Xcel Energy®

Monticello Nuclear Generating Plant
2807 W County Road 75
Monticello, MN 55362

April 4, 2016

L-MT-16-014
10 CFR 50.90

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

Monticello Nuclear Generating Plant
Docket No. 50-263
Renewed Facility Operating License No. DPR-22

License Amendment Request: Revise Battery Charger Surveillance Requirement 3.8.4.2

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," the Northern States Power Company, a Minnesota corporation, d/b/a Xcel Energy (hereafter "NSPM"), requests an amendment to the Technical Specifications (TS) for the Monticello Nuclear Generating Plant (MNGP). The proposed change revises Specification 3.8.4, "DC Sources – Operating", Surveillance Requirement (SR) 3.8.4.2 to increase the required 125 VDC subsystems battery charger output current and to remove the second method specified to perform the surveillance.

Enclosure 1 contains a description and summary safety assessment of the proposed TS change as well as the technical bases for the changes. The enclosure also provides the No Significant Hazards Consideration evaluation in accordance with 10 CFR 50.92, "Issuance of Amendment," and the Environmental Assessment. These provide the bases for the conclusion that the license amendment request involves no significant hazards consideration and meets the eligibility criterion for a categorical exclusion as set forth in 10 CFR 51.22, "Criteria for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," paragraph (c)(9).

Attachment 1 to Enclosure 1 contains the marked-up TS page. Attachment 2 to Enclosure 1 provides the marked-up TS Bases pages for information. Enclosure 2 provides a copy of MNGP Calculation 91-006, Revision 4, "125 VDC Battery Charger Sizing."

The MNGP Plant Operations Review Committee has reviewed this application. In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), NSPM is notifying the State of Minnesota by transmitting a copy of this application, with enclosures, to the designated State Official.

NSPM requests NRC approval of the proposed license amendment request (LAR) by April 4, 2017. Once approved, the amendment will be implemented within 120 days.

Summary of Commitments

This letter proposes no new commitments and does not revise any existing commitments.

If you have any questions or require additional information, please contact Mr. Richard Loeffler at (763) 295-1247.

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

Executed on April 4, 2016.

Peter A. Gardner
Site Vice President – Monticello Nuclear Generating Plant
Northern States Power Company – Minnesota

Enclosures:

| | |
|---|---|
| Enclosure 1: | LAR: Revise 125 VDC Battery Charger SR 3.8.4.2 |
| Attachment 1: | Marked-up Technical Specification Page |
| Attachment 2: | Draft Marked-up Technical Specification Bases Pages |
| Enclosure 2: | MNGP Calculation 91-006, Revision 4, "125 VDC Battery Charger Sizing" |

cc: Administrator, Region III, US NRC
Project Manager, Monticello Nuclear Generating Plant, US NRC
Resident Inspector, Monticello Nuclear Generating Plant, US NRC
State of Minnesota

# LICENSE AMENDMENT REQUEST: REVISE 125 VDC BATTERY CHARGER SURVEILLANCE REQUIREMENT 3.8.4.2

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# LICENSE AMENDMENT REQUEST: REVISE BATTERY CHARGER SURVEILLANCE REQUIREMENT 3.8.4.2

## 1.0 SUMMARY DESCRIPTION

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," the Northern States Power Company, a Minnesota corporation, d/b/a Xcel Energy (hereafter "NSPM"), requests to revise the Technical Specifications (TS) for the Monticello Nuclear Generating Plant (MNGP). There are two proposed changes to Surveillance Requirement (SR) 3.8.4.2 in Specification 3.8.4, "DC Sources – Operating".

The first proposed change is to increase the required 125 Volt (V) Direct Current (DC) battery charger output current specified as the first option under SR 3.8.4.2 to resolve a non-conservative TS condition. The second proposed change is to remove from SR 3.8.4.2 an alternative option for meeting the surveillance requirement. This alternative requires verifying each battery charger can recharge the battery to the fully charged state within the required time period, 24 hours for the 250 VDC and 8 hours for the 125 VDC subsystems, respectively, while supplying the largest combined continuous steady state loads, after a battery discharge to the bounding design basis event (DBE) discharge state. The second option under SR 3.8.4.2 was added during the MNGP Improved Technical Specifications (ITS) conversion process in 2006 (Reference 1) but has not been utilized, and it has been determined that it will not be utilized in the future.

There is no specific schedule or timing constraints related to approval of this license amendment request. However, U. S. Nuclear Regulatory Commission (NRC) approval and issuance of a license amendment revising the MNGP TS is requested as soon as reasonable to resolve the non-conservative TS condition.

## 2.0 BACKGROUND INFORMATION

The value of the required output current specified for the 125 VDC battery chargers in SR 3.8.4.2 within the MNGP TS has been identified as being non-conservative. The guidance of NRC Administrative Letter 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety," is being applied until this condition has been resolved with approval of this proposed license amendment request. Corrective actions have been taken to administratively control via procedure changes the required current value during the interim period between the identification of this condition and resolution to ensure conservative operation.

## 3.0 DETAILED DESCRIPTION

The first option under SR 3.8.4.2 currently requires verifying that each required 125 VDC subsystem battery charger supplies greater than or equal to 50 amps.[1] It is proposed to increase the required current output for each required 125 VDC subsystem battery charger to greater than or equal to 75 amps.

The second option under SR 3.8.4.2 requires the following:

> Verify each required battery charger can recharge the battery to the fully charged state within 24 hours for 250 VDC subsystems and 8 hours for 125 VDC subsystems 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.

It is proposed to remove the second option under SR 3.8.4.2 from the MNGP TS. This method has not been utilized in the past, and it has been determined that this method will not be employed at the MNGP in the future to satisfy the surveillance requirement.

Following incorporation of the proposed changes, revised SR 3.8.4.2 would then read (changes are double underlined and deletions are struck through):

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.8.4.2 | Verify each required battery charger supplies the following:<br>• ≥ 150 amps for 250 VDC Div 1<br>• ≥ 110 amps for 250 VDC Div 2<br>• ≥ 75 amps for 125 VDC subsystems,<br>at greater than or equal to the minimum established float voltage for ≥ 4 hours.<br>~~OR~~<br>~~Verify each required battery charger can recharge the battery to the fully charged state within 24 hours for 250 VDC subsystems and 24 hours for 125 VDC~~ | 24 months |

1. Specification 3.8.5, "DC Sources – Shutdown", SR 3.8.5.1 requires SR 3.8.4.2 to be met for the division of DC sources required to be OPERABLE during shutdown conditions. SR 3.8.5.1 is unaffected by the proposed changes.

| SURVEILLANCE | FREQUENCY |
|---|---|
| ~~subsystems 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.~~ | |

The TS mark-ups indicating the proposed changes are provided in Attachment 1 to this enclosure. The associated proposed TS Bases changes are provided as mark-ups in Attachment 2 to this enclosure, for information. TS Bases changes are issued in accordance with MNGP Specification 5.5.9, "Technical Specification (TS) Bases Control Program," following approval of the associated license amendment request.

## 4.0 TECHNICAL EVALUATION

MNGP is a boiling water reactor (BWR) of the General Electric BWR/3 design, with a Mark I containment. The plant is located within the city limits of Monticello, Minnesota, on the south bank of the Mississippi River. The electrical power system at the MNGP consists of various Alternating Current (AC) and DC systems. The essential plant DC battery system consists of two 125 VDC and two 250 VDC batteries and subsystems which provide for controls and instrumentation which are vital to reactor and overall plant safety and to power certain functional requirements for reactor shutdown. During normal operation, the DC loads are powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to a battery charger, the DC loads are automatically powered from the station batteries.

### 4.1 250 VDC and 125 VDC Electrical Power Systems Description

The following paragraphs provide a summary discussion of the systems, components, and parameters affected by the proposed changes. The discussion is provided for information but does not describe the changes being proposed.

Two independent divisions of 250 VDC and 125 VDC batteries are provided. The 250 VDC "power" batteries serve the larger loads such as DC motor driven pumps, valves, etc. The 125 VDC "control" batteries provide the control power for the in-plant 13.8 kVAC breakers, 4160 VAC breakers, 480 VAC Load Center breakers, auxiliary control power for the 1R and 2R Transformers, and various control relays, annunciators, etc. The 125 VDC System also provides power for some emergency lighting.

The Division 1 and Division 2 250 VDC electrical power subsystems provide power to their associated uninterruptible AC power supply (UPS). The Division 1 electrical power subsystem also provides power to support the Reactor Core Isolation Cooling (RCIC) System motor operated valves, and other non-critical

loads. The Division 2 electrical power subsystem supplies power for the High Pressure Coolant Injection (HPCI) System motor operated valves, the HPCI auxiliary oil pumps, and the Control Room Ventilation System control circuits. Each 250 VDC electrical power subsystem consists of two in series 125 VDC batteries, two normally inservice 125 VDC chargers, a spare 125 VDC charger, and all of the control equipment and interconnecting cabling to the associated distribution panel. Each battery is exclusively associated with a single division. Each set of battery chargers is also exclusively associated with a 250 VDC electrical power subsystem and cannot be interconnected with the other 250 VDC electrical power subsystem. The inservice and spare chargers are supplied from the associated AC load group.

The Division 1 and Division 2 125 VDC electrical power subsystems provide control power to the associated 4.16 kVAC essential bus and each of the two 480 VAC essential Load Centers, in addition to other non-essential loads. Each 125 VDC electrical power subsystem consists of a one battery (No. 11 for Division 1 and No. 12 for Division 2), one battery charger (D10 for Division 1 and D20 for Division 2), and the corresponding control equipment and interconnecting cabling up to the associated distribution panels. Each 125 VDC subsystem battery is composed of 58 C&D Type KCR-13 cells. The inservice battery chargers are supplied from the associated AC load group. The design includes a common spare charger (D40)[2] that can supply either 125 VDC electrical power subsystem.

Each DC battery subsystem is separately housed in a ventilated room. The common standby 125 VDC battery charger is located in a room separate from the other 125 VDC battery chargers electrical power subsystems. Each subsystem is located in an area separated physically and electrically from the other subsystems to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems such as batteries, battery chargers, or distribution panels, except the common standby 125 VDC battery charger may be shared between the Division 1 and Division 2 125 VDC electrical power subsystems, as described previously.

Each division (subsystem) of the DC electrical power system is required to be operable to ensure availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated design basis accident (DBA). Loss of any DC electrical power subsystem does not prevent the minimum safety function from being performed.

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2. The spare 125 VDC battery charger is supplied from the Division 2 AC load group and can only be used to meet the LCO for that division. If it is supplying the Division 1 subsystem, that subsystem is inoperable.

Each essential station battery has adequate storage capacity to meet the duty cycle(s) discussed in Sections 8.5.1.1 and 8.5.2.1 of the MNGP Updated Safety Analysis Report. The essential station batteries are designed with additional capacity above that required by the design duty cycle to allow for temperature variations and aging. The essential batteries for the DC electrical power subsystems are sized to produce capacity greater than required for a DBA and monitored to ensure capacity remains greater than 90 percent during the operating cycle.

### 4.2 Revise the Required 125 VDC System Battery Charger Amperage

SR 3.8.4.2 (first option) currently requires verifying that each 125 VDC battery charger supplies greater than or equal to 50 amps at greater than or equal to the minimum established float voltage to each 125 VDC subsystem for greater than or equal to 4 hours. NSPM proposes to increase the required amperage from each 125 VDC subsystem battery charger from the present value to a value of greater than or equal to 75 amps in SR 3.8.4.2.[3] Increasing the required amperage for each 125 VDC subsystem battery charger corrects a non-conservative TS condition in SR 3.8.4.2.

A simplified methodology for evaluating battery charger sizing is provided within the Institute of Electrical and Electronics Engineers (IEEE) standard, IEEE 946-1985, "IEEE Recommended Practice for the Design of Safety-Related DC Auxiliary Power Systems for Nuclear Power Generating Stations" (Reference 2). MNGP Calculation 91-006, Revision 4, "125 VDC Battery Charger Sizing," provided as Enclosure 2, discusses the methodology and assumptions involved in determining a revised amperage value for the first option under SR 3.8.4.2 of greater than or equal to 75 amps for each 125 VDC subsystem. The125 VDC System battery charger sizing was evaluated by calculating the re-charge times[4] considering the coincident 125 VDC System loads also supplied by the charger, utilizing the IEEE 946-1985 methodology.

MNGP Updated Safety Analysis Report Section 8.5.2.1 states:

> Each 125 VDC [battery] charger is capable of carrying the normal 125 VDC load and at the same time supplying additional charging current to keep the batteries in a fully charged condition.

IEEE 946-1985 recommends that a battery charger have an output current capability greater than the continuous loads plus the largest combination of non-continuous loads that would be likely to occur simultaneously during normal

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3. No change is proposed to the required amperage for each of the 250 VDC subsystem battery chargers under the first option of SR 3.8.4.2.
4. Note, that for the MNGP there are no explicit licensing basis criteria in place for the recharge time after the design basis discharge.

plant operation. This criterion is met if the battery charger output current exceeds the normal continuous system loads by an amount adequate to bound the non-continuous load combinations likely during normal plant operation.

