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August 13, 1992

U.S. Nuclear Regulato., Commission
Mail Station P1-137
Washington, D.C. 20555

Attention: Document Control Desk

Subject: Grand Gulf Nuclear Station
Unit 1
Docket No. 50-416
License No. NPF-29
Additional Information Concerning the DC System Design

Reference: Letter Paul W. O'Connor (NRC) to William T. Cottle, "Request for Additional Information (RAI)" Grand Gulf Nuclear Station, Unit No. 1 (M82595), dated July 13, 1992

GNRO-92/00107

Gentlemen:

Entergy Operations, Inc. by this letter is submitting additional information to support your review of the Grand Gulf Nuclear Station (GGNS) Safety Related DC System. This letter is in response to your letter dated July 13, 1992. This letter and its attachments provide information supporting Entergy Operations' conclusion that the safety related DC system will perform its design function in the event of an accident.

Yours truly,

WTC/WEL/mtc
attachment: Response to NRC Questions
cc: (See Next Page)

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NRC Question 1

The licensee is requested to provide a list of the components that may not be receiving adequate voltage and their purpose and safety significance.

GGNS Response to Question 1

The Grand Gulf Nuclear Station (GGNS) safety related 125 Vdc system is designed to ensure compliance with General Design Criterion (GDC) 17. To ensure the requirements of GDC 17 are met, the system's design is based on the criteria described in IEEE Standard 308-1974 (IEEE 308) and IEEE Standard 485-1975 (IEEE 485) with testing as recommended in IEEE Standard 450-1975 (IEEE 450) and supplemented by Regulatory Guide 1.128. As discussed in the Final Safety Analysis Report (FSAR), the safety related 125 Vdc system has ample capacity available to serve essential loads for the time that alternating current will not be available at the station site.

The GGNS design basis accident for the safety related 125 Vdc system is a Loss of Coolant Accident (LOCA) concurrent with a Loss of Offsite Power (LOP) and the failure of both battery chargers (for Divisions I and II) while maintaining the division operable. To support this system design basis accident, the GGNS safety related 125 Vdc system is designed such that the Division I and II batteries have sufficient stored energy to supply their essential loads for 4 hours (2 hours for Division III). This design feature of the safety related 125 Vdc system bounds the GDC 17 requirements for battery capacity, since the dc system's load will be assumed by the redundant (for Divisions I and II) safety related battery chargers following the starting of the diesel generators instead of being supplied by the batteries.

Table 1 below is a list of the essential components which have the potential to receive less than the manufacturer's minimum operating voltage when they are called upon to operate. Proper operation of these components is verified by the engineering evaluation and testing performed as described in the response to Question 3. All essential components receive adequate voltage to perform their safety functions during the 125 Vdc system's design basis accident.

TABLE 1
COMPONENTS WHICH POTENTIALLY RECEIVE LESS THAN THE MANUFACTURER'S MINIMUM VOLTAGE WHEN THEY ARE REQUIRED TO OPERATE DURING THE SYSTEM DESIGN BASIS PROFILE

Component	Function
DIVISION I	
Breaker 152-1508 Close Coil	Diesel Generator Feeder Breaker to 4160 V Switchgear Bus 15AA
Breaker 152-1509 Close Coil	Residual Heat Removal Pump Motor A Feeder Breaker
Breaker 152-1505 Close Coil	Drywell Purge Compressor A Feeder Breaker
MOV 1E51F045 72F Contactor	Contactor energizes the RCIC Steam to Turbine MOV Actuator to open the 1E51F045 valve
MOV 1E51F013 72F Contactor	Contactor energizes the RCIC Injection Shutoff MOV Actuator to open valve 1E51F013 when valve 1E51F045 opens
MOV 1E51F013 72R Contactor	Contactor energizes the RCIC Injection Shutoff MOV Actuator to close valve 1E51F013 when valve 1E51F045 or the trip valve closes
DIVISION II	
Breaker 152-1608 Close Coil	Diesel Generator Feeder Breaker to 4160 V Switchgear Bus 16AB

