Comanche Peak Pre-Submittal Call with NRC regarding Proposed License Amendment Request (LAR) 18-001 TS 3.8.4 “DC Sources – Operating” Additional Actions to extend Completion Time for Inoperable Battery during Unit 1 Cycle 20 (Spring 2019) and Unit 2 Cycle 17 (Fall 2018)

April 10, 2018

Agenda

- Purpose of Meeting
- System Overview
- Reason for Change
- Description of Proposed Change
- Precedent
- Battery Cell Replacement
- Technical Evaluation (Deterministic Based)
- Supplemental Information – Supporting Risk Insights
- Summary
- Questions

Purpose of Meeting

- Present plan to submit License Amendment Request (LAR) 18-001
- Gain an understanding of NRC staff perspectives needed in the planned submittal
  - Level of detail
  - Technical Content
  - Use of Precedent
  - NRC Regulatory Guidance / Requirements
- Discuss feasibility of CPNPP schedule:
  - 04/10/18 – Pre-submittal teleconference with NRC
  - 04/19/18 – Submit LAR 18-001 to NRC
  - 06/19/18 – Requested approval date from NRC
- The 2-month turnaround will allow Vistra OpCo to replace an inoperable battery cell at power until additional cells are added in 2RF17 (Fall 2018) and 1RF20 (Spring 2019)

System Overview

- Safety related 125 VDC electrical power system consists of two independent and redundant subsystems (Train A & Train B) (See Figure 1)
- Batteries of each subsystem (train) are separated physically and electrically from their chargers and distribution centers (See Figure 2)
- Batteries BT1ED1 (BT2ED1) and BT1ED2 (BT2ED2) are each 60 cell lead-calcium type (See Figure 3)
- In addition to feeding instrumentation and control loads, batteries BT1ED1 (BT2ED1) and BT1ED2 (BT2ED2) also provide power for devices with inrush (momentary) current demand, (e.g., tripping/closing of 6.9 kVAC and 480 VAC breakers and Emergency Diesel Generator (EDG) field flash)