The respective load profiles used to determine the degree of battery discharge were taken from the sizing worksheets of the battery sizing calculations. The 125 VDC System is required to operate without the battery chargers supplying system loads during two DBEs, i.e., during a DBA, a Loss of Coolant Accident (LOCA) with a Loss of Off-site Power (LOOP) and a Station Blackout (SBO). The load profiles modelled are a bounding composite combination of loads that would be needed to mitigate a LOOP / LOCA and the loads necessary to operate equipment necessary to mitigate a 4-hour SBO event.

The IEEE standard recommends that the battery charger output current capacity exceed the combination of continuous system loads plus the largest combination of non-continuous loads that would be likely to occur simultaneously during normal operation. The highest actual operating 125 VDC subsystem operating loads were 23 amps (Division 1) and 24 amps (Division 2) determined from a review of several months of system operating logs. After including allowances for uncertainty and margin, the normal continuous 125 VDC subsystem loads have been determined to be less than 30 amps for either subsystem.[5] The 125 VDC battery chargers provide an output current capability of 75 amps (minimum) resulting in more than 45 amps available to serve simultaneous non-continuous loads.

The proposed revised amperage value for the first option under SR 3.8.4.2, of greater than or equal to 75 amps assures each 125 VDC battery charger supplies sufficient current output to meet the respective 125 VDC subsystem loads, while providing sufficient charging capacity to restore the battery in a reasonable timeframe for a full rated discharge with the normal plant 125 VDC subsystem loads, and for a LOOP-LOCA / 4-hour SBO event.

No change is necessary to the frequency of the surveillance (SR 3.8.4.2) as the surveillance will continue to be performed at the current frequency of 24 months.

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5. The determination of the respective a125 VDC subsystem loading range incorporates tolerances for reading uncertainty and margin.

### 4.3 Basis for Removal of the Second Testing Option Under SR 3.8.4.2

It is proposed to remove the second testing option under SR 3.8.4.2 from the MNGP TS. Technical Specification Task Force (TSTF) traveler TSTF-360, "DC Electrical Rewrite" (Reference 3), was incorporated into the MNGP TS as part of the Monticello ITS conversion. One of the changes included within the TSTF traveler was a new provision under SR 3.8.4.2 providing an alternative to the criteria that specified to meet this surveillance requirement for battery charger testing. TSTF-360 provides the following description as the basis for this alternative:

> NUREG STS [Standard Technical Specification] SR 3.8.4.6 (being revised to SR 3.8.4.2) requires specific parameters for battery charger performance testing. This test is intended to confirm the charger design capacity. <u>Alternate acceptance criteria</u> [emphasis added] are proposed that would allow an actual in service demonstration that the charger can recharge the battery to the fully charged state within [24] 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. This meets the intent of the existing test and allows for normal in-place demonstration of the charger capability thereby minimizing the time when the charger would be disconnected from the DC bus.

The second option under SR 3.8.4.2 states:

> Verify each required battery charger can recharge the battery to the fully charged state within 24 hours for 250 VDC subsystems and 8 hours for 125 VDC subsystems 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.

The second option was added during the Monticello ITS conversion because it was included as part of the standard wording within the applicable NUREG for the BWR/4 design, i.e., NUREG-1433 (which was applied for the Monticello conversion), and it was thought that inclusion of this alternative would provide additional flexibility that might prove useful for testing of the 250 VDC subsystems and 125 VDC subsystems in the future. However, this method has not been utilized to satisfy this surveillance requirement (SR 3.8.4.2) since its incorporation into the MNGP TS for either the 250 VDC System or the 125 VDC System. It has been determined that this second option will not be employed at the MNGP to satisfy this surveillance requirement for either the 250 VDC System or the 125 VDC System.

The second option requires that each battery charger be capable of recharging the battery after a service test coincident with supplying the largest coincident demands of the various continuous steady state loads (irrespective

of the status of the plant during which these demands occur). This level of loading is not normally available following the battery service test and would need to be supplemented with additional loads.

The requirements to satisfy the second option under SR 3.8.4.2 complicate testing at the MNGP and require initial conditions that are not typically present during a refueling outage. As previously indicated, this option has not been employed at the MNGP to satisfy SR 3.8.4.2 and is not planned to be used in the future. NSPM does not typically perform service tests for the essential batteries, but instead performs modified performance tests on a refuel cycle frequency as described in "Supplemental Safety Evaluation Report – Monticello Nuclear Generating Plant Station Blackout Rule", dated August 5, 1992 (Reference 4). The MNGP is therefore not generally in the initial conditions necessary to perform the testing as presently described in the MNGP TS Bases.

Furthermore, the second option is considered less desirable to be performed at the MNGP due to the added complexity of controlling the additional load needed to simulate the largest coincident demands of the various continuous steady state loads during the recharge period. Removing the second option also eliminates the difficulty associated with selecting a conservative recharge time to specify in the TS surveillance requirement considering that the MNGP essential batteries may vary from greater than 100 to 90 percent of rated capacity, that recharge time is affected by temperature as well as charger output voltage, and that the largest coincident steady state loads may change somewhat with future plant modifications. Directly loading and monitoring the battery charger output current as specified under the first option of SR 3.8.4.2 is considered to provide a clearer and more definitive demonstration of the battery charger capacity and capability.

Therefore, since the first (original) testing option under SR 3.8.4.2 is being retained and the second option provides an alternate means of meeting the surveillance requirement, independent of the first option, removal of the second option for testing the 250 VDC System and the 125 VDC System under SR 3.8.4.2 is acceptable. Testing of the 250 VDC and the 125 VDC Systems will continue to be performed under the "first" testing option under SR 3.8.4.2.

## 4.4 Design Basis Accident Considerations

The initial conditions of the DBA and transient analyses in Updated Safety Analysis Report Chapter 14, assume that the Engineered Safety Feature (ESF) systems are operable. The DC electrical power system provides normal and emergency DC electrical power for the emergency diesel generators (EDGs), emergency auxiliaries, and control and switching during all modes of operation. The operability of the DC electrical subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design

basis of the unit. This includes maintaining DC sources operable during accident conditions in the event of:

a. An assumed loss of all offsite AC power or all onsite AC power; and
b. A worst case single failure.

The DC electrical power subsystems are also required to be operable to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an AOO, in addition to a postulated DBA. Loss of any DC electrical power subsystem does not prevent the minimum safety function from being performed.

The revised 125 VDC battery charger required output current will continue to ensure that the Updated Safety Analysis Report described battery charger design basis is met and that essential batteries can be maintained fully charged to provide adequate power to support the Emergency Core Cooling System function. The limit also assures adequate charger capacity at the conclusion of the essential battery duty cycle following a DBA to support continuous steady state DC system loads. Hence, this proposed TS change to increase the required amperage of the 125 VDC battery chargers from 50 to 75 amps under the first option of SR 3.8.4.2 will assure that each 125 VDC battery charger supplies sufficient current output to meet the respective 125 VDC subsystem loads.

Removal of the second (alternate) testing option under SR 3.8.4.2, only removes some unnecessary flexibility in testing methodology from the MNGP TS. The retention of the first testing option under SR 3.8.4.2 maintains the original methodology for performing and meeting SR 3.8.4.2. Therefore, both of the proposed changes to SR 3.8.4.2 are safe and are acceptable.

## 5.0 REGULATORY EVALUATION

### 5.1 Applicable Regulatory Requirements

10 CFR 50.36, "Technical specifications," provides the regulatory requirements for the content required in the TS. 10 CFR 50.36(c)(3) requires the establishment of surveillance 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." The proposed TS changes revise Specification 3.8.4, "DC Sources – Operating", Surveillance Requirement (SR) 3.8.4.2, to increase the required 125 VDC subsystems battery charger amperage, and to also remove a second option under SR 3.8.4.2 to perform battery charger testing.

The MNGP was designed largely before the publishing of the 70 General Design Criteria for Nuclear Power Plant Construction Permits proposed by the Atomic Energy Commission (AEC) for public comment in July 1967, and constructed prior to the 1971 publication of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50. As such, the MNGP was not licensed to the Appendix A, General Design Criteria (GDC).

The MNGP Updated Safety Analysis Report, Section 1.2, lists the principal design criteria (PDCs) for the design, construction and operation of the plant. USAR Appendix E provides a plant comparative evaluation to the 70 proposed AEC design criteria. It was concluded that the plant conforms to the intent of the GDCs. The applicable GDCs and PDCs are discussed below.

- <u>PDC 1.2.6 – Plant Electrical Power</u>

  Sufficient normal and standby auxiliary sources of electrical power are provided to attain prompt shutdown and continued maintenance of the plant in a safe condition under all credible circumstances. The capacity of the power sources is adequate to accomplish all required engineered safeguards functions under all postulated design basis accident conditions.

Of the 70 Draft AEC General Design Criteria (AEC-GDC) the following are applicable:

- <u>AEC-GDC Criterion 24 - Emergency Power for Protection Systems (Category B)</u>

  In the event of the loss of all off-site power, sufficient alternate sources of power shall be provided to permit the required functioning of the protection systems.

- <u>AEC-GDC Criterion 39 - Emergency Power for Engineered Safety Features Category A)</u>

  Alternate power systems shall be provided and designed with adequate independency, redundancy, capacity, and testability to permit the functioning required of the engineered safety features. As a minimum, the on-site power system and the off-site power system shall each, independently, provide this capacity assuming a failure of a single active component in each power system.

- AEC-GDC Criterion 41 - Engineered Safety Features Performance Capability (Category A)

  Engineered safety features such as emergency core cooling and containment heat removal systems shall provide sufficient performance capability to accommodate partial loss of installed capacity and still fulfill the required safety function. As a minimum, each engineered safety feature shall provide this required safety function assuming a failure of a single active component.

While not part of the MNGP Licensing Basis, the applicable 10 CFR 50, Appendix A, GDC are:

- GDC 17 – Electric power systems

  An onsite electric power system and an offsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety. The safety function for each system (assuming the other system is not functioning) shall be to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents.

  The onsite electric power supplies, including the batteries, and the onsite electric distribution system, shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure.

  Electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits (not necessarily on separate rights of way) designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. A switchyard common to both circuits is acceptable. Each of these circuits shall be designed to be available in sufficient time following a loss of all onsite alternating current power supplies and the other offsite electric power circuit, to assure that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. One of these circuits shall be designed to be available within a few seconds following a loss-of-coolant accident to assure that core cooling, containment integrity, and other vital safety functions are maintained.

  Provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with,

the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies.

- <u>GDC 18 – Inspection and testing of electric power systems</u>

  Electric power systems important to safety shall be designed to permit appropriate periodic inspection and testing of important areas and features, such as wiring, insulation, connections, and switchboards, to assess the continuity of the systems and the condition of their components. The systems shall be designed with a capability to test periodically (1) the operability and functional performance of the components of the systems, such as onsite power sources, relays, switches, and buses, and (2) the operability of the systems as a whole and, under conditions as close to design as practical, the full operation sequence that brings the systems into operation, including operation of applicable portions of the protection system, and the transfer of power among the nuclear power unit, the offsite power system, and the onsite power system.

NSPM has evaluated the proposed changes against the applicable regulatory requirements and acceptance criteria. The technical analysis in Section 4.0 concludes that the revised 125V battery charger output current is reasonable and that it is acceptable to remove the second option for meeting SR 3.8.4.2 since it is not necessary and is not going to be performed. Based on this, there is reasonable assurance that the health and safety of the public, following approval of this change, is unaffected.

## 5.2 Precedent

In 1996, the two unit Salem Nuclear Generating Station received two license amendments to revise the respective units TSs to lower the 125 Volt Battery Charger surveillance amperage from at least 200 amps to at least 170 amps so as not to require the replacement of input cables to the battery chargers for charger replacements (Reference 5). IEEE Standard IEEE 946-1992 was utilized to size the replacement battery chargers.

In 1997, Millstone Nuclear Power Station, Unit No. 3, received a somewhat similar license amendment to increase the required test voltage for the 125 Volt Battery Chargers (Reference 6).

## 5.3 No Significant Hazards Determination

In accordance with the requirements of 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," the Northern States Power Company – Minnesota (NSPM), doing business as Xcel Energy, Inc., requests an amendment to revise Monticello Nuclear Generating Plant (MNGP) Technical Specification 3.8.4, "DC Sources – Operating", Surveillance Requirement (SR) 3.8.4.2 to increase the 125 VDC subsystems battery charger amperage and to remove the second surveillance option which requires monitoring battery recharge time while controlling additional load to simulate the largest combined demands of the various continuous steady state loads.

NSPM's evaluation against each of the criteria in 10 CFR 50.92, "Issuance of amendment," follows:

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

Response: No.

The proposed TS changes revise the battery charger surveillance requirements in SR 3.8.4.2. The DC electrical power system, including associated battery chargers, is not an initiator of any accident sequence analyzed in the Updated Safety Analysis Report (USAR). Rather, the DC electrical power system supports operation of equipment used to mitigate accidents. Operation in accordance with the proposed TS continues to ensure that the DC electrical power system is capable of performing its specified safety functions as described in the USAR. Therefore, the mitigating functions supported by the DC electrical power system will continue to provide the protection assumed by the analysis.