In addition to the components identified above, certain indicating lights may receive less than the manufacturer's nominal voltage for intermittent periods. During subsequent time periods, however, most recover and receive adequate voltage. Although the GGNS calculations conservatively assumed that all indicating lights were incandescent, most circuits in the control room use neon lamps. The nominal voltage for neon lamps is less than half of the nominal voltage for incandescent lamps. Circuits which utilize incandescent lamps and experience voltage levels below the manufacturer's nominal voltage may exhibit lights which momentarily become dim. It is not expected that the lights would actually extinguish as a result of the fluctuations in the voltage levels. The most severe voltage drops occur for only a fraction of a second. The lights potentially receiving less than the manufacturer's nominal voltage are indicating lights (e.g., logic initiation lights) and are located both in the control room and various locations in the plant on local panels. The affected lights do not include the control room annunciators. During a LOP LOCA event, all of these lights should receive adequate voltage when the battery chargers assume the dc load after the diesel generators start.

Some indicating lights have the potential to operate at levels below the manufacturer's nominal voltage for extended periods during the evaluated profile. The following are the incandescent lights located in the control room which are expected to receive the lower voltage levels for an extended period of time.

Division I — One indicating light in the control room was identified to receive up to 3 volts less than the manufacturer's nominal voltage after the first 105 seconds and before the last minute of the profile. This indicating light was the Low Pressure Core Spray (LPCS) Logic Initiation light.

Division II — The following indicating lights in the control room were identified to potentially receive up to 5 volts less than the manufacturer's nominal voltage after the first 30 seconds and before the last minute of the profile.:

- Control Room Isolation Initiation (2 lights)
- Control Room Isolation Logic in Auto
- Drywell/Containment Purge Control Initiation (2 lights)
- Containment Isolation Initiation (2 lights)
- Suppression Pool Makeup Initiation (2 lights)
- Standby Gas Treatment System Initiation (2 lights)
- Standby Gas Treatment System in Auto
  Standby Service Water System Initiation (2 lights)

Division III — Two lights in the control room were identified to potentially receive up to 9 volts less than the manufacturer's nominal voltage during the profile. These lights are the High Pressure Core Spray Initiation/Reset and the Reactor Pressure Vessel High Water Level indication lights.

Although these lights are only postulated to dim due to the lower voltages at their terminals, if the lights are assumed not to work at all, sufficient information would be available to the operator from other devices to indicate the affected systems' status. The operation of the indicating lights noted does not affect the operation of the associated equipment.

Other than indicating lights, Division III of the GGNS safety related dc system contains no equipment which has been identified to potentially receive less than the manufacturer's minimum voltage.

NRC Question 2

The licensee is requested to justify (by class where appropriate) the acceptability of below-minimum operating voltage for the components identified by the voltage drop study in Division I, II and III 125 Vdc systems, and demonstrate that the components will function during the plant's design basis event (loss-of-coolant accident with loss of battery chargers for 2 hours). The justification should include discussion of 1) possible effects of low voltage upon the components, 2) damage to the related components and systems, and 3) operator actions during the scenario.

GGNS Response to Question 2

For the equipment verified to be operable via testing, the testing and its associated engineering evaluation provide assurance that there are no possible adverse effects of the lower voltage on the components. This testing and engineering evaluation assure that there will be no damage to related components and systems and that no additional operator actions are required as a result of the operation at voltage levels below the manufacturer's minimum rated voltage. The testing and engineering evaluation are described in the response to question 3.

The voltage drop calculations also identify components which may receive less than the manufacturer's rated minimum voltage during some period but receive adequate voltage when they are postulated to operate, or the components are not required to operate. Table 2 is a list of those components which may receive less than the manufacturer's minimum voltage during some period but will receive the manufacturer's minimum voltage during the times they are postulated to operate. Table 3 is a list of those components which may receive less than the manufacturer's minimum voltage but are not required to operate to mitigate the accident. Since the items in Tables 2 and 3 receive the manufacturer's minimum voltage required to perform their safety functions, these Tables were not included in the response to Question 1. The periods in which these components do not receive their manufacturer's minimum rated voltages do not have any detrimental effects since the components are not required to operate during these times. No operator actions are required to mitigate the effects of the potential degraded voltages to these components.

