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U.S. Nuclear Regulatory Commission
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Washington, DC 20555

Subject: Brunswick Steam Electric Plant, Unit Nos. 1 and 2
Docket Nos. 50-325, 50-324
Response to NRC Bulletin 2012-01: Design Vulnerability in Electric Power System

Reference:

NRC Bulletin 2012-01: Design Vulnerability in Electric Power System, dated July 27, 2012, ADAMS Accession Number ML12074A115

On July 27, 2012, the NRC issued Bulletin 2012-01 to all power reactor licensees and holders of combined licenses for nuclear power reactors. The purpose of this bulletin is to notify Licensees of a recent operating experience concerning the loss of one of the three phases of the offsite power circuit at Byron Station, Unit 2, in order to determine if further regulatory action is warranted. NRC Bulletin 2012-01 requires that each licensee provide a response to the Requested Actions within 90 days of the date of this bulletin. The enclosure to this submittal provides the response to the Requested Actions for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2.

This letter contains no regulatory commitments.

Please refer any questions regarding this submittal to Mr. Lee Grzeck, Manager – Regulatory Affairs, at (910) 457-2487.

I declare, under penalty of perjury, that the foregoing is true and correct. Executed on October 24, 2012.

Sincerely,

Michael J. Annacone

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Enclosure:

Brunswick Response to Bulletin 2012-01: Design Vulnerability in Electric Power System

IE76
NRR

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Brunswick Response to Bulletin 2012-01: Design Vulnerability in Electric Power System

Overview:

- System Description - Items 2., 1.d, 2.a, 2.c
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System Description

Items 2., 1.d, 2.a, and 2.c request system information and will be addressed in this section.

2 Briefly describe the operating configuration of the ESF buses (Class 1E for current operating plants or non-Class 1E for passive plants) at power (normal operating condition).

See Attachment 1 for a simplified one-line diagram of the Brunswick Steam Electric Plant (BSEP) electrical distribution system.

The BSEP 4.16 kV emergency buses E1 (E3) and E2 (E4) (i.e., ESF buses) are powered from the upstream balance-of-plant (BOP) buses 1D (2D) and 1C (2C), respectively. BOP buses 1D (2D) and 1C (2C) are normally powered from the unit auxiliary transformer (UAT) with fast transfer capability to the startup auxiliary transformer (SAT). Therefore, the main generator is the normal source of power for the emergency buses.

1.d Describe the offsite power transformer (e.g., start-up, reserve, station auxiliary) winding and grounding configurations.

The SAT is a three-phase three winding transformer with wye-wye configuration. The high voltage (HV) side is solidly grounded neutral. Each low voltage (LV) winding is high resistance grounded neutral via a neutral grounding transformer and grounding resistor.

The Main Power Transformer (MPT) consists of three separate single-phase transformers connected in three-phase wye-delta configuration. The HV wye side is a solidly grounded neutral.

The UAT is a three-phase three winding transformer with delta-wye configuration. Each LV wye winding is high resistance grounded neutral via a neutral grounding transformer and grounding resistor.

See Attachment 2, Table 3 for additional details regarding the offsite power transformers.

2.a Are the ESF buses powered by offsite power sources? If so, explain what major loads are connected to the buses including their ratings.

For at-power (i.e., normal operating condition) configurations, the emergency buses are not powered by offsite sources. See Attachment 2, Table 1, for emergency bus power sources. See Attachment 2, Table 2, for normally energized major loads powered from the emergency buses.

2.c Confirm that the operating configuration of the ESF buses is consistent with the current licensing basis. Describe any changes in offsite power source alignment to the ESF buses from the original plant licensing.

As stated in the NRC's "Safety Evaluation of the Brunswick Steam Electric Station Units 1 and 2," dated November 1973, BSEP meets the intent of the General Design Criteria (GDC), published in the Federal Register on May 21, 1971, as Appendix A to 10 CFR Part 50. Consistent with the current licensing basis and the intent of GDC 17, BSEP credits two offsite circuits for powering the emergency buses. The SAT is the immediately available offsite circuit (i.e., preferred source) and the UAT is the delayed access offsite circuit (i.e., alternate source). The UAT is available within one hour of post-accident unit shutdown via backfeed from the transmission system through the MPT. The emergency diesel generators (EDGs) are relied upon until the backfeed is completed in the event the preferred source (i.e., SAT) is lost.

