Entergy

Entergy Operations, Inc.
River Bend Station
5485 U. S. Highway 61N
St. Francisville, LA 70775
Tel 225 381 4157
Fax 225 381 4139
tevans4@entergy.com

Terry A. Evans
Director-Nuclear Safety Assurance

RBG-47423

January 16, 2014

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

SUBJECT: Response to Request for Additional Information on License Amendment Request 2013-01
River Bend Station – Unit 1
Docket No. 50-458
License No. NPF-47

REFERENCES:
1. Entergy letter to NRC, dated February 7, 2013, License Amendment Request 2013-01, Battery Surveillance Requirement Acceptance Criteria (Letter No. RBG-47332)

2. NRC letter to Entergy (via email), dated December 3, 2013, Request for Additional Information

RBF1-14-0002

Dear Sir or Madam:

On February 7, 2013, Entergy Operations, Inc. (Entergy) submitted a request to revise certain acceptance criteria for surveillance requirements related to safety-related batteries (Reference 1). During their review, the NRC staff determined that additional information is needed to complete the processing and approval of Entergy's request. The request for that information was transmitted to Entergy per Reference 2. The attachments to this letter contains the requested information.

This letter contains no commitments. If you have any questions on this matter, please contact Joey Clark, Manager – Licensing, at 225-381-4177.

I declare under penalty of perjury that the foregoing is true and correct. Executed on January 16, 2014.

Sincerely,

Terry A Evans

TAE / dwh

Attachment 1: Response to Request for Additional Information
Attachment 2: Revised Technical Specification Mark-up Page

A001
NRR

cc: Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
1600 E. Lamar Blvd.
Arlington, TX 76011-4511

NRC Senior Resident Inspector
River Bend Station

U. S. Nuclear Regulatory Commission
Attn: Mr. Alan Wang
MS 8-G14
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Department of Environmental Quality
Office of Environmental Compliance
Radiological Emergency Planning and Response Section
JiYoung Wiley
P.O. Box 4312
Baton Rouge, LA 70821-4312

Central Records Clerk
Public Utility Commission of Texas
1701 N. Congress Ave.
Austin, TX 78711-3326

Attachment 1
RBG-47423

Response to Request for Additional Information

REQUEST No. 1

On Page 5 of 7 in Attachment 1, the LAR states, "SR 3.8.4.5 specifies that the measured resistance at each inter-cell, inter-rack, inter-tier, and terminal connection will be less than 1.5 E-4 ohms." However, the TS mark-up of the proposed change in Attachment 2 of the LAR reflects the acceptance criteria of inter-cell, inter-rack, interior, and terminal connection as less than or equal to 1.5 E-4 ohms. Please clarify the above discrepancy.

RESPONSE

The referenced statement on Page 5 of 7 in Attachment 1 is incorrect. It should read, "SR 3.8.4.5 specifies that the measured resistance at each inter-cell, inter-rack, inter-tier, and terminal connection will be less than or equal to 1.5 E-4 ohms." See Response no. 3 for further discussion.

REQUEST No. 2

On Page 5 of 7 in Attachment 1, the LAR states, "The surveillance will also be revised to include the additional acceptance criterion that total connection resistance will be less than or equal to 45.75 E-4 ohms." However, Technical Specification Mark-up of the proposed change in Attachment 2 of the LAR reflects the acceptance criteria of total connection resistance as less than 45.75 E-4 ohms. Please clarify the above discrepancy.

RESPONSE

The acceptance criteria on the Technical Specification mark-up page provided in Reference 1 is incorrect. Please see the response to Question No. 3 below for further explanation. A new mark-up page is provided in Attachment 2 to supersede that provided in Reference 1.

REQUEST No. 3

On Page 1 of 7 in Attachment 1, the LAR, states, "The change will add a total resistance value of 45.75 E-4 ohms to SRs 3.8.4.2 and 3.8.4.5. The current individual connection limit of 1.5 E-4 ohms will remain as unchanged." 10 CFR 50.36 (c)(3) Surveillance Requirement states, "Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met."

Please explain how the current TS SR individual connection limits of less than or equal to 1.5 E-4 ohms for inter-cell, inter-rack, inter-tier, terminal connections and the proposed total connection resistance of <45.75 E-4 ohms, in TS SRs 3.8.4.2 and 3.8.4.5, will assure the necessary quality of systems and components. Also, please provide a summary of the calculations including the assumptions and supportive documentation to show that the batteries will perform their intended design functions when operating within these limits.