System Overview

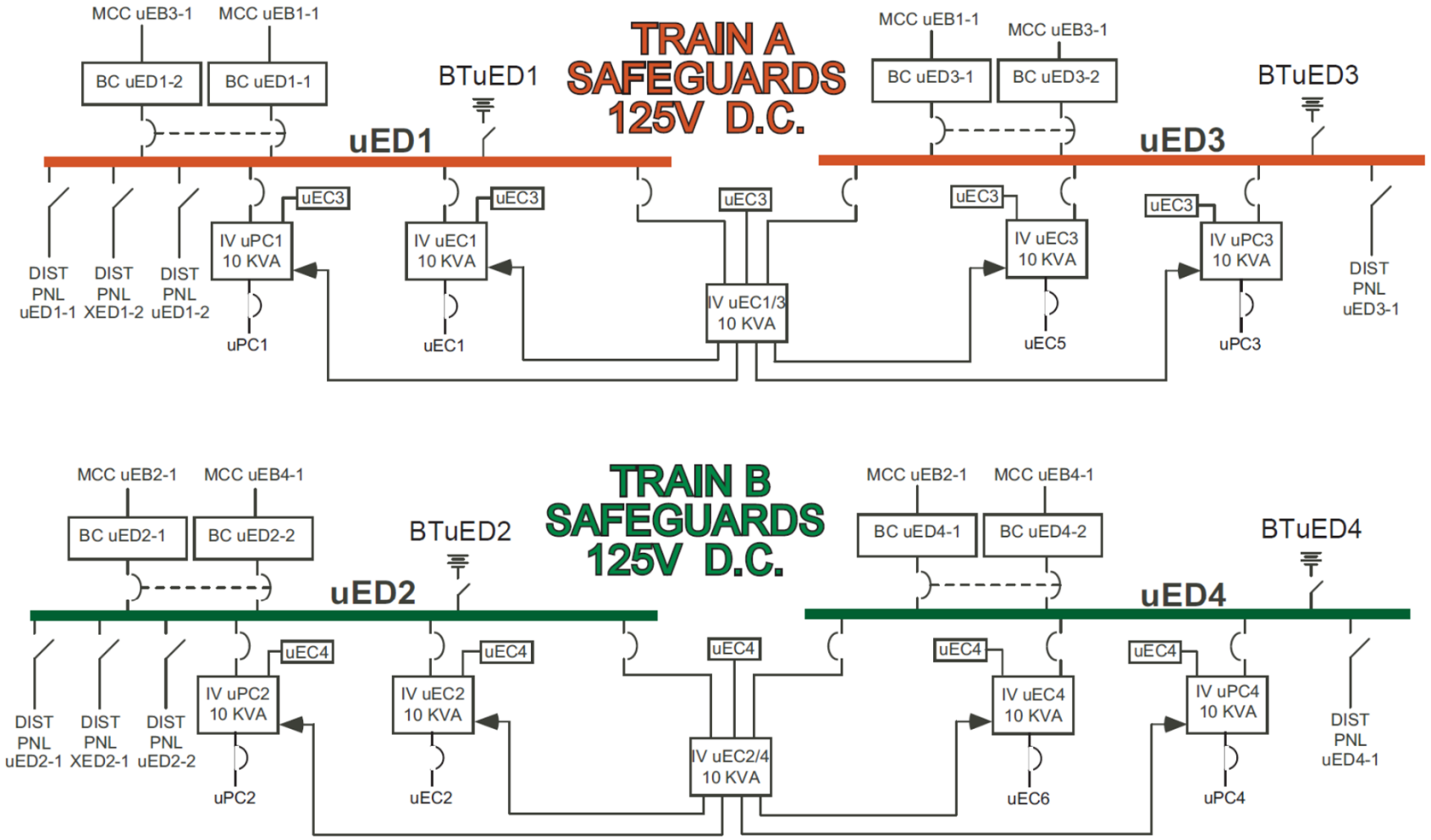

Figure 1

