

RS-16-162

10 CFR 50.90

September 12, 2016

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

Quad Cities Nuclear Power Station, Units 1 and 2  
Renewed Facility Operating License Nos. DPR-29 and DPR-30  
NRC Docket Nos. 50-254 and 50-265

Subject: Request for License Amendment to Revise Loss of Voltage Relay Settings

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Exelon Generation Company, LLC (EGC) requests an amendment to Renewed Facility Operating License Nos. DPR-29 and DPR-30 for Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2, respectively. The proposed change revises the allowable value for Function 1, "4160 V Essential Service System Bus Undervoltage (Loss of Voltage)," in Technical Specifications (TS) Table 3.3.8.1-1, "Loss of Power Instrumentation."

This request is subdivided as follows.

- Attachment 1 provides a description and evaluation of the proposed change.
- Attachment 2 provides a markup of the affected TS page.
- Attachment 3 provides Design Analysis QDC-6700-E-2173, "Evaluation of Degraded Voltage 5 Minute Timer on Normally Running Safety-Related Loads."
- Attachment 4 provides Design Analysis QDC-6700-E-0939, "Loss of Voltage Relay Setpoint for Buses 13-1, 14-1, 23-1, and 24-1."

The proposed change has been reviewed by the QCNPS Plant Operations Review Committee in accordance with the requirements of the EGC Quality Assurance Program.

EGC requests approval of the proposed change by September 12, 2017, to support implementation activities during the Unit 2 spring 2018 refueling outage as changes to the loss of voltage relay settings cannot be completed online. Once approved, the amendment will be implemented for Unit 2 prior to entering Mode 4 following the spring 2018 refueling outage, and the amendment will be implemented for Unit 1 prior to entering Mode 4 following the spring 2019 refueling outage.

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In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), EGC is notifying the State of Illinois of this application for license amendment by transmitting a copy of this letter and its attachments to the designated State Official.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Mr. Kenneth M. Nicely at (630) 657-2803.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 12th day of September 2016.

Respectfully,

A handwritten signature in black ink, appearing to read "Patrick R. Simpson", with a long, sweeping flourish extending to the right.

Patrick R. Simpson  
Manager – Licensing

Attachments:

1. Evaluation of Proposed Change
2. Markup of Proposed Technical Specifications Page
3. Design Analysis QDC-6700-E-2173, "Evaluation of Degraded Voltage 5 Minute Timer on Normally Running Safety-Related Loads," Revision 000
4. Design Analysis QDC-6700-E-0939, "Loss of Voltage Relay Setpoint for Buses 13-1, 14-1, 23-1, and 24-1," Revision 001

cc: NRC Regional Administrator, Region III  
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station  
Illinois Emergency Management Agency – Division of Nuclear Safety

**ATTACHMENT 1**  
**Evaluation of Proposed Change**

- 1.0 SUMMARY DESCRIPTION
- 2.0 DETAILED DESCRIPTION
- 3.0 TECHNICAL EVALUATION
- 4.0 REGULATORY EVALUATION
  - 4.1 Applicable Regulatory Requirements/Criteria
  - 4.2 No Significant Hazards Consideration
  - 4.3 Conclusions
- 5.0 ENVIRONMENTAL CONSIDERATION

# ATTACHMENT 1

## Evaluation of Proposed Change

### 1.0 SUMMARY DESCRIPTION

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Exelon Generation Company, LLC (EGC) requests an amendment to Renewed Facility Operating License Nos. DPR-29 and DPR-30 for Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2, respectively. The proposed change revises the allowable value for Function 1, "4160 V Essential Service System Bus Undervoltage (Loss of Voltage)," in Technical Specifications (TS) Table 3.3.8.1-1, "Loss of Power Instrumentation."