TABLE 2

COMPONENTS WHICH RECEIVE THE MANUFACTURER'S MINIMUM VOLTAGE WHEN THEY ARE REQUIRED TO OPERATE BUT WERE IDENTIFIED TO POTENTIALLY RECEIVE LESS DURING SOME PORTION OF THE DESIGN BASIS PROFILE

Component	Function	Justification
DIVISION I		
Relay R39	Standby Service Water (SSW) Pump Feeder Breaker Control	This relay has the required minimum pickup voltage at its terminals at the time it is postulated to pick up and the voltage at its terminals never drops below its maximum drop out voltage for the remainder of the time that it is energized. Therefore, this device will perform its design function.
Relay R52	Drywell Purge Compressor Manual and Compressor Protective Trip Relay	This relay has the required minimum pickup voltage at its terminals at the time it is postulated to pick up and the voltage at its terminals never drops below its maximum drop out voltage for the remainder of the time that it is energized. Therefore, this device will perform its design function.
Relay 62-1	Enclosure Building Recirculation Fan Feeder Breaker Control	This relay has the required minimum pick up voltage at its terminals at the time it is postulated to pick up and the voltage at its terminals never drops below its maximum drop out voltage. Therefore, this device will perform its design function.

TABLE 2

COMPONENTS WHICH RECEIVE THE MANUFACTURER'S MINIMUM VOLTAGE WHEN THEY ARE REQUIRED TO OPERATE BUT WERE IDENTIFIED TO POTENTIALLY RECEIVE LESS DURING SOME PORTION OF THE DESIGN BASIS PROFILE (continued)

Component	Function	Justification
Relay 74-6 (R20)	Load Center 15BA5 480 V Feeder Breaker Loss of Control Power Indication	This relay functions to provide annunciation on loss of control power. It is continuously energized and would remain picked up on initiation of the postulated event since voltage at its terminals never drops below its maximum drop out voltage. If control power is lost to the logic, the relay would perform its function when it de-energized. Therefore, this device will perform its design function.
Relay R41	SSW Cooling Tower Fan A Feeder Breaker Alarm and Control	This relay provides a permissive to energize the close coil for its respective breaker. The relay has the required minimum pick up voltage at its terminals when it receives its permissive to pick up until the close coil energizes. Therefore, this device performs its design function.
Relay R42	SSW Cooling Tower Fan B Feeder Breaker Alarm and Control	This relay provides a permissive to energize the close coil for its respective breaker. The relay has the required minimum pick up voltage at its terminals when it receives its permissive to pick up until the close coil energizes. Therefore, this device performs its design function.
DIVISION II		
Relay R43	SSW Cooling Tower Fan C Feeder Breaker Alarm and Control	This relay provides a permissive to energize the close coil for its respective breaker. The relay has the required minimum pick up voltage at its terminals when it receives its permissive to pick up until the close coil energizes. Therefore, this device performs its design function.
Relay R44	SSW Cooling Tower Fan D Feeder Breaker Alarm and Control	This relay provides a permissive to energize the close coil for its respective breaker. The relay has the required minimum pick up voltage at its terminals when it receives its permissive to pick up until the close coil energizes. Therefore, this device performs its design function.
Relay 74-5	SSW Cooling Tower Fan C Feeder Breaker Loss of Control Power	This relay functions to provide annunciation on loss of control power. It is continuously energized and would remain picked up on initiation of the postulated event since voltage at its terminals never drops below its maximum drop out voltage. If control power is lost to the logic, the relay would perform its function when it de-energized; therefore, this device will perform its design function.
Relay 74-6 (P41)	SSW Cooling Tower Fan D Feeder Breaker Loss of Control Power	This relay functions to provide annunciation on loss of control power. It is continuously energized and would remain picked up on initiation of the postulated event since voltage at its terminals never drops below its maximum drop out voltage. If control power is lost to the logic, the relay would perform its function when it de-energized; therefore, the device will perform its design function.
Relay 74-6 (R20)	Load Center 16B85 4160 V Feeder Breaker Loss of Control Power Indication	This relay functions to provide annunciation on loss of control power. It is continuously energized and would remain picked up on initiation of the postulated event since voltage at its terminals never drops below its maximum drop out voltage. If control power is lost to the logic, the relay would perform its function when it de-energized; therefore, this device will perform its design function.
Relay 74-22	Load Center 16B85 4160 V Feeder Breaker Undervoltage Circuit Loss of Control Power Indication	This relay functions to provide annunciation on loss of control power. It is continuously energized and would remain picked up on initiation of the postulated event since voltage at its terminals never drops below its maximum drop out voltage. If control power is lost to the logic, the relay would perform its function when it de-energized; therefore, this device will perform its design function.
Relay 74-12	Load Center 16B84 480 V Feeder Breaker to Motor Control Center (MCC) 16B42 Loss of Control Power Indication	This relay functions to provide annunciation on loss of control power. It is continuously energized and would remain picked up on initiation of the postulated event since voltage at its terminals never drops below its maximum drop out voltage. If control power is lost to the logic, the relay would perform its function when it de-energized; therefore, this device will perform its design function.

