10 CFR 50.90

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102-06745-DCM/RKR/CJS
August 26, 2013

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3**
Docket Nos. STN 50-528, 50-529, and 50-530
Response to Request for Additional Information Regarding License Amendment Request for Adoption of Technical Specifications Task Force (TSTF) Traveler TSTF-500, Revision 2, *DC Electrical Rewrite – Update to TSTF-360*

By letter number 102-06640, dated December 26, 2012 (Agencywide Documents Access and Management System Accession number ML13002A197), Arizona Public Service Company (APS) submitted a license amendment request (LAR) for Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3. The proposed LAR would adopt TSTF-500, which revises the direct current (DC) electrical Technical Specification (TS) limiting conditions for operation (LCOs), surveillance requirements (SRs) and proposes a new TS program, 5.5.19, *Battery Monitoring and Maintenance Program*.

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the information provided by APS and determined that additional information was needed in order to complete its review. By e-mail dated June 26, 2013, the NRC staff provided a request for additional information (RAI) and indicated that APS agreed to respond within 60-days.

The enclosure to this letter provides the APS response to the NRC RAI. Attachment 1 to the enclosure contains a complete set of retyped technical specification pages that reflect the RAI responses. Attachment 2 to the enclosure contains relevant conforming TS Bases markup pages, for information.

A001
NRR

The proposed changes remain consistent with the conclusion of the no significant hazards consideration determination [10 CFR 50.91(a)] provided in the original LAR.

In accordance with the PVNGS Quality Assurance Program, the Plant Review Board and the Offsite Safety Review Committee have reviewed and concurred with the proposed changes. By copy of this letter, this LAR update is being forwarded to the Arizona Radiation Regulatory Agency (ARRA) pursuant to 10 CFR 50.91(b)(1).

No commitments are being made to the NRC by this letter.

Should you need further information regarding this response, please contact Robert K. Roehler, Licensing Section Leader, at (623) 393-5241.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on AUGUST 26, 2013
(Date)

Sincerely,

FOR D. C. MIMS

Enclosure: Response to Request for Additional Information Regarding License Amendment Request for Adoption of Technical Specifications Task Force (TSTF) Traveler TSTF-500, Revision 2, *DC Electrical Rewrite – Update to TSTF-360*

DCM//RKR/CJS/hsc

cc:	S. A. Reynolds	NRC Region IV Regional Administrator
	J. K. Rankin	NRC NRR Project Manager
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ENCLOSURE

Response to Request for Additional Information Regarding License Amendment Request for Adoption of Technical Specifications Task Force (TSTF) Traveler TSTF-500, Revision 2, *DC Electrical Rewrite – Update to TSTF-360*

Response to Request for Additional Information Regarding License Amendment Request for Adoption of Technical Specifications Task Force (TSTF) Traveler TSTF-500, Revision 2, *DC Electrical Rewrite – Update to TSTF-360*

Introduction

By letter number 102-06640, dated December 26, 2012 (Agencywide Documents Access and Management System Accession number ML13002A197), Arizona Public Service Company (APS) submitted a license amendment request (LAR) for Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3. The proposed LAR would adopt TSTF-500, which revises the direct current (DC) electrical Technical Specification (TS) limiting conditions for operation (LCOs), surveillance requirements (SRs) and proposes a new TS program, 5.5.19, *Battery Monitoring and Maintenance Program*.

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the information provided by APS and determined that additional information was needed in order to complete its review. By e-mail dated June 26, 2013, the NRC staff provided a request for additional information (RAI). This enclosure is the APS response to the NRC RAI. The NRC request is stated first followed by the APS response.

NRC Request 1

In Attachment 1, Section 1 of the LAR, the licensee proposed relocating the requirements of TS Table 3.8.6-1, "Battery Surveillance Requirements," to the new TS 5.5.19, "Battery Monitoring and Maintenance Program."

Confirm that the Table 3.8.6-1 Categories A, B, and C values (electrolyte level, float voltage, specific gravity) that will be relocated to TS 5.5.19, will continue to be controlled at their current levels in the Battery Monitoring and Maintenance Program and that action to restore deficient values will be implemented in accordance with the licensee's corrective action program.

APS Response

The current TS Table 3.8.6-1 Category C limits for electrolyte level and float voltage are maintained in proposed TS LCO 3.8.6, Conditions C and A, battery cell parameters, respectively.

APS confirms that the current TS Table 3.8.6-1 Category A and B limits for electrolyte level and float voltage will be incorporated into the *Battery Monitoring and Maintenance Program* (float voltage greater than or equal to 2.13 volts; electrolyte level greater than the minimum mark and less than or equal to ¼" above the maximum mark).

The current TS Table 3.8.6-1 Category A limit for specific gravity limits are not applicable because specific gravity is no longer monitored for pilot cells.

APS confirms that the current TS Table 3.8.6-1 Category B limit for specific gravity will be incorporated into the *Battery Monitoring and Maintenance Program* (1.195 for individual cells and an average of 1.205 for all cells).

A Category C limit will not be required to be included in the *Battery Monitoring and Maintenance Program* because corrective action will be initiated at the more restrictive Category B limits.

Actions to restore deficient values will be implemented in accordance with the PVNGS corrective action program.