During a Component Design Bases Inspection (CDBI) at Byron Station in 2009, the NRC identified an unresolved issue related to the design bases for the second level (degraded) voltage timer settings. Specifically, the NRC questioned the impact of operating and/or starting safety related equipment at a voltage as low as 75 percent of the 4.16 kV nominal bus voltage for a long as 5 minutes and 40 seconds (i.e., the degraded voltage time delay period prior to being isolated from the normal offsite power source) during an event involving a degraded grid voltage condition without a loss-of-coolant-accident (LOCA) signal. The 75 percent of 4.16 kV value is based on an operation intervention procedural action to help improve bus voltage.

The inspectors determined that an analysis did not exist to demonstrate the ability of the safety related loads to mitigate an event involving a degraded grid voltage condition when a LOCA signal was not present. The NRC determined that during a degraded grid voltage condition, if a LOCA signal was also present, the emergency diesel generators (EDGs) would start and accept the safety related loads according to the prescribed load sequencing after approximately 10 seconds. However, if a LOCA signal were not present, the degraded voltage condition resulted in an alarm in the control room and the start of a five-minute external timer after the 10 second time delay that is an internal feature of the degraded voltage relays.

The concern was that, if the voltage at the 4.16 kV safety related buses dropped to slightly above 75 percent of the nominal voltage, the operating motors would experience approximately a 28 percent increase in current. If operated within the design limits and properly protected, these motors would most likely experience no major damage. During the subsequent intervening five minutes, however, the increase in motor load current could result in spurious breaker trips and the automatic restart of the same or redundant motors with consequent further decrease in system voltages. The lower voltage buses could experience voltage drops greater than 25 percent due to losses in step-down transformers, cables, and other interposing devices. This voltage drop, complicated by potential motor starts, including the potential start of the motor-driven auxiliary feedwater pump if a plant trip occurred, could result in adverse consequences that had not been evaluated.

As part of the evaluation of the Byron Station issue, it was determined that prior NRC approval had not been received to take manual actions to disconnect from the offsite power source and supply power to the plant with the EDG to address offsite source degraded voltage conditions. Further review of the Byron Station issue has determined that this issue also applies to QCNPS.

EGC has determined that the setpoint for detecting a loss of voltage on the 4.16 kV Essential Service System (ESS) buses should be changed to resolve this concern.

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**2.0 DETAILED DESCRIPTION**

The proposed change revises the allowable value in TS Table 3.3.8.1-1 for Function 1, "4160 V Essential Service System Bus Undervoltage (Loss of Voltage)."

- Current TS Table 3.3.8.1-1, Function 1 Allowable Value states:  $\geq 2797$  V and  $\leq 3063$  V
- Revised TS Table 3.3.8.1-1, Function 1 Allowable Value states:  $\geq 2951$  V and  $\leq 3233$  V

A markup of the proposed change is provided in Attachment 2.

**3.0 TECHNICAL EVALUATION**

The purpose of the degraded voltage protection scheme is to protect the safety related loads from being made unavailable due to a lower than expected bus voltage. The voltage on Unit 1 ESS buses 13-1 and 14-1, and Unit 2 ESS buses 23-1 and 24-1, are each monitored by two undervoltage relays, which are arranged in a two-out-of-two logic. When the bus voltage drops below the loss of voltage relay setpoint, bus load shedding is initiated and the associated EDG is started. The time delay associated with the loss of voltage relay is inherent to the level of undervoltage. This function of the loss of voltage protection scheme is not affected by the proposed change.

Offsite power to QCNPS is supplied to the 345 kV switchyard from the transmission network by five transmission lines. From the 345 kV switchyard, one qualified electrically and physically separated circuit normally provides AC power, through reserve auxiliary transformer (RAT) 12, to 4.16 kV ESS bus 13-1 via ESS bus 13 to supply the Division 1 loads on Unit 1. From the same switchyard, another qualified, electrically and physically separated circuit normally provides AC power, through RAT 22, to 4.16 kV ESS bus 23-1 via ESS bus 23 to supply the Division 1 loads of Unit 2. Unit auxiliary transformer (UAT) 11, which is normally supplied by the Unit 1 main generator, is normally aligned to supply the Unit 1 Division 2 4.16 kV ESS bus 14-1 via ESS bus 14. Finally, UAT 21, which is normally supplied by the Unit 2 main generator, is normally aligned to supply the Unit 2 Division 2 4.16 kV ESS bus 24-1 via ESS bus 24.

