George H. Gellrich
Vice President

Calvert Cliffs Nuclear Power Plant, LLC
1650 Calvert Cliffs Parkway
Lusby, Maryland 20657
410.495.5200
410.495.3500 Fax

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CALVERT CLIFFS
NUCLEAR POWER PLANT

October 23, 2012

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Response to NRC Bulletin 2012-01, "Design Vulnerability in Electric Power System"

REFERENCE: (a) NRC Bulletin 2012-01, Design Vulnerability in Electric Power System, dated July 27, 2012

In Reference (a) the Nuclear Regulatory Commission requested that each licensee submit a written response in accordance with 50.54(f) within 90 days of the bulletin. Attachment (1) provides the written response for the Calvert Cliffs Nuclear Power Plant. There are no regulatory commitments identified in this letter.

IE76
NRR

Should you have questions regarding this matter, please contact Mr. Douglas E. Lauver at (410) 495-5219.

Very truly yours,

STATE OF MARYLAND :
: **TO WIT:**
COUNTY OF CALVERT :

I, George H. Gellrich, being duly sworn, state that I am Vice President - Calvert Cliffs Nuclear Power Plant, LLC (CCNPP), and that I am duly authorized to execute and file this response on behalf of CCNPP. To the best of my knowledge and belief, the statements contained in this document are true and correct. To the extent that these statements are not based on my personal knowledge, they are based upon information provided by other CCNPP employees and/or consultants. Such information has been reviewed in accordance with company practice and I believe it to be reliable.

Subscribed and sworn before me, a Notary Public in and for the State of Maryland and County of St. Mary's, this 23RD day of October, 2012.

WITNESS my Hand and Notarial Seal:

Notary Public

My Commission Expires: March 14 2015
Date

GHG/PSF/bjd

Attachment: (1) Response to NRC Bulletin 2012-01

cc: N. S. Morgan, NRC
W. M. Dean, NRC
Resident Inspector, NRC
S. Gray, DNR

ATTACHMENT (1)

RESPONSE TO NRC BULLETIN 2012-01

Calvert Cliffs Nuclear Power Plant, LLC
October 23, 2012

Bulletin Response

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
  - Figure 1 - Simplified CCNPP Unit 1 & 2 Switchyard Diagram
  - 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 (Typical for all 4 Safety 4 kV buses)
  - Table 4 - Offsite Power Transformers
  - Table 5 - Protective Devices

System Description

Items 2, 1.d, 2.a, and 2.c request system information and are 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 Figure 1 for a simplified one-line diagram.

The 500 kV switchyard normally provides continuous offsite power via 500/13.8 kV plant service transformers P-13000-1 and P-13000-2, to both Calvert Cliffs Units. Each transformer's primary winding is connected to one of the two Calvert Cliffs 500 kV switchyard buses.

The Engineered Safety Features (ESF) buses are normally powered directly from offsite power via the plant service transformers.

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

See 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, ESF buses are powered by offsite sources.

See Tables 1 and 2 for ESF bus power sources.

See Table 3 for ESF bus major loads energized during normal power operations, including their ratings.

Note, some non-safety loads are normally energized from safety-related 4 kV and 480 V 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.

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

Offsite power is supplied to the 500 kV switchyard from the transmission network by three 500 kV transmission lines. Two electrically and physically separated circuits supply electric power from the 500 kV switchyard to two 13 kV buses and then to the two 4.16 kV ESF buses.

Each offsite circuit includes the cabling to and from a 13.8/13.8 kV voltage regulator, 13.8/4.16 kV unit service transformer, and one of the two breakers to one 4.16 kV ESF bus. Transfer capability between the two required offsite circuits is by manual means only. The required circuit breaker to each 4.16 kV ESF bus must be from different 13.8/4.16 kV unit service transformers for the two required offsite circuits. Thus, each unit is able to align one 4.16 kV bus to one required offsite circuit, and the other 4.16 kV bus to the other required offsite circuit.

A third 69 kV/13.8 kV offsite power source that may be manually connected to either 13 kV bus is available from the Southern Maryland Electric Cooperative (SMECO). When appropriate, the Engineered Safety Feature Actuation System (ESFAS) loss of coolant incident and shutdown sequencer for the 4.16 kV bus will sequence loads on the bus after the 69 kV/13.8 kV SMECO line has been manually placed in service. The SMECO offsite power source is not used to carry loads for an operating Unit. The SMECO power source was not part of the plant original license basis. Use of the SMECO line was approved in License Amendments 58 (Unit 1) and 40 (Unit 2).

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 the current licensing basis and General Design Criterion 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.

A preliminary electrical analysis of offsite circuits for an open phase circuit on the 500 kV system with and without a high impedance ground has been reviewed. The analysis shows that the amount of voltage imbalance is a function of the auxiliary load and whether or not the open phase condition introduces another ground on the auxiliary system. The degree of voltage unbalance is significantly increased if the open phase condition is accompanied by a ground on the open terminal on the service transformer. On the other hand, the amount of voltage unbalance is quite modest if the auxiliary system is lightly loaded.