Accidents are initiated by the malfunction of plant equipment, or the catastrophic failure of plant structures, systems, or components (SSCs). Performance of battery testing is not a precursor to any accident previously evaluated, nor does it change the manner in which the batteries and battery chargers are operated. The proposed testing requirements will not contribute to the failure of the batteries nor any plant SSC. NSPM has determined that the proposed TS changes provide an equivalent level of assurance that the batteries and battery chargers are capable of performing their intended safety functions. Thus, the proposed changes do not affect the probability of an accident previously evaluated.

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

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

   Response: No

   The DC electrical power system, including the associated battery chargers, is not an initiator of any accident sequence analyzed in the USAR. The proposed TS changes do not involve operation of the DC electrical power system in a manner or configuration different from those previously evaluated. Performance of battery testing is not a precursor to any accident previously evaluated. NSPM has determined that the proposed TS changes provide an equivalent level of assurance that the batteries and battery chargers are capable of performing their intended safety functions. Therefore, the mitigating functions supported by the DC electrical power system will continue to provide the protection assumed in the safety analyses.

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

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

   Response: No

   The margin of safety is established through the equipment design, the operating parameters, and the setpoints at which automatic actions are initiated. The equipment margins will be maintained in accordance with the plant-specific design bases as a result of the proposed changes. The proposed changes do not adversely affect operation of plant equipment. The proposed TS changes do not result in a change to the setpoints at which protective actions are initiated. Sufficient DC capacity to support operation of mitigation equipment continues to be ensured. The equipment fed by the DC electrical sources will continue to provide adequate power to safety-related loads in accordance with safety analysis assumptions.

   Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

Based on the above, the NSPM has determined that operation of the facility in accordance with the proposed change does not involve a significant hazards consideration as defined in 10 CFR 50.92, "Issuance of amendment," paragraph (c), in that it does not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of

a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety.

## 6.0 ENVIRONMENTAL CONSIDERATION

10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," identifies certain licensing and regulatory actions which are eligible for categorical exclusion from the requirement to perform an environmental assessment. NSPM has determined that the proposed amendment meets the criteria for a categorical exclusion from an environmental review as set forth in 10 CFR 51.22, specifically 10 CFR 51.22(c)(9). First, the proposed amendment changes a requirement with respect to installation or use of a facility or component located within the restricted area, as defined in 10 CFR 20, "Standards for Protection Against Radiation," or involves a change to an inspection or surveillance requirement. Second, the proposed amendment requires no environmental assessment since operation of the facility in accordance with the proposed amendment does not (i) involve a significant hazards consideration, or (ii) authorize a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) result in a significant increase in individual or cumulative occupational radiation exposure. Therefore, the NSPM concludes pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

## 7.0 REFERENCES

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1. Letter from T. Beltz (NRC) to J. Conway (NMC), "Monticello Nuclear Generating Plant (MNGP) – Issuance of Amendment for the Conversion to the Improved Technical Specifications with Beyond-Scope Issues (TAC Nos. MC7505, MC7597 through MC7611, and MC8887," dated June 5, 2006

2. IEEE Std. 946-1985, "IEEE Recommended Practice for the Design of Safety-Related DC Auxiliary Power Systems for Nuclear Power Generating Stations"

3. Technical Specification Task Force (TSTF) traveler TSTF-360-A, Revision 1, "DC Electrical Rewrite", dated December 18, 2000.

4. Supplemental Safety Evaluation – Monticello Nuclear Generating Plant Station Blackout Rule (10 CFR 50.63), dated August 5, 1992

5. Letter from L. Olshan (NRC) to L. Eliason (PSEG), "Salem Nuclear Generating Station, Unit Nos. 1 and 2 (TAC Nos. M94634 and M94635)," dated June 27, 1996. Issuance of Amendment No. 183 for Unit 1 and Amendment No. 164 for Unit 2, respectively.

6. Letter from J. Andersen (NRC) to N. Carns (Northeast Nuclear Energy Company), "Issuance of Amendment (TAC No. M98724)," for the Millstone Nuclear Power Station, Unit No. 3," dated September 5, 1997 (Amendment No. 149)

**ENCLOSURE 1**

**ATTACHMENT 1**

**MONTICELLO NUCLEAR GENERATING PLANT**

**LICENSE AMENDMENT REQUEST**

**REVISE BATTERY CHARGER SURVEILLANCE REQUIREMENT 3.8.4.2**

**MARKED-UP TECHNICAL SPECIFICATION PAGE**

(1 page follows)

ACTIONS (continued)

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| C. Required Action and associated Completion Time not met. | C.1 | Be in MODE 3. | 12 hours |
| | AND | | |
| | C.2 | Be in MODE 4. | 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. | 7 days |
| SR 3.8.4.2 | Verify each required battery charger supplies the following:<br>• ≥ 150 amps for 250 VDC Div 1<br>• ≥ 110 amps for 250 VDC Div 2<br>• ≥ 75 amps for 125 VDC subsystems,<br>at greater than or equal to the minimum established float voltage for ≥ 4 hours.<br>~~OR~~<br>~~Verify each required battery charger can recharge the battery to the fully charged state within 24 hours for 250 VDC subsystems and 8 hours for 125 VDC subsystems 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.~~ | 24 months |

**ENCLOSURE 1**

**ATTACHMENT 2**

**MONTICELLO NUCLEAR GENERATING PLANT**

**LICENSE AMENDMENT REQUEST**

**REVISE BATTERY CHARGER SURVEILLANCE REQUIREMENT 3.8.4.2**

**DRAFT MARKED-UP TECHNICAL SPECIFICATION BASES PAGES**

**(FOR INFORMATION)**

(4 pages follow)

BASES

BACKGROUND (continued)

During normal operation, the DC loads are powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to the battery charger, the DC loads are automatically powered from the station batteries.

The DC power distribution system is described in more detail in Bases for LCO 3.8.7, "Distribution System - Operating," and LCO 3.8.8, "Distribution System - Shutdown."

Each DC battery subsystem is separately housed in a ventilated room. The common standby 125 VDC battery charger is located in a room separate from the other 125 VDC battery chargers electrical power subsystems. Each subsystem is located in an area separated physically and electrically from the other subsystems to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems such as batteries, battery chargers, or distribution panels, except the common standby 125 VDC battery charger may be shared between the Division 1 and Division 2 125 VDC electrical power subsystems.

Each Division 1 and Division 2 250 VDC battery has adequate storage capacity to meet the duty cycle(s) discussed in USAR, Section 8.5.1.1 (Ref 4). Each Division 1 and Division 2 125 VDC battery has adequate storage capacity to meet the duty cycle(s) discussed in USAR, Section 8.5.2.1 (Ref. 5). The battery is designed with additional capacity above that required by the design duty cycle to allow for temperature variations and other factors.

The batteries for DC electrical power subsystems are sized to produce capacity greater than required for a design basis accident and monitored to ensure battery capacity will remain > 90% during the operating cycle. The minimum design voltage limit is 105/210 V.

<u>No Changes</u>.

The page is included for information, so that the context of the change on the next page is clear.

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged, the battery cell will maintain 98% capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage 2.20 to 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge.

Each battery charger of DC electrical power subsystem has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery

BASES

BACKGROUND (continued)

The battery chargers are sized to charge the batteries while supplying the normal continuous DC loads (Refs. 4 and 5).

bank fully charged. ~~Each station service battery charger has sufficient excess capacity to restore the battery from the design minimum charge to its fully charged state within 24 hours while supplying normal steady state loads.~~

The battery charger is normally in the float-charge mode. Float-charge is the condition in which the charger is supplying the connected loads and the battery cells are receiving adequate current to optimally charge the battery. This assures the internal losses of a battery are overcome and the battery is maintained in a fully charged state.

When desired, the charger can be placed in the equalize mode. The equalize mode is at a higher voltage than the float mode and charging current is correspondingly higher. The battery charger is operated in the equalize mode after a battery discharge or for routine maintenance. Following a battery discharge, the battery recharge characteristic accepts current at the current limit of the battery charger (if the discharge was significant, e.g., following a battery service test) until the battery terminal voltage approaches the charger voltage setpoint. Charging current then reduces exponentially during the remainder of the recharge cycle. Lead-calcium batteries have recharge efficiencies of greater than 95%, so once at least 105% of the ampere-hours discharged have been returned, the battery capacity would be restored to the same condition as it was prior to the discharge. This can be monitored by direct observation of the exponentially decaying charging current or by evaluating the amp-hours discharged from the battery and amp-hours returned to the battery.

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in USAR, Chapter 14 (Ref. 6), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the emergency diesel generators (EDGs), emergency auxiliaries, and control and switching during all MODES of operation. The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining DC sources OPERABLE during accident conditions in the event of:

a. An assumed loss of all offsite AC power or all onsite AC power; and

b. A worst case single failure.

The DC Sources - Operating satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge helps to ensure the effectiveness of the battery chargers, which support the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery and maintain the battery in a fully charged state while supplying the continuous steady state loads of the associated DC subsystem. On float charge, battery cells will receive adequate current to optimally charge the battery. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the minimum float voltage established by the battery manufacturer (2.20 Vpc or 132 V (for each 250 VDC subsystem battery) and 127.6 V (for each 125 VDC subsystem battery) at the battery terminals). This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years). The 7 day Frequency is conservative when compared with manufacturer recommendations and IEEE-450 (Ref. 9).

SR 3.8.4.2

This SR verifies the design capacity of the battery chargers. According to Regulatory Guide 1.32 (Ref. 10), the battery charger supply is recommended to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

This SR ~~provides two options. One option~~ requires that each Division 1 battery charger be capable of supplying ≥ 150 amps and each Division 2 battery charger be capable of supplying ≥ 110 amps for the 250 VDC subsystems and ≥ 75 ~~50~~ amps for the 125 VDC subsystems at the minimum established float voltage for 4 hours. The ampere requirements are based on the output rating of the chargers for Division 1 and the rating of circuit breakers in the associated distribution cabinet for Division 2 (Ref. 11). The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least 2 hours.

~~The other option requires that each battery charger be capable of recharging the battery after a service test coincident with supplying the largest coincident demands of the various continuous steady state loads (irrespective of the status of the plant during which these demands occur). This level of loading may not normally be available following the~~

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~battery service test and will need to be supplemented with additional loads. The duration for this test may be longer than the charger sizing criteria since the battery recharge is affected by float voltage, temperature, and the exponential decay in charging current. The battery is recharged when the measured charging current is ≤ 2 amps for 250 VDC batteries and ≤ 1 amp for 125 VDC batteries.~~

The Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these 24 month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

SR 3.8.4.3

A battery service test is a special test of the battery's capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The discharge rate and test length corresponds to the design duty cycle requirements as specified in Reference 4 for the 250 VDC electrical power system and Reference 5 for the 125 VDC electrical power system.

The Frequency of 24 months is acceptable, given plant conditions required to perform the test and the other requirements existing to ensure adequate battery performance during the 24 months intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

This SR is modified by two Notes. Note 1 allows the performance of a modified performance discharge test in lieu of a service test.

The reason for Note 2 is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems. This restriction from normally performing the Surveillance in MODE 1 or 2 is further amplified to allow portions of the Surveillance to be performed for the purpose of reestablishing OPERABILITY (e.g., post work testing following corrective maintenance, corrective modification, deficient or incomplete surveillance testing, and other unanticipated OPERABILITY concerns) provided an assessment determines plant safety is maintained or enhanced. This assessment shall, as a minimum, consider the potential outcomes and transients associated with a failed partial Surveillance, a successful partial Surveillance, and a perturbation of the offsite or onsite system when they are tied together or operated

ENCLOSURE 2

MONTICELLO NUCLEAR GENERATING PLANT

LICENSE AMENDMENT REQUEST

REVISE BATTERY CHARGER SURVEILLANCE REQUIREMENT 3.8.4.2

CALCULATION 91-006, REVISION 4

125 VDC BATTERY CHARGER SIZING

(40 pages follow)

XcelEnergy

# Calculation Signature Sheet

| Document Information | |
|---|---|
| NSPM Calculation (Doc) No: 91-006 | Revision: 4 |
| Title: 125 VDC Battery Charger Sizing | |
| Facility: ☒ MT ☐ PI | Unit: ☒ 1 ☐ 2 |
| Safety Class: ☒ SR ☐ Aug Q ☐ Non SR | |
| Special Codes: ☐ Safeguards ☐ Proprietary | |
| Type: **Calc** Sub-Type: | |

| ***NOTE:*** | Print **and** sign name in signature blocks, as required. |
|---|---|

| Major Revisions | ☐ N/A |
|---|---|
| EC Number: 24146 | ☐ Vendor Calc |
| Vendor Name or Code: | Vendor Doc No: |
| Description of Revision: See Purpose section of calculation. | |
| The following calculation and attachments have been reviewed and deemed acceptable as a legible QA record | ☒ |
| Prepared by: (sign) [signature] / (print) Rhon Sanderson | Date: 10-28-15 |
| Reviewed by: (sign) [signature] / (print) Jake Strasser | Date: 10/28/2015 |
| Type of Review: ☒ Design Verification ☐ Tech Review ☐ Suitability Review | |
| Method Used (For DV Only): ☒ Review ☐ Alternate Calc ☐ Test | |
| Approved by: (sign) [signature] / (print) Ed Watzl | Date: 10/29/2015 |

| Minor Revisions | ☒ N/A |
|---|---|
| EC No: | ☐ Vendor Calc: |
| Minor Rev. No: | |
| Description of Change: | |
| Pages Affected: | |
| The following calculation and attachments have been reviewed and deemed acceptable as a legible QA record | ☐ |
| Prepared by: (sign) / (print) | Date: |
| Reviewed by: (sign) / (print) | Date: |
| Type of Review: ☐ Design Verification ☐ Tech Review ☐ Suitability Review | |
| Method Used (For DV Only): ☐ Review ☐ Alternate Calc ☐ Test | |
| Approved by: (sign) / (print) | Date: |

Record Retention: Retain this form with the associated calculation for the life of the plant.