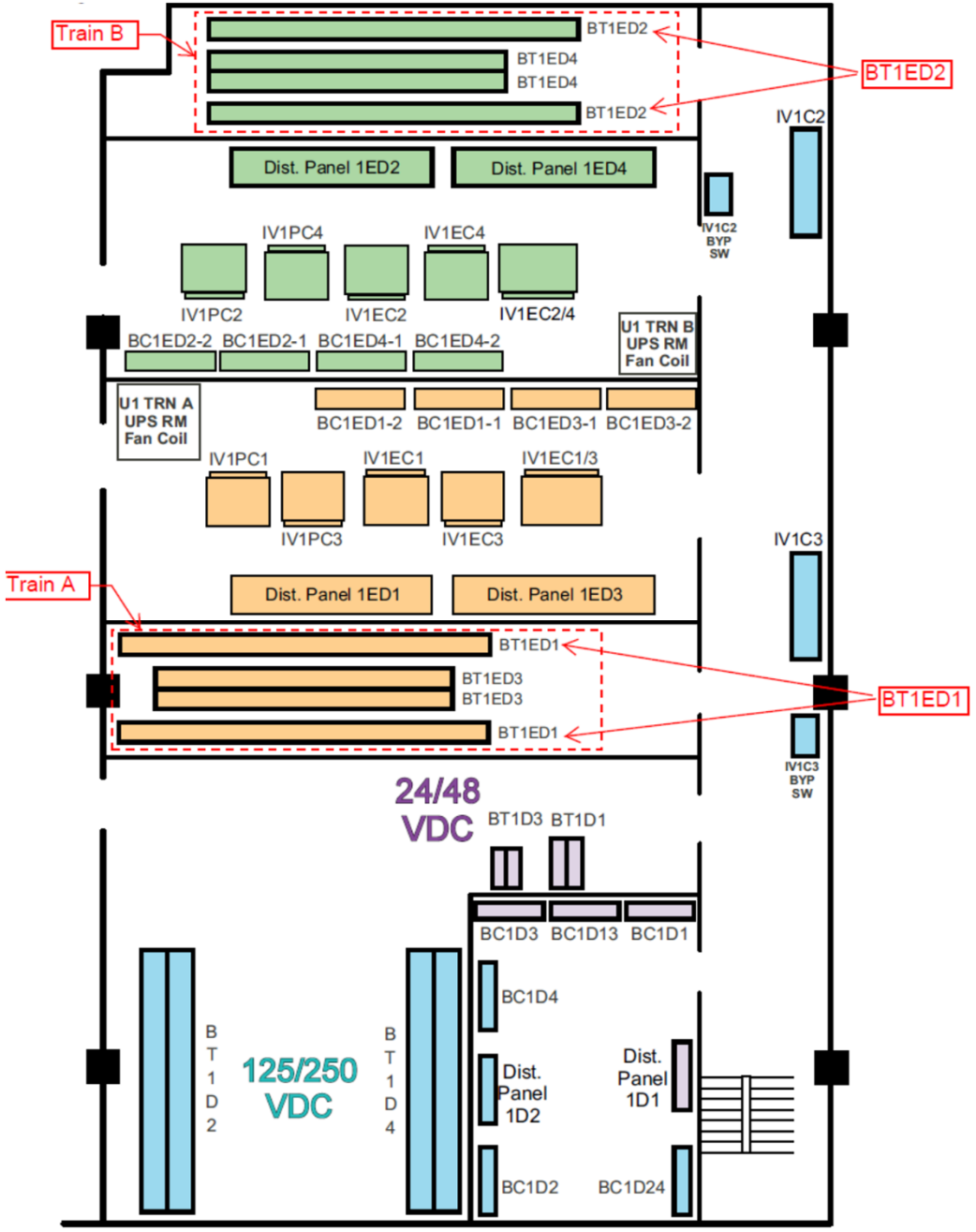

Figure 2
Battery Room layout of Unit 1
(Unit 2 is mirror image)

