Xcel Energy®

Monticello Nuclear Generating Plant
2807 W County Road 75
Monticello, MN 55362

October 22, 2012

L-MT-12-084
10 CFR 50.54(f)

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

Monticello Nuclear Generating Plant
Docket 50-263
Renewed Facility Operating License No. DPR-22

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

On July 27, 2012, the Nuclear Regulatory Commission (NRC) issued Bulletin 2012-01 (Agency wide Documents Access and Management System (ADAMS) Accession No. ML12074A115). Bulletin 2012-01 requested each licensee to submit a written response addressing two issues related to their facility electric power system design within 90 days pursuant to the provisions of 10 CFR 50.54(f).

Northern States Power Company, a Minnesota corporation, doing business as Xcel Energy (hereafter "NSPM"), provides the requested information for the Monticello Nuclear Generating Plant (MNGP), in the enclosure to this letter. NSPM submits this information in accordance with the provisions of 10 CFR 50.54(f).

If there are any questions or if additional information is needed, please contact Carrie Fosaaen, at 763-295-1357.

Summary of Commitments

This letter contains no new commitments and no revisions to existing commitments.

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 22, 2012.

Mark A. Schimmel
Site Vice-President
Monticello Nuclear Generating Plant
Northern States Power Company-Minnesota

Enclosure (1)

cc: Regional Administrator, Region III, USNRC
Project Manager, Monticello Nuclear Generating Plant, USNRC
Resident Inspector, Monticello Nuclear Generating Plant, USNRC

Enclosure 1
Monticello Nuclear Generating Plant
NRC 2012-01 Bulletin Response

Table of Contents

Attachment 1
Monticello Nuclear Generating Plant
NRC 2012-01 Bulletin Response

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 a simplified one-line diagram.

Under normal operating conditions, the ESF buses are continuously powered from the offsite 345kV system via the 2RS Transformer (345kv to 34.5kV) and the primary station auxiliary 2R Transformer (34.5kV to 4.16kV). The 2R Transformer provides power to plant electrical buses (#13 and #14), which in turn provide power to the ESF buses (#15 and #16, respectively).

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. Note: Monticello Nuclear Generating Plant (MNGP) is currently implementing Extended Power Uprate (EPU) which will replace the 2R Transformer and the 1R Transformer. Only the currently installed transformers have been included.

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 a single offsite source. Under normal plant operating conditions, the primary source for the plant's auxiliary load buses and the ESF buses is the 2R station auxiliary transformer. The station reserve transformer, 1R, is a full capacity backup source for the plant's auxiliary load buses and the ESF buses. The reserve auxiliary transformer, 1AR, connects only to the ESF buses and is sized to provide power to the connected loads.

See Attachment 3, Table 1 for ESF bus power sources.
See Attachment 3, Table 2 for ESF bus major loads energized during normal power operations.
See Attachment 3, Table 3 for Non-ESF bus major loads energized during normal power operations.
Note: MNGP is currently implementing Extended Power Uprate (EPU) which will replace switchgear 11 and 12 loads with 13.8kV equipment. Only the currently installed equipment has been included.

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 operating configuration of the ESF buses is consistent with the current licensing basis as described in the following:

Monticello Nuclear Generating Plant USAR

1.2.6 Plant Electrical Power
Sufficient normal and standby auxiliary sources of electrical power are provided to attain prompt shutdown and continued maintenance of the plant in a safe condition under all credible circumstances. The capacity of the power sources is adequate to accomplish all required engineered safeguards functions under all postulated design basis accident conditions.

8.2 Transmission System

8.2.1 Network Interconnections

Three transformers are provided to supply the plant with offsite power from the substation. All three sources can independently provide adequate power for the plant's safety-related loads. These transformers and their interconnections to the substation are as follows:

The primary station auxiliary transformer, 2R, is fed from 345 KV Bus No. 1 via 345 KV to 34.5 KV transformer 2RS, a current limiting reactor and fuse assembly, and underground cabling from the substation to the area northwest of the turbine building where 2R transformer is located. 2R transformer is of adequate size to provide the plant's full auxiliary load requirements.