TABLE 3
COMPONENTS WHICH POTENTIALLY RECEIVE LESS THE MANUFACTURER'S MINIMUM VOLTAGE BUT ARE NOT REQUIRED TO OPERATE

Component	Function	Justification
DIVISION I		
Relay R6	Diesel Generator (ESF Bus 15AA) Breaker: Provides Annunciation of EDG Breaker Automatic Trip	This relay provides a permissive for annunciation of an automatic trip of its respective breaker. Since the diesel generator breaker is not postulated to trip and this relay performs no other control/indication function, this relay is not required to operate.
Relay K47A	Permissive for transfer of Recirculation Pump to Low Speed	This relay provides a permissive for annunciation of a trip of the recirculation pump and a permissive to transfer the recirculation pump to low speed. The recirculation pump is not available during a LOP. Therefore, this relay is not required to operate.
Breaker 152-1503 Spring Charging Motor	SSW Pump A Feeder Breaker	The spring charging motor provides the energy required to compress the respective breaker's close spring and trip spring. The spring charging motor is energized when the breaker's close springs are discharged (i.e., right after the breaker closes). The breaker is not postulated to trip after it closes; therefore, the close springs are not required to be recharged for the breaker to perform its design function. This component was tested as described in the response to question 3.
Breaker 152-15505 Spring Charging Motor	SSW Cooling Tower Fan A Feeder Breaker	The spring charging motor provides the energy required to compress the respective breaker's close spring and trip spring. The spring charging motor is energized when the breaker's close springs are discharged (i.e., right after the breaker closes). This breaker is not postulated to trip after it closes; therefore, the close springs are not required to be recharged for the breaker to perform its design function. This component was tested as described in the response to question 3.
Relay 62-5	Permissive for Annunciation of SSW Cooling Tower Fan A Feeder Breaker Trip	This relay provides a permissive for annunciation of an automatic trip of its respective breaker. Since the SSW Cooling Tower Fan breaker is not postulated to trip and this relay performs no other control/indication function, this relay is not required to operate.
Relay R86	SSW Cooling Tower Fan A Feeder Breaker Test Indication	This relay provides a permissive for annunciation when its respective breaker is in the test position. Since the SSW Cooling Tower Fan breaker is not postulated to be in the test position and this relay performs no other control/indication function, this relay is not required to operate.
Breaker 152-15506 Spring Charging Motor	SSW Cooling Tower Fan B Feeder Breaker	The spring charging motor provides the energy required to compress the respective breaker's close spring and trip spring. The spring charging motor is energized when the breaker's close springs are discharged (i.e., right after the breaker closes). The breaker is not postulated to trip after it closes; therefore, the close springs are not required to be recharged for the breaker to perform its design function. This component was tested as described in the response to question 3.
Relay 62-6	Permissive for Annunciation of SSW Cooling Tower Fan B Feeder Breaker Trip	This relay provides a permissive for annunciation of an automatic trip of its respective breaker. Since the SSW Cooling Tower Fan breaker is not postulated to trip and this relay performs no other control/indication function, this relay is not required to operate.
Relay R87	SSW Cooling Tower Fan B Feeder Breaker Test Indication	This relay provides a permissive for annunciation when its respective breaker is in the test position. Since the SSW Cooling Tower Fan breaker is not postulated to be in the test position and this relay performs no other control/indication function, this relay is not required to operate.