The following at-power (i.e., normal operating condition) configurations have been confirmed to be consistent with the current licensing basis (i.e., Updated Final Safety Analysis Report (UFSAR) Section 8.2, "Offsite Power System," UFSAR Section 8.3, "Onsite Power Systems," and Technical Specification Bases Section 3.8.1, "AC Sources - Operating"):

1. Unit 1 - Power to emergency buses E1 and E2 is from the Unit 1 main generator via the Unit 1 24 kV-4.16 kV UAT.
2. Unit 2 - Power to emergency buses E3 and E4 is from the Unit 2 main generator via the Unit 2 24 kV-4.16 kV UAT.

There have been no changes in the offsite power source alignment to the emergency buses from the original plant licensing.

System Protection

Items 1, 1.a, 2.b, and 2.d request information regarding electrical system protection and will be addressed in this section.

1. Given the requirements above, describe how the protection scheme for ESF buses (Class 1E for current operating plants or non-Class 1E for passive plants) is designed to detect and automatically respond to a single-phase open circuit

condition or high impedance ground fault condition on a credited off-site power circuit or another power sources.

Consistent with Technical Specification Bases 3.3.8.1, "Loss of Power (LOP) Instrumentation," the voltage on each emergency bus is monitored by the Loss of Voltage and the Degraded Voltage circuitry. This circuitry will separate the emergency buses from a connected failed offsite source due to a loss of voltage or a sustained, balanced, degraded grid voltage concurrent with certain design basis accidents (DBAs). The relay systems were not specifically designed to detect a single-phase open of a three-phase system. Detection of a single-open phase condition is beyond the approved design basis of the plant.

The electrical distribution system protection capability with regards to single-phase open circuits and high impedance ground faults is presented below.

Single-phase Open Circuit Condition

Each 4.16 kV emergency bus is equipped with two levels of undervoltage protection. The first level of protection is provided by the 27/59E loss of voltage relay intended mainly for the detection of a complete voltage loss. This is a single-phase induction disk, inverse characteristic relay connected across phases A and B. Therefore, the loss of phase C would not be detected by the 27/59E relay.

The second level of undervoltage protection in each emergency bus is provided by three degraded voltage relays, 27DVA, 27DVB, and 27DVC (i.e., collectively referred to as the 27DV relay). These are single-phase solid state relays, each connected between two phases (i.e., A-B, B-C, and A-C). They are wired in a two-out-of-three trip logic with a trip setting of 89.6 percent of bus nominal voltage with a 10 second time delay. A single-phase open circuit condition which causes the emergency bus voltage to drop below the degraded voltage relay trip setting on any of the three phases, will be detected by two of the three relays required to actuate the trip logic. Bus voltage during single-phase open circuits is a function of transformer connections and size of connected load, which varies between plant operating modes. The discussion that follows addresses bus voltages resulting from single-phase open circuit conditions during plant normal operation and shutdown conditions and the ability of the degraded voltage relay (27DV) to respond.

Normal Plant Operation

During normal plant operation the emergency buses are powered from the UAT. A single-phase open circuit on the MPT 230 kV side would have no effect on the emergency bus voltage since the main generator feeds three-phase power to the primary side of the UAT and onto the emergency buses. If the generator trips from such a condition, primarily due to negative sequence currents, 4.16 kV BOP buses 1D (2D) and 1C (2C) and their associated emergency buses E1 (E3) and E2 (E4) will automatically transfer to the SAT. Therefore, an open phase on the MPT high side, while the plant is in normal operation, will not result in sustained imbalanced phase voltages on the emergency buses.

A single-phase open circuit on the delta connected UAT primary side will be detected by the 27DV relay as the secondary voltage will drop below the 27DV relay setting. As a result, the emergency buses will automatically transfer to their associated EDGs.