Each 4.16 kV ESS bus has its own independent loss of power instrumentation and associated trip logic. The voltage for each bus is monitored at two levels, which can be considered as two different undervoltage functions: loss of voltage and degraded voltage.

Loss of voltage on a 4.16 kV ESS bus indicates that offsite power may be completely lost to the respective 4.16 kV ESS bus, and the bus is unable to supply sufficient voltage for proper operation of the applicable equipment. Therefore, the power supply to the bus is transferred from offsite power to EDG power prior to the voltage on the bus dropping below the TS 3.3.8.1 minimum loss of voltage function allowable value but after the voltage drops below the TS 3.3.8.1 maximum loss of voltage function allowable value (loss of voltage). This ensures that adequate power will be available to the required equipment.

A degraded voltage condition on a 4.16 kV ESS bus indicates that, while offsite power may not be completely lost to the respective emergency bus, available power may be insufficient for starting large Emergency Core Cooling System (ECCS) motors without risking damage to the motors that could disable the ECCS function. Therefore, power supply to the bus is transferred

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from offsite power to onsite EDG power when the voltage on the bus drops below the degraded voltage function allowable value. However, the transfer does not occur until after the inherent and no-LOCA time delays have elapsed, as applicable. The time delay function associated with the bus undervoltage relay is inherent to the bus undervoltage – degraded voltage relay and is nominally adjusted to seven seconds to prevent circuit initiation caused by grid disturbances and motor starting transients. The bus undervoltage/time delay function provides input to the time delay function. The time delay function relay is nominally adjusted to five minutes to allow time for the operator to attempt to restore normal bus voltage. When a bus undervoltage/time delay function setpoint has been exceeded and persists for seven seconds on both relay channels, a control room annunciator alerts the operator of the degraded voltage condition and the five minute time delay function relay timer is initiated. If the degraded voltage condition does not clear within five minutes, the five minute time delay function relay sends a loss of power signal to the respective bus load shedding scheme and starts the associated EDG. If a LOCA condition exists coincident with a loss of power to the bus, the time delay (no LOCA) function is bypassed. This ensures that adequate power will be available to the required equipment.

The bus undervoltage allowable values are low enough to prevent inadvertent power supply transfer, but high enough to ensure that 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 or allow restoration to normal voltages, but short enough to ensure that sufficient power is available to the required equipment.

QCNPS TS Table 3.3.8.1-1 specifies the 4.16 kV ESS bus undervoltage allowable values as summarized in the following table.

Function	Allowable Value (current values)
1. 4160 V Essential Service System Bus Undervoltage (Loss of Voltage)	$\geq 2797 \text{ V}$ and $\leq 3063 \text{ V}$
2. 4160 V Essential Service System Bus Undervoltage (Degraded Voltage)	
a. Bus Undervoltage/Time Delay	$\geq 3885 \text{ V}$ and $\leq 3948 \text{ V}$ with time delay $\geq 5.7$ seconds and $\leq 8.3$ seconds
b. Time Delay (No LOCA)	$\geq 276$ seconds and $\leq 324$ seconds

Based on TS 3.3.8.1, during a degraded condition under normal operating conditions (i.e., no LOCA signal), after the initial degraded voltage relay time delay of seven seconds (i.e.,  $\geq 5.7$  seconds and  $\leq 8.3$  seconds), a five minute timer is started (i.e.,  $\geq 276$  seconds and  $\leq 324$  seconds). Therefore, the normal (non-accident) time delay associated with the second-level undervoltage relays (i.e., degraded voltage relays) could allow the voltage at the 4.16 kV buses to remain at low levels for an extended period of time. This low level of voltage could last as long as 332.3 seconds (i.e., 8.3 seconds plus 324 seconds) before transfer of all safety