NRC Request 2

In Attachment 1, Section 2.2 of the LAR, the licensee states, "The Enclosure of this submittal contains a letter from the manufacturer of the batteries used at PVNGS Units 1, 2, and 3 verifying the acceptability of using float current monitoring instead of specific gravity monitoring as an indication of the state-of-charge of the battery and that this will hold true over the life of the battery." The enclosed letter from the manufacturer dated June 13, 2012, indicated that 1) "The concept of utilizing float current levels of a flooded, stationary string battery to determine state of charge throughout the life of the battery is reasonable." 2) "There is a relationship between percentage of ampere-hours returned following a successful discharge capacity test and battery state-of-charge." and 3) "The charge current of each battery can be affected by impurity levels, age, operating environment and maintenance history."

a) Confirm that the use of float current monitoring instead of specific gravity monitoring is a <u>reliable and accurate</u> indication of the state-of-charge for the PVNGS safety-related batteries.

b) Provide a summary of the evaluation used to establish the value of the float current at which the battery is capable of performing its design function considering the factors affecting the battery state-of-charge and the charge current mentioned in the letter from the manufacturer.

APS Response

Request 2a

The use of float current monitoring for lead acid batteries is discussed in the technical papers included with TSTF-500 and in NUREG/CR-7148, *Confirmatory Battery Testing: The Use of Float Current Monitoring to Determine Battery State-of-Charge.* The NUREG *Executive Summary* concludes that float current is an adequate means to determine the state-of-

charge of the battery and has the advantage over specific gravity, in that it provides an indicator of the entire battery string, while specific gravity is measured on a cell-by-cell basis. NUREG/CR-7148 documents specific testing of a GNB (PVNGS Class 1E battery manufacturer) battery. The GNB battery tested was model NCN-21 and the PVNGS batteries are the same model but a different size (NCN-33). While the battery tested was not the exact GNB size installed at PVNGS, the conclusions of the NUREG are directly applicable to the PVNGS batteries. Based on the NUREG and industry experience, including IEEE-450, *IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations,* the use of float current is a reliable and accurate indication of the state-of-charge of the battery.

Request 2b

PVNGS completed calculation 13-EC-PK-0801, *TSTF-500 Margin Validation*, to confirm that the performance of the PVNGS batteries is consistent with the battery performance discussed in the technical papers included with TSTF-500 and the conclusion of NUREG/CR-7148.

Specifically, the exponential time constant discussed in Appendix A of NUREG/CR-7148 and the technical paper, *A Proposed Method for Selecting the Return to Service Current Limit for Safety-Related Batteries, Draft C for SCC-29 Meeting, 3/29/2000, Kyle Floyd*, was reviewed. For two detailed discharge/recharge evolutions, the three time-constant point, that signifies 95 percent charge has been returned to the battery, was well above the 2 amp float current value. In both cases, the value was greater than 15 amps. The proposed 2 amp float current value, therefore, provides sufficient conservatism to address minor deviations from impurities, age, operating environment and maintenance history.

APS reviewed the TSTF-360 submittals available in ADAMS for other facilities and found that six of the eight sites that have adopted TSTF-360 used 2 amps as the float current value. Three of these six sites have GNB batteries. The APS proposed float current value of 2 amps is, therefore, consistent with precedent in the industry.

NRC Request 3

In Attachment 1, Section 2.2 of the LAR, the licensee stated that the connection resistance limit, which would be relocated to the TS 5.5.19, "Battery Monitoring and Maintenance Program," is 30 micro ohms based on a maximum 20 millivolts drop assumption for intercell battery connections.

a) Clarify whether 30 micro ohms is the overall connection resistance limit or the resistance limit for each intercell connection, each inter-rack connection, each inter-tier connection, and each terminal connection.

b) Provide a summary table that includes current baseline resistance values or the battery manufacturer's recommended resistance limits for each type of battery connections.

c) Provide the basis for the connection resistance values that you proposed relocating to TS 5.5.19.

APS Response

Request 3a

The 30 micro ohms connection resistance limit is for each connection, including each intercell, inter-rack, inter-tier, and terminal connection as further described in the APS response to NRC request 3c, below.

Request 3b

PVNGS has established the intercell connection resistance limit, as described in the APS response to NRC request 3c below, in accordance with IEEE-450 and the manufacture's information. APS proposal is not founded upon the use of baseline values. The 30 micro ohms value for post-to-terminal resistance is recorded for inter-rack, inter-tier, and output connections and held to the same criteria described in the APS response to NRC request 3c, below. The cable resistance is not measured as part of the proposed maintenance program for inter-rack, inter-tier and output cables because the cable resistance is not expected to change over time.

Request 3c

The basis for the connection resistance limit is described in the battery sizing calculations and is summarized in this response.

The PVNGS Class 1E battery manufacturer (GNB) discharge curves include a maximum 20 millivolt drop assumption for intercell battery connections, in accordance with Nuclear Logistics Incorporated (NLI) Technical Bulletin, *TB-Battery-001*. The PVNGS sizing calculation also allows the limiting "D" battery to have an end voltage of 1.78 volts-per-cell which would allow a 2-hour discharge rate of 795 amps. This results in an intercell resistance of (20 mV / 795 Amps) 0.00002516 ohms, which was rounded to 25.2 micro ohms. This value of intercell resistance is included in the manufacturer's discharge tables

and, therefore, is not explicitly listed as a resistance in the mathematical model of the battery.

An additional 300 micro ohms resistance value has been added to the model to cover resistances that may exceed the 25.2 micro ohms value. The 300 micro ohms additional resistance value was divided among the 61 connections for an additional resistance of 4.9 micro ohms-per-connection for a total intercell resistance of (25.2 + 4.9) 30.1 micro ohms, rounded to 30 micro ohms. The selection of this resistance provides an appropriately conservative value for all four Class 1E station batteries in each unit.