TABLE 3

COMPONENTS WHICH RECEIVE LESS THE MANUFACTURER'S MINIMUM VOLTAGE BUT ARE NOT REQUIRED TO OPERATE (continued)

Component	Function	Justification
Breaker 152-1509 Spring Charging Motor	Residual Heat Removal (RHR) Pump A Feeder Breaker	The spring charging motor provides the energy required to compress the respective breaker's close spring and trip spring. The spring charging motor is energized when the breaker's close springs are discharged (i.e., right after the breaker closes). The breaker is not postulated to trip after it closes; therefore, the close springs are not required to be recharged for the breaker to perform its design function. This component was tested as described in the response to question 3.
Breaker 152-15105 Spring Charging Motor	Drywell Purge Compressor A Feeder Breaker	The spring charging motor provides the energy required to compress the respective breaker's close spring and trip spring. The spring charging motor is energized when the breaker's close springs are discharged (i.e., right after the breaker closes). The breaker is not postulated to trip after it closes; therefore, the close springs are not required to be recharged for the breaker to perform its design function. This component was tested as described in the response to question 3.
Solenoid TB1E511C002	RCIC Trip and Throttle Valve Trip Coil	This solenoid operates to allow the RCIC Turbine Trip and Throttle Valve to close. During the accident conditions postulated, the low pressure isolation signal will close the isolation valves in the steam supply line to RCIC and closure of this valve will not be required.
Breaker 152-15106 Spring Charging Motor	Diesel Generator Room Outside Air Fan A Feeder Breaker	The spring charging motor provides the energy required to compress the respective breaker's close spring and trip spring. The spring charging motor is energized when the breaker's close springs are discharged (i.e., right after the breaker closes). The breaker is not postulated to trip after it closes; therefore, the close springs are not required to be recharged for the breaker to perform its design function. This component was tested as described in the response to question 3.
Breaker 152-15304 Spring Charging Motor	Enclosure Building Fan A Feeder Breaker	The spring charging motor provides the energy required to compress the respective breaker's close spring and trip spring. The spring charging motor is energized when the breaker's close springs are discharged (i.e., right after the breaker closes). The breaker is not postulated to trip after it closes; therefore, the close springs are not required to be recharged for the breaker to perform its design function. This component was tested as described in the response to question 3.
DIVISION II		
Relay R6	Diesel Generator (ESF Bus 16AB) Breaker: Provides Annunciation of EDG Breaker Automatic Trip	This relay provides a permissive for annunciation of an automatic trip of its respective breaker. Since the diesel generator breaker is not postulated to trip and this relay performs no other function, this relay is not required to operate.
Relay K47B	Permissive for transfer of Recirculation Pump to Low Speed	This relay provides a permissive for annunciation of a trip of the recirculation pump and a permissive to transfer the recirculation pump to low speed. The recirculation pump is not available during a LOP. Therefore, this relay is not required to operate.
Relay 63X-N025	Component Cooling Water (CCW) control logic low system pressure signal	This relay provides a start signal to Component Cooling Water Pump B on a low discharge pressure signal and annunciation of a low discharge pressure and pump emergency trip. Since this pump is locked out on a LOCA and performs no safety related function, this relay is not required to operate.