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# Calculation Signature Sheet

| | |
|---|---|
| ***NOTE:*** | This reference table is used for data entry into the PassPort Controlled Documents Module reference tables (C012 Panel). It may also be used as the reference section of the calculation. The input documents, output documents and other references should all be listed here. Add additional lines as needed by using the "TAB" key and filling in the appropriate information in each column. |

## Reference Documents (PassPort C012 Panel from C020)

| # | Controlled* Doc? + | Type | Document Name | Document Number | Doc Rev | Ref Type** INPUT | OUTPUT |
|---|---|---|---|---|---|---|---|
| 1 | Y | CALC | Div. I 125 Volt Battery Calculation | 02-179 | 3 | X | |
| 2 | Y | CALC | Div. II 125 Volt Battery Calculation | 02-192 | 3 | X | |
| 3 | N | ------- | IEEE Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and SubStations | IEEE 485-1983 | ------- | X | |
| 4 | Y | PROC | Operations Manual, Lighting, Description of Equipment | B.09.14-02 | 1 | X | |
| 5 | N | ------ | C&D Technologies Publication 12-316, KCR-13 Lead-Calcium Standby Batteries | 12-316 | ------ | X | |
| 6 | Y | PROC | Operations Manual, 125 VDC System, Description of Equipment | B.09.10-02 | 9 | X | |
| 7 | N | ------ | Operator Rounds record, Turbine Building East (2010) 2014-2015 | ------------------- | ------ | X | |
| 8 | N | ------- | IEEE Recommended Practice for the Design of Safety-Related DC Auxiliary Power Systems for Nuclear Power Generating Stations | IEEE 946-1985 | ------ | X | |
| 9 | Y | PROC | D10 Battery Charger Preventive Maintenance | 4066-PM | 3 | X | |
| 10 | Y | PROC | D20 Battery Charger Preventive Maintenance | 4075-PM | 3 | X | |
| 11 | Y | PROC | D40 Battery Charger Preventive Maintenance | 4078-PM | 5 | X | |
| 12 | N | ------- | Replace Div. I 125 VDC Battery Charger D10 | EC 720 | ------- | X | |
| 13 | N | ------ | Replace Div. II 125 VDC Battery Charger D20 | EC 12877 | ------ | X | |
| 14 | N | ------ | Replace 125 VDC Battery Swing Charger D40 | EC 13284 | ------ | X | |
| 15 | N | ------ | ITS 125 VDC charger SR 3.8.4.2-Optoin 2 unachievable | AR # 01131103 | ------ | | |
| 16 | N | ------ | TS SR 3.8.4.2 Non-Conservative for the 125 VDC Chargers | AR # 01456839 | ------ | | |
| 17 | | | | | | | |

Record Retention: Retain this form with the associated calculation for the life of the plant.

| Xcel Energy | Calculation Signature Sheet |
|---|---|

* Controlled Doc marked with an "X" means the reference can be entered on the C012 panel in black. Unmarked lines will be yellow. If marked with an "X", also list the Doc Type, e.g., CALC, DRAW, VTM, PROC, etc.

** Mark with an "X" if the calculation provides inputs and/or outputs or both. If not, leave blank. (Corresponds to PassPort "Ref Type" codes: **Inputs / Both** = "ICALC", **Outputs** = "OCALC", **Other / Unknown** = blank)

## Other PassPort Data

**Associated System** (PassPort C011, first three columns) **OR Equipment References** (PassPort C025, all five columns):

| Facility | Unit | System | Equipment Type | Equipment Number |
|---|---|---|---|---|
| MT | 1 | 125 | CHGR | D10 |
| MT | 1 | 125 | CHGR | D20 |
| MT | 1 | 125 | CHGR | D40 |
| | | | | |

**Superseded Calculations** (PassPort C019):

| Facility | Calc Document Number | Title |
|---|---|---|
| | | |
| | | |

**Description Codes - Optional** (PassPort C018):

| Code | Description (optional) | Code | Description (optional) |
|---|---|---|---|
| | | | |

**Notes (Nts) - Optional** (PassPort X293 from C020):

| Topic Notes | Text |
|---|---|
| ☒ Calc Introduction | ☒ Copy directly from the calculation Intro Paragraph **or** ☐ See write-up below |
| | |
| ☐ (Specify) | |

Record Retention: Retain this form with the associated calculation for the life of the plant.

Xcel Energy

# Calculation Signature Sheet

## Monticello Specific Information

☒ YES ☐ N/A Topic Code(s) (See MT Form 3805): SBO
☐ YES ☒ N/A Structural Code(s) (See MT Form 3805):_______

Does the Calculation:

☐ YES ☒ No Require Fire Protection Review? (Using MT Form 3765, "Fire Protection Program Checklist", determine if a Fire Protection Review is required.) If YES, document the engineering review in the EC. If NO, then attach completed MT Form 3765 to the associated EC.
☐ YES ☒ No Affect piping or supports? (If Yes, Attach MT Form 3544.)
☐ YES ☒ No Affect IST Program Valve or Pump Reference Values, and/or Acceptance Criteria? (If Yes, inform IST Coordinator and provide copy of calculation.)

Record Retention: Retain this form with the associated calculation for the life of the plant.

| Xcel Energy | **Design Review Checklist** |
|---|---|

EC Number or Document Number / Title / Revision Number: 91-006, 125 VDC Battery Charger Sizing, Rev. 4

Verifier's Name: Jake Strasser *Jake Strasser 10/28/2015*

Discipline: Electrical Design

| DESIGN REVIEW CONSIDERATIONS: | | Yes | No | N/A |
|---|---|---|---|---|
| 1. | Were the inputs correctly selected and incorporated into design? | ☒ | ☐ | ☐ |
| 2. | Are assumptions necessary to perform the design activity adequately described and reasonable? Where necessary, are the assumptions identified for subsequent re-verifications when the detailed design activities are completed? | ☒ | ☐ | ☐ |
| 3. | Are the appropriate quality and quality assurance requirements specified? | ☐ | ☐ | ☒ |
| 4. | Are the applicable codes, standards, and regulatory requirements including issue and addends properly identified and are their requirements for design met? | ☒ | ☐ | ☐ |
| 5. | Have applicable construction and operating experience been considered? | ☐ | ☐ | ☒ |
| 6. | Have the design interface requirements been satisfied? | ☒ | ☐ | ☐ |
| 7. | Was an appropriate design method used? | ☒ | ☐ | ☐ |
| 8. | Is the output reasonable compared to inputs? | ☒ | ☐ | ☐ |
| 9. | Are the specified parts, equipment and processes suitable for the required application? | ☐ | ☐ | ☒ |
| 10. | Are the specified materials compatible with each other and the design environmental conditions to which the material will be exposed? | ☐ | ☐ | ☒ |
| 11. | Have adequate maintenance features and requirements been specified? | ☐ | ☐ | ☒ |
| 12. | Are accessibility and other design provisions adequate for performance of needed maintenance and repair? | ☐ | ☐ | ☒ |
| 13. | Has adequate accessibility been provided to perform the in-service inspection expected to be required during the plant life? | ☐ | ☐ | ☒ |
| 14. | Has the design properly considered radiation exposure to the public and plant personnel? | ☐ | ☐ | ☒ |
| 15. | Are the acceptance criteria incorporated in the design documents sufficient to allow verification that design requirements have been satisfactorily accomplished? | ☒ | ☐ | ☐ |
| 16. | Have adequate pre-operational, subsequent periodic test and inspection requirements been appropriately specified, including acceptance criteria? | ☐ | ☐ | ☒ |
| 17. | Are adequate handling, storage, cleaning, and shipping requirements specified? | ☐ | ☐ | ☒ |
| 18. | Are adequate identification requirements specified? | ☐ | ☐ | ☒ |
| 19. | Are requirements for record preparation, review, approval, and retention adequately specified? | ☐ | ☐ | ☒ |
| 20. | Have Design and Operational Margins been considered and documented? | ☒ | ☐ | ☐ |

COMMENTS: ☐ None ☒ Attached (Use Form QF-0528) ☐ In EC Topic Notes

| Xcel Energy | **Design Review Comment Form** |
|---|---|

Sheet 1 of 1

DOCUMENT NUMBER/ TITLE: 91-006, 125 VDC Battery Charger Sizing

REVISION: 4 DATE: 10/28/2015

| ITEM # | REVIEWER'S COMMENTS | PREPARER'S RESOLUTION | REVIEWER'S DISPOSITION |
|---|---|---|---|
| 1. | The calculation references IEEE Std 946-1985 for guidance and methodology. The standard has since been revised (presently IEEE Std 946-2004) and given that MNGP has no licensing commitments to the 1985 version, the latest revision should be referenced or the differences dispositioned within the calculation. | Included a discussion regarding the 1985 version versus the 2004 version. | Accepted. |
| 2. | The recharge time computation for "full-rated" discharge is noted to be very conservative in that the 8-hr rate to 1.75 vpc is used. From a cell sizing and performance test standpoint "rated" capacity for the MNGP application is generally taken to be the 4-hr rate to 1.81 vpc. | No response required. | Accepted. |
| 3. | Reference 10.22 (ML111110396) is noted to be an interim paper discussing the NRC's then ongoing research on float current as an indicator of state-of-charge. The final testing report is documented as NUREG/CR-7148. The information as presented in the final report has no impact on the data as referenced within the calculation. | Reference 10.22 changed to NUREG/CR-7148. | Accepted. |
| 4. | The composite battery duty cycle currents for periods 11 and 9 of Div I and Div II, respectively, need to be adjusted per CAP AR 01474466. | Values adjusted and reference to CAP added. | Accepted. |

Reviewer: [signature] Date: 10/28/2015 | Preparer: [signature] Date: 10-28-15

TABLE OF CONTENTS

## 1. PURPOSE

The purpose of this calculation is to analyze the sizing of the 125V battery chargers.

The specific battery chargers analyzed are:

D10 – Div. I 125 VDC Battery Charger – supplies #11 Battery

D20 – Div. II 125 VDC Battery Charger – supplies #12 Battery

D40 – Swing 125 VDC Battery Charger – can supply either #11 or #12 Battery

Revision 3 addressed the increased DC output current capability of the 125 VDC chargers installed per ECs 13284, 12877, and 720 (References 10.12, 10.13, 10.14).

Revision 4 addresses changes to steady-state loads for post SBO re-charge per new revisions of the station 125 VDC battery calculations (References 10.1, 10.2).

## 2. METHODOLOGY

Ops Manual B.09.10-02 (Ref. 10.6) describes the 125 VDC System equipment. Each battery (#11 for Division I and #12 for Division II) is composed of 58 C&D Type KCR-13 cells. The 125 VDC system battery chargers D10, D20, and D40 are output current-limited at nominal value of 80 amps. The minimum current limit value of 75 amps will be applied in this calculation.

During battery recharging, each charger must also supply its divisional 125 VDC system loads.

A simplified methodology for evaluating charger sizing is given in IEEE 946-1985 (Ref. 10.8). The equation given in this standard will be applied to determine the approximate re-charge times expected for each 125 VDC battery. Note that the IEEE 946 standard has been updated (see following excerpt from IEEE 946-2004). For purposes of this calculation the original 1985 version of IEEE 946 specifically for nuclear generating stations will be the primary reference for the methodology and acceptance criteria employed in evaluating charger sizing. Where the 2004 version provides more technical detail or prescribes a more conservative method of evaluation the 2004 version of IEEE 946 will be adhered to.

**Excerpt of IEEE 946-2004:**

The original issue of IEEE Std 946 was published in 1985 with the title IEEE Recommended Practice for the Design of Safety-Related DC Auxiliary Power Systems for Nuclear Power Generating Stations. The 1992 revision changed the title to apply to all generating stations, while including specific guidance and a detailed bibliography of nuclear design reference standards. This revision makes a general update to reflect the most recent industry practices as well as substantial additions to annexes. In addition, as the design of nuclear plant systems has become well documented by other IEEE standards, the direct emphasis on unique aspects of nuclear plant design has been further diminished, with a full listing of the nuclear design standards included in Annex A. Some nuclear discussion and illustrative figures have been retained as they offer a constructive comparison to non-nuclear designs without having to resort to additional standards.

Charger sizing will be evaluated by calculating re-charge times considering coincident 125 VDC system loads also supplied by the charger, using the IEEE 946 methodology. This is the same method described in the EPRI Power Plant Electrical Reference Series Volume 9, DC Distribution System (Reference 10.18). Acceptance criteria will be from the 1985 version of IEEE-946. The 2004 version will be referenced as appropriate.

