October 24, 2012

NRC 2012-0091
10 CFR 50.54(f)
BL 2012-01

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Point Beach Nuclear Plant, Units 1 and 2
Docket 50-266 and 50-301
Renewed License Nos. DPR-24 and DPR-27

NextEra Energy Point Beach, LLC Response to NRC Bulletin 2012-01
Design Vulnerability in Electric Power System

References: (1) U.S. Nuclear Regulatory Commission, "Design Vulnerability in Electric Power System," NRC Bulletin 2012-01, July 27, 2012 (ML12074A115)

Via Reference (1), the Nuclear Regulatory Commission (NRC) issued Bulletin (BL) 2012-01, "Design Vulnerability in Electric Power System." The BL requested NextEra Energy Point Beach, LLC (NextEra) to provide information regarding the Point Beach Nuclear Plant (PBNP) electric power system design, in response to the recent operating experience that involved the loss of one of the three phases of the offsite power circuit at Byron Station, Unit 2, to determine if future regulatory action is warranted. Enclosure 1 contains the NextEra response to BL 2012-01.

This letter contains no new Regulatory Commitments and no revisions to existing Regulatory Commitments.

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

Very truly yours,

NextEra Energy Point Beach, LLC

for L. Meyer

Larry Meyer
Site Vice President

Enclosure

cc: Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
Resident Inspector, Point Beach Nuclear Plant, USNRC

ENCLOSURE 1

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

NEXTERA ENERGY POINT BEACH, LLC RESPONSE TO NRC BULLETIN 2012-01
DESIGN VULNERABILITY IN ELECTRIC POWER SYSTEM

SYSTEM DESCRIPTION

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

Bulletin Item 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).

NextEra Response

See Attachment 1 for a simplified one-line diagram.

The engineering safeguards features (ESF) buses are normally powered directly from offsite power (are not connected to the main generator during normal operation). The 345kV system continuously provides offsite power via the high voltage station auxiliary transformer (HVSAT) and the low voltage station auxiliary transformer (LVSAT). HVSAT and LVSAT for each unit supplies the offsite power for both ESF A and B Train buses.

Bulletin Item 1.d.

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

NextEra Response

See Attachment 2, Table 4 for offsite power transformer winding and grounding configurations.

High Voltage Station Auxiliary Transformer (1X-03 and 2X-03): The 345kV/13.8kV HVSAT at Point Beach Nuclear Plant (PBNP) provides offsite power to its designated unit and is the alternate offsite power for the opposite unit via the 13.8kV system. The HVSATs have a wye-solidly grounded connected primary side winding and a delta connected secondary winding. The HVSAT provides offsite power to the 13.8kV system. The neutral of the primary winding is solidly grounded and monitored by a ground overcurrent relay. There is one HVSAT per unit. The HVSATs are the normal offsite power source for ESF buses.

Low Voltage Station Auxiliary Transformer (1X-04 and 2X-04): The 13.8kV/4.16kV LVSAT provides offsite power via the 13.8kV system to the 4.16kV system, which powers the ESF buses. The LVSATs have a delta connected primary side winding and two wye–impedance grounded connected secondary windings. One of the secondary windings supplies the A Train ESF buses and the other secondary winding supplies the B Train ESF buses. The secondary windings are grounded through a common point and monitored by a ground overcurrent relay. There is one LVSAT per unit. The LVSATs are the normal offsite power source for the ESF buses.

Station Service Transformers (1X-13, 1X-14, 2X-13, and 2X-14): The safety related 4.16kV/480V station service transformers provide offsite power from the 4.16kV ESF buses to the 480V ESF buses. The station service transformers have a delta connected primary side winding and a delta connected secondary side winding. This is the supply of offsite power to the 480V ESF buses.

Main Power Transformer (1X-01 and 2X-01): The 345kV/18.5kV main power transformer takes the 19kV output of the main generators and steps it up to 345kV for output to the transmission system during at power operation. The main power transformer has a wye-solidly grounded connected primary side winding and a delta connected secondary winding. The neutral of the primary winding is solidly grounded and monitored by a ground overcurrent relay. The main power transformer also supplies power to the unit auxiliary transformer (UAT) at power, startup, and shutdown operation.

