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

CNL-15-084

December 8, 2015

10 CFR 50.90

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

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

Watts Bar Nuclear Plant, Unit 2
Facility Operating License No. NPF-96
NRC Docket No. 50-391

Subject: **Request for License Amendments – Diesel Generator Completion Time Extension for Technical Specification 3.8.1, "AC Sources – Operating" (TS-WBN-15-09)**

References:

1. Letter from NRC to TVA, "Watts Bar Nuclear Plant, Unit 1 – Issuance of Amendment Regarding the Completion Time for the Inoperable Emergency Diesel Generator(s) (TAC No. ME2985)," dated July 6, 2010 [ML101390154]

2. Letter from NRC to TVA, "Watts Bar Nuclear Plant, Unit 1 – Issuance of Amendment Regarding Technical Specification 3.8.1, 'AC [Alternating Current] Sources – Operating' Surveillance Requirements Notes (TAC No. ME6980)," dated November 22, 2011 [ML11234A258]

In accordance with the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) 50.90, "Application for amendment of license, construction permit, or early site permit," Tennessee Valley Authority (TVA) is submitting a request for an amendment to the Watts Bar Nuclear Plant (WBN) Unit 1 Facility Operating License No. NPF-90, and to WBN Unit 2 Facility Operating License No. NPF-96. The proposed amendment revises WBN Units 1 and 2 Technical Specifications (TS) 3.8.1, "AC Sources – Operating," to extend the Completion Time (CT) for one inoperable Diesel Generator (DG) from 72 hours to 14 days based on availability of an alternate alternating current (AC) power source (i.e., a 6.9 kilovolt (kV) FLEX DG).

The proposed amendment represents a risk-informed licensing change, and has been developed using the guidelines established in Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," and Regulatory Guide 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications."

In addition, two changes are being proposed to clarify changes made to WBN Unit 1 TS 3.8.1 with Amendment No. 84 (Reference 1) and Amendment No. 89 (Reference 2). Amendment No. 84, in part, removed the allowance to substitute the C-S DG for any of the required DGs. With the removal of this allowance, the remaining DGs are all required. Therefore, it is no longer necessary to refer to the DGs as "required DGs" in the TS 3.8.1 Conditions and Required Actions. Amendment No. 89 revised several TS 3.8.1 Surveillance Requirement (SR) Notes to allow performance of the SRs on WBN Unit 2 6.9 kV shutdown boards and DGs while WBN Unit 1 is operating in Modes 1, 2, 3 and 4. However, the amendment created a potential conflict between the requirements of SR 3.8.1.19 and the Note modifying SR 3.8.1.19. As currently written, the SR could be read to only allow its performance when WBN Units 1 and 2 are in Mode 5, Mode 6, or are defueled. The proposed change clarifies the SR to remove the potential conflict.

A related WBN Unit 2 TS Bases change is also included. When revising the WBN Unit 2 TS Bases to include Bases Table 3.8.1-2, a difference between WBN Unit 1 and Unit 2 Bases Table 3.8.1-2 was identified associated with contingency actions for SR 3.8.1.14, which verifies each DG can operate for 24 hours. The contingency actions included in the WBN Unit 1 TS Bases are being added to the WBN Unit 2 TS Bases.

Enclosure 1 provides a description and technical basis for the proposed changes. Attachments 1 and 2 to Enclosure 1 provide the WBN Units 1 and 2 TS and Bases pages marked-up to show the proposed changes. Attachments 3 and 4 to Enclosure 1 provide the WBN Units 1 and 2 TS and Bases pages retyped to show the proposed changes. Attachment 5 provides a WBN electrical diagram indicating the location where the alternate AC power source interconnects with the existing electrical system.

Enclosure 2 provides a risk-informed, probabilistic evaluation of the DG CT extension. Enclosure 3 provides a discussion of this submittals implementation of the guidance contained in NRC Branch Technical Position 8-8, "Onsite (Emergency Diesel Generators) and Offsite Power Sources Allowed Outage Time Extensions." Enclosure 4 provides a list of new regulatory commitments associated with this change.

TVA has determined that there are no significant hazards considerations associated with the proposed change and that the change qualifies for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9).

The WBN Plant Operations Review Committee and the TVA Nuclear Safety Review Board have reviewed this proposed change and determined that operation of WBN in accordance with the proposed change will not endanger the health and safety of the public.

Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and the enclosures to the Tennessee Department of Environment and Conservation.

TVA requests that this amendment be approved by May 1, 2016, with implementation within 60 days of receipt of the approved amendment.

Please address any questions regarding this request to Gordon Arent at 423-365-2004.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 8th day of December 2015.

Respectfully,

J. W. Shea

Digitally signed by J. W. Shea
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J. W. Shea
Vice President, Nuclear Licensing

Enclosures:

1. Evaluation of Proposed Change
2. Watts Bar Nuclear Plant Risk-Informed Extension of Diesel Generator Allowed Outage Time
3. Implementation of Branch Technical Position 8-8, "Onsite (Emergency Diesel Generators (EDGs)) and Offsite Power Sources Allowed Outage Time Extensions"
4. List of New Regulatory Commitments

cc (Enclosures):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Watts Bar Nuclear Plant, Unit 1
NRC Senior Resident Inspector - Watts Bar Nuclear Plant, Unit 2
Director, Division of Radiological Health - Tennessee State Department of Environment and Conservation
NRC Project Manager - Watts Bar Nuclear Plant
Branch Chief for Plant Licensing, Branch II-2, NRR
Deputy Regional Administrator for Operation, Region II

ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT
UNIT 1 and UNIT 2

EVALUATION OF PROPOSED CHANGE

Subject: **Request for License Amendments – Diesel Generator Completion Time Extension for Technical Specification 3.8.1, "AC Sources – Operating" (TS-WBN-15-09)**

ATTACHMENTS

1.0 SUMMARY DESCRIPTION

By letter dated August 7, 2001 (Reference 1), the Tennessee Valley Authority (TVA) requested changes to the Watts Bar Nuclear Plant (WBN), Unit 1, Technical Specifications (TS). The requested changes to diesel generator (DG) Limiting Conditions for Operation (LCO) Action Statements would revise the 72-hour Completion Time (CT) specified in LCO 3.8.1, “AC Sources – Operating.” Specifically, the revised TS allowed 14 days to restore an inoperable DG to operable status. The purpose of the proposed changes were to provide the flexibility to perform DG maintenance, particularly 6-year and 18-year maintenance, during power operation. The risk informed justification for the 14-day CT was based on operation of WBN Unit 1 as a single unit.

By letter dated July 1, 2002 (Reference 2), the Nuclear Regulatory Commission (NRC) issued Amendment No. 39 to WBN Unit 1 Facility Operating License No. NPF-90, thereby revising the TS 3.8.1 CT for restoring one inoperable DG to an operable status from 72 hours to 14 days.

By letter dated November 30, 2009 (Reference 3), TVA requested an amendment to WBN Unit 1 Facility Operating License No. NPF-90. The proposed changes revised the CT for inoperable DGs in TS 3.8.1. Specifically, the proposed changes revise the CT from 14 days to 72 hours for restoring one or more inoperable DG(s) in one train to an operable status. The amendment request was necessary due to the planned completion and startup of WBN Unit 2. Because Amendment No. 39 for the 14-day DG CT was based on operation of WBN Unit 1 as a single unit, the justification that the amendment was predicated upon would no longer be valid for two-unit operation.

By letter dated July 6, 2010 (Reference 4), the NRC issued Amendment No. 84 to WBN Unit 1 Facility Operating License No. NPF-90, thereby revising the TS 3.8.1 CT for restoring one or more inoperable DG(s) in one train from 14 days to 72 hours. This amendment will be implemented prior to WBN Unit 2 entry into Mode 4, “Hot Shutdown.”

The enclosed evaluation supports a request for an amendment to WBN Unit 1 Facility Operating License No. NPF-90, and to WBN Unit 2 Facility Operating License No. NPF-96.

The proposed amendment revises WBN Units 1 and 2 TS 3.8.1, “AC Sources – Operating,” to extend the CT for one inoperable DG from 72 hours to 14 days based upon availability of an alternate alternating current (AC) power source (i.e., a 6.9 kilovolt (kV) FLEX DG). The changes will provide operational and maintenance flexibility. They will allow sufficient time to perform planned maintenance activities that cannot be performed within a 72-hour CT.

In addition, two changes are being proposed to clarify changes made to WBN Unit 1 TS 3.8.1 with Amendment No. 84 (Reference 4) and Amendment No. 89 (Reference 5). Amendment No. 84, in part, removed the allowance to substitute the C-S DG for any of the required DGs. With the removal of this allowance, the remaining DGs are all required. Therefore, it is no longer necessary to refer to the DGs as “required DGs” in the TS 3.8.1 Conditions and Required Actions. Amendment No. 89 revised several TS 3.8.1 Surveillance Requirement (SR) Notes to allow performance of the SRs on WBN Unit 2 6.9 kV shutdown boards and DGs while WBN Unit 1 is operating in Modes 1, 2, 3 and 4. However, the amendment created a possible conflict between the requirements of SR 3.8.1.19 and the Note modifying SR 3.8.1.19. The proposed change will clarify the SR to remove the potential conflict.

This License Amendment Request (LAR) includes both deterministic justification and risk-based justification. The proposed new CT is based on the 14-day CT permitted in Branch Technical Position (BTP) 8-8 (Reference 6) and application of the WBN Probabilistic Risk Assessment (PRA) in support of a risk-informed extension, and on additional considerations and compensatory actions. The risk evaluation supporting the proposed change has been developed in accordance with the guidelines established in Regulatory Guide (RG) 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," (Reference 7) and RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" (Reference 8).

2.0 DETAILED DESCRIPTION

2.1 Proposed Changes

A description of the proposed TS changes are provided below. The specific changes to the WBN Units 1 and 2 TS are indicated in the markups provided in Attachment 1 to this enclosure. The specific changes to the WBN Units 1 and 2 TS Bases (For Information Only) are indicated in the markups provided in Attachment 2 to this enclosure. The retyped pages of the WBN Units 1 and 2 TS and Bases are provided in Attachments 3 and 4 to this enclosure, respectively.

2.1.1 WBN Units 1 and 2, TS 3.8.1 - New Required Actions and Associated Completion Times

A new Condition (shown as Condition B in the markup) is being added to address the condition of one DG inoperable. Required Action B.1 will require the performance of SR 3.8.1.1 for the required offsite circuits in 1 hour and once per 8 hours thereafter. Required Action B.2 requires an evaluation of the availability of the 6.9 kV FLEX DG in 2 hours and once per 12 hours thereafter. Required Action B.3 requires the required features supported by the inoperable DG to be declared inoperable in 4 hours from discovery of an inoperable required redundant feature. Required Actions B.4.1 and B.4.2 require either a determination that the operable DGs are not inoperable due to common cause failure or the performance of SR 3.8.1.2 for the operable DGs in 24 hours. Required Action B.5 requires the restoration of the inoperable DG in either: 72 hours from discovery of unavailability of the 6.9 kV FLEX DG, 24 hours from discovery of Condition B entry ≥ 48 hours concurrent with unavailability of the 6.9 kV FLEX DG, 14 days, and 17 days from discovery of failure to meet the LCO. Subsequent Conditions and Required Actions are re-sequenced accordingly. In addition, the existing Condition B (re-sequenced to Condition C) is revised to apply to two DGs in one train inoperable, maintaining the existing 72-hour CT for restoration of two inoperable DGs in one train to an operable status. This new Condition B and associated Required Actions will effectively extend the CT for one inoperable DG from 72 hours to 14 days, provided at least one 6.9 kV FLEX DG is available.

2.1.2 WBN Units 1 and 2, TS 3.8.1 - Maximum Completion Time - Required Action A.3

The maximum CT for Required Action A.3 is proposed to be extended from 6 days to 17 days. The maximum CT limits the total time that LCO 3.8.1 is not met while concurrently or simultaneously in Condition A and the new Condition B. Currently, this CT is the sum of the CT for existing Required Action A.3 (i.e., 72 hours) and B.4 (i.e., 72 hours). TVA is proposing a new Condition B for one inoperable DG. The new Required Action B.5 will allow one DG to be inoperable for up to 14 days, if one 6.9 kV FLEX DG is available. Therefore, the maximum CT for Required Action A.3 will be increased from 6 days to 17 days.

2.1.3 WBN Units 1 and 2, TS 3.8.1 - Clarification of Conditions and Required Actions

The current wording of WBN Unit 1 TS 3.8.1, Required Action B.4, Condition D, Required Action D.2, Condition E, Required Actions E.1 and E.2, and Conditions G and H use the word “required” when referring to the DGs. Changes to these Conditions and Required Actions are proposed to delete the word “required” when immediately proceeding “DGs” or “DG(s).” This proposed change was incorporated in the WBN Unit 2 TS submitted as Revision 0 (Reference 34), except for Required Action E.2. The proposed change to WBN Unit 2 TS 3.8.1, Required Action E.2 includes this deletion of the word "required".

2.1.4 WBN Unit 1, TS 3.8.1 - Clarification of SR 3.8.1.19

The current wording of SR 3.8.1.19.c is proposed to be changed from “DGs of the same power train auto-start from standby condition. . .” to “DG auto-starts from standby condition. . .” As the Note modifying SR 3.8.1.19 precludes performance of the SR for DGs 1A-A and 1B-B in Modes 1, 2, 3, and 4, this proposed change clarifies that the DGs in the same power train can be tested individually. This proposed change was incorporated in the WBN Unit 2 TS submitted as Revision 0 (Reference 34).

2.1.5 WBN Unit 2, SR 3.8.1.14 – Add Contingency Actions to Bases

This TS Bases change is being made to match the contingency actions included in the WBN Unit 1 TS Bases for SR 3.8.1.14. By letter dated October 19, 1998 (Reference 36) the NRC approved WBN Unit 1 License Amendment No. 12 that revised the TS to allow testing of DGs, pursuant to SR 3.8.1.14, during operational Modes 1 or 2. These contingency actions were subsequently moved to TS Table 3.8.1-2 and are included here in the WBN Unit 2 TS Bases.

2.2 Condition the Proposed Changes are Intended to Resolve

The TS changes are being requested to allow sufficient time to perform planned DG surveillance testing and adequate preventive maintenance to ensure DG reliability and availability. The proposed changes also provide flexibility to resolve DG deficiencies and avoid a potential unplanned plant shutdown and associated thermal transient, along with the potential challenges to safety systems during an unplanned shutdown, should a condition occur requiring DG corrective maintenance.

The main purpose of the proposed changes are to extend the TS CT for an inoperable DG from 72 hours to 14 days. The 14-day CT is needed to (1) provide the necessary time to support planned DG surveillance testing, and (2) reduce the likelihood and unnecessary burden of a dual-unit shutdown should an unplanned DG outage occur with the units at power by providing additional time to repair and reestablish operability of the inoperable DG. To justify the 11-day CT extension, a supplemental AC power source capable of bringing the affected unit to a safe shutdown condition during a loss of offsite power (LOOP) is required. In response to NRC Order EA-12-049, TVA added two 6.9 kV FLEX DGs as part of the mitigating strategies for beyond-design-basis-events (Reference 11). The 6.9 kV FLEX DGs have the capability to power any 6.9 kV shutdown board and the capacity to bring the affected unit to a safe shutdown condition following a LOOP. (See Section 3.3.3 for additional information regarding TVA compliance with NRC Order EA-12-049; see Section 3.4 for additional information regarding the 6.9 kV FLEX DGs.)

The 14-day CT, applicable to both the Unit 1 TS and the Unit 2 TS, is needed to perform planned DG surveillance testing and 6-year and 18-year DG maintenance. The TS changes will provide operational and maintenance flexibility. They will also allow more time for unanticipated repairs. If these activities are combined with other DG maintenance activities and performed over an extended DG CT, the number of entries into the TS Actions and the number of associated DG starts performed for post-maintenance testing prior to exiting the TS will be reduced.

An additional purpose of this LAR is to provide clarifications to changes previously made. WBN Unit 1 License Amendment No. 84 removed the allowance to substitute the C-S DG for any of the required DGs. With the removal of this allowance, the remaining DGs are all required. Therefore, it is no longer necessary to refer to the DGs as “required DGs” in the TS 3.8.1 Conditions and Required Actions.

WBN Unit 1 License Amendment No. 89 revised several TS 3.8.1 SR Notes to allow performance of the SRs on WBN Unit 2 6.9 kV shutdown boards and DGs while WBN Unit 1 is operating in Modes 1, 2, 3 and 4. However, the wording of SR 3.8.1.19.c could be read to require both DGs in a power train to auto-start on a loss of offsite power in conjunction with an engineered safety feature (ESF) actuation. As currently written, SR 3.8.1.19 could be read such that it can only be performed when WBN Units 1 and 2 are in Mode 5, Mode 6, or are defueled. The proposed change clarifies the SR to remove the potential conflict.

2.3 Bases for Proposed Changes

2.3.1 Clarification of TS Requirements

With the removal of the allowance to substitute the C-S DG for any of the required DGs, the remaining DGs are all required to be operable by LCO 3.8.1. Therefore, it is no longer necessary to refer to the DGs as “required DGs” in the TS 3.8.1 Conditions and Required Actions. This change is consistent with Technical Specification Task Force (TSTF) guidance TSTF-GG-05-01, “Writer’s Guide for Plant-Specific Improved Technical Specifications,” Revision 1 (Reference 9), which states:

> *"Required" is specifically used in Conditions, Required Actions and Surveillances to denote reference to equipment which is "required" by the LCO for the specific existing Applicability. Typically (for operating MODES), any component referred to is "required." In this case no*

clarification is needed and "required" is not specifically stated in the Conditions, Required Actions, and Surveillances. In cases where the LCO only requires some of all possible components be used to satisfy the LCO requirement, then the clarification of "required" is used in the Conditions, Required Actions, and Surveillances.

With respect to SR 3.8.1.19, the requirement to verify the DGs in the same power train auto-start from the standby condition can be verified by individually simulating the auto-start of each DG in the same power train. As each DG in a power train auto-starts on an undervoltage condition on its respective 6.9 kV shutdown board and a Unit 1 ESF signal auto-starts DGs 1A-A and 1B-B, but not DGs 2A-A and 2B-B, there is no safety-related signal that auto-starts both DGs in the same power train. Therefore, the SR is more appropriately stated on an individual DG basis. This change will allow the auto-start of DGs 2A-A and 2B-B with Unit 1 in Mode 1, 2, 3, or 4. The performance of SR 3.8.1.19, for DGs 1A-A and 1B-B, will be performed when Unit 1 is in Mode 5, Mode 6, or is defueled.

2.3.2 DG Allowed Outage Time

Consistent with the objectives of the NRC's policy entitled “Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities: Final Policy Statement” (60 FR 42622) (Reference 10), the amendment proposed herein provides (1) safety decision-making enhanced by the use of PRA insights, (2) more efficient use of resources, and (3) a reduction in unnecessary burden. The CT of Required Action B.4 of TS 3.8.1 currently allows only 72 hours to perform maintenance and post-maintenance testing, or troubleshooting and repair of an inoperable DG, and return to an operable status when a unit is in Modes 1, 2, 3, or 4.

The purpose of the proposed change is to extend the TS CT for an inoperable DG from 72 hours to 14 days. The 14-day CT is needed to (1) provide the necessary time to support planned DG maintenance, and (2) reduce the likelihood and unnecessary burden of a dual-unit shutdown should an unplanned DG outage occur with the units at power by providing additional time to repair and reestablish operability of the inoperable DG. To justify the 11-day CT extension, a supplemental AC power source (i.e., a 6.9 kV FLEX DG) capable of powering any one of the four 6.9 kV shutdown boards during a LOOP is required. In response to NRC Order EA-12-049, TVA added two 6.9 kV FLEX DGs as part of the mitigation strategies for beyond-design-basis-events (Reference 11). At least one of the 6.9 kV FLEX DGs will be available to power one 6.9 kV shutdown board during the extended DG CT.

Planned maintenance activities for each emergency DG for the period 2016 through 2021 include activities requiring an extended 14-day DG CT. Specific planned DG testing, preventive maintenance, and/or major maintenance requiring a 14-day CT is provided below in Table 1.

Table 1 - Planned DG Maintenance Activities 2016 - 2021

Planned Outages	DG 1A-A	DG 1B-B	DG 2A-A	DG 2B-B
Spring 2016 (duration 96 hours each DG)	• 6-year mechanical maintenance[1] • 10-year Governor controller capacitor change out • 10-year 7-day tank clean and inspect • 18-month battery service test	• 6-year mechanical maintenance[1] • 10-year Governor controller capacitor change out • 10-year 7-day tank clean and inspect • 18-month battery service test	• 6-year mechanical maintenance[1] • 10-year Governor controller capacitor change out • 10-year 7-day tank clean and inspect • 18-month battery service test	• 6-year mechanical maintenance[1] • 10-year Governor controller capacitor change out • 10-year 7-day tank clean and inspect • 18-month battery service test
Summer to Fall 2017 (duration 72 hours each DG)	• 2-year mechanical maintenance[2] • 2-year electrical panel clean and inspect[3] • 2-year generator inspection[3] • replace critical relays • Air System checks • 18-month battery service test	• 2-year mechanical maintenance[2] • 2-year electrical panel clean and inspect[3] • 2-year generator inspection[3] • replace critical relays • Air System checks • 18-month battery service test	• 2-year mechanical maintenance[2] • 2-year electrical panel clean and inspect[3] • 2-year generator inspection[3] • replace critical relays • Air System checks • 18-month battery service test	• 2-year mechanical maintenance[2] • 2-year electrical panel clean and inspect[3] • 2-year generator inspection[3] • replace critical relays • Air System checks • 18-month battery service test
2019 (duration 96 hours each DG)	• 4-year mechanical maintenance[4] • 2-year electrical panel clean and inspect[3] • 2-year generator inspection[3] • VLF[6] cable testing • 18-month battery service test	• 4-year mechanical maintenance[4] • 2-year electrical panel clean and inspect[3] • 2-year generator inspection[3] • VLF[6] cable testing • 18-month battery service test	• 4-year mechanical maintenance[4] • 2-year electrical panel clean and inspect[3] • 2-year generator inspection[3] • VLF[6] cable testing • 18-month battery service test	• 4-year mechanical maintenance[4] • 2-year electrical panel clean and inspect[3] • 2-year generator inspection[3] • VLF[6] cable testing • 18-month battery service test

Table 1 - Planned DG Maintenance Activities 2016 - 2021 (continued)

Planned Outages	DG 1A-A	DG 1B-B	DG 2A-A	DG 2B-B
2021 (duration 120 hours each DG)	• 18-year major overhaul[5] • 2-year electrical panel clean and inspect[3] • 2-year generator inspection[3] • replace critical relays • Air System checks • 18-month battery service test	• 18-year major overhaul[5] • 2-year electrical panel clean and inspect[3] • 2-year generator inspection[3] • replace critical relays • Air System checks • 18-month battery service test	• 18-year major overhaul[5] • 2-year electrical panel clean and inspect[3] • 2-year generator inspection[3] • replace critical relays • Air System checks • 18-month battery service test	• 18-year major overhaul[5] • 2-year electrical panel clean and inspect[3] • 2-year generator inspection[3] • replace critical relays • Air System checks • 18-month battery service test

Notes:
1. 6-year mechanical maintenance includes: replacement of key engine pumps (jacket water, lube oil, and fuel oil), inspection of engine internals, verification of head torques, gaskets, valve conditions, and fuel injectors.
2. 2-year mechanical maintenance includes: filter change out and general inspections.
3. 2-year electrical maintenance includes: generator inspections, generator stator and rotor megger, panel clean and inspects.
4. 4-year mechanical maintenance includes: filter change out and general inspections.
5. 18-year major over-haul includes: power pack change-outs, pump replacements, and fuel system qualification.
6 VLF = very low frequency.

It is anticipated that the above planned maintenance activities will be performed with one or both units in Mode 4 or above. Therefore, the 14-day CT is applicable to both WBN Unit 1 TS and Unit 2 TS, and is needed to perform this work.

As a condition for implementing an extended 14-day CT for a single inoperable DG, at least one 6.9 kV FLEX DG will be available. The 6.9 kV FLEX DG is provided to supply power to any one of the four 6.9 kV shutdown boards via the existing transfer switches. By procedure, the 6.9 kV FLEX DG will power only one 6.9 kV shutdown board (and associated 480 V shutdown boards) and will have sufficient capacity to bring a unit to safe shutdown in the event of a LOOP concurrent with a single failure during plant operations (i.e., Modes 1 through 4). A description of the 6.9 kV FLEX DGs is provided in Section 3.4.

TVA has performed these inspections and other maintenance on these DGs. Table 2 provides actual times for performance of selected inspections and other maintenance activities. The longest DG outage duration listed in Table 2 is 179 hours (7.5 days). Increasing this duration by 50% to provide for unexpected complications results in 11 days. TVA is requesting a CT of 14-days to bound the 11-days and prevent unnecessary regulatory requests for discretion.

Table 2 Actual DG Maintenance Activity Completion Times (hours)				
	1A-A	1B-B	2A-A	2B-B
12-year inspection[1] (120 hours estimated)	107	126	117	138
4-year inspection (96 hours estimated)	111	96	93	100
VLF Cable Testing	179	135	145	132
Emergent Generator Replacement		133	160	

[1] The 12-year overhaul frequency has been changed and is now 18 years

With the implementation of License Amendment No. 84, prior to WBN Unit 2 entering Mode 4, the units are subject to a dual-unit shutdown should an unplanned DG outage occur, with the DG not restored to operable status within 72 hours. The extension of the 72-hour CT to 14 days gives additional time for repairing and reestablishing operability of the inoperable DG; thus, reducing the risk of dual-unit shut down as a result of exceeding the 72-hour CT. A 14-day CT is justifiable as a contingency provision for unexpected DG failures and minimizes the need for expedited licensing actions seeking approval of an extended Completion Time (e.g., enforcement discretion). Given the conclusions reached by the deterministic and risk-based evaluations that follow, extending the CT associated with an inoperable DG would also provide the following:

1. Enhanced Decision-Making

As noted in its approval of the policy statement on the use of PRA methods, the Commission stated an expectation that the use of PRA technology should be increased to the extent supported by the state-of-the-art in PRA methods and in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defense-in-depth philosophy. The NRC's Policy Statement regarding the “Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities” states:

> *PRA and associated analyses (e.g., sensitivity studies, uncertainty analyses, and importance measures) should be used in regulatory matters, where practical within the bounds of the state-of-the-art, to reduce unnecessary conservatism associated with current regulatory requirements, regulatory guides, license commitments, and staff practices.*

The extended Completion Time, to permit a DG to be removed from service for 14 days to perform maintenance or to troubleshoot and repair an inoperable DG, is acceptable from a risk-based approach due to a small increase in Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) consistent with the criteria in RGs 1.177 and 1.174 (References 7 and 8). The results of the risk assessment are provided in Section 4.4.11.

2. Efficient Use of Resources

The extended Completion Time associated with an inoperable DG will improve the effectiveness of the allowed maintenance period. Plant resources can be more focused on the DG maintenance activities rather than preparation and return to service activities. Under the 72-hour CT, a significant portion of maintenance activities is associated with preparation and return to service activities; the duration of which is relatively constant. Longer durations allow more maintenance to be accomplished during a given maintenance period and therefore would improve maintenance efficiency.

3. Reduction in Unnecessary Burden

The proposed changes provide a reduction in unnecessary burden, because it:

- Allows additional time to perform routine maintenance activities on the DG enhancing the ability to focus quality resources on the activity, and improve maintenance efficiency.

- Increases the time to troubleshoot, repair, and reestablish operability of an inoperable DG during Modes 1, 2, 3, and 4.

- Averts unplanned dual-unit shut down and minimizes the potential need for requests for enforcement discretion.

These proposed changes meet the objectives of the NRC's Policy Statement on the use of PRA methods (60 FR 42622) (Reference 10).

3.0 BACKGROUND

Section 3.1 contains a description of the affected systems. Section 3.2 provides a discussion of grid reliability. Section 3.3 provides a discussion of station blackout capability. Section 3.4 provides a discussion of the FLEX DGs, including sizing, design, operation, connections to the onsite AC electrical distribution system, availability, fire protection, staffing and training. Section 3.5 provides a discussion on the DG Reliability Program. Section 3.6 provides a discussion on the Maintenance Rule Program. Section 3.7 provides a discussion on the Configuration Risk Management Program. Section 3.8 provides a discussion on work control and scheduling. Section 3.9 provides a discussion on the current Technical Specifications and their limitations. Section 3.10 provides a discussion of traditional engineering considerations.

3.1 System Description

As required by 10 Code of Federal Regulations (CFR) 50, Appendix A, General Design Criterion (GDC) 17 (Reference 12), the design of the offsite and onsite electrical power systems provide independence and redundancy to ensure an available source of power to the ESF systems.

A description of the relevant portions of the WBN electrical power system is presented below as background for evaluation of the proposed changes. A WBN electrical diagram indicating the location that the alternate AC power source interconnects with the existing electrical system is provided in Attachment 5 to this enclosure.

3.1.1 Offsite AC Power System

Two dedicated 161 kV transmission lines from the WBN Hydro Plant switchyard provide preferred offsite power to four 161 kV / 6.9 kV common station service transformers (CSSTs) located in the WBN 161 kV switchyard. The four CSSTs and their associated switchgear are designed in accordance with GDC 17 and are connected and arranged to provide two physically independent offsite power circuits to the onsite Class 1E distribution system. The two independent offsite power circuits (designated P and R) are designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. A detailed description of the offsite power transmission system and the offsite power circuits associated with the Class 1E shutdown boards are found in WBN Updated Final Safety Analysis Report (UFSAR) Section 8 (Reference 13).

3.1.2 Onsite AC Power System

The safety function of the onsite AC power system is to supply power to permit functioning of components and systems required to assure that: (1) fuel design limits and reactor coolant pressure boundary design conditions are not exceeded due to anticipated operational occurrences, and (2) the core is cooled and vital functions are maintained in the event of a postulated accident, subject to loss of the preferred offsite power system and subject to any single failure in the standby power system.

The onsite AC power system supplies electrical power to two redundant load groups. Each load group is composed of two power trains, i.e., Trains 1A and 2A, and Trains 1B and 2B. Each train is powered by one independent Class 1E 6.9 kV shutdown board. Each 6.9 kV shutdown board has two separate and independent offsite power sources, as well as a dedicated onsite DG source. When the preferred (offsite) power system is not available, each shutdown board is energized from a separate standby DG. The two DGs associated with one load group can provide all safety related functions to mitigate a loss-of-coolant accident (LOCA) in one unit and achieve hot standby in the opposite unit.

A loss of voltage on the 6.9 kV shutdown board starts the associated DG and initiates logic that trips the supply feeder breakers, all 6.9 kV loads (except the 480 V shutdown board transformers), and the major 480 V loads. The bypass breaker for the 480 V shutdown board current-limiting inductive reactor is also closed as part of this logic. When the DG has reached rated speed and voltage, the generator is automatically connected to the 6.9 kV shutdown board. This return of voltage to the 6.9 kV shutdown board initiates logic which connects the required loads in sequence. The standby (onsite) power system's automatic sequencing logic is designed to automatically connect the required loads in proper sequence should the logic receive an accident signal, concurrent with, or following a loss of all nuclear unit and preferred (offsite) power.

There are two loading sequences: (1) one is applied in the absence of a safety injection signal (SIS) (i.e., the “non-accident condition”), and (2) the other is applied when an SIS is received following or coincident with a sustained loss of voltage on the 6.9 kV shutdown board (i.e., the “accident condition”). A LOOP coincident with an SIS is the design basis event. An SIS received during the course of a non-accident shutdown loading sequence will cause the actions described below.

- Loads already sequentially connected that are not required for an accident will be disconnected.

- Loads already sequentially connected that are required for an accident will remain connected.

- Loads pending sequential loading that are not required for an accident will not be connected.

Loads pending sequential loading that are required for an accident will either be sequentially loaded as a result of the non-accident loading sequence or have their sequential timers reset to time zero from which they will then be sequentially loaded in accordance with the accident sequence.

An SIS received in the absence of a sustained loss of voltage on a 6.9 kV shutdown board will start the DGs but will not connect them to the 6.9 kV shutdown boards.

Each DG consists of two 16-cylinder diesel engines directly connected to a 6.9 kV generator. The continuous rating of each DG is 4400 kilowatts (kW) at 0.8 power factor, 6.9 kV, 3 phase, and 60 Hz. Each DG also has an additional rating of 4840 kW for 2 hours out of 24 hours.

3.2 Grid Reliability

3.2.1 Generic Letter 2006-02, Grid Reliability and the Impact on Risk and the Operability of Offsite Power

For WBN Unit 1, the TVA response to Generic Letter (GL) 2006-02 was provided on April 3, 2006 (Reference 14) and supplemented on January 31, 2007 (Reference 15). The NRC completed their review of GL 2006-02 as documented in their letter dated May 3, 2007 (Reference 16).

For WBN Unit 2, the NRC completed their review of GL 2006-02 as documented in NUREG-0847, "Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Unit 2," Supplement 28 (Reference 17).

The proposed amendment does not adversely impact TVA's compliance with NRC regulatory requirements governing electric power sources and associated personnel training.

3.2.2 Recent Offsite AC Power System Reliability Improvements

As described in the TVA LAR for WBN Unit 1, dated August 1, 2013 (Reference 18), and as supplemented in letters dated April 21, 2014 (Reference 19) and January 29, 2015 (Reference 20), TVA performed a study to evaluate the existing WBN AC Power System to determine its adequacy for two unit operation. The scope of the study included common station service transformers (CSSTs) A, B, C, and D; 6.9 kV shutdown boards; 6.9 kV start buses; 6.9 kV common boards; 6.9 kV unit boards; downstream 6.9 kV-480 V transformers; 480 V distribution systems loads, and all interconnections.

The study specifically evaluated existing CSSTs A and B to determine their acceptability as qualified offsite power sources for the safety related boards when used for safe shutdown of the units under a design basis LOCA. The study recommended adding an automatic On Load Tap Changer (OLTC) on the primary side of CSSTs A and B. As a result of the study, TVA upgraded CSSTs A and B to functionally perform as alternate sources of offsite power in order to increase defense-in-depth and add increased reliability to the offsite power sources.

The WBN Design Change Notices that facilitated the use of CSSTs A and B as qualified offsite sources for the 6.9 kV shutdown boards to support safe shutdown of the unit during a design basis event have been completed. The proposed TS change (Reference 18) credited upgrades made to CSSTs A and B to provide two new qualified offsite power circuits, in addition to the current qualified offsite power circuits. This LAR was approved by the NRC staff as License Amendment No.103 (Reference 21).

3.3 Station Blackout Capability

3.3.1 Introduction

Station Blackout (SBO) refers to a complete loss of all offsite and onsite AC power. The SBO rule (10 CFR 50.63) requires utilities to assess the impact of a loss of preferred power (i.e., offsite power) concurrent with a loss of the unit's standby DGs. TVA SBO analysis has been performed in accordance with the guidelines provided in RG 1.155, “Station Blackout” (Reference 22), and Nuclear Utility Management and Resources Council (NUMARC) 87-00, “Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors” (Reference 23), for assessment of TVA compliance with the requirements of 10 CFR 50.63.

The WBN site utilizes the AC-independent approach and is subject to a minimum station blackout coping capability of four hours with a DG Reliability Target of 0.975.

The SBO analysis applies to an SBO on either unit; one unit is in an SBO condition, and the other unit has lost one of two DGs, and is in a non-blackout condition. For the purposes of the analysis, one SBO unit is analyzed without any dependence on the AC power potentially available (for common systems/areas) from the non-blackout unit.

The existing shared design of the WBN site fluid systems, in particular the Essential Raw Cooling Water (ERCW) Systems and the Component Cooling Systems (CCS), requires certain components to be energized from the common or Unit 2 power sources to achieve and maintain hot standby on Unit 1. Similarly, certain components need to be energized from Unit 1 sources for Unit 2.

Furthermore, to achieve hot standby, both Train A DGs or both Train B DGs must be operable. For example, hot standby on Unit 1, with only DG 1A-A available, requires that DG 2A-A (not DG 1B-B or 2B-B) also be available. The converse is true for DG 1B-B. Thus, hot standby for Unit 1 (or Unit 2) requires power from both DG 1A-A and 2A-A, or from both DG 1B-B and 2B-B, and cannot be achieved from DG 1A-A or 1B-B alone.

For SBO coping duration analyses, the determination of how many DGs are necessary must account for the need of two specific DGs. The intent is that one 6.9 kV FLEX DG could be connected to the 6.9 kV shutdown board associated with the DG removed from service; however, the 6.9 kV FLEX DG could be connected to any of the four 6.9 kV shutdown boards following the licensing basis LOOP event. The 6.9 kV FLEX DG is a defense-in-depth measure for SBO and is not credited in the SBO analysis.

3.3.2 Coping Duration

The WBN site is an AC-independent plant subject to a minimum station blackout coping capability of four hours. The required SBO coping duration for WBN was calculated in accordance with the guidance provided in NUMARC 87-00 (Reference 23).

Unique plant site parameters and plant design equipment characteristics for compliance with 10 CFR 50.63 are:

Power Design Characteristic Group (P): P1
Extremely Severe Weather (ESW Group): 1
Severe Weather (SW Group): 2
Emergency AC Power Configuration (EAC): D
Independence of Offsite Power (I Group): I 1/2
DG Reliability Target: 0.975

TVA monitors the DG reliability under the Maintenance Rule Program. Increasing the DG CT will not impact the DG reliability target used in the SBO coping time calculation.

The AC-independent approach evaluates the capability of a WBN unit to cope with and recover from a SBO event. The SBO unit relies on available process steam, DC power, and compressed air supplies to operate equipment necessary to achieve and maintain a hot standby SBO safe shutdown condition until emergency AC power from the “A-A” DGs, “B-B” DGs, or offsite AC power is restored. During the SBO event, the equipment relied upon is electrically independent of the offsite or DG AC power sources. A single SBO safe shutdown (hot standby) path is used and is sufficient to stabilize the plant by achieving and maintaining hot standby.

3.3.3 Beyond Design Basis External Event

On March 12, 2012, the NRC issued Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (Reference 24). This order directed licensees to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment integrity, and spent fuel pool (SFP) cooling capabilities in the event of beyond-design-basis external events (BDBEE).

The purpose of the WBN site FLEX system is to maintain each unit’s reactor in a stable, shutdown condition, protect the reactor core, ensure containment integrity, and maintain SFP level during a BDBEE, which includes an extended loss of AC power (ELAP) and simultaneous loss of normal access to the ultimate heat sink to either or both WBN Unit 1 and WBN Unit 2.

The FLEX system utilizes DGs, portable pumps (both diesel and electrically driven), valves, hoses and support equipment. This equipment is located in hardened buildings and storage areas that are designed to survive BDBEE defined events, which include seismic conditions, high and low outside air temperatures, floods, and high winds or tornados. The guiding procedure for an ELAP will be the Emergency Contingency Actions (ECA)-0.0, Loss of Shutdown Power of the Emergency Operating Instructions.

The FLEX equipment and connections provide multiple methods to: supply all four steam generators with water for reactor cooling, maintain water level in the Reactor Coolant System (RCS), increase RCS boration to a safe shutdown concentration, and maintain water level in the SFP. The FLEX equipment also provides for the control of containment cooling and hydrogen levels.

By letter dated March 12, 2015 (Reference 25), TVA submitted its full compliance letter and revised final integrated plan for WBN Units 1 and 2. By letter dated March 27, 2015 (Reference 11), the NRC transmitted its safety evaluation of the WBN BDBEE mitigation strategies, concluding that, "TVA has developed guidance to maintain or restore core cooling, SFP cooling, and containment following a BDBEE which, if implemented appropriately, should adequately address the requirements of NRC Order EA-12-049."

By letter dated June 22, 2015 (Reference 37), the NRC provided inspection results for their inspection of TVA's implementation of FLEX mitigating strategies at WBN, using NRC Temporary Instruction 2515/191 (Reference 38) for the inspection. The NRC staff stated that the team verified that TVA satisfactorily implemented appropriate elements of the FLEX strategy as described in the WBN submittal(s) and the associated safety evaluation and did not identify any issues of a more than minor significance concerning TVA's compliance with NRC Order EA-12-049 at WBN.

3.4 Alternate AC Sources

Two 6.9 kV FLEX DGs are permanently mounted in the FLEX Equipment Storage Building (FESB) located north of the DG building. Each DG is a 6.9 kV, 3-phase, 60 Hz synchronous machine with a continuous rating of 4062.5 kilovolt-amp (kVA) at 0.8 power factor, from MTU Onsite Energy.

3.4.1 6.9 kV FLEX DGs

Each 6.9 kV FLEX DG skid consists of an air cooled, local electric start, diesel engine with a shaft driven, stationary electric generator. Each DG consists of a 20 cylinder engine directly connected to a 6.9 kV generator with exciter. Each DG has a continuous rating of 3250 kW and has the capability to bring the affected unit to a safe shutdown condition following a LOOP, if needed. The best estimate cold shutdown loads from the time that the 6.9 kV FLEX DG is manually aligned to a 6.9 kV shutdown board (first 72 hours after reactor shutdown) are:

LOAD IDENTIFICATION	kW
Centrifugal Charging Pump	396.9
Essential Raw Cooling Water Pump	600.5
Residual Heat Removal Pump	276.0
Component Cooling System Pump	282.0
Pressurizer Heaters	500.0
Miscellaneous loads	1104.0
Total Load	3159.4

The 6.9 kV FLEX DGs can supply either unit's 6.9 kV shutdown boards and associated 480 V shutdown boards in the event of a BDBEE. The permanently installed electrical connection points for the 6.9 kV FLEX DGs are from the DG integral output connection panel, through conduits within the FESB, to underground conduits located on the outside of the FESB south wall. One 6.9 kV FLEX DG is assigned to Train A on both units and the second 6.9 kV FLEX DG is assigned to Train B of both units.

Each 6.9 kV FLEX DG supplies a bus with two output breakers. Each output breaker is connected to the high side of one transfer switch previously reserved for the C-S (5th) DG. Each output breaker can supply power to two 6.9 kV shutdown boards. A jumper connects the high side of two transfer switches. The transfer switches are interlocked to prevent paralleling the 6.9 kV FLEX DGs with an Emergency DG.

The 6.9 kV FLEX DGs are located in the FESB. The FESB is a seismically hardened building that will resist tornado missiles and high wind speeds. The building is sited in a suitable location above the Probable Maximum Flood grade. The building contains a stand-alone heating, ventilation and air conditioning, fire protection, and electrical system.

Each 6.9 kV FLEX DG is supplied with a 2,900 gallon "day tank" that provides a minimum of 8 hours of operation before make-up fuel is needed. The makeup fuel is supplied by positive displacement rotary gear transfer pumps and associated equipment that draw suction from the existing seven-day tanks in the DG building.

Each 6.9 kV FLEX DG is supplied with a 15 gallons per minute (gpm) diesel fuel oil pump. The pumps take suction from the 2A-A and the 1B-B seven-day DG Fuel Oil Supply Tanks. Each pump is powered from its associated 6.9 kV FLEX DG.

A battery charger rated for 10 amps and 24 volts is located on each 6.9 kV FLEX DG skid to maintain the 24 VDC battery charged. The battery charger is connected to a station supply of AC to ensure the 6.9 kV FLEX DG is available for quick start when needed.

Factory testing was performed by the manufacturer on the assembled FLEX DGs. Factory testing included start, load acceptance, and load capability demonstration.

3.4.2 Fire Detection and Protection

The fire alarm system in the FESB utilizes five flame and smoke detection cameras and one standard smoke detector. The fire alarm control panel contains the fire alarm signal processing electronics and communicates to the main fire alarm panel via dedicated telephone connection. Four manual pull-stations are placed appropriately throughout the building for manual initiation of an alarm condition. The stations are wired to the fire alarm data network via remote input modules local to the devices.

The FESB is provided with a fire protection system connected to the plant's high pressure fire protection system northwest of the FESB. The system is a wet pipe sprinkler system that includes an isolation valve, a strainer, an alarm check valve, closed sprinkler heads, and interconnecting piping. The system actuates when the heat from a fire fuses a sprinkler head. Water flowing through the alarm check valve actuates an alarm when the retard chamber on the check valve trim is filled with water. The retard chamber drains quickly enough that leakage through the check valve should not cause a false alarm.

3.4.3 Availability

The 6.9 kV FLEX DG will be operated and maintained according to approved procedures.

The proposed TS will require evaluation of 6.9 kV FLEX DG availability within 2 hours of entry into TS 3.8.1, Condition B, for an inoperable DG. Following initial verification of FLEX DG availability, the proposed TS will require ongoing verification of availability on a once per 12-hour frequency.

The 6.9 kV FLEX DG will be routinely monitored during Operator Rounds, with monitoring criteria identified in the Operator Rounds. The FLEX DGs will be protected, as defense-in-depth, during the extended DG CT.

The marked-up TS Bases include information to verify the availability of the 6.9 kV FLEX DG as follows:

1. 6.9 kV FLEX DG fuel tank level is verified locally to be ≥ 8-hour supply; and

2. 6.9 kV FLEX DG supporting system parameters for starting and operating are verified to be within required limits for functional availability (e.g., battery state of charge).

3.4.4 FLEX DG Staffing and Training

Alignment of the 6.9 kV FLEX DGs to the 6.9 kV shutdown boards is the primary strategy the station will utilize during an ELAP condition to restore shutdown power.

Operators will use existing procedures to align and operate the FLEX DGs. Licensed Operators and Auxiliary Operators have received training on the purpose and use of the 6.9 kV FLEX DGs and the associated alignment procedures. Licensed Operators and Auxiliary Operators, for the operating crews on-shift when the extended DG CT is in use, will be briefed on the DG work plan, the revised TS 3.8.1, and procedural actions regarding an ELAP and 6.9 kV FLEX DG alignment and use prior to entering the extended DG CT.

3.4.5 FLEX DG Unavailability

In NEI 12-06, Section 11.5, "Maintenance and Testing," it states that the unavailability of equipment and applicable connections that directly performs a FLEX mitigation strategy for the core, containment, and spent fuel pool should be managed such that risk to mitigating strategy capability is minimized.

TVA has reviewed the configuration needed to support the DG Completion Time extension relative to FLEX mitigation strategies and determined that the FLEX DG is fully capable of supporting its FLEX mitigation strategies because its configuration and alignment are not changed. It is fully capable of supporting its FLEX strategies and supporting an inoperable DG.

3.4.6 FLEX DG Monitoring Program

At WBN, a Technical Instruction governs the monitoring and assessment of FLEX equipment. The monitoring includes equipment designated as permanent and portable equipment as well as dedicated tools and equipment required to implement the FLEX strategies.

Monitoring of the FLEX DG includes reviewing system health reports for FLEX interfacing plant systems and reviewing performance packages from preventive maintenance, maintenance instructions, and work orders, etc. A corrective action program condition report is initiated for identified deficiencies or declining performance.

3.5 Diesel Generator Reliability Program

TVA maintains a DG Reliability Program per approved procedures. The program monitors and evaluates DG performance and reliability. The program requires remedial actions when one or more established reliability "trigger values" are exceeded, and requires an evaluation be performed and corrective actions taken. The DG reliability target for WBN is 0.975. This value represents the underlying unit DG reliability values for purposes of establishing a coping duration of four hours for a SBO Event. The DG Reliability Program will not be negatively impacted by the proposed amendment because DG testing frequencies are unaffected.

Using the full duration of the requested 14-day CT would be infrequent. Other TVA programs, including the Maintenance Rule Program (Section 3.6) and Work Control and Scheduling (Section 3.8) ensure the extended CT would not be abused. Frequent use of the full CT duration would adversely impact DG unavailability, which could result in exceeding Maintenance Rule goals, require corrective actions, and increased management attention to restore the DGs to Maintenance Rule (a)(2) status.

3.6 Maintenance Rule Program

The Maintenance Rule performance measure for unavailability provides a control mechanism on the usage of the extended CT. The Maintenance Rule requires an evaluation be performed when equipment covered by the Maintenance Rule does not meet its performance criteria. The reliability and availability of the DGs are monitored under the Maintenance Rule Program. If the pre-established reliability or availability performance criteria are not achieved for the DGs, they are considered for 10 CFR 50.65(a)(1) actions. These actions would require increased management attention and goal setting to restore their performance to an acceptable level. The actual out-of-service time for the DGs is minimized to ensure that the reliability and availability performance criteria are met.

3.7 Configuration Risk Management Program

TVA uses a blended approach to configuration risk management, using both a quantitative and qualitative analysis of work activities prior to work authorization. The configuration risk management program is implemented using plant procedures for integrated scheduling of online processes and outage risk management during shutdown conditions as described in Section 3.8. These procedures, used in conjunction with fleet procedures for the Maintenance Rule Program, work management processes, and online equipment-out-of-service (EOOS) models for risk assessment, control the processes in which risk assessments are performed and integrated into the daily work schedule.

Plant configurations and changes in plant configurations are assessed for risk at the WBN site. In accordance with plant procedures, when risk significant structures, systems and components (SSCs), such as DGs, are made unavailable, actions are taken to protect redundant/diverse SSCs. PRA-based risk assessments are performed for all planned plant configurations as part of the work planning process. These configurations are pre-planned to minimize the risk. If unplanned equipment unavailability occurs during DG maintenance activities, plant procedures direct that the risk be re-evaluated, and if found to be unacceptable, compensatory actions are taken until such a time that the risk is reduced to an acceptable level. Specific risk thresholds are procedurally specified for the assessment of the need for compensatory actions. If compensatory actions are insufficient, then procedural direction is to transition to a mode or other specified condition that reduces overall plant risk to an acceptable level. Configuration risk management is also discussed in Section 4.4, Risk Assessment.

3.8 Work Control and Scheduling

TVA uses a blended approach to risk assessment for work control and scheduling. The blended approach concept uses the best information available to assess and manage risk, including:

1. Quantitative insights from the Probabilistic Safety Assessment (PSA) and the EOOS computer on-line risk model.

2. Expert knowledge of plant operations by licensed Senior Reactor Operators.

3. Qualitative methods of assessing the adequacy of defense-in-depth, potential loss of function, and external factors (e.g., severe weather, offsite power instability due to demand).

Risk thresholds are established and include quantitative and qualitative classifications. Risk management actions address configurations that result in elevated risk profiles. These actions are aimed at providing increased risk awareness of appropriate personnel, providing more rigorous planning and control of the activity, and taking measures to control the duration and the magnitude of the increased risk.

TVA procedure NPG-SPP-07.1, “On Line Work Management,” provides the process for assessing and managing on-line risk.

TVA procedure NPG-SPP-07.3.4, “Protected Equipment,” and WBN plant periodic instruction (PI) 1/2-PI-OPS-1-PE, “Protected Equipment,” provide guidance for the protected equipment process, methodology, and posting.

TVA procedure MMDP-1, “Maintenance Management System,” ensures maintenance is performed in a manner that enhances the reliability and availability of SSCs that is commensurate with safety pursuant to 10 CFR 50.65.

WBN Technical Instruction TI-12.16, “Diesel Generator Outage T/S or SR Contingency Actions,” protects the offsite AC sources and the other DGs, during a DG outage.

TVA procedure NPG-SPP-07.2.11, “Shutdown Risk Management,” addresses shutdown risk management. The WBN Refueling Outage Safety Plan:

1. Contains the site-specific configurations required for various shutdown conditions.

2. Contains the site-specific configurations required to implement the shutdown risk management program, including key safety functions (e.g., decay heat removal capability, electric power availability, inventory control, reactivity control, secondary containment, SFP cooling).

Protocols are in place for daily communications between the Power System (Grid) Operator and the WBN Control Room to discuss the status of the plant and the transmission system and review upcoming plans and work activities, and for weekly communications between the WBN Outage and Scheduling Group and the Power System Operator to coordinate activities and generation planning. All field work activities and switching evolutions are assessed for the risks involved. The WBN Control

Room is responsible for the decision to proceed with activities which involve risk to the plant systems. When it is intended to use the extended DG CT, the WBN Control Room will ensure:

1. Component testing or maintenance of safety systems and important non-safety equipment in the offsite power systems that can increase the likelihood of a plant transient (i.e., unit trip) or LOOP, will be avoided during the extended DG CT. No elective switchyard maintenance will be allowed during the extended DG CT.

2. Weather conditions will be evaluated prior to intentionally entering the extended DG CT and will not be entered if official weather forecasts are predicting adverse weather conditions (e. g., severe thunderstorms or heavy snowfall). Operators will monitor weather forecasts each shift during the extended DG CT. If severe weather or grid instability is expected after a DG outage begins, station management will assess the conditions and determine the best course for returning the DG to an operable status.

3.9 Current Technical Specifications and Limitations

In Modes 1, 2, 3 and 4, TS LCO 3.8.1 requires four operable DGs. With one or more DGs in a train inoperable, TS 3.8.1 Condition B currently requires the inoperable DG(s) to be restored to operable status within 72 hours to avoid entering TS 3.8.1 Condition F, which requires a plant shutdown. If both units are at power and the inoperable DG(s) was not restored within the 72-hour CT, a dual-unit shutdown would be required.

TVA intends to perform the 6-year and 18-year DG maintenance activities with one or both units in Mode 4 or above. Therefore, each unit must enter the TS 3.8.1 Required Actions and associated CTs for an inoperable DG, because each unit's TS LCO 3.8.1 requires four operable DGs. Without the extended DG CT, both units would be required to shut down to support the planned maintenance activities.