The reserve transformer, 1R, is fed from the 115 KV substation via an overhead line from the substation to the area northwest of the turbine building where 1R transformer is located. 1R transformer is of adequate size to provide the plant's full auxiliary load requirements.

The reserve auxiliary transformer, 1AR, is located southwest of the reactor building and may be fed from two separate 13.8 KV sources in the substation. One method of supplying 1AR transformer is from the tertiary winding of #10 transformer, the auto-transformer which interconnects the 345 KV and 115 KV systems. Power is routed from the tertiary winding of 10 transformer to 1AR via circuit breaker 1N2 and underground cabling from the substation to 1AR transformer. The alternate method of feeding 1AR is from the 345 KV Bus No. 1substation via 345 KV to 13.8 KV transformer 1ARS, circuit breaker 1N6, and underground cabling from the substation to 1AR. Circuit breakers 1N2 and 1N6 are interlocked to prevent having both breakers simultaneously in the closed position. 1AR transformer is sized to provide only the plant's essential 4160 Vac buses and connected loads.

8.3.3 Performance Analysis
Auxiliary power is provided by either the primary station auxiliary power transformer, 2R, connected to the 345 KV Bus No. 1 through the 2RS transformer, or the reserve transformer, 1R, connected to the 115 KV ring bus, as shown in Drawings NH-178635 and NF-36175, Section 15. Each of the two transformers has the capacity to carry the full plant load. These

two auxiliary transformers step down the voltage to 4160 Vac to supply the 4160 Vac auxiliary buses. The 1AR reserve auxiliary transformer can provide 4160 Vac power to buses 15 and 16 from the 345 KV substation (via the 1ARS transformer) or from the No.10 transformer. Two transformers (X7 and X8) located at the Discharge Structure Substation, step down the voltage from 13.8 KV to 4160 Vac. These transformers supply 4160 Vac to the cooling tower pumps. Four additional transformers (X50, X60, X70 and X80) step down the voltage from 13.8 KV to 480 Vac to supply the cooling tower fans.

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The switchyard is not designed specifically to meet the single failure criterion.

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Auxiliary power is supplied by the primary station auxiliary transformer, 2R, during normal power operation. Provisions are made for an automatic, fast transfer of the auxiliary load from the primary station auxiliary transformer, 2R, to the reserve transformer, 1R. In the event the 1R reserve transformer is unable to accept load, the essential buses are automatically transferred to the reserve auxiliary transformer, 1AR. These transformers supply power to the equipment used to maintain a safe plant. It is highly improbable that all three electrical power sources would be lost simultaneously because each is supplied from a different source in the substation. Nevertheless, the loss of all auxiliary power is assumed for design purposes.

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The plant auxiliary buses are in six separate sections. Buses 11 and 12 provide power to the feedwater pumps and the reactor recirculating pumps. Buses 13, 14, 15, and 16 supply power to all other plant services. The general design requirement is to supply duplicate services from different buses. Failure of any one bus will still permit the plant to operate at reduced output.

Technical Specification

3.8 ELECTRICAL POWER SYSTEMS
3.8.1 AC Sources – Operating

LCO 3.8.1 The following AC electrical power sources shall be OPERABLE:

a. Two qualified circuits between the offsite transmission network and the onsite Class 1E AC Electrical Power Distribution System; and
b. Two emergency diesel generators (EDGs).

APPLICABILITY: MODES 1, 2, and 3.

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

1. Unit 1 Circuit #1 – Power to ESF buses via 345kV switchyard, 2RS Transformer, 2R Transformer and buses 13 & 14
2. Unit 1 Circuit #2 – Power to ESF buses via 115kV switchyard, 1R Transformer, and buses 13 & 14.
3. Unit 1 Circuit #3 – Power to ESF buses via 345kV, 1ARS and 1AR or #10 transformer and 1AR

The original auxiliary power design included one start-up transformer (1R) energized by the 115kV offsite power, a unit auxiliary transformer (11) energized by the main generator and a backup shutdown transformer (1AR) capable of provided power to the ESF buses only. Unit auxiliary transformer 11 provided all station loads when the plant was in operation while transformer 1R supplied all station loads during startup and shutdown. A plant modification replaced main generator dependent unit auxiliary transformer 11 with a new transformer 2R energized by the 345kV offsite source of power. With installation of transformer 2R in the 1986 outage, the auxiliary power system design provides a total of three sources of offsite power. Amendment 51 to the MNGP Technical Specifications was approved on October 16, 1987 to reflect the additional source of offsite power.