Unit Auxiliary Transformer (1X-02 and 2X-02): The 19kV/4.16kV UAT provides power to the non-safety related balance of plant buses during normal operation. The UATs also could provide alternate power to the 4.16kV ESF buses during shutdown or outage operation. The UATs have a delta connected primary side winding and two wye–impedance grounded connected secondary windings. The secondary windings are grounded through a common point and monitored by a ground overcurrent relay.

Bulletin Item 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.

NextEra Response

For at power (normal operating conditions) configurations, the ESF buses are powered by offsite sources via the HVSAT and LVSAT transformers.

See Attachment 2, Tables 1 and 2 for ESF bus power sources. See Attachment 2, Table 3 for ESF bus major loads energized during normal power operations, including their ratings.

Bulletin Item 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.

NextEra Response

The operating configurations of the ESF buses at PBNP have been confirmed to be consistent with the Current Licensing Basis (CLB). There have been three changes in the offsite power source alignment to the ESF buses since original plant licensing:

1. The original Final Safety Analysis Report (FSAR) states that initially, only three 345kV transmission lines were connected when Unit 1 was placed in-service. However, a fourth transmission line was connected to the PBNP switchyard in 1972 when Unit 2 was placed in-service.

2. An offsite power source alignment was added in 1983 to backfeed the ESF buses through the main power transformer and UAT by removing the generator disconnect links. This offsite power source alignment was added to allow restoration of the preferred offsite power source should a LVSAT become inoperable. This would reestablish a second circuit to the offsite power.

3. A major modification was performed to install main generator breakers in Unit 2 in 2009 and in Unit 1 in 2011. This modification also disabled the fast bus transfer of the non-safety related buses normally powered from the UAT to the LVSAT on a unit trip. Since the modification has been completed, the non-safety related buses are always powered from the UAT except during transformer outages for maintenance. In addition, the backfeed of the ESF buses, as described above, became more reliable and timely since the removal of the generator disconnect links are no longer required because the main generator breaker will isolate the generator.

SYSTEM PROTECTION

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

Bulletin Item 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. Also, include the following information:

NextEra Response

The safety related 4.16kV ESF buses for each unit are normally supplied by offsite power from the LVSAT and the HVSAT. Each ESF bus has three loss of voltage relays and three degraded voltage relays that are monitoring the voltage across each line-to-line voltage (A-B, B-C and A-C). The loss of voltage relays will drop out at approximately 75% of nominal voltage and with a two-out-of-three logic. The degraded voltage relays will drop out at approximately 95% of nominal voltage and with a two-out-of-three logic. Both the loss of voltage relays and degraded voltage relays will initiate the loss of offsite power (LOOP) process for the associated train by tripping the bus supply breaker and initiating a start signal to an emergency diesel generator (EDG).

The HVSATs and main power transformers have feeder breaker overcurrent protection, differential relay protection, and primary winding neutral overcurrent protection. Any of these schemes, if triggered, will isolate the transformers from the switchyard. This would then trigger the above loss of voltage scheme, taking the unit into the LOOP process if the safety buses were being supplied by the associated transformer at the time of the event.

The LVSAT and the UAT have feeder breaker overcurrent protection, differential relay protection, and secondary winding neutral overcurrent protection. Any of these schemes, if triggered, will isolate the transformers from the switchyard. This would then trigger the above loss of voltage scheme, taking the unit into the LOOP process if the safety buses were being supplied by the associated transformer at the time of the event.

In addition, the loads on the safety related 4.16kV ESF buses and non-safety related 4.16kV buses have feeder breaker overcurrent protection and ground overcurrent relay protection.

Loss of Phase at PBNP

The loss of a single phase to the primary winding of a transformer has different effects on the resultant primary and secondary voltages depending on the transformer winding configurations (i.e., delta, wye, or wye-grounded (wye-g)) and electrical characteristics of the transformer. For the normal credited offsite power circuit for Technical Specifications, PBNP has three locations between the offsite power source and the safety related 4.16kV ESF buses were a loss of phase event could occur:

1. High Side of HVSAT, 345kV system;

2. 13.8kV system between HVSAT and LVSAT; and

3. 4.16kV system between LVSAT and safety related 4.16kV ESF buses.

