class 1E distribution systems remain virtually unchanged from the original design tested previously for Unit 1. No changes have been made that would invalidate the independence of each train. Feeders, both normal and alternate, remain the same as the original design. Transfer schemes, as well as the LOOP schemes (degraded and low voltage transfer schemes), remain the same for all Class 1E busses as originally designed for all four trains and DGs.

In conclusion, Unit 1 preoperational tests conducted prior to Unit 1 licensing and fuel load remain valid for present plant operating conditions and continue to prove that the four trains and onsite standby power sources remain independent of each other. Each load group is capable of performing its intended function without reliance on the opposite load group. Loads on the Unit 2 Class 1E boards that have been designated as "required for Unit 1 operations" have been maintained "TS" operable, meeting Unit 1 surveillances.

Therefore, as previously stated, it is TVA's position that the only Unit 2 equipment to be tested will be those Unit 2 loads neither previously connected nor tested in order to demonstrate functional independence during simulated accident conditions to satisfy the Regulatory Guide 1.41 requirements.

Remaining Unit 2 Testing

The only remaining Unit 2 testing that TVA needs to perform is strictly to demonstrate that Unit 2 equipment not previously connected will independently perform its simulated accident functions. The remaining Unit 2 equipment, which has been maintained disconnected for Unit 1 operation, will be connected to support Unit 2 operation. The Unit 1/2 interface boundary program has ensured that the loads have remained disconnected to ensure the integrity of the previous test conclusions. These interface boundaries have provided the control method of ensuring that any component not required for Unit 1 operation would not be inadvertently connected to Class 1E busses.

The Unit 2 Preoperational Test Program Instructions have been written to reflect this approach. Testing will be conducted in accordance with the following instructions:

- 2-PTI-262-01, Integrated Safeguards Test, Train 2A
- 2-PTI-262-02, Integrated Safeguards Test, Train 2B

This testing will be conducted in a manner to accomplish two goals: (1) to demonstrate functional independence of the Unit 2 equipment, and (2) to perform the testing in a manner to safeguard the operating Unit 1 while the Unit 2 testing occurs. This approach will entail the following:

1. Only one Unit 2 power train will be tested at a time.

2. Unit 2 loads or components for the train not under test will be removed from service or disabled such that the components will not actuate and respond. This action will be taken to ensure that only the train under test, receiving the accident signal, and the associated trained components, properly respond as required. For example, while testing Train 2A, the Train 2B safeguard components 2B Charging Pump, Safety Injection Pump, Residual Heat Removal Pump, will be disabled by racking down the 6.9-kV Shutdown Board load breakers thereby removing any possibility of the pumps starting.

3. Class 1E electrical distribution systems will remain energized and operable to satisfy Unit 1 Technical Specifications, as required, since the train independence testing required by Regulatory Guide 1.41 has previously been satisfied for both Unit 1 and Unit 2.

Simulated accident signals and de-energizing of the train under test will be initiated manually. Should an event occur on Unit 1, restoration of the Unit 2 train under test will be a simple operator-initiated manual action to energize the train under test and restore the safety-related function. As part of the planned testing, it will be proven that an accident signal will separate the onsite standby power source from the Class 1E distribution systems and place it in a mode of operation (isochronous) to accept the accident loads as required.

Conclusion

For Unit 2, WBN will completely satisfy the requirements of Regulatory Guide 1.41 by the previous performance of the Unit 1 Independence Load Group tests in 1-PTI-262-01 coupled with the remaining testing of the Unit 2 equipment. It is TVA's position that this approach will be taken to demonstrate compliance with Regulatory Guide 1.41 requirements, but requests NRC concurrence that this test approach is acceptable to the Staff.

References:

1. NRC to TVA dated August 11, 2010, "Summary of August 3, 2010, Meeting with Tennessee Valley Authority Regarding Watts Bar Nuclear Plant, Unit 2, Final Safety Analysis Report"

2. 1-PTI-262-01, Unit 1 Integrated Safeguards Test

3. FSAR Chapter 14

4. Unit 1 Technical Specifications

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN) UNIT 2
NRC ITEMS IN AUGUST 11, 2010 LETTER RELATED TO TESTING

Item 1:

"TVA described the manner by which the onsite and offsite emergency electrical power systems were tested during the integrated safeguards test for WBN Unit 1 prior to initial licensing. TVA indicated that the WBN Unit 1 testing was done in accordance with the guidance in NRC Regulatory Guide 1.41, "Preoperational Testing of Redundant Onsite Electric Power Systems to Verify Proper Load Group Assignments." TVA also stated that all electrical busses associated with the four load groups were tested at the time. Therefore, TVA plans to propose a modification to the integrated safeguards test plan to use portions of the WBN Unit 1 test instead of conducting the same testing for Unit 2."

Item 2

"In response to a staff question, TVA stated that it would review the functional testing of associated circuits and conduct functional performance of loads. Using this approach, TVA stated that WBN Unit 1 would not need to be shut down during the testing. The NRC staff stated that since the Unit 2 loads were not imposed on the power supplies during testing of Unit 1, TVA needs to be assured that the Unit 1 test remains valid for both offsite and onsite power."

TVA Response to Items 1 & 2:

For onsite testing, refer to Enclosure 1. Offsite power is not within the scope of Regulatory Guide 1.41.

Item 3:

"Because of the modification to incorporate a new inverter bank, TVA will have to test for the independence of the new inverters between the units."

TVA Response to Item 3:

Refer to the design change discussion in Enclosure 1 for inverter changes.

Item 4

"Also, the NRC staff stated that TVA would have to demonstrate the capability of each common station service transformer to carry the load required to supply engineered safety feature loads on WBN Unit 2 under loss of coolant accident conditions in addition of power required for safe shutdown of WBN Unit 1."

TVA Response to Item 4:

WBN is committed to verifying that the Common Station Service Transformers C and D (preferred offsite power supply) have the capacity of providing power to both Unit 1 and Unit 2 during an accident event involving either unit, with the opposite unit achieving a safe and orderly shutdown to Mode 5, Cold Shutdown. Amendment 100 to the Unit 2 FSAR has added the requirements for the testing.