TABLE 3
COMPONENTS WHICH RECEIVE LESS THE MANUFACTURER'S MINIMUM VOLTAGE BUT ARE NOT REQUIRED TO OPERATE (continued)

Component	Function	Justification
Breaker 52-16505 Spring Charging Motor	SSW Cooling Tower Fan C	The spring charging motor provides the energy required to compress the respective breaker's close spring and trip spring. Spring charging motors are energized when their breaker's close springs are discharged (i.e., right after the breaker closes). The breaker is not postulated to trip after it closes; therefore, the close spring is not required to be recharged for the breaker to perform its safety function. Circuit protection is provided for the control power circuit to preclude adverse effects in the event of a failure of the component.
Relay 62-7	Permissive for Annunciation of SSW Cooling Tower Fan C Feeder Breaker Trip	This relay provides a permissive for annunciation of an automatic trip of its respective breaker. Since the SSW Cooling Tower fan is not postulated to trip and this relay performs no other control/indication function, this relay is not required to operate.
Breaker 52-16506 Spring Charging Motor	SSW Cooling Tower Fan D	The spring charging motor provides the energy required to compress the respective breaker's close spring and trip spring. Spring charging motors are energized when their breaker's close springs are discharged (i.e., right after the breaker closes). The breaker is not postulated to trip after it closes; therefore, the close spring is not required to be recharged for the breaker to perform its design function. Circuit protection is provided for the control power circuit to preclude adverse effects in the event of a failure of the component.
Relay 62-8	Permissive for Annunciation of SSW Cooling Tower Fan D Feeder Breaker Trip	This relay provides a permissive for annunciation of an automatic trip of its respective breaker. Since the SSW Cooling Tower fan is not postulated to trip and this relay performs no other control/indication function, this relay is not required to operate.
Breaker 52-16104 Spring Charging Motor	Diesel Generator Room Outside Air Fan B Feeder Breaker	The spring charging motor provides the energy required to compress the respective breaker's close spring and trip spring. The spring charging motor is energized when the breaker's close springs are discharged (i.e., right after the breaker closes). The breaker is not postulated to trip after it closes; therefore, the close springs are not required to be recharged for the breaker to perform its design function. Circuit protection is provided for the control power circuit to preclude adverse effects in the event of a failure of the component.
Breaker 52-16304 Spring Charging Motor	Enclosure Building Fan B	The spring charging motor provides the energy required to compress the respective breaker's close spring and trip spring. The spring charging motor is energized when the breaker's close springs are discharged (i.e., right after the breaker closes). The breaker is not postulated to trip after it closes; therefore, the close springs are not required to be recharged for the breaker to perform its design function. Circuit protection is provided for the control power circuit to preclude adverse effects in the event of a failure of the component.

NRC Question 3

The licensee is requested to document the adequacy of its dedication programs to ensure that these components will perform their required functions.

GGNS Response to Question 3

The evaluation of the Division I and II safety related 125 Vdc systems identified components that have the potential to receive less than the manufacturer's rated minimum voltage during the system's design basis accident (Table 1). GGNS established a program to demonstrate the adequacy of these components. This program requires periodic testing of the actual installed devices to demonstrate that the components are capable of performing their safety functions. The devices identified are all electromechanical devices including switchgear close coils and dc

contactors. In addition, testing has been performed on switchgear spring charging motors and dc solenoids. The components are installed in safety related Class 1E equipment. The qualification of Class 1E equipment provides assurance that the equipment will meet or exceed its performance requirements throughout its installed life.

In accordance with the guidance provided in IEEE 323 for qualifying Class 1E equipment, any change to the equipment specification must be evaluated to determine its effect on the equipment's qualification. This evaluation is to indicate whether or not re-qualification is necessary. Re-qualification is not necessary if the modification is fully justified and documented as having no bearing on the validity of the tests or equipment qualification. The evaluation of the effects of the operation of these devices at lower than manufacturer's rated voltage determined that device qualification is not invalidated or the design lifetimes reduced for the following reasons:

A. All of the tested devices are intermittently energized for very brief periods to perform their design function, and the operation of these devices during normal plant operation is only for testing purposes. Therefore, effects such as mechanical wear or thermal aging associated with device energization are insignificant.