A single-phase open circuit on the SAT primary will have no direct effect on emergency bus voltage since the emergency buses are powered from the UAT during normal plant operation. However, the reactor recirculation pump (RRP) variable frequency drives (VFDs), which are powered by the SAT, will likely trip by their "Low Input Voltage Protection" circuit or the "Input Current Imbalance Protection" circuit. This will lead to a reactor manual shutdown, followed by a generator lockout. The generator lockout signal causes 4.16 kV BOP buses 1D (2D) and 1C (2C) and their associated emergency buses E1 (E3) and E2 (E4) to automatically transfer from the UAT to the SAT. There is no analysis available to determine whether the voltage on the emergency buses will drop below the degraded voltage relay (27DV) dropout setting following the bus transfer to the SAT. The operator should be made aware of the single-phase open circuit as a result of the investigation into the VFD trip.

Plant Shutdown Operation

During shutdown conditions, emergency buses can be powered by either offsite source, the SAT or the UAT in the backfeed mode.

- 4.16 kV Buses 1C (2C), 1D (2D), E1 (E3), and E2 (E4) Powered by the UAT backfeed

  No analysis exists for a single-phase open circuit on the MPT 230 kV side. For this condition it is assumed that voltage on the emergency buses will remain higher than the trip setting of the degraded voltage relays. Therefore, there will be no automatic detection of this condition.

  A single-phase open circuit on the delta connected UAT primary side will be detected by the 27DV relay, as the secondary voltage will drop below the 27DV relay setting. As a result, the emergency buses will automatically transfer to their associated EDGs.

  A single-phase open circuit on the SAT primary will have no effect on emergency bus voltage since the emergency buses will continue to be powered by the UAT. With light load or no load on the SAT, this condition could remain undetected for as long as the 4.16 kV buses 1C (2C), 1D (2D), E1 (E3), and E2 (E4) remain powered by the UAT.

- 4.16 kV Buses 1C (2C), 1D (2D), E1 (E3), and E2 (E4) Powered by the SAT

  This bus alignment is typically only used during plant startup and shutdown evolutions and during UAT maintenance windows during plant refueling outages. Defense in depth strategies require that the emergency buses be powered from the UAT backfeed when it is available, due the automatic fast bus transfer capability to the SAT should the UAT be lost. There is no automatic transfer from the SAT to the UAT.

  A single-phase open circuit on the SAT primary may not be detectible. During shutdown conditions, the load on the SAT may not be sufficiently large to cause the 4.16 kV emergency bus voltage to drop below the 27DV relay setting.

A single-phase open circuit on the MPT primary (i.e., 230 kV side) or the UAT primary (i.e., 24 kV side) while in this alignment will have no effect on emergency bus voltage since the emergency buses will continue to be powered by the SAT. With no load on the UAT, this condition could remain undetected for as long as 4.16 kV buses 1C (2C), 1D (2D), E1 (E3), and E2 (E4) remain powered by the SAT.

High Impedance Ground Fault Condition

The electrical protection scheme of the offsite circuits has been reviewed with regard to high impedance ground fault conditions. The review examined ground faults at all segments of the offsite circuits and determined that the effect of a high impedance ground is of no consequence as it relates to a sustained bus voltage imbalance. The following provides the details of the review.

Ground on SAT or MPT 230 kV Side

The neutral connections of the SAT and the MPT 230 kV windings are solidly grounded. A ground fault between the switchyard power circuit breakers (PCBs) and the SAT will be detected by the 230 kV transformer bus differential relay 87TB, whose function is to isolate the transformer by opening the switchyard PCBs and the 4.16 kV BOP bus feeder breakers from the SAT. Similarly, a ground fault between the switchyard PCBs and the MPT will be detected by the MPT and generator differential relay 87GT, whose function is to isolate the generator, MPT and UAT by opening the switchyard PCBs and 4.16 kV BOP bus 1C (2C) and 1D (2D) feeder breakers from the UAT. A high impedance ground fault that does not generate sufficient current to actuate the differential relays, could not result in a voltage imbalance due to the "stiffness" of the 230 kV grid to which this section of the system is directly connected; the entire grid voltage would have to be imbalanced as a result of the high impedance fault, which is not credible. A high impedance fault capable of producing imbalanced 230 kV bus voltages could not be sustained; it would rapidly propagate into a more significant ground fault that would be cleared by the differential protection circuit.

Ground on UAT/MPT Primary Side (24 kV)

The generator neutral connection is high resistance grounded via the neutral grounding transformer. Maximum ground current is approximately 8.5 A. With the generator online, ground fault protection is provided by the generator ground detection relay 59GN, which monitors the neutral grounding transformer voltage and whose function is to isolate the transformers and lock out the generator.