NRC Request 4

In Attachment 1, Section 2.2 of the LAR, the licensee stated that APS will verify or revise the PVNGS Updated Final Safety Analysis Report (UFSAR) to include how a 5 percent design margin for the batteries corresponds to a 2 amperes (amps) float current value indicating that the battery is 95 percent charged consistent with the model application referenced in the TSTF-500.

Explain how maintaining a "5 percent design margin" and "95 percent charge" will ensure that the PVNGS safety-related batteries are fully charged (i.e., capable of performing their design function).

APS Response

The table below shows the margin for each battery from the latest battery sizing calculation. After adding an additional 5 percent design margin, to cover the uncertainties related to the 2 amp charging current, the batteries have sufficient margin to perform their design function.

Battery	End of Service Life Margin	Reference Calculations
1EPKAF11	27%	01-EC-PK-0207 Rev 8
1EPKBF12	45%	01-EC-PK-0207 Rev 8
1EPKCF13	41%	01-EC-PK-0207 Rev 8
1EPKDF14	84%	01-EC-PK-0207 Rev 8
2EPKAF11	34%	02-EC-PK-0207 Rev 10
2EPKBF12	29%	02-EC-PK-0207 Rev 10
2EPKCF13	48%	02-EC-PK-0207 Rev 10
2EPKDF14	84%	02-EC-PK-0207 Rev 10
3EPKAF11	27%	03-EC-PK-0207 Rev 7
3EPKBF12	45%	03-EC-PK-0207 Rev 7
3EPKCF13	45%	03-EC-PK-0207 Rev 7
3EPKDF14	84%	03-EC-PK-0207 Rev 7

The station battery sizing calculations will be revised during the implementation phase for TSTF-500 to include a 5 percent design margin to ensure that the batteries will perform their design function when the batteries are at least 95 percent charged.

NRC Request 5

In Attachment 1, Section 2.3 of the LAR, the licensee proposed adopting TSTF-500 TS 3.8.5, new Condition A with the exception of the statement, "AND the redundant subsystem battery and charger(s) operable," on the basis that it was not addressed in the NRC staff model safety evaluation. Per PVNGS TS Bases 3.8.5, only one Direct Current (DC) electrical power subsystem is required to be operable during shutdown. However, per TSTF-500, Page 9, the new Condition A is included only when the plant-specific implementation of TS 3.8.5 may require both trains of the DC electrical power system to be operable.

a) Justify your request to adopt TS 3.8.5, Condition A even though PVNGS requires only one DC electrical power subsystem to be operable during shutdown.

b) Provide a technical justification for the proposed deviation (i.e., the partial adoption of new Condition A).

APS Response

Request 5a

LCO 3.8.5 states "DC electric power subsystem shall be OPERABLE to support the DC electric power distribution subsystem(s) required by LCO 3.8.10, *Distribution Systems – Shutdown*." The LCO requires a single DC electric power subsystem, and as such, consistent with the TSTF-500 direction mentioned in the RAI, APS has deleted Condition A for chargers. This simplifies the conditions for lower Modes and fuel movement. The updated TS pages are included in Attachment 1 to this enclosure. Conforming TS Bases markup pages are provided in Attachment 2 to this enclosure, for information.

Response 5b

Since the proposed Condition A has been deleted in the updated TS 3.8.5 pages, there is no longer partial adoption of the new TSTF-500 Condition A. Therefore, no justification is needed. Since PVNGS requires only one DC electric power subsystem to be OPERABLE, the proposed phrase "One *or*

more required DC electrical power subsystems inoperable" in the updated Condition A (old Condition B) is modified to remove "or more." The resulting new Condition A reads "One required DC electrical power subsystem inoperable." The phrase "for reasons other than Condition A" and the OR statement "Required Actions and associated Completion Time of Condition A not met" of the originally proposed Condition B are also deleted for consistency in the updated pages that are provided in Attachment 1 to this enclosure. Conforming TS Bases markup pages are provided in Attachment 2 to this enclosure, for information.

NRC Request 6

In Attachment 3 of the LAR, the licensee proposed adding new Condition D to TS 3.8.6 which would apply to a battery found with a pilot cell electrolyte temperature less than the minimum established design limit. The Required Action (RA) associated with new Condition D would require the licensee to restore the pilot cell electrolyte temperature to greater than or equal to minimum established design limits within 12 hours.

a) Discuss how the battery room temperature is periodically monitored at PVNGS and provide the minimum frequency at which the temperature of the battery room is monitored.

b) Explain how the licensee would restore battery room temperature if it was outside the temperature limits.

c) Provide the method of selection of pilot cells at PVNGS.

d) In Section 8.3.2.1.2.1 of the PVNGS UFSAR, the licensee stated that initial battery capacity is at least 25% greater than required to allow for a battery replacement criterion of 80% rated capacity. Provide the margins (e.g., temperature, aging, and design) that were used to size each safety-related battery and confirm that these margins are still maintained at these levels.

APS Response

Request 6a

Battery room temperature is monitored through operator logs daily (minimum of once per 24 hours). Reference Procedures - 40DP-9OPA4, *Area 4 Operator Logs*, MODES 1-4 and 40DP-9OPB2, *Secondary Area Operator Logs, MODES 5, 6 and Defueled.*

The functions of the control building heating, ventilation and air conditioning (HVAC) systems and the battery room exhaust fans are continually monitored in the control room and alarm response procedure 41AL-1RK2A, *Panel B02A Alarm Responses*, specifies the operator actions required to determine the cause and respond to any trouble alarms with this equipment.