## 3. ACCEPTANCE CRITERIA

Per USAR Section 08.05 (Reference 10.17): "Each 125 VDC charger is capable of carrying the normal 125 VDC load and at the same time supplying additional charging current to keep the batteries in a fully charged condition." This criterion is met if the charger output current exceeds the normal system loads such that charging current can be supplied to the battery.

For the purposes of determining required output current capability of the 125 VDC chargers, the methodology and criteria of IEEE 946 (References 10.8 and 10.9) will be used, with acceptance criteria from IEEE 946-1985. IEEE 946-1985 recommends a re-charge time of 8 to 12 hours. This IEEE 946-1985 criteria is met if the calculated re-charge time (after a full-rated discharge of the battery) is between 8 and 12 hours, considering normal 125 VDC system loads.

IEEE 946-1985 also recommends that the charger have output current capability greater than the continuous loads plus the largest combination of non-continuous loads that would be likely to occur simultaneously during normal plant operation. This IEEE 946-1985 criteria is met if the charger output current exceeds normal continuous system loads by an amount adequate to bound non-continuous load combinations likely during normal plant operation. Note that meeting the IEEE 946 criteria ensures the USAR criterion is met.

This calculation will also evaluate re-charge time following a Station Blackout discharge of each battery. The Monticello licensing basis discharge corresponds to the Station Blackout event and the equivalent discharge load profile is taken from the battery sizing calculations (References 10.1 and 10.2). This is the discharge that the battery would undergo if subjected to a service test with a load profile matching that modelled in the battery calculations which

model a composite profile for the 4-hour LOCA / Station Blackout event. The re-charge time will be calculated using the IEEE 946 equation (same equation for both the 1985 and 2004 versions of IEEE 946) with system load considered to be the largest continuous load combination present at the end of the modelled station blackout event. There are currently no explicit licensing basis criteria in place for the recharge time after the design basis discharge.

The load profile used to determine the degree of battery discharge will be taken from the sizing worksheets of the battery sizing calculations. These sizing worksheets tabulate loads vs. time and evaluate battery positive-plates-required in accordance with IEEE Std. 485-1983 (Reference 10.3). The profiles modelled are a composite combination of loads that would be needed to mitigate a LOCA event coincident with a loss of offsite power and the loads necessary to operate equipment necessary to mitigate a 4-hour Station Blackout event.

## 4. INPUTS

4.1 The charger output-current limit setting is 78-82 amps, per PM procedures (References 10.9, 10.10, 10.11). A charger minimum current output of 75 amps will be used for this calculation.

4.2 The battery discharge during an SBO event is modelled in the following calculations:

For Div. I (#11 Battery) – CA-02-179 (Reference 10.1)

For Div. II (#12 Battery) – CA-02-192 (Reference 10.2)

The load data from these calculations is consolidated in the spreadsheet of Attachment 02. This spreadsheet tabulates the effective amp-hours discharged for both the Div. I and Div. II SBO events. The load values were adjusted in select time periods in accordance with the issue identified in CAP AR # 01474466 (Reference 10.24). The corrected values are as given in ECs 25634 and 25511 (References 10.25 and 10.26). Note that the bounding loads considering 1 minute minimum time interval taken from the battery sizing worksheets are used. The results of the calculations in the spreadsheet are as follows:

Div. I (#11 Battery) total amp-hours discharged = 263.01

Div. II (#12 Battery) total amp-hours discharged = 240.49

4.3 The rated battery discharge capacity will be taken to be the full KCR-13 cell capacity for a discharge to 1.75 volts / cell as given in Attachment 01.

Full rated discharge amps hours = 495 maximum

This is conservative as it is a larger value than the 8-hour value recommended by IEEE 946-1985. Also in Attachment 1 are the ratings as given in the battery sizing calculations (excerpt taken from 02-192). Note that the ratings are slightly different. The 495 amp-hour value representing ultimate capacity will be used to determine the maximum re-charge time. The 8 hour value from the C&D ratings table of 61 x 8 = 488 will be used to calculate minimum re-charge time.

Full rated discharge amps hours = 488 minimum

4.4 The steady-state system loads after an SBO discharge will be taken from the node current analysis in the battery sizing calculations. The DC system loads at analyzed time steps were inspected to select the load for each battery that represents the largest combination of steady-state loads that could be present at the end of the SBO event. For the Div. I system, Time Step 52 of the Div. I calculation (Reference 10.1) represents that maximum steady state load on the Div. I 125 VDC system at the end of an SBO event. For the Div. II system, the maximum steady state load considered is taken from Time Step 53 of the Div. II calculation (Reference 10.2). The effective system loads are dependent on the corresponding system voltages. These voltages will be taken as the battery node voltage from the calculations for the applicable time steps.

Div. I (#11 Battery) current at Time Step 52 = 61.54 Amps
Div. I (#11 Battery) voltage at Time Step 52 = 109.204 VDC

Div. II (#12 Battery) current at Time Step 53 = 57.95 Amps
Div. II (#12 Battery) voltage at Time Step 53 = 110.130 VDC

For the Div. I system, the current due to the emergency lighting load will be subtracted, as the emergency lights will switch off once AC power is restored to the holding coil for the DC contactor feeding Panel L40 (Reference 10.4) at the end of the SBO event.

Div. I Emergency Lighting current at Time Step 52 = 13.94 amps

Therefore:

Div. I post-SBO 125 VDC system load = 61.54 – 13.94 = 47.6 amps
(at a battery terminal voltage of 109.204 VDC)

Div. II post-SBO 125 VDC system load = 57.95 amps
(at a battery terminal voltage of 110.130 VDC)

4.5 For full-rated battery discharge, the system loads present during re-charge would be the same as the 125 VDC system loads under normal plant conditions. Per Operation's Logs (Reference 10.7), these normal loads are very consistent. Two separate months of data were reviewed and the highest load value selected for each Division (Attachment 03):

Div. I normal system load = 23 amps

Div. II normal system load = 24 amps

The loading recorded in the logs was very consistent. The panel ammeter has an accuracy of 1% of the 150 amps full scale range or +/- 1.5 amps (Reference 10.20). The current shunt has an accuracy of +/- 0.33% or 0.495 amps (References 10.20, 10.21 and Attachment 5). The ammeter scale has 2 amp graduations for a readability error of +/- 1 amp. Combining these errors statistically using a square-root-sum-of-squares method:

Total ammeter uncertainty = (1.5^2 + 0.495^2 + 1^2)^1/2 = 1.87 amps.

Therefore an uncertainty of +/- 2 amps will be considered to apply to the log readings.

For conservatism, the upper limit and lower limits on normal load will be adjusted by + or – 3 amps, giving normal load limits as follows:

Div. I minimum normal system load = 23 - 2 - 3 = 18 amps
Div. I maximum normal system load = 23 + 2 + 3 = 28 amps

Div. II minimum normal system load = 24 - 2 - 3 = 19 amps
Div. II maximum normal system load = 24 + 2 + 3 = 29 amps

## 5. ASSUMPTIONS

5.1 None

## 6. ANALYSIS

From IEEE 946-1985 (Reference 10.8), the battery charger sizing should be evaluated using the following formula:

$$A = \frac{1.1 \times AHR}{T} + L$$

A = Charger Rating
L = Station Load
AHR = Battery Discharge in Ampere Hours
T = Hours to Recharge
1.1 = Compensation for battery losses

No correction factors for altitude or temperature are needed for the chargers in use at Monticello as temperatures are less than 50 deg. C and altitude is less than 3300 feet.

When solved for time (T), equation 2.1 becomes:

$$T = \frac{1.1 \times AHR}{A - L}$$

## Division I Calculation (D10 or D40 re-charging #11 Battery)

**For a Station Blackout, design basis discharge event (DIV I):**

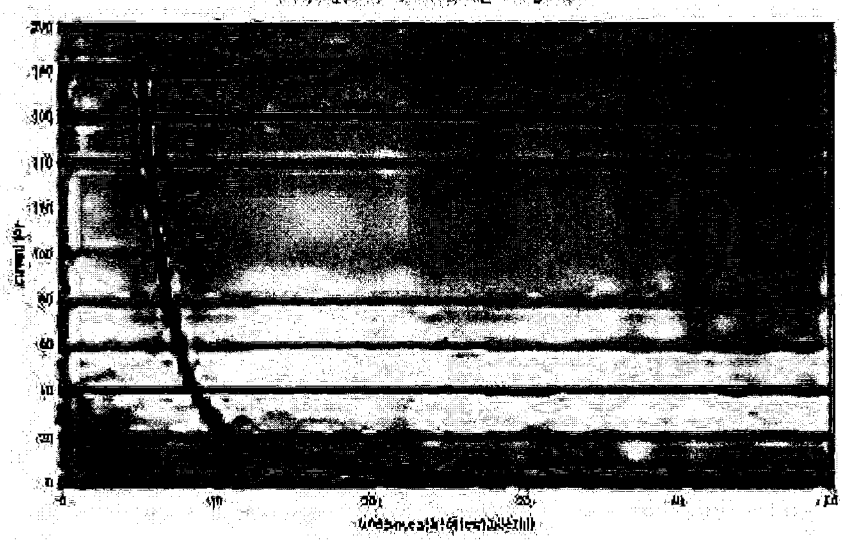
During re-charge following a station blackout event, the continuous load given in Input 4.4 will increase as voltage increases during re-charge. The load will be considered constant resistance for conservatism and adjusted for the maximum charger float voltage of 130.5 volts, as defined in procedure 4510-PM (Reference 10.19).

The 2004 version of IEEE-946 notes that the actual percent charge restored to a battery when using the given sizing equation is dependent on applied voltage. To ensure a 95% restored charge consistent with the standard, a charger voltage output in the equalizing range may be necessary. Per procedure 4510-PM, the maximum equalizing voltage for the 125 VDC chargers is 135.8 VDC, or 2.342 volts / cell. Note however, that during the current limited portion of the re-charge cycle (bulk phase) battery voltage rises over time to the charger setting. As an example of this charging response for lead acid batteries reference the following excerpts from C&D Batteries and NRC (References 10.22 and 10.23). At the onset of charging, battery voltage would be well below normal float voltage. The average current available for re-charging the battery would then be reduced as voltage rises, due to the corresponding increase in current to the system loads. The voltage rise can be conservatively

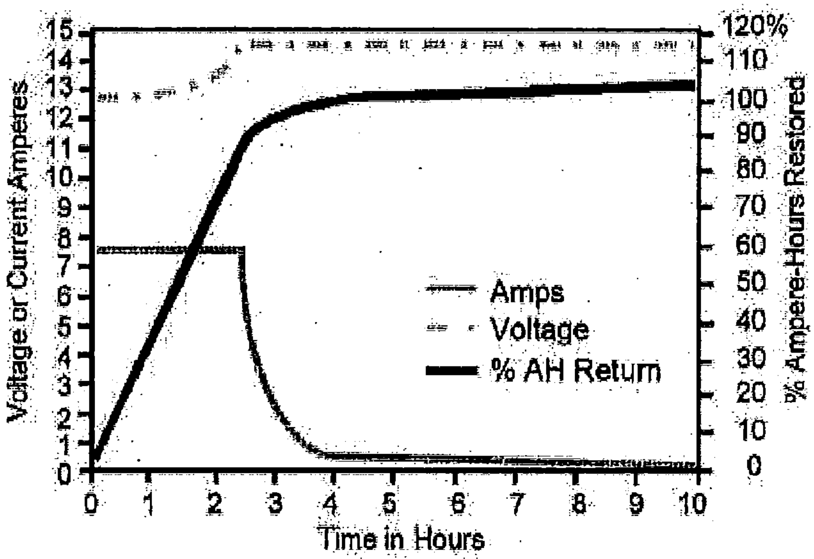
approximated as a linear change in voltage from the starting voltage at the onset of charging to the charger voltage setting at the end of the bulk phase when the charger comes out of current-limit. Assuming that system loads are entirely resistive would then result in a linear increase in current to the loads and a linear decrease in charging current to the battery during the bulk phase of the charging cycle (battery charger current-limited). Therefore the effective system load current rate during the bulk phase would be the average, of this linear increasing load. Note that at the end of the bulk phase the battery charger comes out of current limit and system loads no longer impact charging current. Calculating system loads at a maximum float voltage of 130.5 volts (2.25 volts/cell) and considering a maximum terminal voltage at the end of the bulk phase of 135.8 VDC (2.342 volts/cell) is conservative with respect to bulk phase charging if the time-average terminal voltage seen by the loads is <= 2.25 volts/cell equivalent. The terminal voltage at the onset of charging would have to be <= 2.158 volts/cell equivalent to ensure that the time-average terminal voltage seen by system loads during the bulk phase of charging is less than the 2.25 volts/cell assumed for load modelling. At the onset of charging, the battery voltage will be well below 2.158 volts/cell, which validates the use of the maximum float voltage for determination of system loads. The load determined considering maximum float voltage remains bounding with charging voltage up to the maximum equalize setting.

**Excerpt of Reference 10.22:**

Complete Recharge Cycle



**Excerpt of Reference 10.23:**




Adjusting system loads as discussed and applying the sizing equation gives:

L = 47.6 amps x 130.5 VDC / 109.204 VDC = 56.9 amps Input 4.4

A = 75 amps Input 4.1

AHR = 263.01 amp-hours Input 4.2

T = (1.1 x 263.01) / (75 – 56.9)

<u>T = 16.0 Hours (Div. I, re-charge after design basis Station Blackout event)</u>

**<u>For a full-rated battery discharge (DIV I):</u>**

The system load considered for calculating time for a recharge of the battery after a discharge of its rated capacity is taken from Operator logs of the battery charger output current during normal plant conditions.

