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NL-12-141

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U.S. Nuclear Regulatory Commission
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Washington, DC 20555-0001

Subject: 90-Day Response to Bulletin 2012-01, *Design Vulnerability in Electric Power System*
Indian Point Units 2 & 3
Docket Nos. 50-247 and 50-286
License Nos. DPR-26 and DPR-64

Reference:
1) NRC letter to Entergy, Bulletin 2012-01 *Design Vulnerability in Electric Power System*, dated July 27, 2012

Dear Sir or Madam:

On July 27, 2012, the NRC issued Bulletin 2012-01 (Reference 1), requesting that each licensee submit a written response in accordance with 10 CFR 50.54(f) within 90 days of the bulletin to provide requested information. This letter provides Entergy Nuclear Operations 90-day response for Indian Point Nuclear Generating Units 2 and 3.

In accordance with 10 CFR 50.91, a copy of this submittal, with the enclosure is being provided to the designated New York State official.

If you have any questions or require additional information, please contact Mr. Robert Walpole, Licensing Manager at 914-254-6710.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge. Executed on 10/25/12.

Sincerely,

JAV/nw

IE76
NRR

Attachments: 1. 90-Day Response to NRC Bulletin 2012-01
2. Simplified One-Line Diagrams
3. Tables

cc: NRC Resident Inspector's Office
Mr. Douglas Pickett, Senior Project Manager, NRC NRR DORL
Mr. William M. Dean, Regional Administrator, NRC Region 1
Mr. Francis J. Murray Jr., President and CEO, NYSERDA
Ms. Bridget Frymire, New York State Dept. of Public Service

ATTACHMENT 1 TO NL-12-141

90-Day Response to NRC Bulletin 2012-01

Entergy Nuclear Operations, Inc.
Indian Point Units 2 and 3
Docket Nos. 50-247 and 50-286

Bulletin Response

Please note: NRC Questions are in bold print and italicized. IPEC responses are indented.

Overview:

- System Description - Items 2., 1.d, 2.a, 2.c
- System Protection - 1., 1.a, 2.b, 2.d
- Consequences - 1.b, 1.c, 2.e
- Attachment 2 - Simplified One-Line Diagrams
- Attachment 3 - Tables
    - Table 1 - ESF Buses Continuously Powered From Offsite Power Source(s)
    - Table 2 - ESF Buses Not Continuously Powered From Offsite Power Source(s)
    - Table 3 - ESF Buses Major Loads
    - Table 4 - Offsite Power Transformers
    - Table 5 - Protective Devices

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 2, for simplified one-line diagrams for IP2 and IP3.

The sources of auxiliary power during normal plant operation at Indian Point Unit 2 (IP2) and Unit 3 (IP3) are both the main turbine generator and the 138kV offsite power system.

At both IP2 and IP3, the main turbine generator supplies power to a Unit Auxiliary Transformer (UAT) for non-safety related 6900V Buses (Bus 1, 2, 3 & 4) and safety related 480V Buses 2A and 3A. These two safety related buses are part of the same ESF power train.

The 138kV system provides offsite power to a Station Auxiliary Transformer (SAT) at each plant for non-safety related 6900V Buses (Buses 5 & 6) and safety related 480V Buses 5A and 6A. These two safety related buses are independent ESF power trains.

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

See Attachment 3, Table 4 for offsite power transformer winding and grounding configurations.

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 (normal operating condition) configurations at IP2 and IP3, two ESF buses (two trains) are powered by offsite sources and two ESF buses (one train) are not powered by offsite power.

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

The SATs at IP2 and IP3 each carry non-safety related loads in addition to safety loads during normal operations (at power).

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 indicated in the Updated Final Safety Analysis Report (UFSAR) at IP2 and IP3, 138kV offsite power is supplied from the Buchanan Substation to SATs at each plant. During normal operation, the UATs transform 22kV power from the main turbine generators to 6.9kV and supply four of the six 6900V auxiliary buses at each plant (Bus 1, 2, 3, and 4). The SATs transform 138kV power from the offsite network to the remaining two 6900V auxiliary buses at each plant (Bus 5 and 6). Four of the 6900V buses at each plant, two on the UAT (Bus 2 and 3) and two on the SAT (Bus 5 and 6), supply power to safety related 480V ESF buses.