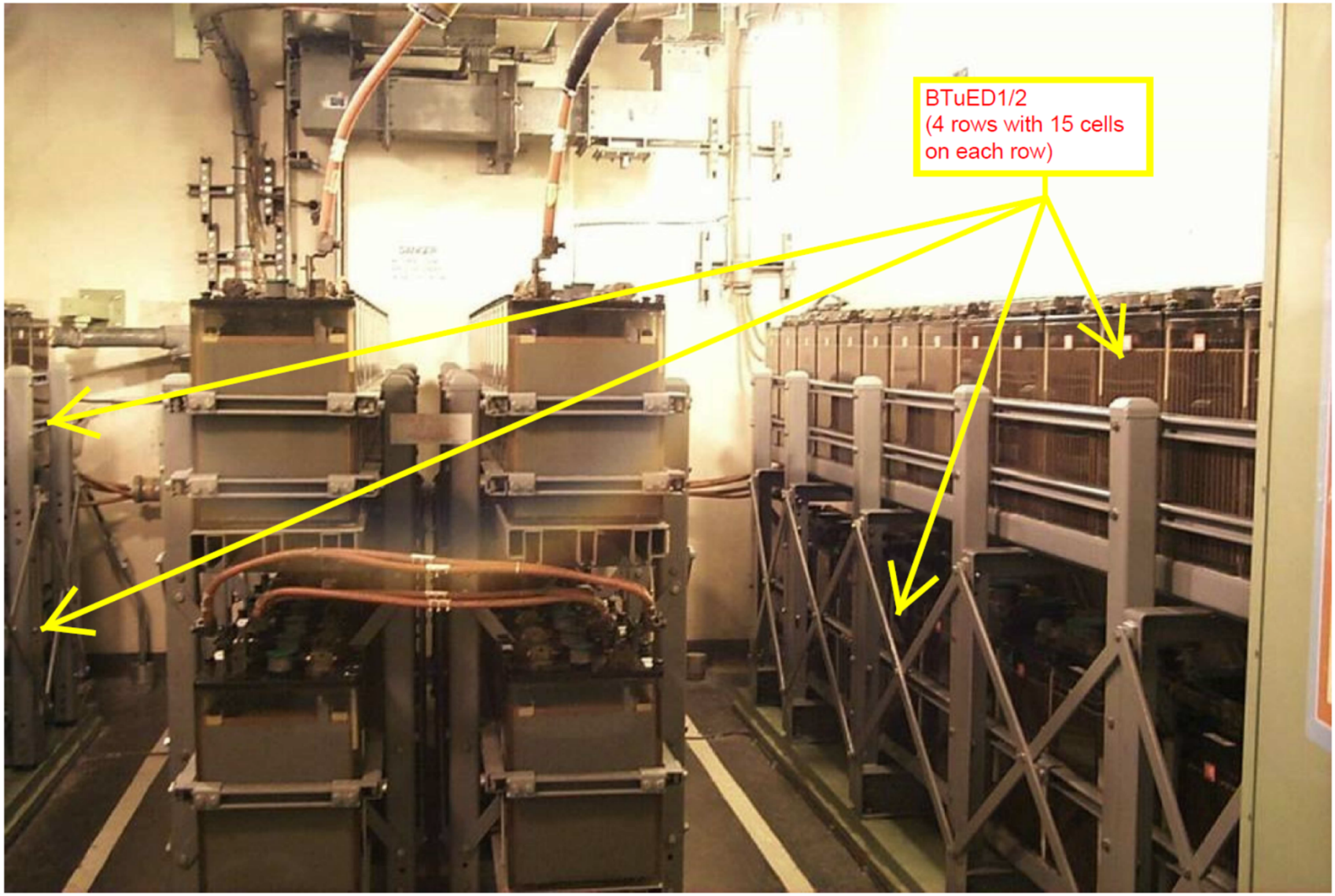

Figure 3 - Train A Battery Room (Typical)

Reason for Change

- Loss of margin in updated safety related battery calculation to address issue from NRC CDBI Inspection Report 2013-007 (loading in 1st and 239th minute)
- Discovery of nodular cracking of battery cell in November 2017
- Batteries are approaching their end-of-life
- To address above items, CPNPP has taken the following actions:
  - The safety related 125 VDC batteries BTuED1 and BTuED2 will be modified (addition of two battery cells) in 2RF17 (Fall 2018) and 1RF20 (Spring 2019) to increase margin to allow jumpering of battery cells (long term planning includes replacement of all the cells)
  - Engineering currently performs weekly inspections of safety related 125 VDC batteries with an identified condition adverse to quality to monitor cracking for potential degradation (in addition to Maintenance surveillances(weekly/monthly/quarterly) and Operations Surveillances / Inspections (shiftly))
  - As a contingency, submittal of Licensing Amendment Request 18-001 allows replacement of an inoperable cell if batteries BT1ED1 (BT2ED1) or BT1ED2 (BT2ED2) are declared inoperable before the safety related 125 VDC batteries are modified in 2RF17 and 1RF20
- Transition of affected Unit from MODE 1 to MODE 3 presents real, but unquantifiable, level of increased risk (with affected unit in stable configuration, offsite power available, and one battery DC train operable)

Description of Change

- Revise TS 3.8.4 “DC Sources – Operating” Condition B, “One or two batteries on one train inoperable”
- In the event batteries BT1ED1 (BT2ED1) or BT1ED2 (BT2ED2) are declared inoperable due to an inoperable battery cell during Unit 1 Cycle 20 and Unit 2 Cycle 17, add one time actions to restore inoperable affected battery to OPERABLE status within 18 hours (see markup of current TS 3.8.4)
- The new Required Actions could be used one time for each battery

Description of Change

- The proposed change to the TS would add three new Required Actions and associated Completion Times, and a new NOTE (new items shown in italics):
  - B.1 Restore affected battery(ies) to OPERABLE status within 2 hours, *OR*
  - *B.2.1 Perform SR 3.8.4.1 and SR 3.8.6.1 for OPERABLE batteries within 2 hours AND*
  - *B.2.2 Perform Engineering inspection of other safety related battery(ies) (Train A and Train B) within 6 hours AND*
  - *B.2.3 Restore affected battery(ies) to OPERABLE status in 18 hours*
  - *NOTE: Required Actions B.2.1, B.2.2, and B.2.3, are applicable on a one-time basis for batteries BT1ED1 (BT2ED1) or BT2ED2 (BT2ED2) being inoperable due to an inoperable battery cell for Unit 1 Cycle 20 and Unit 2 Cycle 17. If the second battery on the same train becomes inoperable, immediately initiate Required Actions D.1 and D.2.*

Existing CPNPP TS 3.8.4 marked up to show proposed changes

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 or two required battery chargers on one train inoperable.	A.1 Restore affected battery(ies) terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND	
	A.2 Verify affected battery(ies) float current ≤ 2 amps.	Once per 12 hours
	AND	
	A.3 Restore required battery charger(s) to OPERABLE status.	7 days
B. One or two batteries on one train inoperable.	B.1 Restore affected battery(ies) to OPERABLE status.	2 hours
C. One DC electrical power subsystem inoperable for reasons other than Condition A or B.	C.1 Restore DC electrical power subsystem to OPERABLE status.	2 hours