L = 23 amps +/- 5 amps Input 4.5

A = 75 amps minimum Input 4.1
A= 82 amps maximum Input 4.1

AHR = 495 amp-hours maximum    Input 4.3
AHR = 488 amp-hour minimum    Input 4.3

Tmin = (1.1 x 488) / (82 - 18) = 8.3 hours
Tmax = (1.1 x 495) / (75 - 28) = 11.6 hours

T = 8.3 Hours to 11.6 Hours (Div. I, re-charge after full rated battery discharge)

## Division II Calculation (D20 or D40 re-charging #12 Battery)

**For a Station Blackout, design basis discharge event (Div II):**

During re-charge following a station blackout event, the continuous load given in Input 4.4 will increase as voltage increases during re-charge. The load given for the Div. II 125 VDC system can be conservatively considered constant-resistance and adjusted for a maximum charger float voltage of 130.5 volts, as defined in procedure 4510-PM (Reference 10.19). See the discussion for the Division I station blackout charging calculation for justification of the use of 130.5 volts for determination of system loads, even if the actual recharge is performed with the charger at a maximum equalize setting of 135.8 VDC.

L = 57.95 amps x 130.5 VDC / 110.130 VDC = 68.7 amps    Input 4.4

This is a large load and bounds the Div. I considered maximum recharge load by a wide margin. As a significant portion of the loading is due to constant power and constant current loads, a DCSDM software run of the Time Step 53 loads was executed with a battery node voltage of 130.5 VDC. The output report of this run is given in Attachment 4. The calculated load value of 60.25 amps from Attachment 4 will be used.

L = 60.25 amps    Attachment 4

A = 75 amps    Input 4.1

AHR = 240.49 amp-hours    Input 4.2

T = (1.1 x 240.49) / (75 – 60.25)

T = 18.0 Hours (Div. II, re-charge after design basis Station Blackout event)

**For a full-rated battery discharge (DIV II):**

The system load considered for calculating time for a recharge of the battery after a discharge of its rated capacity is taken from Operator logs of the battery charger output current during normal plant conditions.

L = 24 amps +/- 5 amps    Input 4.5

A = 75 amps minimum    Input 4.1
A= 82 amps maximum    Input 4.1

AHR = 495 amp-hours maximum    Input 4.3
AHR = 488 amp-hour minimum    Input 4.3

Tmin = (1.1 x 488) / (82 - 19)

Tmax = (1.1 x 495) / (75 - 29)

T = 8.5 Hours to 11.9 Hours (Div. II, re-charge after full rated battery discharge)

## 7.0 CONCLUSIONS

IEEE 946-1985 (Reference 10.8) recommends sizing battery chargers for an 8 to 12 hour re-charge time, considering a battery discharged to its full rating and normal DC system loading. The corresponding re-charge times calculated were:

Re-charge after full rated discharge with normal plant loads
Div. I, 8.3 to 11.6 hours
Div. II, 8.5 to 11.9 hours

These calculated times are within the IEEE 946-1985 recommended time range of 8 to 12 hours. The 125 VDC system loading range assumed incorporates tolerance for reading uncertainty and margin. Therefore the charger current limit settings are well-matched to the battery size considering system loads and in accordance with the standard.

IEEE 946 recommends that charger output current capacity exceed the combination of continuous system loads plus the largest combination of non-continuous loads that would be likely to occur simultaneously during normal operation. With continuous loads less than 30 amps and charger output current capability of 75 amps (minimum), more

than 45 amps is available for simultaneous non-continuous loads. During normal plant operation, additional non-continuous simultaneous loads are very unlikely to exceed 45 amps.

Recharge times were conservatively calculated for a design basis battery re-charge considering the continuous loads that would be present post-event:

Recharge after a Station Blackout, design basis discharge event:

Div. I, 16.0 hours
Div. II, 18.0 hours

The calculated times demonstrate that the each charger's sizing is adequate to supply the maximum combination of continuous loads present after a Station Blackout event and re-charge its battery in a reasonable time (to 95% capacity). The 125 VDC system loads assumed during recharge after the design basis event were conservatively adjusted to correspond to maximum float voltage for the entire recharge time period.

Note that AR #01131103 documented an issue with the 2nd method of determining acceptance for Tech Specs surveillance requirement SR 3.8.4.2, i.e. that the battery chargers can accomplish a re-charge in <= 8 hours after a design basis discharge event (SBO). AR # 01456839 formally documented this issue as a non-conservative Tech Specs surveillance requirement and established administrative limit for the 1st method of meeting SR 3.8.4.2. The administrative limit 125 VDC system battery charger output current was established as >= 75 amps.

The basis for the second method of SR 3.8.4.2 involves achieving re-charge of a battery after a service test with the maximum continuous load applied to the system that could be present regardless of plant conditions. The service test would essentially correspond to the design basis load profile modelled in the battery calculations for a station blackout event. The maximum continuous loads would be as determined in this calculation based on a review of the continuous loads applied at the end of this event. Thus, this calculation demonstrates that re-charge would occur in this case in reasonable time. However, this method of surveillance of the battery chargers would not be used at Monticello as battery testing is performed via a modified performance test, which of necessity discharges the battery to a greater degree than a service test. The most precise way to ensure the battery charger is capable of performing its design functions is to test it per the 1st method, thus ensuring it can supply adequate current at float voltage for a 4 hour time period.

Final resolution of the Tech Spec issue described in ARs 01131103 and 01456839 requires a permanent change to the 1st method of meeting SR 3.8.4.2. The criteria should be changed to >= 75 amps for 4 hours (as is presently administratively

controlled). It is recommended that 2nd method of meeting the surveillance be removed, as this test method is not used at Monticello. This calculation shows that a charger current of 75 amps is adequate to re-charge the 125 VDC batteries within a reasonable time after a design basis event and considering continuous post-event loads .

## 8.0 FUTURE NEEDS

AR # 01456839 tracks completion of a License Amendment Request for Technical Specifications SR 3.8.4.2. The first option should be changed to >= 75 amps, as is currently administratively controlled. The second option should be removed from Tech Specs as this test option would not be of practical use at Monticello. This calculation determines that a charger test to >= 75 amps for 4 hours demonstrates the ability to re-charge batteries after the limiting Station Blackout event in reasonable time, considering the largest combination of 125 VDC system steady state loads.

## 9.0 ATTACHMENTS

Attachment 01 - Excerpt of C&D Technologies, Publication 12-316, KCR-13 Lead-Calcium Standby Batteries

Attachment 02 – Spreadsheet showing total discharge amp-hours for Div. I and Div. II 125 VDC batteries based on SBO battery calc load profiles

Attachment 03 – Excerpt of 2010 Ops Log for D10, D20 charger output current, Sept. 2010, Jan. and June 2011

Attachment 04 – DCSDM software sizing report showing calculation 02-192 Time Step 53 loads at a battery node voltage of 130.5 VDC.

## 10.0 REFERENCES

10.1 Calculation CA-02-179, Div. I 125 Volt Battery Calculation, Rev. 3

10.2 Calculation CA-02-192, Div. II 125 Volt Battery Calculation, Rev. 3

10.3 IEEE Std. 485-1983, 'IEEE Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations'

10.4 B.09.14-02, Operations Manual, Lighting, Description of Equipment, Rev. 1

10.5 C&D Technologies, Publication 12-316, KCR-13 Lead-Calcium Standby Batteries (see Attachment 01 for excerpt)

10.6 B.09.10-02, Operations Manual, 125 VDC System, Description of Equipment, Rev. 9

10.7 Operator rounds records, Turbine Building East (2010), excerpts from December, 2014 and July, 2015 included as Attachment 03.

10.8 IEEE Std. 946-1985, 'IEEE Recommended Practice for the Design of Safety-Related DC Auxiliary Power Systems for Nuclear Power Generating Stations'

10.9 IEEE Std. 946-2004, 'IEEE Recommended Practice for the Design of DC Auxiliary Power Systems for Generating Stations'

10.10 4066-PM, D10 Battery Charger Preventive Maintenance, Rev. 3

10.11 4075-PM, D20 Battery Charger Preventive Maintenance, Rev. 3

10.12 4078-PM, D40 Battery Charger Preventive Maintenance, Rev. 5

10.13 EC 720, Replace DIV. I 125 VDC Battery Charger D10

10.14 EC 12877, Replace Div. II 125 VDC Battery Charger D20

10.15 EC 13284, Replace 125 VDC Battery Swing Charger D40

10.15 AR # 01131103, ITS 125VDC charger SR 3.8.4.2-Option 2 unachievable

10.16 AR # 01456839, TS SR 3.8.4.2 Non Conservative for the 125 VDC Chargers

10.17 USAR-08.05, Plant Electrical Systems, Rev. 30

10.18 EPRI Power Plant Electrical Reference Series, Volume 9, EC Distribution System, Copyright 1987

10.19 4510-PM, Maintenance of On-Site Batteries and Battery Chargers at Monticello Nuclear Plant, rev. 35

10.20 NX-9173-19, C & D Battery Chargers (D10,D20,D40) NLI Model: ARR130K100F-MOD, rev. 1

10.21 Rammeter website page showing F150A50 current shunt accuracy (Attachment 5)

10.22 NUREG/CR-7148, Confirmatory Battery Testing: The Use of Float Current Monitoring to Determine Battery State-of-Charge, published November 2012

10.23 C&D Technologies Technical Bulletin 41-2128, Charging Valve Regulated Lead Acid Batteries

10.24 CAP AR # 01474466, DCSDM Software Issue, initiated 04-14-15

10.25 EC 25634, Monticello 125V #11 Battery Modified Performance Test Profile

10.26 EC 25511, Monticello 125V #12 Battery Modified Performance Test Profile

**Attachment 01** - KCR-13 Battery Ratings: Excerpt of C&D Technologies, Publication 12-316, KCR-13 Lead-Calcium Standby Batteries: Excerpt of 02-192, MNGP 125 Volt Div. II Battery Calculation — page 1 of 2

C&D TECHNOLOGIES Power Solutions — C&D® FLOODED — SG&C

Excerpt of C&D Technologies
Doc. 12-316, 2007

## RATINGS TABLE: AMPERES

| Final Volts | Models | Nominal AH Rating | *Nominal Rates @ 77°F (25°C) in 1.215 Nominal SG (includes connector voltage drop). Amperes | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | | 8 hr | 4 hr | 3 hr | 1.5 hr | 1 hr | 30 min | 15 min | 1 min |
| 1.75 | KCR/KAR-5 | 200 | 25 | 41 | 50 | 77 | 94 | 128 | 165 | 243 |
| | KCR/KAR-7 | 250 | 31 | 53 | 65 | 101 | 126 | 173 | 221 | 309 |
| | KCR/KAR-9 | 330 | 41 | 71 | 87 | 135 | 168 | 231 | 294 | 412 |
| | KCR/KAR-11 | 410 | 52 | 88 | 108 | 166 | 206 | 284 | 364 | 508 |
| | KCR/KAR-13 | 495 | 61 | 106 | 131 | 204 | 254 | 351 | 450 | 655 |
| | KCR/KAR-15 | 577 | 72 | 124 | 152 | 237 | 297 | 411 | 532 | 797 |
| | KCR/KAR-17 | 660 | 82 | 142 | 174 | 272 | 340 | 470 | 604 | 871 |
| | KCR/KAR-19 | 742 | 92 | 159 | 195 | 303 | 378 | 520 | 664 | 949 |
| | KCR/KAR-21 | 825 | 103 | 176 | 216 | 332 | 413 | 567 | 728 | 1028 |
| 1.78 | KCR/KAR-5 | 194 | 24 | 41 | 49 | 74 | 91 | 122 | 154 | 213 |
| | KCR/KAR-7 | 239 | 30 | 51 | 62 | 95 | 117 | 158 | 198 | 264 |
| | KCR/KAR-9 | 319 | 40 | 68 | 83 | 126 | 156 | 211 | 264 | 353 |
| | KCR/KAR-11 | 401 | 50 | 84 | 102 | 155 | 191 | 260 | 327 | 435 |
| | KCR/KAR-13 | 479 | 60 | 102 | 124 | 191 | 236 | 320 | 404 | 560 |
| | KCR/KAR-15 | 558 | 70 | 119 | 145 | 222 | 275 | 375 | 477 | 682 |
| | KCR/KAR-17 | 637 | 80 | 136 | 166 | 254 | 315 | 429 | 542 | 746 |
| | KCR/KAR-19 | 718 | 90 | 152 | 186 | 289 | 350 | 474 | 596 | 812 |
| | KCR/KAR-21 | 802 | 100 | 169 | 205 | 310 | 382 | 518 | 653 | 891 |
| 1.81 | KCR/KAR-5 | 190 | 24 | 39 | 48 | 71 | 86 | 114 | 140 | 183 |
| | KCR/KAR-7 | 231 | 29 | 49 | 59 | 88 | 108 | 143 | 175 | 221 |
| | KCR/KAR-9 | 310 | 39 | 65 | 78 | 117 | 144 | 191 | 233 | 294 |
| | KCR/KAR-11 | 390 | 49 | 80 | 97 | 145 | 177 | 235 | 289 | 364 |
| | KCR/KAR-13 | 464 | 58 | 97 | 118 | 178 | 218 | 290 | 357 | 467 |
| | KCR/KAR-15 | 541 | 68 | 114 | 138 | 207 | 254 | 339 | 422 | 569 |
| | KCR/KAR-17 | 618 | 77 | 130 | 157 | 237 | 291 | 388 | 479 | 621 |
| | KCR/KAR-19 | 698 | 87 | 146 | 176 | 264 | 323 | 429 | 527 | 677 |
| | KCR/KAR-21 | 778 | 97 | 161 | 194 | 289 | 353 | 469 | 577 | 736 |

*Data based on discharge directly from a 72-hour float condition per IEEE-450 procedures.