Condition 1:

An open phase on the primary side of the HVSATs is expected to have no impact on the safety related 4.16kV ESF buses. The paper, "A Practical Guide for Detecting Single-Phasing on a Three-Phase Power System," written and presented to the Western Protective Relay Conference in October 2002 by Basler Electric Company (Basler paper), concludes that a single open phase on the primary side of a wye-g to delta transformer will ideally have no affect on the voltages and currents on the secondary side.

Page 31 of the Basler paper states, "If a single phase is lost in the wye source the phase to neutral voltage of the lost phase will be fairly well reproduced via the delta winding feed-back process." A key physical characteristic of the delta transformer is that the summing of the voltages in the delta loop equal 0 (VA + VB + VC = 0) and that the positive and negative sequence components in the delta loop always sum to zero. Therefore, even with a winding of the delta not receiving any energy from the primary side, the voltage across the terminals of that winding, on the condition that the other two-phase voltages of the primary side are normal, will be equal in magnitude to the other secondary voltages. In addition, the voltage on the open primary side phase will be back-fed from the delta secondary. Therefore, the voltages on both the wye-g and delta transformer phases under ideal conditions would not exhibit unbalanced characteristics.

This condition of a lost phase to the primary side of the HVSAT would increase the currents on both the unaffected primary phases to make up for the missing phase. Additionally, the transformer is expected to have reduced capacity when under these conditions. However, the neutral overcurrent protection of the transformer will prevent the HVSAT from becoming overloaded under these conditions. The neutral overcurrent protection setpoint of the HVSAT will ensure the transformer is tripped offline initiating a LOOP when the loading on the transformer is approximately equal to or greater than 11MVA. Therefore, the HVSAT will remain within its transformer self-cooled rating of 28MVA if an open phase condition were to occur. The neutral current through the transformer will be approximately equal to load current of the transformer, in accordance with the Basler paper. During normal plant alignments, the normal system maximum loading is less than 4MVA and the worst-case calculated maximum load post-accident is less than 10 MVA. Therefore, a LOOP would not be expected to be initiated from a loss of a phase when in normal plant alignments.

The voltages on the secondary side of the transformer during this event could be lower due to the capability of the transformer, but the voltages are expected to remain balanced via the delta windings. With the voltages balanced, all the degraded and undervoltage protection schemes would work as designed and down stream equipment would also function as expected.

The specific voltage and currents on the secondary side of the transformer, and ultimately on the safety buses during this event at PBNP, with loading considerations and transformer characteristics, can not be completely determined without sophisticated modeling and analysis. A full modeling and analyses to evaluate all the transients and magnetic characteristics involved is required to understand the affects and validate the conclusions of the Basler paper.

Condition 2:

An open phase on the 13.8kV system, or worst-case the primary side of the LVSATs, is expected to result in actuations of the degraded voltage relays and initiate a LOOP on the safety related 4.16kV ESF buses. The Basler paper concludes that a single open phase on the primary side of a delta to wye-g transformer will result in one of the three line-to-line voltages remaining normal. Page 23 of the Basler paper shows that the range of voltages on the two line-to-line voltages impacted by the open phase will be less than 87% of nominal voltage. Therefore, the PBNP degraded voltage relays would sense the voltage because two-out-of-three relays would sense the undervoltage and actuate the logic to initiate a LOOP.

A full modeling and analyses to evaluate all the transients and magnetic characteristics involved is required to understand all the affects and validate the conclusions of the Basler paper.

Condition 3:

An open phase on the 4.16kV system between the LVSAT and the ESF buses is expected to result in actuations of the degraded voltage relays and initiate a LOOP on the safety related 4.16kV ESF buses. The loss of a single phase would result in two of the three line-to-line voltages dropping to approximately 58% of nominal voltage. Therefore, the PBNP degraded voltage relays would sense the voltage because two out of three relays would sense the undervoltage and actuate the logic to initiate a LOOP.