When the UATs are not available, such as during unit trip, unit downtime, or startup, the four buses normally supplied by this transformer are reconnected to the two remaining buses, and the SAT supplies all auxiliary loads.

The following at power (normal operating condition) configurations have been confirmed to be consistent with the current licensing basis:

1. IP2 Circuit #1 – Power to ESF buses via 138kV switchyard (SAT). Feeder 95332 is the primary circuit, with backup provided by Feeder 95331.
2. IP3 Circuit #1 - Power to ESF buses via 138kV switchyard (SAT). Feeder 95331 is the primary circuit, with backup provided by Feeder 95332.
3. IP2 Circuit #2 – Power to ESF buses via 13.8kV switchyard (step-down auto transformer).
4. IP3 Circuit #2 - Power to ESF buses via 13.8kV switchyard (step-down auto transformer).

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. 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 the current licensing bases and GDC 17, 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. Independence is maintained since the two offsite sources are fed from separate switchyard buses at different voltage levels (138kV and 13.8kV). The 138kV power supply is also provided with primary and backup feeders (primary for IP2 is backup for IP3, and vice versa). Open phase conditions on one feeder will not impact the other circuit.

The electrical protection for offsite circuits have been reviewed with regard to high impedance grounds. Ground fault protection has been provided for the 138kV and 13.8kV offsite circuits, but the effects of high impedance grounds on ESF buses and energized equipment has not been analyzed based on current licensing basis requirements.

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

Consistent with the current licensing bases and GDC 17, existing electrical protective devices are sufficiently sensitive to detect design basis conditions like a loss of voltage or a degraded voltage, but were not designed to detect a single phase open circuit condition. See Attachment 3, Table 5 for undervoltage protective devices and the basis for the device setpoint(s).

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.

Not Applicable – Two ESF buses at IP2, and two ESF buses at IP3, are normally powered by offsite power sources.

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?

The current plant operating procedures, including operating procedures for off-normal alignments, do not specifically call for verification of the voltages on all three phases of the ESF buses.

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 loss of voltage and degraded voltage relays may respond depending on load and possible grounds. In general, there will be no plant response for an unloaded (e.g., ESF buses normally aligned to unit auxiliary transformer) power source in the event of a single-phase open circuit on a credited off-site power circuit because there is insufficient current to detect a single-phase open circuit for this configuration.

The plant response for a loaded power source cannot be calculated without specifying the amount of loading and the specific loads involved. At IP2 and IP3, the Station Auxiliary Transformers are normally loaded at roughly ten percent of the transformer rating, and some loads are normally energized on the ESF buses. Studies have been initiated to evaluate the effects.

The effects of high impedance grounds and the impact on ESF buses have not been evaluated based on current licensing basis requiements.

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 is not expected to have an immediate effect on plant operation. If the ground is sufficiently large, protective relaying will isolate the ground automatically.

1. The IP2 and IP3 Current Licensing Bases (CLB) do not assume that the Class 1E protection scheme (for the emergency safeguard feature (ESF) buses) was designed to detect and automatically respond to a single-phase open circuit condition on the credited off-site power source as described in the UFSAR and Technical Specifications.

The offsite power circuits for IP2 and IP3 consist of two independent circuits. The preferred offsite source at each plant is from the 138kV system via a Station Auxiliary Transformer. The second offsite source at each plant is from the 13.8kV system via a step-down auto transformer. The Indian Point plants are

also designed with a primary 138kV offsite feeder, and a backup feeder, both of which are normally in-service. The primary feeder for IP2 (95332) is the backup feeder for IP3, and the primary feeder for IP3 (95331) is the backup feeder for IP2. The cross-tie between the two units is provided by underground feeder 33332L&M.

2. Since IP2 and IP3 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, the degraded voltage relay (DVR) scheme or secondary level undervoltage protection system (SLUPS) design criteria. Since open phase detection was not credited in the IP2 and IP3 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 IP2 and IP3 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, motor models; including positive, negative, and zero sequence impedances (voltage and currents), and the models would need to be compiled and analyzed for the IP2 and IP3 specific Class 1E electric distribution system (EDS)).