**Attachment 01** - KCR-13 Battery Ratings: Excerpt of C&D Technologies, Publication 12-316, KCR-13 Lead-Calcium Standby Batteries: Excerpt of 02-192, MNGP 125 Volt Div. II Battery Calculation page 2 of 2

C&D TECHNOLOGIES

Excerpt of 02-192, rev. 3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(215) 619-2700
FAX: (215) 619-7840


Rating Table

KCR - Amperes
Final Voltage 1.75 vDC - at 77.0 °F

| | 1 min | 5 min | 10 min | 15 min | 20 min | 30 min | 45 min | 1 hr | 2 hr | 3 hr | 4 hr | 5 hr | 6 hr | 8 hr | 10 hr | 12 hr | 16 hr | 20 hr | 24 hr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KCR-5 | 243.1 | 213.2 | 184.7 | 164.5 | 149.4 | 128.3 | 108.0 | 94.3 | 64.9 | 50.4 | 41.4 | 35.3 | 30.8 | 24.6 | 20.5 | 17.5 | 13.7 | 11.2 | 9.5 |
| KCR-7 | 308.8 | 277.0 | 245.2 | 220.7 | 201.4 | 173.2 | 145.1 | 126.0 | 84.9 | 65.1 | 53.0 | 44.8 | 38.9 | 30.8 | 25.5 | 21.8 | 16.9 | 13.8 | 11.6 |
| KCR-9 | 411.7 | 369.4 | 326.9 | 294.2 | 268.6 | 230.9 | 193.4 | 168.0 | 113.2 | 86.7 | 70.7 | 59.7 | 51.8 | 41.0 | 34.0 | 29.0 | 22.5 | 18.3 | 15.5 |
| KCR-11 | 508.0 | 458.0 | 405.4 | 364.0 | 331.5 | 284.1 | 237.7 | 206.4 | 139.8 | 107.6 | 87.9 | 74.6 | 64.8 | 51.5 | 42.8 | 36.6 | 28.4 | 23.2 | 19.6 |
| KCR-13 | 654.6 | 576.6 | 503.6 | 450.2 | 409.6 | 350.9 | 293.3 | 254.4 | 170.9 | 130.6 | 106.2 | 89.7 | 77.7 | 61.4 | 50.8 | 43.4 | 33.5 | 27.4 | 23.1 |
| KCR-15 | 797.4 | 693.4 | 598.7 | 531.7 | 481.8 | 411.1 | 342.8 | 396.9 | 199.3 | 152.3 | 123.9 | 104.6 | 90.7 | 71.7 | 59.3 | 50.6 | 39.2 | 31.9 | 27.0 |
| KCR-17 | 870.9 | 771.1 | 675.0 | 603.6 | 548.8 | 469.7 | 392.1 | 339.8 | 228.0 | 174.2 | 141.6 | 119.6 | 103.6 | 81.9 | 67.7 | 57.8 | 44.7 | 36.5 | 30.8 |
| KCR-19 | 948.7 | 843.1 | 740.7 | 664.2 | 605.2 | 519.5 | 435.0 | 377.7 | 254.8 | 195.2 | 159.0 | 134.4 | 116.6 | 92.3 | 76.5 | 65.3 | 50.6 | 41.3 | 34.9 |
| KCR-21 | 1,028.3 | 921.7 | 812.0 | 727.6 | 662.1 | 567.3 | 474.7 | 412.5 | 279.6 | 215.1 | 175.9 | 149.1 | 129.6 | 103.0 | 85.5 | 73.1 | 56.8 | 46.4 | 39.3 |

All critical calculations must be verified with C&D applications.
Specifications are subject to change without notice.

**Attachment 02** – Spreadsheets showing total discharge amp-hours for Div. I and Div. II 125 VDC batteries based on SBO battery Calc. load profiles (from calc. sizing worksheets)



| | Div. I Battery SBO Discharge | | |
|---|---|---|---|
| Time Step | Duration (minutes) | Div. I Batt. Current (Amps) | Div I Batt. Dischrg (Amp-Hours) |
| 1 | 1.00 | 149.03 | 2.483833 |
| 2 | 1.00 | 77.79 | 1.296500 |
| 3 | 27.00 | 77.63 | 34.933500 |
| 4 | 1.00 | 83.21 | 1.386833 |
| 5 | 29.00 | 64.75 | 31.295833 |
| 6 | 1.00 | 65.42 | 1.090333 |
| 7 | 30.00 | 64.67 | 32.335000 |
| 8 | 29.00 | 62.11 | 30.019833 |
| 9 | 1.00 | 127.75 | 2.129167 |
| 10 | 30.00 | 62.12 | 31.060000 |
| 11 | 1.00 | 67.24 * | 1.120667 |
| 12 | 1.00 | 110.52 | 1.842000 |
| 13 | 28.00 | 61.87 | 28.872667 |
| 14 | 30.00 | 61.72 | 30.860000 |
| 15 | 28.00 | 61.54 | 28.718667 |
| 16 | 1.00 | 105.58 | 1.759667 |
| 17 | 1.00 | 108.22 | 1.803667 |
| * Time Step 11 value increased per CAP AR # 01474466 (see EC 25634) | | | |
| Total Duration = | | 240.00 | minutes |
| Total Discharge = | | 263.01 | amp-hours |

**Attachment 02** – Spreadsheets showing total discharge amp-hours for Div. I and Div. II 125 VDC batteries based on SBO battery Calc. load profiles (from calc. sizing worksheets) 

| | Div. II Battery SBO Discharge | | |
|---|---|---|---|
| **Time Step** | **Duration (minutes)** | **Div. II Batt. Current (Amps)** | **Div I Batt. Dischrg (Amp-Hours)** |
| 1 | 1.0 | 130.47 | 2.174500 |
| 2 | 1.0 | 62.98 | 1.049667 |
| 3 | 27.0 | 62.93 | 28.318500 |
| 4 | 1.0 | 68.22 | 1.137000 |
| 5 | 29.0 | 59.44 | 28.729333 |
| 6 | 1.0 | 59.44 | 0.990667 |
| 7 | 30.0 | 59.38 | 29.690000 |
| 8 | 29.0 | 58.89 | 28.463500 |
| 9 | 1.0 | 124.24 * | 2.070667 |
| 10 | 30.0 | 58.12 | 29.060000 |
| 11 | 1.0 | 63.29 | 1.054833 |
| 12 | 1.0 | 107.12 | 1.785333 |
| 13 | 28.0 | 58.05 | 27.090000 |
| 14 | 30.0 | 58.01 | 29.005000 |
| 15 | 15.0 | 57.98 | 14.495000 |
| 16 | 13.0 | 57.95 | 12.555833 |
| 17 | 1.0 | 63.11 | 1.051833 |
| 18 | 1.0 | 105.86 | 1.764333 |

*** Time Step 9 value increased per CAP AR #01474466 (see EC 25511)**

| | | | |
|---|---|---|---|
| **Total Duration =** | | **240.00** | **minutes** |
| **Total Discharge =** | | **240.49** | **amp-hours** |

**Attachment 03** – Excerpt of 2010 Ops Log for D10, D20 charger output current, Dec. 2014 and July, 2015 page 1 of 8

Turbine Building East (2010) OWI-02.03 Operator Rounds

125VDC CHARGER FOR #12 BATTERY CURRENT Normal = 20 Amps

D20 Max: 50 Units: Amps BATTERIES Seq: 11 Rec: 39

| | | | |
|---|---|---|---|
| 12/31/2014 | 2000 | 24 | Petersen, Gary |
| 12/31/2014 | 0800 | 24 | Casey, Joe |
| 12/30/2014 | 2000 | 24 | Petersen, Gary |
| 12/30/2014 | 0800 | 24 | Casey, Joe |
| 12/29/2014 | 2000 | 24 | Petersen, Gary |
| 12/29/2014 | 0800 | 24 | Casey, Joe |
| 12/28/2014 | 2000 | 24 | Schaiber, James |
| 12/28/2014 | 0800 | 24 | Ramaley, Mike |
| 12/27/2014 | 2000 | 24 | Schaiber, James |
| 12/27/2014 | 0800 | 24 | Ramaley, Mike |
| 12/26/2014 | 2000 | 24 | Schaiber, James |
| 12/26/2014 | 0800 | 24 | Ramaley, Mike |
| 12/25/2014 | 2000 | 24 | Schaiber, James |
| 12/25/2014 | 0800 | 24 | Ramaley, Mike |
| 12/24/2014 | 2000 | 24 | Patterson, Scott |
| 12/24/2014 | 0800 | 24 | Klekow, Lonny |
| 12/23/2014 | 2000 | 24 | Patterson, Scott |
| 12/23/2014 | 0800 | 24 | Klekow, Lonny |
| 12/22/2014 | 2000 | 24 | Patterson, Scott |
| 12/22/2014 | 0800 | 24 | Klekow, Lonny |
| 12/21/2014 | 2000 | 24 | Gustafson, Stanley |
| 12/21/2014 | 0800 | 24 | Lawrence, Bill |
| 12/20/2014 | 2000 | 24 | Patterson, Scott |
| 12/20/2014 | 0800 | 24 | Lawrence, Bill |
| 12/19/2014 | 2000 | 24 | Kothenbeutel, Rick |
| 12/19/2014 | 0800 | 24 | Lawrence, Bill |
| 12/18/2014 | 2000 | 24 | Kothenbeutel, Rick |
| 12/18/2014 | 0800 | 24 | Lawrence, Bill |
| 12/17/2014 | 2000 | 24 | Casey, Joe |
| 12/17/2014 | 0800 | 24 | Heinks, Jeffrey |
| 12/16/2014 | 2000 | 24 | Casey, Joe |
| 12/16/2014 | 0800 | 24 | Heinks, Jeffrey |
| 12/15/2014 | 2000 | 24 | Casey, Joe |
| 12/15/2014 | 0800 | 24 | Heinks, Jeffrey |
| 12/14/2014 | 2000 | 24 | Brokch, Cory |
| 12/14/2014 | 0800 | 24 | Petersen, Gary |
| 12/13/2014 | 2000 | 24 | Noble, Matthew |
| 12/13/2014 | 0800 | 24 | Petersen, Gary |
| 12/12/2014 | 2000 | 24 | Brokch, Cory |
| 12/12/2014 | 0800 | 24 | Petersen, Gary |
| 12/11/2014 | 2000 | 24 | Brokch, Cory |
| 12/11/2014 | 0800 | 24 | Petersen, Gary |
| 12/10/2014 | 2000 | 24 | Albold, Nic |
| 12/10/2014 | 0800 | 24 | Bisila, David |
| 12/09/2014 | 2000 | 24 | Albold, Nic |
| 12/09/2014 | 0800 | 24 | Ramaley, Mike |
| 12/08/2014 | 2000 | 24 | Albold, Nic |
| 12/08/2014 | 0800 | 24 | Patterson, Scott |
| 12/07/2014 | 2000 | 24 | Noble, Matthew |
| 12/07/2014 | 0800 | 24 | Patterson, Scott |
| 12/06/2014 | 2000 | 24 | Casey, Joe |
| 12/06/2014 | 0800 | 24 | Patterson, Scott |
| 12/05/2014 | 2000 | 24 | Casey, Joe |
| 12/05/2014 | 0800 | 24 | Patterson, Scott |
| 12/04/2014 | 2000 | 24 | Casey, Joe |
| 12/04/2014 | 0800 | 24 | Patterson, Scott |
| 12/03/2014 | 2000 | 24 | Kothenbeutel, Rick |
| 12/03/2014 | 0800 | 24 | Smeby, Lee |