For the alternate credited offsite power circuit for Technical Specifications, the discussion above would be equivalent if the 4.16kV ESF buses would be supplied by main power transformers and the UAT except for the following: An open phase on the primary winding of the main power transformer would be equivalent to the HVSAT except that the main power transformer will not trip on neutral overcurrent because the maximum plant system loading will never reach the neutral overcurrent relays setpoint. However, the maximum system loading would be less than 0.10x the main power transformer rating of 675MVA.

A full modeling and analyses to evaluate all the transients and magnetic characteristics involved is required to understand all the affects and validate the conclusions of the Basler paper.

Consistent with the CLB, existing protective circuitry will separate the ESF 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. The relay systems were not specifically designed to detect an open single phase of a three phase system. Detection of a single-open phase condition is beyond the approved design and licensing basis of the plant. However, due to the transformer configurations at PBNP, it is expected that either adequately balanced three phase conditions will exist or actuation of the degraded voltage relays will occur because two of the three line-to-line voltages will be below the degraded voltage relays setpoint. Therefore, if an open phase condition were to exist at PBNP, all ESF equipment would remain capable of performing its designated safety function by having adequate offsite power or be isolated from offsite power and loaded onto the EDGs.

High Impedance Ground Faults

As discussed in the previous section, there are three locations between the offsite power source and the safety related 4.16kV ESF buses were a high impedance ground fault event could occur:

1. High Side of HVSAT, 345kV system;
2. 13.8kV system between HVSAT and LVSAT; and
3. 4.16kV system between LVSAT and safety related 4.16kV ESF buses.

Condition 1:

A high impedance ground fault on the 345kV system will result in an actuation of the transmission system's protective relaying or have the same effect as described in the loss of a phase section discussed above. Therefore, it would not impact to the ESF buses at PBNP.

Condition 2:

A high impedance ground fault on the 13.8kV system will not impact the ESF system because the 13.8kV system is an ungrounded system in a delta configuration. A single ground fault will not result in a current flow for a high impedance or low impedance fault. However, the 13.8kV system has ground detection that will alarm the Control Room if a single ground exists and corrective actions would be taken to remove the ground from the system. Therefore, a high impedance ground fault would not negatively impact the offsite power source to the ESF system.

Condition 3:

The 4.16kV system is an impedance grounded system because the LVSAT secondary neutral windings are grounded through an impedance. As a result, this limits the fault current from a single line to ground to acceptable levels to minimize or prevent damage or abnormal operation of the 4.16kV system. In addition, the impedance grounded system is designed to limit a single line to ground fault to a maximum of 1000 amps. In addition, the transformer and individual 4.16kV loads have ground/neutral protection relays to isolate the equipment with a ground fault that could sufficiently negatively impact the system. Therefore, a single line to ground fault that would negatively impact the 4.16kV system will be limited to a maximum of 1000 amps and would be properly isolated by the protective relaying before ground current reaches an unacceptable level.

The discussion above would be equivalent if the 4.16kV ESF buses would be supplied by main power transformers and the UAT.

Bulletin Item 1.a.

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

NextEra Response

Consistent with the CLB, existing electrical protective devices are sufficiently sensitive to detect design basis conditions like a loss of voltage or a degraded voltage event, but were not designed to detect a single phase open circuit condition. However, due to the characteristics of a secondary delta winding, the secondary voltages are not expected to be unbalanced in response to an open phase condition on the primary side of the transformer. Therefore, analyses and calculations to determine the setpoints and protection schemes are considered valid and will respond to this event. See Attachment 2, Table 5 for undervoltage protective devices and the basis for the device setpoints.

Existing electrical protective devices are also sufficiently sensitive to detect a ground fault on the secondary side of the supply transformers. Attachment 2, Table 5 lists ground overcurrent protective devices on the high resistance grounded ESF buses and the basis for the device setpoints.

Bulletin Item 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.

NextEra Response

This question is not applicable to PBNP because the ESF buses are normally powered from an offsite power source.

Bulletin Item 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?