Insert A

Insert A (Note: Proposed changes are clouded)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETEION TIME
B. One or two batteries on one train inoperable.	B.1 Restore affected battery(ies) to OPERABLE status.	2 hours
	OR	
	B.2.1 ----------NOTE---------- Required Actions B.2.1, B.2.1, and B.2.3, are applicable on a one-time basis for batteries BT1ED1 (BT2ED1) or BT1ED2 (BT2ED2) being inoperable due to an inoperable battery cell for Unit 1 Cycle 20 and Unit 2 Cycle 17. If the second battery on the same train becomes inoperable, immediately initiate Required Actions D.1 and D.2. ---------- Perform SR 3.8.4.1 and SR 3.8.6.1 for OPERABLE batteries.	2 hours
	AND	
	B.2.2 Perform Engineering Inspection of other safety related batteries (Train A and Train B)	6 hours
	AND	
	B.2.3 Restore affected battery(ies) to OPERABLE status.	18 hours

Precedent

- Industry Licensing Actions / Amendments were reviewed for applicability to LAR 18-001
- There were no proposed changes to Technical Specification 3.8.4 Condition B identical to those requested by LAR 18-001
- However, LAR 18-001 does address specific attributes from two similar NRC approved License Amendments for
  - Diablo Canyon, November 2006 (LA190 / ML063140003) and
  - McGuire, September 2014 (LA274 / ML14231A634)

Battery Cell Replacement

- Batteries consist of 60 single cells connected in series mounted on 2 rows of steel supported racks (15 cells on top and 15 cells on bottom). Figure 2 shows plan view and Figure 3 shows typical battery room.
- Replacement of a battery cell will require partial disassembly of the seismically qualified rack assembly, installation of rigging, removal of unaffected cell(s) to gain access, removal of cell connectors, removal of the affected cell, placement of the new cell and reassembly of the previously removed cells (including connectors and seismic supports). Each cell weighs approximately 400 pounds.
- The estimated time to declare affected battery OPERABLE includes a best case scenario of 11 hours and worst case scenario of 18 hours (worst case requires more disassembly due to greater inaccessibility of cell location).
- It's estimated the earliest time the affected battery could be available and functional is 8 hours for the best case scenario and 13 hours for the worst case scenario (additional actions such as re-torque connections are required to declare battery OPERABLE per TS).

Technical Evaluation

- Applicable Regulatory Requirements
  - 10 CFR 50, Appendix A, General Design Criterion (GDC) 17, the Class 1E DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure
  - The DC electrical power system conforms to the recommendations of the following Regulatory Guides (RGs) and IEEE standards. Compliance with these RGs and IEEE standards is described in FSAR Section 8.3.2 and Appendix 1A(B).
    - RG 1.6 dated March 10, 1971, Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems.
    - RG 1.32 Rev 2, Criteria For Class 1E Electric Systems For Nuclear Power Generating Stations. [IEEE Standard 308-1974]
    - RG 1.75 Rev 1, Physical Independence of Electrical Systems. [IEEE Standard 384-1974]
    - RG 1.81 Rev 1, Shared emergency and shutdown electrical systems for multi-unit nuclear power plants, with an exception to Regulatory Position C1, DC systems in multi-unit nuclear power plants should not be shared.
    - RG 1.93 Rev 1, Availability of Electric Power Sources.
    - RG 1.129 Rev 1 Maintenance, Testing, and Replacement of Vented Lead Acid Batteries for Nuclear Power Plants [IEEE Standard 450-1995]
  - With the exception of guidance in RG 1.93, the proposed change does not affect compliance with these regulations or guidance and will ensure that the lowest functional capabilities or performance levels of equipment required for safe operation are met.

Technical Evaluation

- Applicable Regulatory Requirements
  - Section C.6 of Regulatory Guide 1.93, Revision 1, “Availability of Electric Power Sources,” states in part, “If the available onsite DC power sources are one less than the LCO, power operation may continue for a period that should not exceed 2 hours”.
  - The proposed change does deviate from the NRC guidance “should not exceed 2 hours” on a one-time basis as supported by the Technical Evaluation in Section 3 of this LAR.
  - To minimize the failure of the remaining onsite DC power source of the opposite train, testing / inspections and risk reduction measures are implemented during the extended Completion Time.