In the UAT backfeed mode, with the generator offline and the No Load Disconnect (NLD) switch open, the 24kV system is effectively ungrounded due to the generator neutral grounding scheme being isolated. For this configuration ground detection is provided by the isophase bus ground detection relay 59BF, whose function is to actuate a control room annunciator. A single ground in this portion of the distribution system, while in the backfeed mode, cannot affect line to line voltages on the UAT secondary side. A second ground on another phase is effectively a phase to phase short circuit which will be rapidly cleared by the 87GT differential relay. Therefore, ground faults in this section of the distribution system cannot result in sustained imbalanced voltage conditions on the 4.16 kV buses.

Ground on UAT/SAT Secondary Side (4.16 kV)

The neutral connection of the secondary windings of the UAT and the SAT is high resistance grounded via the neutral grounding transformers. Maximum ground current is limited to approximately 8.0 A, which is incapable of producing an imbalance in the transformer secondary voltage. Ground detection relays (64UT/64ST) monitor the neutral grounding transformer voltage and provide control room annunciation. A second ground in another phase is effectively a phase to phase short circuit, which will be detected by either bus overcurrent relays or the UAT/SAT differential relays 87UT/87ST, as applicable, based on ground fault location.

Based on the above, grounds of any impedance value anywhere in the distribution system, including transformer connections to the switchyard PCBs, will either be rapidly detected and automatically isolated by protective relay circuitry or will have no impact on bus voltages.

1.a. The sensitivity of protective devices to detect abnormal operating conditions and the basis for the protective device setpoint(s).

Consistent with the BSEP current licensing basis and the intent of GDC 17, existing electrical protective devices are sufficiently sensitive to detect design basis conditions such as a loss of voltage or a sustained degraded voltage, but were not specifically designed to detect a single-phase open circuit condition. See Attachment 2, Table 4 for undervoltage protective devices and the basis for the device setpoints.

As indicated in response to Question 1, during normal plant operation, the electrical distribution system protection circuitry has sufficient sensitivity to detect and respond to single-phase open circuits in the source that powers the emergency buses (i.e., UAT). Single-phase open circuits on the standby source (i.e., SAT) will likely result in a unit trip with the emergency buses being transferred to this source. There is no analysis available to determine whether the emergency bus degraded voltage protection scheme has sufficient sensitivity to detect the single-phase open circuit.

Existing electrical protective devices (i.e., differential relays and ground fault detection relays) are also sufficiently sensitive to detect ground fault conditions. Attachment 2, Table 5, lists the differential relays and ground fault relays and the basis for their settings.

2.b. If the ESF buses are not powered by offsite power sources, explain how the surveillance tests are performed to verify that a single-phase open circuit condition or high impedance ground fault condition on an off-site power circuit is detected.

Consistent with Technical Specification Surveillance Requirement (SR) 3.8.1.1, surveillance tests verify proper circuit breaker alignment and power availability. The tests are not designed to verify single-phase open circuit conditions. There are no surveillance tests for the detection of high impedance ground fault conditions on the offsite circuit.

2.d. Do the plant operating procedures, including off-normal operating procedures, specifically call for verification of the voltages on all three phases of the ESF buses?

Plant procedures do not require verification of all three-phase voltages on the Class 1E emergency buses. Plant procedures require verification of balanced three-phase voltage on 4.16 kV BOP buses 1B (2B), 1C (2C), and 1D (2D) during plant shutdown conditions (i.e., Modes 4 and 5).

Consequences

Items 1.b, 1.c, and 2.e request information regarding the electrical consequences of an event and will be addressed in this section.

1.b. The differences (if any) of the consequences of a loaded (i.e., ESF bus normally aligned to offsite power transformer) or unloaded (e.g., ESF buses normally aligned to unit auxiliary transformer) power source.

Installed relays were not designed to detect single-phase open circuit conditions. Existing degraded voltage relays may respond depending on load size.