NextEra Response

After a review of the plant operating procedures, no specific steps were found that call for the Operators to verify the voltage of all three phases on the ESF buses. However, the voltmeters for the 4.16kV ESF buses do not have the capability to read all three line-to-line bus voltages. The voltage meters on the 4.16kV ESF buses are connected to only read a single line-to-line voltage (only capable of monitoring V_{BC}), and plant operators do not have the capability to check all three phases. The voltage meters on the 480V ESF buses are capable of all three phases but only one at a time with the use of a selector switch. As discussed previously, based on the transformer configuration at PBNP, an open phase condition will either result in an undetectable condition or in an actuation of the degraded voltage protection scheme. Therefore, even if the voltage were cycled through on a periodic basis or by procedure, the voltage observed would not identify an open phase condition.

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:

Bulletin Item 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.

NextEra Response

The ESF buses are normally powered from offsite power and do not automatically transfer to an unloaded transformer. Therefore, this question is not applicable to PBNP and an analysis of an unloaded transformer configuration has not been performed. However, based on the transformer configuration at PBNP, there would be little difference between a loaded and unloaded transformer.

Bulletin Item 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.

NextEra Response

A high impedance ground 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.

A loss of phase event will have no effect or consequences on the ESF buses and equipment as discussed in the response to Question 1 above based on the assessment performed utilizing the Basler paper. However, note the following:

1. In the CLB, the Class 1E protection scheme (for the ESF buses) was not designed to detect and automatically respond to a single-phase open circuit condition on the credited offsite power source as described in the FSAR and Technical Specifications.

2. Since PBNP did not credit the ESF bus protection scheme as being capable of detecting and automatically responding to a single phase open circuit condition, 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. Since open phase detection was not credited in the PBNP design or licensing basis, no design basis calculations or design documents exist that previously considered this condition.

3. Without formalized engineering calculations or engineering evaluations, the electrical consequences of such an open phase event (including plant response), can only be evaluated to the extent of what has already been published by EPRI and Basler, which is a generic overview. The difficulty in applying these documents to the PBNP-specific response is that these are generic assessments and cannot be formally credited as a basis for an accurate response. The primary reason is that detailed plant specific models would need to be developed (e.g., transformer magnetic circuit models; electric distribution models; and motor models, including positive, negative, and zero sequence impedances (voltage and currents)) and the models would need to be compiled and analyzed for the PBNP-specific Class 1E electric distribution system.

Bulletin Item 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.

NextEra Response

Consistent with the CLB, protective circuitry will separate the ESF buses from a failed offsite source due to a loss of voltage or a sustained balanced degraded grid voltage concurrent with certain design basis accidents. The relay systems were not specifically designed to detect an open single phase of a three phase system. Detection of a single-phase open circuit is beyond the design and licensing basis of the plant. No calculations for this scenario have been performed. However, at PBNP, the ESF buses would either maintain a sufficiently balanced three phase system voltage or actuate the degraded voltage relays depending on the location of the open phase between the 345kV system and the 4.16kV ESF buses (See the NextEra Response to Bulletin Item 1. for more information). Therefore, if the open phase condition occurred, it would either result in adequate system voltage for ESF equipment to operate satisfactorily or it would actuate the degraded voltage relays and place the ESF buses on the EDGs. The open phase event would not prevent one or both trains of ESF equipment from performing their designated safety functions.

Consistent with the current station design, protective circuitry will protect from a ground fault condition with all three phases intact.