The protection schemes at each plant are not designed to detect open phase conditions, and may not be able to automatically respond, but with primary and backup 138kV offsite feeders normally in-service the impact of a single open phase condition will be minimal. Operators will respond based on the existing plant alarms for ESF bus voltage and the various motor trip conditions at 6900V and 480V.

Operators will continue performing rounds to monitor; 138kV, 6.9kV and 480V bus voltage; 6.9kV motor current; 6900V-480V station service transformer current; and, Station Auxiliary Transformer and 480V transformer temperatures.

Corona and thermography scans are also conducted semi-annually to detect loose or degraded connections in the 138kV offsite power circuits.

In the long term, electromagnetic transient type analyses need to be performed to understand the voltage impact at the ESF buses and determine whether additional

protection is feasible. Long term solutions may be developed based on the results of these analyses.

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.

Consistent with the Current Licensing Bases and GDC 17, 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-open phase circuit is beyond the approved design and licensing bases of the plants. No calculations for this scenario have been performed.

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

At IP2 and IP3, the use of primary and backup 138kV offsite feeders (normally in-service) will minimize the impact of a single open phase condition. Operators will respond based on walkdown information and existing plant alarms for ESF bus voltage and the various motor trip conditions at 6900V and 480V.

ATTACHMENT 2 TO NL-12-141

Simplified One-Line Diagrams

Entergy Nuclear Operations, Inc.
Indian Point Units 2 and 3
Docket Nos. 50-247 and 50-286