During normal plant operation, the emergency buses E1 (E3) and E2 (E4) and their upstream BOP buses 1C (2C) and 1D (2D) are aligned to the UAT with the offsite source (i.e., SAT) providing power to 4.16 kV BOP buses 1B (2B) and Common A (B). A single-phase open circuit on the SAT primary should result in the automatic trip of the reactor recirculation pump VFDs, powered from 4.16 kV bus 1B (2B), which will lead to a reactor manual shutdown and a generator lockout. This will cause a transfer of BOP buses 1D (2D) and 1C (2C) and the downstream emergency buses E1 (E3) and E2 (E4) from the UAT to the impaired SAT. There is no analysis available to determine whether the degraded voltage relay circuit will automatically detect this condition and transfer the emergency buses to the EDGs.

During plant shutdown operations, the emergency buses can be aligned to either offsite source, the UAT in the backfeed mode or the SAT, with the remaining source being unloaded or very lightly loaded if the SAT is the standby source. In general, there will be no plant response for an unloaded offsite power source in the event of a single-phase open circuit. The plant response for the loaded power source cannot be calculated without specifying the amount of loading and the specific loads involved.

1.c. If the design does not detect and automatically respond to a single-phase open circuit condition or high impedance ground fault condition on a credited offsite power circuit or another power sources, describe the consequences of such an event and the plant response.

A high impedance ground fault will have no immediate effect on plant operation. If the ground is sufficiently large to affect plant operation, protective relaying will isolate the ground automatically.

The BSEP licensing basis of the Class 1E protection scheme for the emergency buses does not address the ability to detect and automatically respond to a single-phase open circuit condition on the credited off-site power source. As such, an open phase fault was not included in the design criteria for either the loss of voltage or the degraded voltage relay scheme design criteria and no design basis calculations or design documents exist that previously considered this condition.

Without formalized engineering calculations or engineering evaluations, the electrical consequences of such an open phase event (i.e., including plant response), can only be evaluated to the extent of a generic overview. To provide more specifics, detailed plant specific models would need to be developed (e.g., transformer magnetic circuit models, electric distribution models, motor models; including positive, negative, and zero sequence impedances (i.e., voltage and currents)) and the models would need to be compiled and analyzed for the BSEP-specific Class 1E electric distribution system.

2.e. If a common or single offsite circuit is used to supply redundant ESF buses, explain why a failure, such as a single-phase open circuit or high impedance ground fault condition, would not adversely affect redundant ESF buses.