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. Also, include the following information:

Consistent with the current licensing basis, 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.

The electrical analyses for off-site circuits have been reviewed with regard to high impedance grounds. Additional analysis is required to determine the effect of a high impedance grounds on the supply side of the offsite power transformers and the corresponding effects to plant buses.

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

MNGP has two relay schemes designed to detect undervoltage conditions on the #15 and #16 Safety Related buses. The relays for each division are completely independent and provide the undervoltage protection for the bus to which they are connected. The "Loss of Voltage" scheme is designed to detect the complete loss of voltage to the bus. The "Degraded Voltage" scheme is designed to detect a degraded voltage condition which lasts longer than the designed delay time. Both of these undervoltage schemes are described below.

The essential bus "Loss of Voltage" relay scheme at MNGP uses four individual single-phase undervoltage relays per division to monitor for loss of voltage. The relays are connected in a "one out of two" taken twice scheme. The "Loss of Voltage" relays for the #15 Bus are: 127-5, 127-5X, 127-5Y and 127-5Z. The "Loss of Voltage" relays for the #16 Bus are: 127-6, 127-6X, 127-6Y and 127-6Z. These relays are connected to the same potential transformers as the Degraded Voltage relays. Relays 127-5, 127-5X, 127-6 and 127-6X are connected between A phase and B phase. Relays 127-5Y, 127-5Z, 127-6Y and 127-6Z are connected between C phase and B phase. Therefore, these relays may not actuate on the loss of a single phase. Per design, these relays are not designed to provide for loss of voltage on a single phase, rather they are designed to identify a complete loss of the offsite power source.

The essential bus Degraded Voltage relay scheme at MNGP uses individual single-phase undervoltage relays to monitor all three line-to-line voltages (V_{AB}, V_{BC} and V_{CA}) on both essential buses. The outputs of the undervoltage relays are arranged in 2-out-of-3 logic such that a detected degraded voltage condition on any two line-to-line voltages will provide an essential bus degraded voltage actuation. The Degraded Voltage relays for the #15 Bus are: 127-5A, 127-5B and 127-5C. The Degraded Voltage relays for the #16 Bus are: 127-6A, 127-6B and 127-6C. The Technical Specifications minimum allowable value for the essential bus degraded voltage setpoint is ≥ 3913V, or approximately 94% of 4.16kV.

The design of the present Loss of Voltage and Degraded Voltage schemes will provide the desired functional requirement when there is complete loss of voltage or when there is a sustained degraded voltage on all three phases of the Safety Related #15 or #16 busses.

With the loss of a single phase, the voltage at the Safety Related busses may be reconstituted due to the configuration of the offsite source transformers. Depending upon the configuration of the transformer (shell or core) either wye-wye or wye-delta connected transformers may under lightly loaded conditions reconstitute the lost phase. In these cases, even though the voltage is reconstituted, there will most likely be abnormal phase currents, which can actuate current limiting devices on individual components. Therefore, with the loss of a single phase, the present Loss of Voltage and Degraded Voltage schemes may not detect the loss of the single phase and, if undetected, would not actuate the desired transfer to the alternate source (1AR or EDG).

Consistent with the current licensing basis, 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).

Existing electrical protective devices are also sufficiently sensitive to detect a ground fault. Attachment 3, Table 5 lists ground protection/alarms 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 MNGP 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, specifically call for verification of the voltages on all three phases of the ESF buses.