Figure 1

IP2 Simplified One-Line Diagram

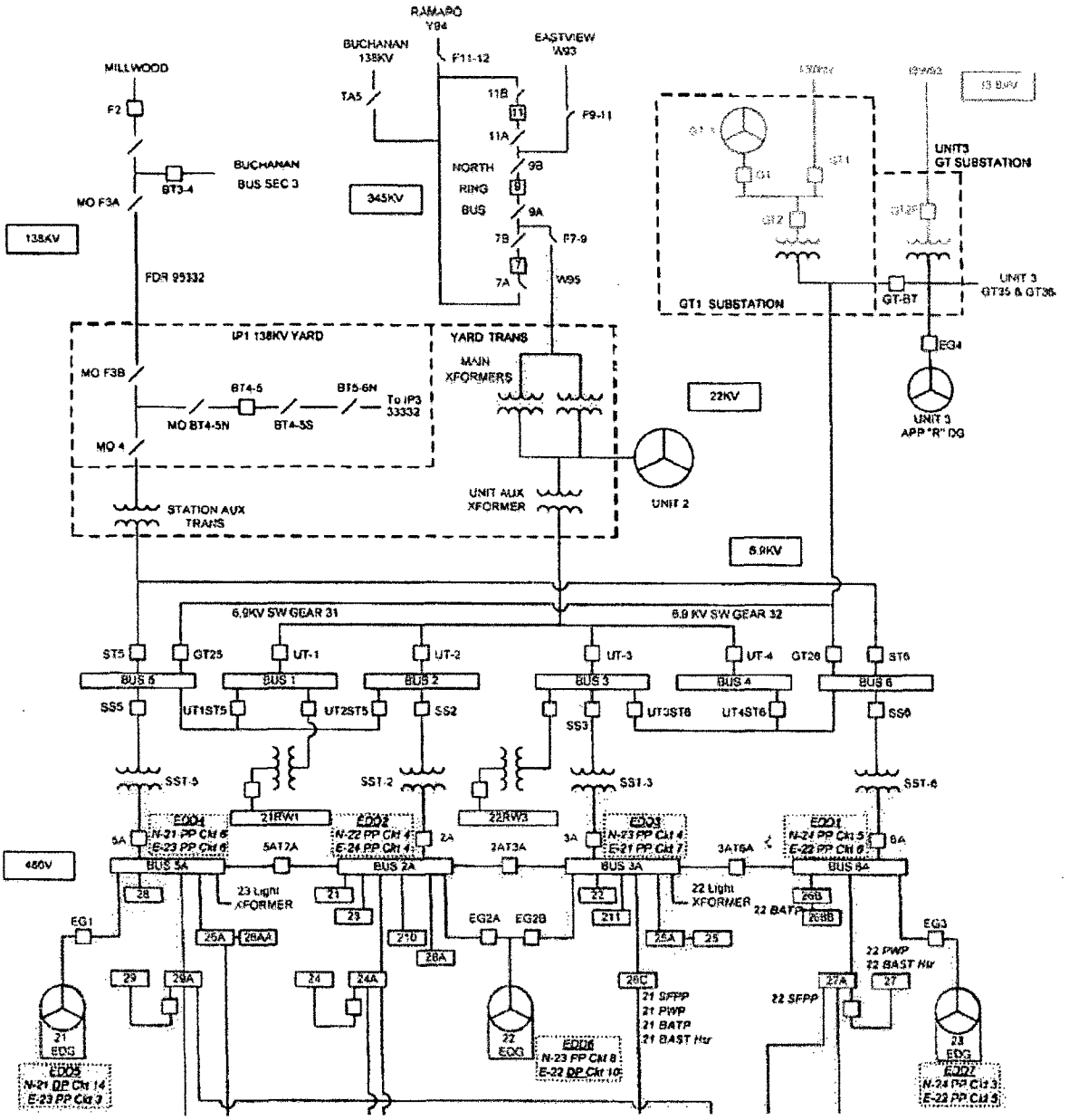
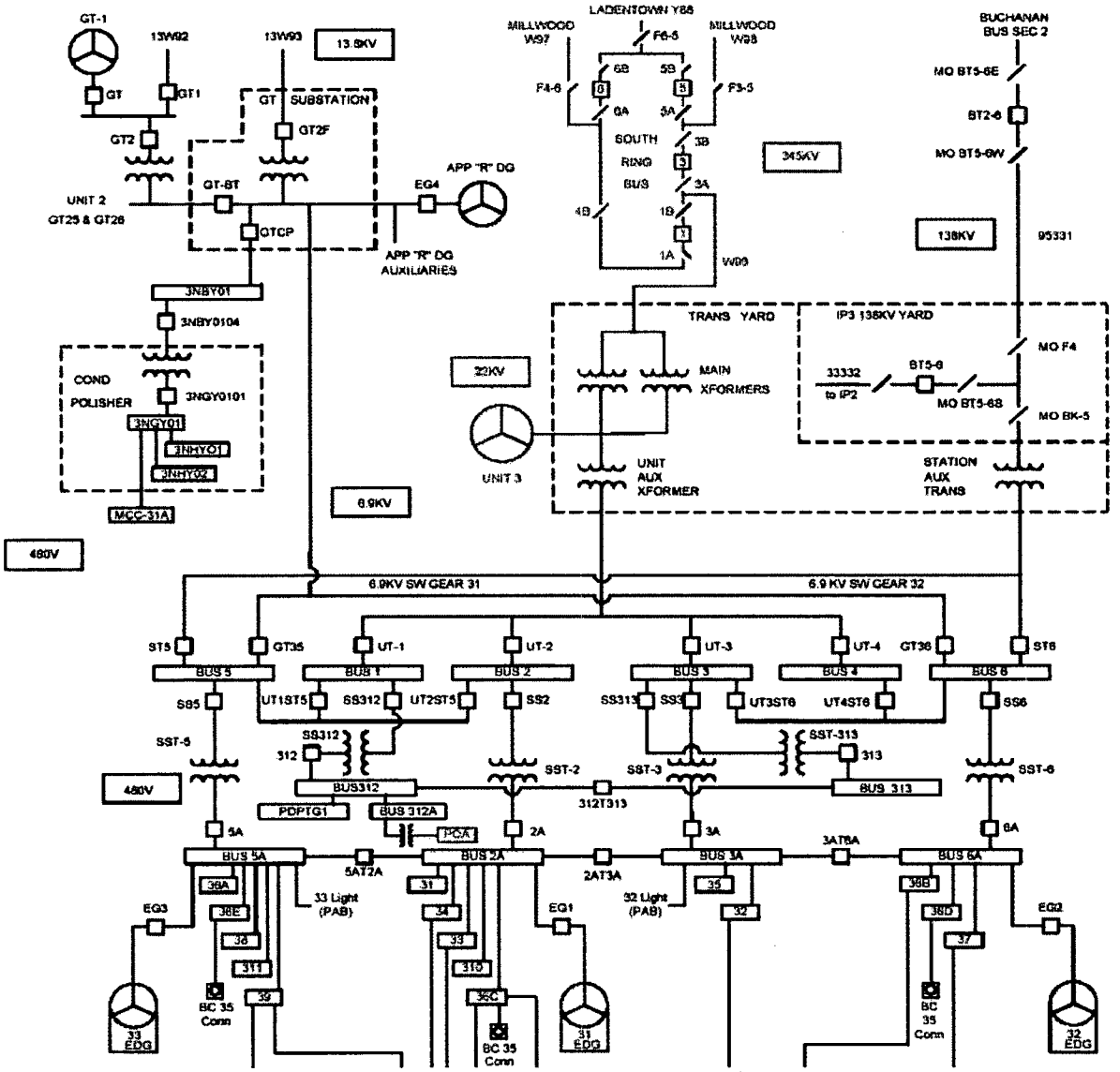