3.10 Traditional Engineering Considerations

For a LOOP, the redundant DGs have sufficient capacity to power one train of LOOP loads. The Safety Function Determination Program will be utilized to ensure that cross-train checks are performed to determine if a loss of safety function exists if there are concurrent equipment inoperabilities, and will ensure the appropriate actions are taken if a loss of safety function is identified. Since the probability of these events occurring concurrently during a planned maintenance window is low, there is minimal safety impact due to the proposed CT extension.

The combination of defense-in-depth and safety margin inherent in the onsite emergency power system ensures an emergency supply of power will be available to perform the required safety function. This supports the CT extension to allow a DG to be out-of-service for a longer period of time, as discussed further below.

3.10.1 Defense-In-Depth

The proposed changes to the CTs maintain system redundancy, independence, and diversity commensurate with the expected challenges to system operation. The other DGs, offsite power sources, and the associated engineered safety equipment will remain operable to mitigate the consequences of any previously analyzed accident. Otherwise, the Safety Function Determination Program will require that a loss of safety function be declared, and the appropriate TS Conditions and Required Actions taken. In addition to the Safety Function Determination Program, the Work Management Process, Integrated Scheduling Program, and Maintenance Rule Program provide for controls and assessments to preclude the possibility of simultaneous outages of redundant load groups and ensure system reliability. The Maintenance Rule performance measure for unavailability also provides a control mechanism on the usage of the extended CT. The proposed increase in the CT associated with an inoperable DG while the unit is in Mode 1, 2, 3, or 4, will not alter the assumptions relative to the causes or mitigation of an accident.

With a DG inoperable, a loss of function has not occurred. The remaining offsite power sources and DGs are capable of supporting the minimum safety functions necessary to shut down the reactor and maintain it in a safe shutdown condition, assuming no single failure.

As defined by RG 1.174, consistency with the defense-in-depth principle is maintained if the following occurs:

1. <u>A reasonable balance is preserved among prevention of core damage, prevention of containment failure, and consequence mitigation.</u>

   The proposed extensions to the CTs, associated with an inoperable DG while the unit is in Mode 1, 2, 3, or 4, have only a small calculated impact on CDF and LERF. The proposed changes are not accomplished by degrading core damage prevention and compensating with improved containment integrity nor do the changes degrade containment integrity and compensate with improved core damage prevention. The balance between prevention of core damage and prevention of containment failure is maintained. Consequence mitigation remains unaffected by the proposed changes. Furthermore, no new accident or transients are introduced with the proposed changes and the likelihood of accidents or transients is not impacted.

   The balance between mitigation of core damage and containment failure are preserved by the implementation of this 14-day CT for the DGs in that the overall DG reliability is expected to be improved in the near term, and over the long term, the DG unavailability is expected to be improved with fewer emergent issues. Additionally, the 6.9 kV FLEX DG, which provides an additional AC power source, will add to the overall ability to prevent core damage and also prevent containment challenge or failure. Thus, the DG's ability to support the mitigation of both core damage and containment failure is preserved and in the long term enhanced.

2. <u>Over-reliance on programmatic activities as compensatory measures associated with the changes are avoided</u>.

   As prescribed in BTP 8-8, a supplemental power source (i.e., the 6.9 kV FLEX DG) will be available as a backup to the inoperable DG to maintain the defense-in-depth design philosophy for the electrical system to meet its intended safety function. The 6.9 kV FLEX DG reduces the reliance on programmatic activities as compensatory measures associated with the changes.

   Plant safety systems are designed with redundancy so when one train is inoperable, a redundant train can provide the necessary design function. During the timeframe when a DG is inoperable, a redundant source of power will be maintained operable. In the event other equipment becomes inoperable concurrent with the DG inoperability, the Safety Function Determination Program requires cross-division checks to ensure a loss of safety function does not go undetected. If a loss of safety function is identified, TS LCO 3.0.6 will require entry into the applicable Conditions and Required Actions for the system(s) that have lost safety function. Proposed TS 3.8.1, Required Action B.3 (as shown in the markup provided in Attachment 1 to this enclosure) requires declaring supported feature(s), supported by the inoperable DG, inoperable when the redundant required feature(s) are inoperable. These features are designed to be powered from redundant safety related 6.9 kV shutdown boards. Redundant required feature failures consist of inoperable features associated with a shutdown board redundant to the shutdown board that has an inoperable DG. In addition, the PRA analysis indicates that there is a small calculated impact on CDF and LERF with the proposed TS changes.

3. <u>System redundancy, independence, and diversity are preserved commensurate with the expected frequency, consequences of challenges to the system, and uncertainties.</u>

   The redundancy, independence, and diversity of the onsite emergency power system will be maintained during the extended CTs. There were no identified uncertainties in redundancy, independence or diversity with the introduction of the 6.9 kV FLEX DG or the extended CT. With the exception of the DG seven-day fuel oil tanks, the 6.9 kV FLEX DG is not susceptible to the same common cause failures as the currently installed DGs; thus the proposed configuration improves the independence and diversity of the on-site AC power sources.

4. <u>Defenses against potential common cause failures are preserved, and the potential for the introduction of new common cause failure mechanisms is assessed</u>.

   Defenses against common cause failures are preserved. No new common cause failure mechanisms are created by the proposed changes. The operating environment and operating parameters for the DGs remain constant; therefore, no new common cause failure modes are created. Redundant and backup systems are not impacted by the changes and no new common cause links between the primary and backup systems are introduced; therefore, no new potential common cause failure mechanisms have been introduced by the proposed changes.

5. Independence of barriers is not degraded.

The barriers protecting the public and the independence of these barriers are maintained. Multiple DGs, systems or electrical distribution systems will not be intentionally taken out of service simultaneously. This could lead to degradation of these barriers and an increase in risk to the public. In the event other equipment becomes inoperable concurrent with the DG inoperability, the Safety Function Determination Program requires cross-train checks to ensure a loss of safety function does not go undetected. If a loss of safety function is identified, TS LCO 3.0.6 will require entry into the applicable Conditions and Required Actions for the system(s) that have lost safety function. Proposed TS 3.8.1, Required Action B.3 requires declaring supported feature(s), supported by the inoperable DG, inoperable when the redundant required feature(s) are inoperable. These features are designed to be powered from redundant safety related 6.9 kV shutdown boards. Redundant required feature failures consist of inoperable features associated with a shutdown board redundant to the shutdown board that has an inoperable DG. In addition, the extended CT does not provide a mechanism that degrades the independence of the barriers: fuel cladding, reactor coolant system, and containment.

6. Defenses against human errors are preserved.

The proposed extension to the CT does not introduce any new operator actions for the existing plant equipment. However, operators will be required to align and operate the 6.9 kV FLEX DG. These actions to align and operate the FLEX DG include alignment actions that are the same as or are similar to current plant actions. Operators will use existing procedures to align and operate the FLEX DG. Licensed Operators and Auxiliary Operators have received training on the purpose and use of the 6.9 kV FLEX DG and the associated alignment procedures. Licensed Operators and Auxiliary Operators, for the on-shift operating crews, will be briefed on the DG work plan, the revised TS 3.8.1, and procedural actions regarding LOOP and FLEX DG alignment and use prior to entering the extended DG CT. An analysis has been performed for the required actions to start and align the 6.9 kV FLEX DG and it is concluded that these actions are feasible with adequate indications and time to perform.

7. The intent of the plant's design criteria is maintained.

The design and operation of the remaining DGs are not altered by the proposed extension to the CT. The ability of the remaining TS required DGs to mitigate the consequences of an accident is not affected, because no additional failures are postulated while equipment is inoperable within the TS CT.

3.10.2 Safety Margin

For the extended CT associated with an inoperable DG while the unit is in Mode 1, 2, 3, or 4, the plant remains in a condition for which the plant has already been analyzed; therefore, from a deterministic aspect, these changes are acceptable. The 14-day and 17-day CTs are risk-informed CTs based on a plant specific analysis using the methodology defined in this LAR. The Maintenance Rule (10 CFR 50.65) requires each licensee to monitor the performance or condition of the DGs to ensure that the DGs are capable of fulfilling their intended functions. If the performance or condition of the DGs do not meet performance criteria, appropriate corrective action is required along with goals to monitor the effectiveness of the corrective action. The Maintenance Rule performance measure for unavailability also provides a control mechanism on the usage of the extended CT. Additionally, TVA has added a supplemental AC power source. For non-accident conditions, one 6.9 kV FLEX DG with the capability to power any 6.9 kV shutdown board within approximately 1 hour, has the capacity to bring the affected unit to cold shutdown in the event of a LOOP.

As defined in RG 1.174, the overall margin of safety is not decreased due to the extended CT for the DGs, because:

1. Codes and standards or their alternatives approved for use by the NRC are met.

   The design and operation of the DGs are not altered by the proposed CT extension or use of the 6.9 kV FLEX DG. Redundancy and diversity of the electrical distribution system will be maintained, because the system design and operation are not altered by the proposed CT extension or use of the 6.9 kV FLEX DG. In addition, the 6.9 kV FLEX DG provides an additional AC power source as a defense-in-depth measure in the event of a LOOP.

2. Safety analysis acceptance criteria in the Licensing Basis (e.g., FSAR, supporting analyses) are met or proposed revisions provide sufficient margin to account for analysis and data uncertainty.

   The safety analysis acceptance criteria stated in the UFSAR are not impacted by the changes. The ability of the remaining TS required DGs to mitigate the consequences of an accident is not affected, because no additional failures are postulated while equipment is inoperable within the TS CT.

   Given the above, TVA concludes that safety margins are not impacted by the proposed changes.

4.0 TECHNICAL EVALUATION

This section provides the technical analysis of the proposed changes with regard to the principles that adequate defense-in-depth is maintained, sufficient safety margins are maintained, and the calculated increases in CDF and LERF are small and consistent with the guidance of RG 1.177, “An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications” (Reference 7) and RG 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis” (Reference 8).

4.1 Current Licensing Basis for DG Completion Time

Under the current TS, if a DG is inoperable, the 6.9 kV shutdown board design is sufficient to allow operation to continue for a period not to exceed 72 hours. In this Condition, the three remaining operable DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E distribution system. The 72-hour CT takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a design basis accident (DBA) occurring during this period.

4.2 Proposed TS 3.8.1 Changes and Benefits

The TS changes are being requested to allow sufficient time to perform adequate preventive maintenance to ensure DG reliability and availability. The proposed changes also provides flexibility to resolve DG deficiencies and avoid potential unplanned plant shut downs, along with the potential challenges to safety systems during an unplanned shut down, should a condition occur requiring DG corrective maintenance.

The proposed changes to TS are described in Section 2.1. The purpose of the proposed changes are to extend the TS CT for an inoperable DG from 72 hours to 14 days. The 14-day CT is needed to (1) provide the necessary time to support planned DG maintenance, and (2) reduce the likelihood and unnecessary burden of a dual-unit shutdown should an unplanned DG outage occur with both units at power by providingadditional time to repair and reestablish operability of the inoperable DG. To justify the 11-day CT extension, a supplemental AC power source capable of powering any of the four 6.9 kV shutdown boards during a LOOP is required. In response to NRC Order EA-12-049, TVA added two 6.9 kV FLEX DGs as part of the mitigation strategies for beyond-design-basis-events. At least one 6.9 kV FLEX DG will be utilized as a supplemental AC power source during the extended DG CT.

The TS changes will provide operational and maintenance flexibility. The changes will also allow more time for unanticipated DG repairs.

The proposed change to WBN Unit 1 TS 3.8.1 Conditions and Required Actions and SR 3.8.1.19 will clarify the requirements and remove potential conflicts with the current wording.

4.3 Deterministic Assessment of Proposed DG Completion Time Extension

The effect of this LAR would be to allow continued power operation up to an additional 11 days while DG maintenance or testing is performed. The DG is a standby electrical power supply whose safety function is required when both the normal and alternate offsite power supplies are unavailable and there is an event that requires operation of the plant ESF and protection systems.

Independent standby power systems (DGs) are provided with adequate capacity and testability to supply the required ESF and protection systems. The standby power source is designed with adequate independency, redundancy, capacity, and testability to ensure power is available for the ESF and protection systems required to avoid undue risk to the health and safety of the public. This power source will successfully provide this capacity when a failure of a single active component is assumed.

Each of the four DGs can supply one of the four separate Class 1E 6.9 kV shutdown boards. Each DG is started automatically on a LOOP or LOCA. The DG arrangement provides adequate capacity to supply the ESF and protection systems for the DBA, assuming the failure of a single active component in the system. Because the standby power systems can accommodate a single failure, extending the CT for an out-of-service

DG has no impact on the system design basis. Safety analyses acceptance criteria as provided in the UFSAR are not impacted by the changes.

To ensure that the single failure design criterion is met, LCOs are specified in the plant TS requiring all redundant components of the onsite power system to be operable. In the event that a DG is inoperable in Modes 1, 2, 3, and 4, existing TS 3.8.1 Condition B requires verification of the operability of the offsite circuits on a more frequent basis. When the required redundancy is not maintained, action is required to initiate a plant shutdown after the specified CT expires. The CT provides a limited time to restore equipment to operable status and represents a balance between the risk associated with continued plant operation with less than the required system or component redundancy and the risk associated with initiating a plant transient while transitioning the unit to a shutdown condition. Thus, the acceptability of the maximum length of the extended CT interval relative to the potential occurrences of design basis events is considered. Since extending the CT for a single inoperable DG does not change the design basis for the standby emergency power system (i.e., DGs), extending the CT by 11 days is acceptable and consistent with BTP 8-8 (Reference 6).

The WBN coping time during SBO is not affected by the proposed changes. The coping time is calculated based on guidance provided in NUMARC 87-00 (Reference 23). The assumptions and the results of the SBO analyses are not changed by an extension of the CT, and compliance with 10 CFR 50.63 will be maintained as it does not impact the reliability of the DGs. In addition, DG reliability is maintained at or above the SBO target level of 0.975, and the effectiveness of maintenance on the DGs and support systems is monitored pursuant to the Maintenance Rule. The Maintenance Rule performance measure for unavailability also provides a control mechanism on the usage of the extended CT.

Based on the above discussion, extending the CT for a single inoperable DG from 72 hours to 14 days is acceptable because the proposed change will not impact the plant design basis. The 11-day extension of the CT is consistent with BTP 8-8. The impact of extended plant operation is also evaluated in a probabilistic framework (Section 4.4).

To ensure that the risk associated with extending the CT for a DG is minimized, and consistent with the philosophy of maintaining defense-in-depth, compensatory measures will be applied. The availability of the 6.9 kV FLEX DG for extending the DG CT is incorporated into the proposed TS. Other measures are provided in the list of new commitments provided in Enclosure 4. These measures will ensure the risks associated with removing a DG from service are managed to minimize the increase in risk during the extended DG CT.

If this LAR is not granted, extended scheduled DG maintenance (i.e., 6-year or 18-year) would require a dual-unit shutdown so that a DG could be removed from service without TS implication. Additionally, if an unplanned DG outage occurred with both units at power, and the DG was not restored to operable status within 72 hours, this would require a dual-unit shutdown upon expiration of the 72-hour CT provided in TS 3.8.1, Condition B. Shutdown of the plant involves many plant operator activities and plant evolutions. These activities and evolutions provide challenges to plant equipment, opportunities for operator errors and increase the possibility of a plant trip. By granting this LAR and allowing continued steady state operation, additional operator activities and plant operations evolutions associated with plant shutdown can be avoided. The increased possibility for plant trip may also be avoided. This LAR proposes an additional 11 days as a reasonable time for which a regulatory basis exists for CT extension. This additional time period is considered small. Due to the short time period, the probability of a DBA occurring during this interval is low.

4.4 Risk Assessment

The evaluation for extending the CT from 72 hours to 14 days for a single DG was based on a three-tiered approach to assess the risk associated with the proposed amendment. The first tier evaluated the PRA model and the impact of the change on plant operational risk. The second tier addressed the need to prevent potentially high-risk configurations if additional equipment will be taken out of service simultaneously, or other risk-significant operational factors such as concurrent system or equipment testing. The third tier evaluated the configuration risk management program to ensure that equipment removed from service prior to, or during, the proposed CT will be appropriately assessed from a risk perspective.

A description of the WBN PRA Model is provided in Enclosure 2, Section 3.2, including a discussion of the model background and update process. As described in Section 3.2.1, subheading “Revised WBN CAFTA [computer aided fault tree analysis] PRA Model for Dual Unit EDG AOT Extension Submittal,” several model updates were performed to support this submittal, including an extension of the LOOP events through the end of 2013, incorporation of the FLEX DGs, update of the DG maintenance unavailability, and incorporation of several updates included in the Re-evaluation of the Watts Bar Unit 2 Severe Accident Mitigation Alternatives Report.

4.4.1 PRA Quality

The TVA has followed a rigorous process in the development and maintenance of the WBN PRA. This process has resulted in a level of quality allowing enhancement of safety through risk insights and regulatory applications. Some characteristics of this process include independent reviews, the Westinghouse Pressurized Water Reactor Owners Group (PWROG) peer review, detail analysis and integration of PRA elements, supportable assumptions, updates to reflect industry and plant specific data, updates to address any PRA issues identified, and thorough documentation. The TVA has also implemented program controls to ensure as-built plant changes (including modifications, procedure changes, etc.) are routinely evaluated and are accurately reflected in the current model.

The peer review for the WBN Units 1 and 2 Internal Events CAFTA, Revision 0, PRA model was performed by the PWROG during the week of November 16, 2009, at the TVA offices in Chattanooga, Tennessee, using the process described in Nuclear Energy Institute (NEI) NEI 05-04 (Reference 26), the American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) PRA Standard (i.e., ASME/ANS RA-Sa-2009) (Reference 27), and RG 1.200, Revision 2 (Reference 28). The peer review included review of both the internal events analysis and the internal flooding analysis.

A team of independent PRA experts from nuclear utility groups and PRA consulting organizations carried out these peer review certifications. The purpose of the peer review is to provide a method for establishing the technical adequacy of a PRA for the spectrum of potential risk-informed plant licensing applications for which the PRA may be used. The 2009 WBN PRA peer review provided a full-scope review of the technical elements of the internal events, at-power PRA, including internal flooding. The PRA was not reviewed for fires, external flooding, seismic, high winds, or other external events.

This intensive peer review involved over two person-months of engineering effort by the review team and provided a comprehensive assessment of the strengths and limitations of each element of the PRA model. All finding-level facts and observations (F&Os) from this peer review were addressed to at least the requirements of Capability Category II.

All comments that could potentially affect the models and results have already been resolved. The WBN Revision 1 CAFTA PRA now meets at least Capability Category II of the technical requirements of the ASME/ANS Standard (Reference 27) and RG 1.200 (Reference 28), with respect to internal events and internal flooding. Fire and external events such as seismic events, high winds, and external floods are not evaluated in the dual-unit WBN PRA model.

The continual development and improvement of the WBN PRA makes the PRA analysis sufficient to adequately provide risk insights in support of regulatory applications. The WBN PRA has been used in support of several submittals to the NRC, including Fire Induced Vulnerability Assessment for approval of the WBN Unit 2 Operating License and Severe Accident Mitigation Alternatives for License Renewal.

4.4.2 Analysis of Internal Events and Internal Floods

Evaluations for the risk associated with this proposed amendment are performed for the effects of the changes on the following:

- Internal Events and Internal Floods Using the WBN Dual-Unit “At-Power” PRA
- Internal Fires Using the Fire Induced Vulnerability Evaluation (FIVE) Analyses for WBN Unit 1 and Unit 2
- Seismic Events Using the WBN Seismic Hazard Curves and Safe Shutdown Earthquake

The following assumptions were used in performing the analysis:

- For the time-averaged maintenance evaluations in the calculations of change in core damage frequency (ΔCDF) and change in large early release frequency (ΔLERF), it is assumed that the DG maintenance conditions (i.e., preventive maintenance versus corrective maintenance) do not impact the conditional failure probabilities of redundant equipment. This is appropriate for planned maintenance, but is slightly optimistic for corrective maintenance and is typical of time-averaged calculations.

- The evaluation is based on the assumption that the extended allowed CT would be applied to only one major maintenance activity (i.e., 6-year or 18-year overhaul maintenance) per DG per refueling cycle. The cycle time is based on the current 18-month fuel cycle.

- In each month, it is assumed that there is, at most, one planned maintenance event and one unplanned maintenance event for each DG. All planned maintenance duration during each month was combined into one event. Similarly, all unplanned maintenance duration during each month was also combined into one event.

- Only one DG is allowed to be in planned maintenance at a time. In addition, planned maintenance of equipment identified for operation restrictions is not allowed during the entire CT period. Furthermore, no DG planned maintenance is allowed when corrective or planned maintenance of the same equipment identified for operation restrictions is in progress.

- With the 72-hour CT, it is assumed that the 18-month and 2-year maintenance would be performed online, but the 6-year and 18-year preventive maintenance (overhauls) would not be performed online. With the 14-day CT, the 6-year and 18-year overhauls would be performed online and included in the preventive maintenance alignments.

- Because the current DG maintenance unavailability values (including contributions from planned and unplanned maintenance activities) were derived from the maintenance duration data associated with the WBN Unit 1 operation under the 14-day CT, the planned (preventive) and unplanned (corrective) maintenance unavailability values are assumed to remain approximately the same after the implementation of CT extension for both WBN Unit 1 and Unit 2 (i.e., 14-day CT case). Decrease in the DG maintenance unavailability for the 72-hour CT case is primarily due to the exclusion of the longer maintenance events that may be performed during power operation under the 14-day CT condition. As such, the DG maintenance unavailability values for the 72-hour CT case are derived by excluding the contributions of all planned maintenance events with durations exceeding 43.2 hours (i.e., 60% of the 72-hour CT), and the contributions of all unplanned maintenance events with durations exceeding 72 hours.

- The Incremental Conditional Core Damage Probability (ICCDP) and Incremental Conditional Large Early Release Probability (ICLERP) for a single DG out of service are calculated separately for the cases in which the affected DG is in planned maintenance and the cases of corrective maintenance. It is assumed that all planned maintenance events are associated with preventive maintenance and all unplanned maintenance events are associated with corrective maintenance. For the calculation of the planned/preventive maintenance cases, the flag file FLAGSettings.txt was revised to increase the maintenance unavailability of the corresponding DG to 1.0. For the calculation of the unplanned/corrective maintenance cases, it is assumed that the unplanned maintenance was due to failure. As such, flag file FLAGSettings.txt was revised to increase the maintenance unavailability of the corresponding DG to 1.0, and the conditional failure probabilities of common cause failures of the remaining DGs were also increased accordingly.

The proposed changes were evaluated to determine that current regulations and applicable requirements continue to be met, that adequate defense-in-depth and sufficient safety margins are maintained, and that any increase in CDF and LERF is small and consistent with the NRC's policy entitled “Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities: Final Policy Statement”

(60 FR 42622) (Reference 10), as further described by RGs 1.177 and 1.174 (References 7 and 8).

4.4.3 Maintenance Unavailability Calculation Summary

The basic change in risk for this proposed 14-day DG CT concerns the potential for a DG being out of service with both units “at power” for a time frame longer than is allowed under the 72-hour CT. This extended out of service time is primarily associated with planned maintenance, which would increase the overall maintenance unavailability. In order to calculate the differential risk associated with this potential maintenance (i.e., between the 72-hour CT and 14-day CT cases), the maintenance unavailability for DGs was evaluated for both the 72-hour CT and the 14-day CT cases.

Because the current values for the DG maintenance unavailabilities (including contributions from planned and unplanned maintenance activities) were derived from the maintenance duration data associated with WBN Unit 1 operation under the 14-day CT, the planned (preventive) and unplanned (corrective) maintenance unavailabilities are assumed to remain approximately the same after implementation of the CT extension for both WBN Unit 1 and Unit 2 (i.e., 14-day CT case). Decrease in the DG maintenance unavailability for the 72-hour CT case is primarily due to the exclusion of the longer maintenance events that may be performed during power operation under the 14-day CT. As such, the DG maintenance unavailability values for the 72-hour CT case is derived by excluding the contributions of all planned maintenance events with durations exceeding 43.2 hours (i.e., 60% of the 72-hour CT), and the contributions of all unplanned maintenance events with durations exceeding 72 hours.

The maintenance unavailability for the 72-hour CT case is estimated only for calculational purposes in this evaluation of the extended CT and is expected to actually be higher; however, actual evaluation will not be possible unless maintenance duration data is collected under this condition. Random failure probabilities were not adjusted for these calculations.

It is assumed in this analysis that all planned maintenance events are associated with preventive maintenance and all unplanned maintenance events are associated with corrective maintenance. For the calculation of the planned maintenance (preventive maintenance) cases, the maintenance unavailability of the corresponding DG was increased to 1.0. For the calculation of the unplanned maintenance (corrective maintenance) cases, it is assumed that the unplanned maintenance was due to failure. As such, the maintenance unavailability of the corresponding DG was increased to 1.0, and the conditional failure probabilities of common cause failures of the remaining DGs were also increased accordingly.

The DG unavailability is calculated separately for each DG based on the time spent in TS 3.8.1 Actions or TS 3.8.2 Actions. The DG maintenance duration data was downloaded from the Maintenance Rule database (from January 1, 2003, through December 31, 2014). It is assumed that, in each month, there is at most one planned maintenance event and one unplanned maintenance event for each DG. This assumption could conservatively lead to the exclusion of selected maintenance events with durations less than the maximum duration allowed, thereby minimizing the DG maintenance unavailability for the 72-hour CT case and maximizing the delta risk between the 72-hour CT and 14-day CT cases.

4.4.4 Summary of Impact on Internal Events and Internal Flooding Risk

The impact of the proposed CT changes on internal events and internal flooding induced CDF and LERF was evaluated using the revised WBN dual-unit PRA internal events and internal flooding model. The calculations include the overall changes in average CDF and LERF, as well as the incremental changes in CDF and LERF, given that a DG is out of service due to either planned maintenance (preventive maintenance) or unplanned maintenance (corrective maintenance).

The first set of calculations were baseline average risk calculations using the revised WBN dual-unit PRA model and the DG average maintenance unavailability for both before (72-hour CT case) and after (14-day CT case) the implementation of the CT extension. The overall CDF and LERF were calculated using the average unavailability values for all components including the DGs. In the calculations of ΔCDF and ΔLERF, it is assumed that the DG maintenance conditions (i.e., preventive maintenance versus corrective maintenance) do not impact the conditional failure probabilities of redundant equipment. This is appropriate for planned maintenance, but is slightly optimistic for corrective maintenance and is typical of time-averaged calculations.

In the second set of calculations associated with the instantaneous DG maintenance conditions (e.g., DG 1A-A always in maintenance), the CDFs and LERFs for Unit 1 and Unit 2 were computed with one DG removed from service separately for the removal from service due to planned preventive maintenance and the removal from service due to unplanned corrective maintenance. In the first case of planned maintenance, the DG removed from service is assumed to not be the result of a component failure (i.e., the maintenance is planned and no component failure is involved), so that no changes to the conditional failure probabilities of redundant equipment are necessary. For corrective maintenance conditions, where a DG is known to have failed, the conditional failure probabilities of the remaining redundant DGs may be higher due to common cause failure possibilities. At WBN, the redundant DGs are not required to be tested for common cause failure for a period of time (i.e., 24 hours per TS 3.8.1), so one cannot be assured that a common cause is not present until verified. As such, this analysis conservatively assumes that testing of the redundant DGs does not occur for the entire time that corrective maintenance is ongoing. Therefore, the probabilities of the redundant equipment failure modes are adjusted for such unplanned corrective maintenance conditions to reflect the fact that one DG failure has already occurred, and that the redundant, identical equipment may not have been tested. However, existing plant TSs assure that such testing would take place within 24 hours. Therefore, the assumption that no testing takes place is conservative.

To evaluate the effect of the proposed increase in the DG CT on the overall CDF and LERF, ΔCDF and ΔLERF were calculated using values from Enclosure 2, Table 2. The ICCDP and ICLERP were calculated by assuming a DG was in maintenance for the entire CT duration. The calculated ICCDPs associated with a DG out of service due to preventive maintenance and due to corrective maintenance were probabilistically weighted using the relative fraction of maintenance contributions from planned maintenance and from unplanned maintenance. Similarly, the calculated ICLERPs associated with a DG out of service due to preventive maintenance and due to corrective maintenance were also probabilistically weighted using the relative fraction of maintenance contributions from planned maintenance and from unplanned maintenance.

The results of these evaluations and comparison with RG 1.174 and RG 1.177 are provided in Enclosure 2, Table 3.

As seen in Enclosure 2, Table 3, ΔCDF, ΔLERF, ICCDP, and ICLERP associated with the proposed CT change (i.e., 14 days for a single DG inoperable) are all well below the risk thresholds discussed in the regulatory guidance for both WBN Unit 1 and Unit 2. Therefore, the risk changes can be considered small and the evaluation of the 14-day CT for a single DG inoperable meet the risk criteria specified in RG 1.174 and RG 1.177.

4.4.5 Seismic Considerations

In addition to examining the CDF and LERF from internal events and internal flooding, external events are also reviewed. Seismic and fire events can cause a LOOP, though the probability is extremely low. Potential vulnerabilities of WBN to both seismic and fire issues were evaluated in the WBN Individual Plant Evaluation of External Events (IPEEE) using the Electric Power Research Institute (EPRI) Seismic Margins Assessment and Fire Induced Vulnerability Evaluation (FIVE) methodologies, respectively (References 31 and 32). No vulnerabilities to these external events were identified.

The WBN design basis safe shutdown earthquake (SSE) is 0.18g. The mean annual frequency of exceedance for an SSE at the WBN site is 2.35×10^{-4}/year in accordance with the WBN Seismic Hazard and Screening Report submitted to the NRC in response to NRC requests for information related to Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident (Reference 29). The probability of an SSE occurring during the 14-day (0.038 year) period during which the DG is out of service is 8.93×10^{-6}. Because this is a very small probability, the frequency of an SSE occurring in the 14-day period when a DG is out of service can be approximated by this same value.

The evaluation of seismic events performed as part of the IPEEE used the EPRI Seismic Margins Assessment methodology, with a review level earthquake (RLE) of 0.3g for WBN Unit 1 and 0.5g for WBN Unit 2. Both trains of WBN DGs were included in the list of components evaluated for safe shutdown of either unit following an earthquake. The DG building was also evaluated. The evaluation of seismic events provides adequate evidence of the ability of the WBN site to withstand a seismic event up to the RLE and initiate a safe shutdown of the plant. The IPEEE program for both WBN units did not identify any adverse spatial interactions or any components with seismic high confidence, low probability of failure capacity below the RLE level.

In the WBN design bases, the switchyard is assumed to fail during a design-basis earthquake. The conditional core damage probability (CCDP) of an earthquake was assumed to be equal to that of a guaranteed LOOP. For this assessment, the WBN PRA model was modified with the LOOP frequency set equal to 1.0, the possibility of recovering offsite power during the 24-hour mission time failed, and one DG failed due to removal from service for maintenance (DG 1A-A, 1B-B, 2A-A, or 2B-B). The possibility of recovering the DG undergoing maintenance and any other DG that failed during the 24-hour mission time was also failed. The inability to recover offsite power or any DG that failed is a conservative assumption since recovery of a failed DG or the DG undergoing maintenance is possible.

The maximum CCDP is 2.91 x 10^{-3} for WBN Unit 1 (assuming DG 2B-B undergoing maintenance) and 2.96 x 10^{-3} for WBN Unit 2 (assuming DG 1B-B undergoing maintenance). The maximum CDF due to a design basis or larger earthquake during the 14-day period that the DG is out of service may be calculated as:

(Probability of an SSE occurring during the 14-day period) x (Maximum CCDP) =

$(8.93 \times 10^{-6})(2.91 \times 10^{-3}) = 2.60 \times 10^{-8}$ per year for WBN Unit 1

$(8.93 \times 10^{-6})(2.96 \times 10^{-3}) = 2.64 \times 10^{-8}$ per year for WBN Unit 2

Additionally, when performing a Seismic Margins Assessment with an RLE of 0.3g/0.5g compared with the SSE of 0.18g, the WBN IPEEE indicates that both trains of DGs could withstand a seismic event up to the RLE and initiate a safe shutdown of the plant. These conclusions are consistent with the guidance of RG 1.177, Key Component 4 in Section 2.3.7.2, which states, "The licensee should treat external hazards and Level 2 issues either qualitatively or quantitatively, or both."

In conclusion, the probability of an SSE occurring during the 14-day DG CT is low, and the opposite train of DGs would be available to provide safe shutdown of the units, thus no additional considerations due to seismic events are required.

4.4.6 Fire Considerations

Based on information provided in NUREG-1407, "Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities," (Reference 30) TVA concluded that the site was reasonably clear of combustible materials and therefore, external fires were not considered in the WBN IPEEE for either WBN Unit 1 or Unit 2.

The effects from an internal fire were examined in the IPEEE using the FIVE methodology. No fire-induced vulnerabilities were identified during the evaluation.

At WBN, each DG is housed in its own room. Physical separation requirements are provided for each room as well as fire suppression from a Carbon Dioxide system described in the WBN Fire Protection Report, Parts II and III. In the IPEEE, DG Rooms DGB-1A, DGB-2A, DGB-1B, and DGB-2B are Fire Areas 49, 50, 51, and 52, respectively. These rooms screened out in Phase II.3 of both the WBN Unit 1 and WBN Unit 2 IPEEE analyses. In the WBN Unit 1 IPEEE analysis submitted to the NRC in February 1998 (Reference 31), the fire related CDF for the DG Rooms ranged from 1.52 x 10^{-7} to 1.64 x 10^{-7} per year. In the WBN2 IPEEE analysis submitted to the NRC in March 2015 (Reference 32) , the fire related CDF for the DG Rooms ranged from 2.75 x 10^{-7} to 3.39 x 10^{-7}. This fire related frequency may increase during DG maintenance due to the potential for introducing additional transient combustibles. These transient combustibles, if present, are controlled and any necessary fire protection and impairment permits are prepared according to plant procedures. In addition, equipment in the opposite train would be protected so that safe shutdown of the affected units can be achieved.

Summary of WBN Unit 1 Evaluation

Overall, the evaluations of the specified fire areas (see Enclosure 2, Section 3.5.5) demonstrate that the risk increase due to severe fire with a combination of a LOOP is small. There are three areas where the probability of a severe fire while a DG is out of service for maintenance could cause the conditional core damage frequency to slightly exceed the IPEEE screening criteria. These areas are Elevation 757.0 (Areas A2 and A24, 6.9 kV and 480 V Shutdown Board Rooms A and B, respectively), and Elevation 772.0 (Area A15, 480 V Board Room 2-B). The actual probability of a severe fire in these areas is low and fire in these areas would most likely be detected before they would become severe. The 6.9 kV and 480 V Shutdown Board Rooms A and B are located close to the main control room and personnel traverse these areas frequently. Personnel are also required to enter the 480 V Board Room at least twice a shift.

Summary of WBN Unit 2 Evaluation

The evaluations of the relevant WBN Unit 2 fire areas (see Enclosure 2, Section 3.5.6) demonstrate that the CDF risk increase due to severe fire is small. The annual, average CDF for the 14-day CT case is below the FIVE screening criteria for all of the areas evaluated. There are nine rooms where the probability of a severe fire while a DG is out of service for maintenance could cause the fire related CDF to exceed the IPEEE screening criteria. These rooms are 737.0-A1 (selected areas in Auxiliary Building, Elevation 737.0), 757.0-A22 (125 V Vital Battery Board Room IV), 757.0-A24 (6.9 kV and 480 V Shutdown Board Room B), 772.0-A2 (480 V Board Room 1-B), 786.0-AR (Roof), 708.0-C3 (Computer Room), 708.0-C4 (Unit 2 Auxiliary Instrument Room), 755.0-C13 and C20 (Relay Room and DPSO Shop), and 757.0-A2 (6.9 kV and 480 V Shutdown Board Room A).

The actual frequency of a severe fire in these rooms is low and fire in these rooms would most likely be detected before they would become severe. For example, the 6.9 kV and 480 V Shutdown Board Rooms A and B are located close to the main control room and personnel traverse these areas frequently. Personnel are also required to enter the 480 V Board Room at least twice a shift. Furthermore, the fire related ICCDPs calculated for these rooms given a DG out of service for maintenance are all below the ICCDP criterion of 10^{-6}. This is because the likelihood of a fire during the time when the DG is out of service for maintenance is very low. In addition, although the ICCDP criterion of 10^{-6} specified in RG 1.177 is meant to be applied on an overall unit basis, it is used in this evaluation due to the screening nature of the FIVE methodology.

4.4.7 Other External Events

As shown in the TVA IPEEEs for both WBN Unit 1 and Unit 2, the severe accident risk resulting from other external hazards is extremely low. Therefore, no additional evaluation of the other external hazards leading to the LOOP and/or loss of DGs was performed in the Enclosure 2 analysis.

4.4.8 Configuration Risk Management Program

The methods of evaluating risk during maintenance and the station procedure for configuration risk management are designed to control and minimize the risks involved with this proposed CT extension.

TVA currently manages risk with a procedurally controlled program that governs the scheduling of maintenance activities. This program involves review from a probabilistic and/or deterministic standpoint of all, planned and unplanned, maintenance activities. Maintenance is normally assessed from a probabilistic standpoint using a computerized online risk monitor, that uses the EPRI sponsored software called EOOS. The on-line risk monitor uses the actual WBN PRA model to quantify results. In cases where a quantitative solution is not possible because the functions or systems being evaluated are not modeled, a qualitative assessment is used. Under certain risk significant conditions, both quantitative and qualitative assessments are required. TVA implements the appropriate restrictions through work planning, risk assessment, and during the performance of DG maintenance, precludes simultaneous equipment outages that would erode the principles of redundancy and diversity.

Work Planning

The long-term maintenance plan at WBN specifies the frequency for implementation of maintenance and surveillance activities necessary for the reliability of components in each system. The rolling schedule includes the preliminary defense-in-depth assessment that documents the allowable combinations of system and functional equipment groups (FEG) that may be simultaneously worked online or during shutdown conditions. FEGs are common sets of boundaries encompassing equipment that has been evaluated for acceptable out-of-service combinations. They are used to schedule planned maintenance and establish equipment clearances.

Predetermined system or FEG work windows are established for online maintenance and outage periods. The work windows are based on recommended maintenance frequencies and are sequenced to minimize the risk of online maintenance. Work windows are defined by week and repeat at 13-week intervals. The work windows ensure required surveillances are performed within their required frequency and that division/train/loop/channel interferences are minimized. The WBN scheduling organization maintains a long range schedule based on required surveillance testing for online activities and plant conditions.

The long-term maintenance plan is implemented by the surveillance testing schedule. In addition, other periodic activities, such as preventive maintenance items, are scheduled to coincide with related surveillance tests to maximize component availability. System FEGs are used to ensure work on related components is evaluated for inclusion in the work window. Related corrective maintenance activities are also evaluated for inclusion in the work window. The inclusion of all identified work (surveillance tests, preventive and corrective maintenance items) in the FEG work window maximizes component availability and operability.

Risk Assessment

The effectiveness of maintenance on the DGs and support systems is monitored pursuant to the Maintenance Rule (10 CFR 50.65), which requires licensees to assess and manage the increase in risk that may result from proposed maintenance activities before performing such activities. Therefore, before performing maintenance activities on a DG during the extended CT, pursuant to 10 CFR 50.65(a)(4), TVA assesses and manages any increase in risk that may result from such activities. This assessment is performed in accordance with the configuration risk management process. This ensures that PRA-informed processes are in place to assess the overall impact of maintenance activities on plant risk before entering the TS Condition for planned activities.

The assessment includes the following:

- The schedule is evaluated against the risk bases derived from the WBN PRA.
- The scheduled activities are assessed before starting work to maximize safety (reduce risk) when performing online work.
- Avoidance of recurrent entry into a specific TS Condition for multiple activities. Activities that require entering the same TS Condition are combined to limit the number of times a TS Condition entry is made, thus maximizing the equipment's availability.
- If the risk associated with a particular activity cannot be determined, a risk assessment is performed.

Work Activity Risk Management is the tool used to enhance the preparation, execution, and oversight of high risk work activities. It includes the following three-phase process used to evaluate the risk associated with work activities:

- Risk Characterization of the Work Activities
- Development of High Risk Management Plans for High Risk Activities
- Aggregate Risk Assessment

Work activity risk characterization and evaluation is performed as early in the work control/planning process as possible. Emergent, support, and repetitive activities are addressed individually with specific actions for risk management.

DG Maintenance

During power operation, the DGs help to ensure that sufficient power is available to the safety-related equipment needed for safe shutdown of the plant and for mitigation and control during accident conditions. During shutdown and refueling conditions, the DGs help to ensure that the facility is able to maintain shutdown or refueling conditions for extended periods of time.

Experience has shown that, even with careful planning, maintenance duration sometimes approaches the CT limit. In order to accommodate unanticipated problems, TVA has developed the practice of scheduling work for only 50 to 60 percent of the CT for planned maintenance (schedules work only if the work is anticipated to take no more than 50 to 60 percent of the CT). Compared to the 72-hour CT, the proposed 14-day CT will significantly reduce DG unavailability for the 6-year and 18-year maintenance. Maintenance activities that can be performed within a CT of 72 hours are not expected to change. By combining activities into fewer DG outages, based on the extended CT, the DG availability is expected to improve, which would result in a net reduction in risk.

4.4.9 Compensatory Measures

To manage the risk activities associated with the DG CT extension, compensatory measures involving additional operational restrictions may be taken when performing extended-scheduled maintenance on a DG (i.e., using the extended 14-day CT). The following contingency actions (i.e., limitations for planned maintenance during power operation) are being incorporated into the TS 3.8.1 Bases.

- Verify that the offsite power system is stable. This action will establish that the offsite power system is within single-contingency limits and will remain stable upon the loss of any single component supporting the system. If a grid stability problem exists, the planned DG outage will not be scheduled.
- Verify that no adverse weather conditions are expected during the outage period. The planned DG outage will be postponed if inclement weather (such as severe thunderstorms or heavy snowfall) is projected.
- Do not remove from service the ventilation systems for the 6.9 kV shutdown board rooms, the elevation 772 transformer rooms, or the 480-V shutdown board rooms, concurrently with the DG, or implement appropriate compensatory measures.
- Do not remove the reactor trip breakers from service concurrently with planned DG outage maintenance.
- Do not remove the turbine-driven auxiliary feedwater (AFW) pump from service concurrently with the planned DG outage of the same unit.
- Do not remove the AFW level control valves to the steam generators from service concurrently with planned DG outage of the same unit.
- Do not remove the opposite train residual heat removal (RHR) pump from service concurrently with planned DG outage of the same unit.

4.4.10 Uncertainties

Based on RG 1.177, previous sensitivity analyses performed for risk-informed TS changes have shown that the risk resulting from TS CT changes is relatively insensitive to uncertainties. This is because the uncertainties associated with CT changes tend to similarly affect the base case and the change case. Since no new initiating events or subsequent failure modes are likely to have been introduced by the CT changes, the risks result from similar causes in both cases. Completion Time changes subject the plant to a variation in its exposure to the same type of risk, and the PRA model is able to predict, with relative surety, based on data from operating experience, how much that risk will change based on that changed exposure.

Details of the qualitative and quantitative PRA evaluation of risk impact are documented in Enclosure 2, Sections 3.3 through 3.6. The quantitative evaluation was performed on a point estimate basis. Due to the extensive number of cases evaluated and the significant margin below the acceptance criteria, propagation of parameter uncertainties was not performed. Because the calculated values for ∆CDF, ∆LERF, ICCDP, and ICLERP are significantly lower than the acceptance criteria for these risk metrics, the conclusions (i.e., the risk of extending the DG CT from 72 hours to 14 days is small) are not expected to be changed even if uncertainty propagation is performed.

For the CT change evaluation, the only source of uncertainty that is not offset between the base and the change cases and is likely to impact the calculated risk metrics is the maintenance unavailability of the affected DGs. In this analysis, however, conservative maintenance unavailability values were used such that conservative risk results are obtained. As such, the impact of uncertainty in the DG maintenance unavailability is already accounted for by the use of conservative maintenance unavailability values.

4.4.11 PRA Results

As documented in Enclosure 2, the risk change calculated using the WBN PRA for the proposed DG CT extension for all four DGs is small. The quantitative results of the evaluation are shown in Table 3 below:

Table 3 - Quantitative Results of PRA Evaluation

Risk Metric	**Risk Metric Results**		**Risk Significant Guideline**	**Meets Acceptance Guideline**
	Unit 1	**Unit 2**		
Total CDF	1.12×10^{-5}	1.16×10^{-5}	RG 1.174	Yes
Total Δ CDF	1.75×10^{-7}	1.56×10^{-7}	RG 1.174	Yes
Total LERF	8.95×10^{-7}	9.12×10^{-7}	RG 1.174	Yes
Total Δ LERF	2.88×10^{-9}	3.59×10^{-9}	RG 1.174	Yes
ICCDP	2.18×10^{-7}	2.63×10^{-7}	RG 1.177	Yes
ICLERP	8.55×10^{-9}	1.16×10^{-8}	RG 1.177	Yes

4.4.12 Sensitivity Studies

The PRA risk analysis used as input to the DG 14 day AOT LAR was discussed with industry peers, with respect to inclusion of the FLEX DGs in the PRA model. The industry peers were supportive of the analysis but suggested that two sensitivity cases be performed. Because limited failure data is available at this time for the FLEX DGs the industry peers suggested a sensitivity case be calculated using an assumption of a tenfold increase in the probability that the FLEX DGs might fail to start or run. The industry peers also observed that for initiating events which would require a safety injection, even given the pre-planning that will be performed for safety-related DG maintenance, there would be more delay in lining up a FLEX DG than in starting and loading a safety-related DG. As such, they recommended a sensitivity case in which the FLEX DGs were assumed to be unavailable for SI initiators. Both sensitivity cases were performed and neither case resulted in a significant increase in the calculated results. That is, the results still were well within RG 1.177 and RG 1.174 guidelines.

4.4.13 Regulatory Issue Summary (RIS) 2008-15 Insights

In NRC RIS 2008-15, "NRC Staff Position on Crediting Mitigating Strategies Implemented in Response to Security Orders in Risk-Informed Licensing Actions and in the Significance Determination Process," the NRC staff provided their position on crediting mitigating strategies implemented in response to security Orders in the risk assessments associated with risk-informed licensing actions and the significance determination process (SDP) used in the Reactor Oversight Process.

Regulatory Issue Summary 2008-15 is directed at crediting mitigating strategies implementing in response to security Orders but its guidance is generic enough to be referenced for crediting Flex mitigating strategies. The RIS states that if a licensee seeks to obtain such credit, the crediting of these strategies in risk assessments must be consistent with current, extant guidance on PRA quality such as found in Regulatory Guide (RG) 1.200, “An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities,” and also clarifies some of the salient points of existing guidance.

For risk-informed licensing actions RIS 2008-15 states that licensees should submit LARs using the guidance of RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," and/or one of the application-specific risk informed guides, RG 1.175, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Inservice Testing," RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," or RG 1.178, "An Approach for Plant-Specific Risk-Informed Decisionmaking for Inservice Inspection of Piping."

Because this LAR is a change to WBN Unit 1 and Unit 2 TS, TVA used RGs 1.174 and 1.177, and provides a discussion of PRA quality referencing RG 1.200.

4.5 Conclusion

The results of the deterministic evaluation and risk-informed assessment described above provide assurance that the equipment required to safely shut down the plant and mitigate the effects of a LOOP, SBO, or DBA (without a single failure) will remain capable of performing their safety functions when a DG is out-of-service in accordance with the proposed 14-day CT.

The proposed CT is consistent with NRC policy and will continue to provide protection of the public health and safety. As detailed in Section 2.3 of this enclosure, the proposed changes align with the objectives of the NRC's Policy Statement on the use of PRA methods, including safety decision-making enhanced by the use of PRA insights, more efficient use of resources, and reduction of unnecessary burden. In addition, the proposed changes meet the following principles:

1. It meets the current regulations.

2. It is consistent with the defense-in-depth philosophy.

3. It maintains sufficient safety margins.

4. It results in acceptable risk metrics consistent with the criteria in RG 1.177 and RG 1.174 (References 7 and 8) and is consistent with the NRC's Safety Goal Policy Statement, as implemented via the NRC Standard Review Plan, NUREG-0800.

5. Its impact will be monitored using performance measurement strategies.

Therefore, based on the above evaluations and conclusions, the proposed changes are acceptable and operation in the proposed manner will not present undue risk to public health and safety or be inimical to the common defense and security.

5.0 REGULATORY EVALUATION

5.1 Applicable Regulatory Requirements and Criteria

10 CFR 50.63(a), “Loss of all alternating current power,” requires that each light water-cooled nuclear power plant licensed to operate be able to withstand for a specified duration and recover from a station blackout. The proposed changes do not affect TVA's compliance with the intent of 10 CFR 50.63(a).

10 CFR 50.65, “Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” requires that preventive maintenance activities must not reduce the overall availability of the systems, structures and components (SSCs). It also requires that before performing maintenance activities, the licensee shall assess and manage the increase in risk that may result from the proposed maintenance activities. The proposed changes do not affect TVA's compliance with the intent of 10 CFR 50.65.

10 CFR 50, Appendix A, GDC 17, “Electric power systems,” states, in part, that nuclear power plants have onsite and offsite electric power systems to permit the functioning of SSCs that are important to safety. The onsite system is required to have sufficient independence, redundancy, and testability to perform its safety function, assuming a single failure. The offsite power system is required to be supplied by two physically independent circuits that are designed and located so as to minimize, to the extent practical, the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. The proposed changes do not affect TVA's compliance with the intent of GDC 17.

GDC 18, “Inspection and testing of electric power systems,” states that electric power systems that are important to safety must be designed to permit appropriate periodic inspection and testing of important areas and features, such as insulation and connections to assess the continuity of the systems and the condition of their components. The proposed changes do not affect TVA's compliance with the intent of GDC 18.

RG 1.155, “Station Blackout,” describes a method acceptable to the NRC staff for complying with the Commission regulation that requires nuclear power plants to be capable of coping with a SBO event for a specified duration. The proposed changes do not affect TVA's compliance with the intent of RG 1.155.

RG 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” describes a risk-informed approach, acceptable to the NRC, for assessing the nature and impact of proposed licensing basis changes by considering engineering issues and applying risk insights. This RG also provides risk acceptance guidelines for evaluating the results of such assessments. RG 1.174 was used for the evaluation of risk provided with this license amendment request.

RG 1.177, “An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical

Specifications," identifies an acceptable risk-informed approach including additional guidance specifically geared toward the assessment of proposed TS CT changes. Specifically, RG 1.177 identifies a three-tiered approach for the evaluation of the risk associated with a proposed CT TS change. RG 1.177 was used for the evaluation of risk provided with this license amendment request.

5.2 Precedent

TVA reviewed past NRC approved License Amendments looking for similar instances where the NRC approved DG AOT extensions to 14-days. Two similar extension request approvals were found; one for the Seabrook Station, Unit 1; another for the Brunswick Steam Electric Plant, Units 1 and 2.

By letter dated September 21, 2004 (Reference 35), the NRC issued License Amendment No. 97 to Facility Operating License No. NPF-86 for the Seabrook Station, Unit No. 1 (Seabrook). The amendment modified the Seabrook TSs to extend the Emergency DG allowed outage time from 72 hours to a period of 14 days and to allow extension of the current 2-hour time requirement to 4 hours for verification of redundant component operability. These changes were in support of installing a non-safety-related supplemental emergency power system.

By letter dated February 24, 2014 (Reference 33), the NRC issued License Amendment Nos. 264 and 292 to Renewed Facility Operating License Nos. DPR-71 and DPR-62 for the Brunswick Steam Electric Plant, Units 1 and 2, respectively, approving the extension of the CT for an inoperable DG from 7 days to 14 days, in order to perform DG preventative maintenance. The approved change also permitted avoidance of an unplanned plant shut downs for DG corrective maintenance. As a defense-in-depth measure consistent with NUREG-0800, BTP 8-8, the licensee proposed a supplemental AC power source (SUPP-DG). The SUPP-DG could be substituted for any one of the four DGs under SBO conditions, and has the capacity to bring the affected unit to cold shutdown.

These approved amendments are similar to TVA's WBN DG 14-day AOT extension request in that they used a deterministic evaluation and a risk-informed evaluation, relying on a supplemental DG.

5.3 Significant Hazards Consideration

The Tennessee Valley Authority (TVA) proposes to revise Technical Specification (TS) 3.8.1, "AC Sources – Operating," to extend the Completion Time (CT) for an inoperable diesel generator (DG) from 72 hours to 14 days. The proposed CT is based on application of the Watts Bar Nuclear Plant probabilistic risk assessment in support of a risk-informed extension, and on additional considerations and compensatory actions. The proposed CT of an additional 11 days is a reasonable time for which a regulatory basis exists for CT extension. The risk evaluation and deterministic engineering analysis supporting the proposed change have been developed in accordance with the guidelines established in Regulatory Guide (RG) 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," and RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis." Secondly, changes are proposed to TS 3.8.1 to clarify the Conditions and Required Actions by removing the word “required” when immediately preceding “DGs” and “DG(s).” Lastly, changes are proposed to the wording of Surveillance Requirement (SR) 3.8.1.19 to remove a potential conflict between the SR wording and the Note modifying SR 3.8.1.19.

TVA has concluded that the changes to TS 3.8.1 do not involve a significant hazards consideration. This conclusion is based on an evaluation in accordance with 10 CFR 50.91(a)(1) of the three standards set forth in 10 CFR 50.92, “Issuance of amendment,” as discussed below:

1. *Does the proposed amendment involve a significant increase in the probability or consequence of an accident previously evaluated?*

Response: No.