MNGP issued an Operations Memo on 2/16/2012 to make operators aware of the Byron OE and potential vulnerability to a similar event at MNGP. The memo includes direction on how to identify a single open phase condition from a control room panel. Primary breakers have ammeters located on Main Control Room Electrical Distribution panel C-08 which provide individual phase currents and may be used to identify unbalanced phase currents. Primary buses have volt meters located on panel C-08 which provide indication of abnormal voltages. Individually or in combination, these meters may be used to identify abnormal power conditions. Additionally, abnormal operation of plant equipment may be an indication of abnormal power conditions.

MNGP initiated procedure changes to provide guidance to the operators in diagnosing and responding to a single-phase open circuit condition. The procedure changes include a new Abnormal Operating Procedure (AOP), C.4-B.09.06.D, "Non-Essential 4.16kV Bus Abnormal Phase Voltage" to address identification and response to a single phase condition. The procedure provides direction for an open bus transfer of the plant electrical buses due to off normal electric plant conditions.

Indications which the operators may encounter are:

- Voltage on the plant buses fluctuating.
- One or more 4kV Bus individual phase voltages less than 3800 volts during steady state operation.
- Unbalanced individual phase current on Ammeters, either on C-08 or at the individual 4kV breaker cubicles.
- Red lights on Loss of Voltage relays or Degraded Voltage relays located in the upper portion of 4kV cubicles 152-510 or 152-601.
- Various unexplained trips and/or overloads of 4kV and/or 480V motors.

The following documents were revised to direct operators to the new AOP in the event of a motor trip or over-current condition:

C.6-004-C-31 - Recirculation Drive Motor A Trip
C.6-004-C-32 - Recirculation Drive Motor B Trip
C.6-006-A-06 - RCT Feed Pump P-2A Trip
C.6-006-A-07 - RCT Feed Pump P-2B Trip
C.6-006-A-08 - Condensate Pump P-1A Trip
C.6-006-A-09 - Condensate Pump P-1B Trip
C.6-006-A-11 - RCT Feed Pump P-2A Overload
C.6-006-A-12 - RCT Feed Pump P-2B Overload
C.6-006-A-13 - Condensate Pump P-1A Overload
C.6-006-A-14 - Condensate Pump P-1B Overload
C.6-006-C-09 - Circ Water PP P-100A Trip
C.6-006-C-10 - Circ Water PP P-100B Trip

Operations validated the functionality of the Abnormal Operating Procedure in the plant simulator during the development of the procedure. Plant Operating crews have been trained on the AOP to recognize conditions associated with an abnormal single 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:

> ***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 protective devices 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 normal operation, two of the three offsite power transformers are unloaded. In general, there will be no plant response for an unloaded 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.

A high impedance ground is not expected to have an immediate effect on either loaded or unloaded offsite power sources. If the ground fault current is sufficiently large to affect operation, protective relaying is expected to isolate the ground automatically. Additional analysis is required to determine the effect resulting from system grounds which would have an adverse effect on loaded or unloaded offsite power sources.

> ***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.***

MNGP did not credit in the Current Licensing Basis (CLB) 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. See below:

Technical Specifications

3.3 INSTRUMENTATION

3.3.8.1 Loss of Power (LOP) Instrumentation

LCO 3.3.8.1 The LOP instrumentation for each Function in Table 3.3.8.1-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3,
When the associated emergency diesel generator (EDG) is required to be OPERABLE by LCO 3.8.2, "AC Sources - Shutdown."

Table 3.3.8.1-1 (page 1 of 1)
Loss of Power Instrumentation

FUNCTION	REQUIRED CHANNELS PER BUS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. 4.16 kV Essential Bus Loss of Voltage	4	SR 3.3.8.1.1 SR 3.3.8.1.3 SR 3.3.8.1.4	≥ 2345 V and ≤ 2905 V
2. 4.16 kV Essential Bus Degraded Voltage			
a. Bus Undervoltage	3	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.4	≥ 3913 V and ≤ 3927 V
b. Time Delay	3	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.4	≥ 8.8 seconds and ≤ 9.2 seconds

B 3.3 INSTRUMENTATION

B 3.3.8.1 Loss of Power (LOP) Instrumentation Bases

Each 4.16 kV essential bus has its own independent LOP instrumentation and associated trip logic. The voltage for each bus is monitored at two levels, which can be considered as two different undervoltage Functions:

4.16 kV Essential Bus Loss of Voltage and 4.16 kV Essential Bus Degraded Voltage. Each Function causes various bus transfers and disconnects. The 4.16 kV Essential Bus Loss of Voltage Function is monitored by four undervoltage relays for each emergency bus, whose outputs are arranged in a one-out-of-two twice logic configuration (i.e., one channel in each of two trip systems must trip for LOP actuation). The 4.16 kV Essential Bus Degraded Voltage Function is monitored by three undervoltage relays (with its associated time delay) for each emergency bus, whose outputs are arranged in a two-out-of-three logic configuration. Both LOP Functions provide an automatic start signal to both EDGs.

However, only the automatic start signal to the associated EDG (the EDG in the same division) is required. If the 4.16 kV Essential Bus Loss of Voltage signal is present for approximately 5 seconds, it will trip the supply breaker (from bus 13 or 14, as applicable) to the associated essential bus and provide a transfer signal to the reserve auxiliary transformer (1AR). If the 4.16 kV Essential Bus Loss of Voltage signal is present for approximately 10 seconds (i.e., the transfer to 1AR fails or 1AR is de-energized) it will trip all supply breakers to the essential bus (from bus 13 and 14, as applicable and from 1AR) and provide a close signal to the EDG output breaker. If the 4.16 kV Essential Bus Degraded Voltage signal (normally 3920 Vac for approximately 9 seconds) is present, it will trip the supply breaker (from bus 13 or 14, as applicable) to the associated essential bus and provide a close signal to the EDG output breaker.

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1. 4.16 kV Essential Bus Loss of Voltage

Loss of voltage on a 4.16 kV essential bus indicates that offsite power may be completely lost to the respective essential bus and is unable to supply sufficient power for proper operation of the applicable equipment. Therefore, the power supply to the bus is transferred from offsite power to EDG power when the voltage on the bus drops below the 4.16 kV Essential Bus Loss of Voltage Function Allowable Value. This ensures that adequate power will be available to the required equipment. The 4.16 kV Essential Bus Loss of Voltage Allowable Values are low enough to prevent inadvertent power supply transfer, but high enough to ensure that power is available to the required equipment.

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2. 4.16 kV Essential Bus Degraded Voltage

A reduced voltage condition on a 4.16 kV essential bus indicates that, while offsite power may not be completely lost to the respective essential bus, available power may be insufficient for starting large ECCS motors without risking damage to the motors that could disable the ECCS function. Therefore, power supply to the bus is transferred from offsite power to onsite EDG power when the voltage on the bus drops below the 4.16 kV Essential Bus Degraded Voltage Function Allowable Values (degraded voltage with a time delay). This ensures that adequate power will be available to the required equipment. The 4.16 kV Essential Bus Degraded Voltage Allowable Values are low enough to prevent inadvertent power supply transfer, but high enough to ensure that sufficient power is available to the required equipment. The Time Delay Allowable Values are long enough to provide time for the offsite power supply to recover to normal voltages, but short enough to ensure that sufficient power is available to the required equipment.

USAR

8.3.3 Performance Analysis

Auxiliary power is supplied by the primary station auxiliary transformer, 2R, during normal power operation. Provisions are made for an automatic, fast transfer of the auxiliary load from the primary station auxiliary transformer, 2R, to the reserve transformer, 1R. In the event the 1R reserve transformer is unable to accept load, the essential buses are automatically transferred to the reserve auxiliary transformer, 1AR. These transformers supply power to the equipment used to maintain a safe plant. It is highly improbable that all three electrical power sources would be lost simultaneously because each is supplied from a different source in the substation. Nevertheless, the loss of all auxiliary power is assumed for design purposes.

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The switchyard is not designed specifically to meet the single failure criterion.

Since MNGP 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 design criteria. Since open phase detection was not credited in the MNGP design or licensing basis, 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 (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 MNGP 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 MNGP specific Class 1E electric distribution system (EDS)).

Long term corrective actions will require a detailed analysis of the system to determine the effects of a single phase open circuit condition. See response to question 2.d for interim action implemented to address this issue.