RESPONSE

The current individual connection limit of ≤ 1.5 E-4 ohms remains unchanged. This will be supplemented by the total resistance value of ≤ 27.45 E-4 ohms.

The calculated total resistance value is based on the following. The division 1, 2, and 3 batteries each contain 60 cells. For each battery, the 60 cells are connected in series. There are 59 cell-to-cell connections and 2 terminal connections. The 59 cell-to-cell connections include inter-cell, inter-rack, and inter-tier connections. Therefore, in total, there are 61 connections per battery. The battery vendor provided inter-cell connections of 25 micro-ohms. RBS battery calculations add an additional equivalent 20 micro-ohms per inter-cell connections for margin. RBS battery calculations also add another equivalent 30 micro-ohms per inter-cell connections to account for instrument uncertainty. Therefore, total calculated cell-to-cell resistance is ≤ 61*(25+20+30), that is, ≤ 45.75 E-4 ohms.

An engineering change was issued to update all the battery calculations to include the updated inter-cell connections resistance values. The calculations conclude that the batteries are adequately sized and are able to perform their design functions with the new inter-cell connection resistance values added. In order to protect the Technical Specification value for total resistance, the total resistance value used in the surveillance test procedure and Technical Specification should be ≤ 61*(25+20), that is, ≤ 27.45 E-4 ohms, instead of ≤ 45.75 E-4 ohms. This acceptance criterion will account for additional 30 micro-ohms per connection for instrument uncertainty and ensure that the batteries will perform their intended design functions. The 30 micro-ohms value for instrument uncertainty used in design basis calculations is acceptable based on measuring and test equipment accuracy of ±0.5% of reading plus one least significant digit, and the vendor provided inter-cell resistance of 25 micro-ohms.

Calculations for the division 1, 2, and 3 batteries include the total inter-cell connection with the instrument uncertainty in the form of cable length. This additional resistance or equivalent cable length is added to the one-way length of the cable supplying the system. This additional resistance is used for the load flow and voltage drop calculations. The results of the calculations summarized below demonstrate that the batteries are adequately sized for the design basis event (DBE) and station blackout (SBO) scenarios and the batteries are capable of performing their intended design functions. The summary of the battery sizing calculations is as follows:

Battery	Scenario	Spare Capacity
Division I	DBE	44.18%
	SBO	2.41%
Division II	DBE	91.26%
	SBO	1.82%
Division III	DBE	6.61%

The calculations demonstrate that the proposed addition of a total resistance value of ≤27.45 E-4 ohms will assure that the batteries will perform their intended design function.

The assumptions used for battery sizing are:

1. The minimum assumed battery temperature for the batteries is 60°F which is the minimum design requirement for the battery room stated in the Environmental Design Criteria.
2. The battery aging margin used is 25%, consistent with IEEE-Std-485-1983. The aging factor allows the battery to meet its duty cycle as it reaches end of life. IEEE Std-485-1983 recommends an aging factor of 1.25, which will allow operation to approximately 80% of rated capacity.
3. The design margin for each battery is assumed to be 1.0 since the battery sizing calculations are being performed on existing batteries. Actual available battery margin is calculated as part of the battery sizing calculation. Also, additional loading has been included at several buses to account for future additions to the system.
4. 20 micro-ohms per connection is added to allow margin for connection resistances that may be higher than those included in the manufacturer's battery curves. An additional 30 micro-ohms per connection is added to account for instrument uncertainties. Battery calculations include the total inter-cell connection with the instrument uncertainty in the form of cable length. This additional resistance of equivalent cable length is added to the one-way length of the cable supplying the system. This additional resistance is used for the load flow and voltage drop calculations.

REQUEST No. 4

On Page 2 of 7 in Attachment 1, the LAR states, "Battery Sizing Requirements: The Divisions 1 and 2 batteries have sufficient capacity to power their required safety loads for 4 hours per RBS Calculations E-143 and E-144. The Division 3 battery has sufficient capacity for 2 hours per RBS Calculation G13.18.3.6*09. These calculations include design margin and aging. The batteries are sized in accordance with the methodology of The Institute of Electrical and Electronics Engineers (IEEE) Standard (Std.) 485-1983." IEEE Std. 485-1983 also recommends considering temperature correction factor in cell sizing.

Please, confirm that RBS calculations for battery sizing included appropriate temperature correction factor in addition to the design and aging margins in accordance with IEEE Std. 485-1983.