Technical Evaluation

- Battery Sizing / Margins
  - Class 1E batteries are designed to provide adequate voltage for their loads considering the voltage drop from battery to load.
  - Class 1E batteries, during duty cycle, maintain a voltage of greater than 105 VDC to provide adequate voltage for operation of all required loads
  - Each battery's cell voltage is approximately 1.9 VDC. A battery voltage margin of greater than or equal to 1.9 VDC will allow jumpering of an inoperable cell.
  - Margin of batteries BT1ED1 (BT2ED1) or BT1ED2 (BT2ED2) (3 batteries have a margin less than 1.9 VDC during the 1st minute of battery duty cycle which does not allow jumpering of an inoperable cell).
    - BT1ED1 – margin of 1.64 VDC
    - BT1ED2 – margin of 3.00 VDC
    - BT2ED1 – margin of 0.53 VDC
    - BT2ED2 – margin of 0.12 VDC

Technical Evaluation

- Defense in Depth Considerations
  - TS 3.8.9 “Distribution Systems – Operating”
    - Removal of a battery from service to replace a cell would not result in a loss of the associated DC electrical power distribution subsystem because it would still be powered from one of its two battery chargers.
  - Design Basis Accident (with no Loss of offsite Power)
    - The opposite Train of DC power remains available during extended Completion Time. Risk reduction measures are implemented as commitments to minimize potential failure of the opposite Train.
  - Loss of Offsite Power (LOOP)
    - In the event of a LOOP, the opposite Train of DC power would be available to start its Emergency Diesel Generator. Risk reduction measures are implemented as commitments to minimize potential for LOOP and failure of the opposite Train.

Technical Evaluation

- Defense in Depth Considerations
  - Monitoring / Inspections – ongoing and enhanced
    - Maintenance performs surveillances / inspections
      - Weekly – total battery voltage $\geq$ 128 V
      - Monthly – battery float $\leq$ 2 amps
      - Quarterly
        - electrolyte level $\geq$ design limits, cell voltage $\geq$ 2.07 V
        - Comprehensive inspection of battery conditions includes "all cells inspected for cracks and leakage of electrolyte including post seals (if cracks or leaks then System Engineering is notified)"

Technical Evaluation

- Defense in Depth Considerations
  - Monitoring / Inspections – ongoing and enhanced
    - Operations Surveillance / Inspections
      - Shiftly Surveillance of battery rooms to verify area temperature
      - Shiftly Tour / Inspection for batteries –
        - Proper electrolyte level,
        - Cell integrity - no leakage,
        - Cell exterior cleanliness,
        - Proper room ventilation,
        - No foreign objects on cells,
        - Corrosion of terminals or connectors,
        - No unauthorized hotwork around the cells.

Technical Evaluation

- Defense in Depth Considerations
  - Monitoring / Inspections – ongoing and enhanced
    - Engineering performs a weekly walk down inspection for all 1E batteries with an identified condition adverse to quality (CAQ) to monitor for potential degradation
  - New B.2.2 battery inspection
    - Perform Engineering walk down inspection for all 1E batteries
  - Preplanning / staging of spare battery cell as described in “Battery Cell Replacement”

Technical Evaluation

- Defense in Depth Considerations
  - Fire Program Considerations
    - If CPNPP Unit 1 or Unit 2 is kept in operation with battery BT1ED1 (BT2ED1) or battery BT1ED2 (BT2ED2) inoperable, the following administrative controls and protective measures will be implemented for fire areas / fire zones of the affected Unit and Train of the inoperable battery prior to exceeding the 2-hour limitation of the existing LCO:
      - Provide a compensatory measure (e.g., hourly roving fire watch),
      - Suspend performance of any ongoing “Hot Work” and prohibit the start of any new “Hot Work,”
      - Do not introduce any new transient combustibles, or add to any transient combustibles already authorized to be in the Fire Areas of Concern (does not include the cell replacement activities / materials which are addressed by station procedures)

Technical Evaluation

- NUREG-0800
  - CPNPP conforms to the required GDCs and guidance of RGs, identified in NUREG-0800 for review of Safety related 125 VDC systems.
- NUREG-0800, Branch Technical Position 8-8
  - Even though LAR 18-001 is not requesting an extension for EDG Completion Time, the guidance and recommendations of BTP 8-8 were addressed as noted below

Technical Evaluation

- (continued) NUREG-0800, Branch Technical Position 8-8
  - *A supplemental power source should be available as a backup to the inoperable EDG or offsite power source, to maintain the defense-in-depth design philosophy of the electrical system to meet its intended safety function. The supplemental source must have capacity to bring a unit to safe shutdown (cold shutdown) in case of a loss of offsite power (LOOP) concurrent with a single failure during plant operation (Mode 1).*
    - If there is a Loss of Offsite Power (LOOP) the unavailability of the safety related DC power could preclude the starting of the Emergency Diesel Generator (EDG) of the same train.
    - Risk reduction measures will be implemented as to minimize the probability of a LOOP. The measures are captured as regulatory commitments.