Under normal plant operating conditions, only one offsite source provides power to the plant's essential and non-essential buses. The loss of a single phase may be detected by existing phase overcurrent, neutral current imbalance, negative sequence, and power factor relays. Existing and newly generated plant procedures will assist plant operators in detecting the loss of a single phase condition on the primary offsite source. Unloaded offsite sources not connected to the plant buses do not have the capability to detect an open phase condition because there will be no current and the lost phase voltage may be reconstituted due to transformer configurations.

The possibility of experiencing the loss of a single phase between the 2R or 1R transformer and the ESF buses is extremely unlikely because the connection between these two devices is a non-segregated bus and switchgear bus. These buses are not subject to the loss of a single phase condition experienced at the Byron plant. Each bus connection is bolted and preventive maintenance periodically tests these connections.

The connection between the 2R Transformer and the 2RS Transformer is implemented with direct buried cable with a short section routed in underground conduit. This cable was replaced in 2011. The failure of this cable would result in a ground fault condition which would trip the feeder breaker. The exposed connections at the disconnect switches are bolted connections, which have thermography performed on a routine basis.

The connection between the 1AR transformer and ESF buses is direct buried cable. The failure of this cable would result in a ground fault condition which may actuate the ground alarm relay.

The connection between the 1ARS or #10 Transformer and the 1AR Transformer is direct buried cable or cable routed in underground duct. The failure of this cable would result in a ground fault condition which would trip the feeder breakers.

The loss of a single phase in an offsite source has the potential to affect both ESF buses. MNGP Station's switchyard was not designed to meet the single failure criterion.

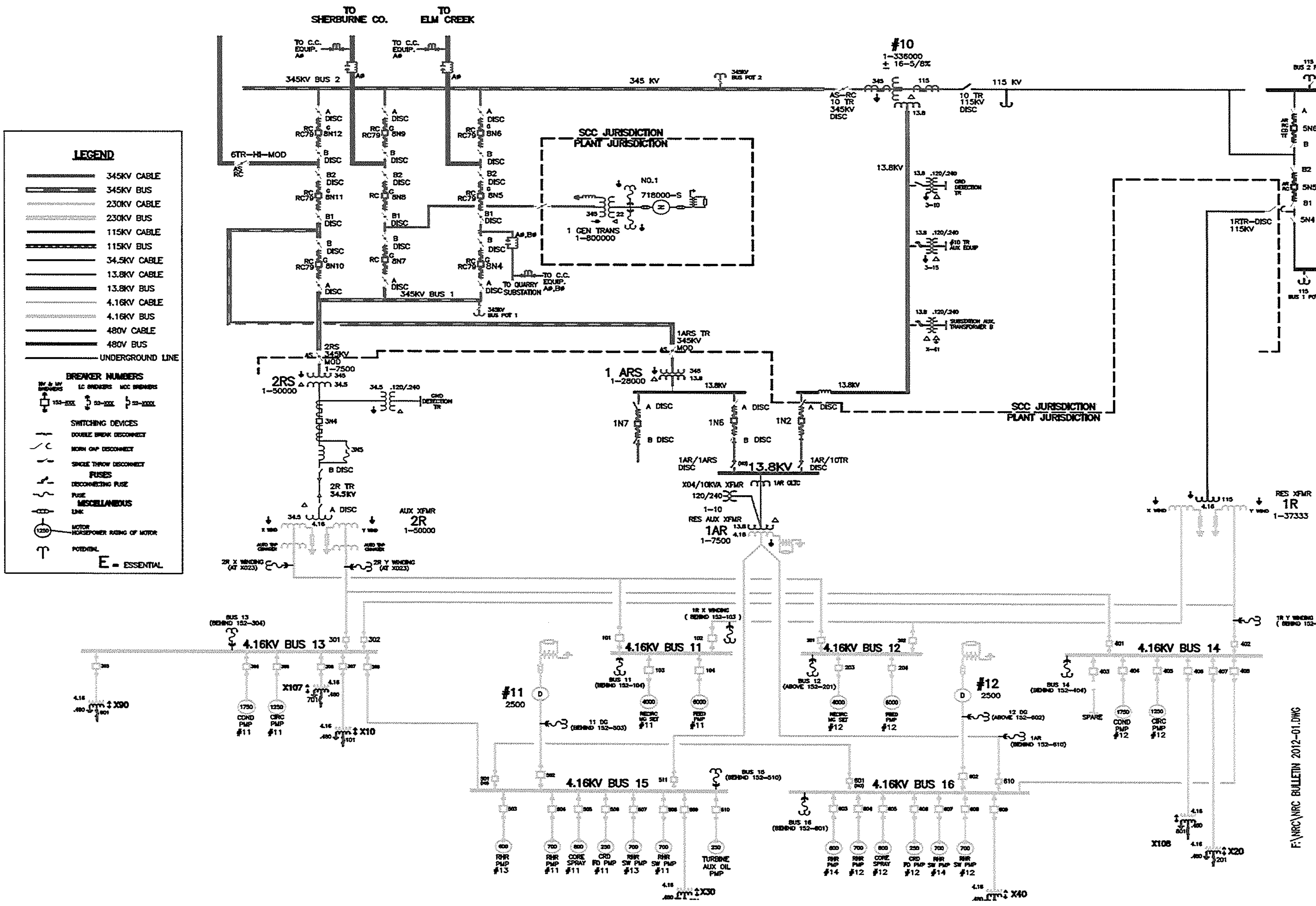
2.e. If a common or single offsite circuit is used to supply redundant ESF buses, explain why a failure, such as a single-phase open circuit or high impedance ground fault condition, would not adversely affect redundant ESF buses.