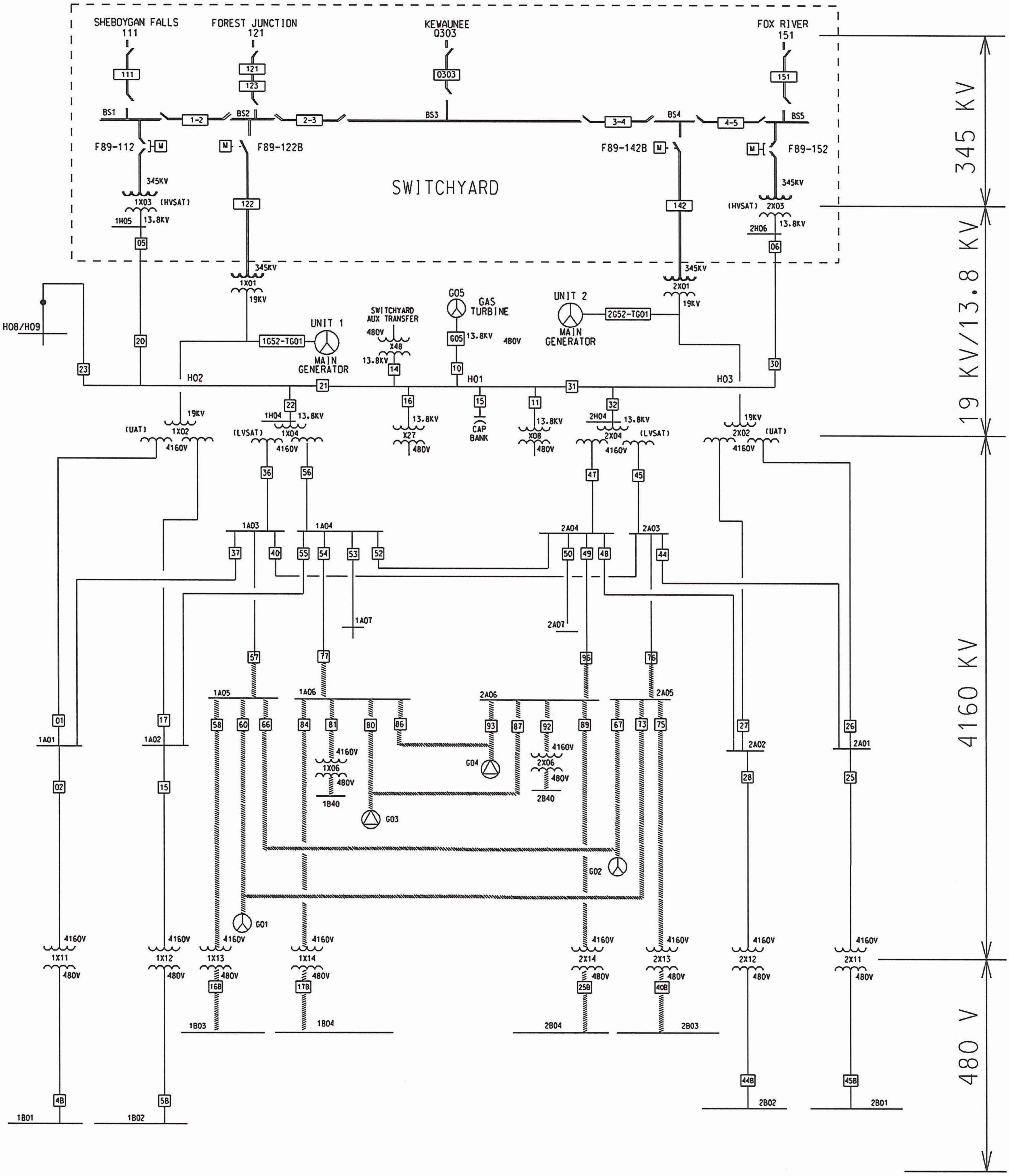
ENCLOSURE 1
ATTACHMENT 1

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

NEXTERA ENERGY POINT BEACH, LLC RESPONSE TO NRC BULLETIN 2012-01
DESIGN VULNERABILITY IN ELECTRIC POWER SYSTEM

SIMPLIFIED ONE-LINE DIAGRAM

1 page follows


SHEBOYGAN FALLS
111
FOREST JUNCTION
121
KEWAUNEE
0303
FOX RIVER
151
SWITCHYARD
BS1
BS2
BS3
BS4
BS5
F89-112
F89-122B
F89-142B
F89-152
UNIT 1
MAIN GENERATOR
UNIT 2
MAIN GENERATOR
GAS TURBINE
SWITCHYARD AUX TRANSFER
CAP BANK
345 KV
19 KV/13.8 KV
4160 KV
480 V

ENCLOSURE 1
ATTACHMENT 2

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

NEXTERA ENERGY POINT BEACH, LLC RESPONSE TO NRC BULLETIN 2012-01
DESIGN VULNERABILITY IN ELECTRIC POWER SYSTEM

TABLES

Table 1: ESF Buses Continuously Powered From Offsite Power Source(s)