Figure 2

IP3 Simplified One-Line Diagram



ATTACHMENT 3 TO NL-12-141

Tables

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

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

Table 3 - ESF Buses Normally Energized Major Loads

Table 4 - Offsite Power Transformers

Table 5 - Protective Devices

Entergy Nuclear Operations, Inc.
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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)
Station Aux Transformer (IP2-Circuit #1)	480V Bus 5A	Y
Station Aux Transformer (IP2-Circuit #1)	480V Bus 6A	Y
Station Aux Transformer (IP3-Circuit #1)	480V Bus 5A	Y
Station Aux Transformer (IP3-Circuit #1)	480V Bus 6A	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)
Unit Aux Transformer (IP2)	480V Bus 2A	Y
Unit Aux Transformer (IP2)	480V Bus 3A	Y
Unit Aux Transformer (IP3)	480V Bus 2A	Y
Unit Aux Transformer (IP3)	480V Bus 3A	Y

Table 3 - ESF Buses Normally Energized Major Loads

ESF Bus	Load	Voltage Level	Rating (HP)
480V Bus 5A	Containment Recirc Fan	480V	350 (IP2) / 225 (IP3)
	Component Cooling Pump	480V	250
	Charging Pump	480V	200
	Service Water Pump	480V	350
480V Bus 6A	Containment Recirc Fan	480V	350 (IP2) / 225 (IP3)
	Service Water Pump	480V	350
	Rod Power MG Set	480V	150

Table 4 - Offsite Power Transformers

Transformer	Winding Configuration	MVA Size (AO/FA/FA)	Voltage Rating (Primary/Secondary)	Grounding Configuration
Station Aux Transformer (IP2)	Delta-Wye (3 Leg)	43 MVA (FOA)	138kV / 6.9kV	Neutral Grounded
Station Aux Transformer (IP3)	Delta-Wye (3 Leg)	43 MVA (FOA)	138kV / 6.9kV	Neutral Grounded
Auto Transformer (IP2)	Delta-Wye (3 Leg)	20 MVA	13.8kV / 6.9kV	Neutral Grounded
Auto Transformer (IP3)	Delta-Wye (3 Leg)	20 MVA	13.8kV / 6.9kV	Neutral Grounded

Table 5 - Protective Devices

Protection Zone	Protective Device	UV Logic	Setpoint (Nominal)	Basis for Setpoint
IP2 - 480V ESF Buses	Loss of Voltage Relay	2 of 3	220V (~46% of 480V)	To actuate upon complete loss of ESF Bus voltage
IP2 - 480V ESF Buses	Degraded Grid	2 of 2	421V (~88% of 480V)	To activate upon degraded voltage on ESF Bus (3-phase)
IP2 - SAT	Ground Protection (51N/ST)	N/A	1200A	To coordinate with upstream and downstream protective devices
IP3 – 480V ESF Buses	Loss of Voltage Relay	1 of 2	220V (~46% of 480V)	To actuate upon complete loss of ESF Bus voltage
IP3 – 480V ESF Buses	Degraded Grid	2 of 2	422V (~88% of 480V)	To activate upon degraded voltage on ESF Bus (3-phase)
IP3 - SAT	Ground Protection (51NST)	N/A	1200A	To coordinate with upstream and downstream protective devices