Consistent with the Current Licensing Basis, 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 basis of the plant. No calculations for this scenario have been performed.

Abnormal Operating Procedure (AOP), C.4-B.09.06.D, "Non-Essential 4.16kV Bus Abnormal Phase Voltage" addresses identification and response to a single phase condition. The procedure provides direction for an open bus transfer of the plant electrical buses due to off normal electric plant conditions.

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

Attachment 2
Monticello Nuclear Generating Plant
Simplified One-Line Diagram



Attachment 3
Monticello Nuclear Generating Plant
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)
Normal: 2R Transformer (Y Winding) via 4.16kV Bus # 13	4.16kV Bus # 15 (Energized)	N (Note 1)
Standby: 1R Transformer (Y Winding) via 4.16kV Bus # 13		Y
Standby: 1AR Transformer		Y
Normal: 2R Transformer (Y Winding) via 4.16kV Bus # 14	4.16kV Bus # 16 (Energized)	N (Note 1)
Standby: 1R Transformer (Y Winding) via 4.16kV Bus # 14		Y
Standby: 1AR Transformer		Y

Note 1: Modification 85Z014 removed the #11 Auxiliary Transformer, which was supplied directly from the main generator isolated phase bus, and replaced it with the 2RS and 2R Transformers which are supplied from the 345kV substation. The 2RS is a 345kV to 34.5kv Transformer and the 2R is a 34.5kV to 4.16kV Transformer.

Table 2 - ESF Buses Major Loads

Essential Bus	Load	Voltage Level	Rating (HP)	Normally Energized
#15	#11 RHR Pump	4.16kV	700 (Note 2)	N
#15	#13 RHR Pump	4.16kV	600 (Note 2)	N
#15	#11 Core Spray Pump	4.16kV	800	N
#15	#11 RHRSW Pump	4.16kV	700	N
#15	#13 RHRSW Pump	4.16kV	700	N
#15	#11 CRD Pump	4.16kV	250	Y (Note 1)
#15	Turbine Auxiliary Oil Pump	4.16kV	250	N
#15	Load Center 103	4.16kV	1500 kVA	Y
#16	#12 RHR Pump	4.16kV	700 (Note 2)	N
#16	#14 RHR Pump	4.16kV	600 (Note 2)	N
#16	#12 Core Spray Pump	4.16kV	800	N
#16	#12 RHRSW Pump	4.16kV	700	N
#16	#14 RHRSW Pump	4.16kV	700	N
#16	#12 CRD Pump	4.16kV	250	Y (Note 1)
#16	Load Center 104	4.16kV	1500 kVA	Y

Note 1: Normal alignment includes one CRD Pump running and the second CRD Pump in standby.