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 basis and General Design Criterion 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 Table 5 for undervoltage protective devices and the basis for the device setpoint(s).

Existing electrical protective devices are also sufficiently sensitive to detect a ground fault. Table 5 lists ground protection on the ESF buses 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 - The ESF buses at Calvert Cliffs are 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. The procedures do, however, require that the voltage meter selector switch be set on the one phase not monitored by the existing degraded voltage relays such that a loss of phase voltage would be detected.

Consequences

Items 1.b, 1.c, and 2.e request information regarding the electrical consequences of an event and are 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.

The 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. The Calvert Cliffs transformers are normally loaded when the plant is operational since the majority of the transformer load is from the reactor coolant pumps.

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.

1. Calvert Cliffs did not credit in the Current Licensing Basis that the Class 1E protection scheme for ESF buses was designed to detect and automatically respond to a single-phase open circuit condition on the credited offsite power source as described in the Updated Final Safety Analysis Report and Technical Specifications.

   Two electrically and physically separated circuits supply electric power from the 500 kV switchyard to two 13 kV buses and then to the two 4.16 kV ESF buses.

2. Since Calvert Cliffs 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 (DVR) scheme. Since open phase detection was not credited in the design or licensing basis, no design basis calculations or design documents exist that previously considered this condition.

A preliminary electrical analysis of offsite circuits for an open phase circuit on the 500 kV system with and without a high impedance ground was, however, completed. The analysis shows that the amount of voltage imbalance is a function of the auxiliary load and whether or not the open phase condition introduces another ground on the auxiliary system. The degree of voltage unbalance is significantly increased if the open phase condition is accompanied by a ground on the open terminal on the service transformer (similar to the first Byron event). On the other hand, the amount of voltage unbalance is quite modest if the auxiliary system is lightly loaded.

Each Calvert Cliffs 4 kV ESF bus is equipped with one set of four DVR relays, and upon receipt of a two-out-of-four logic signal, the bus normal feeder breakers are tripped and power is supplied by the onsite emergency diesel generators. The DVR relays sense voltage levels at the 4 kV bus between phases A-B and phases B-C. Two relays are connected to phases A-B and two to phases B-C. Because phases A-C are not connected, and from the results of the preliminary calculation and DVR settings described above it was determined that the DVR relays may not detect all loss of phase conditions, particularly with a lightly loaded transformer.

As a result of the findings above, the following compensatory actions have been completed:

- Operating crews at Calvert Cliffs were briefed on the operating indications for a single loss of phase on the alternating current high and medium voltage systems.

- A long-term note was added to the Shift Turnover Sheet to maintain 13 kV and 4 kV vital bus voltmeters in position "3-1" (A-C phase) to allow Calvert Cliffs operating crews to identify the precursors to the Byron event and minimize its potential at Calvert Cliffs.

- The Unit 1 and 2 Control Room operating logs have been revised to check that the 13 kV and 4 kV bus voltages are within range and that the voltage phase selector switch is in the "3-1" position.

Potential design changes are being evaluated.

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.

Not applicable - Calvert Cliffs does not normally use a common or single offsite circuit to supply redundant ESF buses.