RESPONSE

RBS calculations for battery sizing also include temperature correction factor of 1.11 (60°F) in addition to the design and aging margins in accordance with IEEE Std. 485-1983.

REQUEST No. 5

Design Requirements on Page 2 of 7 in Attachment 1 of the LAR states, "The minimum acceptable node voltage (i.e., voltage at the terminals of the distribution panels, motor control centers, switchgear, or inverter) shall be greater than 108 VDC at the end of the 4-hour battery duty cycle. This is based on the battery sizing for a final terminal voltage of 110 VDC."

Please, confirm that the voltages (i.e., voltage at the terminals of the equipment downstream of the distribution panels, motor control centers, switchgear, or inverters) shall be greater than or equal to the equipment minimum required voltages at the end of the 4-hour battery duty cycle. In addition, provide a summary of the calculations and assumptions postulated which determines that the limiting component will have the minimum required voltage with the proposed battery connection resistance specified in TS 3.8.4.2 and 3.8.4.5.

RESPONSE

The voltages at the terminals of the equipment downstream of the distribution panels, motor control centers, switchgear, or inverters shall be greater than or equal to the equipment minimum required voltages at the end of the 4-hour battery duty cycle for the division 1 and 2 batteries, and the 2-hour duty cycle for division 3 battery. This is demonstrated in the RBS design basis calculations E-143, E-144, and G13.18.3.6*009.

These calculations use Direct Current System Database Model (DCSDM) software for the system battery sizing, load flow, and voltage drop calculations to each device. The DCSDM contains detailed operating and loading information for each electrical device in the DC system. Iterative load flow/voltage drop calculations are performed to calculate the node voltages and currents based on the loads that are operating as defined in the DCSDM. Once these nodal voltages are calculated, voltage drop calculations for each electrical device that is expected to operate are performed by DCSDM.

The minimum required voltage for all devices modeled (other than resistors and lights) are compared to their respective bus voltages for each battery. RBS calculations confirm that all components analyzed meet the voltage requirements with the proposed battery connection resistance incorporated into the calculations. Additional analyses are performed on a case-by-case basis for the devices that do not meet this requirement. The analyses in the calculations also confirm that the under-voltage conditions for such cases are acceptable.

Assumptions used in the calculations for load flow and voltage drop:

1) The voltage drop and load flow calculations in DCSDM are calculated using a conductor temperature of 90°C which will produce more conservative results since the control circuit current is negligible and the cable temperature for control devices should be less than 75°C. The cables are designed to operate with a maximum conductor temperature of 90°C. This assumption will produce the largest voltage drop for the cable operating within its design.

2) For constant-resistive devices, the device current for the path voltage drop is based on the assumption that the node voltage is at the terminals of the device. This will produce a calculated voltage drop larger than actual voltage drop and a conservative result.

3) For constant-power devices, the device current for the path is based on the assumption that the device is operating at its minimum operating voltage. This will produce a calculated voltage drop larger than the actual voltage drop and a conservative result.

4) Alternate devices will be considered operating at the specified diversity for all time steps that the analyzed device is on. This assumption may have current flowing for an alternate device that is actually off. Therefore, the calculated voltage drop will be larger than the actual voltage drop.

5) The voltage drop due to jumpers, internal wiring, and contact resistance is conservatively accounted for by assuming that the minimum required voltage at the device must be equal or greater than the device minimum required voltage plus one volt.

Attachment 2
RBG-47423

Revised Technical Specification Mark-up Page
(page TS 3.8-25)

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is ≥ 130.2 V on float charge.	7 days
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. OR Verify battery connection resistance is ≤ 1.5 E-4 ohm for inter-cell connections, ≤ 1.5 E-4 ohm for inter-rack connections, ≤ 1.5 E-4 ohm for inter-tier connections, and ≤ 1.5 E-4 ohm for terminal connections.	92 days
SR 3.8.4.3	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration.	24 months
SR 3.8.4.4	Remove visible corrosion, and verify battery cell to cell and terminal connections are coated with anti-corrosion material.	24 months
SR 3.8.4.5	Verify battery connection resistance is ≤ 1.5 E-4 ohm for inter-cell connections, ≤ 1.5 E-4 ohm for inter-rack connections, ≤ 1.5 E-4 ohm for inter-tier connections, and ≤ 1.5 E-4 ohm for terminal connections.	24 months

(continued)

AND
Verify the total resistance for battery inter-cell, inter-rack, inter-tier, and terminal connections combined is ≤ 27.45 E-4 ohms.