Description of ESF Bus Power Source	ESF Bus Name (Normal Operating Condition).	Original Licensing Basis Configuration (Y/N)
Unit 1 High Voltage Station Auxiliary Transformer (1X-03) and Low Voltage Station Auxiliary Transformer (1X-04)	Unit 1 A Train Buses 4.16kV Bus 1A-05 480V Bus 1B-03	Y
Unit 1 High Voltage Station Auxiliary Transformer (1X-03) and Low Voltage Station Auxiliary Transformer (1X-04)	Unit 1 B Train Buses 4.16kV Bus 1A-06 480V Bus 1B-04	Y
Unit 2 High Voltage Station Auxiliary Transformer (2X-03) and Low Voltage Station Auxiliary Transformer (2X-04)	Unit 2 A Train Buses 4.16kV Bus 2A-05 480V Bus 2B-03	Y
Unit 2 High Voltage Station Auxiliary Transformer (2X-03) and Low Voltage Station Auxiliary Transformer (2X-04)	Unit 2 B Train Buses 4.16kV Bus 2A-06 480V Bus 2B-04	Y

Table 2: ESF Buses Not Continuously Powered From Offsite Power Source(s)

Description of ESF Bus Power Source	ESF Bus Name (Normal Operating Condition).	Original Licensing Basis Configuration (Y/N)
Not Applicable	Not Applicable	Not Applicable

Table 3: ESF Buses Normally Energized Major Loads

ESF Bus	Load	Voltage Level	Rating (HP)
1B-03 (480V A Train)	Unit 1 Component Cooling Water Pump A	480V	250
1B-03 (480V A Train)	Service Water Pump A	480V	300
1B-03 (480V A Train)	Service Water Pump B	480V	300
1B-03 (480V A Train)	Unit 1 Charging Pump (A and B)	480V	90 kVA
1B-03 (480V A Train)	Unit 1 Containment Accident Fans (A and B)	480V	150
1B-04 (480V B Train)	Unit 1 Component Cooling Water Pump B	480V	250
1B-04 (480V B Train)	Service Air Compressor (A)	480V	200
1B-04 (480V B Train)	Service Water Pump C	480V	300
1B-04 (480V B Train)	Unit 1 Charging Pump C	480V	90 kVA
1B-04 (480V B Train)	Unit 1 Containment Accident Fans (C and D)	480V	150
2B-03 (480V A Train)	Unit 2 Component Cooling Water Pump A	480V	250
2B-03 (480V A Train)	Service Water Pump F	480V	300
2B-03 (480V A Train)	Unit 2 Charging Pump (A and B)	480V	90 kVA
2B-03 (480V A Train)	Unit 2 Containment Accident Fans (A and B)	480V	150
2B-04 (480V B Train)	Service Air Compressor (B)	480V	125
2B-04 (480V B Train)	Unit 2 Component Cooling Water Pump B	480V	250
2B-04 (480V B Train)	Unit 2 Charging Pump C	480V	90 kVA
2B-04 (480V B Train)	Service Water Pump D	480V	300
2B-04 (480V B Train)	Service Water Pump E	480V	300
2B-04 (480V B Train)	Unit 2 Containment Accident Fans (C and D)	480V	150

Table 4: Offsite Power Transformers

Transformer	Winding Configuration	Nominal MVA	Voltage Rating (Primary/Secondary)	Grounding Configuration
High Voltage Station Auxiliary Transformer (1X-03 and 2X-03)	Wye – Delta	28MVA	345kV/13.8kV	Primary – Solidly Grounded
Low Voltage Station Auxiliary Transformer (1X-04 and 2X-04)	Delta – Wye – Wye	28MVA/14.8MVA/14.8MVA	13.8kV/4.16kV/4.16kV	Secondary – Impedance Grounded
Station Service Transformer (1X-13, 1X-14, 2X-13, and 2X-14)	Delta – Delta	1.5MVA	4.16kV/480V	Ungrounded
Main Transformer (1X-01 and 2X-01)	Wye – Delta	675MVA	345kV/18.5kV	Primary – Solidly Grounded
Unit Auxiliary Transformer (1X-02 and 2X-02)	Delta – Wye – Wye	28MVA/14.8MVA/14.8MVA	19kV/4.16kV/4.16kV	Secondary – Impedance Grounded