The DGs are safety related components that provide backup electrical power supply to the onsite electrical power distribution system. The proposed change does not affect the design of the DGs, the operational characteristics or function of the DGs, the interfaces between the DGs and other plant systems, or the reliability of the DGs. The DGs are not accident initiators; the DGs are designed to mitigate the consequences of previously evaluated accidents including a loss of offsite power. Extending the CT for a single DG does not affect the previously evaluated accidents, because the remaining DGs supporting the redundant engineered safety feature (ESF) systems would continue to be available to perform the accident mitigation functions. Therefore, allowing a DG to be inoperable for an additional 11 days for performance of maintenance or testing does not increase the probability of a previously evaluated accident.

Deterministic and probabilistic risk assessments evaluated the effect of the proposed TS change on the availability of an electrical power supply to the plant ESF systems. These assessments concluded that the proposed TS change does not involve a significant increase in the risk of power supply unavailability.

There is small incremental risk associated with continued operation for an additional 11 days with one DG inoperable; however, the calculated impact on risk provides risk metrics consistent with the acceptance guidelines contained in RG 1.177 and RG 1.174. This risk is judged to be reasonably consistent with the risk associated with continued operation for 72 hours with one DG inoperable as allowed by the current TS.

Specifically, the remaining operable DGs and paths are adequate to supply electrical power to the onsite electrical power distribution system. A DG is required to operate if both offsite power sources fail to ensure the unit can be brought to a cold shutdown condition. The probability of a design basis accident occurring during this period is low.

The consequences of previously evaluated accidents will remain the same during the proposed 14-day CT as during the current 72-hour CT. The ability of the remaining TS required DGs to mitigate the consequences of an accident will not be affected, because no additional failures are postulated while equipment is inoperable within the TS CT. The standby AC power supply for each of the four 6.9 kV shutdown boards consists of one DG complete with its auxiliaries, which include the cooling water, starting air, lubrication, intake and exhaust, and fuel oil systems. The sizing of the DGs and the loads assigned among them is such that two DGs in a load group are capable of shutting down the plant safely, maintaining the plant in a safe shutdown condition, and mitigating the consequences of accident conditions. Therefore, this change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. *Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?*

Response: No.

The proposed change does not involve a change in the plant design, plant configuration, system operation, or procedures involved with the DGs. The proposed change allows a DG to be inoperable for additional time. Equipment will be operated in the same configuration and manner that is currently allowed, consistent with plant design. The functional demands on credited equipment is unchanged. Utilization of a 6.9 kV FLEX DG will provide additional time to respond to a loss of offsite power. The design of the 6.9 kV FLEX DG includes features and administrative controls to maintain the separation and protection of the AC distribution system and does not create the possibility of a new or different kind of accident from any previously evaluated. Therefore, there are no new failure modes or mechanisms created due to plant operation for an extended period to perform DG maintenance or testing. Extended operation with an inoperable DG does not involve any modification in the operational limits or physical design of plant systems. There are no new accident precursors generated due to the extended CT. Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. *Does the proposed amendment involve a significant reduction in a margin of safety?*

Response: No.

Currently, if an inoperable DG is not restored to operable status within 72 hours, TS 3.8.1, Condition F, requires the unit to be in Mode 3 (i.e., Hot Shutdown) within a CT of 6 hours, and to be in Mode 5 (i.e., Cold Shutdown) within a CT of 36 hours. This TS Condition would be entered on both units resulting in a dual-unit shutdown. The proposed TS change will allow steady state plant operation at 100 percent power for an additional 11 days for performance of DG preventive and corrective maintenance or testing.

Deterministic and probabilistic risk assessments evaluated the effect of the proposed TS change on the availability of an electrical power supply to the plant ESF systems. These assessments concluded that the proposed TS change does not involve a significant increase in the risk of power supply unavailability.

The DGs continue to meet their design requirements. There is no reduction in capability or change in design configuration. The DG response to a loss of offsite power, loss of coolant accident, station blackout, or fire is not changed by this proposed change. There is no change to the DG operating parameters. In the extended CT, as in the existing CT, the remaining operable DGs and associated equipment are adequate to supply electrical power to the onsite emergency power distribution system. The proposed change does not alter a design basis or safety limit. Therefore, it does not significantly reduce the margin of safety. The DGs will continue to operate per the existing design and regulatory requirements.

The proposed TS change does not alter the plant design nor does it change the assumptions contained in the safety analyses. The standby AC power system is designed with sufficient redundancy such that a DG may be removed from service for maintenance or testing. The remaining DGs are capable of carrying sufficient electrical loads to satisfy the Updated Final Safety Analysis Report requirements for accident mitigation or unit safe shutdown. The proposed change does not impact the redundancy or availability requirements of offsite power circuits or change the ability of the plant to cope with a station blackout event. Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, TVA concludes that the proposed change does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of “no significant hazards consideration” is justified.

5.4 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission’s regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

6.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7.0 REFERENCES

1. Letter from TVA to NRC, “Watts Bar Nuclear Plant (WBN) - Technical Specification Change TS-01-04, Diesel Generator (DG) Risk Informed Allowed Outage Time (AOT) Extension,” dated August 7, 2001. [ML012290076]

2. Letter from NRC to TVA, “Watts Bar Nuclear Plant, Unit 1 – Issuance of Amendment Regarding Increase In Allowed Outage Times for Emergency Diesel Generators (TAC No. MB2720),” dated July 1, 2002. [ML021840589]

3. Letter from TVA to NRC, “Technical Specification Change Request to Revise Completion Time for Inoperable Diesel Generator(s),” dated November 30, 2009. [ML093640790]

4. Letter from NRC to TVA, “Watts Bar Nuclear Plant, Unit 1 – Issuance of Amendment Regarding the Completion Time for the Inoperable Emergency Diesel Generator(s) (TAC No. ME2985),” dated July 6, 2010. [ML101390154]

5. Letter from NRC to TVA, “Watts Bar Nuclear Plant, Unit 1 – Issuance of Amendment Regarding Technical Specification 3.8.1, ‘AC [Alternating Current] Sources - Operating,’ Surveillance Requirements Notes (TAC No. ME6980),” dated November 22, 2011. [ML11234A258]

6. BTP 8-8, “Onsite (Emergency Diesel Generators) and Offsite Power Sources Allowed Outage Time Extensions,” Initial - February 2012. [ML113640138]

7. RG 1.177, “An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications,” Revision 1, May 2011. [ML100910008]

8. RG 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” Revision 2, May 2011. [ML100910006]

9. TSTF-GG-05-01, “Writer’s Guide for Plant-Specific Improved Technical Specifications,” Revision 1, dated August 2010. [ML12046A089]

10. NRC Policy Statement, “Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities; Final Policy Statement,” Federal Register, Volume 60, p. 42622, August 16, 1995. [60 FR 42622]

11. Letter from NRC to TVA, “Watts Bar Nuclear Plant, Units 1 and 2 - Safety Evaluation Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC Nos. MF0950, MF0951, MF1177, and MF1178),” dated March 27, 2015. [ML15078A193]

12. 10 CFR 50, Appendix A, General Design Criterion 17, Electric Power Systems.

13. Watts Bar Nuclear Plant Updated Final Safety Analysis Report, Section 8, Amendment 12.

14. Letter from TVA to NRC, "Browns Ferry Nuclear Plant (BFN) Units 1, 2 & 3, Sequoyah Nuclear Plant (SQN) Units 1 & 2 and Watts Bar Nuclear Plant (WBN) Unit 1 - Nuclear Regulatory Commission (NRC) Generic Letter (GL) 2006-02: Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power - Response," dated April 3, 2006. [ML060950306]

15. Letter from TVA to NRC, "Browns Ferry Nuclear Plant (BFN) Units 1, 2 & 3, Sequoyah Nuclear Plant (SQN) Units 1 & 2 and Watts Bar Nuclear Plant (WBN) Unit 1 - Request For Additional Information Regarding Resolution of Generic Letter 2006-02, Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power (TAC Nos. MD0947 through MD1050)," dated January 31, 2007. [ML060950306]

16. Letter from NRC to TVA, "Watts Bar Nuclear Plant, Unit 1 - Response to Generic Letter 2006-02 "Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power" (TAC No. MD1049)," dated May 3, 2007. [ML071080225]

17. NUREG-0847, "Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Unit 2," Supplement 28, published August 2015. [ML15229A195]

18. Letter from TVA to NRC, "Application to Modify Watts Bar Nuclear Plant, Unit 1 Technical Specifications Regarding AC Sources - Operating (TS-WBN-13-02)," dated August 1, 2013. [ML13220A103]

19. Letter from TVA to NRC, CNL-14-015, "Response to NRC Requests for Additional Information Related to Application to Modify Watts Bar Nuclear Plant, Unit 1 Technical Specifications Regarding AC Sources - Operating (TS-WBN-13-02)," dated April 21, 2014. [ML14112A341]

20. Letter from TVA to NRC, CNL-14-107, "Response to NRC Requests for Additional Information Related to Application to Modify Watts Bar Nuclear Plant, Unit 1 Technical Specifications Regarding AC Sources - Operating (TS-WBN-13-02)," dated January 29, 2015. [ML15041A732]

21. Letter from NRC to TVA, "Watts Bar Nuclear Plant, Unit 1 – Issuance of Amendment Regarding Alternating Current Sources (TAC NO. MF2549)," dated September 29, 2015. [ML15225A094]

22. RG 1.155, "Station Blackout," August 1988. [ML003740034]

23. NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," Revision 1, August 1991.

24. NRC Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012.

25. Letter from TVA to NRC, CNL-14-233, "Compliance Letter and Final Integrated Plan in Response to the March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049) for Watts Bar Nuclear Plant (TAC Nos. MF0950 and MF1177)," dated March 12, 2015. [ML15072A116]

26. NEI 05-04, "Process for Performing Internal Events PRA Peer Reviews Using the ASME/ANS PRA Standard," Revision 2, November 2008. [ML083430462]

27. ASME, "Addenda to ASME/ANS Ra-S-2008 – Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," RA-Sa-2009, February 2009.

28. RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," Revision 2, March 2009. [ML090410014]

29. Letter from TVA to NRC, CNL-14-038, "Tennessee Valley Authority's Seismic Hazard and Screening Report (CEUS Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," Enclosure 4, "Seismic Hazard and Screening Report for Tennessee Valley Authority's Watts Bar Nuclear Plant," dated March 31, 2014. [ML14098A478]

30. NUREG-1407, "Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities," June 1991.

31. Letter from TVA to NRC, "Watts Bar Nuclear Plant (WBN) Unit 1 – Generic Letter 88-20, Supplements 4 and 5 – Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities (TAC No. M83693)," dated February 17, 1998. [ML073240219]

32. Letter from TVA to NRC, CNL-15-027, "Watts Bar Nuclear Plant Unit 2 – Individual Plant Examination of External Events Final Report," dated March 20, 2015. [ML15079A182]

33. Letter from NRC to Brunswick Steam Electric Plant, "Brunswick Steam Electric Plant, Units 1 and 2 License Amendments Regarding Changes to Technical Specifications for Extension of Completion Time for an Inoperable Emergency Diesel Generator (TAC Nos. ME8893 and ME8894)," dated February 24, 2014. [ML13329A362]

34. Letter from TVA to NRC, CNL-15-190, "Watts Bar Nuclear Plant Unit 2 – Submittal of Final Revision 0 of the Technical Specifications & Technical Specification Bases, and Final Revision 0 of the Technical Requirements Manual & Technical Requirements Manual Bases," dated September 23, 2015. [ML15267A183]

35. Letter from NRC to FPL Energy Seabrook, LLC, "Seabrook Station, Unit No. 1 - Issuance of Amendment RE: Change to Emergency Power Systems (TAC No. MC0635)," dated September 21, 2004. [ML042240471]

36. Letter from NRC to TVA, "Issuance of Amendment on Diesel Generator Systems Testing (TAC No. M98919)," dated October 19, 1998. [ML020780221]

37. Letter from NRC to TVA, "Watts Bar Nuclear Plant Units 1 and 2 – NRC Team Inspection Report 05000390/2015009 and 05000391/2015616," dated June 22, 2015. [ML15173A317]

38. NRC Inspection Manual Temporary Instruction 2515/191, "Inspection of the Implementation of Mitigation Strategies and Spent Fuel Pool Instrumentation Orders and Emergency Preparedness Communication/Staffing/Multi-Unit Dose Assessment Plans," dated October 6, 2014. [ML14273A444]

ATTACHMENT 1

Proposed TS Changes (Mark-Ups) for WBN Units 1 and 2

Proposed TS Changes (Mark-Ups) for WBN Unit 1

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. (continued)	A.3	Restore required offsite circuit to OPERABLE status.	72 hours AND ~~6~~17 days from discovery of failure to meet LCO
B. One DG inoperable.	B.1	Perform SR 3.8.1.1 for the required offsite circuits.	1 hour AND Once per 8 hours thereafter
	AND		
	B.2	Evaluate availability of 6.9 kV FLEX DG.	2 hours AND Once per 12 hours thereafter
	AND		
	B.3	Declare required feature(s) supported by the inoperable DG inoperable when its required redundant feature(s) is inoperable.	4 hours from discovery of Condition B concurrent with inoperability of redundant required feature(s)
	AND		

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.4.1 Determine OPERABLE DGs are not inoperable due to common cause failure. OR B.4.2 Perform SR 3.8.1.2 for OPERABLE DGs. AND B.5 Restore DG to OPERABLE status.	24 hours 24 hours 72 hours from discovery of unavailability of 6.9 kV FLEX DG AND 24 hours from discovery of Condition B entry ≥ 48 hours concurrent with unavailability of 6.9 kV FLEX DG AND 14 days AND 17 days from discovery of failure to meet LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
~~B~~C. ~~One or more~~Two DG~~(s)~~ in Train A inoperable. OR ~~One or more~~Two DG~~(s)~~ in Train B inoperable.	~~B~~C.1	Perform SR 3.8.1.1 for the required offsite circuits.	1 hour AND Once per 8 hours thereafter
	AND		
	~~B~~C.2	Declare required feature(s) supported by the inoperable DG~~(s)~~ inoperable when its required redundant feature(s) is inoperable.	4 hours from discovery of Condition ~~B~~C concurrent with inoperability of redundant required feature(s)
	AND		
	~~B~~C.3.1	Determine OPERABLE DG~~(s)~~ are not inoperable due to common cause failure.	24 hours
	OR		
	~~B~~C.3.2	Perform SR 3.8.1.2 for OPERABLE DG~~(s)~~.	24 hours
	AND		
			(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
~~B~~C. (continued)	~~B~~C.4	Restore ~~required~~ DG~~(s)~~ to OPERABLE status.	72 hours <u>AND</u> 6 days from discovery of failure to meet LCO
~~C~~D. Two required offsite circuits inoperable.	~~C~~D.1	Declare required feature(s) inoperable when its redundant required feature(s) is inoperable.	12 hours from discovery of Condition ~~C~~D concurrent with inoperability of redundant required features
	<u>AND</u>		
	~~C~~D.2	Restore one required offsite circuit to OPERABLE status.	24 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~D~~E. One required offsite circuit inoperable. AND One or more ~~required~~ DG(s) in Train A inoperable. OR One or more ~~required~~ DG(s) in Train B inoperable.	--------------------NOTE-------------------- Enter applicable Conditions and Required Actions of LCO 3.8.9, "Distribution Systems - Operating," when Condition ~~D~~E is entered with no AC power source to any train. --	
	~~D~~E.1 Restore required offsite circuit to OPERABLE status.	12 hours
	OR	
	~~D~~E.2 Restored ~~required~~ DG(s) to OPERABLE status.	12 hours
~~E~~F. One or more ~~required~~ DG(s) in Train A inoperable. AND One or more ~~required~~ DG(s) in Train B inoperable.	~~E~~F.1 Restored ~~required~~ DG(s) in Train A to OPERABLE status.	2 hours
	OR	
	~~E~~F.2 Restored ~~required~~ DG(s) in Train B to OPERABLE status.	2 hours
~~F~~G. Required Action and associated Completion Time of Condition A, B, C, D, E, or ~~E~~F not met.	~~F~~G.1 Be in MODE 3.	6 hours
	AND	
	~~F~~G.2 Be in MODE 5.	36 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
~~G~~H. Two required offsite circuits inoperable. AND One or more ~~required~~ DG(s) in Train A inoperable. OR One or more ~~required~~ DG(s) in Train B inoperable.	~~G~~H.1	Enter LCO 3.0.3.	Immediately
~~H~~I. One required offsite circuit inoperable. AND One or more ~~required~~ DG(s) in Train A inoperable. AND One or more ~~required~~ DG(s) in Train B inoperable.	~~H~~I.1	Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.19	------------------------------NOTE-------------------------------- For DGs 1A-A and 1B-B, this Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR. --- Verify on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated ESF actuation signal: a. De-energization of emergency buses; b. Load shedding from emergency buses; c. DG~~s of the same power train~~ auto-starts from standby condition and: 1. energizes permanently connected loads in ≤ 10 seconds, 2. energizes auto-connected emergency loads through load sequencer, 3. achieves steady state voltage: ≥ 6800 V and ≤ 7260 V, 4. achieves steady state frequency ≥ 59.8 Hz and ≤ 60.1 Hz, and 5. supplies permanently connected and auto-connected emergency loads for ≥ 5 minutes.	18 months
SR 3.8.1.20	Verify during idle operation that any automatic or emergency start signal disables the idle start circuitry and commands the engine to full speed.	18 months

(continued)

Proposed TS Changes (Mark-Ups) for WBN Unit 2

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. (continued)	A.3	Restore required offsite circuit to OPERABLE status.	72 hours AND ~~6~~17 days from discovery of failure to meet LCO
B. One DG inoperable.	B.1	Perform SR 3.8.1.1 for the required offsite circuits.	1 hour AND Once per 8 hours thereafter
	AND		
	B.2	Evaluate availability of 6.9 kV FLEX DG.	2 hours AND Once per 12 hours thereafter
	AND		
	B.3	Declare required feature(s) supported by the inoperable DG inoperable when its required redundant feature(s) is inoperable.	4 hours from discovery of Condition B concurrent with inoperability of redundant required feature(s)
	AND		
			(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.4.1 Determine OPERABLE DGs are not inoperable due to common cause failure.	24 hours
	OR	
	B.4.2 Perform SR 3.8.1.2 for OPERABLE DGs.	24 hours
	AND	
	B.5 Restore DG to OPERABLE status.	72 hours from discovery of unavailability of 6.9 kV FLEX DG AND 24 hours from discovery of Condition B entry ≥ 48 hours concurrent with unavailability of 6.9 kV FLEX DG AND 14 days AND 17 days from discovery of failure to meet LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B~~C. ~~One or more~~Two DG~~(s)~~ in Train A inoperable. OR ~~One or more~~Two DG~~(s)~~ in Train B inoperable.	~~B~~C.1 Perform SR 3.8.1.1 for the required offsite circuits.	1 hour AND Once per 8 hours thereafter
	AND ~~B~~C.2 Declare required feature(s) supported by the inoperable DG~~(s)~~ inoperable when its required redundant feature(s) is inoperable.	4 hours from discovery of Condition ~~B~~C concurrent with inoperability of redundant required feature(s)
	AND ~~B~~C.3.1 Determine OPERABLE DG~~(s)~~ ~~is~~ are not inoperable due to common cause failure.	24 hours
	OR ~~B~~C.3.2 Perform SR 3.8.1.2 for OPERABLE DG~~(s)~~.	24 hours
	AND	(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B~~C. (continued)	~~B~~C.4 Restore DG~~(s)~~ to OPERABLE status.	72 hours AND 6 days from discovery of failure to meet LCO
~~C~~D. Two required offsite circuits inoperable.	~~C~~D.1 Declare required feature(s) inoperable when its redundant required feature(s) is inoperable.	12 hours from discovery of Condition ~~C~~D concurrent with inoperability of redundant required features
	AND	
	~~C~~D.2 Restore one required offsite circuit to OPERABLE status.	24 hours
~~D~~E. One required offsite circuit inoperable. AND One or more DG(s) in Train A inoperable. OR One or more DG(s) in Train B inoperable.	--------------------NOTE-------------------- Enter applicable Conditions and Required Actions of LCO 3.8.9, "Distribution Systems - Operating," when Condition ~~D~~E is entered with no AC power source to any train. --	
	~~D~~E.1 Restore required offsite circuit to OPERABLE status.	12 hours
	OR	
	~~D~~E.2 Restore ~~required~~ DG(s) to OPERABLE status.	12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~E~~F. One or more DG(s) in Train A inoperable. AND One or more DG(s) in Train B inoperable.	~~E~~F.1 Restore DG(s) in Train A to OPERABLE status. OR ~~E~~F.2 Restore DG(s) in Train B to OPERABLE status.	2 hours 2 hours
~~F~~G. Required Action and associated Completion Time of Condition A, B, C, D, E, or ~~E~~F not met.	~~F~~G.1 Be in MODE 3. AND ~~F~~G.2 Be in MODE 5.	6 hours 36 hours
~~G~~H. Two required offsite circuits inoperable. AND One or more DG(s) in Train A inoperable. OR One or more DG(s) in Train B inoperable.	~~G~~H.1 Enter LCO 3.0.3.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~H~~I. One required offsite circuit inoperable. <u>AND</u> One or more DG(s) in Train A inoperable. <u>AND</u> One or more DG(s) in Train B inoperable.	~~H~~I.1 Enter LCO 3.0.3.	Immediately

ATTACHMENT 2

Proposed TS Bases Changes (Mark-Ups) for WBN Units 1 and 2

Proposed TS Bases Changes (Mark-Ups) for WBN Unit 1

BASES

BACKGROUND (continued)

A single offsite circuit is capable of providing the ESF loads. Two of these circuits are required to meet the Limiting Condition for Operation.

The onsite standby power source for each 6.9 kV shutdown board is a dedicated DG. WBN uses 4 DG sets for Unit 1 operation. These same DGs will be shared for Unit 2 operation. A DG starts automatically on a safety injection (SI) signal (i.e., low pressurizer pressure or high containment pressure signals) or on an 6.9 kV shutdown board degraded voltage or loss-of-voltage signal (refer to LCO 3.3.5, "Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation"). After the DG has started, it will automatically tie to its respective 6.9 kV shutdown board after offsite power is tripped as a consequence of 6.9 kV shutdown board loss-of-voltage or degraded voltage, independent of or coincident with an SI signal. The DGs will also start and operate in the standby mode without tying to the 6.9 kV shutdown board on an SI signal alone. Following the trip of offsite power, a loss-of-voltage signal strips all nonpermanent loads from the 6.9 kV shutdown board. When the DG is tied to the 6.9 kV shutdown board, loads are then sequentially connected to its respective 6.9 kV shutdown board by the automatic sequencer. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading the DG by automatic load application.

In the event of a loss of preferred power, the 6.9 kV shutdown boards are automatically connected to the DGs in sufficient time to provide for safe reactor shutdown and to mitigate the consequences of a Design Basis Accident (DBA) such as a LOCA.

Certain required plant loads are returned to service in a predetermined sequence in order to prevent overloading the DG in the process. Within the required interval (FSAR Table 8.3-3) after the initiating signal is received, all automatic and permanently connected loads needed to recover the plant or maintain it in a safe condition are returned to service.

Ratings for Train 1A, 1B, 2A and 2B DGs satisfy the requirements of Regulatory Guide 1.9 (Ref. 3). The continuous service rating of each DG is 4400 kW with 10% overload permissible for up to 2 hours in any 24 hour period. The ESF loads that are powered from the 6.9 kV shutdown boards are listed in Reference 2.

<u>The capability is provided to connect a 6.9 kV FLEX DG to supply power to any of the four 6.9 kV shutdown boards. The 6.9 kV FLEX DG is commercial-grade and not designed to meet Class 1E requirements. The FLEX DG is made available to support extended Completion Times in the event of an inoperable DG. The FLEX DG is made available as a defense-in-depth alternate source of AC power to mitigate a loss of offsite power event. The FLEX DG would remain disconnected from the</u>

(continued)

BASES

BACKGROUND (continued)

Class 1E distribution system unless required during a loss of offsite power.

APPLICABLE SAFETY ANALYSES

The initial conditions of DBA and transient analyses in the FSAR, Section 6 (Ref. 4) and Section 15 (Ref. 5), assume ESF systems are OPERABLE. The AC electrical power sources are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, Reactor Coolant System (RCS), and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems.

The OPERABILITY of the AC electrical power sources is consistent with the initial assumptions of the Accident analyses and is based upon meeting the design basis of the plant. This results in maintaining at least two DG's associated with one load group or one offsite circuit OPERABLE during Accident conditions in the event of:

a. An assumed loss of all offsite power or all onsite AC power; and

b. A worst case single failure.

The AC sources satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii)~~NRC Policy Statement~~.

LCO

Two qualified circuits between the Watts Bar Hydro 161 kV switchyard and the onsite Class 1E Electrical Power System and separate and independent DGs for each train ensure availability of the required power to shut down the reactor and maintain it in a safe shutdown condition after an anticipated operational occurrence (AOO) or a postulated DBA.

Qualified offsite circuits are those that are described in the FSAR and are part of the licensing basis for the plant.

Each offsite circuit must be capable of maintaining acceptable frequency and voltage, and accepting required loads during an accident, while connected to the 6.9 kV shutdown boards.

(continued)

BASES

ACTIONS (continued)

A.3

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition A for a period that should not exceed 72 hours. With one required offsite circuit inoperable, the reliability of the offsite system is degraded, and the potential for a loss of offsite power is increased, with attendant potential for a challenge to the plant safety systems. In this Condition, however, the remaining OPERABLE offsite circuit and DGs are adequate to supply electrical power to the onsite Class 1E Distribution System.

The 72 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

The second Completion Time for Required Action A.3 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition A is entered while, for instance, a DG is inoperable and that DG is subsequently returned OPERABLE, the LCO may already have been not met for up to 14 days~~72 hours~~. This could lead to a total of 17 days~~144 hours~~, since initial failure to meet the LCO, to restore the offsite circuit. At this time, a DG could again become inoperable, the circuit restored OPERABLE, and an additional 14 days~~72 hours~~ (for a total of 31~~9~~ days) allowed prior to complete restoration of the LCO. The 17~~6~~ day Completion Time provides a limit on the time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The "AND" connector between the 72 hour and 17~~6~~ day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

As in Required Action A.2, the Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time that the LCO was initially not met, instead of at the time Condition A was entered.

(continued)

ACTIONS (continued)

B.1 and C.1

To ensure a highly reliable power source remains with one or more DGs inoperable in Train A OR with one or more DGs inoperable in Train B, it is necessary to verify the availability of the required offsite circuits on a more frequent basis. Since the Required Action only specifies "perform," a failure of SR 3.8.1.1 acceptance criteria does not result in a Required Action being not met. However, if a circuit fails to pass SR 3.8.1.1, it is inoperable. Upon required offsite circuit inoperability, additional Conditions and Required Actions must then be entered.

B.2

In order to extend the Required Action B.5 Completion Time for an inoperable DG from 72 hours to 14 days, it is necessary to verify the availability of the 6.9 kV FLEX DG within 2 hours upon entry into LCO 3.8.1 and every 12 hours thereafter. Since Required Action B.2 only specifies "evaluate," discovering the 6.9 kV FLEX DG unavailable does not result in the Required Action being not met (i.e., the evaluation is performed). However, on discovery of an unavailable 6.9 kV FLEX DG, the Completion Time for Required Action B.5 starts the 72 hour and/or 24 hour clock.

6.9 kV FLEX DG availability requires that:

1) 6.9 kV FLEX DG fuel tank level is verified locally to be ≥ 8-hour supply; and
2) 6.9 kV FLEX DG supporting system parameters for starting and operating are verified to be within required limits for functional availability (e.g., battery state of charge).

The 6.9 kV FLEX DG is not used to extend the Completion Time for more than one inoperable DG at any one time.

(continued)

BASES

ACTIONS (continued)

B.~~2~~3 and C.2

Required Actions B.~~2~~3 and C.2 are~~is~~ intended to provide assurance that a loss of offsite power, during the period that a DG is inoperable, does not result in a complete loss of safety function of critical systems. These features are designed with redundant safety related trains. This includes motor driven auxiliary feedwater pumps. Single train systems, such as the turbine driven auxiliary feedwater pump, are not included. Redundant required feature failures consist of inoperable features associated with a train, redundant to the train that has inoperable DG(s).

The Completion Time for Required Actions B.~~2~~3 and C.2 are~~is~~ intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal “time zero” for beginning the allowed outage time “clock.” In this Required Action, the Completion Time only begins on discovery that both:

a. An inoperable DG exists; and

b. A required feature on the other train (Train A or Train B) is inoperable.

If at any time during the existence of this Condition (one or more DGs inoperable) a required feature subsequently becomes inoperable, this Completion Time would begin to be tracked.

Discovering one or more ~~required~~ DGs in Train A or one or more DGs in Train B inoperable coincident with one or more inoperable required support or supported features, or both, that are associated with the OPERABLE DGs, results in starting the Completion Time for the Required Action. Four hours from the discovery of these events existing concurrently is acceptable because it minimizes risk while allowing time for restoration before subjecting the plant to transients associated with shutdown.

In this Condition, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. Thus, on a component basis, single failure protection for the required feature's function may have been lost; however, function has not been lost. The 4 hour Completion Time takes into account the OPERABILITY of the redundant counterpart to the inoperable required feature. Additionally, the 4 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

(continued)

ACTIONS (continued)

B.~~3~~4.1, ~~or~~ B.~~3~~4.2, C.3.1 and C.3.2

Required Actions B.~~3~~4.1 and C.3.1 provide~~s~~ an allowance to avoid unnecessary testing of OPERABLE DG~~(s)~~. If it can be determined that the cause of the inoperable DG(s) does not exist on the OPERABLE DG~~(s)~~, SR 3.8.1.2 does not have to be performed. For the performance of a Surveillance, Required Action B.~~3~~4.1 is considered satisfied since the cause of the DG(s) being inoperable is apparent. If the cause of inoperability exists on other DG(s), the other DG(s) would be declared inoperable upon discovery and Condition ~~E~~F of LCO 3.8.1 would be entered if the other inoperable DGs are not on the same train, otherwise, if the other inoperable DGs are on the same train, the unit is in Condition C. Once the failure is repaired, the common cause failure no longer exists, and Required Actions B.~~3~~4.1 and B.~~3~~4.2 are satisfied. If the cause of the initial inoperable DG(s) cannot be confirmed not to exist on the remaining DG~~(s)~~, performance of SR 3.8.1.2 suffices to provide assurance of continued OPERABILITY of that DG(s).

In the event the inoperable DG(s) is restored to OPERABLE status prior to completing either B.~~3~~4.1, ~~or~~ B.~~3~~4.2, C.3.1 or C.3.2, the corrective action program will continue to evaluate the common cause possibility. This continued evaluation, however, is no longer under the 24 hour constraint imposed while in Condition B or C.

According to Generic Letter 84-15 (Ref. 11), 24 hours is reasonable to confirm that the OPERABLE DG(s) is not affected by the same problem as the inoperable DG(s).

B.5

In Condition B, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. The 14-day Completion Time takes into account the capacity and capability of the remaining AC sources (including the 6.9 kV FLEX DG), a reasonable time for repairs, and the low probability of a DBA occurring during this period.

If the 6.9 kV FLEX DG is or becomes unavailable with an inoperable DG, then action is required to restore the 6.9 kV FLEX DG to available status or to restore the DG to OPERABLE status within 72 hours from discovery of an unavailable 6.9 kV FLEX DG. However, if the 6.9 kV FLEX DG unavailability occurs sometime after 48 hours of continuous DG inoperability, then the remaining time to restore the 6.9 kV FLEX DG to available status or to restore the DG to OPERABLE status is limited to 24 hours.

(continued)

ACTIONS

B.5 (continued)

The 72 hour and 24 hour Completion Times allow for an exception to the normal "time zero" for beginning the allowed outage time "clock." The 72 hour Completion Time only begins on discovery that both an inoperable DG exists and the 6.9 kV FLEX DG is unavailable. The 24 hour Completion Time only begins on discovery that an inoperable DG exists for ≥ 48 hours and the 6.9 kV FLEX DG is unavailable.

Therefore, when one DG is inoperable due to either preplanned maintenance (preventive or corrective) or unplanned corrective maintenance work, the Completion Time can be extended from 72 hours to 14 days if the 6.9 kV FLEX DG is verified available for backup operation.

The third Completion Time for Required Action B.5 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition B is entered while, for instance, an offsite circuit is inoperable and that circuit is subsequently restored OPERABLE, the LCO may already have been not met for up to 14 days. This could lead to a total of 17 days, since initial failure to meet the LCO, to restore the DGs. At this time, an offsite circuit could again become inoperable, the DGs restored OPERABLE, and an additional 72 hours (for a total of 20 days) allowed prior to complete restoration of the LCO. The 17-day Completion Time provides a limit on time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The "AND" connector between the 14-day and 17-day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

Compliance with the contingency actions listed in Bases Table 3.8.1-2 is required whenever Condition B is entered for a planned or unplanned outage that will extend beyond 72 hours. If Condition B is entered initially for an activity intended to last less than 72 hours or for an unplanned outage, the contingency actions should be invoked as soon as it is established that the outage period will be longer than 72 hours. The contingency actions applicable to Surveillance Requirement (SR) 3.8.1.14 must be invoked prior to initiation of the test.

As in Required Action B.3, the Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time that the LCO was initially not met, instead of at the time Condition B was entered.

(continued)

ACTIONS (continued)

~~B~~C.4

According to Regulatory Guide 1.93, (Ref. 6), operation may continue in Condition ~~B~~C for a period that should not exceed 72 hours.

In Condition ~~B~~C, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. The 72 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period. Restoration of at least one DG within 72 hours results in reverting back under Condition B and continuing to track the “time zero” Completion Time for one DG inoperable.

The second Completion Time for Required Action ~~B~~C.4 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition ~~B~~C is entered while, for instance, an offsite circuit is inoperable and that circuit is subsequently restored OPERABLE, the LCO may already have been not met for up to 72 hours. This could lead to a total of 144 hours, since initial failure to meet the LCO, to restore the DGs. At this time, an offsite circuit could again become inoperable, the DGs restored OPERABLE, and an additional 72 hours (for a total of 9 days) allowed prior to complete restoration of the LCO. The 6 day Completion Time provides a limit on time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and ~~B~~C are entered concurrently. The “AND” connector between the 72 hour and 6 day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

As in Required Action ~~B~~C.2, the Completion Time allows for an exception to the normal “time zero” for beginning the allowed outage time “clock.” This will result in establishing the “time zero” at the time that the LCO was initially not met, instead of at the time Condition ~~B~~C was entered.

~~C~~D.1 and ~~C~~D.2

Required Action ~~C~~D.1, which applies when two required offsite circuits are inoperable, is intended to provide assurance that an event with a coincident single failure will not result in a complete loss of redundant required safety functions. The Completion Time for this failure of redundant required features is reduced to 12 hours from that allowed for one train without offsite power (Required Action A.2). The rationale for the

(continued)

ACTIONS

CD.1 and CD.2 (continued)

reduction to 12 hours is that Regulatory Guide 1.93 (Ref. 6) allows a Completion Time of 24 hours for two required offsite circuits inoperable, based upon the assumption that two complete safety trains are OPERABLE. When a concurrent redundant required feature failure exists, this assumption is not the case, and a shorter Completion Time of 12 hours is appropriate. These features are powered from redundant AC safety trains. This includes motor driven auxiliary feedwater pumps. Single train features, such as the turbine driven auxiliary pump, are not included in the list.

The Completion Time for Required Action CD.1 is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." In this Required Action the Completion Time only begins on discovery that both:

a. All required offsite circuits are inoperable; and

b. A required feature is inoperable.

If at any time during the existence of Condition CD (two required offsite circuits inoperable) a required feature becomes inoperable, this Completion Time begins to be tracked.

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition CD for a period that should not exceed 24 hours. This level of degradation means that the offsite electrical power system does not have the capability to effect a safe shutdown and to mitigate the effects of an accident; however, the onsite AC sources have not been degraded. This level of degradation generally corresponds to a total loss of the immediately accessible offsite power sources.

Because of the normally high availability of the offsite sources, this level of degradation may appear to be more severe than other combinations of two AC sources inoperable (e.g., combinations that involve an offsite circuit and one DG inoperable, or one or more DGs in each train inoperable). However, two factors tend to decrease the severity of this level of degradation:

a. The configuration of the redundant AC electrical power system that remains available is not susceptible to a single bus or switching failure; and

(continued)

ACTIONS

~~C~~D.1 and ~~C~~D.2 (continued)

b. The time required to detect and restore an unavailable required offsite power source is generally much less than that required to detect and restore an unavailable onsite AC source.

With both of the required offsite circuits inoperable, sufficient onsite AC sources are available to maintain the plant in a safe shutdown condition in the event of a DBA or transient. In fact, a simultaneous loss of offsite AC sources, a LOCA, and a worst case single failure were postulated as a part of the design basis in the safety analysis. Thus, the 24 hour Completion Time provides a period of time to effect restoration of one of the offsite circuits commensurate with the importance of maintaining an AC electrical power system capable of meeting its design criteria.

According to Reference 6, with the available offsite AC sources, two less than required by the LCO, operation may continue for 24 hours. If two offsite sources are restored within 24 hours, unrestricted operation may continue. If only one offsite source is restored within 24 hours, power operation continues in accordance with Condition A.

~~D~~E.1 and ~~D~~E.2

Pursuant to LCO 3.0.6, the Distribution System ACTIONS would not be entered even if all AC sources to it were inoperable, resulting in de-energization. Therefore, the Required Actions of Condition ~~D~~E are modified by a Note to indicate that when Condition ~~D~~E is entered with no AC source to any train, the Conditions and Required Actions for LCO 3.8.9, “Distribution Systems - Operating,” must be immediately entered. This allows Condition ~~D~~E to provide requirements for the loss of one offsite circuit and one or more DGs in a train, without regard to whether a train is de-energized. LCO 3.8.9 provides the appropriate restrictions for a de-energized train.

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition ~~D~~E for a period that should not exceed 12 hours.

In Condition ~~D~~E, individual redundancy is lost in both the offsite electrical power system and the onsite AC electrical power system. Since power system redundancy is provided by two diverse sources of power, however, the reliability of the power systems in this Condition may appear higher than that in Condition ~~C~~D (loss of both required offsite circuits). This difference in reliability is offset by the susceptibility of this

(continued)

ACTIONS

~~D~~E.1 and ~~D~~E.2 (continued)

power system configuration to a single bus or switching failure. The 12 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

~~E~~F.1 and ~~E~~F.2

With one or more ~~required~~ DG(s) in Train A inoperable simultaneous with one or more ~~required~~ DG(s) in Train B inoperable, there are no remaining standby AC sources. Thus, with an assumed loss of offsite electrical power, insufficient standby AC sources are available to power the minimum required ESF functions. Since the offsite electrical power system is the only source of AC power for this level of degradation, the risk associated with continued operation for a very short time could be less than that associated with an immediate controlled shutdown (the immediate shutdown could cause grid instability, which could result in a total loss of AC power). Since any inadvertent generator trip could also result in a total loss of offsite AC power, however, the time allowed for continued operation is severely restricted. The intent here is to avoid the risk associated with an immediate controlled shutdown and to minimize the risk associated with this level of degradation.

According to Reference 6, with one or more ~~required~~ DG(s) in Train A inoperable simultaneous with one or more ~~required~~ DG(s) in Train B inoperable, operation may continue for a period that should not exceed 2 hours.

~~F~~G.1 and ~~F~~G.2

If the inoperable AC electric power sources cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

(continued)

ACTIONS (continued)

~~G~~H.1 and ~~H~~I.1

Condition ~~G~~H and Condition ~~H~~I correspond to a level of degradation in which all redundancy in the AC electrical power supplies cannot be guaranteed. At this severely degraded level, any further losses in the AC electrical power system will cause a loss of function. Therefore, no additional time is justified for continued operation. The plant is required by LCO 3.0.3 to commence a controlled shutdown.

SURVEILLANCE REQUIREMENTS

The AC sources are designed to permit inspection and testing of all important areas and features, especially those that have a standby function, in accordance with 10 CFR 50, Appendix A, GDC 18 (Ref. 8). Periodic component tests are supplemented by extensive functional tests during refueling outages (under simulated accident conditions). The SRs for demonstrating the OPERABILITY of the DGs are in accordance with the recommendations of Regulatory Guide 1.9 (Ref. 3) and Regulatory Guide 1.137 (Ref. 9), as addressed in the FSAR.

Where the SRs discussed herein specify voltage and frequency tolerances, the following is applicable. 6800 volts is the minimum steady state output voltage and the 10 second transient value. 6800 volts is 98.6% of the nominal bus voltage of 6900 V corrected for instrument error and is the upper limit of the minimum voltage required for the DG supply breaker to close on the 6.9 kV shutdown board. The specified maximum steady state output voltage of 7260 V is 110% of the nameplate rating of the 6600 V motors. The specified 3 second transient value of 6555 V is 95% of the nominal bus voltage of 6900 V. The specified maximum transient value of 8880 V is the maximum equipment withstand value provided by the DG manufacturer. The specified minimum and maximum frequencies of the DG are 58.8 Hz and 61.2 Hz, respectively. The steady state minimum and maximum frequency values are 59.8 Hz and 60.1 Hz. These values ensure that the safety related plant equipment powered from the DGs is capable of performing its safety functions.

SR 3.8.1.1

This SR ensures proper circuit continuity for the offsite AC electrical power supply to the onsite distribution network and availability of offsite AC electrical power. The breaker alignment verifies that each breaker is in its correct position to ensure that distribution buses and loads are connected to their preferred power source, and that appropriate independence of offsite circuits is maintained. The 7 day Frequency is adequate since breaker position is not likely to change without the operator being aware of it and because its status is displayed in the control room.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.18

Under accident and loss of offsite power conditions loads are sequentially connected to the 6.9 kV shutdown board by the automatic load sequencer. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading of the DGs due to high motor starting currents. The load sequence time specified in FSAR Table 8.3-3 ensures that sufficient time exists for the DG to restore frequency and voltage prior to applying the next load block and that safety analysis assumptions regarding ESF equipment time delays are not violated. The allowable values for the time delay relays are contained in system specific setpoint scaling documents. Reference 2 provides a summary of the automatic loading of ESF buses.

The Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.9 (Ref. 3), Table 1, takes into consideration plant conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle lengths.

This SR is modified by a Note. The reason for the Note is that performing the Surveillance for DG 1A-A or 1B-B would remove a required offsite circuit from service, perturb the electrical distribution system, and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:

1) Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation of the required performance is available; and

2) Post corrective maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

SR 3.8.1.19

In the event of a DBA coincident with a loss of offsite power, the DGs are required to supply the necessary power to ESF systems so that the fuel, RCS, and containment design limits are not exceeded.

This Surveillance demonstrates the DG operation, as discussed in the Bases for SR 3.8.1.11, during a loss of offsite power actuation test signal in conjunction with an ESF actuation signal. In lieu of actual demonstration of connection and loading of loads, testing that adequately shows the capability of the DG system to perform these functions is acceptable. This testing may include any series of sequential, overlapping, or total steps so that the entire connection and loading sequence is verified.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.1.19 (continued)

The Frequency of 18 months takes into consideration plant conditions required to perform the Surveillance and is intended to be consistent with an expected fuel cycle length of 18 months.

For the purpose of this testing, the DGs shall be started from standby conditions, that is, with the engine coolant and oil being continuously circulated and temperature maintained consistent with manufacturer recommendations. The DG engines for WBN have an oil circulation and soakback system that operates continuously to preclude the need for a prelube and warmup when a DG is started from standby. ~~With WBN in one unit operation, this test will be conducted on a per train basis. Since the Unit 2 DGs are required to carry the common loads during a loss of offsite power event, the respective Unit 2 DG on the same power train will be tested with its respective Unit 1 DG. This is to minimize shutdown board room alignment and restoration.~~

This SR is modified by a Note. The reason for the Note is that the performance of the Surveillance for DG 1A-A or 1B-B would remove a required offsite circuit from service, perturb the electrical distribution system, and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:

1) Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation of the required performance is available; and

2) Post corrective maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

SR 3.8.1.20

This SR verifies that DG availability is not compromised by the idle start circuitry, when in the idle mode of operation, and that an automatic or emergency start signal will disable the idle start circuitry and command the engine to go to full speed. The 18 month frequency is consistent with the expected fuel cycle lengths and is considered sufficient to detect any degradation of the idle start circuitry.

(continued)

Bases Table 3.8.1-2
TS Action or Surveillance Requirement (SR) Contingency Actions

	Contingency Actions to be Implemented	Applicable TS Action or SR	Applicable Modes
1.	Verify that the offsite power system is stable. This action will establish that the offsite power system is within single-contingency limits and will remain stable upon the loss of any single component supporting the system. If a grid stability problem exists, the planned DG outage will not be scheduled.	SR 3.8.1.14 Action B.5	1, 2 1, 2, 3, 4
2.	Verify that no adverse weather conditions are expected during the outage period. The planned DG outage will be postponed if inclement weather (such as severe thunderstorms or heavy snowfall) is projected.	SR 3.8.1.14 Action B.5	1, 2 1, 2, 3, 4
3.	Do not remove from service the ventilation systems for the 6.9 kV shutdown board rooms, the elevation 772 transformer rooms, or the 480-volt shutdown board rooms, concurrently with the DG, or implement appropriate compensatory measures.	Action B.5	1, 2, 3, 4
4.	Do not remove the reactor trip breakers from service concurrently with planned DG outage maintenance.	Action B.5	1, 2, 3, 4
5.	Do not remove the turbine-driven auxiliary feedwater (AFW) pump from service concurrently with a Unit 1 DG outage.	Action B.5	1, 2, 3, 4
6.	Do not remove the AFW level control valves to the steam generators from service concurrently with a Unit 1 DG outage.	Action B.5	1, 2, 3, 4
7.	Do not remove the opposite train residual heat removal (RHR) pump from service concurrently with a Unit 1 DG outage.	Action B.5	1, 2, 3, 4

Proposed TS Bases Changes (Mark-Ups) for WBN Unit 2

BASES

BACKGROUND (continued)

The onsite standby power source for each 6.9 kV shutdown board is a dedicated DG. WBN uses 4 DG sets for Unit 2 operation. These same DGs will be shared for Unit 1 operation. A DG starts automatically on a safety injection (SI) signal (i.e., low pressurizer pressure or high containment pressure signals) or on an 6.9 kV shutdown board degraded voltage or loss-of-voltage signal (refer to LCO 3.3.5, "Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation."). After the DG has started, it will automatically tie to its respective 6.9 kV shutdown board after offsite power is tripped as a consequence of 6.9 kV shutdown board loss-of-voltage or degraded voltage, independent of or coincident with an SI signal. The DGs will also start and operate in the standby mode without tying to the 6.9 kV shutdown board on an SI signal alone. Following the trip of offsite power, a loss-of-voltage signal strips all nonpermanent loads from the 6.9 kV shutdown board. When the DG is tied to the 6.9 kV shutdown board, loads are then sequentially connected to its respective 6.9 kV shutdown board by the automatic sequencer. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading the DG by automatic load application.

In the event of a loss of preferred power, the 6.9 kV shutdown boards are automatically connected to the DGs in sufficient time to provide for safe reactor shutdown and to mitigate the consequences of a Design Basis Accident (DBA) such as a LOCA.

Certain required plant loads are returned to service in a predetermined sequence in order to prevent overloading the DG in the process. Within the required interval (FSAR Table 8.3-3) after the initiating signal is received, all automatic and permanently connected loads needed to recover the plant or maintain it in a safe condition are returned to service.

Ratings for Train 1A, 1B, 2A and 2B DGs satisfy the requirements of Regulatory Guide 1.9 (Ref. 3). The continuous service rating of each DG is 4400 kW with 10% overload permissible for up to 2 hours in any 24 hour period. The ESF loads that are powered from the 6.9 kV shutdown boards are listed in Reference 2.

The capability is provided to connect a 6.9 kV FLEX DG to supply power to any of the four 6.9 kV shutdown boards. The 6.9 kV FLEX DG is commercial-grade and not designed to meet Class 1E requirements. The FLEX DG is made available to support extended Completion Times in the event of an inoperable DG. The FLEX DG is made available as a defense-in-depth alternate source of AC power to mitigate a loss of offsite power event. The FLEX DG would remain disconnected from the Class 1E distribution system unless required during a loss of offsite power.

(continued)

BASES

ACTIONS

A.2 (continued)

Discovering no offsite power to one train of the onsite Class 1E Electrical Power Distribution System coincident with one or more inoperable required support or supported features, or both, that are associated with the other train that has offsite power, results in starting the Completion Times for the Required Action. Twenty four hours is acceptable because it minimizes risk while allowing time for restoration before subjecting the plant to transients associated with shutdown.

The remaining OPERABLE offsite circuit and DGs are adequate to supply electrical power to Train A and Train B of the onsite Class 1E Distribution System. The 24 hour Completion Time takes into account the component OPERABILITY of the redundant counterpart to the inoperable required feature.

Additionally, the 24 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

A.3

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition A for a period that should not exceed 72 hours. With one required offsite circuit inoperable, the reliability of the offsite system is degraded, and the potential for a loss of offsite power is increased, with attendant potential for a challenge to the plant safety systems. In this Condition, however, the remaining OPERABLE offsite circuit and DGs are adequate to supply electrical power to the onsite Class 1E Distribution System.

The 72 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

The second Completion Time for Required Action A.3 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition A is entered while, for instance, a DG is inoperable and that DG is subsequently returned OPERABLE, the LCO may already have been not met for up to 14 days~~72 hours~~. This could lead to a total of 17 days~~144 hours~~, since initial failure to meet the LCO, to restore the offsite circuit. At this time, a DG could again become inoperable, the circuit restored OPERABLE, and an additional 14 days~~72 hours~~ (for a total of 31~~9~~ days) allowed prior to complete restoration of the

(continued)

BASES

ACTIONS

A.3 (continued)

LCO. The 176 day Completion Time provides a limit on the time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The "AND" connector between the 72 hour and 176 day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

As in Required Action A.2, the Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time that the LCO was initially not met, instead of at the time Condition A was entered.

B.1 and C.1

To ensure a highly reliable power source remains with one or more DGs inoperable in Train A OR with one or more DGs inoperable in Train B, it is necessary to verify the availability of the required offsite circuits on a more frequent basis. Since the Required Action only specifies "perform," a failure of SR 3.8.1.1 acceptance criteria does not result in a Required Action being not met. However, if a circuit fails to pass SR 3.8.1.1, it is inoperable. Upon required offsite circuit inoperability, additional Conditions and Required Actions must then be entered.

B.2

In order to extend the Required Action B.5 Completion Time for an inoperable DG from 72 hours to 14 days, it is necessary to verify the availability of the 6.9 kV FLEX DG within 2 hours upon entry into LCO 3.8.1 and every 12 hours thereafter. Since Required Action B.2 only specifies "evaluate," discovering the 6.9 kV FLEX DG unavailable does not result in the Required Action being not met (i.e., the evaluation is performed). However, on discovery of an unavailable 6.9 kV FLEX DG, the Completion Time for Required Action B.5 starts the 72 hour and/or 24 hour clock.

6.9 kV FLEX DG availability requires that:

1. 6.9 kV FLEX DG fuel tank level is verified locally to be ≥ 8-hour supply; and
2) 6.9 kV FLEX DG supporting system parameters for starting and operating are verified to be within required limits for functional availability (e.g., battery state of charge).

(continued)

BASES

ACTIONS

B.2 (continued)

The 6.9 kV FLEX DG is not used to extend the Completion Time for more than one inoperable DG at any one time.

B.~~2~~3 and C.2

Required Actions B.~~2~~3 and C.2 are~~is~~ intended to provide assurance that a loss of offsite power, during the period that a DG is inoperable, does not result in a complete loss of safety function of critical systems. These features are designed with redundant safety related trains. This includes motor driven auxiliary feedwater pumps. Single train systems, such as the turbine driven auxiliary feedwater pump, are not included. Redundant required feature failures consist of inoperable features associated with a train, redundant to the train that has inoperable DG(s).

The Completion Time for Required Actions B.~~2~~3 and C.2 are~~is~~ intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." In this Required Action, the Completion Time only begins on discovery that both:

a. An inoperable DG exists; and

b. A required feature on the other train (Train A or Train B) is inoperable.

If at any time during the existence of this Condition (one or more DGs inoperable) a required feature subsequently becomes inoperable, this Completion Time would begin to be tracked.

Discovering one or more ~~required~~ DGs in Train A or one or more DGs in Train B inoperable coincident with one or more inoperable required support or supported features, or both, that are associated with the OPERABLE DGs, results in starting the Completion Time for the Required Action. Four hours from the discovery of these events existing concurrently is acceptable because it minimizes risk while allowing time for restoration before subjecting the plant to transients associated with shutdown.