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related loads to the EDGs. During this time, motors may stall due to low voltages. Design Analysis QDC-6700-E-2173, "Evaluation of Degraded Voltage 5 Minute Timer on Normally Running Safety-Related Loads," was created to evaluate the loss of voltage relay setpoint to ensure that the safety related motors that may be running during normal conditions will continue to operate during the 332.3 second time delay without stalling, tripping due to thermal overload relay operation, or being damaged. Design Analysis QDC-6700-E-2173, which is provided in Attachment 3, also establishes new analytical limits for the loss of voltage relays. A setpoint of 88.35 V with +/- 5 percent tolerance for the loss of voltage relays was found to be high enough to prevent the stalling and tripping of safety related motors that may be running during normal conditions and low enough to prevent spurious operation due to expected voltage transients. New upper and lower analytical limits for the loss of voltage relay were calculated as 3246 V and 2938 V, respectively.

Design Analysis QDC-6700-E-0939, "Loss of Voltage Relay Setpoint for Buses 13-1, 14-1, 23-1, and 24-1," establishes the new loss of voltage relay setpoint, setting tolerances, expanded tolerances, and allowable values based on the new analytical limits. The existing loss of voltage relays are set to a new setpoint value of 88.35 V, which corresponds to a 4.16 kV bus voltage of 3092.25 V (i.e., approximately 74.3 percent of rated bus voltage). The new setpoint ensures that none of the safety related motors that may be running during normal operating conditions will stall during a sustained degraded voltage condition. Furthermore, the setpoint is low enough to preclude spurious trips due to the voltage transient during a LOCA block start and low enough to preclude spurious trips due to the largest expected voltage transient when the 4.16 kV ESS buses are fed from the EDGs. Design Analysis QDC-6700-E-0939, which is provided in Attachment 4, calculates the allowable value of the loss of voltage relays as  $\geq 2951$  V and  $\leq 3233$  V.

#### **4.0 REGULATORY EVALUATION**

##### **4.1 Applicable Regulatory Requirements/Criteria**

The following General Design Criteria (GDC) are applicable to this amendment request. It should be noted that, although QCNPS is not formally committed to the GDC due to the vintage of the station, an evaluation was performed addressing the QCNPS conformance with the GDC. This evaluation is documented in the UFSAR Section 3.1, "Conformance with NRC General Design Criteria." This evaluation concluded that QCNPS fully satisfies the intent of the (then draft) GDC.

GDC 5, "Sharing of structures, systems, and components," states that no safety related systems, structures, or components are shared unless such sharing has been evaluated to ensure that there will be no significant adverse impact on safety functions.

GDC 17, "Electric power systems," states that provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies.

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Based on the review of the above requirements, EGC has determined that the proposed change does not require any exemptions or relief from regulatory requirements, other than revising the TS as described, and does not affect conformance with any of the above noted regulatory requirements or criteria.

**4.2 No Significant Hazards Consideration**

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Exelon Generation Company, LLC (EGC) requests an amendment to Renewed Facility Operating License Nos. DPR-29 and DPR-30 for Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2, respectively. The proposed change revises the allowable value for Function 1, "4160 V Essential Service System Bus Undervoltage (Loss of Voltage)," in Technical Specifications (TS) Table 3.3.8.1-1, "Loss of Power Instrumentation."

According to 10 CFR 50.92, "Issuance of amendment," paragraph (c), a proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not:

- (1) Involve a significant increase in the probability or consequences of any accident previously evaluated; or
- (2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or
- (3) Involve a significant reduction in a margin of safety.