Technical Evaluation

- (continued) NUREG-0800, Branch Technical Position 8-8
  - *The extended AOT will be used no more than once in a 24-month period (or refueling interval) on a per diesel basis to perform EDG maintenance activities, or any major maintenance on offsite power transformer and bus.*
    - The proposed Required Actions would only be used once for each identified battery during Unit 1 Cycle 20 and Unit 2 Cycle 17.

Technical Evaluation

- (continued) NUREG-0800, Branch Technical Position 8-8
  - Regulatory commitments address the following:
    - *The preplanned maintenance will not be scheduled if severe weather conditions are anticipated.*
    - *The system load dispatcher will be contacted once per day to ensure no significant grid perturbations (high grid loading unable to withstand a single contingency of line or generation outage) are expected during the extended AOT* [Completion Time].
    - *Component testing or maintenance of safety systems and important non-safety equipment in the offsite power systems that can increase the likelihood of a plant transient (unit trip) or LOOP will be avoided. In addition, no discretionary switchyard maintenance will be performed.*
    - *TS required systems, subsystems, trains, components, and devices that depend on the remaining power sources will be verified to be operable and positive measures will be provided to preclude subsequent testing or maintenance activities on these systems, subsystems, trains, components, and devices.*
    - *Steam-driven emergency feed water pump(s) in case of PWR units, and Reactor Core Isolation Cooling and High Pressure Coolant Injection systems in case of BWR units, will be controlled as "protected equipment."*

Technical Evaluation

- Regulatory Commitments
  - Access to both switchyards and relay houses will be controlled and posted, and all maintenance will be suspended for the duration of the Completion Time (CT).
  - The EDGs, APGs, TDAFWPs, startup transformers, CCWPs, and SSWPs will have testing and maintenance activities suspended for the duration of an extended battery CT. Additionally, during the CT extension, signs will be placed on the doorways to the equipment, or in the case of startup transformers, barricades will be erected around the equipment, noting the restriction of testing and maintenance.
  - Both Unit 1 and 2 Transient Combustible safe zones identified in the fire assessment and the cable routing paths for the startup transformers (to minimize loss of offsite power) will have additional restrictions relating to combustible storage during the extended CT durations
  - All hot work activities along the routing associated with power and control cabling for the inserivce startup transformers will be suspended during the CT (to minimize loss of offsite power).

Technical Evaluation

- Regulatory Commitments
  - During the extended CT, a compensatory measure (e.g., hourly roving fire watch) will be in effect prior to exceeding the 2-hour limitation of the existing TS 3.8.4 Required Action B.1 to protect
    1. the areas credited by the fire assessment and
    2. the areas containing power and control cabling of the inservice startup transformers (to minimize loss of offsite power).
  - Severe weather – Severe Thunderstorm and Tornado warnings will be assessed / monitored during the extended CT
  - Grid conditions – grid stability will be assessed / monitored during the extended CT

Supplementary Information

Supporting Risk Insights – Quantitative Models meet RG 1.200

- Risk impacts of proposed Completion Time extension are small and risk information is consistent with results from engineering analysis
  - Quantified risk metrics well below thresholds suggested by RGs
  - Proposed duration - within the range granted at similar plants
  - Other modeled event and action probabilities remain unchanged
  - Functional requirements, redundancy, basis for success – unaffected
- Quantitative - Internal Events including Internal Flood, At-Power
- Qualitative - Fire, Seismic, Tornado and Other External Events
  - Fire assessment also referenced Quantitative Fire PRA results
- Risk Management Strategies – Configuration Risk Management Program (CRMP) and recommended actions

Summary

- Results of the deterministic evaluation / analysis provides assurance that the systems and equipment required to safely shutdown the plant and mitigate the effects of a design basis accident will remain capable of performing their safety functions.
- Risk impacts of proposed CT extension are small and risk information is consistent with results from engineering analysis
- Risk Reduction measures are provided to address the guidance of NUREG-0800 Branch Technical Position 8-8 Recommendations and the supplemental risk assessment.
- The proposed changes to TS 3.8.4 are consistent with NRC guidance and meet the following principles:
  - Meets the current regulations
  - Consistent with defense-in-depth philosophy
  - Maintains sufficient safety margins

Questions

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