(continued)

BASES

ACTIONS

B.~~2~~3 and C.2 (continued)

In this Condition, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. Thus, on a component basis, single failure protection for the required feature's function may have been lost; however, function has not been lost. The 4 hour Completion Time takes into account the OPERABILITY of the redundant counterpart to the inoperable required feature. Additionally, the 4 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

B.~~3~~4.1,~~and~~ B.~~3~~4.2, C.3.1 and C.3.2

Required Actions B.~~3~~4.1 and C.3.1 provide~~s~~ an allowance to avoid unnecessary testing of OPERABLE DG~~(s)~~. If it can be determined that the cause of the inoperable DG(s) does not exist on the OPERABLE DGs, SR 3.8.1.2 does not have to be performed. For the performance of a Surveillance, Required Action B.~~3~~4.1 is considered satisfied since the cause of the DG(s) being inoperable is apparent. If the cause of inoperability exists on other DG(s), the other DG(s) would be declared inoperable upon discovery and Condition ~~E~~F of LCO 3.8.1 would be entered if the other inoperable DGs are not on the same train, otherwise, if the other inoperable DGs are on the same train, the unit is in Condition C. Once the failure is repaired, the common cause failure no longer exists, and Required Actions B.~~3~~4.1and B.~~3~~4.2 are satisfied. If the cause of the initial inoperable DG(s) cannot be confirmed not to exist on the remaining DG~~(s)~~, performance of SR 3.8.1.2 suffices to provide assurance of continued OPERABILITY of that DG(s).

(continued)

BASES

ACTIONS

B.~~3~~4.1, ~~and~~ B.~~3~~4.2, C.3.1 and C.3.2 (continued)

In the event the inoperable DG(s) is restored to OPERABLE status prior to completing either B.~~3~~4.1, ~~or~~ B.~~3~~4.2, C.3.1 or C.3.2, the corrective action program will continue to evaluate the common cause possibility. This continued evaluation, however, is no longer under the 24 hour constraint imposed while in Condition B or C.

According to Generic Letter 84-15 (Ref. 7), 24 hours is reasonable to confirm that the OPERABLE DG(s) is not affected by the same problem as the inoperable DG(s).

B.5

In Condition B, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. The 14-day Completion Time takes into account the capacity and capability of the remaining AC sources (including the 6.9 kV FLEX DG), a reasonable time for repairs, and the low probability of a DBA occurring during this period.

If the 6.9 kV FLEX DG is or becomes unavailable with an inoperable DG, then action is required to restore the 6.9 kV FLEX DG to available status or to restore the DG to OPERABLE status within 72 hours from discovery of an unavailable 6.9 kV FLEX DG. However, if the 6.9 kV FLEX DG unavailability occurs sometime after 48 hours of continuous DG inoperability, then the remaining time to restore the 6.9 kV FLEX DG to available status or to restore the DG to OPERABLE status is limited to 24 hours.

(continued)

BASES

ACTIONS

B.5 (continued)

The 72 hour and 24 hour Completion Times allow for an exception to the normal "time zero" for beginning the allowed outage time "clock." The 72 hour Completion Time only begins on discovery that both an inoperable DG exists and the 6.9 kV FLEX DG is unavailable. The 24 hour Completion Time only begins on discovery that an inoperable DG exists for ≥ 48 hours and the 6.9 kV FLEX DG is unavailable.

Therefore, when one DG is inoperable due to either preplanned maintenance (preventive or corrective) or unplanned corrective maintenance work, the Completion Time can be extended from 72 hours to 14 days if the 6.9 kV FLEX DG is verified available for backup operation.

The third Completion Time for Required Action B.5 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition B is entered while, for instance, an offsite circuit is inoperable and that circuit is subsequently restored OPERABLE, the LCO may already have been not met for up to 14 days. This could lead to a total of 17 days, since initial failure to meet the LCO, to restore the DGs. At this time, an offsite circuit could again become inoperable, the DGs restored OPERABLE, and an additional 72 hours (for a total of 20 days) allowed prior to complete restoration of the LCO. The 17-day Completion Time provides a limit on time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The "AND" connector between the 14-day and 17-day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

Compliance with the contingency actions listed in Bases Table 3.8.1-2 is required whenever Condition B is entered for a planned or unplanned outage that will extend beyond 72 hours. If Condition B is entered initially for an activity intended to last less than 72 hours or for an unplanned outage, the contingency actions should be invoked as soon as it is established that the outage period will be longer than 72 hours.

As in Required Action B.3, the Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time that the LCO was initially not met, instead of at the time Condition B was entered.

(continued)

BASES

ACTIONS (continued)

~~B~~C.4

According to Regulatory Guide 1.93, (Ref. 6), operation may continue in Condition ~~B~~C for a period that should not exceed 72 hours.

In Condition ~~B~~C, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. The 72 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period. Restoration of at least one DG within 72 hours results in reverting back under Condition B and continuing to track the "time zero" Completion Time for one DG inoperable.

The second Completion Time for Required Action ~~B~~C.4 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition ~~B~~C is entered while, for instance, an offsite circuit is inoperable and that circuit is subsequently restored OPERABLE, the LCO may already have been not met for up to 72 hours. This could lead to a total of 144 hours, since initial failure to meet the LCO, to restore the DGs. At this time, an offsite circuit could again become inoperable, the DGs restored OPERABLE, and an additional 72 hours (for a total of 9 days) allowed prior to complete restoration of the LCO. The 6 day Completion Time provides a limit on time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and ~~B~~C are entered concurrently. The "AND" connector between the 72 hour and 6 day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

As in Required Action ~~B~~C.2, the Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time that the LCO was initially not met, instead of at the time Condition ~~B~~C was entered.

(continued)

BASES

ACTIONS (continued)

CD.1 and CD.2

Required Action CD.1, which applies when two required offsite circuits are inoperable, is intended to provide assurance that an event with a coincident single failure will not result in a complete loss of redundant required safety functions. The Completion Time for this failure of redundant required features is reduced to 12 hours from that allowed for one train without offsite power (Required Action A.2). The rationale for the reduction to 12 hours is that Regulatory Guide 1.93 (Ref. 6) allows a Completion Time of 24 hours for two required offsite circuits inoperable, based upon the assumption that two complete safety trains are OPERABLE. When a concurrent redundant required feature failure exists, this assumption is not the case, and a shorter Completion Time of 12 hours is appropriate. These features are powered from redundant AC safety trains. This includes motor driven auxiliary feedwater pumps. Single train features, such as the turbine driven auxiliary pump, are not included in the list.

The Completion Time for Required Action CD.1 is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." In this Required Action the Completion Time only begins on discovery that both:

a. All required offsite circuits are inoperable; and

b. A required feature is inoperable.

If at any time during the existence of Condition CD (two required offsite circuits inoperable) a required feature becomes inoperable, this Completion Time begins to be tracked.

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition CD for a period that should not exceed 24 hours. This level of degradation means that the offsite electrical power system does not have the capability to effect a safe shutdown and to mitigate the effects of an accident; however, the onsite AC sources have not been degraded. This level of degradation generally corresponds to a total loss of the immediately accessible offsite power sources.

(continued)

ACTIONS

~~C~~D.1 and ~~C~~D.2 (continued)

Because of the normally high availability of the offsite sources, this level of degradation may appear to be more severe than other combinations of two AC sources inoperable (e.g., combinations that involve an offsite circuit and one DG inoperable, or one or more DGs in each train inoperable). However, two factors tend to decrease the severity of this level of degradation:

a. The configuration of the redundant AC electrical power system that remains available is not susceptible to a single bus or switching failure; and

b. The time required to detect and restore an unavailable required offsite power source is generally much less than that required to detect and restore an unavailable onsite AC source.

With both of the required offsite circuits inoperable, sufficient onsite AC sources are available to maintain the plant in a safe shutdown condition in the event of a DBA or transient. In fact, a simultaneous loss of offsite AC sources, a LOCA, and a worst case single failure were postulated as a part of the design basis in the safety analysis. Thus, the 24 hour Completion Time provides a period of time to effect restoration of one of the offsite circuits commensurate with the importance of maintaining an AC electrical power system capable of meeting its design criteria.

According to Reference 6, with the available offsite AC sources, two less than required by the LCO, operation may continue for 24 hours. If two offsite sources are restored within 24 hours, unrestricted operation may continue. If only one offsite source is restored within 24 hours, power operation continues in accordance with Condition A.

~~D~~E.1 and ~~D~~E.2

Pursuant to LCO 3.0.6, the Distribution System ACTIONS would not be entered even if all AC sources to it were inoperable, resulting in de-energization. Therefore, the Required Actions of Condition ~~D~~E are modified by a Note to indicate that when Condition ~~D~~E is entered with no AC source to any train, the Conditions and Required Actions for LCO 3.8.9, "Distribution Systems - Operating," must be immediately entered. This allows Condition ~~D~~E to provide requirements for the loss of one offsite circuit and one or more DGs in a train, without regard to whether a train is de-energized. LCO 3.8.9 provides the appropriate restrictions for a de-energized train.

(continued)

ACTIONS

~~D~~E.1 and ~~D~~E.2 (continued)

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition ~~D~~E for a period that should not exceed 12 hours.

In Condition ~~D~~E, individual redundancy is lost in both the offsite electrical power system and the onsite AC electrical power system. Since power system redundancy is provided by two diverse sources of power, however, the reliability of the power systems in this Condition may appear higher than that in Condition ~~C~~D (loss of both required offsite circuits). This difference in reliability is offset by the susceptibility of this power system configuration to a single bus or switching failure. The 12 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

~~E~~F.1 and ~~E~~F.2

With one or more ~~required~~ DG(s~~)~~ in Train A inoperable simultaneous with one or more ~~required~~ DG(s) in Train B inoperable, there are no remaining standby AC sources. Thus, with an assumed loss of offsite electrical power, insufficient standby AC sources are available to power the minimum required ESF functions. Since the offsite electrical power system is the only source of AC power for this level of degradation, the risk associated with continued operation for a very short time could be less than that associated with an immediate controlled shutdown (the immediate shutdown could cause grid instability, which could result in a total loss of AC power). Since any inadvertent generator trip could also result in a total loss of offsite AC power, however, the time allowed for continued operation is severely restricted. The intent here is to avoid the risk associated with an immediate controlled shutdown and to minimize the risk associated with this level of degradation.

According to Reference 6, with one or more ~~required~~ DG(s) in Train A inoperable simultaneous with one or more ~~required~~ DG(s) in Train B inoperable, operation may continue for a period that should not exceed 2 hours.

~~F~~G.1 and ~~F~~G.2

If the inoperable AC electric power sources cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are

(continued)

BASES

ACTIONS

FG.1 and FG.2 (continued)

reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

GH.1 and HI.1

Condition GH and Condition HI correspond to a level of degradation in which all redundancy in the AC electrical power supplies cannot be guaranteed. At this severely degraded level, any further losses in the AC electrical power system will cause a loss of function. Therefore, no additional time is justified for continued operation. The plant is required by LCO 3.0.3 to commence a controlled shutdown.

SURVEILLANCE REQUIREMENTS

The AC sources are designed to permit inspection and testing of all important areas and features, especially those that have a standby function, in accordance with 10 CFR 50, Appendix A, GDC 18 (Ref. 8). Periodic component tests are supplemented by extensive functional tests during refueling outages (under simulated accident conditions). The SRs for demonstrating the OPERABILITY of the DGs are in accordance with the recommendations of Regulatory Guide 1.9 (Ref. 3) and Regulatory Guide 1.137 (Ref. 9), as addressed in the FSAR.

Where the SRs discussed herein specify voltage and frequency tolerances, the following is applicable. 6800 volts is the minimum steady state output voltage and the 10 seconds transient value. 6800 volts is 98.6% of the nominal bus voltage of 6900 V corrected for instrument error and is the upper limit of the minimum voltage required for the DG supply breaker to close on the 6.9 kV shutdown board. The specified maximum steady state output voltage of 7260 V is 110% of the nameplate rating of the 6600 V motors. The specified 3 second transient value of 6555 V is 95% of the nominal bus voltage of 6900 V. The specified maximum transient value of 8880 V is the maximum equipment withstand value provided by the DG manufacturer. The specified minimum and maximum transient frequencies of the DG are 58.8 Hz and 61.2 Hz, respectively. The steady state minimum and maximum frequency values are 59.8 Hz and 60.1 Hz. These values ensure that the safety related plant equipment powered from the DGs is capable of performing its safety functions.

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.14

Regulatory Guide 1.9 (Ref. 3), paragraph C2.2.9, requires demonstration once per 18 months that the DGs can start and run continuously for an interval of not less than 24 hours, ≥ 2 hours of which is at a load between 105% and 110% of the continuous duty rating and the remainder of the time at a load equivalent to 90% to 100% of the continuous duty rating of the DG. The DG starts for this Surveillance can be performed either from standby or hot conditions. The provisions for prelubricating and warmup, discussed in SR 3.8.1.2, and for gradual loading, discussed in SR 3.8.1.3, are applicable to this SR.

In order to ensure that the DG is tested under load conditions that are as close to design conditions as possible, testing must be performed using a power factor of ≥ 0.8 and ≤ 0.9. This power factor is chosen to be representative of the actual design basis inductive loading that the DG would experience. The load band is provided to avoid routine overloading of the DG. Routine overloading may result in more frequent teardown inspections in accordance with vendor recommendations in order to maintain DG OPERABILITY.

This Surveillance is modified by three Notes. Note 1 states that momentary transients due to changing bus loads do not invalidate this test. Similarly, momentary power factor transients above the power factor limit will not invalidate the test. Note 2 establishes that this SR may be performed on only one DG at a time while in MODE 1, 2, 3, or 4. This is necessary to ensure the proper response to an operational transient (i.e., loss of offsite power, ESF actuation). Therefore, three DGs must be maintained operable and in a standby condition during performance of this test. In this configuration, the plant will remain within its design basis, since at all times safe shutdown can be achieved with two DGs in the same train.

Note 3 establishes that credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:

1) Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation of the required performance is available; and
2) Post-corrective maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.14 (continued)

Prior to performance of this SR in MODES 1 or 2, actions are taken to establish that adequate conditions exist for performance of the SR. The required actions are defined in Bases Table 3.8.1-2.

SR 3.8.1.15

This Surveillance demonstrates that the diesel engine can restart from a hot condition, such as subsequent to shutdown from normal Surveillances, and achieve the required voltage and frequency within 10 seconds. The minimum voltage and frequency stated in the SR are those necessary to ensure the DG can accept DBA loading while maintaining acceptable voltage and frequency levels. Stable operation at the nominal voltage and frequency values is also essential to establishing DG OPERABILITY, but a time constraint is not imposed. This is because a typical DG will experience a period of voltage and frequency oscillations prior to reaching steady state operation if these oscillations are not dampened out by load application. This period may extend beyond the 10 second acceptance criteria and could be a cause for failing the SR. In lieu of a time constraint in the SR, WBN will monitor and trend the actual time to reach steady state operation as a means of ensuring there is no voltage regulator or governor degradation which could cause a DG to become inoperable. The 10 second time is derived from the requirements of the accident analysis to respond to a design basis large break LOCA. The 18 month Frequency is consistent with the recommendations of Regulatory Guide 1.9 (Ref. 3), Table 1.

The DG engines for WBN have an oil circulation and soakback system that operates continuously to preclude the need for a prelube and warmup when a DG is started from standby.

This SR is modified by a Note to ensure that the test is performed with the diesel sufficiently hot. The load band is provided to avoid routine overloading of the DG. Routine overloads may result in more frequent teardown inspections in accordance with vendor recommendations in order to maintain DG OPERABILITY. The requirement that the diesel has operated for at least 2 hours at full load conditions prior to performance of this Surveillance is based on manufacturer recommendations for achieving hot conditions. Momentary transients due to changing bus loads do not invalidate this test.

(continued)

Bases Table 3.8.1-2
TS Action or Surveillance Requirement (SR) Contingency Actions

	Contingency Actions to be Implemented	Applicable TS Action or SR	Applicable MODES
1.	Verify that the offsite power system is stable. This action will establish that the offsite power system is within single-contingency limits and will remain stable upon the loss of any single component supporting the system. If a grid stability problem exists, the planned DG outage will not be scheduled.	SR 3.8.1.14 Action B.5	1, 2 1, 2, 3, 4
2.	Verify that no adverse weather conditions are expected during the outage period. The planned DG outage will be postponed if inclement weather (such as severe thunderstorms or heavy snowfall) is projected.	SR 3.8.1.14 Action B.5	1, 2 1, 2, 3, 4
3.	Do not remove from service the ventilation systems for the 6.9 kV shutdown board rooms, the elevation 772 transformer rooms, or the 480-volt shutdown board rooms, concurrently with the DG, or implement appropriate compensatory measures.	Action B.5	1, 2, 3, 4
4.	Do not remove the reactor trip breakers from service concurrently with planned DG outage maintenance.	Action B.5	1, 2, 3, 4
5.	Do not remove the turbine-driven auxiliary feedwater (AFW) pump from service concurrently with a Unit 2 DG outage.	Action B.5	1, 2, 3, 4
6.	Do not remove the AFW level control valves to the steam generators from service concurrently with a Unit 2 DG outage.	Action B.5	1, 2, 3, 4
7.	Do not remove the opposite train residual heat removal (RHR) pump from service concurrently with a Unit 2 DG outage.	Action B.5	1, 2, 3, 4

ATTACHMENT 3

Proposed TS Changes (Final Typed) for WBN Units 1 and 2

Proposed TS Changes (Final Typed) for WBN Unit 1

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. (continued)	A.3	Restore required offsite circuit to OPERABLE status.	72 hours AND 17 days from discovery of failure to meet LCO
B. One DG inoperable.	B.1	Perform SR 3.8.1.1 for the required offsite circuits.	1 hour AND Once per 8 hours thereafter
	AND		
	B.2	Evaluate availability of 6.9 kV FLEX DG.	2 hours AND Once per 12 hours thereafter
	AND		
	B.3	Declare required feature(s) supported by the inoperable DG inoperable when its required redundant feature(s) is inoperable.	4 hours from discovery of Condition B concurrent with inoperability of redundant required feature(s)
	AND		
			(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.4.1 Determine OPERABLE DGs are not inoperable due to common cause failure.	24 hours
	OR	
	B.4.2 Perform SR 3.8.1.2 for OPERABLE DGs.	24 hours
	AND	
	B.5 Restore DG to OPERABLE status.	72 hours from discovery of unavailability of 6.9 kV FLEX DG AND 24 hours from discovery of Condition B entry ≥ 48 hours concurrent with unavailability of 6.9 kV FLEX DG AND 14 days AND 17 days from discovery of failure to meet LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Two DGs in Train A inoperable. OR Two DGs in Train B inoperable.	C.1 Perform SR 3.8.1.1 for the required offsite circuits.	1 hour AND Once per 8 hours thereafter
	AND	
	C.2 Declare required feature(s) supported by the inoperable DGs inoperable when its required redundant feature(s) is inoperable.	4 hours from discovery of Condition C concurrent with inoperability of redundant required feature(s)
	AND	
	C.3.1 Determine OPERABLE DGs are not inoperable due to common cause failure.	24 hours
	OR	
	C.3.2 Perform SR 3.8.1.2 for OPERABLE DGs.	24 hours
	AND	(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. (continued)	C.4	Restore DGs to OPERABLE status.	72 hours <u>AND</u> 6 days from discovery of failure to meet LCO
D. Two required offsite circuits inoperable.	D.1	Declare required feature(s) inoperable when its redundant required feature(s) is inoperable.	12 hours from discovery of Condition D concurrent with inoperability of redundant required features
	<u>AND</u>		
	D.2	Restore one required offsite circuit to OPERABLE status.	24 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. One required offsite circuit inoperable. AND One or more DG(s) in Train A inoperable. OR One or more DG(s) in Train B inoperable.	--------------------NOTE------------------- Enter applicable Conditions and Required Actions of LCO 3.8.9, "Distribution Systems - Operating," when Condition E is entered with no AC power source to any train. --	
	E.1 Restore required offsite circuit to OPERABLE status.	12 hours
	OR	
	E.2 Restored DG(s) to OPERABLE status.	12 hours
F. One or more DG(s) in Train A inoperable. AND One or more DG(s) in Train B inoperable.	F.1 Restored DG(s) in Train A to OPERABLE status.	2 hours
	OR	
	F.2 Restored DG(s) in Train B to OPERABLE status.	2 hours
G. Required Action and associated Completion Time of Condition A, B, C, D, E, or F not met.	G.1 Be in MODE 3.	6 hours
	AND	
	G.2 Be in MODE 5.	36 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
H. Two required offsite circuits inoperable. AND One or more DG(s) in Train A inoperable. OR One or more DG(s) in Train B inoperable.	H.1 Enter LCO 3.0.3.	Immediately
I. One required offsite circuit inoperable. AND One or more DG(s) in Train A inoperable. AND One or more DG(s) in Train B inoperable.	I.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.19	-----------------------------NOTE----------------------------- For DGs 1A-A and 1B-B, this Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR. -- Verify on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated ESF actuation signal: a. De-energization of emergency buses; b. Load shedding from emergency buses; c. DG auto-starts from standby condition and: 1. energizes permanently connected loads in ≤ 10 seconds, 2. energizes auto-connected emergency loads through load sequencer, 3. achieves steady state voltage: ≥ 6800 V and ≤ 7260 V, 4. achieves steady state frequency ≥ 59.8 Hz and ≤ 60.1 Hz, and 5. supplies permanently connected and auto-connected emergency loads for ≥ 5 minutes.	18 months
SR 3.8.1.20	Verify during idle operation that any automatic or emergency start signal disables the idle start circuitry and commands the engine to full speed.	18 months

(continued)

Proposed TS Changes (Final Typed) for WBN Unit 2

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. (continued)	A.3	Restore required offsite circuit to OPERABLE status.	72 hours AND 17 days from discovery of failure to meet LCO
B. One DG inoperable.	B.1	Perform SR 3.8.1.1 for the required offsite circuits.	1 hour AND Once per 8 hours thereafter
	AND		
	B.2	Evaluate availability of 6.9 kV FLEX DG.	2 hours AND Once per 12 hours thereafter
	AND		
	B.3	Declare required feature(s) supported by the inoperable DG inoperable when its required redundant feature(s) is inoperable.	4 hours from discovery of Condition B concurrent with inoperability of redundant required feature(s)
	AND		
			(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.4.1 Determine OPERABLE DGs are not inoperable due to common cause failure.	24 hours
	OR	
	B.4.2 Perform SR 3.8.1.2 for OPERABLE DGs.	24 hours
	<u>AND</u>	
	B.5 Restore DG to OPERABLE status.	72 hours from discovery of unavailability of 6.9 kV FLEX DG <u>AND</u> 24 hours from discovery of Condition B entry ≥ 48 hours concurrent with unavailability of 6.9 kV FLEX DG <u>AND</u> 14 days <u>AND</u> 17 days from discovery of failure to meet LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Two DGs in Train A inoperable. OR Two DGs in Train B inoperable.	C.1	Perform SR 3.8.1.1 for the required offsite circuits.	1 hour AND Once per 8 hours thereafter
	AND		
	C.2	Declare required feature(s) supported by the inoperable DGs inoperable when its required redundant feature(s) is inoperable.	4 hours from discovery of Condition C concurrent with inoperability of redundant required feature(s)
	AND		
	C.3.1	Determine OPERABLE DGs are not inoperable due to common cause failure.	24 hours
	OR		
	C.3.2	Perform SR 3.8.1.2 for OPERABLE DGs.	24 hours
	AND		(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. (continued)	C.4 Restore DGs to OPERABLE status.	72 hours <u>AND</u> 6 days from discovery of failure to meet LCO
D. Two required offsite circuits inoperable.	D.1 Declare required feature(s) inoperable when its redundant required feature(s) is inoperable. <u>AND</u> D.2 Restore one required offsite circuit to OPERABLE status.	12 hours from discovery of Condition D concurrent with inoperability of redundant required features 24 hours
E. One required offsite circuit inoperable. <u>AND</u> One or more DG(s) in Train A inoperable. <u>OR</u> One or more DG(s) in Train B inoperable.	-------------------NOTE------------------- Enter applicable Conditions and Required Actions of LCO 3.8.9, “Distribution Systems - Operating,” when Condition E is entered with no AC power source to any train. --- E.1 Restore required offsite circuit to OPERABLE status. <u>OR</u> E.2 Restore DG(s) to OPERABLE status.	 12 hours 12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
F. One or more DG(s) in Train A inoperable.	F.1	Restore DG(s) in Train A to OPERABLE status.	2 hours
<u>AND</u>	<u>OR</u>		
One or more DG(s) in Train B inoperable.	F.2	Restore DG(s) in Train B to OPERABLE status.	2 hours
G. Required Action and associated Completion Time of Condition A, B, C, D, E, or F not met.	G.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	G.2	Be in MODE 5.	36 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
H. Two required offsite circuits inoperable. <u>AND</u> One or more DG(s) in Train A inoperable. <u>OR</u> One or more DG(s) in Train B inoperable.	H.1 Enter LCO 3.0.3.	Immediately
I. One required offsite circuit inoperable. <u>AND</u> One or more DG(s) in Train A inoperable. <u>AND</u> One or more DG(s) in Train B inoperable.	I.1 Enter LCO 3.0.3.	Immediately

ATTACHMENT 4

Proposed TS Bases Changes (Final Typed) for WBN Units 1 and 2

Proposed TS Bases Changes (Final Typed) for WBN Unit 1

BASES

BACKGROUND (continued)

A single offsite circuit is capable of providing the ESF loads. Two of these circuits are required to meet the Limiting Condition for Operation.

The onsite standby power source for each 6.9 kV shutdown board is a dedicated DG. WBN uses 4 DG sets for Unit 1 operation. These same DGs will be shared for Unit 2 operation. A DG starts automatically on a safety injection (SI) signal (i.e., low pressurizer pressure or high containment pressure signals) or on an 6.9 kV shutdown board degraded voltage or loss-of-voltage signal (refer to LCO 3.3.5, "Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation"). After the DG has started, it will automatically tie to its respective 6.9 kV shutdown board after offsite power is tripped as a consequence of 6.9 kV shutdown board loss-of-voltage or degraded voltage, independent of or coincident with an SI signal. The DGs will also start and operate in the standby mode without tying to the 6.9 kV shutdown board on an SI signal alone. Following the trip of offsite power, a loss-of-voltage signal strips all nonpermanent loads from the 6.9 kV shutdown board. When the DG is tied to the 6.9 kV shutdown board, loads are then sequentially connected to its respective 6.9 kV shutdown board by the automatic sequencer. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading the DG by automatic load application.

In the event of a loss of preferred power, the 6.9 kV shutdown boards are automatically connected to the DGs in sufficient time to provide for safe reactor shutdown and to mitigate the consequences of a Design Basis Accident (DBA) such as a LOCA.

Certain required plant loads are returned to service in a predetermined sequence in order to prevent overloading the DG in the process. Within the required interval (FSAR Table 8.3-3) after the initiating signal is received, all automatic and permanently connected loads needed to recover the plant or maintain it in a safe condition are returned to service.

Ratings for Train 1A, 1B, 2A and 2B DGs satisfy the requirements of Regulatory Guide 1.9 (Ref. 3). The continuous service rating of each DG is 4400 kW with 10% overload permissible for up to 2 hours in any 24 hour period. The ESF loads that are powered from the 6.9 kV shutdown boards are listed in Reference 2.

The capability is provided to connect a 6.9 kV FLEX DG to supply power to any of the four 6.9 kV shutdown boards. The 6.9 kV FLEX DG is commercial-grade and not designed to meet Class 1E requirements. The FLEX DG is made available to support extended Completion Times in the event of an inoperable DG. The FLEX DG is made available as a defense-in-depth alternate source of AC power to mitigate a loss of offsite power event. The FLEX DG would remain

(continued)

BASES

BACKGROUND (continued)

disconnected from the Class 1E distribution system unless required during a loss of offsite power.

APPLICABLE SAFETY ANALYSES

The initial conditions of DBA and transient analyses in the FSAR, Section 6 (Ref. 4) and Section 15 (Ref. 5), assume ESF systems are OPERABLE. The AC electrical power sources are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, Reactor Coolant System (RCS), and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems.

The OPERABILITY of the AC electrical power sources is consistent with the initial assumptions of the Accident analyses and is based upon meeting the design basis of the plant. This results in maintaining at least two DG's associated with one load group or one offsite circuit OPERABLE during Accident conditions in the event of:

a. An assumed loss of all offsite power or all onsite AC power; and

b. A worst case single failure.

The AC sources satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Two qualified circuits between the Watts Bar Hydro 161 kV switchyard and the onsite Class 1E Electrical Power System and separate and independent DGs for each train ensure availability of the required power to shut down the reactor and maintain it in a safe shutdown condition after an anticipated operational occurrence (AOO) or a postulated DBA.

Qualified offsite circuits are those that are described in the FSAR and are part of the licensing basis for the plant.

Each offsite circuit must be capable of maintaining acceptable frequency and voltage, and accepting required loads during an accident, while connected to the 6.9 kV shutdown boards.

(continued)

ACTIONS (continued)

A.3

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition A for a period that should not exceed 72 hours. With one required offsite circuit inoperable, the reliability of the offsite system is degraded, and the potential for a loss of offsite power is increased, with attendant potential for a challenge to the plant safety systems. In this Condition, however, the remaining OPERABLE offsite circuit and DGs are adequate to supply electrical power to the onsite Class 1E Distribution System.

The 72 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

The second Completion Time for Required Action A.3 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition A is entered while, for instance, a DG is inoperable and that DG is subsequently returned OPERABLE, the LCO may already have been not met for up to 14 days. This could lead to a total of 17 days, since initial failure to meet the LCO, to restore the offsite circuit. At this time, a DG could again become inoperable, the circuit restored OPERABLE, and an additional 14 days (for a total of 31 days) allowed prior to complete restoration of the LCO. The 17 day Completion Time provides a limit on the time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The “AND” connector between the 72 hour and 17 day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

As in Required Action A.2, the Completion Time allows for an exception to the normal “time zero” for beginning the allowed outage time “clock.” This will result in establishing the “time zero” at the time that the LCO was initially not met, instead of at the time Condition A was entered.

(continued)

ACTIONS (continued)

B.1 and C.1

To ensure a highly reliable power source remains with one or more DGs inoperable in Train A OR with one or more DGs inoperable in Train B, it is necessary to verify the availability of the required offsite circuits on a more frequent basis. Since the Required Action only specifies “perform,” a failure of SR 3.8.1.1 acceptance criteria does not result in a Required Action being not met. However, if a circuit fails to pass SR 3.8.1.1, it is inoperable. Upon required offsite circuit inoperability, additional Conditions and Required Actions must then be entered.

B.2

In order to extend the Required Action B.5 Completion Time for an inoperable DG from 72 hours to 14 days, it is necessary to verify the availability of the 6.9 kV FLEX DG within 2 hours upon entry into LCO 3.8.1 and every 12 hours thereafter. Since Required Action B.2 only specifies "evaluate," discovering the 6.9 kV FLEX DG unavailable does not result in the Required Action being not met (i.e., the evaluation is performed). However, on discovery of an unavailable 6.9 kV FLEX DG, the Completion Time for Required Action B.5 starts the 72 hour and/or 24 hour clock.

6.9 kV FLEX DG availability requires that:

1) 6.9 kV FLEX DG fuel tank level is verified locally to be ≥ 8-hour supply; and
2) 6.9 kV FLEX DG supporting system parameters for starting and operating are verified to be within required limits for functional availability (e.g., battery state of charge).

The 6.9 kV FLEX DG is not used to extend the Completion Time for more than one inoperable DG at any one time.

(continued)

ACTIONS (continued)

B.3 and C.2

Required Actions B.3 and C.2 are intended to provide assurance that a loss of offsite power, during the period that a DG is inoperable, does not result in a complete loss of safety function of critical systems. These features are designed with redundant safety related trains. This includes motor driven auxiliary feedwater pumps. Single train systems, such as the turbine driven auxiliary feedwater pump, are not included. Redundant required feature failures consist of inoperable features associated with a train, redundant to the train that has inoperable DG(s).

The Completion Time for Required Actions B.3 and C.2 are intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal “time zero” for beginning the allowed outage time “clock.” In this Required Action, the Completion Time only begins on discovery that both:

a. An inoperable DG exists; and

b. A required feature on the other train (Train A or Train B) is inoperable.

If at any time during the existence of this Condition (one or more DGs inoperable) a required feature subsequently becomes inoperable, this Completion Time would begin to be tracked.

Discovering one or more DGs in Train A or one or more DGs in Train B inoperable coincident with one or more inoperable required support or supported features, or both, that are associated with the OPERABLE DGs, results in starting the Completion Time for the Required Action. Four hours from the discovery of these events existing concurrently is acceptable because it minimizes risk while allowing time for restoration before subjecting the plant to transients associated with shutdown.

In this Condition, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. Thus, on a component basis, single failure protection for the required feature's function may have been lost; however, function has not been lost. The 4 hour Completion Time takes into account the OPERABILITY of the redundant counterpart to the inoperable required feature. Additionally, the 4 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

(continued)

ACTIONS (continued)

B.4.1, B.4.2, C.3.1 and C.3.2

Required Actions B.4.1 and C.3.1 provide an allowance to avoid unnecessary testing of OPERABLE DGs. If it can be determined that the cause of the inoperable DG(s) does not exist on the OPERABLE DGs, SR 3.8.1.2 does not have to be performed. For the performance of a Surveillance, Required Action B.4.1 is considered satisfied since the cause of the DG(s) being inoperable is apparent. If the cause of inoperability exists on other DG(s), the other DG(s) would be declared inoperable upon discovery and Condition F of LCO 3.8.1 would be entered if the other inoperable DGs are not on the same train, otherwise, if the other inoperable DGs are on the same train, the unit is in Condition C. Once the failure is repaired, the common cause failure no longer exists, and Required Actions B.4.1 and B.4.2 are satisfied. If the cause of the initial inoperable DG(s) cannot be confirmed not to exist on the remaining DGs, performance of SR 3.8.1.2 suffices to provide assurance of continued OPERABILITY of that DG(s).

In the event the inoperable DG(s) is restored to OPERABLE status prior to completing either B.4.1, B.4.2, C.3.1 or C.3.2, the corrective action program will continue to evaluate the common cause possibility. This continued evaluation, however, is no longer under the 24 hour constraint imposed while in Condition B or C.

According to Generic Letter 84-15 (Ref. 11), 24 hours is reasonable to confirm that the OPERABLE DG(s) is not affected by the same problem as the inoperable DG(s).

B.5

In Condition B, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. The 14-day Completion Time takes into account the capacity and capability of the remaining AC sources (including the 6.9 kV FLEX DG), a reasonable time for repairs, and the low probability of a DBA occurring during this period.

If the 6.9 kV FLEX DG is or becomes unavailable with an inoperable DG, then action is required to restore the 6.9 kV FLEX DG to available status or to restore the DG to OPERABLE status within 72 hours from discovery of an unavailable 6.9 kV FLEX DG. However, if the 6.9 kV FLEX DG unavailability occurs sometime after 48 hours of continuous DG inoperability, then the remaining time to restore the 6.9 kV FLEX DG to available status or to restore the DG to OPERABLE status is limited to 24 hours.

The 72 hour and 24 hour Completion Times allow for an exception to the normal “time zero” for beginning the allowed outage time “clock.” The 72 hour Completion Time only begins on discovery that both an inoperable DG exists and the 6.9 kV FLEX DG is unavailable. The 24 hour Completion Time only begins on discovery that an inoperable DG exists for ≥ 48 hours and the 6.9 kV FLEX DG is unavailable.

(continued)

BASES

ACTIONS

B.5 (continued)

Therefore, when one DG is inoperable due to either preplanned maintenance (preventive or corrective) or unplanned corrective maintenance work, the Completion Time can be extended from 72 hours to 14 days if the 6.9 kV FLEX DG is verified available for backup operation.

The third Completion Time for Required Action B.5 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition B is entered while, for instance, an offsite circuit is inoperable and that circuit is subsequently restored OPERABLE, the LCO may already have been not met for up to 14 days. This could lead to a total of 17 days, since initial failure to meet the LCO, to restore the DGs. At this time, an offsite circuit could again become inoperable, the DGs restored OPERABLE, and an additional 72 hours (for a total of 20 days) allowed prior to complete restoration of the LCO. The 17-day Completion Time provides a limit on time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The “AND” connector between the 14-day and 17-day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

Compliance with the contingency actions listed in Bases Table 3.8.1-2 is required whenever Condition B is entered for a planned or unplanned outage that will extend beyond 72 hours. If Condition B is entered initially for an activity intended to last less than 72 hours or for an unplanned outage, the contingency actions should be invoked as soon as it is established that the outage period will be longer than 72 hours. The contingency actions applicable to Surveillance Requirement (SR) 3.8.1.14 must be invoked prior to initiation of the test.

As in Required Action B.3, the Completion Time allows for an exception to the normal “time zero” for beginning the allowed outage time “clock.” This will result in establishing the “time zero” at the time that the LCO was initially not met, instead of at the time Condition B was entered.

(continued)

ACTIONS (continued)

C.4

According to Regulatory Guide 1.93, (Ref. 6), operation may continue in Condition C for a period that should not exceed 72 hours.

In Condition C, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. The 72 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period. Restoration of at least one DG within 72 hours results in reverting back under Condition B and continuing to track the "time zero" Completion Time for one DG inoperable.

The second Completion Time for Required Action C.4 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition C is entered while, for instance, an offsite circuit is inoperable and that circuit is subsequently restored OPERABLE, the LCO may already have been not met for up to 72 hours. This could lead to a total of 144 hours, since initial failure to meet the LCO, to restore the DGs. At this time, an offsite circuit could again become inoperable, the DGs restored OPERABLE, and an additional 72 hours (for a total of 9 days) allowed prior to complete restoration of the LCO. The 6 day Completion Time provides a limit on time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and C are entered concurrently. The "AND" connector between the 72 hour and 6 day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

As in Required Action C.2, the Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time that the LCO was initially not met, instead of at the time Condition C was entered.

D.1 and D.2

Required Action D.1, which applies when two required offsite circuits are inoperable, is intended to provide assurance that an event with a coincident single failure will not result in a complete loss of redundant required safety functions. The Completion Time for this failure of redundant required features is reduced to 12 hours from that allowed for one train without offsite power (Required Action A.2). The rationale for the reduction to 12 hours is that Regulatory Guide 1.93 (Ref. 6) allows a Completion Time of 24 hours for two required offsite circuits inoperable, based upon the assumption that two complete safety trains are

(continued)

BASES

ACTIONS

D.1 and D.2 (continued)

OPERABLE. When a concurrent redundant required feature failure exists, this assumption is not the case, and a shorter Completion Time of 12 hours is appropriate. These features are powered from redundant AC safety trains. This includes motor driven auxiliary feedwater pumps. Single train features, such as the turbine driven auxiliary pump, are not included in the list.

The Completion Time for Required Action D.1 is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal “time zero” for beginning the allowed outage time “clock.” In this Required Action the Completion Time only begins on discovery that both:

a. All required offsite circuits are inoperable; and

b. A required feature is inoperable.

If at any time during the existence of Condition D (two required offsite circuits inoperable) a required feature becomes inoperable, this Completion Time begins to be tracked.

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition D for a period that should not exceed 24 hours. This level of degradation means that the offsite electrical power system does not have the capability to effect a safe shutdown and to mitigate the effects of an accident; however, the onsite AC sources have not been degraded. This level of degradation generally corresponds to a total loss of the immediately accessible offsite power sources.

Because of the normally high availability of the offsite sources, this level of degradation may appear to be more severe than other combinations of two AC sources inoperable (e.g., combinations that involve an offsite circuit and one DG inoperable, or one or more DGs in each train inoperable). However, two factors tend to decrease the severity of this level of degradation:

a. The configuration of the redundant AC electrical power system that remains available is not susceptible to a single bus or switching failure; and

(continued)

ACTIONS

D.1 and D.2 (continued)

b. The time required to detect and restore an unavailable required offsite power source is generally much less than that required to detect and restore an unavailable onsite AC source.

With both of the required offsite circuits inoperable, sufficient onsite AC sources are available to maintain the plant in a safe shutdown condition in the event of a DBA or transient. In fact, a simultaneous loss of offsite AC sources, a LOCA, and a worst case single failure were postulated as a part of the design basis in the safety analysis. Thus, the 24 hour Completion Time provides a period of time to effect restoration of one of the offsite circuits commensurate with the importance of maintaining an AC electrical power system capable of meeting its design criteria.

According to Reference 6, with the available offsite AC sources, two less than required by the LCO, operation may continue for 24 hours. If two offsite sources are restored within 24 hours, unrestricted operation may continue. If only one offsite source is restored within 24 hours, power operation continues in accordance with Condition A.

E.1 and E.2

Pursuant to LCO 3.0.6, the Distribution System ACTIONS would not be entered even if all AC sources to it were inoperable, resulting in de-energization. Therefore, the Required Actions of Condition E are modified by a Note to indicate that when Condition E is entered with no AC source to any train, the Conditions and Required Actions for LCO 3.8.9, "Distribution Systems - Operating," must be immediately entered. This allows Condition E to provide requirements for the loss of one offsite circuit and one or more DGs in a train, without regard to whether a train is de-energized. LCO 3.8.9 provides the appropriate restrictions for a de-energized train.

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition E for a period that should not exceed 12 hours.

In Condition E, individual redundancy is lost in both the offsite electrical power system and the onsite AC electrical power system. Since power system redundancy is provided by two diverse sources of power, however, the reliability of the power systems in this Condition may appear higher than that in Condition D (loss of both required offsite circuits). This difference in reliability is offset by the susceptibility of this

(continued)

ACTIONS

E.1 and E.2 (continued)

power system configuration to a single bus or switching failure. The 12 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

F.1 and F.2

With one or more DG(s) in Train A inoperable simultaneous with one or more DG(s) in Train B inoperable, there are no remaining standby AC sources. Thus, with an assumed loss of offsite electrical power, insufficient standby AC sources are available to power the minimum required ESF functions. Since the offsite electrical power system is the only source of AC power for this level of degradation, the risk associated with continued operation for a very short time could be less than that associated with an immediate controlled shutdown (the immediate shutdown could cause grid instability, which could result in a total loss of AC power). Since any inadvertent generator trip could also result in a total loss of offsite AC power, however, the time allowed for continued operation is severely restricted. The intent here is to avoid the risk associated with an immediate controlled shutdown and to minimize the risk associated with this level of degradation.

According to Reference 6, with one or more DG(s) in Train A inoperable simultaneous with one or more DG(s) in Train B inoperable, operation may continue for a period that should not exceed 2 hours.

G.1 and G.2

If the inoperable AC electric power sources cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

(continued)

BASES

ACTIONS (continued)

H.1 and I.1

Condition H and Condition I correspond to a level of degradation in which all redundancy in the AC electrical power supplies cannot be guaranteed. At this severely degraded level, any further losses in the AC electrical power system will cause a loss of function. Therefore, no additional time is justified for continued operation. The plant is required by LCO 3.0.3 to commence a controlled shutdown.

SURVEILLANCE REQUIREMENTS

The AC sources are designed to permit inspection and testing of all important areas and features, especially those that have a standby function, in accordance with 10 CFR 50, Appendix A, GDC 18 (Ref. 8). Periodic component tests are supplemented by extensive functional tests during refueling outages (under simulated accident conditions). The SRs for demonstrating the OPERABILITY of the DGs are in accordance with the recommendations of Regulatory Guide 1.9 (Ref. 3) and Regulatory Guide 1.137 (Ref. 9), as addressed in the FSAR.

Where the SRs discussed herein specify voltage and frequency tolerances, the following is applicable. 6800 volts is the minimum steady state output voltage and the 10 second transient value. 6800 volts is 98.6% of the nominal bus voltage of 6900 V corrected for instrument error and is the upper limit of the minimum voltage required for the DG supply breaker to close on the 6.9 kV shutdown board. The specified maximum steady state output voltage of 7260 V is 110% of the nameplate rating of the 6600 V motors. The specified 3 second transient value of 6555 V is 95% of the nominal bus voltage of 6900 V. The specified maximum transient value of 8880 V is the maximum equipment withstand value provided by the DG manufacturer. The specified minimum and maximum frequencies of the DG are 58.8 Hz and 61.2 Hz, respectively. The steady state minimum and maximum frequency values are 59.8 HZ and 60.1 HZ. These values ensure that the safety related plant equipment powered from the DGs is capable of performing its safety functions.

SR 3.8.1.1

This SR ensures proper circuit continuity for the offsite AC electrical power supply to the onsite distribution network and availability of offsite AC electrical power. The breaker alignment verifies that each breaker is in its correct position to ensure that distribution buses and loads are connected to their preferred power source, and that appropriate independence of offsite circuits is maintained. The 7 day Frequency is adequate since breaker position is not likely to change without the operator being aware of it and because its status is displayed in the control room.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.18

Under accident and loss of offsite power conditions loads are sequentially connected to the 6.9 kV shutdown board by the automatic load sequencer. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading of the DGs due to high motor starting currents. The load sequence time specified in FSAR Table 8.3-3 ensures that sufficient time exists for the DG to restore frequency and voltage prior to applying the next load block and that safety analysis assumptions regarding ESF equipment time delays are not violated. The allowable values for the time delay relays are contained in system specific setpoint scaling documents. Reference 2 provides a summary of the automatic loading of ESF buses.

The Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.9 (Ref. 3), Table 1, takes into consideration plant conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle lengths.

This SR is modified by a Note. The reason for the Note is that performing the Surveillance for DG 1A-A or 1B-B would remove a required offsite circuit from service, perturb the electrical distribution system, and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:

1) Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation of the required performance is available; and

2) Post corrective maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

SR 3.8.1.19

In the event of a DBA coincident with a loss of offsite power, the DGs are required to supply the necessary power to ESF systems so that the fuel, RCS, and containment design limits are not exceeded.

This Surveillance demonstrates the DG operation, as discussed in the Bases for SR 3.8.1.11, during a loss of offsite power actuation test signal in conjunction with an ESF actuation signal. In lieu of actual demonstration of connection and loading of loads, testing that adequately shows the capability of the DG system to perform these functions is acceptable. This testing may include any series of sequential, overlapping, or total steps so that the entire connection and loading sequence is verified.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.19 (continued)

The Frequency of 18 months takes into consideration plant conditions required to perform the Surveillance and is intended to be consistent with an expected fuel cycle length of 18 months.

For the purpose of this testing, the DGs shall be started from standby conditions, that is, with the engine coolant and oil being continuously circulated and temperature maintained consistent with manufacturer recommendations. The DG engines for WBN have an oil circulation and soakback system that operates continuously to preclude the need for a prelube and warmup when a DG is started from standby.

This SR is modified by a Note. The reason for the Note is that the performance of the Surveillance for DG 1A-A or 1B-B would remove a required offsite circuit from service, perturb the electrical distribution system, and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:

1) Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation of the required performance is available; and

2) Post corrective maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

SR 3.8.1.20

This SR verifies that DG availability is not compromised by the idle start circuitry, when in the idle mode of operation, and that an automatic or emergency start signal will disable the idle start circuitry and command the engine to go to full speed. The 18 month frequency is consistent with the expected fuel cycle lengths and is considered sufficient to detect any degradation of the idle start circuitry.

(continued)

Bases Table 3.8.1-2
TS Action or Surveillance Requirement (SR) Contingency Actions

	Contingency Actions to be Implemented	Applicable TS Action or SR	Applicable Modes
1.	Verify that the offsite power system is stable. This action will establish that the offsite power system is within single-contingency limits and will remain stable upon the loss of any single component supporting the system. If a grid stability problem exists, the planned DG outage will not be scheduled.	SR 3.8.1.14 Action B.5	1, 2 1, 2, 3, 4
2.	Verify that no adverse weather conditions are expected during the outage period. The planned DG outage will be postponed if inclement weather (such as severe thunderstorms or heavy snowfall) is projected.	SR 3.8.1.14 Action B.5	1, 2 1, 2, 3, 4
3.	Do not remove from service the ventilation systems for the 6.9 kV shutdown board rooms, the elevation 772 transformer rooms, or the 480-volt shutdown board rooms, concurrently with the DG, or implement appropriate compensatory measures.	Action B.5	1, 2, 3, 4
4.	Do not remove the reactor trip breakers from service concurrently with planned DG outage maintenance.	Action B.5	1, 2, 3, 4
5.	Do not remove the turbine-driven auxiliary feedwater (AFW) pump from service concurrently with a Unit 1 DG outage.	Action B.5	1, 2, 3, 4
6.	Do not remove the AFW level control valves to the steam generators from service concurrently with a Unit 1 DG outage.	Action B.5	1, 2, 3, 4
7.	Do not remove the opposite train residual heat removal (RHR) pump from service concurrently with a Unit 1 DG outage.	Action B.5	1, 2, 3, 4

Proposed TS Bases Changes (Final Typed) for WBN Unit 2

BACKGROUND (continued)

The onsite standby power source for each 6.9 kV shutdown board is a dedicated DG. WBN uses 4 DG sets for Unit 2 operation. These same DGs will be shared for Unit 1 operation. A DG starts automatically on a safety injection (SI) signal (i.e., low pressurizer pressure or high containment pressure signals) or on an 6.9 kV shutdown board degraded voltage or loss-of-voltage signal (refer to LCO 3.3.5, “Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation.”). After the DG has started, it will automatically tie to its respective 6.9 kV shutdown board after offsite power is tripped as a consequence of 6.9 kV shutdown board loss-of-voltage or degraded voltage, independent of or coincident with an SI signal. The DGs will also start and operate in the standby mode without tying to the 6.9 kV shutdown board on an SI signal alone. Following the trip of offsite power, a loss-of-voltage signal strips all nonpermanent loads from the 6.9 kV shutdown board. When the DG is tied to the 6.9 kV shutdown board, loads are then sequentially connected to its respective 6.9 kV shutdown board by the automatic sequencer. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading the DG by automatic load application.

In the event of a loss of preferred power, the 6.9 kV shutdown boards are automatically connected to the DGs in sufficient time to provide for safe reactor shutdown and to mitigate the consequences of a Design Basis Accident (DBA) such as a LOCA.

Certain required plant loads are returned to service in a predetermined sequence in order to prevent overloading the DG in the process. Within the required interval (FSAR Table 8.3-3) after the initiating signal is received, all automatic and permanently connected loads needed to recover the plant or maintain it in a safe condition are returned to service.

Ratings for Train 1A, 1B, 2A and 2B DGs satisfy the requirements of Regulatory Guide 1.9 (Ref. 3). The continuous service rating of each DG is 4400 kW with 10% overload permissible for up to 2 hours in any 24 hour period. The ESF loads that are powered from the 6.9 kV shutdown boards are listed in Reference 2.

The capability is provided to connect a 6.9 kV FLEX DG to supply power to any of the four 6.9 kV shutdown boards. The 6.9 kV FLEX DG is commercial-grade and not designed to meet Class 1E requirements. The FLEX DG is made available to support extended Completion Times in the event of an inoperable DG. The FLEX DG is made available as a defense-in-depth alternate source of AC power to mitigate a loss of offsite power event. The FLEX DGs would remain disconnected from the Class 1E distribution system unless required during a loss of offsite power.

(continued)

BASES

ACTIONS

A.2 (continued)

Discovering no offsite power to one train of the onsite Class 1E Electrical Power Distribution System coincident with one or more inoperable required support or supported features, or both, that are associated with the other train that has offsite power, results in starting the Completion Times for the Required Action. Twenty four hours is acceptable because it minimizes risk while allowing time for restoration before subjecting the plant to transients associated with shutdown.

The remaining OPERABLE offsite circuit and DGs are adequate to supply electrical power to Train A and Train B of the onsite Class 1E Distribution System. The 24 hour Completion Time takes into account the component OPERABILITY of the redundant counterpart to the inoperable required feature.

Additionally, the 24 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

A.3

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition A for a period that should not exceed 72 hours. With one required offsite circuit inoperable, the reliability of the offsite system is degraded, and the potential for a loss of offsite power is increased, with attendant potential for a challenge to the plant safety systems. In this Condition, however, the remaining OPERABLE offsite circuit and DGs are adequate to supply electrical power to the onsite Class 1E Distribution System.

The 72 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

The second Completion Time for Required Action A.3 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition A is entered while, for instance, a DG is inoperable and that DG is subsequently returned OPERABLE, the LCO may already have been not met for up to 14 days. This could lead to a total of 17 days, since initial failure to meet the LCO, to restore the offsite circuit. At this time, a DG could again become inoperable, the circuit restored OPERABLE, and an additional 14 days (for a total of 31 days) allowed prior to complete restoration of the LCO. The 17 day Completion

(continued)

ACTIONS

A.3 (continued)

Time provides a limit on the time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The "AND" connector between the 72 hour and 17 day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

As in Required Action A.2, the Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time that the LCO was initially not met, instead of at the time Condition A was entered.

B.1 and C.1

To ensure a highly reliable power source remains with one or more DGs inoperable in Train A OR with one or more DGs inoperable in Train B, it is necessary to verify the availability of the required offsite circuits on a more frequent basis. Since the Required Action only specifies "perform," a failure of SR 3.8.1.1 acceptance criteria does not result in a Required Action being not met. However, if a circuit fails to pass SR 3.8.1.1, it is inoperable. Upon required offsite circuit inoperability, additional Conditions and Required Actions must then be entered.

B.2

In order to extend the Required Action B.5 Completion Time for an inoperable DG from 72 hours to 14 days, it is necessary to verify the availability of the 6.9 kV FLEX DG within 2 hours upon entry into LCO 3.8.1 and every 12 hours thereafter. Since Required Action B.2 only specifies "evaluate," discovering the 6.9 kV FLEX DG unavailable does not result in the Required Action being not met (i.e., the evaluation is performed). However, on discovery of an unavailable 6.9 kV FLEX DG, the Completion Time for Required Action B.5 starts the 72 hour and/or 24 hour clock.

6.9 kV FLEX DG availability requires that:

1) 6.9 kV FLEX DG fuel tank level is verified locally to be ≥ 8-hour supply; and
2) 6.9 kV FLEX DG supporting system parameters for starting and operating are verified to be within required limits for functional availability (e.g., battery state of charge).