Request 6b

Class 1E battery room temperatures are maintained with the normal and essential control building HVAC systems. Restoration of room temperature is typically accomplished with the operation of the control building HVAC system (HJ). UFSAR section 9.4.1 identifies in table 9.4-2 that the control building HVAC system maintains the battery room temperatures between a minimum and maximum of 60-85 degrees (F). The essential HVAC systems could also be used, if needed.

Request 6c

Implementation of the battery maintenance and monitoring program will utilize pilot cell selection based on the lowest individual cell voltages for each battery. This methodology is in accordance with Regulatory Guide 1.129, "Maintenance, Testing, and Replacement of Vented Lead-Acid Storage Batteries for Nuclear Power Plants" and as described in proposed TS 5.5.19, item a.3.

Request 6d

The station battery sizing calculations have the following statements regarding margin included in the calculation, consistent with IEEE-485:

The sizing of the battery for a loss of coolant accident (LOCA) is conservatively based on an electrolyte temperature of 60°F which is the same as the design basis minimum battery room temperature. This results in a 1.11 temperature correction factor. Battery sizing for a station blackout (SBO) event is based on 40°F which is the assumed room temperature, which results in a 1.30 temperature correction factor.

Design margin for future growth is not included in the calculation because the purpose of the calculation is to compare battery sizing with the as-built configuration of the plant. However, 5 percent design margin will be included during the implementation phase of any approved license amendment to ensure that at 95 percent charge the batteries will perform their design functions.

The battery aging factor is 1.25, which is 125 percent of the load expected at the end of the battery's service life.

The lowest design margin at the end of battery life for a Class 1E battery is 27 percent (See the table in the response to NRC request 4), which includes both the aging and temperature correction factors.

NRC Request 7

In Attachment 3 of the LAR, the licensee proposed a float voltage limit of 2.07 Volts (V) in the TS 5.5.19, "Battery Monitoring and Maintenance Program." TSTF-500 indicates a bracketed float voltage limit of 2.13 V for this program.

Provide the basis for the proposed float voltage limit of 2.07 V.

APS Response

This value will be changed to be 2.13 V consistent with the TSTF-500 bracketed float voltage value. Corrective actions will be initiated at this value to ensure that the individual cell does not drop below 2.07 V. The updated 2.13 V value is not an indication of immediate battery inoperability, but rather, is a threshold value to ensure that actions are taken to ensure battery performance consistent with the objectives of the *Battery Monitoring and Maintenance Program*. The updated TS page is provided in Attachment 1 to this enclosure.

NRC Request 8

In Attachment 3 of the LAR, the Completion Time (CT) for TS 3.8.4, new Condition C is 6 hours. In attachment 4 of the LAR, the CT for TS 3.8.4, new Condition C is 1 hour.

Clarify this apparent discrepancy.

APS Response

The value in Attachment 4 was a typographical error. The original LAR Attachment 3 marked-up TS pages correctly showed 6 hours as the completion time. An updated page is provided in Attachment 1 to this enclosure.

NRC Request 9

In Attachment 3 of the LAR, the licensee proposed certain CTs for TS 3.8.4 RAs A.2, A.3, TS 3.8.5 RAs A.2, A.3, and TS 3.8.6 RA B.2. These CTs are bracketed values in TSTF-500.

Explain how these values are applicable to PVNGS.

APS Response

As described in the response to NRC request 5, TS 3.8.5, Condition A, for an inoperable battery charger has been deleted. As a result, no justifications for TS 3.8.5 Required Actions A.2 and A.3 are provided.

For TS 3.8.4, Required Action A.2 is to verify battery float current is less than or equal to 2 amps, once per 12 hours. Required Action A.1 requires restoration of battery terminal voltage to greater than or equal to the minimum established float voltage within 2 hours, so Required Action A.2 is a periodic verification action until the battery charger is restored to OPERABLE status. The once per 12 hours completion time is applicable to PVNGS because it allows the verification to be completed once per shift during scheduled operator rounds.

For TS 3.8.4, Required Action A.3 is to restore the battery charger to an OPERABLE status. The 72 hour completion time is appropriate for PVNGS as it provides a period of time to correct the problem commensurate with the importance of maintaining the DC electrical power subsystem battery charger in an OPERABLE status. The 72 hour completion time is also a reasonable period of time, based upon operating experience, to perform corrective maintenance.

TS 3.8.6, Required Action B.2 is to restore battery float current to less than or equal to 2 amps in 12 hours. Required Action B.1 verifies battery terminal voltage is greater than or equal to the minimum established float voltage within 2 hours, which provides a level of confidence that the battery will perform if called upon.

The 12 hour completion time is applicable to PVNGS as UFSAR Section 8.3.2.1.2.2 requires that the battery charger be capable of restoring the battery to the fully charged state within 12 hours. Should the charger not restore the battery to a fully charged state within 12 hours, it may be an indication of battery or other charger issues, such that other Conditions may be entered (TS 3.8.4, TS 3.8.5 and/or TS 3.8.6). The 12 hour completion time takes into account the capacity and capability of the remaining DC sources, a reasonable time for repairs, and the low probability of a design basis accident occurring during this period.