EGC has evaluated the proposed change, using the criteria in 10 CFR 50.92, and has determined that the proposed change does not involve a significant hazards consideration. The following information is provided to support a finding of no significant hazards consideration.

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No

The proposed change to the 4.16 kV Essential Service System (ESS) bus loss of voltage allowable values allows the protection scheme to function as originally designed. This change will involve alteration of nominal trip setpoints in the field and will also be reflected in revisions to the calibration procedures. The proposed change does not affect the probability or consequences of any accident. Analysis was conducted and demonstrates that the proposed allowable values will allow the normally operating safety related motors to continue to operate without sustaining damage or tripping during the worst-case, non-accident degraded voltage condition for the maximum possible time-delay of 332.3 seconds. Thus, these safety related loads will be available to perform their

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safety function if a loss-of-coolant accident (LOCA) concurrent with a loss-of-offsite power (LOOP) occurs following the degraded voltage condition.

The proposed change does not adversely affect accident initiators or precursors, and do not alter the design assumptions, conditions, or configuration or the plant or the manner in which the plant is operated or maintained. The proposed allowable values ensure that the 4.16 kV distribution system remains connected to the offsite power system when adequate offsite voltage is available and motor starting transients are considered. The emergency diesel generator (EDG) start due to a LOCA signal is not adversely affected by this change. During an actual loss of voltage condition, the loss of voltage time delay will continue to isolate the 4.16 kV distribution system from offsite power before the EDG is ready to assume the emergency loads, which is the limiting time basis for mitigating system responses to the accident. For this reason, the existing loss of power / LOCA analysis continues to be valid.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No

The proposed change involves the revision of 4.16 kV ESS bus loss of voltage allowable values to satisfy existing design requirements. The proposed change does not introduce any changes or mechanisms that create the possibility of a new or different kind of accident. The proposed change does not install any new or different type of equipment, and installed equipment is not being operated in a new or different manner. No new effects on existing equipment are created nor are any new malfunctions introduced.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

Response: No

The proposed protection 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 EDG start due to a LOCA signal is not adversely affected by this change. During an actual loss of voltage condition, the loss of voltage time delays will continue to isolate the 4.16 kV distribution system from offsite power before the EDG is ready to assume the emergency loads.

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Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above evaluation, EGC concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92, paragraph (c), and accordingly, a finding of no significant hazards consideration is justified.

**4.3 Conclusions**

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or the health and safety of the public.

**5.0 ENVIRONMENTAL CONSIDERATION**

EGC has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, "Standards for Protection Against Radiation." However, the proposed amendment does not involve: (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," paragraph (c)(9). Therefore, pursuant to 10 CFR 51.22, paragraph (b), no environmental impact statement or environmental assessment needs to be prepared in connection with the proposed amendment.

**ATTACHMENT 2**  
**Markup of Proposed Technical Specifications Page**

**Quad Cities Nuclear Power Station, Units 1 and 2**  
**Renewed Facility Operating License Nos. DPR-29 and DPR-30**

REVISED TECHNICAL SPECIFICATIONS PAGE

3.3.8.1-3

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

FUNCTION	REQUIRED CHANNELS PER BUS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. 4160 V Essential Service System Bus Undervoltage (Loss of Voltage)	2	SR 3.3.8.1.3 SR 3.3.8.1.4 SR 3.3.8.1.5	<del><math>\geq 2797 \text{ V}</math> and <math>\leq 3063 \text{ V}</math></del>
2. 4160 V Essential Service System Bus Undervoltage (Degraded Voltage)			
a. Bus Undervoltage/Time Delay	2	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.5	$\geq 3885 \text{ V}$ and $\leq 3948 \text{ V}$ with time delay $\geq 5.7$ seconds and $\leq 8.3$ seconds
b. Time Delay (No LOCA)	1	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.5	$\geq 276$ seconds and $\leq 324$ seconds

$\geq 2951 \text{ V}$  and  $\leq 3233 \text{ V}$