.

(continued)

BASES

ACTIONS

B.2 (continued)

The 6.9 kV FLEX DG is not used to extend the Completion Time for more than one inoperable DG at any one time.

B.3 and C.2

Required Actions B.3 and C.2 are intended to provide assurance that a loss of offsite power, during the period that a DG is inoperable, does not result in a complete loss of safety function of critical systems. These features are designed with redundant safety related trains. This includes motor driven auxiliary feedwater pumps. Single train systems, such as the turbine driven auxiliary feedwater pump, are not included. Redundant required feature failures consist of inoperable features associated with a train, redundant to the train that has inoperable DG(s).

The Completion Time for Required Actions B.3 and C.2 are intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal “time zero” for beginning the allowed outage time “clock.” In this Required Action, the Completion Time only begins on discovery that both:

a. An inoperable DG exists; and

b. A required feature on the other train (Train A or Train B) is inoperable.

If at any time during the existence of this Condition (one or more DGs inoperable) a required feature subsequently becomes inoperable, this Completion Time would begin to be tracked.

Discovering one or more DGs in Train A or one or more DGs in Train B inoperable coincident with one or more inoperable required support or supported features, or both, that are associated with the OPERABLE DGs, results in starting the Completion Time for the Required Action. Four hours from the discovery of these events existing concurrently is acceptable because it minimizes risk while allowing time for restoration before subjecting the plant to transients associated with shutdown.

(continued)

ACTIONS

B.3 and C.2 (continued)

In this Condition, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. Thus, on a component basis, single failure protection for the required feature's function may have been lost; however, function has not been lost. The 4 hour Completion Time takes into account the OPERABILITY of the redundant counterpart to the inoperable required feature. Additionally, the 4 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

B.4.1, B.4.2, C.3.1 and C.3.2

Required Actions B.4.1 and C.3.1 provide an allowance to avoid unnecessary testing of OPERABLE DGs. If it can be determined that the cause of the inoperable DG(s) does not exist on the OPERABLE DGs, SR 3.8.1.2 does not have to be performed. For the performance of a Surveillance, Required Action B.4.1 is considered satisfied since the cause of the DG(s) being inoperable is apparent. If the cause of inoperability exists on other DG(s), the other DG(s) would be declared inoperable upon discovery and Condition F of LCO 3.8.1 would be entered if the other inoperable DGs are not on the same train, otherwise, if the other inoperable DGs are on the same train, the unit is in Condition C. Once the failure is repaired, the common cause failure no longer exists, and Required Actions B.4.1 and B.4.2 are satisfied. If the cause of the initial inoperable DG(s) cannot be confirmed not to exist on the remaining DGs, performance of SR 3.8.1.2 suffices to provide assurance of continued OPERABILITY of that DG(s).

(continued)

BASES

ACTIONS

B.4.1, B.4.2, C.3.1 and C.3.2 (continued)

In the event the inoperable DG(s) is restored to OPERABLE status prior to completing either B.4.1, B.4.2, C.3.1 or C.3.2, the corrective action program will continue to evaluate the common cause possibility. This continued evaluation, however, is no longer under the 24 hour constraint imposed while in Condition B or C.

According to Generic Letter 84-15 (Ref. 7), 24 hours is reasonable to confirm that the OPERABLE DG(s) is not affected by the same problem as the inoperable DG(s).

B.5

In Condition B, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. The 14-day Completion Time takes into account the capacity and capability of the remaining AC sources (including the 6.9 kV FLEX DG), a reasonable time for repairs, and the low probability of a DBA occurring during this period.

If the 6.9 kV FLEX DG is or becomes unavailable with an inoperable DG, then action is required to restore the 6.9 kV FLEX DG to available status or to restore the DG to OPERABLE status within 72 hours from discovery of an unavailable 6.9 kV FLEX DG. However, if the 6.9 kV FLEX DG unavailability occurs sometime after 48 hours of continuous DG inoperability, then the remaining time to restore the 6.9 kV FLEX DG to available status or to restore the DG to OPERABLE status is limited to 24 hours.

(continued)

BASES

ACTIONS

B.5 (continued)

The 72 hour and 24 hour Completion Times allow for an exception to the normal “time zero” for beginning the allowed outage time “clock.” The 72 hour Completion Time only begins on discovery that both an inoperable DG exists and the 6.9 kV FLEX DG is unavailable. The 24 hour Completion Time only begins on discovery that an inoperable DG exists for ≥ 48 hours and the 6.9 kV FLEX DG is unavailable.

Therefore, when one DG is inoperable due to either preplanned maintenance (preventive or corrective) or unplanned corrective maintenance work, the Completion Time can be extended from 72 hours to 14 days if the 6.9 kV FLEX DG is verified available for backup operation.

The third Completion Time for Required Action B.5 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition B is entered while, for instance, an offsite circuit is inoperable and that circuit is subsequently restored OPERABLE, the LCO may already have been not met for up to 14 days. This could lead to a total of 17 days, since initial failure to meet the LCO, to restore the DGs. At this time, an offsite circuit could again become inoperable, the DGs restored OPERABLE, and an additional 72 hours (for a total of 20 days) allowed prior to complete restoration of the LCO. The 17-day Completion Time provides a limit on time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The “AND” connector between the 14-day and 17-day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

Compliance with the contingency actions listed in Bases Table 3.8.1-2 is required whenever Condition B is entered for a planned or unplanned outage that will extend beyond 72 hours. If Condition B is entered initially for an activity intended to last less than 72 hours or for an unplanned outage, the contingency actions should be invoked as soon as it is established that the outage period will be longer than 72 hours.

As in Required Action B.3, the Completion Time allows for an exception to the normal “time zero” for beginning the allowed outage time “clock.” This will result in establishing the “time zero” at the time that the LCO was initially not met, instead of at the time Condition B was entered.

(continued)

BASES

ACTIONS (continued)

C.4

According to Regulatory Guide 1.93, (Ref. 6), operation may continue in Condition C for a period that should not exceed 72 hours.

In Condition C, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. The 72 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period. Restoration of at least one DG within 72 hours results in reverting back under Condition B and continuing to track the "time zero" Completion Time for one DG inoperable.

The second Completion Time for Required Action C.4 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition C is entered while, for instance, an offsite circuit is inoperable and that circuit is subsequently restored OPERABLE, the LCO may already have been not met for up to 72 hours. This could lead to a total of 144 hours, since initial failure to meet the LCO, to restore the DGs. At this time, an offsite circuit could again become inoperable, the DGs restored OPERABLE, and an additional 72 hours (for a total of 9 days) allowed prior to complete restoration of the LCO. The 6 day Completion Time provides a limit on time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and C are entered concurrently. The "AND" connector between the 72 hour and 6 day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

As in Required Action C.2, the Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time that the LCO was initially not met, instead of at the time Condition C was entered.

D.1 and D.2

Required Action D.1, which applies when two required offsite circuits are inoperable, is intended to provide assurance that an event with a coincident single failure will not result in a complete loss of redundant required safety functions. The Completion Time for this failure of redundant required features is reduced to 12 hours from that allowed for one train without offsite power (Required Action A.2).

(continued)

ACTIONS

D.1 and D.2 (continued)

The rationale for the reduction to 12 hours is that Regulatory Guide 1.93 (Ref. 6) allows a Completion Time of 24 hours for two required offsite circuits inoperable, based upon the assumption that two complete safety trains are OPERABLE. When a concurrent redundant required feature failure exists, this assumption is not the case, and a shorter Completion Time of 12 hours is appropriate. These features are powered from redundant AC safety trains. This includes motor driven auxiliary feedwater pumps. Single train features, such as the turbine driven auxiliary pump, are not included in the list.

The Completion Time for Required Action D.1 is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." In this Required Action the Completion Time only begins on discovery that both:

a. All required offsite circuits are inoperable; and

b. A required feature is inoperable.

If at any time during the existence of Condition D (two required offsite circuits inoperable) a required feature becomes inoperable, this Completion Time begins to be tracked.

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition D for a period that should not exceed 24 hours. This level of degradation means that the offsite electrical power system does not have the capability to effect a safe shutdown and to mitigate the effects of an accident; however, the onsite AC sources have not been degraded. This level of degradation generally corresponds to a total loss of the immediately accessible offsite power sources.

Because of the normally high availability of the offsite sources, this level of degradation may appear to be more severe than other combinations of two AC sources inoperable (e.g., combinations that involve an offsite circuit and one DG inoperable, or one or more DGs in each train inoperable). However, two factors tend to decrease the severity of this level of degradation:

a. The configuration of the redundant AC electrical power system that remains available is not susceptible to a single bus or switching failure; and

(continued)

ACTIONS

D.1 and D.2 (continued)

b. The time required to detect and restore an unavailable required offsite power source is generally much less than that required to detect and restore an unavailable onsite AC source.

With both of the required offsite circuits inoperable, sufficient onsite AC sources are available to maintain the plant in a safe shutdown condition in the event of a DBA or transient. In fact, a simultaneous loss of offsite AC sources, a LOCA, and a worst case single failure were postulated as a part of the design basis in the safety analysis. Thus, the 24 hour Completion Time provides a period of time to effect restoration of one of the offsite circuits commensurate with the importance of maintaining an AC electrical power system capable of meeting its design criteria.

According to Reference 6, with the available offsite AC sources, two less than required by the LCO, operation may continue for 24 hours. If two offsite sources are restored within 24 hours, unrestricted operation may continue. If only one offsite source is restored within 24 hours, power operation continues in accordance with Condition A.

E.1 and E.2

Pursuant to LCO 3.0.6, the Distribution System ACTIONS would not be entered even if all AC sources to it were inoperable, resulting in de-energization. Therefore, the Required Actions of Condition E are modified by a Note to indicate that when Condition E is entered with no AC source to any train, the Conditions and Required Actions for LCO 3.8.9, "Distribution Systems - Operating," must be immediately entered. This allows Condition E to provide requirements for the loss of one offsite circuit and one or more DGs in a train, without regard to whether a train is de-energized. LCO 3.8.9 provides the appropriate restrictions for a de-energized train.

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition E for a period that should not exceed 12 hours.

In Condition E, individual redundancy is lost in both the offsite electrical power system and the onsite AC electrical power system. Since power system redundancy is provided by two diverse sources of power, however, the reliability of the power systems in this Condition may appear higher than that in Condition D (loss of both required offsite circuits). This difference in reliability is offset by the susceptibility of this power system configuration to a single bus or switching failure.

(continued)

BASES

ACTIONS

E.1 and E.2 (continued)

The 12 hour Completion Time takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

F.1 and F.2

With one or more DG(s) in Train A inoperable simultaneous with one or more DG(s) in Train B inoperable, there are no remaining standby AC sources. Thus, with an assumed loss of offsite electrical power, insufficient standby AC sources are available to power the minimum required ESF functions. Since the offsite electrical power system is the only source of AC power for this level of degradation, the risk associated with continued operation for a very short time could be less than that associated with an immediate controlled shutdown (the immediate shutdown could cause grid instability, which could result in a total loss of AC power). Since any inadvertent generator trip could also result in a total loss of offsite AC power, however, the time allowed for continued operation is severely restricted. The intent here is to avoid the risk associated with an immediate controlled shutdown and to minimize the risk associated with this level of degradation.

According to Reference 6, with one or more DG(s) in Train A inoperable simultaneous with one or more DG(s) in Train B inoperable, operation may continue for a period that should not exceed 2 hours.

G.1 and G.2

If the inoperable AC electric power sources cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

(continued)

BASES

ACTIONS (continued)

H.1 and I.1

Condition H and Condition I correspond to a level of degradation in which all redundancy in the AC electrical power supplies cannot be guaranteed. At this severely degraded level, any further losses in the AC electrical power system will cause a loss of function. Therefore, no additional time is justified for continued operation. The plant is required by LCO 3.0.3 to commence a controlled shutdown.

SURVEILLANCE REQUIREMENTS

The AC sources are designed to permit inspection and testing of all important areas and features, especially those that have a standby function, in accordance with 10 CFR 50, Appendix A, GDC 18 (Ref. 8). Periodic component tests are supplemented by extensive functional tests during refueling outages (under simulated accident conditions). The SRs for demonstrating the OPERABILITY of the DGs are in accordance with the recommendations of Regulatory Guide 1.9 (Ref. 3) and Regulatory Guide 1.137 (Ref. 9), as addressed in the FSAR.

Where the SRs discussed herein specify voltage and frequency tolerances, the following is applicable. 6800 volts is the minimum steady state output voltage and the 10 second transient value. 6800 volts is 98.6% of the nominal bus voltage of 6900 V corrected for instrument error and is the upper limit of the minimum voltage required for the DG supply breaker to close on the 6.9 kV shutdown board. The specified maximum steady state output voltage of 7260 V is 110% of the nameplate rating of the 6600 V motors. The specified 3 second transient value of 6555 V is 95% of the nominal bus voltage of 6900 V. The specified maximum transient value of 8880 V is the maximum equipment withstand value provided by the DG manufacturer. The specified minimum and maximum frequencies of the DG are 58.8 Hz and 61.2 Hz, respectively. The steady state minimum and maximum frequency values are 59.8 HZ and 60.1 HZ. These values ensure that the safety related plant equipment powered from the DGs is capable of performing its safety functions.

SR 3.8.1.1

This SR ensures proper circuit continuity for the offsite AC electrical power supply to the onsite distribution network and availability of offsite AC electrical power.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.14

Regulatory Guide 1.9 (Ref. 3), paragraph C2.2.9, requires demonstration once per 18 months that the DGs can start and run continuously for an interval of not less than 24 hours, ≥ 2 hours of which is at a load between 105% and 110% of the continuous duty rating and the remainder of the time at a load equivalent to 90% to 100% of the continuous duty rating of the DG. The DG starts for this Surveillance can be performed either from standby or hot conditions. The provisions for prelubricating and warmup, discussed in SR 3.8.1.2, and for gradual loading, discussed in SR 3.8.1.3, are applicable to this SR.

In order to ensure that the DG is tested under load conditions that are as close to design conditions as possible, testing must be performed using a power factor of ≥ 0.8 and ≤ 0.9. This power factor is chosen to be representative of the actual design basis inductive loading that the DG would experience. The load band is provided to avoid routine overloading of the DG. Routine overloading may result in more frequent teardown inspections in accordance with vendor recommendations in order to maintain DG OPERABILITY.

This Surveillance is modified by three Notes. Note 1 states that momentary transients due to changing bus loads do not invalidate this test. Similarly, momentary power factor transients above the power factor limit will not invalidate the test. Note 2 establishes that this SR may be performed on only one DG at a time while in MODE 1, 2, 3, or 4. This is necessary to ensure the proper response to an operational transient (i.e., loss of offsite power, ESF actuation). Therefore, three DGs must be maintained operable and in a standby condition during performance of this test. In this configuration, the plant will remain within its design basis, since at all times safe shutdown can be achieved with two DGs in the same train.

Note 3 establishes that credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:

1) Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation of the required performance is available; and
2) Post-corrective maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.14 (continued)

Prior to performance of this SR in MODES 1 or 2, actions are taken to establish that adequate conditions exist for performance of the SR. The required actions are defined in Bases Table 3.8.1-2.

SR 3.8.1.15

This Surveillance demonstrates that the diesel engine can restart from a hot condition, such as subsequent to shutdown from normal Surveillances, and achieve the required voltage and frequency within 10 seconds. The minimum voltage and frequency stated in the SR are those necessary to ensure the DG can accept DBA loading while maintaining acceptable voltage and frequency levels. Stable operation at the nominal voltage and frequency values is also essential to establishing DG OPERABILITY, but a time constraint is not imposed. This is because a typical DG will experience a period of voltage and frequency oscillations prior to reaching steady state operation if these oscillations are not dampened out by load application. This period may extend beyond the 10 second acceptance criteria and could be a cause for failing the SR. In lieu of a time constraint in the SR, WBN will monitor and trend the actual time to reach steady state operation as a means of ensuring there is no voltage regulator or governor degradation which could cause a DG to become inoperable. The 10 second time is derived from the requirements of the accident analysis to respond to a design basis large break LOCA. The 18 month Frequency is consistent with the recommendations of Regulatory Guide 1.9 (Ref. 3), Table 1.

The DG engines for WBN have an oil circulation and soakback system that operates continuously to preclude the need for a prelube and warmup when a DG is started from standby.

This SR is modified by a Note to ensure that the test is performed with the diesel sufficiently hot. The load band is provided to avoid routine overloading of the DG. Routine overloads may result in more frequent teardown inspections in accordance with vendor recommendations in order to maintain DG OPERABILITY. The requirement that the diesel has operated for at least 2 hours at full load conditions prior to performance of this Surveillance is based on manufacturer recommendations for achieving hot conditions. Momentary transients due to changing bus loads do not invalidate this test.

(continued)

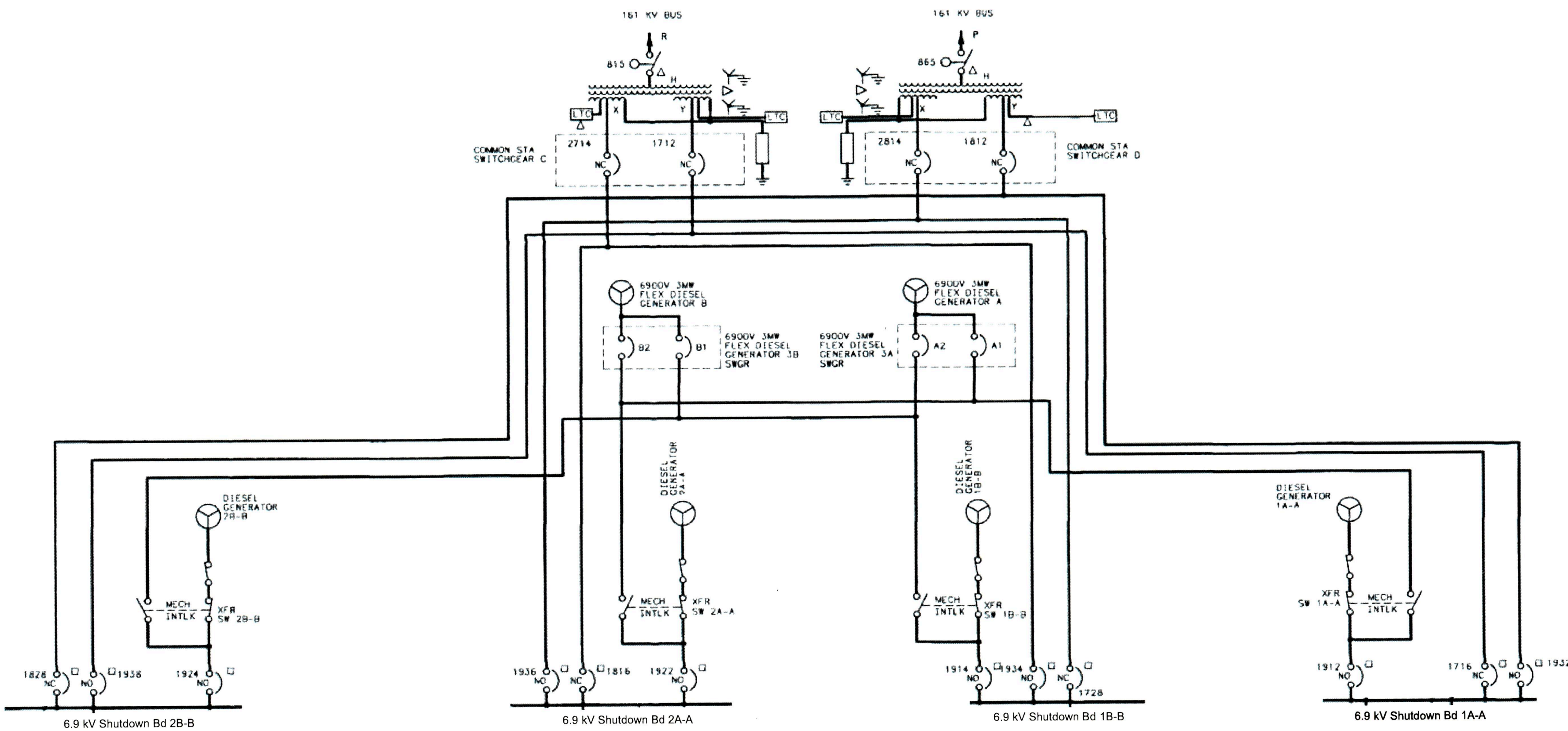
Bases Table 3.8.1-2
TS Action or Surveillance Requirement (SR) Contingency Actions

	Contingency Actions to be Implemented	Applicable TS Action or SR	Applicable MODES
1.	Verify that the offsite power system is stable. This action will establish that the offsite power system is within single-contingency limits and will remain stable upon the loss of any single component supporting the system. If a grid stability problem exists, the planned DG outage will not be scheduled.	SR 3.8.1.14 Action B.5	1, 2 1, 2, 3, 4
2.	Verify that no adverse weather conditions are expected during the outage period. The planned DG outage will be postponed if inclement weather (such as severe thunderstorms or heavy snowfall) is projected.	SR 3.8.1.14 Action B.5	1, 2 1, 2, 3, 4
3.	Do not remove from service the ventilation systems for the 6.9 kV shutdown board rooms, the elevation 772 transformer rooms, or the 480-volt shutdown board rooms, concurrently with the DG, or implement appropriate compensatory measures.	Action B.5	1, 2, 3, 4
4.	Do not remove the reactor trip breakers from service concurrently with planned DG outage maintenance.	Action B.5	1, 2, 3, 4
5.	Do not remove the turbine-driven auxiliary feedwater (AFW) pump from service concurrently with a Unit 2 DG outage.	Action B.5	1, 2, 3, 4
6.	Do not remove the AFW level control valves to the steam generators from service concurrently with a Unit 2 DG outage.	Action B.5	1, 2, 3, 4
7.	Do not remove the opposite train residual heat removal (RHR) pump from service concurrently with a Unit 2 DG outage.	Action B.5	1, 2, 3, 4

ATTACHMENT 5

WBN Electrical Diagram Showing 6.9 kV FLEX DG Connection

Enclosure 1
Attachment 5



Simplified Diagram - 6.9 kV Flex Diesel Generator Connection to 6.9 kV Shutdown Boards

ENCLOSURE 2

Watts Bar Nuclear Plant Risk-Informed Extension of Diesel Generator Allowed Outage Time

ABS Consulting

R-3317133-1964

Watts Bar Nuclear Plant Risk-Informed Extension of Diesel Generator Allowed Outage Time

January 23, 2015

Prepared for:

Tennessee Valley Authority

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ABS Consulting

R-3317133-1964

Watts Bar Nuclear Plant Risk-Informed Extension of Diesel Generator Allowed Outage Time

January 23, 2015

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1. Introduction

On August 7, 2001, Tennessee Valley Authority (TVA) submitted a Technical Specification (TS) Change Request (TS-01-04) to U.S. Nuclear Regulatory Commission (NRC) to extend the Watts Bar Nuclear Plant (WBN), Unit 1 emergency diesel generator (EDG) allowed outage time (AOT) from 72 hours to 14 days; i.e., to allow one emergency diesel generator to be out of service (OOS) for 14 days. This request was later supplemented by additional information provided in TVA letters dated December 14, 2001, and April 1, 2002.

On July 1, 2002, NRC issued Amendment No. 39 to Facility Operating License No. NPF-90 for WBN Unit 1, which changes Technical Specification Limiting Condition for Operation (LCO) 3.8.1, “AC Sources Operating,” action AOT to restore an inoperable emergency diesel generator to operable status from 72 hours to 14 days. This approved amendment, which is based on the overall plant electrical design with four EDGs supplying the common and the Unit 1 loads only, provides needed flexibility to perform EDG maintenance, particularly the 6-year and 12-year overhaul maintenance, during WBN Unit 1 power operation. However, with the planned dual unit operation by the end of 2015, it is necessary to re-submit to the NRC a new Technical Specification Change Request allowing an extended EDG AOT with the same four EDGs supplying the loads of both Units 1 and 2.

It is therefore the purpose of this analysis to perform a risk-informed, probabilistic evaluation to support an extended EDG AOT during power operation of both WBN units by determining if the proposed change in emergency diesel generator AOT is justified from a risk perspective. As required by Regulatory Guides (RG) 1.174 and 1.177, risk-informed changes to a nuclear power plant’s licensing basis consist of both deterministic and probabilistic evaluations. This analysis includes only the probabilistic evaluation completed using the WBN Probabilistic Risk Assessment (PRA) to supplement the deterministic engineering evaluations in support of the WBN submittal of an AOT extension request for the emergency diesel generators.

This report documents the methods used in the evaluation as well as the results and findings from the analysis, which was performed by the use of a revised version of the latest CAFTA-based, dual unit PRA model for the Watts Bar Nuclear Plant. The major changes made to the WBN PRA model of record (MOR) includes an update to the analysis of the non-recovery probabilities for the loss of offsite power (LOOP) events and incorporation of selected Diverse and Flexible Coping Strategy (FLEX) installed equipment and the associated procedures.

The results of this evaluation indicates that the impact on plant risk of relaxing the EDG AOT for both Watts Bar units from 72 hours to 14 days for a single EDG is very small for both internal and external events.

Section 2 of this report provides a list of acronyms used. Evaluation of the risk impact is documented in Section 3. Section 4 discusses the considerations for the avoidance of risk significant configurations. Section 5 explains the configuration risk management at WBN. Finally, Section 6 presents a summary and the conclusion of the analysis.

2. List of Acronyms

Acronyms	
AFW	Auxiliary Feedwater
ANS	American Nuclear Society
AOT	Allowed Outage Time
ASME	American Society of Mechanical Engineers
CCF	Common Cause Failure
CCP	Centrifugal Charging Pump
CCS	Component Cooling Water System
CDF	Core Damage Frequency
CM	Corrective Maintenance
CST	Condensate Storage Tank
CT	Completion Time
DC	Direct Current
DG	Diesel Generator
EDG	Emergency Diesel Generator
EOOS	Equipment Out of Service Risk Monitor
EPRI	Electric Power Research Institute
ERCW	Emergency Raw Cooling Water
F&O	Fact and Observation
FEG	Functional Equipment Group
FIVE	Fire Induced Vulnerability Evaluation
FLEX	Diverse and Flexible Coping Strategy
FVI	Fussell-Vesely Importance
HEP	Human Error Probability
HRA	Human Reliability Analysis
HVAC	Heating, Ventilation, and Air Conditioning
ICCDP	Incremental Conditional Core Damage Probability
ICLERP	Incremental Conditional Large Early Release Probability
IPE	Individual Plant Examination

Acronyms (Continued)	
IPEEE	IPE for External Events
ISLOCA	Inter-System Loss of Coolant Accident
LCO	Limiting Condition for Operation
LERF	Large Early Release Frequency
LOOP	Loss of Offsite Power
MOR	Model of Record
NEI	Nuclear Energy Institute
NRC	U.S. Nuclear Regulatory Commission
OOS	Out of Service
PDS	Plant Damage State
PM	Preventive Maintenance
PORV	Power-Operated Relief Valve
PRA	Probabilistic Risk Assessment
PWROG	Pressurized Water Reactor Owners Group
RAW	Risk Achievement Worth
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RG	Regulatory Guide
RHR	Residual Heat Removal
RLE	Review Level Earthquake
SAMA	Severe Accident Mitigation Alternative
SBO	Station Blackout
SG	Steam Generator
SLOCA	Small Loss of Coolant Accident
SPP	Standard Programs and Processes
SSE	Safe Shutdown Earthquake
TDAFWP	Turbine Driven Auxiliary Feedwater Pump
TLPCA	Total Loss of Plant Compressed Air
TS	Technical Specifications
TVA	Tennessee Valley Authority
WBN	Watts Bar Nuclear Plant

Acronyms (Continued)	
WBN1	Watts Bar Unit 1
WBN2	Watts Bar Unit 2

3. Evaluation of Risk Impact

Risk-informed changes to a nuclear power plant's licensing basis consist of both deterministic and probabilistic evaluations, as required by NRC Regulatory Guides 1.174 (Reference 1) and 1.177 (Reference 2). This section documents the probabilistic evaluation performed using Probabilistic Risk Assessment to supplement the deterministic engineering evaluations in support of the Watts Bar Nuclear Power Plant submittal of an allowed Completion Time (CT, or allowed outage time) extension request for the emergency diesel generators.

The evaluation for extending the AOT from 72 hours to 14 days for a single EDG was based on a three-tiered approach to assess the risk associated with the proposed amendment. The first tier evaluated the PRA model and the impact of the change on plant operational risk. The second tier addressed the need to prevent potentially high-risk configurations if additional equipment will be taken out of service simultaneously, or other risk-significant operational factors such as concurrent system or equipment testing are involved. The third tier evaluated the configuration risk management program to ensure that equipment removed from service prior to, or during, the proposed AOT will be appropriately assessed from a risk perspective.

The evaluation of quantitative risk impact of the proposed permanent, risk-informed Technical Specification change in the allowed Completion Time for a single EDG from 72 hours to 14 days (336 hours) was performed using the figures of merit from Revision 2 of Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment In Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," and Revision 1 of Regulatory Guide 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications."

The risk methods employed are discussed in Section 3.1. The PRA model used and PRA quality are described in Section 3.2. The analysis tasks and results are presented in Sections 3.3 through 3.6.

This is a plant-specific evaluation using the Watts Bar Dual Unit PRA model. For the analysis performed in support of this amendment request, both the Regulatory Guides 1.174 and 1.177 criteria for low risk significance are met, justifying the extension of the allowed Completion Time associated with the EDGs for both Watts Bar Unit 1 (WBN1) and Unit 2 (WBN2).

3.1 Technical Approach

The guidance provided in Regulatory Guides 1.174 and 1.177 was used to evaluate the quantitative risk impact of the requested completion time extension for the Watts Bar EDGs. The following information discusses the calculations involved in the Watts Bar risk impact evaluation.

Regulatory Guide 1.174

The risk measures adopted in Regulatory Guide 1.174 include change in core damage frequency (ΔCDF) and change in large early release frequency (ΔLERF). For the extension of EDG completion times, these measures are intended to estimate the increase in annual, average "at-power" risk in terms of CDF and LERF associated with the predicted increase in online EDG maintenance unavailability. The CDF and LERF values were quantified based on average test and maintenance unavailabilities. These risk metrics are used to compare against the criteria of RG 1.174 to determine whether changes in CDF and LERF are regarded as risk significant.

ΔCDF = CDF(New Base) – CDF(Base)

ΔCDF represents the increase in average risk in terms of the quantified core damage frequency based on new value for EDG maintenance unavailability as opposed to the baseline value. Increase in the average risk results from increases in the completion times for EDGs from the baseline value of 72 hours to 14 days for a single EDG being inoperable. The increased EDG maintenance unavailability accounts for the additional EDG maintenance work (e.g., 6-year and 12-year overhauls) being done while the plant units are at power.

CDF(New Base) is the new average risk in terms of the quantified core damage frequency obtained using the increased EDG maintenance unavailability. CDF(Base) is the average core damage frequency quantified using the baseline EDG maintenance unavailability.

ΔLERF = LERF(New Base) – LERF(Base)

ΔLERF represents the increase in average large early release frequency based on the increased value for EDG maintenance unavailability as opposed to the baseline value. Increase in the average LERF results from increases in the Completion Times for EDGs from the baseline value of 72 hours to 14 days for a single EDG being inoperable.

LERF(New Base) is the new average large early release frequency obtained using the increased EDG maintenance unavailability. LERF(Base) is the large early release frequency quantified using the baseline EDG maintenance unavailability.

The requirements of RG 1.174 include ΔCDF less than 1.0×10^{-6} and ΔLERF less than 1.0×10^{-7} so that the changes in time-averaged CDF and LERF risks can be declared small.

Regulatory Guide 1.177

The risk measures adopted in Regulatory Guide 1.177 include Incremental Conditional Core Damage Probability (ICCDP) and Incremental Conditional Large Early Release Probability (ICLERP). ICCDP and ICLERP represent the incremental conditional probability with the EDG in question out of service for a period equal to the proposed allowed Completion Time. They signify the risk change only for that period while the EDG is out of service in maintenance. These risk metrics are used in RG 1.177 to determine whether a proposed increase in allowed completion time will have an acceptable instantaneous risk impact.

ICCDP = [(conditional CDF with the subject equipment out of service and nominal expected equipment unavailabilities for other equipment permitted to be out of service by the TS) – (baseline CDF with nominal expected equipment unavailabilities)] * (total AOT duration under consideration for the subject equipment being OOS)

ICLERP = [(conditional LERF with the subject equipment out of service and nominal expected equipment unavailabilities for other equipment permitted to be out of service by the TS) – (baseline LERF with nominal expected equipment unavailabilities)] * (total AOT duration under consideration for the subject equipment being OOS)

For the extension of the Completion Time for a single inoperable EDG from 72 hours to 14 days, ICCDP and ICLERP are designed to show the instantaneous increase in probability for core damage and large early release, respectively, under the condition that one EDG is out of service for maintenance for 14 days. The following shows the equations used to calculate these risk measures:

$$\textbf{ICCDP} = [\textbf{CDF(New AOT)} - \textbf{CDF(New Base)}] \times (\textbf{14 days} \div \textbf{365 days})$$

$$\textbf{ICLERP} = [\textbf{LERF(New AOT)} - \textbf{LERF(New Base)}] \times (\textbf{14 days} \div \textbf{365 days})$$

Due to the uneven distribution of loads among the safety buses (i.e., shutdown boards) and other subtle reasons, the risk worth of the EDGs at Watts Bar Units 1 and 2 are not identical. Depending on the specific EDG being out of service, CDF(New AOT) can be designated as CDF(1A-A EDG OOS | 14-Day AOT), CDF(1B-B EDG OOS | 14-Day AOT), CDF(2A-A EDG OOS | 14-Day AOT), or CDF(2B-B EDG OOS | 14-Day AOT). CDF(1A-A EDG OOS | 14-Day AOT) is the average Core Damage Frequency for WBN Unit 1 or Unit 2 with “1A-A” EDG being out of service. CDF(1B-B EDG OOS | 14-Day AOT), CDF(2A-A EDG OOS | 14-Day AOT), and CDF(2B-B EDG OOS | 14-Day AOT) are the average Core Damage Frequencies with the “1B-B”, “2A-A”, and “2B-B” EDGs, respectively, being out of service. Similarly, LERF(New AOT) can be designated as LERF(1A-A EDG OOS | 14-Day AOT), LERF(1B-B EDG OOS | 14-Day AOT), LERF(2A-A EDG OOS | 14-Day AOT), or LERF(2B-B EDG OOS | 14-Day AOT). LERF(1A-A EDG OOS | 14-Day AOT), LERF(1B-B EDG OOS | 14-Day AOT), LERF(2A-A EDG OOS | 14-Day AOT), and LERF(2B-B EDG OOS | 14-Day AOT) are the average Large Early Release Frequencies with “1A-A”, “1B-B”, “2A-A”, and “2B-B” EDGs, respectively, being out of service. The values for these terms are quantified with certain stipulations that will become part of the configuration risk management plant procedure.

The requirements of RG 1.177 include ICDDP less than 1.0×10^{-6} and ICLERP less than 1.0×10^{-7} so that the change in the LERF risk during the time an EDG is out of service can be declared small.

In summary, the overall methodology is designed to address the considerations described in the Regulatory Guides 1.174 and 1.177.

3.2 Description of the Watts Bar PRA Model

3.2.1 Background and Overview of WBN PRA Model

The current WBN PRA model of record is a linked fault tree model developed for both Unit 1 and Unit 2 based on the CAFTA suite of codes. This dual unit PRA was converted from the RISKMAN™-based Watts Bar Unit 1 PRA and has been developed to meet the requirements of the American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) PRA standard (Reference 3) and Regulatory Guide 1.200 (Reference 4). The dual unit WBN PRA model includes system fault trees with basic event identifiers, plant-specific data, core damage sequences, which are used to calculate CDF, and are further developed and processed through the Level 2 analysis to calculate the plant LERF.

Because changes are being made continually at the Watts Bar Nuclear Plant, the PRA models and results are representative of the plant at a specific time. A number of major updates to the WBN PRA have been completed since the Unit 1 PRA was first prepared for submittal to the NRC to satisfy Generic Letter 88-20 requirements.

The risk-informed input for the proposed change is based on a revised dual unit WBN PRA, which is used to quantify the changes in CDF and LERF resulting from the extended Completion Times for the EDGs. These quantitative results are used to compare to the regulatory guide criteria.

TVA PRA Update Process

In the following, the process adopted at TVA for PRA updates are described. The TVA process for controlling updates to the PRA is documented in TVA Procedures SPP-9.11, “The Probabilistic Risk Assessment Program”, and NEDP-26, “Probabilistic Risk Assessment”.

SPP-9.11 (Reference 5) covers the management of PRA applications, periodic updates, and interdepartmental PRA documentation. This procedure provides definitions for PRA model update, PRA model application, and PRA evaluation. This procedure also defines responsibilities of other departments such as operations and system engineering for review of the PRA.

NEDP-26 (Reference 6) describes the process used by the PRA staff to perform applications, model updates and PRA model maintenance and review. The terms PRA upgrade and maintenance are defined in the ASME standard (Reference 3). The procedure requires that updates be completed at least once every other fuel cycle (for the lead unit at multiunit sites) or sooner if estimated cumulative impact of plant configuration changes exceeds +/- 10% of CDF or LERF. Changes in PRA inputs or discovery of new information are evaluated to determine whether such information warrants PRA update. Items exceeding the above threshold are tracked in the Corrective Action Program. Changes that do not meet the threshold for immediate update are tracked in the PRA Model Open Items Database. PRA updates follow the guidelines established by the ASME Standard for a minimum of a Category II assessment.

NEDP-26 also defines the requirements for PRA documentation of the model of record and PRA applications. The MOR is composed of the (1) PRA computer model and supporting documentation, (2) MAAP model and supporting documentation, and (3) other Supporting Computer Evaluation Tools; e.g., UNCERT, HRA Calculator, etc. The purpose of the PRA MOR is to provide a prescriptive method for quality, configuration, and documentation control. PRA applications and evaluations are referenced to a MOR and therefore the pedigree of PRA applications and evaluations is traceable and verifiable. NEDP-26 also specifies the requirements for independent review and periodic self-assessments of the model.

After September 2008, all PRA notebooks modified will be converted to desirable calculations. The NEDP-2 (Reference 7) calculation process requires calculations to be prepared and independently checked and approved.

WBN Unit 1 Individual Plant Examination (IPE) and Subsequently Updated RISKMAN PRA Model

The WBN Unit 1 IPE, developed using the RISKMAN software and independently reviewed by Dr. Ian Wall, was submitted to NRC in response to Generic Letter 88-20 on September 1, 1992. Later, Revision 1 to the IPE was submitted on May 2, 1994, and an NRC safety evaluation was received on October 5, 1994. Since that time, the WBN PRA has gone through a number of revisions. In particular, TVA had performed a self-assessment of Revision 2 of the WBN RISKMAN PRA which was later used to develop the WBN Unit 1 risk-informed license amendment request for diesel generator (DG) allowed outage time extension. In addition, Revision 2 was also used by the NRC staff during their review of the implementation of the requirements of the Maintenance Rule. Furthermore, during April 23–27, 2001, Revision 3 of the RISKMAN PRA model had undergone a peer review process with a team of industry experts selected by the Westinghouse Owner's Group. The facts and observations (F&O) identified in this peer review had been addressed in the WBN RISKMAN PRA model Revision 4.

WBN Dual Unit CAFTA PRA Model, Revision 0

The most substantial WBN PRA model revision was to change the WBN Unit 1 PRA Revision 4 from the RISKMAN software platform to the CAFTA software suite. As part of the conversion of the WBN PRA from RISKMAN to CAFTA, the analyses supporting the PRA were completely redone. The revised model is referred to as the CAFTA WBN dual unit PRA model, Revision 0. All documentation for the Internal Events (ASME/ANS RA-Sa-2009 Part 2, Reference 3) and Internal Flooding (ASME/ANS RA-Sa–2009 Part 3, Reference 3) PRA has been upgraded to meet the requirements of Regulatory Guide 1.200, Revision 2 (Reference 4). Major differences between Revision 0 CAFTA PRA model and the Revision 4 RISKMAN model are listed as follows:

- Inclusion of Unverified Unit 2 Model
- Upgraded to Address Requirements of ASME/ANS RA-Sa-2009
- Processed to Comply with Requirements of TVA Procedure NEDP-2 (engineering calculations)

- Upgraded Flooding Analysis Approach
- Expansion of Flooding Initiating Events from 6 to 133
- Expansion of Interfacing System Loss of Coolant Accident (ISLOCA) Initiating Events from 2 to 24
- Addition of TLPCA Initiating Event
- Expanded Common Cause Failure (CCF) Coverage

The Revision 0 WBN dual unit CAFTA PRA model was peer reviewed by the Pressurized Water Reactor Owners Group (PWROG) against ASME/ANS RA-Sa-2009 and RG 1.200.

WBN Dual Unit CAFTA PRA Model, Revision 1

Since the model was converted from RISKMAN to CAFTA, a number of changes that need to be incorporated into the PRA model have been identified. These include incorporation of recent plant modifications, resolution of PRA issues identified since the PRA was last updated, resolution of those PRA Peer Review comments that affect the model or quantification results, incorporation of ASME/ANS PRA Standard items affecting more than just documentation, etc.

In early 2014, the WBN PRA has been updated from the original Revision 0 CAFTA model to Revision 1. This update of the dual unit WBN PRA model (i.e., Revision 1 CAFTA model) was based on the as-built, as-operated configuration of the plant as of April 30, 2013. Significant modifications to Unit 2 intended for completion prior to unit startup were also included. It was assumed that no new significant modifications will be developed for Unit 2 prior to startup.

Additionally, during the process of quantifying the WBN PRA, various changes were made to the fault tree model to address modeling logic corrections, and changes to accommodate peer review comments. Many of these changes occurred after the system models were issued. These changes were incorporated in Revision 1 of the WBN PRA. Also incorporated are the changes identified through development of the WBN Unit 2 Severe Accident Mitigation Alternatives (SAMA) model.

The following is a summary of the model changes incorporated in the Revision 1 CAFTA model:

- Credit for additional capacity of Condensate Storage Tank (CST) – The CST always maintains a capacity well above technical specification requirements which was not credited previously in the Revision 0 Model.
- Credit recovery of Total Loss of Emergency Raw Cooling Water (ERCW) initiating event using the Portable Diesel Driven Fire Pump source connected to an ERCW supply header.

- Credit for recovery of offsite power from Watts Bar Hydro Station through dedicated 161 kV lines to WBN during station blackout (SBO).
- Correction of motor-driven auxiliary feedwater (AFW) pump failure probabilities.
- Correction of battery board failures in model logic.
- Change Small Loss of Coolant Accident (SLOCA) Sequences 004, 014, and 022 from CDF to success.
- Credit use of permanent Diesel Driven Fire Pump to cool Charging Pump CCP 2A-A (and CCP 1A-A).
- Correction of SBO recovery sequences.
- Addition of electrical crosstie of Shutdown Boards from 6.9-kV 1B-B to 2A-A and 2B-B to 1A-A during unit blackout conditions. This cross-train alignment ensures appropriate safe shutdown loads are available, and aligned or locked out to support availability of a complete train.
- Addition of limitation of ERCW pumps during 6.9-kV crosstie conditions.
- Correction of AFW pre-initiator restoration errors for inlet valves (WHEMDA_1, WHEMDA_2, and WHEAFW).
- Addition of Offsite Power Recovery for Non-SBO Loss of Offsite Power Sequences.
- Modification to Loss of Battery Board Initiating Events.
- Modification to Loss of 120VAC Vital Instrument Board Initiating Events.
- Addition of portable diesel generator to Shutdown Board 2B-B.
- Correction of Reactor Coolant Pump (RCP) Seal Loss of Coolant Accident 182 gpm probability (RCPSEAL182) from 0.05 to 0.2075.
- Addition of new human reliability analysis (HRA) dependencies and modification of HRA dependencies for HRADEP-LERF-POST-837 and HRADEP-LERF-POST-853 based on LERF nonconvergence at a truncation value of 1E-13.
- AFW 1-51 (trip and throttle) valves added. Note that this could be considered to be subsumed in the turbine driven auxiliary feedwater pump (TDAFWP) but the valve was modeled separately at the request of the station Maintenance Rule/Mitigating System Performance Index coordinator, to facilitate data tracking and risk monitoring. Use of generic TDAFWP failure data as an input to the data evaluation may be slightly conservative as a result.
- Residual Heat Removal (RHR) 74-12 and -24 (minimum flow) valves added.

- Logic for vital inverters and battery chargers enhanced.

- DG ERCW supply valves changed from locked open to closed, required to open for DG success.

- ERCW model enhancements.

- Component Cooling Water System (CCS) model enhancements.

- Minor changes to HRA pre-initiators.

- Revised HRA dependency approach to retain individual human error probabilities (HEP) in cutsets.

Based on the Revision 1 CAFTA model with a truncation value of 1.00 x 10^{-13}/year, the WBN baseline annual core damage frequency with expected, average equipment unavailabilities is 1.39 x 10^{-5}/reactor-year for Unit 1 and 1.43 x 10^{-5}/reactor-year for Unit 2. The baseline large early release frequency is 1.12 x 10^{-6}/reactor-year for Unit 1 and 1.16 x 10^{-6}/reactor-year for Unit 2, based on a truncation value of 3.00 x 10^{-13}/year.

Revised WBN CAFTA PRA Model for Dual Unit EDG AOT Extension Submittal

In support of this submittal, the following additional updates have been made to the dual unit WBN PRA model:

- Offsite power recovery analysis was updated by including additional loss of offsite power events through the end of 2013; i.e., the collection period of LOOP events covers from January 1, 1997, through December 31, 2013. The MathCad offsite power non-recovery probability analysis was updated using the most current diesel generator failure rates and CCF parameter values (as derived in the Revision 1 CAFTA model) in addition to the updated loss of offsite power duration curve parameters.

- The 3-MW FLEX Diesel Generators 0-DG-360-3A and 0-DG-360-3B are incorporated into the WBN PRA model (Gates FDG3AL and FDG3BL in WBN_U1_U2_AOT.caf) to provide power to the 6.9-kV Shutdown Boards 1A-A (1-BD-211-A-A) and 2A-A (2-BD-211-A-A), respectively. In principle, either of these two 3-MW DGs can be aligned to provide power to any one of the four 6.9-kV shutdown boards. However, for conservatism, 0-DG-360-3A is only credited to provide power to 6.9-kV Shutdown Board 1A-A and 0-DG-360-3B is only credited to provide power to 6.9-kV Shutdown Boards 2A-A. The operator action to start and align the 3-MW DG to the 6.9-kV shutdown board is conservatively using the HEP evaluated for HA6190SDX3 (for portable DG).

- The maintenance unavailability for each of the four EDGs was updated using the EDG maintenance duration data from January 1, 2003, through December 31, 2014, covering a period of 12 years under the 14-day EDG AOT for the WBN Unit 1 power operation.

- The WBN Level 2 PRA model is revised to incorporate changes listed as Items 2, 3, and 4 in Section 4.2 of the SAMA Re-Evaluation report (R-3087636-1931, Reference 8):

  1. Remove SLOCA Sequences 004, 014, and 022 from Plant Damage State (PDS) BIN 2.

     The SLOCA Event Tree Sequences 004 (Gate U2_SLOCA-004), 014 (Gate U2_SLOCA-014), and 022 (Gate U2_SLOCA-022) do not lead to core damage due to success of low pressure recirculation. These sequences are not included in the CDF model, but were inadvertently included in PDS BIN 2. These sequences were therefore removed from PDS BIN 2 in the AOT model.

  2. Addition of missing ISLOCA CDF Sequences ISLM-004, 013, and 016 to the fault tree gate for BIN 4.

     ISLOCA Sequences ISLM-004, 013, and 016 were identified for Bin 4 but were not included in the fault tree model. There were added to Level 2 Gate U2_L2BIN-4 in the AOT model.

  3. Correct selected split fraction values for early containment failure events to remove contributions from rocket mode and ex-vessel steam explosions in sequences involving core damage arrest prior to vessel breach; i.e., no vessel breach occurs.

     For sequences in which the vessel is not breached at the time of core damage (i.e., core damage arrested prior to vessel breach due to offsite power recovery following a SBO event), the rocket mode and ex-vessel steam explosion failure modes cannot occur because there is no water in the reactor cavity. Therefore, the following split fraction values for the early containment failure events are corrected to reflect contribution from hydrogen burn only.

Branch	Split Fraction	SBO Value
CFE11	U2_L2_CFE11	0.00
No CFE11	U2_L2_NOTCFE11	1.00
CFE12	U2_L2_CFE12	0.07
No CFE12	U2_L2_NOTCFE12	0.93
CFE15	U2_L2_CFE15	0.00
No CFE15	U2_L2_NOTCFE15	1.00
CFE16	U2_L2_CFE16	0.04
No CFE16	U2_L2_NOTCFE16	0.96

Based on the revised model developed for the analysis of this submittal and using a truncation value of 1.00×10^{-13}/year, the WBN baseline annual core damage frequency with expected, average equipment unavailabilities is 1.12×10^{-5}/reactor-year for Unit 1 and 1.16 x 10^{-5}/reactor-year for Unit 2. The baseline large early release frequency is 8.95 x 10^{-7}/reactor-year for Unit 1 and 9.12 x 10^{-7}/reactor-year for Unit 2, based on a truncation value of 3.00 x 10^{-13}/year. The decreases in CDFs and LERFs as shown in the table below are attributed to both the 3-MW FLEX diesels and the update of the offsite power recovery analysis, but primarily due to the credit of the 3-MW FLEX diesel generators.

Record Model and AOT Model CDF and LERF

Risk Metric	Model of Record		AOT Model	
	WBN1	WBN2	WBN1	WBN2
CDF	1.39E-05	1.43E-05	1.12E-05	1.16E-05
LERF	1.12E-06	1.16E-06	8.95E-07	9.12E-07

3.2.2 WBN PRA Quality

Watts Bar Nuclear Plant has followed a rigorous process in the development and maintenance of its PRA. This process has resulted in a level of quality allowing enhancement of safety through risk insights and regulatory applications. Some characteristics of this process include independent reviews, the Westinghouse PWR Owners Group peer review, detail analysis and integration of PRA elements, supportable assumptions, updates to reflect industry and plant specific data, updates to address any PRA issues identified, and thorough documentation. WBN has also implemented program controls to ensure as-built plant changes (including modifications, procedure changes, etc.) are routinely evaluated and are accurately reflected in the current model.

The peer review for the WBN Units 1 and 2 Internal Events CAFTA Revision 0 PRA model was performed by the PWROG during the week of November 16, 2009, at the TVA offices in Chattanooga, Tennessee, using the process described in Nuclear Energy Institute (NEI) NEI 05-04 (Reference 9), the ASME/ANS PRA Standard (i.e., ASME/ANS RA-Sa-2009, Reference 3), and Regulatory Guide 1.200 (Reference 4). Two different models were peer-reviewed: WBN_U1_U2(NoFlood).caf and WBN_U1_U2(withFlood).caf. Thus, the peer review included review of both the internal events analysis and the internal flooding analysis. This Peer Review is documented in Westinghouse LTR-RAM-II-09-084, "RG 1.200 PRA Peer Review Against the ASME/ANS PRA Standard Requirements for the Watts Bar Nuclear Power Plant Probabilistic Risk Assessment," dated December 17, 2009 (Reference 10).

A team of independent PRA experts from nuclear utility groups and PRA consulting organizations carried out these peer review certifications. The purpose of the peer review is to provide a method for establishing the technical adequacy of a PRA for the spectrum of potential risk-informed plant licensing applications for which the PRA may be used. The 2009 WBN PRA Peer Review provided a full-scope review of the technical elements of the internal events, at-power PRA, including internal flooding. The PRA was not reviewed for fires, external flooding, seismic, high winds, or other external events.

This intensive peer review involved over two person-months of engineering effort by the review team and provides a comprehensive assessment of the strengths and limitations of each element of the PRA model. All finding-level F&Os from this peer review were addressed to at least the requirements of Capability Category II.

Therefore, as part of the continual update process, all PWROG comments that could potentially affect the models and results have already been resolved. The Revision 1 CAFTA WBN PRA now meets at least Capability Category II of the technical requirements of the ASME/ANS Standard (Reference 11) and Regulatory Guide 1.200, Revision 2, with respect to internal events and internal flooding. However, fire and external events such as seismic events, high winds, and external floods are not evaluated in the dual unit WBN PRA model.

Since resolution and incorporation of the PWROG peer review comments that affect the PRA model and results was completed before the evaluation for the EDG Completion Time extension submittal, the WBN PRA model is adequate for use in the proposed extension of EDG Completion Times.

In summary, the preceding discussion outlines several measures which were taken to ensure the adequacy/quality of the model used as a basis for this proposed amendment. The continual development and improvement of the WBN PRA makes the PRA analysis sufficient to adequately provide risk insights in support of regulatory applications. The WBN PRA has been used in support of several submittals to the NRC, including Fire Induced Vulnerability Assessment for approval of the WBN Unit 2 operating license, Severe Accident Mitigation Alternatives for license renewal, etc. NRC reviews associated with these submittals have found the quality of the WBN PRA acceptable. With consideration of the actions taken, TVA believes the results of the continuous improvement process and the current evaluation of this application show that the WBN PRA is appropriate for use in the Risk-Informed extension of allowed Completion Times for EDGs. And, the results of this evaluation are acceptable to support this amendment request.