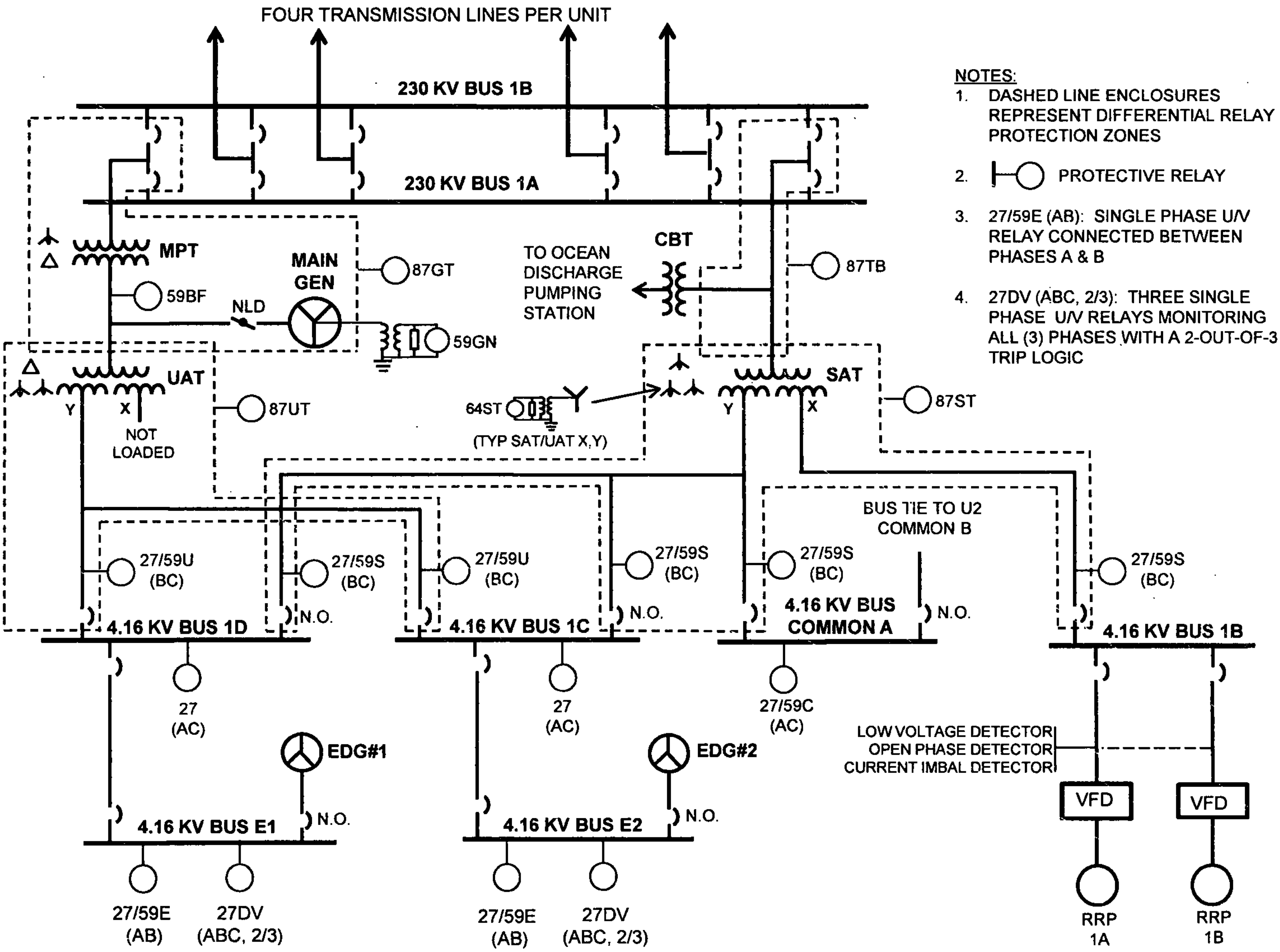
A common power source is used to supply both divisions of the emergency buses. As a result, a failure of the power source would affect both division buses. Consistent with the BSEP current licensing basis and the intent of GDC 17, protective circuitry will separate the emergency buses from a failed offsite source due to a loss of voltage or a sustained balanced degraded grid voltage concurrent with certain DBAs. The relay systems were not specifically designed to detect a single-phase open circuit of a three-phase system. No calculations for this scenario have been completed.

Ground faults of any impedance value anywhere in the distribution system, including transformer connections to the switchyard PCBs, will either be rapidly detected and automatically isolated by protective relay circuitry or will have no impact on bus voltages.

In response to Institute of Nuclear Power Operations (INPO) Event Report (IER) 2012-14 recommendations, site procedures have been revised to require daily visual inspections of the SAT and MPT 230 kV connections and to obtain voltage measurements on 4.16 kV buses, during plant shutdown conditions (i.e., Modes 4 and 5). The visual inspections verify continuity of all three phases between the 230 kV MPT and SAT bushings and the 230 kV switchyard buses A and B. The voltage measurements verify balanced three-phase voltage on 4.16 kV buses 1B (2B), 1C (2C), and 1D (2D). The basis for limiting these activities to plant shutdown conditions only is that, during normal plant operations, a single-phase open circuit on the UAT or the SAT should be detected either by the emergency bus degraded voltage protection circuit or by tripping of the reactor recirculation pump VFDs.

Site annunciator procedures have also been revised to provide operator guidance for the recognition of, confirmation and response to single phase open circuit conditions. Recognition of the open phase condition is symptom based, which includes the transfer of an emergency bus to the diesel generator, a VFD trip on current imbalance or low input voltage, a VFD alarm on high motor current, low input voltage or loss of input phase and various motor overload alarms. The operator response to these symptoms includes confirmation of the single phase open circuit via field walkdown inspection and/or verification of imbalanced 4.16 kV bus phase voltages and the manual transfer of the emergency bus(es) to their diesel generator.