Note 2: MNGP's inventory includes both 600HP and 700HP motors which can be used on any of the four RHR pumps.

Table 3 – Non-ESF Buses Major Loads

Non-Essential Bus	Load	Voltage Level	Rating (HP)	Normally Energized
#11	#11 Feedwater Pump	4.16kV	6000	Y
#11	#11 Reactor Recirculation Pump	4.16kV	4000	Y
#12	#12 Feedwater Pump	4.16kV	6000	Y
#12	#12 Reactor Recirculation Pump	4.16kV	4000	Y
#13	Load Center 101	4.16kV	1500 kVA	Y
#13	#11 Condensate Pump	4.16kV	1750	Y
#13	#11 Circulating Water Pump	4.16kV	1250	Y
#13	Load Center 107	4.16kV	1500 kVA	Y
#13	Load Center 109	4.16kV	1500 kVA	Y
#13	Bus #15	4.16kV	-	Y
#14	Load Center 102	4.16kV	1500 kVA	Y
#14	#12 Condensate Pump	4.16kV	1750	Y
#14	#12 Circulating Water Pump	4.16kV	1250	Y
#14	Load Center 108	4.16kV	1500 kVA	Y
#14	Bus #16	4.16kV	-	Y

Table 4 - Offsite Power Transformers

Transformer	Winding Configuration	MVA Size	Voltage Rating (Primary/Secondary)	Grounding Configuration
2RS	WYE / DELTA	50 (OA, 55C)	345kV / 34.5KV	Grounded Primary
2R	DELTA / WYE - WYE	50 (FOA, 55C)	34.5kV / 4.16kV /4.16kV	Resistance Grounded Secondary
1R	WYE / WYE -WYE	20/26.7/33.3 (OA/FA/FA, 55C)	115kV / 4.16kV /4.16kV	Grounded Primary and Resistance Grounded Secondary
1ARS	WYE / DELTA	15/20/25 (OA/FA/FOA, 55C)	345kV / 13.8kV	Neutral Grounded Primary
1AR	DELTA / WYE	7.5 (ONAN, 65C)	13.8kV / 4.16kV	High Impedance Grounded Secondary

Table 5 - Protective Devices

Protection Zone	Protective Device	Logic	Setpoint (Nominal)	Basis for Setpoint
4 KV ESF Bus15 V_{AB} V_{BC}	 127-5, 127-5X 127-5Y, 127-5Z	2 of 2	2625V	Loss of Voltage Relay was set to actuate upon complete loss of ESF Bus voltage.
4 KV ESF Bus16 V_{AB} V_{BC}	 127-6, 127-6X 127-6Y, 127-6Z	2 of 2		
4 KV ESF Bus 15 V_{BC} V_{CA} V_{AB}	 127-5A 127-5B 127-5C	2 of 3	3920V	The degraded grid relay setpoint was set at the minimum acceptable voltage limit for safety buses 15 and 16 with loss-of-coolant accident (LOCA) loads under steady-state condition.
4 KV ESF Bus16 V_{BC} V_{CA} V_{AB}	 127-6A 127-6B 127-6C	2 of 3		
 TR 2R LV X TR 2R LV Y TR 1R LV X TR 1R LV Y TR 1AR	Ground Protection 151G/AT-A 151G/AT- B 151G/ST-A 151G/ST-B X04-HRG-64	 1 of 1	 240A 240A 240A 240A (Alarm Only)	Settings for the ground fault protective devices for the 4160V system when fed from transformer 2R or 1R are selected to provide selective coordination with the maximum available fault current of 1200A. All breakers at buses 15 and 16 when fed from transformer 1AR are designed not to sense the available ground fault current and will not trip on a ground fault. The neutral overvoltage relay is set adequately to quickly alarm the control room operator if a ground fault occurs when buses 15 and 16 are fed from transformer IAR.