3.3 Analysis of Internal Events and Internal Floods

Evaluations for the risk associated with this proposed amendment are performed for the effects of the change on the following:

- Internal Events and Internal Floods Using the WBN Dual Unit “At-Power” PRA
- Internal Fires Using the Fire Induced Vulnerability Evaluation (FIVE) Analyses for WBN Unit 1 and Unit 2
- Seismic Events Using the WBN Seismic Hazard Curves and safe Shutdown Earthquake

This section discusses the evaluation of internal events and internal floods for the Risk-Informed extension of allowed Completion Times for EDGs.

3.3.3 Analysis Assumptions

The following assumptions were used in performing the analysis:

- For the time-averaged maintenance evaluations in the calculations of ΔCDF and ΔLERF, it is assumed that the EDG maintenance conditions (i.e., preventive maintenance [PM] versus corrective maintenance [CM]) do not impact the conditional failure probabilities of redundant equipment. This is appropriate for planned maintenance, but is slightly optimistic for corrective maintenance and is typical of time-averaged calculations.

- The evaluation is based on the assumption that the extended allowed Completion Time would be applied to only one major maintenance activity (i.e., 6-year or 12-year overhaul maintenance) per EDG per refueling cycle. The cycle time is based on the current 18-month fuel cycle.

- In each month, it is assumed that there is only at most one planned maintenance event and one unplanned maintenance event for each EDG. All planned maintenance duration during each month was combined into one event. Similarly, all unplanned maintenance duration during each month was also combined into one event.

- Only one EDG is allowed to be in planned maintenance at a time. In addition, planned maintenance of PRA equipment identified for operation restrictions based on Tables 12 through 15 is not allowed during the entire completion time period. Further, no EDG planned maintenance is allowed when corrective or planned maintenance of the same PRA equipment identified for operation restrictions is in progress.

- With the 72-hour completion time, it is assumed that the 18-month and 3-year maintenance would be performed online, but the 6-year and 12-year preventive maintenance would not be performed online. With the 14-day completion time, the 6-year and 12-year overhauls would be performed online and included in the preventive maintenance alignments.

- Since the presently used values for the EDG maintenance unavailabilities (including contributions from planned and unplanned maintenance activities) were derived from the maintenance duration data associated with the WBN Unit 1 operation under the 14-day AOT, the planned (preventive) and unplanned (corrective) maintenance unavailabilities are assumed to remain approximately the same after the implementation of completion time extension for both WBN Unit 1 and Unit 2; i.e., 14-day AOT case. Decrease in the EDG maintenance unavailability for the 72-hour AOT case is primarily due to the exclusion of the longer maintenance events that may be performed during power operation under the 14-day AOT condition. As such, the EDG maintenance unavailability values for the 72-hour AOT case are derived by excluding the contributions of all planned maintenance events with duration exceeding 43.2 hours (i.e., 60% of the 72-hour AOT), and the contributions of all unplanned maintenance events with duration exceeding 72 hours.

- The ICCDP and ICLERP for a single EDG out of service are calculated separately for the cases in which the affected EDG is in planned maintenance and the case of corrective maintenance. It is assumed that all planned maintenance events are associated with preventive maintenance and all unplanned maintenance events are pertaining to corrective maintenance. For the calculation of the planned/preventive maintenance cases, the flag file FLAGSettings.txt was revised to increase the maintenance unavailability of the corresponding EDG to 1.0. For the calculation of the unplanned/corrective maintenance cases, it is assumed that the unplanned maintenance was due to failure. As such, flag file FLAGSettings.txt was revised to increase the maintenance unavailability of the corresponding EDG to 1.0, and to increase accordingly the conditional failure probabilities of CCFs of the remaining diesel generators.

3.3.4 Maintenance Unavailability Calculations

The basic change in risk for this proposed 14-day EDG Completion Time concerns the potential for an EDG being out of service with the plant units “at power” for a time frame longer than is allowed under the 72-hour AOT condition. This extended out of service time is primarily associated with planned maintenance, which would increase the overall maintenance unavailability. In order to calculate the differential risk associated with this potential maintenance (i.e., between the 72-hour AOT and 14-day AOT cases), the maintenance unavailability for EDGs was evaluated for both the 14-day AOT and the 72-hour AOT cases.

Since the presently used values for the EDG maintenance unavailabilities (including contributions from planned and unplanned maintenance activities) were derived from the maintenance duration data associated with the WBN Unit 1 operation under the 14-day AOT, the planned (preventive) and unplanned (corrective) maintenance unavailabilities are assumed to remain approximately the same after the implementation of Completion Time extension for both WBN Unit 1 and Unit 2; i.e., 14-day AOT case. Decrease in the EDG maintenance unavailability for the 72-hour AOT case is primarily due to the exclusion of the longer maintenance events that may be performed during power operation under the 14-day AOT condition. As such, the EDG maintenance unavailability values for the 72-hour AOT case is derived by excluding the contributions of all planned maintenance events with duration exceeding 43.2 hours (i.e., 60% of the 72-hour AOT), and the contributions of all unplanned maintenance events with duration exceeding 72 hours.

The maintenance unavailability for the 72-hour AOT case is estimated only for calculational purposes in this evaluation of the extended Completion Time and is expected to actually be higher; however, actual evaluation will not be possible unless maintenance duration data is collected under this condition. Random failure probabilities were not adjusted for these calculations.

It is assumed in this analysis that all planned maintenance events are associated with preventive maintenance and all unplanned maintenance events are pertaining to corrective maintenance. For the calculation of the planned preventive maintenance cases, the maintenance unavailability of the corresponding EDG was increased to 1.0. For the calculation of the unplanned corrective maintenance cases, it is assumed that the unplanned maintenance was due to failure. As such, the maintenance unavailability of the corresponding EDG was increased to 1.0, and the conditional failure probabilities of CCFs of the remaining diesel generators were also increased accordingly.

For WBN, the EDG unavailability is calculated separately for each EDG set based on the time spent in LCOs 3.8.1 or 3.8.2. The EDG maintenance duration data was downloaded from the Maintenance Rule database (from January 1, 2003, through December 31, 2014). This downloaded summary data only contains the monthly total planned maintenance duration and the monthly total unplanned maintenance duration for each EDG. It is assumed that, in each month, there is only at most one planned maintenance event and one unplanned maintenance event for each EDG. This assumption could conservatively lead to the exclusion of selected maintenance events with duration less than the maximum duration allowed, thus minimizing the EDG maintenance unavailability for the 72-hour AOT case and maximizing the delta risk between the 14-day AOT and the 72-hour AOT cases.

The mean values listed in Table 1 for the EDG maintenance unavailability were calculated using the classical statistical approach.

Table 1. EDG Maintenance Unavailability

EDG	72-Hour EDG AOT			14-Day EDG AOT		
	Planned PM	Unplanned CM	Total	Planned PM	Unplanned CM	Total
1A-A	2.67E-03	6.46E-05	2.73E-03	1.24E-02	8.22E-04	1.32E-02
1B-B	3.07E-03	1.07E-03	4.15E-03	1.20E-02	1.07E-03	1.31E-02
2A-A	3.08E-03	4.93E-04	3.58E-03	1.36E-02	1.25E-03	1.49E-02
2B-B	2.44E-03	4.91E-04	2.73E-03	1.16E-02	1.24E-03	1.19E-02

3.3.3 Impact on Internal Events and Internal Flooding Risk

The impact of the proposed Completion Time changes on internal events and internal flooding induced CDF and LERF was evaluated using the revised WBN dual unit PRA internal events and internal flooding model (see Section 3.2.1). The calculations include the overall changes in average CDF and LERF as well as the incremental changes in CDF and LERF given that an EDG is out of service due to either planned maintenance (preventive maintenance) or unplanned maintenance (corrective maintenance).

The first set of calculations were baseline average risk calculations using the revised WBN dual unit PRA model described in Section 3.2.1 and the EDG average maintenance unavailability for both before (i.e., 72-hour EDG AOT case) and after (i.e., 14-day EDG AOT case) the implementation of Completion Time extension. The overall CDF and LERF were calculated using the average unavailabilities for all components including the EDGs. In the calculations of ΔCDF and ΔLERF, it is assumed that the EDG maintenance conditions (i.e., preventive maintenance versus corrective maintenance) do not impact the conditional failure probabilities of redundant equipment.

This is appropriate for planned maintenance, but is slightly optimistic for corrective maintenance and is typical of time-averaged calculations.

The baseline CDFs for the 72-hour EDG AOT case (i.e., before the completion time change) are 1.10 x 10^{-5} event/year and 1.14 x 10^{-5} event/year for Unit 1 and Unit 2, respectively. The baseline LERFs for the 72-hour EDG AOT case are 8.92 x 10^{-7} event/year and 9.08 x 10^{-7} event/year for Unit 1 and Unit 2, respectively. The new baseline CDFs for the 14-day EDG AOT case (i.e., the new baseline CDFs after the completion time change) are 1.12 x 10^{-5} event/year and 1.16 x 10^{-5} event/year for Unit 1 and Unit 2, respectively. The new baseline LERFs for the 14-day EDG AOT case are 8.95 x 10^{-7} event/year and 9.12 x 10^{-7} event/year for Unit 1 and Unit 2, respectively. These calculations were performed with a cutset truncation value of 1.0 x 10^{-13} for CDFs and 3.0 x 10^{-13} for LERFs (see Table 2).

In the second set of calculations associated with the instantaneous EDG maintenance conditions (e.g., Emergency Diesel Generator 1A-A always in maintenance), the CDFs and LERFs for Unit 1 and Unit 2 were computed with one EDG removed from service separately for the following two cases: removal from service due to planned preventive maintenance and removal from service due to unplanned corrective maintenance. In the first case of planned maintenance, the EDG removed from service is assumed not as the result of a component failure (i.e., the maintenance is planned and no component failure is involved), so that no changes to the conditional failure probabilities of redundant equipment are necessary. For corrective maintenance conditions, where an emergency diesel generator is known to have failed, the conditional failure probabilities of the remaining redundant emergency diesel generators may be higher due to common cause failure possibilities. At Watts Bar, the redundant emergency diesel generators are not required to be tested for a period of time (i.e., 12 hours), so one cannot be assured that a common cause is not present until verified. As such, this analysis conservatively assumes that testing of the redundant emergency diesel generators does not occur for the entire time that corrective maintenance is ongoing. Therefore, the probabilities of the redundant equipment failure modes are adjusted for such unplanned corrective maintenance conditions to reflect the fact that one emergency diesel generator failure has already occurred, and that the redundant, identical equipment may not have been tested. However, existing plant technical specifications assure that such testing would take place within 12 hours. Therefore, the assumption that no testing takes place is conservative.

Average maintenance unavailabilities were used for all other PRA equipment in these calculations. The basic event for the maintenance unavailability of one of the EDGs was set to failed (with an unavailability value of 1.0); a separate run was made for each of the following cases: assuming EDG 1A-A was out of service due to preventive maintenance, EDG 1B-B out of service due to preventive maintenance, EDG 2A-A out of service due to preventive maintenance, EDG 2B-B out of service due to preventive maintenance, EDG 1A-A out of service due to corrective maintenance, EDG 1B-B out of service due to corrective maintenance, EDG 2A-A out of service due to corrective maintenance, and EDG 2B-B out of service due to corrective maintenance. The basic events for the test and maintenance unavailabilities of all other PRA equipment were set to their average unavailabilities. The results of these calculations are listed in Table 2. The cutset truncation values used for these calculations were also 1.0 x 10^{-13} for CDFs and 3.0 x 10^{-13} for LERFs.

To evaluate the effect of the proposed increases in the EDG Completion Times on the overall CDF and LERF, ∆CDF and ∆LERF were calculated using values from Table 2 and the results are shown in Table 3. The incremental conditional CDP and LERP were calculated by assuming an EDG was in maintenance for the entire Completion Time duration. The calculated ICCDPs associated with an EDG out of service due to preventive maintenance and due to corrective maintenance were probabilistically weighted using the relative fraction of maintenance contributions from planned maintenance and from unplanned maintenance. Similarly, the calculated ICLERPs associated with an EDG out of service due to preventive maintenance and due to corrective maintenance were also probabilistically weighted using the relative fraction of maintenance contributions from planned maintenance and from unplanned maintenance. The unconditional ICCDPs and ICLERPs calculated are given in Table 3. The results of all of these evaluations and comparison with Regulatory Guides 1.174 and 1.177 are also shown in Table 3.

As seen in Table 3, ∆CDF, ∆LERF, ICCDP, and ICLERP associated with the proposed Completion Time change (i.e., 14 days for a single EDG inoperable) are all well below the risk thresholds discussed in the regulatory guidance for both WBN Unit 1 and Unit 2. Therefore, the risk changes can be considered small and the evaluation of the 14-day Completion Time for a single EDG inoperable meet the risk criteria specified in RG 1.174 and RG 1.177.

Table 2. Calculated Risk Values

Risk Term	WBN1 Calculated Value	WBN2 Calculated Value	Truncation Value
CDF(Base-72 Hour)	1.10E-05	1.14E-05	1.0E-13
CDF(New Base-14 Day)	1.12E-05	1.16E-05	1.0E-13
LERF(Base-72 Hour)	8.92E-07	9.08E-07	3.0E-13
LERF(New Base- 14 Day)	8.95E-07	9.12E-07	3.0E-13
CDF(1A-A EDG PM OOS | 14-Day AOT)	1.57E-05	1.42E-05	1.0E-13
CDF(1B-B EDG PM OOS | 14-Day AOT)	1.69E-05	1.60E-05	1.0E-13
CDF(2A-A EDG PM OOS | 14-Day AOT)	1.48E-05	1.49E-05	1.0E-13
CDF(2B-B EDG PM OOS | 14-Day AOT)	1.58E-05	1.79E-05	1.0E-13
CDF(1A-A EDG CM OOS | 14-Day AOT)	1.63E-05	1.49E-05	1.0E-13
CDF(1B-B EDG CM OOS | 14-Day AOT)	1.76E-05	1.68E-05	1.0E-13
CDF(2A-A EDG CM OOS | 14-Day AOT)	1.53E-05	1.58E-05	1.0E-13
CDF(2B-B EDG CM OOS | 14-Day AOT)	1.65E-05	1.88E-05	1.0E-13
LERF(1A-A EDG PM OOS | 14-Day AOT)	9.88E-07	9.73E-07	3.0E-13
LERF(1B-B EDG PM OOS | 14-Day AOT)	1.11E-06	1.00E-06	3.0E-13
LERF(2A-A EDG PM OOS | 14-Day AOT)	9.29E-07	1.02E-06	3.0E-13
LERF(2B-B EDG PM OOS | 14-Day AOT)	9.57E-07	1.18E-06	3.0E-13
LERF(1A-A EDG CM OOS | 14-Day AOT)	1.04E-06	1.03E-06	3.0E-13
LERF(1B-B EDG CM OOS | 14-Day AOT)	1.17E-06	1.07E-06	3.0E-13

Table 2. Calculated Risk Values (Continued)

Risk Term	WBN1 Calculated Value	WBN2 Calculated Value	Truncation Value
LERF(2A-A EDG CM OOS | 14-Day AOT)	9.62E-07	1.11E-06	3.0E-13
LERF(2B-B EDG CM OOS | 14-Day AOT)	1.00E-06	1.28E-06	3.0E-13

Table 3. Results of EDG Completion Time Extension Evaluation

Regulatory Guide 1.174 Comparison: Proposed 14-Day AOT versus Baseline 72-Hour AOT		
RG 1.174 Criteria	**WBN1 Average Delta Risk/Year**	**WBN2 Average Delta Risk/Year**
∆CDF ≤ 1.0E-06	1.75E-07	1.56E-07
∆LERF ≤ 1.0E-07	2.88E-09	3.59E-09
Regulatory Guide 1.177 Comparison: Proposed 14-Day EDG AOT		
RG 1.177 Criteria	**WBN1 EDG OOS Incremental Risk**	**WBN2 EDG OOS Incremental Risk**
Planned Preventive Maintenance	ICCDP (1A-A EDG OOS) = 1.71E-07	ICCDP (1A-A EDG OOS) = 9.92E-08
	ICCDP (1B-B EDG OOS) = 2.16E-07	ICCDP (1B-B EDG OOS) = 1.68E-07
	ICCDP (2A-A EDG OOS) = 1.36E-07	ICCDP (2A-A EDG OOS) = 1.27E-07
	ICCDP (2B-B EDG OOS) = 1.76E-07	ICCDP (2B-B EDG OOS) = 2.40E-07
	ICLERP (1A-A EDG OOS) = 3.57E-07	ICLERP (1A-A EDG OOS) = 2.35E-09
	ICLERP (1B-B EDG OOS) = 8.38E-09	ICLERP (1B-B EDG OOS) = 3.43E-09
	ICLERP (2A-A EDG OOS) = 1.31E-09	ICLERP (2A-A EDG OOS) = 4.13E-09
	ICLERP (2B-B EDG OOS) = 2.41E-09	ICLERP (2B-B EDG OOS) = 1.08E-08
Unplanned Corrective Maintenance	ICCDP (1A-A EDG OOS) = 1.97E-07	ICCDP (1A-A EDG OOS) = 1.25E-07
	ICCDP (1B-B EDG OOS) = 2.44E-07	ICCDP (1B-B EDG OOS) = 1.98E-07
	ICCDP (2A-A EDG OOS) = 1.57E-07	ICCDP (2A-A EDG OOS) = 1.61E-07
	ICCDP (2B-B EDG OOS) = 2.01E-07	ICCDP (2B-B EDG OOS) = 2.76E-07
	ICLERP (1A-A EDG OOS) = 5.69E-09	ICLERP (1A-A EDG OOS) = 4.64E-09
	ICLERP (1B-B EDG OOS) = 1.06E-08	ICLERP (1B-B EDG OOS) = 5.99E-09
	ICLERP (2A-A EDG OOS) = 2.60E-09	ICLERP (2A-A EDG OOS) = 7.64E-09
	ICLERP (2B-B EDG OOS) = 4.04E-09	ICLERP (2B-B EDG OOS) = 1.41E-08
Unconditional ICCDP ≤ 1.0E-06	ICCDP (1A-A EDG OOS) = 1.73E-07	ICCDP (1A-A EDG OOS) = 1.01E-07
	ICCDP (1B-B EDG OOS) = 2.18E-07	ICCDP (1B-B EDG OOS) = 1.70E-07
	ICCDP (2A-A EDG OOS) = 1.38E-07	ICCDP (2A-A EDG OOS) = 1.30E-07
	ICCDP (2B-B EDG OOS) = 1.92E-07	ICCDP (2B-B EDG OOS) = 2.63E-07
Unconditional ICLERP ≤ 1.0E-07	ICLERP (1A-A EDG OOS) = 3.70E-09	ICLERP (1A-A EDG OOS) = 2.50E-09
	ICLERP (1B-B EDG OOS) = 8.55E-09	ICLERP (1B-B EDG OOS) = 3.63E-09
	ICLERP (2A-A EDG OOS) = 1.41E-09	ICLERP (2A-A EDG OOS) = 4.41E-09
	ICLERP (2B-B EDG OOS) = 2.77E-09	ICLERP (2B-B EDG OOS) = 1.16E-08

3.4 Seismic Considerations

In addition to examining the CDF and LERF from internal events and internal flooding, external events are also reviewed. Seismic and fire events can cause a LOOP, though the probability is extremely low. Potential vulnerabilities of WBN to both seismic and fire issues were evaluated in the WBN Individual Plant Evaluation of External Events (IPEEE) using the Electric Power Research Institute (EPRI) seismic margins and Fire Induced Vulnerability Evaluation methodologies, respectively (References 12 and 13). No vulnerabilities to these external events were identified. NRC's safety evaluation of the WBN Unit 1 IPEEE is documented in a letter dated March 19, 2000.

The seismic and fire issues were also discussed previously in WBN submittal to NRC for Technical Specification Change WBN-TS-01-04 DG Risk Informed Allowed Outage Time (AOT) Extension, which requested a permanent change in the EDG completion time to 14 days for power operation of WBN Unit 1 only.

The WBN design basis safe shutdown earthquake (SSE) is 0.18g. The mean annual frequency of exceedance for an SSE at WBN is 2.35 x 10^{-4}/year in accordance with "NTTF 2.1 Seismic Hazard and Screening Report Watts Bar Nuclear Plant" (Reference 14). The probability of an SSE occurring during the 14-day (.038 yr.) period during which the EDG is out of service may be taken from the equation:

$$P = 1 - e^{-\lambda\tau}$$

Therefore, P(SSE in 14 days) = $1 - e^{(-2.35E-4)(0.038)} = 8.93 \times 10^{-6}$

Since this is a very small probability, the frequency of an SSE occurring in the 14-day period during which the EDG is out of service can be approximated by this same value; i.e., 8.93 x 10^{-6}/year.

The evaluation of seismic events performed as part of the Individual Plant Examination for External Events used the Electric Power Research Institute Seismic Margins Assessment methodology, with a review level earthquake (RLE) of .3g for WBN Unit 1 and 0.5g for Unit 2. Both trains of WBN EDGs were included in the list of components evaluated for safe shutdown of either unit following an earthquake. The DG building was also evaluated. The evaluation of seismic events provided adequate evidence of the ability of WBN to resist a seismic event up to the RLE and initiate a safe shutdown of the plant. The IPEEE program for both WBN units did not identify any adverse spatial interactions or any components with seismic high confidence, low probability of failure capacity below the RLE level.

In the WBN design bases, the switchyard is assumed to fail during a design-basis earthquake. The conditional core damage probability (CCDP) of an earthquake was assumed to be equal to that of a guaranteed LOOP. For this assessment, the WBN PRA model was modified with the LOOP frequency set equal to 1.0, the possibility of recovering offsite power during the 24-hour mission time failed, and one EDG failed due to removal from service for maintenance (EDG 1A-A, 1B-B, 2A-A, or 2B-B). The possibility of recovering the EDG in maintenance and any other EDG that failed during the 24-hour mission time was also failed. This (i.e., no recovery of offsite power or any EDG that failed) is a conservative assumption since recovery of a failed EDG or an EDG in maintenance is possible. The results of the quantification are shown below:

Seismic CCDP with Loss of Offsite Power and Failure of Power Recovery

EDG Removed from Service	WBN1	WBN2
1A-A	2.53E-03	2.22E-03
1B-B	2.45E-03	2.96E-03
2A-A	1.97E-03	2.61E-03
2B-B	2.91E-03	2.69E-03

As shown above, the maximum CCDP is 2.91×10^{-3} for WBN Unit 1 (due to EDG 2B-B in maintenance) and 2.96×10^{-3} for Unit 2 (due to EDG 1B-B in maintenance).

The maximum CDF due to a design basis or larger earthquake during the 14-day period that the EDG is out of service may be calculated as:

$(8.93 \times 10^{-6})(2.91 \times 10^{-3}) = 2.60 \times 10^{-8}$ per year for WBN1

$(8.93 \times 10^{-6})(2.96 \times 10^{-3}) = 2.64 \times 10^{-8}$ per year for WBN2

Additionally, when performing a Seismic Margins Assessment with an RLE of .3g/0.5g compared with the SSE of .18 g, the WBN IPEEE indicates that both trains of EDGs could withstand a seismic event up to the RLE and initiate a safe shutdown. These conclusions are consistent with the guidance of RG 1.177, Key Component 4 in Section 2.3.7.2, which states that "The licensee should treat external hazards and Level 2 issues either qualitatively or quantitatively, or both."

In conclusion, the probability of an SSE occurring during the 14-day EDG outage is low, and the opposite train of EDGs would be available to provide safe shutdown of the units so no additional considerations due to seismic events are required.

3.5 Internal Fire Considerations

Based on information provided in NUREG-1407, "Procedural and Submittal Guidance for the Individual Plant Examination of External Events for Severe Accident Vulnerabilities," WBN concluded that the site was reasonably clear of combustible materials and therefore, external fires were not considered in the WBN IPEEE for both Unit 1 and Unit 2. The effects from an internal fire were examined in the IPEEE using the Fire Induced Vulnerabilities Evaluation methodology. However, no fire-induced vulnerabilities were identified during the evaluation.

At WBN, each EDG set is housed in its own room. Physical separation requirements are provided for each room as well as fire suppression from a CO_2 system described in the WBN Fire Protection Report, Parts II and III. In the IPEEE report, EDG Rooms DGB-1A, DGB-2A, DGB-1B, and DGB-2B are Fire Areas 49, 50, 51, and 52, respectively; and these rooms screened out in Phase II.3 of both WBN1 and WBN2 IPEEE analyses. In the WBN1 IPEEE analysis submitted to NRC in February 1998, the fire related CDF for the EDG Rooms ranged from 1.52×10^{-7} to 1.64×10^{-7} per year. In the WBN2 IPEEE analysis completed in November 2014, the fire related CDF for the EDG Rooms ranged from 2.75 x 10^{-7} to 3.39 x 10^{-7}. This fire related frequency may increase during EDG maintenance due to the potential for introducing additional transient combustibles. These transient combustibles, if present, are controlled and any necessary fire protection and impairment permits are posted according to plant procedures. In addition, equipment in the opposite train is protected so that safe shutdown of the affected units can be achieved.

3.5.5 WBN Unit 1 Evaluation

The potential for a fire in other areas of the plant to occur was discussed in detail in the submittals made to NRC regarding:

1. Amendment 30 to WBN's Operating License with EDG 1B-B
2. Amendment 39 to WBN's Operating License for Increase in AOTs for EDGs

The objective of the reviews performed in the above submittals was to identify plant areas where an emergency diesel generator was the only credited power train available following the fire. This was necessary to determine vulnerabilities to a combination station blackout and fire. Amendment 30 was issued by NRC on December 8, 2000, and allowed the Completion Time for Action B.4 of LCO 3.8.1 to be extended to 10 days for the replacement of the 1B-B generator. Amendment 39 was issued by NRC on July 1, 2002, and changed Technical Specifications LCO 3.8.1 action allowed outage time to restore an inoperable EDG to operable status from 72 hours to 14 days. The information provided for Amendments 30 and 39 are repeated in the following discussion.

A review of the WBN Fire Protection Report identified three fire areas, where if a fire started in that area EDG 1B-B and 2B-B are the only protected train of power available to achieve safe shutdown. These areas are:

Table 4. Fire Areas with Protected Train of Power from EDGs 1B-B/2B-B Only

	Fire Area	Compartment	Location
1.	Fire Area 14 AV-036	737.0-A1A	Auxiliary Building, Column Lines Q-U/A1-A6
		737.0-A1AN	Auxiliary Building, Column Lines Q-U/A6-A8
		737.0-A2	Hot Instrument Shop
		737.0-A4	Air Lock
		757.0-A13	Refueling Room
2.	Fire Area 17 AV-042	757.0-A2	6.9-kV and 480V Shutdown Board Room A
		757.0-A9	Unit 1 Personnel and Equipment Access
	Fire Area 17 AV-042D	757.0-A2	6.9-kV and 480V Shutdown Board Room A
		757.0-A9	Unit 1 Personnel and Equipment Access
	Fire Area 17 AV-042E	757.0-A2	6.9-kV and 480V Shutdown Board Room A
		757.0-A9	Unit 1 Personnel and Equipment Access
	Fire Area 17 AV-042F	757.0-A2	6.9-kV and 480V Shutdown Board Room A
		757.0-A9	Unit 1 Personnel and Equipment Access
	Fire Area 17 AV-042G	757.0-A2	6.9-kV and 480V Shutdown Board Room A
		757.0-A9	Unit 1 Personnel and Equipment Access
3.	Fire Area 24 AV-049	757.0-A28	Auxiliary Control Instrument Room 2B

WBN used the Fire Induced Vulnerability Evaluation methodology in its Individual Plant Examination of External Events analyses for Unit 1. The WBN1 FIVE analysis was performed using the WBN Revision 1 RISKMAN PRA model.

In Fire Area 14, Area AV-036, Compartment 737.0-A2 and 737.0-A4 screened out during Phase I using the FIVE methodology. Compartment 737.0-A2 is the Hot Instrument Shop. It does not contain any equipment required for safe shutdown or plant trip initiators and is separated from adjacent rooms in the Auxiliary Building by 2-hour rated reinforced concrete barriers with the door and penetrations also fire rated. The room is provided with a detection system and the combustible loading is low, < 16,000 BTU/ft^2. Compartment 737.0-A4 is the Air Lock between the Air Intake Room and Elevation 737.0-A1. This room is separated from the Air Intake Room by 2-hour fire rated reinforced concrete and from Compartment 737.0-A1 by non-fire rated reinforced concrete. The doors and penetrations are fire rated. The combustible loading in Room 737.0-A4 is insignificant. Compartments 737.0-A2 and 737.0-A4 will not be discussed further. The other compartments in AV-036 contain the equipment which would affect safe shutdown of the unit.

Fire Compartment 737.0-A1A and 737.0-A1AN (20-foot buffer zone around Compartment A1A) were evaluated together in the WBN1 IPEEE. These compartments were screened in Phase II.3 using the FIVE methodology.

A fire in Compartment 737.0-A1A could affect systems and components powered from the A-train 6.9-kV and 480V shutdown boards, including EDG 1A-A and normal power fed from common station service transformer (CSST) A. If the Train B EDG is taken out of service for maintenance, a safe shutdown path is still provided through CSST B to Shutdown Boards 1B and 2A. The IPE evaluation did note that there were cables for 6.9-kV shutdown bus in the area; however, the cables were away from any significant fire sources in the area.

Also, it was noted during the review that the alternate offsite feeds for these buses are routed at Elevation 772.0, such that each bus has at least one offsite power supply available, even during an engulfing fire on Elevation 737.0. The boards transfer to the alternate offsite feeds automatically on a containment spray system transformer fault.

The evaluation of this fire compartment in the IPEEE was performed using three case scenarios ranging from a minor fire in the compartment to a severe fire assumed to result in extensive damage. The IPEEE assumes EDG 1B-B is available. The results of this evaluation from the IPEEE are presented below.

Table 5. IPEEE Evaluation of Fire Area 737.0-A1A (Auxiliary Building, Column Lines Q-U/A1-A6)

Case	Description	Case Frequency (F1)	Conditional Core Damage Probability (P2) CCDP	Core Damage Frequency F2 = (F1 x P2) FCCDF
Case 1	Minor fire, suppressed	2.65E-03	2.16E-06	5.72E-09
Case 2	Significant fire with manual suppression	2.82E-05	1.29E-04	3.64E-09
Case 3	Severe fire, assumed to result in extensive damage, similar to screening evaluation	3.14E-06	7.49E-02	2.35E-07
Total		2.68E-03		2.44E-07

As can be seen in the above table, approximately 95% of the fire conditional core damage frequency (FCCDF) comes from Case 3. This case was re-quantified with EDG 1B-B failed in addition to what was already failed for this case. The CCDP for Case 3 increased to 7.58E-2 and F2 would equal 2.38E-7. Because offsite power is still available, the increase in fire CDF from this scenario still allows this case to remain below the IPEEE screening criteria.

Fire Compartment 757.0-A13 was evaluated in the IPEEE and screened in Phase II.3 using the FIVE methodology. The value for F2 was calculated as:

F2 = 2.00E-03 x 1.22E-05 = 2.44E-08

This case was re-quantified with EDG 1B-B failed in addition to what was already failed for this case. The CCDP for this case increased to 1.36E-5 and F2 would equal 2.72E-8. Because offsite power is available and "bleed and feed" are still available the increase in fire CDF still allows this case to remain below the IPEEE screening criteria. "Bleed and feed" cooling consists of opening the pressurizer power-operated relief valves (PORV) to bleed inventory from the reactor coolant system (RCS) and feeding inventory via the charging pumps to effect a once through cooling of the RCS.

It must be noted, however, in the updated Fire Protection Report completed in 2014, Fire Compartment 757.0-A13 is no longer part of Fire Area 14. It is now part of Fire Area 10.

Fire Area 17 – AV-042 is a fire analysis volume that contains cables and/or equipment associated with the fifth Vital Battery. The fifth Vital Battery is an installed spare battery that can be used if one of the existing batteries is out of service for maintenance or testing. This fire area was originally analyzed as a spare battery and then four additional analyses (AV-042D through AV-042G) were performed with the fifth Vital Battery in place of each of the four normally credited batteries. The results of the initial screening were similar so further evaluation as in Phase II.3, was performed as just one fire area.

The evaluation of this fire compartment in the IPEEE was performed using three case scenarios ranging from a minor fire in the compartment to a severe fire assumed to result in extensive damage. The results of this evaluation from the IPEEE are presented below.

Table 6. IPEEE Evaluation of Fire Area 757.0-A2 (6.9-kV and 480V Shutdown Board Room A)

Case	Description	Case Frequency (F1)	Conditional Core Damage Probability (P2) CCDP	Core Damage Frequency F2 = (F1 x P2) FCCDF
Case 1	Minor fire, suppressed	1.43E-03	5.98E-05	8.55E-08
Case 2	Significant fire with manual suppression	9.72E-06	7.34E-03	7.13E-08
Case 3	Severe fire, assumed to result in extensive damage, similar to screening evaluation	1.08E-06	0.338	3.65E-07
Total		1.44E-03		5.22E-07

In this case there is the potential for a fire-related loss of offsite power. When EDG 1B-B is also failed, the CCDP for Case 3 approaches 1.0. While a safe-shutdown path would not be available for this area should a fire occur with EDG 1B-B out of service, it should be noted that the actual probability for a severe fire is very low. The FCCDF for Case 3 would then approach 1.08E-06. This is also an area that is well traveled and contains the personnel and equipment access into the Auxiliary Building. A fire in this area has a high probability of being noticed.

Fire Area 24 – AV-049 is a fire analysis volume containing only Room 757.0-A28, Auxiliary Control Instrument Room 2B. A fire in AV-049 could potentially affect systems and components necessary to maintain the Unit 1 and Unit 2 long term decay heat removal, containment heating, ventilation, and air conditioning (HVAC), reactor coolant inventory control, steam generator (SG) inventory control and reactor pressure control functions and Unit 2 secondary side isolation functions. Mitigating features are required to restore systems necessary for safe shutdown. Based on the updated Fire Protection Report completed in 2014, offsite and onsite power is not affected by a fire in Room 757.0-A28. Since the 6.9-kV power supply is available, the effect of extended maintenance on EDGs would be minimal.

A review of the WBN Fire Protection Report identified four fire areas, where if a fire started in that area, EDGs 1A-A and 2A-A are the only protected trains of power available to achieve safe shutdown. These areas are:

Table 7. Fire Areas with Protected Train of Power from EDGs 1A-A/2A-A Only

	Fire Area	Compartment	Location
1.	Fire Area 14 AV-037 and AV-037C	737.0-A1AN	Auxiliary Building, Column Lines Q-U1/A6-A8
		737.0-A1BN	Auxiliary Building, Column Lines Q-U/A8-A10
		737.0-A1CN	Auxiliary Building, Column Lines V-U/A5-A11
		737.0-A7	Unit 1 Letdown Heat Exchanger
		757.0-A8	Unit 2 Letdown Heat Exchanger
2.	Fire Area 20 AV-045	757.0-A1	Auxiliary Control Room
3.	Fire Area 31 AV-057	757.0-A24	6.9-kV and 480V Shutdown Board Room B
		757.0-A17	Unit 2 Personnel and Equipment Access
	Fire Area 31 AV-057D	757.0-A24	6.9-kV and 480V Shutdown Board Room B
		757.0-A17	Unit 2 Personnel and Equipment Access
	Fire Area 31 AV-057E	757.0-A24	6.9-kV and 480V Shutdown Board Room B
		757.0-A17	Unit 2 Personnel and Equipment Access
	Fire Area 31 AV-057F	757.0-A24	6.9-kV and 480V Shutdown Board Room B
		757.0-A17	Unit 2 Personnel and Equipment Access
	Fire Area 31 AV-057G	757.0-A24	6.9-kV and 480V Shutdown Board Room B
		757.0-A17	Unit 2 Personnel and Equipment Access
4.	Fire Area 45 AV-072	772.0-A15A1	480V Board Room 2-B, Column Lines A13-A12
		772.0-A15A2	480V Board Room 2-B, Column Lines A12-A11

Fire Area 20 – Area AV-045 screened out during Phase II.2 because the fire-induced core damage frequency was less than 1E-6. This area is the auxiliary control room and a fire in this area could potentially affect systems and components necessary to maintain the steam generator inventory control, long term decay heat removal, containment HVAC, fire pumps, reactor coolant inventory control, reactor pressure control and secondary side isolation functions. The conditional core damage probability calculated for a fire damaging all equipment and cables in this room was 1.22E-3. Examination of the equipment available shows that even with EDG 1A-A failed in addition to the equipment already lost in the fire, a safe shutdown path is available using the turbine-driven auxiliary feedwater pump (125V direct current [DC] power is not affected), secondary side cooling to Steam Generators 1 and 2 and two ERCW pumps supplied by EDG 2A-A. The conditional core damage probability would increase with EDG 1A-A unavailable but the probability would not approach 1.0. It should also be noted that an automatic sprinkler system and fire pumps are available to the area.

Fire Area 45 – AV-072 is a fire analysis volume for the 480V Board Room 2-B. This area screened out during Phase II.3. An automatic sprinkler system and fire pumps are available to the area in the event of a fire. Both B-train EDGs and offsite power are assumed unavailable in the event of a fire. A fire in this area could potentially affect systems and components necessary to maintain long term decay heat removal, the steam generator inventory control, containment HVAC, fire pumps, reactor coolant inventory control, and reactor pressure control. Unlike Fire Area 20 described above, the turbine-driven AFW pump is also unavailable due to a fire.

The evaluation of this fire compartment in the IPEEE was performed using three case scenarios ranging from a minor fire in the compartment to a severe fire assumed to result in extensive damage. The IPEEE assumes EDGs 1A-A and 2A-A are available. The results of this evaluation from the IPEEE are presented below.

Table 8. IPEEE Evaluation of Room 772.0-A15 (480V Board Room 2-B)

Case	Description	Case Frequency (F1)	Conditional Core Damage Probability (P2) CCDP	Core Damage Frequency F2 = (F1 x P2) FCCDF
Case 1	Minor fire, suppressed	1.87E-03	5.98E-05	1.12E-07
Case 2	Significant fire with manual suppression	1.27E-05	7.34E-03	9.31E-08
Case 3	Severe fire, assumed to result in extensive damage, similar to screening evaluation	1.41E-06	0.146	2.06E-07
Total		1.88E-03		4.11E-07

Like previous scenarios with EDG 1B-B out of service, if EDG 1A-A is removed from service the safe shutdown path credited is unavailable and the CCDP for Case 3 approaches 1.0. While a safe-shutdown path would not be available for this area should a fire occur with EDG 1A-A out of service, it should be noted that the actual probability for a severe fire is very low. It is probable that a fire in the area might be noticed before it becomes severe because the auxiliary unit operators enter this area twice a shift. Also other activities like the tagging of equipment out of service for maintenance could result in additional entry to the area.

In Fire Area 14, Fire Compartments 737.0-A1AN and 737.0-A1BN are 20 foot buffer zones created to analyze Fire Areas 36 (737.0-A1A) and 38 (737.0-A1B) on Elevation 737. Fire Analysis Volume AV-037 only contains 737.0-A1AN and 737.0-A1BN. Fire Analysis Volume AV-037C is analyzed to address the interface between 737.0-A1CN and 737.0-A1AN and 737.0-A1BN (i.e., to obtain 20 feet of separation on either side of Column Line U). These areas were evaluated together with those rooms in the IPEEE. Fire Area 36 was discussed above with the Train B EDGs. In Fire Area 38, the EDGs are not the only safe shutdown path credited, offsite power is also credited and so this room is not analyzed as a part of this submittal. Rooms A7 and A8 screened out in Phase 1 of the IPEEE evaluation.

Room 737.0-A7 is the Unit 1 Letdown Heat Exchanger Room. This compartment is separated from adjacent rooms by 2-hour fire rated reinforced concrete, with fire-rated doors and penetrations. The combustible loading is low (< 7,500 BTU/ft^2) of which greater than 96% is located with two bags of radwaste located at the step-off pad. This area contains no safe shutdown or plant trip initiator equipment and was screened from further evaluation.

Room 737.0-A8 is the Unit 2 Letdown Heat Exchanger Room. This compartment is separated from adjacent rooms by 2-hour fire rated reinforced concrete, with fire-rated doors and penetrations. The combustible loading is very low (< 200 BTU/ft^2). This area contains no safe shutdown or plant trip initiator equipment and was screened from further evaluation.

Fire Area 31 – AV-057 is a fire analysis volume that contains two rooms on Elevation 757; i.e., 757.0-A17 and 757.0-A24. Separate fire frequencies were developed for each of these rooms. These rooms contain cables and/or equipment associated with the fifth vital battery. The fifth vital batter is an installed spare battery that can be used if one of the existing batteries is out of service for maintenance or testing. This fire area was originally analyzed with the fifth vital battery as a spare battery and then four additional analyses (AV-057D through AV-057G) were performed with the fifth vital battery in place of each of the four normally credited batteries. The results of the initial screening show that Case 57G is the limiting case so further evaluation of the conditional core damage probability was performed as just one fire area using Case 57G. A fire in Area 57G assumes that the Train B EDGs and the turbine-driven AFW pump are unavailable. Dominant failure sequences also involve the loss of the Train A EDGs.

The evaluation of this fire compartment in the IPEEE was performed using three case scenarios ranging from a minor fire in the compartment to a severe fire assumed to result in extensive damage. The results of this evaluation from the IPEEE are presented below for Room 757.0-A17.

Table 9. IPEEE Evaluation of Room 757.0-A17 (Unit 2 Personnel and Equipment Access)

Case	Description	Case Frequency (F1)	Conditional Core Damage Probability (P2) CCDP	Core Damage Frequency F2 = (F1 x P2) FCCDF
Case 1	Minor fire, suppressed	3.09E-04	5.98E-05	1.85E-08
Case 2	Significant fire with manual suppression	2.10E-06	7.34E-03	1.54E-08
Case 3	Severe fire, assumed to result in extensive damage, similar to screening evaluation	2.33E-07	0.143	3.34E-08
Total		3.11E-04		6.72E-08

In this case there is the potential for a fire-related loss of offsite power. When EDG 1A-A is also failed, the CCDP for Case 3 approaches 1.0. While a safe-shutdown path would not be available for this area should a fire occur with EDG 1A-A out of service, it should be noted that the actual probability for a severe fire is very low. The FCCDF for Case 3 above would then approach 2.33E-07. This is also an area that is well traveled and contains the personnel and equipment access into the Auxiliary Building. A fire in this area has a high probability of being noticed.

The following are the results for Room 757.0-A24:

Table 10. IPEEE Evaluation of Room 757.0-A24 (6.9-kV and 480V Shutdown Board Room B)

Case	Description	Case Frequency (F1)	Conditional Core Damage Probability (P2) CCDP	Core Damage Frequency F2 = (F1 x P2) FCCDF
Case 1	Minor fire, suppressed	1.74E-03	5.98E-05	1.04E-07
Case 2	Significant fire with manual suppression	1.18E-05	7.34E-03	8.67E-08
Case 3	Severe fire, assumed to result in extensive damage, similar to screening evaluation	1.31E-06	0.143	1.88E-07
Total		1.75E-03		3.78E-07

In Room 757.0-A24 there is the potential for a fire-related loss of offsite power. When EDG 1A-A is also failed, the CCDP for Case 3 approaches 1.0. While a safe-shutdown path would not be available for this area should a fire occur with EDG 1A-A out of service, it should be noted that the actual probability for a severe fire is very low. The FCCDF for Case 3 would then approach 1.31E-06. This is also an area that is well traveled and is near the personnel and equipment access into the Auxiliary Building. A fire in this area has a high probability of being noticed.

Overall, the evaluations of the specific fire areas above demonstrate that the risk increase due to severe fire with a combination of loss of offsite power is small. There are three areas where the probability of a severe fire while an emergency diesel generator is out of service for maintenance could cause the conditional core damage frequency to slightly exceed the IPEEE screening criteria. These areas are Elevation 757.0, Areas A2 and A24, 6.9-kV and 480V Shutdown Board Rooms A and B, respectively, and Elevation 772.0 Area A15, 480V Board Room 2-B. The actual probability of a severe fire in these areas is low and fire in these areas would probably be detected before they would become severe. The 6.9-kV and 480V Shutdown Board Rooms A and B are located close to the main control room and personnel traverse these areas frequently. Personnel are also required to enter the 480V Board Room at least twice a shift.

3.5.6 WBN Unit 2 Evaluation

A review of the WBN Fire Protection Report identified a number of fire areas, where if a fire started in that area the offsite power to at least one of the 6.9-kV shutdown boards may be affected due to fire damage and EDG 1A-A, 2A-A, 1B-B, or 2B-B may be needed in support of achieving safe shutdown. These areas are listed in Table 11.

Table 11. Fire Areas with Potential Fire Damage to Offsite Power (with one train of protected power from EDGs)

	Fire Area	Compartment	Location
EDGs 1A-A and 2A-A Protected			
1.	Fire Area 14 AV-037	737.0-A1AN	Auxiliary Building, Column Lines Q-U1/A6-A8
		737.0-A1BN	Auxiliary Building, Column Lines Q-U/A8-A10
	Fire Area 14 AV-037C	737.0-A1AN	Auxiliary Building, Column Lines Q-U1/A6-A8
		737.0-A1BN	Auxiliary Building, Column Lines Q-U/A8-A10
		737.0-A1CN	Auxiliary Building, Column Lines V-U/A5-A11
		737.0-A7	Unit 1 Letdown Heat Exchanger
		737.0-A8	Unit 2 Letdown Heat Exchanger
	Fire Area 14 AV-038	737.0-A1B	Auxiliary Building, Column Lines Q-U/A10-A15
		737.0-A1BN	Auxiliary Building, Column Lines Q-U/A8-A10
		737.0-A11	Air Lock
2.	Fire Area 18 AV-043	757.0-A3	125V Vital Battery Board Room II
3.	Fire Area 29 AV-055	757.0-A22	125V Vital Battery Board Room IV
4.	Fire Area 31 AV-057	757.0-A17	Unit 2 Personnel and Equipment Access
		757.0-A24	6.9-kV and 480V Shutdown Board Room B
	Fire Area 31 AV-057D	757.0-A17	Unit 2 Personnel and Equipment Access
		757.0-A24	6.9-kV and 480V Shutdown Board Room B
	Fire Area 31 AV-057E	757.0-A17	Unit 2 Personnel and Equipment Access
		757.0-A24	6.9-kV and 480V Shutdown Board Room B
	Fire Area 31 AV-057F	757.0-A17	Unit 2 Personnel and Equipment Access
		757.0-A24	6.9-kV and 480V Shutdown Board Room B
	Fire Area 31 AV-057G	757.0-A17	Unit 2 Personnel and Equipment Access
		757.0-A24	6.9-kV and 480V Shutdown Board Room B
15.	Fire Area 33 AV-059	772.0-A2A1	480V Board Room 1-B, Column Lines A8-A6
		772.0-A2A2	480V Board Room 1-B, Column Lines A6-A5
		772.0-A2A3	480V Board Room 1-B, Column Lines A5-A4

Table 11. Fire Areas with Potential Fire Damage to Offsite Power (with one train of protected power from EDGs) (Continued)

	Fire Area	Compartment	Location
6.	Fire Area 34 AV-061	772.0-A3	125V Vital Battery Room II
7.	Fire Area 39 AV-066E	772.0-A8	Fifth Vital Battery and Board Room
	Fire Area 39 AV-066G	772.0-A8	Fifth Vital Battery and Board Room
8.	Fire Area 43 AV-070	772.0-A13	125V Vital Battery Room IV
9.	Fire Area 47 AV-075	786.0-A2	Roof Access Air Lock
		786.0-A3	Mechanical Equipment Room 2B
		786.0-A4	Mechanical Equipment Room 1B
		786.0-A5	225 kVA DG Room B
		786.0-A6	225 kVA DG Room A
		786.0-AR	Roof
10.	Fire Area 48 AV-076	Stair C1	Stairwell, elevation 692 through 755
		Stair C2	Stairwell, elevation 692 through 755
		692.0-C1	Mechanical Equipment Room
		692.0-C2	Mechanical Equipment Room
		692.0-C3	250V Battery Room 1
		692.0-C4	250V Battery Board Room 1
		692.0-C5	250V Battery Board Room 2
		692.0-C6	250V Battery Room 2
		692.0-C7	24V and 48V Battery Room
		692.0-C8	24V and 48V Battery Board and Charger Room
		692.0-C9	Communications Room
		692.0-C10	Mechanical Equipment Room
		692.0-C11	Corridor
		692.0-C12	Secondary Alarm Station Room
		708.0-C1	Unit 1 Auxiliary Instrument Room
		708.0-C2	Corridor

Table 11. Fire Areas with Potential Fire Damage to Offsite Power (with one train of protected power from EDGs) (Continued)

	Fire Area	Compartment	Location
		708.0-C3	Computer Room
		708.0-C4	Unit 2 Auxiliary Instrument Room
		729.0-C1	Cable Spreading Room
		755.0-C1	Mechanical Equipment Room
		755.0-C2	Women's Restroom
		755.0-C3	Corridor (includes space above Operations office and living area)
		755.0-C4	Kitchen
		755.0-C5	Toilet
		755.0-C6	Locker Room
		755.0-C7	Shower
		755.0-C8	Shower
		755.0-C9	Conference Room
		755.0-C10	Shift Manager's Office
		755.0-C12	Main Control Room
		755.0-C13	Relay Room
		755.0-C14	Technical Support Center
		755.0-C15	Corridor
		755.0-C16	Conference Room
		755.0-C17	Telephone Room
		755.0-C18	NRC Office
		755.0-C19	Corridor
		755.0-C20	DPSO Shop
		CB Roof	Control Building Roof

Table 11. Fire Areas with Potential Fire Damage to Offsite Power (with one train of protected power from EDGs) (Continued)

	Fire Area	Compartment	Location
EDGs 1B-B and 2B-B Protected			
1.	Fire Area 14 AV-036	737.0-A1A	Auxiliary Building, Column Lines Q-U1/A1-A6
		737.0-A1AN	Auxiliary Building, Column Lines Q-U1/A6-A8
		737.0-A2	Hot Instrument Shop
		737.0-A4	Air Lock
2.	Fire Area 17 AV-042	757.0-A2	6.9-kV and 480V Shutdown Board Room A
		757.0-A9	Unit 1 Personnel and Equipment Access
	Fire Area 17 AV-042D	757.0-A2	6.9-kV and 480V Shutdown Board Room A
		757.0-A9	Unit 1 Personnel and Equipment Access
	Fire Area 17 AV-042E	757.0-A2	6.9-kV and 480V Shutdown Board Room A
		757.0-A9	Unit 1 Personnel and Equipment Access
	Fire Area 17 AV-042F	757.0-A2	6.9-kV and 480V Shutdown Board Room A
		757.0-A9	Unit 1 Personnel and Equipment Access
	Fire Area 17 AV-042G	757.0-A2	6.9-kV and 480V Shutdown Board Room A
		757.0-A9	Unit 1 Personnel and Equipment Access
3.	Fire Area 19 AV-044	757.0-A4	125V Vital Battery Board Room I
4.	Fire Area 23 AV-048	757.0-A27	Auxiliary Control Instrument Room 2A
5.	Fire Area 30 AV-056	757.0-A23	125V Vital Battery Board Room III
6.	Fire Area 35 AV-062	772.0-A4	125V Vital Battery Room I
7.	Fire Area 39 AV-066D	772.0-A8	Fifth Vital Battery and Board Room
	Fire Area 39 AV-066F	772.0-A8	Fifth Vital Battery and Board Room
8.	Fire Area 44 AV-071	772.0-A14	125V Vital Battery Room III

Table 11. Fire Areas with Potential Fire Damage to Offsite Power (with one train of protected power from EDGs) (Continued)

	Fire Area	Compartment	Location
9.	Fire Area 47 AV-075	786.0-A2	Roof Access Air Lock
		786.0-A3	Mechanical Equipment Room 2B
		786.0-A4	Mechanical Equipment Room 1B
		786.0-A5	225 kVA DG Room B
		786.0-A6	225 kVA DG Room A
		786.0-AR	Roof
10.	Fire Area 48 AV-076	Stair C1	Stairwell, elevation 692 through 755
		Stair C2	Stairwell, elevation 692 through 755
		692.0-C1	Mechanical Equipment Room
		692.0-C2	Mechanical Equipment Room
		692.0-C3	250V Battery Room 1
		692.0-C4	250V Battery Board Room 1
		692.0-C5	250V Battery Board Room 2
		692.0-C6	250V Battery Room 2
		692.0-C7	24V and 48V Battery Room
		692.0-C8	24V and 48V Battery Board and Charger Room
		692.0-C9	Communications Room
		692.0-C10	Mechanical Equipment Room
		692.0-C11	Corridor
		692.0-C12	Secondary Alarm Station Room
		708.0-C1	Unit 1 Auxiliary Instrument Room
		708.0-C2	Corridor
		708.0-C3	Computer Room
		708.0-C4	Unit 2 Auxiliary Instrument Room
		729.0-C1	Cable Spreading Room
		755.0-C1	Mechanical Equipment Room
		755.0-C2	Women's Restroom
		755.0-C3	Corridor (includes space above Operations office and living area)

Table 11. Fire Areas with Potential Fire Damage to Offsite Power (with one train of protected power from EDGs) (Continued)

	Fire Area	Compartment	Location
		755.0-C4	Kitchen
		755.0-C5	Toilet
		755.0-C6	Locker Room
		755.0-C7	Shower
		755.0-C8	Shower
		755.0-C9	Conference Room
		755.0-C10	Shift Manager's Office
		755.0-C12	Main Control Room
		755.0-C13	Relay Room
		755.0-C14	Technical Support Center
		755.0-C15	Corridor
		755.0-C16	Conference Room
		755.0-C17	Telephone Room
		755.0-C18	NRC Office
		755.0-C19	Corridor
		755.0-C20	DPSO Shop
		CB Roof	Control Building Roof

TVA used the Fire Induced Vulnerability Evaluation methodology in its IPEEE analyses for WBN Unit 2. The most recent WBN2 FIVE analysis completed in November 2014 uses the WBN Revision 0 CAFTA PRA model (Reference 15) for the quantification of the fire scenarios evaluated. In the WBN Revision 0 CAFTA PRA model, the basic events representing the EDG maintenance unavailability have already accounted for the maintenance duration data compiled under the 14-day DG AOT condition (January 1, 2003, through March 31, 2008). In the analysis for this submittal, however, the IPEEE fire analysis results are updated with the EDG maintenance unavailability reflecting data through December 31, 2014.