Attachment 1
Simplified One-Line Diagram
(Unit 1 distribution system is shown. Unit 2 is similar)



Note: GDC-17 credited off-site circuits are: (1) SAT – immediately available, (2) UAT Backfeed via MPT – delayed availability (i.e., 1 hour)

Attachment 2 - Tables

Table 1 - Emergency Buses Not Continuously Powered From Offsite Power Source(s)		
Description of Emergency Bus Power Source	**Emergency Bus Name (normal operating condition).**	**Original licensing basis configuration (Y/N)**
Unit Auxiliary Transformer (UAT)	4.16 kV bus E1 (E3)	Y
Unit Auxiliary Transformer	4.16 kV bus E2 (E4)	Y

Table 2 - Emergency Buses Normally Energized Major Loads			
Emergency Bus	**Load**	**Voltage Level**	**Rating (HP)**
E1 (E3)	Control Rod Drive Pump 1A (2A)	4 kV	250
E1 (E3)	Nuclear Service Water Pump 1A (2A)	4 kV	300
E1 (E3)	Conventional Service Water Pump 1B (2A)	4 kV	300
E2 (E4)	Control Rod Drive Pump 1B (2B)	4 kV	250
E2 (E4)	Nuclear Service Water Pump 1B (2B)	4 kV	300
E2 (E4)	Conventional Service Water Pump 1C (2B)	4 kV	300

Table 3 – Offsite Power Transformers				
Transformer	**Winding Configuration**	**MVA Size (AO/FA/FA)**	**Voltage Rating (Primary/Secondary)**	**Grounding Configuration**
Start-up Auxiliary Transformer (SAT)	Wye-Wye-Wye (3 Leg)	H: 27/36/45 X: 9.6/12.8/16 Y: 17.4/23.2/29	230 kV/4.16 kV/4.16 kV	H: Solidly Grounded X: High Resist Grounded Y: High Resist Grounded
Unit Auxiliary Transformer (UAT)	Delta-Wye-Wye (3 Leg)	H: 27/36/45 X: 9.6/12.8/16 Y: 17.4/23.2/29	23.5 kV/4.16 kV/4.16 kV)	H: Ungrounded X: High Resist Grounded Y: High Resist Grounded
Main Power Transformer (MPT)	Wye-Delta (Three single-phase banks)	1200 MVA (400 MVA/Bank)	230 kV/24 kV	HV (Wye): Solidly Grounded LV (Delta): Ungrounded

Table 4 – Emergency Bus Undervoltage Protection Devices					
Protection Zone	**Protective Device**	**Output Logic**	**Setpoint (Nominal)**	**Function (Trip/Alarm)**	**Basis for Setpoint**
4.16 kV Emergency Bus	Loss of Voltage Relay 27/59E (Single-phase induction disk connected across phases A and B)	1 of 1	3255 V (78% of 4160 V), Inverse Time (1.1 sec at 0 Volts, 5 sec at 70% Voltage)	Trip	To actuate upon complete loss of ESF Bus voltage condition
4.16 kV Emergency Bus	Degraded Voltage Relay 27DV (27DVA/27DVB/27DVC) – (three single-phase relays each connected across two phases, A to B, B to C, A to C)	2 of 3	3727 V (89.6% of 4160 V), 10 sec time delay	Trip	To actuate on ESF bus sustained degraded voltage

Table 5 – Ground Fault Protection Devices				
Protection Zone	**Protective Device**	**Setpoint (Nominal)**	**Function (Trip/Alarm)**	**Basis for Setpoint**
24 kV System including Generator, Isophase Bus, UAT and MPT 24 kV Windings	Generator Neutral Overvoltage Relay 59GN (GE IAV51K)	12.5 V, Time Dial 4 (Equivalent to 0.5 A ground current on 24 kV system)	Trip	To actuate on ground faults in the protection zone with the generator online.
24 kV System including Isophase Bus, UAT and MPT 24 kV Windings	Isophase Bus Ground Detection Relay 59BF (GE IAV52D)	16 V (Equivalent to approximately 40% voltage imbalance)	Alarm	To actuate on ground faults in the protection zone with the generator offline.
4.16 kV BOP and Emergency System	UAT Ground Relay 64UT (ABB type CV-8)	10 V, Time Dial 2 (Equivalent to 0.6 A ground current on 4.16 kV system)	Alarm	To detect ground conditions on the 4.16 kV system when powered by the UAT
4.16 kV BOP and Emergency System	SAT Ground Relay 64ST (ABB type CV-8)	10 V, Time Dial 2 (Equivalent to 0.6 A ground current on 4.16 kV system)	Alarm	To detect ground conditions on the 4.16 kV system when powered by the SAT