NRC Request 10

The proposed change to SR 3.8.4.6 to verify each battery charger can recharge the battery to the fully charged state within '24' hours is not consistent with PVNGS UFSAR 8.3.2.1.2.2 which requires that the battery charger be capable of recharging the battery to the fully charged state within 12 hours.

Provide justification for the deviation from the PVNGS UFSAR.

APS Response

Based upon further review and review of other facilities that have adopted this specification, the 24 hours value has been revised to 12 hours in SR 3.8.4.6. An updated page is provided in Attachment 1 to this enclosure.

NRC Request 11

In Attachment 3 of the LAR, the licensee proposed a battery cell float voltage limit of greater than or equal to 2.07 V which is reflected in TS 3.8.6 RA A.3, SR 3.8.6.5, and SR 3.8.6.8. However, the current TS Bases for TS Table 3.8.6-1 states that the Category C allowable value for float voltage is based on vendor recommendations which state that a cell voltage of 2.07 V or below, under float conditions and not caused by elevated temperature of the cell, indicates internal cell problems and may require cell replacement.

Justify the deviation from the vendor's recommendations and current TS Table 3.8.6-1.

APS Response

The appropriate value is greater than 2.07 V. The inclusion of "equal to" has been removed. The symbol for 'greater than or equal to' (≥) was not bracketed in TSTF-500, so the symbol was included in the original LAR submittal. For consistency, "equal to" has been applied to TS 3.8.6, Conditions A and F, such that the less than or equal to symbol (≤) precedes the minimum float voltage value of 2.07 V for battery cells. Updated pages are provided in Attachment 1 to this enclosure. Conforming TS Bases markup pages are provided in Attachment 2 to this enclosure, for information.

Attachment 1

Retyped Technical Specification Pages

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources – Operating

LCO 3.8.4 The Train A and Train B DC electrical power subsystems shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One battery charger on one subsystem inoperable.	A.1	Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND		
	A.2	Verify battery float current ≤ 2 amps.	Once per 12 hours
	AND		
	A.3	Restore battery charger to OPERABLE status.	72 hours
B. One DC electrical power subsystem inoperable for reasons other than Condition A.	B.1	Restore DC electrical power subsystem to OPERABLE status	2 hours
C. Required Action and associated Completion Time not met.	C.1	Be in MODE 3.	6 hours
	AND		
	C.2	Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is greater than or equal to the minimum established float voltage.	In accordance with the Surveillance Frequency Control Program
SR 3.8.4.2	Deleted	
SR 3.8.4.3	Deleted	
SR 3.8.4.4	Deleted	
SR 3.8.4.5	Deleted	
SR 3.8.4.6	Verify each battery charger supplies ≥ 400 amps for Batteries A and B and ≥ 300 amps for Batteries C and D at greater than or equal to the minimum established float voltage for ≥ 8 hours. OR Verify each battery charger can recharge the battery to the fully charged state within 12 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.7	----------NOTES---------- 1. The modified performance discharge test in SR 3.8.6.9 may be performed in lieu of SR 3.8.4.7. 2. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. ---------- Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	In accordance with the Surveillance Frequency Control Program
SR 3.8.4.8	Deleted	

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources – Shutdown

LCO 3.8.5 DC electrical power subsystem shall be OPERABLE to support the DC electrical power distribution subsystem(s) required by LCO 3.8.10, "Distribution Systems – Shutdown."

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

----------NOTE----------
In MODES 1, 2, 3, and 4, Required Action A.2.3 is not applicable.

A. One required DC electrical power subsystem inoperable.	A.1	Declare affected required feature(s) inoperable.	Immediately
	OR		
	A.2.1	Suspend CORE ALTERATIONS.	Immediately
	AND		
	A.2.2	Suspend movement of irradiated fuel assemblies.	Immediately
	AND		
	A.2.3	Initiate action to suspend operations involving positive reactivity additions.	Immediately
	AND		
	A.2.4	Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.5.1	----------NOTE---------- The following SRs are not required to be performed: SR 3.8.4.6 and SR 3.8.4.7. ---------- For DC sources required to be OPERABLE, the following SRs are applicable: SR 3.8.4.1 SR 3.8.4.6 SR 3.8.4.7	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery Parameters

LCO 3.8.6 Battery parameters for the Train A and Train B electrical power subsystem batteries shall be within limits.

APPLICABILITY: When associated DC electrical power subsystems are required to be OPERABLE.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each battery.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One battery with one or more battery cells float voltage ≤ 2.07 V.	A.1	Perform SR 3.8.4.1.	2 hour
	AND		
	A.2	Perform SR 3.8.6.4.	2 hours
	AND		
	A.3	Restore affected cell voltage > 2.07 V.	24 hours
B. One battery with float current > 2 amps.	B.1	Perform SR 3.8.4.1.	2 hours
	AND		
	B.2	Restore float current to ≤ 2 amps.	12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
----------NOTE---------- Required Action C.2 shall be completed if electrolyte level was below the top of plates. ----------	----------NOTE---------- Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of plates. ----------	
C. One battery with one or more cells electrolyte level less than minimum established design limits.	C.1 Restore electrolyte level to above top of plates.	8 hours
	AND	
	C.2 Verify no evidence of leakage.	12 hours
	AND	
	C.3 Restore electrolyte level to greater than equal to minimum established design limits.	31 days
D. One battery with pilot cell electrolyte temperature less than minimum established design limits.	D.1 Restore battery pilot cell temperature to greater than or equal to minimum established design limits.	12 hours
E. One or more batteries in redundant subsystems with battery parameters not within limits.	E.1 Restore battery parameters for batteries in one subsystem to within limits.	2 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and associated Completion Time of condition A, B, C, D or E not met. OR One battery with one or more battery cells float voltage ≤ 2.07 V and float current > 2 amps.	F.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.6.1	Deleted	
SR 3.8.6.2	Deleted	
SR 3.8.6.3	Deleted	
SR 3.8.6.4	----------NOTE---------- Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. ---------- Verify each battery float current is ≤ 2 amps.	In accordance with the Surveillance Frequency Control Program
SR 3.8.6.5	Verify each battery pilot cell float voltage is > 2.07 V.	In accordance with the Surveillance Frequency Control Program
SR 3.8.6.6	Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.6.7	Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.	In accordance with the Surveillance Frequency Control Program
SR 3.8.6.8	Verify each battery connected cell float voltage is > 2.07 V.	In accordance with the Surveillance Frequency Control Program
SR 3.8.6.9	----------NOTE---------- This Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR. ---------- Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or modified performance discharge test.	In accordance with the Surveillance Frequency Control Program AND 12 months when battery shows degradation, or has reached 85% of the expected life with capacity < 100% of manufacturer's rating AND 24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating

5.5 Programs and Manuals (continued)

5.5.18 Surveillance Frequency Control Program

This program provides controls for Surveillance Frequencies. The program shall ensure that Surveillance Requirements specified in the Technical Specifications are performed at intervals sufficient to assure the associated Limiting Conditions for Operation are met.

a. The Surveillance Frequency Control Program shall contain a list of Frequencies of those Surveillance Requirements for which the Frequency is controlled by the program.

b. Changes of the Frequencies listed in the Surveillance Frequency Control Program shall be made in accordance with NEI 04-10, "Risk-Informed Method for Control of Surveillance Frequencies," Revision 1.

c. The provisions of Surveillance Requirements 3.0.2 and 3.0.3 are applicable to the Frequencies established in the Surveillance Frequency Control Program.

5.5.19 Battery Monitoring and Maintenance Program

This Program provides controls for battery restoration and maintenance. The program shall be in accordance with IEEE Standard (Std) 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," as endorsed by Regulatory Guide 1.129, Revision 2 (RG), with RG expectations and program provisions as identified below:

a. The program allows the following RG 1.129, Revision 2 exceptions:

1. Battery temperature correction may be performed before or after conducting discharge tests.

2. RG 1.129, Regulatory Position 1, Subsection 2, "References," is not applicable to this program.

3. In lieu of RG 1.129, Regulatory Position 2, Subsection 5.2, "Inspection," the following shall be used: "Where reference is made to the pilot cell, pilot cell selection shall be based on the lowest voltage cell in the battery."

(continued)

5.5 Programs and Manuals

5.5.19 Battery Monitoring and Maintenance Program (continued)

4. In Regulatory Guide 1.129, Regulatory Position 3, Subsection 5.4.1, "State of Charge Indicator," the following statements in paragraph (d) may be omitted: "When it has been recorded that the charging current has stabilized at the charging voltage for three consecutive hourly measurements, the battery is near full charge. These measurements shall be made after the initially high charging current decreases sharply and the battery voltage rises to approach the charger output voltage."

5. In lieu of RG 1.129, Regulatory Position 7, Subsection 7.6, "Restoration," the following may be used: "Following the test, record the float voltage of each cell of the string."

b. The program shall include the following provisions:

1. Actions to restore battery cells with float voltage < 2.13 V;

2. Actions to determine whether the float voltage of the remaining battery cells is ≥ 2.13 V when the float voltage of a battery cell has been found to be < 2.13 V;

3. Actions to equalize and test battery cells that had been discovered with electrolyte level below the top of the plates;

4. Limits on average electrolyte temperature, battery connection resistance, and battery terminal voltage; and

5. A requirement to obtain specific gravity readings of all cells at each discharge test, consistent with manufacturer recommendations.

Attachment 2

Conforming Technical Specification Bases Markup Pages

(For Information)

Changes as a Result of RAI Responses

BASES

LCO (continued)

required to be OPERABLE by LCO 3.8.10, the necessary DC buses of that additional DC distribution subsystem ~~train~~ shall be energized by a minimum of its associated battery charger or backup battery charger. Should the minimum battery charger requirements not be maintained for that additional DC distribution subsystem ~~train~~ required by LCO 3.8.10, then LCO 3.8.10 (Condition 'A') would be applicable and not LCO 3.8.5. This is because the requirements of LCO 3.8.5 would still be met (i.e. one OPERABLE DC electrical power subsystem maintained).

APPLICABILITY

The DC electrical power sources required to be OPERABLE in MODES 5 and 6, and during movement of irradiated fuel assemblies provide assurance that:

a. Required features needed to mitigate a fuel handling accident are available;

b. Required features necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

c. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

Movement of spent fuel casks containing irradiated fuel assemblies is not within the scope of the Applicability of this technical specification. The movement of dry casks containing irradiated fuel assemblies will be done with a single-failure-proof handling system and with transport equipment that would prevent any credible accident that could result in a release of radioactivity.

The DC electrical power requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.4.

ACTIONS

The Actions are modified by a Note that identifies required Action ~~B~~A.2.3 is not applicable to the movement of irradiated fuel assemblies in Modes 1 through 4.