Table 5: Protective Devices

Protection Zone	Protective Device	UV Logic	Setpoint (Nominal)	Basis for Setpoint
4.16 KV ESF Bus	Loss of Voltage Relay	2 of 3	3230V (77.7% of 4160V)	To actuate upon complete loss of ESF Bus voltage condition and prevent spurious tripping during motor start.
480V ESF Bus	Loss of Voltage Relay	2 of 3	255V (53% of 480V)	To actuate after the 4.16kV loss of voltage relay to initiate 480V load shedding scheme.
4.16 kV ESF Bus	Degraded Voltage Relays	2 of 3	3965V (95.3% of 4160V)	To actuate upon a degraded voltage condition to ensure that the 4.16kV safeguards buses are separated from offsite power prior to unsatisfactory operation of equipment or trip on overcurrent.
Each HVSAT	Differential	1 of 3	Primary – 3.8A Tap Secondary – 8.7A Tap	To actuate upon a fault within the differential zone of protection.
Each HVSAT	Overcurrent - Primary	1 of 3	160A	To actuate after a high phase overcurrent condition and the setpoint is based on criteria for transformer protection from the NEC.
Each HVSAT	Neutral Overcurrent	1 of 1	50A	To actuate upon a phase to ground fault and to isolate the transformer prior to damage. The setpoint ensures the transformer will remain within its rating or trip to isolate the transformer. In addition, the setpoint is established to minimize spurious tripping from normal transmission system phase imbalance.
Each LVSAT	Differential	1 of 3	Primary – 3.2A Tap Secondary – 8.7A Tap, 8.7A Tap	To actuate upon a fault within the differential zone of protection
Each LVSAT	Overcurrent	1 of 3	3200A	To actuate after a high phase overcurrent condition and the setpoint is based on criteria for transformer protection from the NEC.
Each LVSAT	Neutral Overcurrent	1 of 1	200A	To actuate upon a phase to ground fault and to isolate the transformer prior to damage. The setpoint ensures the transformer will remain within its rating or trip to isolate the transformer. The setpoint is 20% of the maximum single line to ground fault current of 1000A.
Main Power Transformer	Differential	1 of 3	Primary – 8.7A Tap Secondary – 4.6A Tap	To actuate upon a fault within the differential zone of protection.

Protection Zone	Protective Device	UV Logic	Setpoint (Nominal)	Basis for Setpoint
Main Power Transformer	Overcurrent	1 of 1	1427A	To actuate upon a high phase overcurrent condition and the setpoint is based 125% of generator output and protecting the transformer.
Main Power Transformer	Neutral Overcurrent	1 of 1	480A	To actuate upon a phase to ground fault and to isolate the transformer prior to damage. The setpoint ensures the transformer will remain within its rating or trip to isolate the transformer. In addition, the setpoint is established to minimize spurious tripping from normal transmission system phase imbalance.
Each UAT	Differential	1 of 3	Primary – 3.8A Tap Secondary – 8.7A Tap	To actuate upon a fault within the differential zone of protection.
Each UAT	Overcurrent	1 of 3	1920A	To actuate after a high phase overcurrent condition and the setpoint is based on criteria for transformer protection from the NEC.
Each UAT	Neutral Overcurrent	1 of 1	400A	To actuate upon a phase to ground fault and to isolate the transformer prior to damage. The setpoint ensures the transformer will remain within its rating or trip to isolate the transformer. The setpoint is 40% of the maximum single line to ground fault current of 1000A.
Each Load on A01, A02, A04	Ground Overcurrent Relay	1 of 1	2.5A	To actuate upon a phase to ground fault and isolate the individual load. The setpoint is based on the guidance of IEEE Standard 242-2001 for impedance grounded systems but is set more sensitively.
Each Load on A05 (ESF Bus)	Ground Overcurrent Relay	1 of 1	5A	To actuate upon a phase to ground fault and isolate the individual load. The setpoint is based on the guidance of IEEE Standard 242-2001 for impedance grounded systems but is set more sensitively.
Each Load on A06 (ESF Bus)	Ground Overcurrent Relay	1 of 1	30A	To actuate upon a phase to ground fault and isolate the individual load. The setpoint is based on the guidance of IEEE Standard 242-2001 for impedance grounded systems.