B. All of the tested devices were procured in accordance with IEEE 323. Therefore, the devices are qualified for the service conditions to which the devices could be exposed. The only electrically induced failure mode for these electromechanical devices is insulation failure. (Coil winding conductors and device cores are metallic and, as a result, not susceptible to radiation or thermal aging. Therefore, the device qualification needs specific review only to ensure that reduced voltage does not increase the degradation rate for which the device was qualified.)

C. As discussed in IEEE 323, routine maintenance and housekeeping practices reduce the possibility of degradation of the components due to external contamination.

D. Device performance variation due to conductor temperature effects for the tested devices is not significant. This is due to the relatively low resistance temperature coefficient for copper in conjunction with the tested devices being located in areas where temperature swings are accounted for by the available margins (e.g., Switchgear Rooms). Only the contactors associated with the RCIC valves are located in an area where accident conditions for temperature exist.

The test program was performed using a variable DC voltage source to demonstrate the operation of the tested component at a voltage level below the postulated minimum voltage available. This testing was performed by:

1. connecting a variable dc power supply and a multimeter to the circuit,

2. increasing the output voltage of the variable dc power supply until the device operates,

3. recording the multimeter indicated operating voltage,

4. repeating steps 2 and 3, and

5. verifying that the recorded operating voltage was at least 10% below the calculated minimum available voltage.

The testing was specified to be performed every 18 months to verify that component degradation has not occurred, although the evaluation of the components' qualification indicates that degradation should not be expected. The method of testing ensures that conservative results are obtained. The test is intended to demonstrate that the component will function at voltage levels below the calculated minimum voltage level. The results may not indicate a trend since the voltage gradient applied during the testing could affect the point of operation due to response of the test power supply (a slow rate of increase in test voltage would produce the most accurate response, a fast rate of increase in test voltage would result in a higher voltage level measurement upon completion of the test due to response of the test power supply). The test results, however, are conservative by demonstrating operation of the component in successive testing below the calculated voltage level.

This testing has been performed twice (during RFO4 and RFO5) since this condition was identified. All of the installed components passed both of these tests.

TABLE 4
COMPONENT TESTING

Component	Manufacturer's Rated Minimum Voltage (Vdc)	Test Acceptance Criteria	Calculated Minimum Voltage (Vdc) during Design Basis Profile
DIVISION I			
Breaker 152-1508 Close Coil	100	70.1	78
Solenoid TB1E51C002 ***	108	79.5	88.3
MOV 1E51F045 72F Contactor	88.8	72.5	80.6
MOV 1E51F013 72F Contactor	88.8	78.5	87.3
MOV 1E51F013 72R Contactor	88.8	78.9	87.7
Breaker 152-1503 Spring Charging Motor ***	100	82.1	91.3
Breaker 52-15304 Spring Charging Motor ***	100	75.8	84.3
Breaker 152-15505 Spring Charging Motor ***	100	54.2	60.2
Breaker 152-15506 Spring Charging Motor ***	100	54.2	60.2
Breaker 152-1509 Spring Charging Motor ***	100	75.8	84.3
Breaker 152-1509 Close Coil	100	88.4	98.2
Breaker 152-15105 Close Coil	100	87.7	97.5
Breaker 152-15105 Spring Charging Motor ***	100	75.6	84.1
Breaker 152-15106 Spring Charging Motor ***	100	77.7	86.4
DIVISION II			
Breaker 152-1608 Close Coil	100	81.5	90.6

Due to the nature of the devices affected (all electromechanical and procured in accordance to IEEE 323) and the margin between the actual minimum device operation voltage and the calculated minimum voltage, this testing provides adequate assurance of the proper operation of this equipment during a Design Basis Accident.

*** These devices were tested although they are not required to operate at voltages below their manufacturer's minimum voltage.