Figure 1

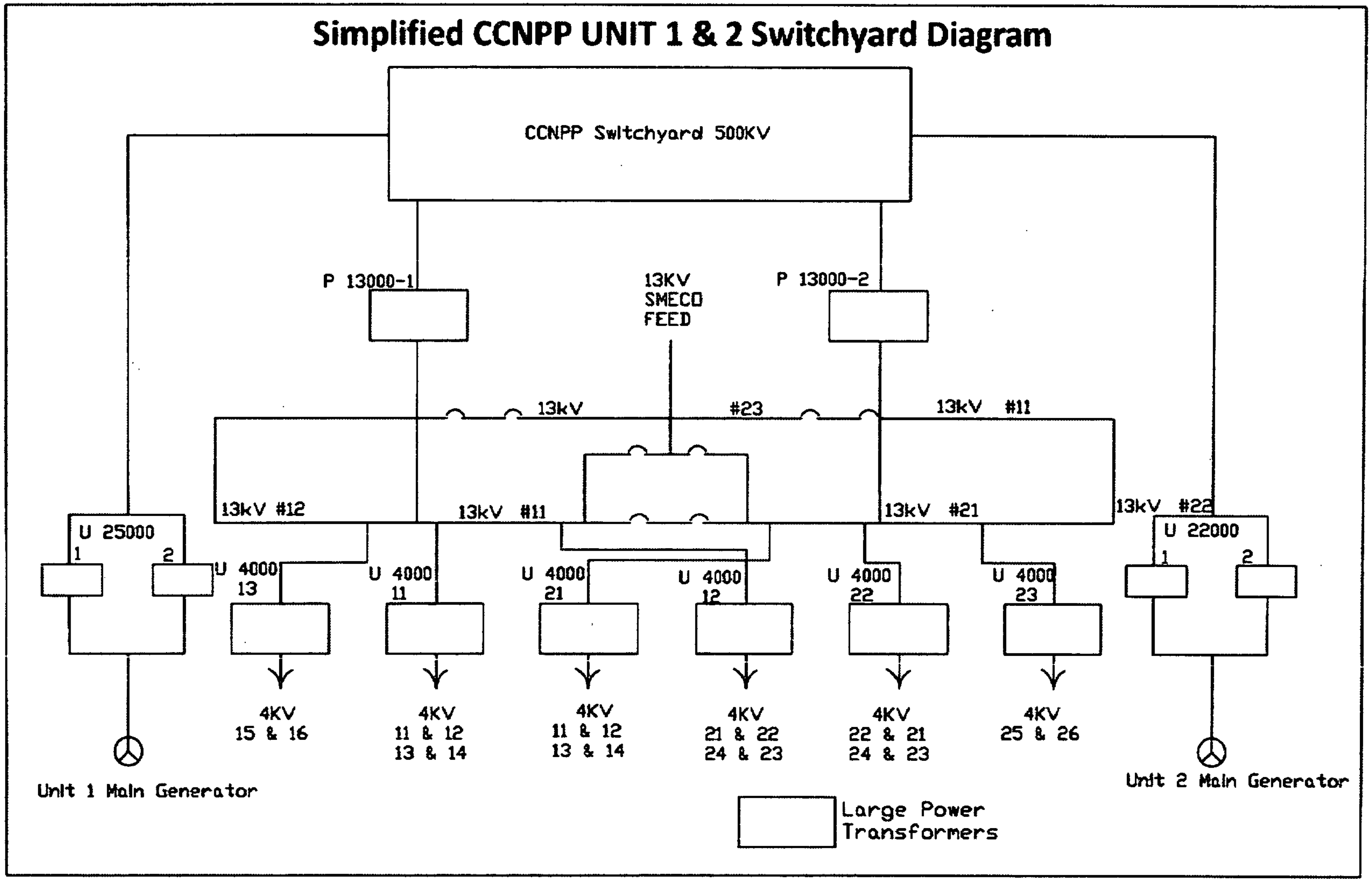
Simplified CCNPP UNIT 1 & 2 Switchyard Diagram
CCNPP Switchyard 500KV
P 13000-1
13KV
SMECO
FEED
P 13000-2
13kV
#23
13kV #11
13kV #12
13kV #11
13kV #21
13kV #22
U 25000
1
2
U 4000
13
U 4000
11
U 4000
21
U 4000
12
U 4000
22
U 4000
23
U 22000
1
2
4KV
15 & 16
4KV
11 & 12
13 & 14
4KV
11 & 12
13 & 14
4KV
21 & 22
24 & 23
4KV
22 & 21
24 & 23
4KV
25 & 26
Unit 1 Main Generator
Unit 2 Main Generator
Large Power
Transformers

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)
Plant Service Transformer P13000-1	4 kV Vital Bus 11	Y
Plant Service Transformer P13000-2	4 kV Vital Bus 14	Y
Plant Service Transformer P13000-1	4 kV Vital Bus 21	Y
Plant Service Transformer P13000-2	4 kV Vital Bus 24	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)
Note: Table 2 is not applicable to Calvert Cliffs		

Table 3 - ESF Buses Normally Energized Major Loads (Typical for all 4 Safety 4 kV buses)

ESF Bus	Load	Voltage Level	Rating
4 kV Vital Bus 11	Transformer U-440-11A	4 kV	1000 KVA
4 kV Vital Bus 11	Transformer U-440-11B	4 kV	1000 KVA
4 kV Vital Bus 11	Service Water Pump 11	4 kV	400 HP
4 kV Vital Bus 11	Saltwater Pump 11	4 kV	450 HP
4 kV Vital Bus 11	500 kV Substation (Bus 11 and 21 only)	4 kV	500 KVA (Non-Safety Load)

Table 4 - Offsite Power Transformers

Transformer	Winding Configuration	MVA Size (AO/FA/FOA)	Voltage Rating (Primary/Secondary)	Grounding Configuration
500/14 kV Plant Service Transformers - P-13000	Wye-Wye	60/80/100 MVA	500/14 kV	Primary Neutral Solidly Grounded Secondary Neutral Resistance Grounded
13.8/4.16 kV/4.16 kV Plant Service Transformers - U-4000	Delta-Wye-Wye	12/16/20 MVA	13.8/4.16/4.16 kV	Primary Ungrounded Secondary Neutrals Resistance Grounded

Table 5 - Protective Devices

Protection Zone	Protective Device	UV Logic	Setpoint (Nominal)	Basis for Setpoint
4 KV ESF Bus	Loss of Voltage Relay	2 of 4	2450V (59% of 4160V)	To actuate upon complete loss of ESF bus voltage condition
4 KV ESF Bus	Degraded Grid-Transient Undervoltage	2 of 4	3710V (89% of 4160V)	To actuate upon degraded ESF bus voltage condition for motor start condition
4 KV ESF Bus	Degraded Grid-Sustained Undervoltage	2 of 4	3900V (94% of 4160V)	To actuate upon degraded ESF bus voltage condition for motor run condition
4 KV ESF Bus	Ground Protection	N/A	25A	Set to coordinate with downstream instantaneous ground relays