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U. S. Nuclear Regulatory Commission
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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: Additional Information Supporting Request for License Amendment to Establish Total Battery Connector Resistance Acceptance Criteria in Technical Specifications Surveillance Requirements 3.8.4.2 and 3.8.4.5

References:

1. Letter from J. L. Hansen (Exelon Generation Company, LLC) to U. S. NRC, "Request for License Amendment to Establish Total Battery Connector Resistance Acceptance Criteria in Technical Specifications Surveillance Requirements 3.8.4.2 and 3.8.4.5," dated December 21, 2007

2. Letter from J. S. Wiebe (U. S. NRC) to C. G. Pardee (Exelon Generation Company, LLC), "Quad Cities Nuclear Power Station, Units 1 and 2 – Request for Additional Information Related to License Amendment to Establish Total Battery Connector Resistance Acceptance Criteria in Technical Specifications (TAC Nos. MD7539 and MD7540)," dated July 18, 2008

In Reference 1, Exelon Generation Company, LLC (EGC) requested an amendment to Renewed Facility Operating License Nos. DPR-29 and DPR-30 for Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2. The proposed change revises Technical Specification (TS) Surveillance Requirements (SR) 3.8.4.2 and 3.8.4.5 to add an additional acceptance criterion to verify that the total battery connector resistance is within the pre-established limits that ensure the QCNPS safety-related batteries can perform their intended design function.

In Reference 2, the NRC requested additional information to complete its review. In response to Reference 2, EGC is providing the attached information.

EGC has reviewed the information supporting a finding of no significant hazards consideration that was previously provided to the NRC in Attachment 1 of Reference 1. The information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Michelle Yun at (630) 657-2818.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 14th day of August 2008.

Respectfully,

Jeffrey L. Hansen
Manager – Licensing

cc: NRC Senior Resident Inspector
NRC Regional Administrator, Region III

Attachment: Response to Request for Additional Information

ATTACHMENT

NRC Request 1

In the November 28, 2006, Component Design Bases Inspection report referenced in your license amendment request, the NRC inspectors identified that the 125 volt direct current safety-related batteries would be incapable of meeting their design basis function if the inter-cell connection resistance were allowed to increase to the existing TS allowed value (i.e., 150 micro-ohms). Describe the basis for maintaining the existing150 [sic] micro-ohm inter-cell connection resistance value in TS SR 3.8.4.2 and 3.8.4.5.

Response

Technical Specification (TS) Surveillance Requirements (SR) 3.8.4.2 and 3.8.4.5 establish the requirement to perform inspections and measurements to detect localized battery connector degradation. A measurement of inter-cell and terminal connection resistance provides an indication of localized deterioration that could unacceptably degrade local battery performance if left uncorrected. The specific resistance value (150 micro-ohms) was not initially established as an absolute limit for battery operability. The value was based on industry experience as a threshold for identifying localized degradation so that issues potentially affecting battery performance are promptly identified and corrected. EGC concludes that SR 3.8.4.2 and 3.8.4.5 will continue to serve this function while the proposed expanded SR provide the necessary surveillance of total battery resistance to ensure battery operability.

NRC Request 2

In the license amendment request, the license [sic] stated that in response to the nonconservative [sic] TS value (i.e., 150 micro-ohms) it has initiated a compensatory measure to ensure safety-related battery operability by declaring the 125 and 250 volt direct current batteries inoperable if any inter-cell resistance exceeds 70 micro-ohms. Describe the methodology and calculation used to determine the inter-cell resistance value of 70 micro-ohms. Does this value represent the worst-case inter-cell resistance (i.e., the operability limit)?

Response

The 70 micro-ohm limit is based on two factors associated with the 125 VDC batteries. The first factor is the inherent voltage drop that exists between each inter-cell connector when the battery is new. This voltage drop is typically 20 millivolts and is accounted for in the battery manufacturer's discharge curves. Using Ohm's Law and rated current (750 amps), an inherent inter-cell resistance value can be determined. In this case, this value is 26.67 micro-ohms. In other words, when the battery voltage drops to its 105 VDC UFSAR minimum value, 26.67 micro-ohms will nominally be found across each inter-cell connector.

The second factor is the amount of voltage margin that exists when a battery service test is performed. During a service test, the battery is subjected to its worst case load profile. The voltage at the battery's terminals is monitored to verify that it does not drop below 105 VDC as required per the UFSAR. The lowest recorded voltage for the limiting battery was found to be 107.2 VDC. Therefore, 2.2 VDC of margin exists for this battery. Using Ohm's Law, this 2.2 VDC of margin can be converted to a resistance when the battery's maximum current draw is considered. This resistance, when divided by the number of inter-cell connectors, produces a value of 44 micro-ohms. When the 44 micro-ohm value is added to the inherent value of 26.67 (conservatively rounded to 26) micro-ohms, a 70 micro-ohm limit is established. Note that a 120% design factor is included in the 44 micro-ohm value to account for future load growth.

The inputs to this calculation are periodically verified and after load additions to the battery to ensure the 70 micro-ohm limit remains valid. The 70 micro-ohm limit is conservatively applied to the 250 VDC batteries because the 125 VDC batteries are the most limiting case.

The 70 micro-ohm limit was determined by conservatively assuming all inter-cell and terminal connections are degraded to the same degree at the same time. This worst-case scenario is unlikely and the compensatory measure was deemed an appropriate and conservative response to the NRC violation referenced below and was established as a short-term action in accordance with NRC Administrative Letter 98-10, "Dispositioning of Technical Specifications That Are Insufficient to Assure Plant Safety." It is not feasible to establish a localized terminal/connector resistance limit for battery operability because localized degradation does not necessarily reflect overall battery performance. As noted in the response to NRC Request 1, the proposed expanded SRs provide the necessary surveillance of total battery resistance to ensure battery operability is maintained.

NRC Request 3

Describe the controls that will be implemented to direct the QCNPS staff how and when (i.e., how frequently?) to update the Individual Battery Total Connector Resistance Acceptance Criteria that you proposed locating in the TS bases.

Response

Battery total connector resistance acceptance criteria will be maintained in a formal calculation. This calculation receives its inputs from the 125 VDC and 250 VDC battery sizing calculations which are revised when the loading on the batteries is changed (e.g., modifications). There is a formal administrative tie between the inter-cell connection calculation and the battery sizing calculation such that they will both be revised when battery loading changes.

The inter-cell resistance calculation contains both a total allowable resistance limit and the TS bases acceptance criteria. The TS bases acceptance criteria will always be less than the total allowable resistance limit to allow for minor load changes to be added to the battery without revising the TS bases. Changes to the TS bases are governed by TS 5.5.10, "Technical Specifications (TS) Bases Control Program."

Calculations are controlled by EGC procedure CC-AA-309, "Control of Design Analyses," which contains administrative requirements for calculation revisions. In this case, if battery loading changes, the battery sizing calculations as well as all related calculations will also be revised at that time. Since the inter-cell connection resistance calculation establishes the values in the TS bases, these TS bases values will be reviewed anytime a battery load addition or reduction occurs.

Reference:

Letter from A. M. Stone (U. S. NRC) to C. M. Crane (Exelon Generation Company, LLC), "Quad Cities Nuclear Power Station, Units 1 and 2, NRC Component Design Bases Inspection (CDBI), Inspection Report 05000254/2006003(DRS), 05000265/2006003(DRS)," dated November 28, 2006