A

(continued)

BASES

Delete

A.1, A.2 and A.3

Condition A represents one subsystem with one battery charger inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period. Required Action A.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage (2.17 volts per cell (Vpc) times the number of connected cells or 130.2 V for a 60 cell battery at the battery terminals) within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage (e.g., backup Class 1E battery charger). Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action A.2) from any discharge that might have occurred due to the charger inoperability.

A discharged battery having terminal voltage of at least the minimum established float voltage indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

If established battery terminal float voltage cannot be restored to greater than or equal to the minimum established float voltage within 2 hours, and the charger is not operating in the current-limit mode, a faulty charger is indicated. A faulty charger that is incapable of maintaining established battery terminal float voltage does not provide assurance that it can revert to and operate properly in the current-limit mode that is necessary during the recovery period following a battery discharge event that the DC system is designed for.

If the charger is operating in the current limit mode after 2 hours that is an indication that the battery is partially discharged and its capacity margins will be reduced. The

(continued)

BASES

time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action A.2).

Required Action A.2 requires that the battery float current be verified as less than or equal to 2 amps. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it is now fully capable of supplying the maximum expected load requirement. The 2 amp value is based on returning the battery to 95% charge and assumes a 5% design margin for the battery. If at the expiration of the initial 12 hour period the battery float current is not less than or equal to 2 amps this indicates there may be additional battery problems and the battery must be declared inoperable.

Delete

Required Action A.3 limits the restoration time for the inoperable battery charger to 72 hours. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., backup Class 1E battery charger). The 72 hour Completion Time reflects a reasonable time to effect restoration of the qualified battery charger to OPERABLE status.

The loss of the two required (in-service) battery chargers on the same subsystem would be a degradation of the subsystem beyond the scope of Condition A, thus rendering the subsystem inoperable and requiring entry into Condition B.

(continued)

Substitute "A" for "B" in each Action

BASES

ACTIONS

B~~A~~.1, B~~A~~.2.1, B~~A~~.2.2, B~~A~~.2.3, and B~~A~~.2.4

If two 125 VDC subsystems ~~trains~~ buses are required to be energized per LCO 3.8.10, of the two required subsystems ~~trains~~, the remaining buses with DC power available may be capable of supporting sufficient systems to allow continuation of CORE ALTERATIONS and fuel movement. By allowing the option to declare required features inoperable with the associated DC power source(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features LCO ACTIONS. For example, assume that the 'A' subsystem ~~train~~ 125 VDC sources are required to be OPERABLE per LCO 3.8.5. Also assume that two SDC subsystems ~~trains~~ are required to be OPERABLE and the corresponding 125VDC subsystems' ~~trains'~~ buses energized (i.e. PK system buses 'A' and 'C' for subsystem ~~train~~ 'A' and buses 'B' and 'D' for subsystem ~~train~~ 'B') per LCO 3.8.10. Finally, assume that an electrical fault occurs on the PK system channel 'C' bus and the bus has been declared INOPERABLE. The action of LCO 3.8.5 would allow declaring the corresponding SDC suction valve J-SIC-UV-653 INOPERABLE. However the SDC system itself would not necessarily need to be declared INOPERABLE and this would allow CORE ALTERATIONS to continue. However, in many instances, this option may involve undesired administrative efforts.

Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and operations involving positive reactivity additions). The Required Action to suspend positive reactivity additions does not preclude actions to maintain or increase reactor vessel inventory, provided the required SDM is maintained.

Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. If moving irradiated fuel assemblies while in MODES 1, 2, 3, or 4, the fuel movement is independent of reactor operations. Therefore, inability to immediately suspend movement of irradiated fuel assemblies would not be sufficient reason to require a reactor shutdown. These actions minimize probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required DC electrical power subsystem and to continue this action until restoration is accomplished in order to provide the necessary DC electrical power to the unit safety systems.

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention.

(continued)

Substitute "A" for "B" for each Action

BASES

ACTIONS

B~~A~~.1, B~~A~~.2.1, B~~A~~.2.2, B~~A~~.2.3, and B~~A~~.2.4 (continued)

The restoration of the required DC electrical power subsystem should be completed as quickly as possible in order to minimize the time during which the unit safety systems may be without sufficient power.

~~Entry into Condition A is not required with one of the required (in-service) battery chargers inoperable. When one of the required (in-service) battery chargers is inoperable, Condition B is appropriate to enter. The loss of two required (in-service) battery chargers on the same train would be a degradation of the train beyond the scope of Condition B, thus rendering the train inoperable and requiring entry into Condition A.~~

~~B.1 and B.2~~

~~Condition B represents the loss of one of the required (in-service) battery chargers and assumes that action will be taken immediately to restore charging capability to the battery with the alternate charger (i.e., normal or backup). Under normal plant load conditions, the loss of the battery charger for ≤ 1 hour has a negligible effect on the rated battery capacity and does not impact the DC electrical power subsystem's capability to perform its DBA safety function. Immediately following the loss of the charging capability, battery cell parameters may not meet Category A limits because these limits assume that the battery is being charged at a minimum float voltage. The 1 hour Completion Time allows for re-establishing charging capability such that Category A parameters can be met. Operation with the DC electrical power subsystem battery charger inoperable is not allowed for an indefinite period of time even when the battery cell parameters have been verified to meet the category A limits of Table 3.8.6-1. The 24 hours completion time provides a period of time to correct the problem commensurate with the importance of maintaining the DC electrical power subsystem battery charger in an OPERABLE status.~~

~~The loss of the two required (in-service) battery chargers on the same train would be a degradation of the train beyond the scope of Condition B, thus rendering the train inoperable and requiring entry into Condition A.~~