3.5.6.1 EDGs 1A-A and 2A-A Protected

In Table 11, the analysis volumes in which the EDGs 1A-A and 2A-A are protected include AV-037, AV-037C, AV-038, AV-043, AV-055, AV-057, AV-057D, AV-057E, AV-057F, AV-057G, AV-059, AV-061, AV-066E, AV-066G, AV-070, AV-075, and AV-076. These analysis volumes are located inside Fire Areas 14, 18, 29, 31, 33, 34, 39, 43, 47, and 48. The evaluation of the fire compartments encompassed in these analysis volumes is discussed in the following by fire area.

Fire Area 14

Analysis Volume AV-037 in Fire Area 14 contains Fire Zones 737.0-A1AN and 737.0-A1BN. Based on the WBN Fire Protection Report, fire in this analysis volume could affect offsite power and Train 1B and Train 2B onsite emergency AC power supply. The compartments in this analysis volume were evaluated as part of Room 737.0-A1 which was screened in Phase II.3 of the WBN2 IPEEE completed in November 2014. The evaluation of Room 737.0-A1 was subdivided into three areas: 737.0-A1A, 737.0-A1B, and 737.0-A1C. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDFs for these areas are 4.69×10^{-7}, 2.94×10^{-7}, and 3.94×10^{-7}, respectively, which are below the FIVE screening criterion of 10^{-6}. Additionally, these screening CDFs were re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. Where the re-quantified screening CDF is greater than 10^{-6}, a screening ICCDP is also calculated. The resulting fire related screening CDFs and selected ICCDPs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF (Screening ICCDP)					
737.0-A1A	4.69E-07	4.69E-07	4.69E-07	2.00E-06 (5.86E-08)	1.12E-06 (2.50E-08)
737.0-A1B	2.93E-07	2.93E-07	2.94E-07	1.25E-06 (3.67E-08)	7.01E-07
737.0-A1C	3.94E-07	3.94E-07	3.94E-07	1.68E-06 (4.93E-08)	9.41E-07

As can be seen in the above table, most CDFs re-quantified with one EDG out of service are still below the IPEEE screening criteria of 10^{-6}. Where the re-quantified CDFs are greater than 10^{-6}, the corresponding ICCDPs are all below the ICCDP criterion of 10^{-6}.

Analysis Volume AV-037C in Fire Area 14 contains Fire Zones 737.0-A1AN, 737.0-A1BN, and 737.0-A1CN, as well as Rooms 737.0-A7 and 737.0-A8. Similar to Analysis Volume AV-037, fire in this analysis volume could affect offsite power and Train 1B and Train 2B onsite emergency AC power supply (based on the WBN Fire Protection Report). Fire Zones 737.0-A1AN, 737.0-A1BN, and 737.0-A1CN were evaluated in the WBN2 IPEEE as part of Room 737.0-A1, which was screened in Phase II.3 of the WBN2 IPEEE completed in November 2014. As described previously, the evaluation of Room 737.0-A1 was subdivided into three areas: 737.0-A1A, 737.0-A1B, and 737.0-A1C. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the calculated screening CDFs for these fire zones in Analysis Volume AV-037C are 4.69×10^{-7}, 2.94×10^{-7}, and 3.94×10^{-7}, respectively, which are below the FIVE screening criterion of 10^{-6}. Additionally, these screening CDFs were re-quantified assuming that one of the four

EDGs is also out of service due to planned maintenance. Where the re-quantified screening CDF is greater than 10^{-6}, a screening ICCDP is also calculated. The resulting fire related screening CDFs and selected ICCDPs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF (Screening ICCDP)					
737.0-A1A	4.69E-07	4.69E-07	4.69E-07	2.00E-06 (5.86E-08)	1.12E-06 (2.50E-08)
737.0-A1B	2.93E-07	2.93E-07	2.94E-07	1.25E-06 (3.67E-08)	7.01E-07
737.0-A1C	3.94E-07	3.94E-07	3.94E-07	1.68E-06 (4.93E-08)	9.41E-07

As can be seen in the above table, most CDFs re-quantified with one EDG out of service are still below the IPEEE screening criteria of 10^{-6}. Where the re-quantified CDFs are greater than 10^{-6}, the corresponding ICCDPs are all below the ICCDP criterion of 10^{-6}.

Room 737.0-A7 is Unit 1 Letdown Heat Exchanger Room which was screened in the Phase I FIVE analysis of the WBN1 IPEEE. Room 737.0-A8 is Unit 2 Letdown Heat Exchanger Room which was also screened in the Phase I FIVE analysis of the WBN2 IPEEE completed in November 2014. These two rooms would still be screened in the Phase I FIVE analysis even with the changes in the EDG maintenance unavailability due to the extended EDG Completion Time of 14 days.

Analysis Volume AV-038 in Fire Area 14 contains Fire Zones 737.0-A1B and 737.0-A1BN, as well as Room 737.0-A11. Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1B and Train 2B offsite AC power supply. Offsite power is available for 6.9-kV Shutdown Board 1A-A and onsite power is available for 6.9-kV Shutdown Board 2A-A. Fire zones 737.0-A1B and 737.0-A1BN were evaluated as part of Room 737.0-A1, which was screened in Phase II.3 of the WBN2 IPEEE completed in November 2014. As described previously, the evaluation of Room 737.0-A1 was subdivided into three areas: 737.0-A1A, 737.0-A1B, and 737.0-A1C. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the calculated screening CDFs for these fire zones in Analysis Volume AV-038 are 5.46×10^{-7}, 3.42×10^{-7}, and 4.59×10^{-7}, respectively, which are below the FIVE screening criterion of 10^{-6}. Additionally, these screening CDFs were re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. Where the re-quantified screening CDF is greater than 10^{-6}, a screening ICCDP is also calculated. The resulting fire related screening CDFs and selected ICCDPs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF (Screening ICCDP)					
737.0-A1A	5.46E-07	1.11E-06 (2.18E-08)	5.47E-07	2.01E-06 (5.63E-08)	1.20E-06 (2.50E-08)
737.0-A1B	3.42E-07	6.97E-07	3.42E-07	1.26E-06 (3.52E-08)	7.49E-07
737.0-A1C	4.59E-07	9.36E-07	4.59E-07	1.69E-06 (4.73E-08)	1.01E-06 (2.10E-08)

As can be seen in the above table, one-half of the CDFs re-quantified with one EDG out of service are still below the IPEEE screening criteria of 10^{-6}. Where the re-quantified CDFs are greater than 10^{-6}, the corresponding ICCDPs are all below the ICCDP criterion of 10^{-6}.

Room 737.0-A11 is Air Lock which was screened in the Phase I FIVE analysis of the WBN2 IPEEE completed in November 2014. Even with the changes in the EDG maintenance unavailability due to the extended EDG Completion Time of 14 days, this room would still be screened in the Phase I FIVE analysis.

Fire Area 18

Analysis Volume AV-043 in Fire Area 18 contains Room 757.0-A3 (125V Vital Battery Board Room II). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1B and Train 2B offsite AC power supply. Offsite power is available to Trains 1A and 2A. This compartment was screened in Phase II.2 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDF for this compartment is 1.77 x 10^{-7}, which is below the FIVE screening criterion of 10^{-6}. Additionally, this screening CDF was re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. The resulting fire related screening CDFs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF					
757.0-A3	1.77E-07	1.77E-07	1.77E-07	1.79E-07	1.77E-07

As can be seen in the above table, all of the CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}.

Fire Area 29

Analysis Volume AV-055 in Fire Area 29 contains Room 757.0-A22 (125V Vital Battery Board Room IV). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1B and Train 2B offsite AC power supply. Offsite power is available to Trains 1A and 2A. This compartment was screened in Phase II.3 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDF for this area is 8.38 x 10^{-7}, which is below the FIVE screening criterion of 10^{-6}. Additionally, this screening CDF was re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. Where the re-quantified screening CDF is greater than 10^{-6}, a screening ICCDP is also calculated. The resulting fire related screening CDFs and selected ICCDP for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF (Screening ICCDP)					
757.0-A22	8.38E-07	8.38E-07	8.38E-07	1.09E-06 (9.63E-09)	8.50E-07

As can be seen in the above table, most CDFs re-quantified with one EDG out of service are still below the IPEEE screening criteria of 10^{-6}. Where the re-quantified CDF is greater than 10^{-6}, the corresponding ICCDP is also below the ICCDP criterion of 10^{-6}.

Fire Area 31

Analysis Volume AV-057 in Fire Area 31 contains Rooms 757.0-A17 (Unit 2 Personnel and Equipment Access) and 757.0-A24 (6.9-kV and 480V Shutdown Board Room B). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1B and Train 2B onsite emergency AC power supply. In addition, offsite power supply could be affected. These compartments were screened in Phase II.3 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDFs for these two rooms are 5.46 x 10^{-8} and 1.33 x 10^{-7}, respectively, which are below the FIVE screening value of 10^{-6}. Additionally, these screening CDFs were re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. Where the re-quantified screening CDF is greater than 10^{-6}, a screening ICCDP is also calculated. The resulting fire related screening CDFs and selected ICCDP for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF (Screening ICCDP)					
757.0-A17	5.46E-08	2.59E-07	1.69E-07	8.60E-07	2.65E-07
757.0-A24	1.33E-07	5.79E-07	3.83E-07	2.12E-06 (7.62E-08)	6.03E-07

As can be seen in the above table, most CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}. Where the re-quantified CDF is greater than 10^{-6}, the corresponding ICCDP is also below the ICCDP criterion of 10^{-6}.

Analysis Volumes AV-057D, AV-057E, AV-057F, and AV-057G in this fire area are also defined to contain Rooms 757.0-A17 and 757.0-A24. As such, the fire evaluations for these analysis volumes are the same as that for Analysis Volume AV-057.

Fire Area 33

Analysis Volume AV-059 in Fire Area 33 contains fire zones 772.0-A2A1 (480V Board Room 1-B, Column Lines A8-A6), 772.0-A2A2 (480V Board Room 1-B, Column Lines A6-A5), and 772.0-A2A3 (480V Board Room 1B, Column Lines A5-A4). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1B onsite emergency AC power supply and the Train 2B offsite AC power supply. Offsite power is available for Trains 1A and 2A. However, based on the detailed cable/circuit failure evaluation performed in the WBN2 FIVE analysis, offsite AC power supply is actually available to all four trains (1A, 1B, 2A, and 2B). The compartments in this analysis volume were evaluated as part of Room 772.0-A2 which was screened in Phase II.2 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDF for this analysis volume is 3.60×10^{-7}, which is below the FIVE screening criterion of 10^{-6}. Additionally, this screening CDF was re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. Where the re-quantified screening CDF is greater than 10^{-6}, a screening ICCDP is also calculated. The resulting fire related screening CDFs and selected ICCDPs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF (Screening ICCDP)					
772.0-A2	3.60E-07	3.61E-07	3.60E-07	1.05E-06 (2.63E-08)	1.02E-06 (2.54E-08)

As can be seen in the above table, two of the four CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}. Where the re-quantified

CDFs are greater than 10^{-6}, the corresponding ICCDPs are all below the ICCDP criterion of 10^{-6}.

Fire Area 34

Analysis Volume AV-061 in Fire Area 34 contains Room 772.0-A3 (125V Vital Battery Room II). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1B and Train 2B offsite AC power supply. Offsite power is available for Trains 1A and 2A. However, based on the detailed cable/circuit failure evaluation performed in the WBN2 FIVE analysis, offsite AC power supply is actually available to all four trains (1A, 1B, 2A, and 2B). The compartment in this analysis volume was screened in Phase II.2 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDF for this area is 1.55×10^{-8}, which is below the FIVE screening criterion of 10^{-6}. Additionally, this screening CDF was re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. The resulting fire related screening CDFs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF					
772.0-A3	1.55E-08	1.55E-08	1.55E-08	1.55E-08	1.55E-08

As can be seen in the above table, all of the CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}.

Fire Area 39

Analysis Volumes AV-066E and AV-066G in Fire Area 39 contain Room 772.0-A8 (Fifth Vital Battery and Board Room). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1B and Train 2B offsite AC power supply. Offsite power is available to Trains 1A and 2A. However, based on the detailed cable/circuit failure evaluation performed in the WBN2 FIVE analysis, offsite AC power supply is actually available to all four trains (1A, 1B, 2A, and 2B). The compartment in these analysis volumes was screened in Phase II.2 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDF for this area is 2.06×10^{-8}, which is below the FIVE screening criterion of 10^{-6}. Additionally, this screening CDF was re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. The resulting fire related screening CDFs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF					
772.0-A8	2.06E-08	2.06E-08	2.06E-08	2.06E-08	2.07E-08

As can be seen in the above table, all of the CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}.

Fire Area 43

Analysis Volume AV-070 in Fire Area 43 contains Room 772.0-A13 (125V Vital Battery Room IV). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1B and Train 2B offsite AC power supply. Offsite power is available to Trains 1A and 2A. However, based on the detailed cable/circuit failure evaluation performed in the WBN2 FIVE analysis, offsite AC power supply is actually available to all four trains (1A, 1B, 2A, and 2B). The compartment in this analysis volume was screened in Phase II.2 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDF for this area is 7.42×10^{-8}, which is below the FIVE screening criterion of 10^{-6}. Additionally, this screening CDF was re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. The resulting fire related screening CDFs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF					
772.0-A13	7.42E-08	7.42E-08	7.42E-08	7.71E-08	7.42E-08

As can be seen in the above table, all of the CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}.

Fire Area 47

Analysis Volume AV-075 in Fire Area 47 contains Rooms 786.0-A2 (Roof Access Air Lock), 786.0-A3 (Mechanical Equipment Room 2B), 786.0-A4 (Mechanical Equipment Room 1B), 786.0-A5 (225 kVA DG Room B), 786.0-A6 (225 kVA DG Room A), and 786.0-AR (Roof). Based on the WBN Fire Protection Report, fire in this analysis volume could affect the offsite AC power supply to Trains 1A, 1B, 2A, and 2B. Emergency onsite power supply, however, is available. However, based on the detailed cable/circuit failure evaluation performed in the WBN2 FIVE analysis, offsite AC power supply is actually available to Train 1B and 2B. Rooms 786.0-A2, 786.0-A3, 786.0-A4, 786.0-A5, and 786.0-A6 were screened in the Phase I FIVE analysis of the WBN2 IPEEE completed in November 2014. Room 786.0-AR was screened in Phase II.2 of the WBN2 IPEEE completed in November 2014. Even with the changes in the EDG maintenance unavailability due to the extended EDG Completion Time of 14 days, Rooms 786.0-A2, 786.0-A3, 786.0-A4, 786.0-A5, and 786.0-A6 would still be screened in the Phase I FIVE analysis. For Room 786.0-AR, using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDF is 5.57 x 10^{-7}, which is below the FIVE screening criterion of 10^{-6}. Additionally, this screening CDF was re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. Where the re-quantified screening CDF is greater than 10^{-6}, a screening ICCDP is also calculated. The resulting fire related screening CDFs and selected ICCDPs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF (Screening ICCDP)					
786.0-AR	5.57E-07	5.88E-06 (2.04E-07)	6.04E-06 (2.10E-07)	8.45E-06 (3.03E-07)	8.67E-06 (3.11E-07)

As can be seen in the above table, all four CDFs re-quantified with one EDG out of service are above the IPEEE screening criteria of 10^{-6}. However, the corresponding ICCDPs are all below the ICCDP criterion of 10^{-6}.

Fire Area 48

Analysis Volume AV-076 in Fire Area 48 contains Rooms Stair C1, Stair C2, 692.0-C1 (Mechanical Equipment Room), 692.0-C2 (Mechanical Equipment Room), 692.0-C3 (250V Battery Room 1), 692.0-C4 (250V Battery Board Room 1), 692.0-C5 (250V Battery Board Room 2), 692.0-C6 (250V Battery Room 2), 692.0-C7 (24V and 48V Battery Room), 692.0-C8 (24V and 48V Battery Board and Charger Room), 692.0-C9 (Communications Room), 692.0-C10 (Mechanical Equipment Room), 692.0-C11 (Corridor), 692.0-C12 (Secondary Alarm Station Room), 708.0-C1 (Unit 1 Auxiliary Instrument Room), 708.0-C2 (Corridor), 708.0-C3 (Computer Room), 708.0-C4 (Unit 2 Auxiliary Instrument Room), 729.0-C1 (Cable Spreading Room), 755.0-C1 (Mechanical Equipment Room), 755.0-C2 (Women's Restroom), 755.0-C3 (Corridor including space above Operations Office and living area), 755.0-C4 (Kitchen), 755.0-C5 (Toilet), 755.0-C6 (Locker Room), 755.0-C7 (Shower), 755.0-C8 (Shower), 755.0-C9 (Conference Room), 755.0-C10 (Shift Manager's Office), 755.0-C12 (Main Control Room), 755.0-C13 (Relay Room), 755.0-C14 (Technical Support Center), 755.0-C15 (Corridor), 755.0-C16 (Conference Room), 755.0-C17 (Telephone Room), 755.0-C18 (NRC Office), 755.0-C19 (Corridor), 755.0-C20 (DPSO Shop), and CB Roof (Control Building Roof). Based on the WBN Fire Protection Report, fire in this analysis volume could affect the offsite AC power supply to Trains 1A, 1B 2A, and 2B. Emergency onsite power supply, however, is available.

Stair C1, Stair C2, and Rooms 692.0-C1, 692.0-C2, 692.0-C3, 692.0-C4, 708.0-C1, 755.0-C1, 755.0-C2, 755.0-C3, 755.0-C4, 755.0-C5, 755.0-C6, 755.0-C7, 755.0-C8, 755.0-C9, 755.0-C10, and 755.0-C14 were not considered in the WBN2 IPEEE completed in November 2014 because these fire compartments do not contain Unit 2 equipment and are not relevant to the Unit 2 operation. Fires in these areas would not result in a Unit 2 fire-induced initiating event and would not affect the Unit 2 safe shutdown capability. CB Roof was screened in the Phase I FIVE analysis of the WBN2 IPEEE completed in November 2014. Even with the changes in the EDG maintenance unavailability due to the extended EDG Completion Time of 14 days, these rooms would still not be considered in the WBN2 IPEEE fire analysis or would still be screened in the Phase I FIVE analysis.

Rooms 692.0-C5, 692.0-C6, 692.0-C7, 692.0-C8, 692.0-C9, 692.0-C10, 692.0-C11, 692.0-C12, 708.0-C2, 708.0-C3, 708.0-C4, 729.0-C1, 755.0-C12, 755.0-C13, and 755.0-C20 were screened in Phase II.3 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDFs for these areas are 1.27 x 10^{-7} for 692.0-C5, 7.84 x 10^{-8} for 692.0-C6, 7.84 x 10^{-8} for 692.0-C7, 1.76 x 10^{-7} for 692.0-C8, 1.89 x 10^{-7} for 692.0-C9, 1.21 x 10^{-7} for 692.0-C10, 5.39 x 10^{-8} for 692.0-C11, 9.18 x 10^{-8} for 692.0-C12, 3.79 x 10^{-8} for 708.0-C2, 1.76 x 10^{-7} for 708.0-C3, 7.60 x 10^{-7} for 708.0-C4, 6.87 x 10^{-7} for 729.0-C1, 9.61 x 10^{-7} for 755.0-C12, and 2.38 x 10^{-7} for 755.0-C13 in conjunction with 755.0-C20, which are all below the FIVE screening criterion of 10^{-6}.

Additionally, these screening CDFs were re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. Where the re-quantified screening CDF is greater than 10^{-6}, a screening ICCDP is also calculated. The resulting fire related screening CDFs and selected ICCDPs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF (Screening ICCDP)					
692.0-C5	1.27E-07	1.27E-07	1.27E-07	1.27E-07	1.27E-07
692.0-C6	7.84E-08	7.84E-08	7.84E-08	7.85E-08	7.84E-08
692.0-C7	7.84E-08	7.84E-08	7.84E-08	7.85E-08	7.84E-08
692.0-C8	1.76E-07	1.76E-07	1.76E-07	1.76E-07	1.76E-07
692.0-C9	1.89E-07	1.89E-07	1.89E-07	1.89E-07	1.89E-07
692.0-C10	1.21E-07	1.21E-07	1.21E-07	7.65E-07	1.49E-07
692.0-C11	5.39E-08	5.39E-08	5.39E-08	5.39E-08	5.39E-08
692.0-C12	9.18E-08	9.18E-08	9.18E-08	9.19E-08	9.18E-08
708.0-C2	3.79E-08	3.79E-08	3.79E-08	3.79E-08	3.79E-08
708.0-C3	1.76E-07	1.76E-07	1.77E-07	1.38E-06 (4.62E-08)	2.35E-07
708.0-C4	7.60E-07	7.60E-07	7.64E-07	5.93E-06 (1.98E-07)	1.01E-06 (9.61E-09)

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
729.0-C1	6.87E-07	6.87E-07	6.87E-07	6.87E-07	6.87E-07
755.0-C12	9.61E-07	9.61E-07	9.61E-07	9.62E-07	9.61E-07
755.0-C13 & C20	2.38E-07	1.22E-06 (3.76E-08)	1.24E-06 (3.85E-08)	3.94E-06 (1.42E-07)	1.99E-06 (6.74E-08)

As can be seen in the above table, most CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}. Where the re-quantified CDFs are greater than 10^{-6}, the corresponding ICCDPs are all below the ICCDP criterion of 10^{-6}.

3.5.6.2 EDGs 1B-B and 2B-B Protected

In Table 11, the analysis volumes in which the EDGs 1B-B and 2B-B are protected include AV-036, AV-042, AV-042D, AV-042E, AV-042F, AV-042G, AV-044, AV-048, AV-056, AV-062, AV-066D, AV-066F, AV-071, AV-075, and AV-076. These analysis volumes are located inside Fire Areas 14, 17, 19, 23, 30, 35, 39, 44, 47, and 48. The evaluation of the fire compartments encompassed in these analysis volumes is discussed in the following by fire area.

Fire Area 14

Analysis Volume AV-036 in Fire Area 14 contains fire zones 737.0-A1A (Auxiliary Building, Column Lines Q-U1/A1-A6) and 737.0-A1AN (Auxiliary Building, Column Lines Q-U1/A6-A8), as well as Rooms 737.0-A2 (Hot Instrument Shop) and 737.0-A4 (Air Lock). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1A and Train 2A onsite emergency AC power supply. In addition, the offsite power to Trains 1A and 2A may be affected. Offsite power supply is available to Train 1B and onsite emergency power supply is available to Train 2B. Fire Zones 737.0-A1A and 737.0-A1AN were evaluated as part of Room 737.0-A1, which was screened in Phase II.3 of the WBN2 IPEEE completed in November 2014. As described previously, the evaluation of Room 737.0-A1 was subdivided into three areas: 737.0-A1A, 737.0-A1B, and 737.0-A1C. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the calculated screening CDFs for these fire zones in Analysis Volume AV-038 are 4.12×10^{-7}, 2.58×10^{-7}, and 3.46×10^{-7}, respectively, which are below the FIVE screening criterion of 10^{-6}. Additionally, these screening CDFs were re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. Where the re-quantified screening CDF is greater than 10^{-6}, a screening ICCDP is also calculated. The resulting fire related screening CDFs and selected ICCDPs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF (Screening ICCDP)					
737.0-A1A	4.12E-07	4.12E-07	5.58E-07	1.31E-06 (3.45E-08)	1.83E-06 (5.43E-08)
737.0-A1B	2.58E-07	2.58E-07	3.49E-07	8.21E-07	1.14E-06 (3.40E-08)
737.0-A1C	3.46E-07	3.46E-07	4.69E-07	1.10E-06 (2.90E-08)	1.54E-06 (4.56E-08)

As can be seen in the above table, majority of the CDFs re-quantified with one EDG out of service are still below the IPEEE screening criteria of 10^{-6}. Where the re-quantified CDFs are greater than 10^{-6}, the corresponding ICCDPs are all below the ICCDP criterion of 10^{-6}.

Rooms 737.0-A2 and 737.0-A4 were not considered in the WBN2 IPEEE completed in November 2014 because these fire compartments do not contain Unit 2 equipment and are not relevant to the Unit 2 operation. Fires in these areas would not result in a Unit 2 fire-induced initiating event and would not affect the Unit 2 safe shutdown capability.

Fire Area 17

Analysis Volume AV-042 in Fire Area 17 contains Rooms 757.0-A2 (6.9-kV and 480V Shutdown Board Room A) and 757.0-A9 (Unit 1 Personnel and Equipment Access). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1A and Train 2A onsite emergency AC power supply. In addition, offsite power could be affected. Emergency onsite power supply is however available to Trains 1B and 2B. These compartments were screened in Phase II.3 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDFs for these two rooms are 2.21×10^{-7} and 6.35×10^{-8}, respectively, which are below the FIVE screening value of 10^{-6}. Additionally, these screening CDFs were re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. Where the re-quantified screening CDF is greater than 10^{-6}, a screening ICCDP is also calculated. The resulting fire related screening CDFs and selected ICCDP for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF (Screening ICCDP)					
757.0-A2	2.21E-07	4.99E-07	5.54E-07	1.95E-06 (6.65E-08)	1.00E-06 (2.99E-08)
757.0-A9	6.35E-08	1.47E-07	1.63E-07	5.38E-07	2.95E-07

As can be seen in the above table, most CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}. Where the re-quantified CDF is greater than 10^{-6}, the corresponding ICCDP is also below the ICCDP criterion of 10^{-6}.

Analysis Volumes AV-042D, AV-042E, AV-042F, and AV-042G in this fire area are also defined to contain Rooms 757.0-A2 and 757.0-A9. As such, the fire evaluations for these analysis volumes are the same as that for Analysis Volume AV-042.

Fire Area 19

Analysis Volume AV-044 in Fire Area 19 contains Room 757.0-A4 (125V Vital Battery Board Room I). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1A and Train 2A offsite AC power supply. Offsite power is available to Trains 1B and 2B. This compartment was screened in Phase II.2 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDF for this compartment is 8.50×10^{-7}, which is below the FIVE screening criterion of 10^{-6}. Additionally, this screening CDF was re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. The resulting fire related screening CDFs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF					
757.0-A4	8.50E-07	8.50E-07	8.50E-07	8.50E-07	8.67E-07

As can be seen in the above table, all of the CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}.

Fire Area 23

Analysis Volume AV-048 in Fire Area 23 contains Room 757.0-A27 (Auxiliary Control Instrument Room 2A). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1A and Train 2A offsite AC power supply. Offsite power is available to Trains 1B and 2B. However, based on the detailed cable/circuit failure evaluation performed in the WBN2 FIVE analysis, offsite AC power supply is actually available to all four trains (1A, 1B, 2A, and 2B). This compartment was screened in Phase II.2 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDF for this compartment is 3.18 x 10^{-7}, which is below the FIVE screening criterion of 10^{-6}. Additionally, this screening CDF was re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. The resulting fire induced screening CDFs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF					
757.0-A27	3.18E-07	3.18E-07	3.18E-07	3.18E-07	3.18E-07

As can be seen in the above table, all of the CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}.

Fire Area 30

Analysis Volume AV-056 in Fire Area 30 contains Room 757.0-A23 (125V Vital Battery Board Room III). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1A and Train 2A offsite AC power supply. Offsite power is available to Trains 1B and 2B. This compartment was screened in Phase II.2 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDF for this compartment is 1.70 x 10^{-7}, which is below the FIVE screening criterion of 10^{-6}. Additionally, this screening CDF was re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. The resulting fire related screening CDFs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF					
757.0-A23	1.70E-07	1.70E-07	1.70E-07	1.70E-07	1.72E-07

As can be seen in the above table, all of the CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}.

Fire Area 35

Analysis Volume AV-062 in Fire Area 35 contains Room 772.0-A4 (125V Vital Battery Room I). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1A and Train 2A offsite AC power supply. Offsite power is available for Trains 1B and 2B. However, based on the detailed cable/circuit failure evaluation performed in the WBN2 FIVE analysis, offsite AC power supply is actually available to all four trains (1A, 1B, 2A, and 2B). The compartment in this analysis volume was screened in Phase II.2 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDF for this area is 2.34 x 10^{-8}, which is below the FIVE screening criterion of 10^{-6}. Additionally, this screening CDF was re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. The resulting fire related screening CDFs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF					
772.0-A4	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08

As can be seen in the above table, all of the CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}.

Fire Area 39

Analysis Volumes AV-066D and AV-066F in Fire Area 39 contain Room 772.0-A8 (Fifth Vital Battery and Board Room). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1B and Train 2B offsite AC power supply. Offsite power is available to Trains 1A and 2A. However, based on the detailed cable/circuit failure evaluation performed in the WBN2 FIVE analysis, offsite AC power supply is actually available to all four trains (1A, 1B, 2A, and 2B). The evaluation of the compartment in these analysis volumes was described previously for Analysis Volumes AV-066E and AV-066F.

Fire Area 44

Analysis Volume AV-071 in Fire Area 44 contains Room 772.0-A14 (125V Vital Battery Room III). Based on the WBN Fire Protection Report, fire in this analysis volume could affect Train 1A and Train 2A offsite AC power supply. Offsite power is available for Trains 1B and 2B. However, based on the detailed cable/circuit failure evaluation performed in the WBN2 FIVE analysis, offsite AC power supply is actually available to all four trains (1A, 1B, 2A, and 2B). The compartment in this analysis volume was screened in Phase II.2 of the WBN2 IPEEE completed in November 2014. Using the most current EDG maintenance unavailability (with unavailability duration data through December 31, 2014), the updated screening CDF for this area is 5.82 x 10^{-8}, which is below the FIVE screening criterion of 10^{-6}. Additionally, this screening CDF was re-quantified assuming that one of the four EDGs is also out of service due to planned maintenance. The resulting fire related screening CDFs for these cases with one EDG out of service are shown in the following table:

Area	14-Day AOT Base Case	14-Day AOT DG 1A OOS	14-Day AOT DG 1B OOS	14-Day AOT DG 2A OOS	14-Day AOT DG 2B OOS
Screening CDF					
772.0-A14	5.82E-08	5.82E-08	5.82E-08	5.82E-08	5.97E-08

As can be seen in the above table, all of the CDFs re-quantified with one EDG out of service are still below the IPEEE screening criterion of 10^{-6}.

Fire Area 47

The evaluation of rooms contained in Analysis Volume AV-075 was described previously in Section 3.5.2.1.

Fire Area 48

The evaluation of rooms contained in Analysis Volume AV-076 was described previously in Section 3.5.2.1.

3.5.6.3 Summary of WBN Unit 2 Fire Considerations

The evaluations of the relevant WBN2 fire areas demonstrate that the CDF risk increase due to severe fire is small. The annual, average CDF for the 14-day AOT case is below the FIVE screening criteria for all of the areas evaluated. There are nine rooms where the probability of a severe fire while a specific emergency diesel generator is out of service for maintenance could cause the fire related CDF to exceed the IPEEE screening criteria. These rooms are 737.0-A1 (selected areas in Auxiliary Building, Elevation 737.0), 757.0-A22 (125V Vital Battery Board Room IV), 757.0-A24 (6.9-kV and 480V Shutdown Board Room B), 772.0-A2 (480V Board Room 1-B), 786.0-AR (Roof), 708.0-C3 (Computer Room), 708.0-C4 (Unit 2 Auxiliary Instrument Room), 755.0-C13 and C20 (Relay Room and DPSO Shop), and 757.0-A2 (6.9-kV and 480V Shutdown Board Room A). The actual frequency of a severe fire in these rooms is low and fire in these rooms would probably be detected before they would become severe. For example, the 6.9-kV and 480V Shutdown Board Rooms A and B are located close to the main control room and personnel traverse these areas frequently. Personnel are also required to enter the 480V board room at least twice a shift. Furthermore, the fire related ICCDPs calculated for these rooms given an EDG out of service for maintenance are all below the ICCDP criterion of 10^{-6}. This is because the likelihood of a fire during the time when the EDG is out of service for maintenance is very low. It must be noted that, although the ICCDP criterion of 10^{-6} specified in RG 1.117 is meant to be applied on an overall unit basis, it is used in this evaluation due to the screening nature of the FIVE methodology.

3.6 Other External Events

As shown in the Watts Bar IPEEEs for both Unit 1 and Unit 2, the severe accident risk resulting from other external hazards is extremely low. Therefore, no additional evaluation of the other external hazards leading to the loss of offsite power and/or emergency diesel generators is performed in this analysis.

4. Avoidance of Risk Significant Configurations

The online work management processes described in Section 5 are designed to facilitate the avoidance of risk significant configurations during equipment maintenance. As described in Section 5, equipment is removed from service at WBN using a 13-week schedule and according to the guidelines established by NPG-SPP-09.11.1 (Reference 16). These guidelines limit the equipment that can be electively removed from service concurrent with one EDG.

NPG-SPP-09.11.1 applies to activities that render a system/component unavailable. The risk assessment specified in NPG-SPP-09-11.1 considers quantitative assessment, qualitative (deterministic) assessment, or a combination of both. For both WBN Unit 1 and Unit 2, quantitative risk assessment is performed using the EPRI Equipment Out of Service Risk Monitor (EOOS) software for those activities that could impact the equipment or configurations modeled in the WBN PRA. The online EOOS model is based on the WBN's Internal Events Full Power PRA Model and may be used to determine risk in Modes 1 and 2. Quantitative risk information provided by the at-power EOOS model is considered as one input to a blended approach to risk management that includes deterministic information, operating experience, engineering judgment, and management standards.

The color shown on the EOOS risk meter represents the CDF and LERF risk colors for the unit configuration for a period of seven days. Each of the color risk thresholds are defined below:

- Green – an acceptable risk threshold and requires no risk management actions.
- Yellow – an increased level of risk. Establish risk management actions per NUMARC 93-01.
- Orange – an increased level of risk above Yellow. Entry into the orange threshold should be infrequent. Establish risk management actions per NUMARC 93-01. In addition, TVA management expectations are to ensure protective measures are established; e.g., rope and stanchions around vital equipment.
- Red – a high risk threshold.

For activities that cannot be analyzed quantitatively, qualitative assessment is performed, which may include:

- Technical specification requirements.
- Redundancy available for performance of the safety function served by the out of service system or component.
- Duration of the activity.

- The likelihood of an initiating event that would require the performance of the affected safety function.
- The likelihood that the activity will increase the frequency of an initiating event.
- Component or system dependencies.
- Performance issues for the in-service redundant components/trains.
- The risk of performing the maintenance at power compared to the risk of performing the maintenance during shutdown conditions.
- The impact of transition risk if the maintenance activity would require a shutdown that would otherwise not be necessary.
- Whether the out of service component could be restored to service in an emergent accident situation.

4.1 Risk Assessment of EDG Removal from Service

As described previously for the risk management process, the effectiveness of maintenance on the EDGs and support system is monitored pursuant to the Maintenance Rule (10 CFR 50.65), which requires licensees to assess and manage the increase in risk that may result from proposed maintenance activities before performing such activities. Thus, before performing maintenance activities on an EDG during the requested extended AOT, TVA will, pursuant to 10 CFR 50.65(a)(4), assess and manage any increase in risk that may result from such activities. This assessment is performed in accordance with the configuration risk management process as described in the NPG-SPP-07.3 (Reference 17) and NPG-SPP-09.11.1 (Reference 16) that implements 10 CFR 50.65. This ensures that PRA-informed processes are in place to assess the overall impact of maintenance activities on plant risk before entering the LCO action statement for planned activities.

4.2 Risk Significant Configurations

This subsection discusses the review of the model results from the EDG maintenance evaluation for equipment which should not be removed from service concurrently with an EDG. If necessary, additional compensatory measures may also be implemented to reduce risk during periods of extended EDG unavailability.

As part of the tier 2 evaluation, high-risk configurations are identified for the period of time when the out-of-service component is unavailable. To accomplish this, the basic event importance reports are generated. High-ranking basic events are then identified and correlated to high-risk configurations for each case using the risk achievement worth (RAW) measures and Fussell-Vesely importance (FVI) rankings. The use of the RAW ranking provides indication on the high risk equipment items that should not be arbitrarily removed from service for preventive maintenance concurrently with EDG unavailability. Because of the consideration of both failure likelihood and the consequence, the FVI ranking provides information on the potential equipment failures while EDG is unavailable that should be considered for risk control and management.

The top 10 equipment-related basic events with the greatest RAW to CDF are provided in Tables 12 and 13 for WBN Unit 1 and Unit 2, respectively. Ten cases are included in each of these two tables: 72-Hour AOT Base Case, 14-Day AOT Case, 14-Day AOT with One EDG (i.e., 1A-A, 1B-B, 2A-A, and 2B-B) Out of Service in Planned Preventive Maintenance, and 14-Day AOT with One EDG in Unplanned Corrective Maintenance. Similarly, the top 10 equipment-related basic events with the greatest FVI to CDF are provided in Tables 14 and 15 for WBN Unit 1 and Unit 2, respectively. Ten cases are included in each of these two tables: 72-Hour AOT Base Case, 14-Day AOT Case, 14-Day AOT with One EDG (i.e., 1A-A, 1B-B, 2A-A, and 2B-B) Out of Service in Planned Preventive Maintenance, and 14-Day AOT with One EDG in Unplanned Corrective Maintenance.

Based on these tables, there is no significant difference in the time-averaged rankings when the 14-day Completion Time is assumed versus the base case of 72-hour Completion Time. It must be noted that the rankings for cases with one EDG out of service for maintenance are not symmetrical partly because power recovery using the 3-MW FLEX diesel generators and bus cross-connection is only considered for 6.9-kV Shutdown Board 1A and 2A.

Using information contained in and insights derived from Tables 12 through 15, appropriate restrictions on plant operation (i.e., not taking selected equipment out of service concurrently with the EDGs) will be developed, defined, and controlled in the TVA risk management procedure for equipment out of service.

Table 12. WBN1 Equipment-Related Event Importance by RAW to CDF

RAW Ranking	72-Hour AOT	14-Day AOT	14-D AOT EDG 1A-A in PM	14-D AOT EDG 1B-B in PM	14-D AOT EDG 2A-A in PM	14-D AOT EDG 2B-B in PM	14-D AOT EDG 1A-A in CM	14-D AOT EDG 1B-B in CM	14-D AOT EDG 2A-A in CM	14-D AOT EDG 2B-B in CM
1	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)
2	SMPPS1STN_SUM P2 (SUMP SUCTION STRAINERS PLUGGED)	SMPPS1STN_SUMP2 (SUMP SUCTION STRAINERS PLUGGED)	SMPPS1STN_SUMP2 (SUMP SUCTION STRAINERS PLUGGED)	XRFFR1OXF_212A2 -A (WBN-1-OXF-212-A2-A TRANSFORMER FAILS DURING OPERATION)	SMPPS1STN_SUMP 2 (SUMP SUCTION STRAINERS PLUGGED)	BUSFR1BD__211A-A (WBN-1-BD-211-A SHUTDOWN BOARD FAILS)	SMPPS1STN_SUMP 2 (SUMP SUCTION STRAINERS PLUGGED)	XRFFR1OXF_212A2 -A (WBN-1-OXF-212-A2-A TRANSFORMER FAILS DURING OPERATION)	SMPPS1STN_SUMP 2 (SUMP SUCTION STRAINERS PLUGGED)	BUSFR1BD__211A-A (WBN-1-BD-211-A SHUTDOWN BOARD FAILS)
3	BUSFR1BD__211A-A (WBN-1-BD-211-A SHUTDOWN BOARD FAILS)	BUSFR1BD__211A-A (WBN-1-BD-211-A SHUTDOWN BOARD FAILS)	BUSFR1BD__211A-A (WBN-1-BD-211-A SHUTDOWN BOARD FAILS)	BUSFR1BD__212A2 -A (WBN-1-BD-212-A002-A SWITCHBOARD FAILS DURING OPERATION)	BUSFR1BD__211A-A (WBN-1-BD-211-A SHUTDOWN BOARD FAILS)	BUSFR0BDL__2361-D (BUS FAILS TO OPERATE OVER REMAINDER OF 24 HOUR MISSION TIME (20 HOURS))	BUSFR1BD__211A-A (WBN-1-BD-211-A SHUTDOWN BOARD FAILS)	BUSFR1BD__212A2 -A (WBN-1-BD-212-A002-A SWITCHBOARD FAILS DURING OPERATION)	BUSFR1BD__211A-A (WBN-1-BD-211-A SHUTDOWN BOARD FAILS)	BUSFR0BDL__2361-D (BUS FAILS TO OPERATE OVER REMAINDER OF 24 HOUR MISSION TIME (20 HOURS))
4	XRFFR1OXF_212A 1-A (6.9 kV TO 480V TRANSFORMER 1A1-A (XFMR 1A1-A))	XRFFR1OXF_212A1-A (6.9 kV TO 480V TRANSFORMER 1A1-A (XFMR 1A1-A))	CKRRI0CKV_0670503F (DISCHARGE CHECK VALVE 503F GROSS REVERSE LEAKAGE WBN-0-67-503F)	CBKXO1BKR_2121A -A (WBN-1-BKR-212-A2-A BREAKER TRANSFERS OPEN)	XRFFR1OXF_212A1 -A (6.9 kV TO 480V TRANSFORMER 1A1-A (XFMR 1A1-A))	BUSFR0BD__2361-D (Failure of 125V DC Battery Board 1)	CKRRI0CKV_067050 3F (DISCHARGE CHECK VALVE 503F GROSS REVERSE LEAKAGE WBN-0-67-503F)	CBKXO1BKR_2121A -A (WBN-1-BKR-212-A2-A BREAKER TRANSFERS OPEN)	XRFFR1OXF_212A1 -A (6.9 kV TO 480V TRANSFORMER 1A1-A (XFMR 1A1-A))	BUSFR0BD__2361-D (Failure of 125V DC Battery Board 1)
5	BUSFR1BD__212A1 -A (480V SHUTDOWN BOARD 1A1-A BUS)	BUSFR1BD__212A1-A (480V SHUTDOWN BOARD 1A1-A BUS)	CKRRI0CKV_0670503H (DISCHARGE CHECK VALVE 503H GROSS REVERSE LEAKAGE WBN-0-67-503H)	CBKXO1BKR_212A2 /1B-A (WBN-1-BKR-212-A2/1B-A BREAKER TRANSFERS OPEN)	BUSFR1BD__212A1 -A (480V SHUTDOWN BOARD 1A1-A BUS)	BCHFR0CHRG2361-D (WBN-0-CHRG-236-0001-D BATTERY CHARGER FAILS)	CKRRI0CKV_067050 3H (DISCHARGE CHECK VALVE 503H GROSS REVERSE LEAKAGE WBN-0-67-503H)	CBKXO1BKR_212A2 /1B-A (WBN-1-BKR-212-A2/1B-A BREAKER TRANSFERS OPEN)	BUSFR1BD__212A1 -A (480V SHUTDOWN BOARD 1A1-A BUS)	BCHFR0CHRG2361-D (WBN-0-CHRG-236-0001-D BATTERY CHARGER FAILS)
6	CBKXO1BKR_212A 1/1B-A (TRANSFORMER OUTPUT TO 480V SDBD 1A1-A (1-BKR-212-A1/1B-A) TRANSFERS OPEN)	CBKXO1BKR_212A1/1B-A (TRANSFORMER OUTPUT TO 480V SDBD 1A1-A (1-BKR-212-A1/1B-A) TRANSFERS OPEN)	XRFFR1OXF_212A1-A (6.9 kV TO 480V TRANSFORMER 1A1-A (XFMR 1A1-A))	BUSFR1BD__211A-A (WBN-1-BD-211-A SHUTDOWN BOARD FAILS)	CBKXO1BKR_212A1 /1B-A (TRANSFORMER OUTPUT TO 480V SDBD 1A1-A (1-BKR-212-A1/1B-A) TRANSFERS OPEN)	CBKXO0BKR_2361/226-D (Normal Supply Breaker 226 from 125V Vital Batt Chgr 1)	XRFFR1OXF_212A1 -A (6.9 kV TO 480V TRANSFORMER 1A1-A (XFMR 1A1-A))	BUSFR1BD__211A-A (WBN-1-BD-211-A SHUTDOWN BOARD FAILS)	CBKXO1BKR_212A1 /1B-A (TRANSFORMER OUTPUT TO 480V SDBD 1A1-A (1-BKR-212-A1/1B-A) TRANSFERS OPEN)	CBKXO0BKR_2361/226-D (Normal Supply Breaker 226 from 125V Vital Batt Chgr 1)
7	CBKXO1BKR_212A 1-A (6.9 kV SUPPLY TO TRANSFORMER 1A-A (1-BKR-212-A1-A) TRANSFERS OPEN)	CBKXO1BKR_212A1-A (6.9 kV SUPPLY TO TRANSFORMER 1A-A (1-BKR-212-A1-A) TRANSFERS OPEN)	BUSFR1BD__212A1-A (480V SHUTDOWN BOARD 1A1-A BUS)	BUSFR0BDL__2361-D (BUS FAILS TO OPERATE OVER REMAINDER OF 24 HOUR MISSION TIME (20 HOURS))	CBKXO1BKR_212A1 -A (6.9 kV SUPPLY TO TRANSFORMER 1A-A (1-BKR-212-A1-A) TRANSFERS OPEN)	CBKXO0SW__2361/SW1-S (480V AC Vital Disconnect Panel 1 Switch 0-SW-236-0001/SW1-S Transfers Open)	BUSFR1BD__212A1 -A (480V SHUTDOWN BOARD 1A1-A BUS)	BUSFR0BDL__2361-D (BUS FAILS TO OPERATE OVER REMAINDER OF 24 HOUR MISSION TIME (20 HOURS))	CBKXO1BKR_212A1 -A (6.9 kV SUPPLY TO TRANSFORMER 1A-A (1-BKR-212-A1-A) TRANSFERS OPEN)	CBKXO0SW__2361/SW1-S (480V AC Vital Disconnect Panel 1 Switch 0-SW-236-0001/SW1-S Transfers Open)
8	XRFFR1OXF_212A 2-A (WBN-1-OXF-212-A2-A TRANSFORMER FAILS DURING OPERATION)	XRFFR1OXF_212A2-A (WBN-1-OXF-212-A2-A TRANSFORMER FAILS DURING OPERATION)	CBKXO1BKR_212A1/1B -A (TRANSFORMER OUTPUT TO 480V SDBD 1A1-A (1-BKR-212-A1/1B-A) TRANSFERS OPEN)	BUSFR0BD__2361-D (Failure of 125V DC Battery Board 1)	XRFFR1OXF_212A2 -A (WBN-1-OXF-212-A2-A TRANSFORMER FAILS DURING OPERATION)	XRFFR1OXF_212A1 -A (6.9 kV TO 480V TRANSFORMER 1A1-A (XFMR 1A1-A))	CBKXO1BKR_212A1 /1B-A (TRANSFORMER OUTPUT TO 480V SDBD 1A1-A (1-BKR-212-A1/1B-A) TRANSFERS OPEN)	BUSFR0BD__2361-D (Failure of 125V DC Battery Board 1)	XRFFR1OXF_212A2 -A (WBN-1-OXF-212-A2-A TRANSFORMER FAILS DURING OPERATION)	FUSFP0FU__2361/210-D (SUPPLY BREAKER MAIN LINE FUSE 210)

Table 12. WBN1 Equipment-Related Event Importance by RAW to CDF (Continued)

RAW Ranking	72-Hour AOT	14-Day AOT	14-D AOT EDG 1A-A in PM	14-D AOT EDG 1B-B in PM	14-D AOT EDG 2A-A in PM	14-D AOT EDG 2B-B in PM	14-D AOT EDG 1A-A in CM	14-D AOT EDG 1B-B in CM	14-D AOT EDG 2A-A in CM	14-D AOT EDG 2B-B in CM
9	BUSFR1BD__212A2 -A (WBN-1-BD-212-A002-A SWITCHBOARD FAILS DURING OPERATION)	BUSFR1BD__212A2-A (WBN-1-BD-212-A002-A SWITCHBOARD FAILS DURING OPERATION)	CBKXO1BKR_212A1-A (6.9 kV SUPPLY TO TRANSFORMER 1A-A (1-BKR-212-A1-A) TRANSFERS OPEN)	BCHFR0CHRG2361-D (WBN-0-CHRG-236-0001-D BATTERY CHARGER FAILS)	BUSFR1BD__212A2 -A (WBN-1-BD-212-A002-A SWITCHBOARD FAILS DURING OPERATION)	FUSFP0FU__2361/2 10-D (SUPPLY BREAKER MAIN LINE FUSE 210)	CBKXO1BKR_212A1 -A (6.9 kV SUPPLY TO TRANSFORMER 1A-A (1-BKR-212-A1-A) TRANSFERS OPEN)	BCHFR0CHRG2361-D (WBN-0-CHRG-236-0001-D BATTERY CHARGER FAILS)	BUSFR1BD__212A2 -A (WBN-1-BD-212-A002-A SWITCHBOARD FAILS DURING OPERATION)	XRFFR1OXF_212A1 -A (6.9 kV TO 480V TRANSFORMER 1A1-A (XFMR 1A1-A))
10	CBKXO1BKR_2121 A-A (WBN-1-BKR-212-A2-A BREAKER TRANSFERS OPEN)	CBKXO1BKR_2121A-A (WBN-1-BKR-212-A2-A BREAKER TRANSFERS OPEN)	XRFFR1OXF_212A2-A (WBN-1-OXF-212-A2-A TRANSFORMER FAILS DURING OPERATION)	CBKXO0BKR_2361/ 226-D (Normal Supply Breaker 226 from 125V Vital Batt Chgr 1)	CBKXO1BKR_2121A -A (WBN-1-BKR-212-A2-A BREAKER TRANSFERS OPEN)	BUSFR1BD__212A1 -A (480V SHUTDOWN BOARD 1A1-A BUS AVAILABLE (WBN-1-BD -212-A001 -A))	XRFFR1OXF_212A2 -A (WBN-1-OXF-212-A2-A TRANSFORMER FAILS DURING OPERATION)	CBKXO0BKR_2361/ 226-D (Normal Supply Breaker 226 from 125V Vital Batt Chgr 1)	CBKXO1BKR_2121A -A (WBN-1-BKR-212-A2-A BREAKER TRANSFERS OPEN)	BUSFR1BD__212A1 -A (480V SHUTDOWN BOARD 1A1-A BUS AVAILABLE (WBN-1-BD -212-A001 -A))