(continued)

BASES

ACTIONS

~~A.1, A.2, and A.3 (continued)~~

~~Continued operation is only permitted for 31 days before battery cell parameters must be restored to within Category A and B limits. With the consideration that, while battery capacity is degraded, sufficient capacity exists to perform the intended function and to allow time to fully restore the battery cell parameters to normal limits, this time is acceptable prior to declaring the battery inoperable.~~

A.1, A.2, and A.3

less than or equal to

With one or more cells in one battery in one subsystem ~~<~~ 2.07 V, the battery cell is degraded. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage (SR 3.8.4.1) and of the overall battery state of charge by monitoring the battery float charge current (SR 3.8.6.4). This assures that there is still sufficient battery capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of one or more cells in one or more batteries < 2.07 V, and continued operation is permitted ~~for a limited~~ period up to 24 hours.

less than or equal to

Since the Required Actions only specify "perform," a failure of SR 3.8.4.1 or SR 3.8.6.4 acceptance criteria does not result in this Required Action not met. However, if one of the SRs is failed the appropriate Condition(s), depending on the cause of the failures, is entered. If SR 3.8.6.4 is failed then there is no assurance that there is still sufficient battery capacity to perform the intended function and the battery must be declared inoperable immediately.

B.1 and B.2

One battery in one subsystem with float current > 2 amps indicates that a partial discharge of the battery capacity has occurred. This may be due to a temporary loss of a battery charger or possibly due to one or more battery cells in a low voltage condition reflecting some loss of capacity. Within 2 hours verification of the

(continued)

BASES

required battery charger OPERABILITY is made by monitoring the battery terminal voltage. If the terminal voltage is found to be less than the minimum established float voltage (2.17 volts per cell (Vpc) times the number of connected cells or 130.2 V for a 60 cell battery at the battery terminals) there are two possibilities, the battery charger is inoperable or is operating in the current limit mode. Condition A addresses charger inoperability. If the charger is operating in the current limit mode after 2 hours that is an indication that the battery has been substantially discharged and likely cannot perform its required design functions. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action B.2). The battery must therefore be declared inoperable.

or equal to

If the float voltage is found to be satisfactory but there are one or more battery cells with float voltage less than 2.07 V, the associated "OR" statement in Condition F is applicable and the battery must be declared inoperable immediately. If float voltage is satisfactory and there are no cells less than 2.07 V there is good assurance that, within 12 hours, ~~the~~ battery will be restored to its fully charged condition (Required Action B.2) from any discharge that ~~might~~ have occurred due to a temporary loss of the battery charger.

or equal to

A discharged battery with float voltage (the charger setpoint) across its terminals indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

If the condition is due to one or more cells in a low voltage condition but still greater than 2.07 V and float voltage is found to be satisfactory, this is not indication of a substantially discharged battery and 12

(continued)

12 hours is allowed to restore the temperature to within limits. A low electrolyte temperature limits the current and power available. Since the battery is sized with margin, while battery capacity is degraded, sufficient capacity exists to perform the intended function and the affected battery is not required to be considered inoperable solely as a result of the pilot cell temperature not met.

E.1

With one or more batteries in redundant subsystems with battery parameters not within limits there is not sufficient assurance that battery capacity has not been affected to the degree that the batteries can still perform their required function, given that redundant batteries are involved. With redundant batteries involved this potential could result in a total loss of function on multiple systems that rely upon the batteries. The longer Completion Times specified for battery parameters on non-redundant batteries not within limits are therefore not appropriate, and the parameters must be restored to within limits on at least one subsystem within 2 hours.

F~~B~~.1

With one battery with any ~~one or more~~ battery cell parameters outside the allowances of the Required Actions for Condition A, B, C, D, or E, ~~not within the Category C limit for any connected cell,~~ sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding battery ~~DC electrical power subsystem~~ must be declared inoperable. Additionally, discovering one or more batteries in one subsystem with one or more battery cells float voltage less than 2.07 V and float current greater than 2 amps indicates that the battery capacity may not be sufficient to perform the intended functions. The battery must therefore be declared inoperable immediately. ~~other potentially extreme conditions, such as not completing any of the Required Actions of Condition A within the required Completion Time or average electrolyte temperature of representative cells falling below 60°F, are also cause for immediately declaring the associated DC electrical power subsystem inoperable.~~

or equal to

(continued)

are being taken, which provide the necessary and appropriate verifications of the battery condition. Furthermore, the float current limit of 2 amps is established based on the nominal float voltage value and is not directly applicable when this voltage is not maintained.

SR 3.8.6.5 and SR 3.8.6.8

Optimal long term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer, which corresponds to 130.2 V at the battery terminals, or 2.17 volts per cell (Vpc). This provides adequate over-potential, which limits the formation of lead sulfate and self discharge, which could eventually render the battery inoperable. Float voltages in this range or less, but greater than 2.07 Vpc, are addressed in Specification 5.5.19. SRs 3.8.6.5 and 3.8.6.8 require verification that the cell float voltages are ~~equal to or~~ greater than the short term absolute minimum voltage of 2.07 V.

Plant procedures must require verification of the selection of the pilot cell or cells when performing SR 3.8.6.5.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.6.6

The limit specified for electrolyte level ensures that the plates suffer no physical damage and maintains adequate electron transfer capability. The minimum design electrolyte level is the minimum level indication mark on the battery cell jar.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

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