Table 13. WBN2 Equipment-Related Event Importance by RAW to CDF

RAW Ranking	72-Hour AOT	14-Day AOT	14-D AOT EDG 1A-A in PM	14-D AOT EDG 1B-B in PM	14-D AOT EDG 2A-A in PM	14-D AOT EDG 2B-B in PM	14-D AOT EDG 1A-A in CM	14-D AOT EDG 1B-B in CM	14-D AOT EDG 2A-A in CM	14-D AOT EDG 2B-B in CM
1	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)
2	SMPPS2STN_SUMP2 (SUMP SUCTION STRAINERS PLUGGED)	SMPPS2STN_SUMP2 (SUMP SUCTION STRAINERS PLUGGED)	SMPPS2STN_SUMP2 (SUMP SUCTION STRAINERS PLUGGED)	BUSFR2BD__211A-A (SHUTDOWN BOARD 2A-A FAILS (2-BD-211-A-A))	SMPPS2STN_SUMP2 (SUMP SUCTION STRAINERS PLUGGED)	XRFFR2OXF_212A2-A (6.9 kV/480V TRANSFORMER 2A2A (2-OXF-212-A002-A))	SMPPS2STN_SUMP2 (SUMP SUCTION STRAINERS PLUGGED)	BUSFR2BD__211A-A (SHUTDOWN BOARD 2A-A FAILS (2-BD-211-A-A))	SMPPS2STN_SUMP2 (SUMP SUCTION STRAINERS PLUGGED)	XRFFR2OXF_212A2-A (6.9 kV/480V TRANSFORMER 2A2A (2-OXF-212-A002-A))
3	BUSFR2BD__211A-A (SHUTDOWN BOARD 2A-A FAILS (2-BD-211-A-A))	BUSFR2BD__211A-A (SHUTDOWN BOARD 2A-A FAILS (2-BD-211-A-A))	BUSFR2BD__211A-A (SHUTDOWN BOARD 2A-A FAILS (2-BD-211-A-A))	BUSFR0BDL__2363-F (BUS FAILS TO OPERATE OVER REMAINDER OF 24 HOUR MISSION TIME (20 HOURS))	CKRRI0CKV_0670503F (DISCHARGE CHECK VALVE 503F GROSS REVERSE LEAKAGE WBN-0-67-503F)	BUSFR2BD__212A2-A (480V SHUTDOWN BOARD 2A2-A BUS FAILS TO OPERATE)	BUSFR2BD__211A-A (SHUTDOWN BOARD 2A-A FAILS (2-BD-211-A-A))	BUSFR0BDL__2363-F (BUS FAILS TO OPERATE OVER REMAINDER OF 24 HOUR MISSION TIME (20 HOURS))	CKRRI0CKV_0670503F (DISCHARGE CHECK VALVE 503F GROSS REVERSE LEAKAGE WBN-0-67-503F)	BUSFR2BD__212A2-A (480V SHUTDOWN BOARD 2A2-A BUS FAILS TO OPERATE)
4	XRFFR2OXF_212A2-A (6.9 kV/480V TRANSFORMER 2A2A (2-OXF-212-A002-A))	XRFFR2OXF_212A2-A (6.9 kV/480V TRANSFORMER 2A2A (2-OXF-212-A002-A))	TKURP2TANK00200229 (CS TANK A RUPTURES WBN-2-TK-2-229)	BUSFR0BD__2363-F (Failure of 125V DC Battery Board 3)	CKRRI0CKV_0670503H (DISCHARGE CHECK VALVE 503H GROSS REVERSE LEAKAGE WBN-0-67-503H)	CBKXO2BKR_212A2/1B-A (480V SDBD 2A2-A SUPPLY BREAKER (2-BKR-212-A2/1B-A) TRANSFERS OPEN)	TKURP2TANK00200229 (CS TANK A RUPTURES WBN-2-TK-2-229)	BUSFR0BD__2363-F (Failure of 125V DC Battery Board 3)	CKRRI0CKV_0670503H (DISCHARGE CHECK VALVE 503H GROSS REVERSE LEAKAGE WBN-0-67-503H)	CBKXO2BKR_212A2/1B-A (480V SDBD 2A2-A SUPPLY BREAKER (2-BKR-212-A2/1B-A) TRANSFERS OPEN)
5	BUSFR2BD__212A2-A (480V SHUTDOWN BOARD 2A2-A BUS FAILS TO OPERATE)	BUSFR2BD__212A2-A (480V SHUTDOWN BOARD 2A2-A BUS FAILS TO OPERATE)	HOCXC2ISV_00200504 (CS TANK A SUPPLY LINE VALVE TRANSFERS CLOSED WBN-2-2-504)	BCHFR0CHRG2363-F (CHARGER III FAILS DURING OPERATION (0-CHRG-236-0003/F))	BUSFR2BD__211A-A (SHUTDOWN BOARD 2A-A FAILS (2-BD-211-A-A))	CBKXO2BKR_212A2-A (6.9 kV SUPPLY TO 2A2A (2-BKR-212-A2-A) TRANSFERS OPEN)	HOCXC2ISV_00200504 (CS TANK A SUPPLY LINE VALVE TRANSFERS CLOSED WBN-2-2-504)	BCHFR0CHRG2363-F (CHARGER III FAILS DURING OPERATION (0-CHRG-236-0003/F))	BUSFR2BD__211A-A (SHUTDOWN BOARD 2A-A FAILS (2-BD-211-A-A))	CBKXO2BKR_212A2-A (6.9 kV SUPPLY TO 2A2A (2-BKR-212-A2-A) TRANSFERS OPEN)
6	CBKXO2BKR_212A2/1B-A (480V SDBD 2A2-A SUPPLY BREAKER (2-BKR-212-A2/1B-A) TRANSFERS OPEN)	CBKXO2BKR_212A2/1B-A (480V SDBD 2A2-A SUPPLY BREAKER (2-BKR-212-A2/1B-A) TRANSFERS OPEN)	HOCXC2ISV_00300800 (CS TANK A SUPPLY LINE VALVE TRANSFERS CLOSED WBN-2-3-800)	CBKXO0BKR_2363/226-F (Normal Supply Breaker 226 from 125V Vital Batt Chgr 3)	TKURP2TANK00200229 (CS TANK A RUPTURES WBN-2-TK-2-229)	BUSFR2BD__211A-A (SHUTDOWN BOARD 2A-A FAILS (2-BD-211-A-A))	HOCXC2ISV_00300800 (CS TANK A SUPPLY LINE VALVE TRANSFERS CLOSED WBN-2-3-800)	CBKXO0BKR_2363/226-F (Normal Supply Breaker 226 from 125V Vital Batt Chgr 3)	TKURP2TANK00200229 (CS TANK A RUPTURES WBN-2-TK-2-229)	BUSFR2BD__211A-A (SHUTDOWN BOARD 2A-A FAILS (2-BD-211-A-A))
7	CBKXO2BKR_212A2-A (6.9 kV SUPPLY TO 2A2A (2-BKR-212-A2-A) TRANSFERS OPEN)	CBKXO2BKR_212A2-A (6.9 kV SUPPLY TO 2A2A (2-BKR-212-A2-A) TRANSFERS OPEN)	XRFFR2OXF_212A2-A (6.9 kV/480V TRANSFORMER 2A2A (2-OXF-212-A002-A))	CBKXO0SW__2363/SW1-S (480V AC Vital Disconnect Panel III Switch 0-SW-236-0003/SW1-S Transfers Open)	HOCXC2ISV_00200504 (CS TANK A SUPPLY LINE VALVE TRANSFERS CLOSED WBN-2-2-504)	BUSFR0BDL__2363-F (BUS FAILS TO OPERATE OVER REMAINDER OF 24 HOUR MISSION TIME (20 HOURS))	XRFFR2OXF_212A2-A (6.9 kV/480V TRANSFORMER 2A2A (2-OXF-212-A002-A))	CBKXO0SW__2363/SW1-S (480V AC Vital Disconnect Panel III Switch 0-SW-236-0003/SW1-S Transfers Open)	HOCXC2ISV_00200504 (CS TANK A SUPPLY LINE VALVE TRANSFERS CLOSED WBN-2-2-504)	BUSFR0BDL__2363-F (BUS FAILS TO OPERATE OVER REMAINDER OF 24 HOUR MISSION TIME (20 HOURS))
8	BUSFR0BDL__2363-F (BUS FAILS TO OPERATE OVER REMAINDER OF 24 HOUR MISSION TIME (20 HOURS))	BUSFR0BDL__2363-F (BUS FAILS TO OPERATE OVER REMAINDER OF 24 HOUR MISSION TIME (20 HOURS))	BUSFR2BD__212A2-A (480V SHUTDOWN BOARD 2A2-A BUS FAILS TO OPERATE)	FUSFP0FU__2363/210-F (SUPPLY BREAKER MAIN LINE FUSE 210)	HOCXC2ISV_00300800 (CS TANK A SUPPLY LINE VALVE TRANSFERS CLOSED WBN-2-3-800)	BUSFR0BD__2363-F (Failure of 125V DC Battery Board 3)	BUSFR2BD__212A2-A (480V SHUTDOWN BOARD 2A2-A BUS FAILS TO OPERATE)	FUSFP0FU__2363/210-F (SUPPLY BREAKER MAIN LINE FUSE 210)	HOCXC2ISV_00300800 (CS TANK A SUPPLY LINE VALVE TRANSFERS CLOSED WBN-2-3-800)	BUSFR0BD__2363-F (Failure of 125V DC Battery Board 3)

Table 13. WBN2 Equipment-Related Event Importance by RAW to CDF (Continued)

RAW Ranking	72-Hour AOT	14-Day AOT	14-D AOT EDG 1A-A in PM	14-D AOT EDG 1B-B in PM	14-D AOT EDG 2A-A in PM	14-D AOT EDG 2B-B in PM	14-D AOT EDG 1A-A in CM	14-D AOT EDG 1B-B in CM	14-D AOT EDG 2A-A in CM	14-D AOT EDG 2B-B in CM
9	BUSFR0BD__2363-F (Failure of 125V DC Battery Board 3)	BUSFR0BD__2363-F (Failure of 125V DC Battery Board 3)	CBKXO2BKR_212A2/1B-A (480V SDBD 2A2-A SUPPLY BREAKER (2-BKR-212-A2/1B-A) TRANSFERS OPEN)	XRFFR2OXF_212A2-A (6.9 kV/480V TRANSFORMER 2A2A (2-OXF-212-A002-A))	XRFFR2OXF_212A2-A (6.9 kV/480V TRANSFORMER 2A2A (2-OXF-212-A002-A))	BCHFR0CHRG2363-F (CHARGER III FAILS DURING OPERATION (0-CHRG-236-0003/F))	CBKXO2BKR_212A2/1B-A (480V SDBD 2A2-A SUPPLY BREAKER (2-BKR-212-A2/1B-A) TRANSFERS OPEN)	XRFFR2OXF_212A2-A (6.9 kV/480V TRANSFORMER 2A2A (2-OXF-212-A002-A))	XRFFR2OXF_212A2-A (6.9 kV/480V TRANSFORMER 2A2A (2-OXF-212-A002-A))	BCHFR0CHRG2363-F (CHARGER III FAILS DURING OPERATION (0-CHRG-236-0003/F))
10	BCHFR0CHRG2363-F (CHARGER III FAILS DURING OPERATION (0-CHRG-236-0003/F))	BCHFR0CHRG2363-F (CHARGER III FAILS DURING OPERATION (0-CHRG-236-0003/F))	CBKXO2BKR_212A2-A (6.9 kV SUPPLY TO 2A2A (2-BKR-212-A2-A) TRANSFERS OPEN)	BUSFR2BD__212A2-A (480V SHUTDOWN BOARD 2A2-A BUS FAILS TO OPERATE)	BUSFR2BD__212A2-A (480V SHUTDOWN BOARD 2A2-A BUS FAILS TO OPERATE)	CBKXO0BKR_2363/226-F (Normal Supply Breaker 226 from 125V Vital Batt Chgr 3)	CBKXO2BKR_212A2-A (6.9 kV SUPPLY TO 2A2A (2-BKR-212-A2-A) TRANSFERS OPEN)	BUSFR2BD__212A2-A (480V SHUTDOWN BOARD 2A2-A BUS FAILS TO OPERATE)	BUSFR2BD__212A2-A (480V SHUTDOWN BOARD 2A2-A BUS FAILS TO OPERATE)	CBKXO0BKR_2363/226-F (Normal Supply Breaker 226 from 125V Vital Batt Chgr 3)

Table 14. WBN1 Equipment-Related Event Importance by FVI to CDF

FVI Ranking	72-Hour AOT	14-Day AOT	14-D AOT EDG 1A-A in PM	14-D AOT EDG 1B-B in PM	14-D AOT EDG 2A-A in PM	14-D AOT EDG 2B-B in PM	14-D AOT EDG 1A-A in CM	14-D AOT EDG 1B-B in CM	14-D AOT EDG 2A-A in CM	14-D AOT EDG 2B-B in CM
1	FNSFR1FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	FNSFR1FAN_030001 83 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	DGGFR1GEN_0821B-B (DG 1B-B FAILS TO RUN)	PTSF11PMP_00300 1AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	PCOFD1PMP_07000 51S （WBN-0-PMP-070-0051-S PUMP CS FAILS TO START ON DEMAND）	BCHFR0CHRG2361-D （WBN-0-CHRG-236-0001-D BATTERY CHARGER FAILS）	DGGFR1GEN_0821 B-B (DG 1B-B FAILS TO RUN)	PTSF11PMP_00300 1AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	PCOFD1PMP_07000 51S （WBN-0-PMP-070-0051-S PUMP CS FAILS TO START ON DEMAND）	BCHFR0CHRG2361-D （WBN-0-CHRG-236-0001-D BATTERY CHARGER FAILS）
2	RLVFO1RFV_06206 36 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	RLVFO1RFV_062063 6 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	PCOFD1PMP_0700051 S （WBN-0-PMP-070-0051-S PUMP CS FAILS TO START ON DEMAND）	BCHFR0CHRG2361-D （WBN-0-CHRG-236-0001-D BATTERY CHARGER FAILS）	DGGFR2GEN_0822 B-B （DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B)）	CBKFO1BKR_21117 16/16-A （WBN-1-BKR-211-1716/16-A BREAKER FAILS TO OPEN）	PTSF11PMP_00300 1AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	BCHFR0CHRG2361-D （WBN-0-CHRG-236-0001-D BATTERY CHARGER FAILS）	DGGFR2GEN_0822 B-B （DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B)）	CBKFO1BKR_21117 16/16-A （WBN-1-BKR-211-1716/16-A BREAKER FAILS TO OPEN）
3	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	PTSF11PMP_003001AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	CBKFO1BKR_21117 16/16-A （WBN-1-BKR-211-1716/16-A BREAKER FAILS TO OPEN）	DGGFR1GEN_0821 B-B (DG 1B-B FAILS TO RUN)	DGGFR1GEN_0821 A-A （DG 1A-A FAILS TO RUN）	PCOFD1PMP_07000 51S （WBN-0-PMP-070-0051-S PUMP CS FAILS TO START ON DEMAND）	CBKFO1BKR_21117 16/16-A （WBN-1-BKR-211-1716/16-A BREAKER FAILS TO OPEN）	DGGFR1GEN_0821 B-B (DG 1B-B FAILS TO RUN)	DGGFR1GEN_0821 A-A （DG 1A-A FAILS TO RUN）
4	PTSF11PMP_00300 1AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	PTSF11PMP_003001 AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	DGGFR2GEN_0822B-B （DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B)）	DGGFR1GEN_0821 A-A （DG 1A-A FAILS TO RUN）	FNSFR1FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	DGGFR1GEN_0821 B-B (DG 1B-B FAILS TO RUN)	DGGFR2GEN_0822 B-B （DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B)）	DGGFR1GEN_0821 A-A （DG 1A-A FAILS TO RUN）	FNSFR1FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	DGGFR1GEN_0821 B-B (DG 1B-B FAILS TO RUN)
5	DGGFR1GEN_0821 B-B (DG 1B-B FAILS TO RUN)	DGGFR1GEN_0821B-B (DG 1B-B FAILS TO RUN)	FNSFR1FAN_03000183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	XRFFR1OXF_212A2-A （WBN-1-OXF-212-A2-A TRANSFORMER FAILS DURING OPERATION）	RLVFO1RFV_06206 36 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	DGGFR2GEN_0822 A-A （DIESEL GENERATOR FAILS TO RUN AFTER FIRST HOUR）	DGGFR_0-DG-360-3A （FLEX Diesel Generator 0-DG-360-3A fails to run after first hour）	XRFFR1OXF_212A2-A （WBN-1-OXF-212-A2-A TRANSFORMER FAILS DURING OPERATION）	RLVFO1RFV_06206 36 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	DGGFR2GEN_0822 A-A （DIESEL GENERATOR FAILS TO RUN AFTER FIRST HOUR）
6	SRVSR1SRV_0680 0563 (SAFETY VALVE FAILS TO RESEAT AFTER STEAM RELIEF WBN-1-68-563)	CBKFO1BKR_211171 6/16-A (WBN-1-BKR-211-1716/16-A BREAKER FAILS TO OPEN)	RLVFO1RFV_0620636 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	PCOFD1PMP_07000 46A （WBN-1-PMP-070-0046-A PUMP 1A-A FAILS TO START ON DEMAND）	FNSFD1FAN_03000 183 （CCP 1A-A ROOM COOLING FAN FAILS TO START AND RUN DURING FIRST HOUR）	FNSFR1FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	FNSFR1FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	PCOFD1PMP_07000 46A （WBN-1-PMP-070-0046-A PUMP 1A-A FAILS TO START ON DEMAND）	FNSFD1FAN_03000 183 （CCP 1A-A ROOM COOLING FAN FAILS TO START AND RUN DURING FIRST HOUR）	FNSFR1FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)
7	SRVSR1SRV_0680 0564 (SAFETY VALVE FAILS TO RESEAT AFTER STEAM RELIEF WBN-1-68-564)	SRVSR1SRV_068005 63 (SAFETY VALVE FAILS TO RESEAT AFTER STEAM RELIEF WBN-1-68-563)	DGGFR_0-DG-360-3A （FLEX Diesel Generator 0-DG-360-3A fails to run after first hour）	FNSFR1FAN_03000 183 （CCP A ROOM COOLER FAN FAILS DURING OPERATION）	DGGFD1GEN_0821 B-B （DG 1B-B FAILS TO START AND RUN FIRST HOUR）	RLVFO1RFV_06206 36 （WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN）	RLVFO1RFV_06206 36 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	FNSFR1FAN_03000 183 （CCP A ROOM COOLER FAN FAILS DURING OPERATION）	PTSF11PMP_00300 1AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	RLVFO1RFV_06206 36 （WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN）
8	SRVSR1SRV_0680 0565 (SAFETY VALVE FAILS TO RESEAT AFTER STEAM RELIEF WBN-1-68-565)	SRVSR1SRV_068005 64 (SAFETY VALVE FAILS TO RESEAT AFTER STEAM RELIEF WBN-1-68-564)	DGGFD1GEN_0821B-B （DG 1B-B FAILS TO START AND RUN FIRST HOUR）	DGGFR2GEN_0822 B-B （DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B)）	PTSF11PMP_00300 1AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	DGGFD1GEN_0821 A-A （DG 1A-A FAILS TO START AND RUN FIRST HOUR）	DGGFD1GEN_0821 B-B （DG 1B-B FAILS TO START AND RUN FIRST HOUR）	DGGFR2GEN_0822 B-B （DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B)）	DGGFD1GEN_0821 B-B （DG 1B-B FAILS TO START AND RUN FIRST HOUR）	DGGFR_0-DG-360-3A （FLEX Diesel Generator 0-DG-360-3A fails to run after first hour）

Table 14. WBN1 Equipment-Related Event Importance by FVI to CDF (Continued)

FVI Ranking	72-Hour AOT	14-Day AOT	14-D AOT EDG 1A-A in PM	14-D AOT EDG 1B-B in PM	14-D AOT EDG 2A-A in PM	14-D AOT EDG 2B-B in PM	14-D AOT EDG 1A-A in CM	14-D AOT EDG 1B-B in CM	14-D AOT EDG 2A-A in CM	14-D AOT EDG 2B-B in CM
9	CBKFO1BKR_2111 716/16-A (WBN-1-BKR-211-1716/16-A BREAKER FAILS TO OPEN)	SRVSR1SRV_068005 65 (SAFETY VALVE FAILS TO RESEAT AFTER STEAM RELIEF WBN-1-68-565)	FNSFD1FAN_03000183 （CCP 1A-A ROOM COOLING FAN FAILS TO START AND RUN DURING FIRST HOUR ）	RLVFO1RFV_06206 36 （WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN）	DGGFD2GEN_0822 B-B （DIESEL GENERATOR FAILS TO START AND RUN FIRST HOUR (WBN-2-GEN -082-0002B -B)）	FNSFD1FAN_03000 183 （CCP 1A-A ROOM COOLING FAN FAILS TO START AND RUN DURING FIRST HOUR）	FNSFD1FAN_03000 183 （CCP 1A-A ROOM COOLING FAN FAILS TO START AND RUN DURING FIRST HOUR）	RLVFO1RFV_06206 36 （WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN）	DGGFD2GEN_0822 B-B （DIESEL GENERATOR FAILS TO START AND RUN FIRST HOUR (WBN-2-GEN -082-0002B -B)）	DGGFD1GEN_0821 A-A （DG 1A-A FAILS TO START AND RUN FIRST HOUR）
10	DGGFR2GEN_0822 B-B (DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B))	DGGFR2GEN_0822B-B (DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B))	DGGFD2GEN_0822B-B （DIESEL GENERATOR FAILS TO START AND RUN FIRST HOUR (WBN-2-GEN -082-0002B -B)）	DGGFR2GEN_0822 A-A （DIESEL GENERATOR FAILS TO RUN AFTER FIRST HOUR）	FNSFD1FAN_03046 1 （BOARD ROOM EXHAUST FAN FAILS TO START OR RUN FIRST HOUR）	DGGFR_0-DG-360-3A （FLEX Diesel Generator 0-DG-360-3A fails to run after first hour）	DGGFD2GEN_0822 B-B （DIESEL GENERATOR FAILS TO START AND RUN FIRST HOUR (WBN-2-GEN -082-0002B -B)）	DGGFR2GEN_0822 A-A （DIESEL GENERATOR FAILS TO RUN AFTER FIRST HOUR）	FNSFD1FAN_03046 1 （BOARD ROOM EXHAUST FAN FAILS TO START OR RUN FIRST HOUR）	FNSFD1FAN_03000 183 （CCP 1A-A ROOM COOLING FAN FAILS TO START AND RUN DURING FIRST HOUR）

Table 15. WBN2 Equipment-Related Event Importance by FVI to CDF

FVI Ranking	72-Hour AOT	14-Day AOT	14-D AOT EDG 1A-A in PM	14-D AOT EDG 1B-B in PM	14-D AOT EDG 2A-A in PM	14-D AOT EDG 2B-B in PM	14-D AOT EDG 1A-A in CM	14-D AOT EDG 1B-B in CM	14-D AOT EDG 2A-A in CM	14-D AOT EDG 2B-B in CM
1	FNSFR2FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	FNSFR2FAN_030001 83 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	DGGFR2GEN_0822B-B (DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B))	BCHFR0CHRG2363-F (CHARGER III FAILS DURING OPERATION)	DGGFR2GEN_0822 B-B (DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B))	BCHFR0CHRG2363-F (CHARGER III FAILS DURING OPERATION)	DGGFR2GEN_0822 B-B (DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B))	BCHFR0CHRG2363-F (CHARGER III FAILS DURING OPERATION)	DGGFR2GEN_0822 B-B (DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B))	PTSF12PMP_00300 1AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)
2	RLVFO2RFV_06206 36 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	RLVFO2RFV_062063 6 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	DGGFR1GEN_0821B-B (DG 1B-B FAILS TO RUN)	CBKFO2BKR_21118 16/16-A (6.9 kV SDBD BREAKER 1816 FAILS TO OPEN)	PTSF12PMP_00300 1AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	PTSF12PMP_00300 1AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	DGGFR1GEN_0821 B-B (DG 1B-B FAILS TO RUN)	CBKFO2BKR_21118 16/16-A (6.9 kV SDBD BREAKER 1816 FAILS TO OPEN)	PTSF12PMP_00300 1AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	CBKFO2BKR_21118 16/16-A (6.9 kV SDBD BREAKER 1816 FAILS TO OPEN)
3	CRI (CONTROL RODS FAIL TO INSERT)	CRI (CONTROL RODS FAIL TO INSERT)	FNSFR2FAN_03000183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	DGGFR2GEN_0822 A-A (DIESEL GENERATOR FAILS TO RUN AFTER FIRST HOUR)	DGGFR1GEN_0821 B-B (DG 1B-B FAILS TO RUN)	CBKFO2BKR_21118 16/16-A (6.9 kV SDBD BREAKER 1816 FAILS TO OPEN)	FNSFR2FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	DGGFR2GEN_0822 A-A (DIESEL GENERATOR FAILS TO RUN AFTER FIRST HOUR)	DGGFR_0-DG-360-3B (FLEX Diesel Generator 0-DG-360-3B fails to run after first hour)	BCHFR0CHRG2363-F (CHARGER III FAILS DURING OPERATION)
4	DGGFR2GEN_0822 B-B (DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B))	DGGFR2GEN_0822B-B (DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B))	RLVFO2RFV_0620636 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	DGGFR2GEN_0822 B-B (DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B))	DGGFR_0-DG-360-3B (FLEX Diesel Generator 0-DG-360-3B fails to run after first hour)	DGGFR2GEN_0822 A-A (DIESEL GENERATOR FAILS TO RUN AFTER FIRST HOUR)	CBKFO2BKR_21118 16/16-A (6.9 kV SDBD BREAKER 1816 FAILS TO OPEN)	DGGFR2GEN_0822 B-B (DG 2B-B FAILS FAILS TO RUN (WBN-2-GEN -082-0002B -B))	DGGFR1GEN_0821 B-B (DG 1B-B FAILS TO RUN)	DGGFR2GEN_0822 A-A (DIESEL GENERATOR FAILS TO RUN AFTER FIRST HOUR)
5	PTSF12PMP_00300 1AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	PTSF12PMP_003001 AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	CBKFO2BKR_2111816/16-A (6.9 kV SDBD BREAKER 1816 FAILS TO OPEN)	DGGFR1GEN_0821 A-A (DG 1A-A FAILS TO RUN)	FNSFR2FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	XRFFR2OXF_212A2 -A (6.9 kV/480V TRANSFORMER 2A2A)	RLVFO2RFV_06206 36 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	DGGFR1GEN_0821 A-A (DG 1A-A FAILS TO RUN)	FNSFR2FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	XRFFR2OXF_212A2 -A (6.9 kV/480V TRANSFORMER 2A2A)
6	CBKFO2BKR_2111 816/16-A (6.9 kV SDBD BREAKER 1816 FAILS TO OPEN)	CBKFO2BKR_211181 6/16-A (6.9 kV SDBD BREAKER 1816 FAILS TO OPEN)	DGGFD2GEN_0822B-B (DIESEL GENERATOR FAILS TO START AND RUN FIRST HOUR (WBN-2-GEN -082-0002B -B))	FNSFR2FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	DGGFD2GEN_0822 B-B (DIESEL GENERATOR FAILS TO START AND RUN FIRST HOUR (WBN-2-GEN -082-0002B -B))	FNSFR2FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	DGGFD2GEN_0822 B-B (DIESEL GENERATOR FAILS TO START AND RUN FIRST HOUR (WBN-2-GEN -082-0002B -B))	FNSFR2FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)	DGGFD2GEN_0822 B-B (DIESEL GENERATOR FAILS TO START AND RUN FIRST HOUR (WBN-2-GEN -082-0002B -B))	FNSFR2FAN_03000 183 (CCP A ROOM COOLER FAN FAILS DURING OPERATION)
7	SRVSR2SRV_0680 0563 (SAFETY VALVE FAILS TO RESEAT AFTER STEAM RELIEF WBN-2-68-563)	SRVSR2SRV_068005 63 (SAFETY VALVE FAILS TO RESEAT AFTER STEAM RELIEF WBN-2-68-563)	CRI (CONTROL RODS FAIL TO INSERT)	RLVFO2RFV_06206 36 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	RLVFO2RFV_06206 36 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	PCOFD2PMP_07000 59 (WBN-2-PMP-070-0059 PUMP 2A-A FAILS TO START ON DEMAND)	PTSF12PMP_00300 1AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	DGGFR_0-DG-360-3B (FLEX Diesel Generator 0-DG-360-3B fails to run after first hour)	RLVFO2RFV_06206 36 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	FNSFD2FAN_03000 183 (CCP 1A-A ROOM COOLING FAN FAILS TO START AND RUN DURING FIRST HOUR)
8	SRVSR2SRV_0680 0564 (SAFETY VALVE FAILS TO RESEAT AFTER STEAM RELIEF WBN-2-68-564)	SRVSR2SRV_068005 64 (SAFETY VALVE FAILS TO RESEAT AFTER STEAM RELIEF WBN-2-68-564)	PTSF12PMP_003001AS (PUMP FAILS TO START AND RUN FOR 1 HOUR WBN-1-3-1AS)	DGGFD2GEN_0822 A-A (DIESEL GENERATOR 2A-A FAILS TO START AND RUN FIRST HOUR)	DGGFD1GEN_0821 B-B (DG 1B-B FAILS TO START AND RUN FIRST HOUR)	FNSFD2FAN_03000 183 (CCP 1A-A ROOM COOLING FAN FAILS TO START AND RUN DURING FIRST HOUR)	CRI (CONTROL RODS FAIL TO INSERT)	RLVFO2RFV_06206 36 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	DGGFD_0-DG-360-3B (FLEX DG 0-DG-360-3B fails to start or during first hour of operation)	PCOFD2PMP_07000 59 (WBN-2-PMP-070-0059 PUMP 2A-A FAILS TO START ON DEMAND)

Table 15. WBN2 Equipment-Related Event Importance by FVI to CDF (Continued)

FVI Ranking	72-Hour AOT	14-Day AOT	14-D AOT EDG 1A-A in PM	14-D AOT EDG 1B-B in PM	14-D AOT EDG 2A-A in PM	14-D AOT EDG 2B-B in PM	14-D AOT EDG 1A-A in CM	14-D AOT EDG 1B-B in CM	14-D AOT EDG 2A-A in CM	14-D AOT EDG 2B-B in CM
9	SRVSR2SRV_06800565 (SAFETY VALVE FAILS TO RESEAT AFTER STEAM RELIEF WBN-2-68-565)	SRVSR2SRV_06800565 (SAFETY VALVE FAILS TO RESEAT AFTER STEAM RELIEF WBN-2-68-565)	FNSFD2FAN_030462 (BOARD ROOM EXHAUST FAN FAILS TO START OR RUN FIRST HOUR)	CRI (CONTROL RODS FAIL TO INSERT)	FNSFD2FAN_030462 (BOARD ROOM EXHAUST FAN FAILS TO START OR RUN FIRST HOUR)	DGGFR1GEN_0821B-B (DG 1B-B FAILS TO RUN)	FNSFD2FAN_03000183 (CCP 1A-A ROOM COOLING FAN FAILS TO START AND RUN DURING FIRST HOUR)	DGGFD2GEN_0822A-A (DIESEL GENERATOR 2A-A FAILS TO START AND RUN FIRST HOUR)	DGGFD1GEN_0821B-B (DG 1B-B FAILS TO START AND RUN FIRST HOUR)	DGGFR1GEN_0821B-B (DG 1B-B FAILS TO RUN)
10	DGGFD2GEN_0822B-B (DIESEL GENERATOR FAILS TO START AND RUN FIRST HOUR (WBN-2-GEN -082-0002B -B))	DGGFD2GEN_0822B-B (DIESEL GENERATOR FAILS TO START AND RUN FIRST HOUR (WBN-2-GEN -082-0002B -B))	FNSFD2FAN_03000183 (CCP 1A-A ROOM COOLING FAN FAILS TO START AND RUN DURING FIRST HOUR)	DGGFD2GEN_0822B-B (DIESEL GENERATOR FAILS TO START AND RUN FIRST HOUR (WBN-2-GEN -082-0002B -B))	DGGFD_0-DG-360-3B (FLEX DG 0-DG-360-3B fails to start or during first hour of operation)	RLVFO2RFV_0620636 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)	DGGFR_0-DG-360-3B (FLEX Diesel Generator 0-DG-360-3B fails to run after first hour)	DGGFD2GEN_0822B-B (DIESEL GENERATOR FAILS TO START AND RUN FIRST HOUR (WBN-2-GEN -082-0002B -B))	FNSFD2FAN_030462 (BOARD ROOM EXHAUST FAN FAILS TO START OR RUN FIRST HOUR)	RLVFO2RFV_0620636 (WBN-1-RFV-062-0636-S RELIEF VALVE FAILS TO OPEN)

4.3 Previously Identified Risk Significant Configurations and Compensatory Measures for Extended EDG Maintenance

Equipment identified in the previous version of the WBN configuration risk management procedure that is not to be removed from service concurrent with an EDG includes:

- Reactor Trip Breakers in the Reactor Protection System
- The Engineered Safety Features Actuation System Trains
- The ERCW Headers and Pumps
- The CCS Trains
- The Refueling Water Storage Tank
- The Containment Sump and Equipment Affecting High Pressure Recirculation
- AFW Level Control Valves
- The SG PORVs
- The Pressurizer Safety Relief Valves
- An Offsite Power Line or Switchyard Equipment
- The 6.9-kV Shutdown Boards
- The 480V Shutdown Boards
- The 125VDC Bus I and II
- The 120VAC Vital Power Boards

Additionally, to manage the risk activities associated with the EDG Completion Time extension, compensatory measures involving additional operational restrictions may be taken when performing extended-scheduled maintenance on an EDG; i.e., using the extended Completion Time of 14 days. The following contingency actions (i.e., limitations for planned maintenance during power operation) will be incorporated into the TS bases associated with LCO 3.8.1 for both units:

- Verify that the offsite power system is stable. This action will establish that the offsite power system is within single-contingency limits and will remain stable upon the loss of any single component supporting the system. If a grid stability problem exists, the planned EDG outage will not be scheduled.

- Verify that no adverse weather conditions are expected during the outage period. The planned EDG outage will be postponed if inclement weather (such as severe thunderstorms or heavy snowfall) is projected.

- Do not remove from service the ventilation systems for the 6.9-kV shutdown board rooms, the Elevation 772 transformer rooms; or the 480V shutdown board rooms, concurrently with the EDG, or implement appropriate compensatory measures.

- Do not remove the reactor trip breakers from service concurrently during planned EDG outage maintenance.

- Do not remove the turbine-driven AFW pump from service concurrently with the outage of an EDG of the same unit.

- Do not remove the AFW level control valves to the steam generators from service concurrently with the outage of an EDG of the same unit.

- Do not remove the opposite train RHR pump from service concurrently with the outage of an EDG of the same unit.

The procedures governing these measures are described in the Updated Final Safety Analysis Report, and they may only be changed upon evaluating the changes under the provisions of 10 CFR 50.59. This provides adequate control over these measures.

5. Risk-Informed Configuration Risk Management

The methods of evaluating risk during maintenance and the station procedure for configuration risk management are designed to control and minimize the risks involved with this proposed Completion Time extension.

WBN presently manages risk with a procedurally controlled program that governs the scheduling of maintenance activities. This program involves review from a probabilistic and/or deterministic standpoint of all, planned and unplanned, maintenance activities. Maintenance is normally assessed from a probabilistic standpoint using a computerized online risk monitor, which uses the EPRI sponsored software called EOOS. The risk monitor system uses the actual WBN PRA model to quantify results. In cases where quantitative solution is not possible because the functions or systems under consideration are not modeled, a qualitative assessment is used. Under certain risk significant conditions, both quantitative and qualitative assessments are required.

The following discusses how WBN implements the appropriate restrictions that preclude simultaneous equipment outages that would erode the principles of redundancy and diversity.

5.1 Work Planning

The following procedures control WBN's online work management risk evaluation processes:

- NPG Standard Programs and Processes, NPG-SPP-07.1, "On Line Work Management" (Reference 18)
- NPG Standard Programs and Processes, NPG-SPP-07.3, "Work Activity Risk Management Process" (Reference 17)
- NPG Standard Programs and Processes, NPG-SPP-09.11.1, "Equipment Out of Service Management" (Reference 16)

NPG-SPP-07.1 specifies the general responsibilities and standard programmatic controls for the online work management process during plant operation. This procedure applies to all work activities that affect or have the potential to affect a plant component, system, or configuration. Work performed during a planned or forced outage is controlled by NPG-SPP-07.2, Outage Management (Reference 19).

WBN's long-term maintenance plan is a product of the preventive and surveillance process, and specifies the frequency for implementation of maintenance and surveillance activities necessary for the reliability of components in each system. The rolling schedule includes the preliminary defense-in-depth assessment, which documents the allowable combinations of system and functional equipment groups (FEG) that may be simultaneously worked online or during shutdown conditions. FEGs are common sets of boundaries encompassing equipment that has been evaluated for acceptable out-of-service combinations. They are used to schedule planned maintenance and establish equipment clearances.

Predetermined system or FEG work windows are established for online maintenance and outage periods. The work windows are based on recommended maintenance frequencies and sequenced to minimize the risk of online maintenance. Work windows are defined by week and repeat at 13-week intervals. The work windows ensure required surveillances are performed within their required frequency and that division/train/loop/channel interferences are minimized. The WBN Scheduling organization maintains a long range schedule based on required surveillance testing of online activities and plant conditions.

The surveillance testing schedule provides the “backbone” for the long-term maintenance plan. Other periodic activities (preventive maintenance items) are scheduled with related surveillance tests to maximize component availability. System FEGs are used to ensure work on related components is evaluated for inclusion in the work window. Related corrective maintenance activities are also evaluated for inclusion in the work window provided by surveillance and preventive maintenance performance. The inclusion of identified work in the FEG work window with the surveillance tests and preventive maintenance items maximizes component availability and operability.

5.2 Risk Assessment

Procedures are also in place at Watts Bar for the online work management risk evaluation process. The NPG-SPP-09.11.1 risk assessment methodology is used for online maintenance activities. A risk assessment is performed before beginning online maintenance (i.e., prior to work window implementation), and emergent work is evaluated against the assessed scope.

The NPG-SPP-09.11.1 risk assessment guidelines use the results of the WBN PRA analysis, along with other safety considerations, such as Technical Specifications, to determine which system, component, and equipment groups (or FEG combinations) may be worked online. An online assessment of scheduled activities is performed before implementation of a work window. The assessment includes reviews for the following:

- The schedule is evaluated against the risk bases derived from the WBN PRA.
- The scheduled activities are assessed before starting work to maximize safety (reduce risk) when performing online work.
- Avoidance of recurrent entry into a specific LCO for multiple activities. Activities that require entering the same LCO are combined to limit the number of times an LCO must be established, thus maximizing the equipment’s availability.
- If the risk associated with a particular activity cannot be determined, Nuclear Engineering is requested to perform a risk assessment.

Work Activity Risk Management is the tool to enhance the preparation, execution, and oversight of high risk work activities. It includes the following three-phase process used to evaluate the risk associated with work activities:

- Risk Characterization of the Work Activities
- Development of High Risk Management Plans for High Risk Activities
- Aggregate Risk Assessment

Work activity risk characterization and evaluation is performed as early in the work control/planning process as possible. Emergent, support, and repetitive activities are addressed individually with specific actions for risk management.

5.3 EDG Maintenance

During power operation, the EDGs help to ensure that sufficient power is available to the safety-related equipment, which is needed for safe shutdown of the plant and for mitigation and control during accident conditions. During shutdown and refueling conditions, the EDGs help to ensure that the facility is able to maintain shutdown or refueling conditions for extended periods of time.

Experience has shown that, even with careful planning, maintenance duration sometimes approaches the Completion Time limit. In order to accommodate unanticipated problems, WBN has developed the practice of scheduling work for only 50 to 60 percent of the Completion Time for planned maintenance; i.e., WBN schedules work only if the work is anticipated to take no more than 50 to 60 percent of the AOT. It was believed that, compared to the 72-hour AOT, the proposed 14-day Completion Time would significantly reduce EDG unavailability for the 12- and 6-year maintenance. Maintenance activities that can be performed within a Completion Time of 72 hours are not expected to change. However, by combining activities into fewer outages of the EDGs, the EDG availability is expected to improve, which would result in additional risk reductions.

6. Summary and Conclusion

Regulatory Guide 1.174 recommends that the ∆CDF and ∆LERF associated with the AOT extension be calculated. For this proposed extension of the EDG Completion Time to 14 days, the calculated increase in core damage frequency associated with internal events and internal flooding is 1.75×10^{-7} and 1.56×10^{-7} per year for WBN Unit 1 and Unit 2, respectively. The associated increase in large early release frequency is less than 1.0×10^{-8} for each WBN unit. Comparing these values to the acceptance guidelines in Regulatory Guide 1.174, Figures 4 and 5, all reside in Region III (the least risk-significant region) of the appropriate figure.

Regulatory Guide 1.177 provides the following acceptance guidelines for AOT changes: "The licensee has demonstrated that the TS CT change has only a small quantitative impact on plant risk. An ICCDP of less than 1.0×10^{-6} and an ICLERP of less than 1.0×10^{-7} are considered small for a single TS condition entry." For WBN Unit 1 analysis based on internal events and internal flooding, the ICCDP calculated for the proposed AOT of 14 days associated with a single EDG being out of service is 1.73×10^{-7} for EDG 1A-A out of service, 2.18×10^{-7} for EDG 1B-B out of service, 1.38×10^{-7} for EDG 2A-A out of service, and 1.92×10^{-7} for EDG 2B-B out of service. For WBN Unit 2, the ICCDPs calculated are 1.01×10^{-7}, 1.70×10^{-7}, 1.30×10^{-7}, and 2.63×10^{-7} for EDGs 1A-A, 1B-B, 2A-A, and 2B-B, respectively, out of service. The calculated ICCDPs are less than the example of "small" ICCDP referred to in Regulatory Guide 1.177.

For WBN Unit 1, the ICLERP calculated for the extended Completion Time associated with a single EDG out of service is 3.70×10^{-9} for EDG 1A-A out of service, 8.55×10^{-9} for EDG 1B-B out of service, 1.41×10^{-9} for EDG 2A-A out of service, and 2.77×10^{-9} for EDG 2B-B out of service. For WBN Unit 2, the calculated ICLERPs are 2.50×10^{-9}, 3.63×10^{-9}, 4.41×10^{-9}, and 1.16×10^{-8} for EDGs 1A-A, 1B-B, 2A-A, and 2B-B, respectively, out of service. These ICLERPs are all well below the example of "small" ICLERP of 1.0×10^{-7} referred to in Regulatory Guide 1.177.

In conclusion, the risk-informed assessment concluded that the increase in plant risk is small and consistent with the NRC "Safety Goals for the Operations of Nuclear Power Plants; Policy Statement," Federal Register, Vol. 51, p. 30028 (51 FR 30028), August 4, 1986, as further described by NRC Regulatory Guides 1.174 and 1.177. These analyses provide high assurance of the WBN capability to provide power to the safety related shutdown boards during the proposed, extended EDG Completion Times.

Based on PRA analysis, TVA has demonstrated that, for both WBN Unit 1 and Unit 2, performing online maintenance at power using the proposed extended EDG AOT would not result in a significant increase in risk.

7. References

1. U.S. Nuclear Regulatory Commission, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” Regulatory Guide 1.174, Revision 2, May 2011.

2. U.S. Nuclear Regulatory Commission, “An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications,” Regulatory Guide 1.177, Revision 1, May 2011.

3. American Society of Mechanical Engineers, “Addenda to ASME/ANS RA-S-2008 – Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications,” RA-Sa-2009, February 2009.

4. U.S. Nuclear Regulatory Commission, “An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities,” Regulatory Guide 1.200, Revision 2, March 2009.

5. Tennessee Valley Authority, “NPG Standard Programs and Processes, Probabilistic Risk Assessment (PRA) Program,” SPP-9.11, Revision 0.

6. Tennessee Valley Authority, “NPG Department Procedure, Probabilistic Risk Assessment (PRA),” NEDP-26, Revision 2.

7. Tennessee Valley Authority, “NPG Department Procedure, Design Calculation Process Control,” NEDP-2, Revision 14.

8. ABSG Consulting Inc., “Re-Evaluation of Seven Watts Bar Unit 2 Severe Accident Mitigation Alternatives,” R-3087636-1931, March 2014.

9. Nuclear Energy Institute, “Process for Performing Internal Events PRA Peer Reviews using the ASME/ANS PRA Standard,” NEI 05-04, Revision 2.

10. PWR Owners Group, “RG 1.200 PRA Peer Review Against the ASME/ANS PRA Standard Requirements for the Watts Bar Nuclear Power Plant Probabilistic Risk Assessment,” LTR-RAM-II-09-084 (B45 100125 001), December 17, 2009.

11. American Society of Mechanical Engineers, “Addenda to ASME/ANS RA-S-2008 – Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications,” RA-Sb-2013, September 2013.

12. Tennessee Valley Authority, “Watts Bar Nuclear Plant (WBNP) Individual Plant Evaluation of External Events (IPEEE) Final Report,” February 1998.

13. Tennessee Valley Authority, “Watts Bar Nuclear Plant Unit 2 (WBN2) Individual Plant Evaluation of External Events (IPEEE) Final Report,” November 2014.

14. Tennessee Valley Authority, "Enclosure 4 – Seismic Hazard and Screening Report for Tennessee Valley Authority's Watts Bar Nuclear Plant," Tennessee Valley Authority's Seismic Hazard and Screening Report (CEUS Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, March 31, 2014.

15. Tennessee Valley Authority, "Watts Bar Nuclear Plant (WBN) Unit 2 – Probabilistic Risk Assessment Individual Plant Examination Summary Report," February 2010.

16. Tennessee Valley Authority, "NPG Standard Programs and Processes, Equipment Out of Service Management," NPG-SPP-09.11.1, Revision 0010.

17. Tennessee Valley Authority, "NPG Standard Programs and Processes, Work Activity Risk Management Process," NPG-SPP-07.3, Revision 0016.

18. Tennessee Valley Authority, "NPG Standard Programs and Processes, On Line Work Management," NPG-SPP-07.1, Revision 0013.

19. Tennessee Valley Authority, "NPG Standard Programs and Processes, Outage Management," NPG-SPP-07.2, Revision 0005.

ENCLOSURE 3

Implementation of Branch Technical Position 8-8

Onsite (Emergency Diesel Generators (EDGs)) and Offsite Power Sources Allowed Outage Time Extensions

The Tennessee Valley Authority (TVA) reviewed the NRC's NUREG 0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Branch Technical Position (BTP) 8-8 Onsite (Emergency Diesel Generators) and Offsite Power Sources Allowed Outage Time Extensions," (Reference 1) as acceptable approach to analyzing and evaluating changes for AOT extensions. This enclosure discuses TVA's implementation of the guidance provided in BTP 8-8. TVA extracted the salient points from BTP 8-8 and discusses below how they have been implemented in this WBN submittal.

IMPLEMENTATION OF BTP 8-8

What follows is a listing of the guidance provided in BTP 8-8 followed by a discussion explaining how TVA implemented this guidance in WBN proposed Technical Specification change WBN-TS-15-09.

1. A supplemental power source should be available as a backup to the inoperable EDG or offsite power source, to maintain the defense-in-depth design philosophy of the electrical system to meet its intended safety function.

   TVA Implementation – TVA is using a FLEX 6.9 kV diesel generator. This DG is discussed in Enclosure 1, Section 3.4

2. The supplemental source must have capacity to bring a unit to safe shutdown (cold shutdown)[1] in case of a loss of offsite power (LOOP) concurrent with a single failure during plant operation (Mode 1).

   TVA Implementation – The FLEX DG capability is discussed in Enclosure 1, section 3.4

3. Multi-unit sites that have installed a single AAC power source for SBO cannot substitute it for the inoperable diesel when requesting AOT extensions unless the AAC source has enough capacity to carry all LOOP loads to bring the unit to a cold shutdown as a substitute for the EDG in an extended AOT and carry all SBO loads for the unit that has an SBO event without any load shedding.

   TVA Implementation – TVA is not using a SBO AAC power source, WBN is using a FLEX DG. The capability of the FLEX DG is discussed in Enclosure 1, Section 3.4

4. The time to make the AAC or supplemental power source available, including accomplishing the cross-connection, should be approximately one hour.

   TVA Implementation – Time to make FLEX DG available is approximately 1 hour and is discussed in Enclosure 1, Section 3.10.2.

[1] By "cold shutdown" it is not implied that the plant needs to go to cold shutdown during LOOP. The unit can remain in either hot shutdown or hot standby in accordance with its licensing basis for the short term. However if the offsite power is not recovered in a timely manner it may become necessary for the unit to go to cold shutdown, therefore the supplemental or AAC power source must have the capacity and capability to accomplish this function if needed.

5. The availability of AAC or supplemental power source should be verified within the last 30 days before entering extended AOT by operating or bringing the power source to its rated voltage and frequency for 5 minutes and ensuring all its auxiliary support systems are available or operational.

   TVA Implementation – Enclosure 4 provides a commitment to ensure the availability of one 6.9 kV FLEX Diesel Generator is verified within the last 30 days before entering the extended diesel generator Completion Time by operating the 6.9 kV FLEX Diesel Generator at its rated voltage and frequency for 5 minutes and ensuring the skid-mounted auxiliary support systems are available. (Commitment 7)

6. To support the one-hour time for making this power source available, plants must assess their ability to cope with loss of all AC power for one hour independent of an AAC power source.

   TVA Implementation – This item is discussed in Enclosure 1, Section 3.10.2.

7. The plant should have formal engineering calculations for equipment sizing and protection and have approved procedures for connecting the AAC or supplemental power sources to the safety buses.

   TVA Implementation – TVA has a formal engineering calculation to determine the voltage drop of and the ampacity of the power cabling systems associated with the two 6.9 kV 3MW Flex Diesel Generators supplying various loads on the 6.9-kV Shutdown Boards when the plant is in an outside of a design basis event. In addition, TVA has FLEX support instructions providing actions for the initial assessment of plant equipment and system status, staging FLEX equipment, and to align and start up the FLEX DGs in preparation for use in plant recovery.

8. The EDG or offsite power AOT should be limited to 14 days to perform maintenance activities.

   TVA Implementation – TS Required Action B.5, Restore DG to OPERABLE status, Completion Time limits the maximum allowed outage time to 14 days.

9 The TS must contain Required Actions and Completion Times to verify that the supplemental AC source is available before entering extended AOT.

   TVA Implementation – TS Required Action B.2 requires evaluation of the availability of the FLEX DG and Required Action B.5 extended outage Completion Time is contingent upon a FLEX DG being available.

10. The availability of AAC or supplemental power source shall be checked every 8-12 hours (once per shift).

TVA Implementation – TS Required Action B.2 requires that the availability of the FLEX DG be evaluated initially within 2 hours then once per 12 hours thereafter.

11. If the AAC or supplemental power source becomes unavailable any time during extended AOT, the unit shall enter the LCO and start shutting down within 24 hours.

    TVA implementation – One of the Completion Times for TS Required Action B.5 requires monitoring of the availability of the FLEX DG and the length of time from entry into Condition B, "One DG inoperable." If Condition B has been entered for ≥ 48 hours concurrent with the unavailability of the FLEX DG a maximum of 24 hours is allowed before entry into TS Condition G requiring a unit shutdown.

12 The staff expects that the licensee will provide the following Regulatory Commitments:

    a) The extended AOT will be used no more than once in a 24-month period (or refueling interval) on a per diesel basis to perform EDG maintenance activities, or any major maintenance on offsite power transformer and bus.

       TVA Implementation - Enclosure 4 provides a commitment to ensure the extended AOT will be used no more than once in a 18-month period (a refueling interval) on a per diesel basis to perform EDG planned maintenance activities. No limit is placed on the use of the extended AOT for unplanned maintenance. (Commitment 8)

    b) The preplanned maintenance will not be scheduled if severe weather conditions are anticipated.

       TVA Implementation – This activity has been implemented at WBN. Refer to WBN TS Bases Table 3.8.1-2, Item 2.

    c) The system load dispatcher will be contacted once per day to ensure no significant grid perturbations (high grid loading unable to withstand a single contingency of line or generation outage) are expected during the extended AOT.

       TVA Implementation – This activity is already in place at WBN. Refer to Enclosure 1, Section 3.8 for a discussion concerning this activity.

    d) Component testing or maintenance of safety systems and important non safety equipment in the offsite power systems that can increase the likelihood of a plant transient (unit trip) or LOOP will be avoided. In addition, no discretionary switchyard maintenance will be performed.

       TVA Implementation - Enclosure 4 provides two commitments to ensure component testing or maintenance of safety systems and important non safety equipment in the offsite power systems that can increase the likelihood of a plant transient (unit trip) or LOOP will be avoided and to ensure no discretionary switchyard maintenance will be performed. (Commitments 3 and 4)

e) TS required systems, subsystems, trains, components, and devices that depend on the remaining power sources will be verified to be operable and positive measures will be provided to preclude subsequent testing or maintenance activities on these systems, subsystems, trains, components, and devices.

TVA Implementation - This activity is already in place at WBN. Refer to Enclosure 1, Section 3.8 for a discussion concerning this activity.

f) Steam-driven emergency feed water pump(s) in case of PWR units, and Reactor Core Isolation Cooling and High Pressure Coolant Injection systems in case of BWR units, will be controlled as "protected equipment."

TVA Implementation - Enclosure 4 provides a commitment to ensure the steam-driven emergency feed water pump will be controlled as "protected equipment." (Commitment 6)

For the commitments listed in Enclosure 4 TVA plans on placing this information in an operations technical instruction that provides the contingency actions to be taken for a planned or unplanned DG Outage or another nuclear power group standard program or process document.

REFERENCES:

1. BTP 8-8, "Onsite (Emergency Diesel Generators) and Offsite Power Sources Allowed Outage Time Extensions," dated February 2012. [ML113640138]

ENCLOSURE 4

List of New Regulatory Commitments

New Regulatory Commitments

No.	Commitment	Due Date/Event
1	One 6.9 kV FLEX Diesel Generator will be protected, as defense-in-depth, during the extended diesel generator Completion Time.	Prior to implementing the approved Technical Specification 3.8.1 diesel generator Completion Time extension.
2	One 6.9 kV FLEX Diesel Generator will be routinely monitored during Operator Rounds, with monitoring criteria identified in the Operator Rounds. One 6.9 kV FLEX Diesel Generator will be monitored for fire hazards during Operator Rounds.	
3	Component testing or maintenance of safety systems and important non-safety equipment in the offsite power systems which can increase the likelihood of a plant transient or loss-of-offsite-power, will be avoided during the extended diesel generator Completion Time.	
4	No elective switchyard maintenance will be allowed during the extended diesel generator Completion Time.	
5	Licensed Operators and Auxiliary Operators, for the operating crews on-shift when the extended diesel generator Completion Time is in use, will be briefed on the DG work plan, the revised Technical Specification 3.8.1, and procedural actions regarding loss-of-offsite-power and 6.9 kV FLEX Diesel Generator alignment and use prior to entering the extended diesel generator Completion Time.	
6	The steam-driven Auxiliary Feedwater Pump will be controlled as “protected equipment,” during the extended diesel generator Completion Time.	
7	The availability of one 6.9 kV FLEX Diesel Generator will be verified within the last 30 days before entering the extended diesel generator Completion Time by operating the 6.9 kV FLEX Diesel Generator at its rated voltage and frequency for 5 minutes and ensuring the skid-mounted auxiliary support systems are available.	
8	The extended diesel generator Completion Time will be used no more than once in an 18-month period on a per diesel generator basis to perform planned diesel generator maintenance activities.	