**Attachment 03** – Excerpt of 2010 Ops Log for D10, D20 charger output current, Dec. 2014 and July, 2015 page 2 of 8

**Turbine Building East (2010)** **OWI-02.03 Operator Rounds**

| | | | | |
|---|---|---|---|---|
| **125VDC CHARGER FOR #12 BATTERY CURRENT** | | | Normal = 20 Amps | |
| D20 | | Max: 50 Units: Amps | BATTERIES | Seq: 11 Rec: 39 |
| 12/02/2014 2000 | 24 | Kothenbeutel, Rick | | |
| 12/02/2014 0800 | ISOLATED | Smeby, Lee | | |
| 12/01/2014 2000 | ISOLATED | Kothenbeutel, Rick | | |
| 12/01/2014 0800 | 24 | Smeby, Lee | | |
| **D-20 NEG TO GROUND VOLT** | | | Normal = 65V | |
| D20 | | Min: 60 Units: Volts | BATTERIES | Seq: 12 Rec: 40 |
| 12/31/2014 2000 | 66 | Petersen, Gary | | |
| 12/31/2014 0800 | 66 | Casey, Joe | | |
| 12/30/2014 2000 | 66 | Petersen, Gary | | |
| 12/30/2014 0800 | 67 | Casey, Joe | | |
| 12/29/2014 2000 | 67 | Petersen, Gary | | |
| 12/29/2014 0800 | 67 | Casey, Joe | | |
| 12/28/2014 2000 | 66 | Scharber, James | | |
| 12/28/2014 0800 | 66 | Ramaley, Mike | | |
| 12/27/2014 2000 | 66 | Scharber, James | | |
| 12/27/2014 0800 | 66 | Ramaley, Mike | | |
| 12/26/2014 2000 | 66 | Scharber, James | | |
| 12/26/2014 0800 | 66 | Ramaley, Mike | | |
| 12/25/2014 2000 | 66 | Scharber, James | | |
| 12/25/2014 0800 | 66 | Ramaley, Mike | | |
| 12/24/2014 2000 | 67 | Patterson, Scott | | |
| 12/24/2014 0800 | 67 | Klekow, Lonny | | |
| 12/23/2014 2000 | 67 | Patterson, Scott | | |
| 12/23/2014 0800 | 67 | Klekow, Lonny | | |
| 12/22/2014 2000 | 67 | Patterson, Scott | | |
| 12/22/2014 0800 | 67 | Klekow, Lonny | | |
| 12/21/2014 2000 | 67 | Gustafson, Stanley | | |
| 12/21/2014 0800 | 67 | Lawrence, Bill | | |
| 12/20/2014 2000 | 67 | Patterson, Scott | | |
| 12/20/2014 0800 | 67 | Lawrence, Bill | | |
| 12/19/2014 2000 | 67 | Kothenbeutel, Rick | | |
| 12/19/2014 0800 | 67 | Lawrence, Bill | | |
| 12/18/2014 2000 | 67 | Kothenbeutel, Rick | | |
| 12/18/2014 0800 | 67 | Lawrence, Bill | | |
| 12/17/2014 2000 | 67 | Casey, Joe | | |
| 12/17/2014 0800 | 67 | Heinks, Jeffrey | | |
| 12/16/2014 2000 | 67 | Casey, Joe | | |
| 12/16/2014 0800 | 67 | Heinks, Jeffrey | | |
| 12/15/2014 2000 | 67 | Casey, Joe | | |
| 12/15/2014 0800 | 66 | Heinks, Jeffrey | | |
| 12/14/2014 2000 | 66 | Brokh, Cory | | |
| 12/14/2014 0800 | 66 | Petersen, Gary | | |
| 12/13/2014 2000 | 67 | Noble, Matthew | | |
| 12/13/2014 0800 | 67 | Petersen, Gary | | |
| 12/12/2014 2000 | 67 | Brokh, Cory | | |
| 12/12/2014 0800 | 67 | Petersen, Gary | | |
| 12/11/2014 2000 | 67 | Brokh, Cory | | |
| 12/11/2014 0800 | 66 | Petersen, Gary | | |
| 12/10/2014 2000 | 66 | Albold, Nic | | |
| 12/10/2014 0800 | 66 | Bisila, David | | |
| 12/09/2014 2000 | 67 | Albold, Nic | | |
| 12/09/2014 0800 | 66 | Ramaley, Mike | | |
| 12/08/2014 2000 | 67 | Albold, Nic | | |
| 12/08/2014 0800 | <u>57</u> | Patterson, Scott | Notified CRS. AR 01458586 WR 001669 | |
| 12/07/2014 2000 | <u>57</u> | Noble, Matthew | Notified CRS. AR 01458586 WR 001669 | |
| 12/07/2014 0800 | <u>57</u> | Patterson, Scott | Notified CRS. AR 01458586 WR 001669 | |
| 12/06/2014 2000 | <u>57</u> | Casey, Joe | Notified CRS. AR 01458586 WR 001669 | |
| 12/06/2014 0800 | 66 | Patterson, Scott | | |

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**Attachment 03** – Excerpt of 2010 Ops Log for D10, D20 charger output current, Dec. 2014 and July, 2015 page 3 of 8

**Turbine Building East (2010)** **OWI-02.03 Operator Rounds**

**D-10 VOLTAGE-FLOAT #11 BATTERY** Normal = 130V

D10 Min: 128 Max: 132 Units: Volts BATTERIES Seq: 38 Rec: 29

| | | | |
|---|---|---|---|
| 12/26/2014 | 0800 | 131 | Ramaley, Mike |
| 12/25/2014 | 2000 | 131 | Schauber, James |
| 12/25/2014 | 0800 | 131 | Ramaley, Mike |
| 12/24/2014 | 2000 | 131 | Patterson, Scott |
| 12/24/2014 | 0800 | 131 | Klekow, Lonny |
| 12/23/2014 | 2000 | 131 | Patterson, Scott |
| 12/23/2014 | 0800 | 131 | Klekow, Lonny |
| 12/22/2014 | 2000 | 131 | Patterson, Scott |
| 12/22/2014 | 0800 | 131 | Klekow, Lonny |
| 12/21/2014 | 2000 | 131 | Gustafson, Stanley |
| 12/21/2014 | 0800 | 131 | Lawrence, Bill |
| 12/20/2014 | 2000 | 131 | Patterson, Scott |
| 12/20/2014 | 0800 | 131 | Lawrence, Bill |
| 12/19/2014 | 2000 | 131 | Kothenbeutel, Rick |
| 12/19/2014 | 0800 | 131 | Lawrence, Bill |
| 12/18/2014 | 2000 | 131 | Kothenbeutel, Rick |
| 12/18/2014 | 0800 | 131 | Lawrence, Bill |
| 12/17/2014 | 2000 | 131 | Casey, Joe |
| 12/17/2014 | 0800 | 131 | Heinks, Jeffrey |
| 12/16/2014 | 2000 | 131 | Casey, Joe |
| 12/16/2014 | 0800 | 131 | Heinks, Jeffrey |
| 12/15/2014 | 2000 | 131 | Casey, Joe |
| 12/15/2014 | 0800 | 131 | Heinks, Jeffrey |
| 12/14/2014 | 2000 | 130 | Broich, Cory |
| 12/14/2014 | 0800 | 131 | Petersen, Gary |
| 12/13/2014 | 2000 | 131 | Noble, Matthew |
| 12/13/2014 | 0800 | 131 | Petersen, Gary |
| 12/12/2014 | 2000 | 131 | Broich, Cory |
| 12/12/2014 | 0800 | 131 | Petersen, Gary |
| 12/11/2014 | 2000 | 130 | Broich, Cory |
| 12/11/2014 | 0800 | 131 | Petersen, Gary |
| 12/10/2014 | 2000 | 131 | Altobl, Nic |
| 12/10/2014 | 0800 | 131 | Bisila, David |
| 12/09/2014 | 2000 | 131 | Altobl, Nic |
| 12/09/2014 | 0800 | 131 | Ramaley, Mike |
| 12/08/2014 | 2000 | 131 | Altobl, Nic |
| 12/08/2014 | 0800 | 131 | Patterson, Scott |
| 12/07/2014 | 2000 | 131 | Noble, Matthew |
| 12/07/2014 | 0800 | 131 | Patterson, Scott |
| 12/06/2014 | 2000 | 131 | Casey, Joe |
| 12/06/2014 | 0800 | 131 | Patterson, Scott |
| 12/05/2014 | 2000 | 131 | Casey, Joe |
| 12/05/2014 | 0800 | 131 | Patterson, Scott |
| 12/04/2014 | 2000 | 131 | Casey, Joe |
| 12/04/2014 | 0800 | 131 | Patterson, Scott |
| 12/03/2014 | 2000 | 131 | Kothenbeutel, Rick |
| 12/03/2014 | 0800 | 131 | Smeby, Lee |
| 12/02/2014 | 2000 | 131 | Kothenbeutel, Rick |
| 12/02/2014 | 0800 | 131 | Smeby, Lee |
| 12/01/2014 | 2000 | 131 | Kothenbeutel, Rick |
| 12/01/2014 | 0800 | 131 | Smeby, Lee |

**125VDC CHARGER FOR #11 BATTERY CURRENT** Normal = 25 Amps

D10 Max: 50 Units: Amps BATTERIES Seq: 39 Rec: 30

| | | | |
|---|---|---|---|
| 12/31/2014 | 2000 | 23 | Petersen, Gary |
| 12/31/2014 | 0800 | 23 | Casey, Joe |
| 12/30/2014 | 2000 | 23 | Petersen, Gary |
| 12/30/2014 | 0800 | 23 | Casey, Joe |
| 12/29/2014 | 2000 | 23 | Petersen, Gary |

**Attachment 03** – Excerpt of 2010 Ops Log for D10, D20 charger output current, Dec. 2014 and July, 2015 page 4 of 8

Turbine Building East (2010) OWI-02.03 Operator Rounds

125VDC CHARGER FOR #11 BATTERY CURRENT Normal = 25 Amps

D10 Max: 50 Units: Amps BATTERIES Seq: 39 Rec: 30

| | | | |
|---|---|---|---|
| 12/29/2014 | 0800 | 23 | Casey, Joe |
| 12/28/2014 | 2000 | 23 | Scharber, James |
| 12/28/2014 | 0800 | 23 | Ramaley, Mike |
| 12/27/2014 | 2000 | 23 | Scharber, James |
| 12/27/2014 | 0800 | 23 | Ramaley, Mike |
| 12/26/2014 | 2000 | 23 | Scharber, James |
| 12/26/2014 | 0800 | 23 | Ramaley, Mike |
| 12/25/2014 | 2000 | 23 | Scharber, James |
| 12/25/2014 | 0800 | 23 | Ramaley, Mike |
| 12/24/2014 | 2000 | 23 | Patterson, Scott |
| 12/24/2014 | 0800 | 23 | Klekow, Lonny |
| 12/23/2014 | 2000 | 23 | Patterson, Scott |
| 12/23/2014 | 0800 | 23 | Klekow, Lonny |
| 12/22/2014 | 2000 | 23 | Patterson, Scott |
| 12/22/2014 | 0800 | 23 | Klekow, Lonny |
| 12/21/2014 | 2000 | 23 | Gustafson, Stanley |
| 12/21/2014 | 0800 | 23 | Lawrence, Bill |
| 12/20/2014 | 2000 | 23 | Patterson, Scott |
| 12/20/2014 | 0800 | 23 | Lawrence, Bill |
| 12/19/2014 | 2000 | 23 | Kothenbeutel, Rick |
| 12/19/2014 | 0800 | 23 | Lawrence, Bill |
| 12/18/2014 | 2000 | 23 | Kothenbeutel, Rick |
| 12/18/2014 | 0800 | 23 | Lawrence, Bill |
| 12/17/2014 | 2000 | 23 | Casey, Joe |
| 12/17/2014 | 0800 | 23 | Heinks, Jeffrey |
| 12/16/2014 | 2000 | 23 | Casey, Joe |
| 12/16/2014 | 0800 | 23 | Heinks, Jeffrey |
| 12/15/2014 | 2000 | 23 | Casey, Joe |
| 12/15/2014 | 0800 | 23 | Heinks, Jeffrey |
| 12/14/2014 | 2000 | 23 | Brokh, Cory |
| 12/14/2014 | 0800 | 23 | Petersen, Gary |
| 12/13/2014 | 2000 | 23 | Noble, Matthew |
| 12/13/2014 | 0800 | 23 | Petersen, Gary |
| 12/12/2014 | 2000 | 23 | Brokh, Cory |
| 12/12/2014 | 0800 | 23 | Petersen, Gary |
| 12/11/2014 | 2000 | 23 | Brokh, Cory |
| 12/11/2014 | 0800 | 23 | Petersen, Gary |
| 12/10/2014 | 2000 | 23 | Albold, Nic |
| 12/10/2014 | 0800 | 23 | Bisila, David |
| 12/09/2014 | 2000 | 23 | Albold, Nic |
| 12/09/2014 | 0800 | 23 | Ramaley, Mike |
| 12/08/2014 | 2000 | 23 | Albold, Nic |
| 12/08/2014 | 0800 | 23 | Patterson, Scott |
| 12/07/2014 | 2000 | 23 | Noble, Matthew |
| 12/07/2014 | 0800 | 23 | Patterson, Scott |
| 12/06/2014 | 2000 | 23 | Casey, Joe |
| 12/06/2014 | 0800 | 23 | Patterson, Scott |
| 12/05/2014 | 2000 | 23 | Casey, Joe |
| 12/05/2014 | 0800 | 23 | Patterson, Scott |
| 12/04/2014 | 2000 | 23 | Casey, Joe |
| 12/04/2014 | 0800 | 23 | Patterson, Scott |
| 12/03/2014 | 2000 | 23 | Kothenbeutel, Rick |
| 12/03/2014 | 0800 | 23 | Smeby, Lee |
| 12/02/2014 | 2000 | 23 | Kothenbeutel, Rick |
| 12/02/2014 | 0800 | 23 | Smeby, Lee |
| 12/01/2014 | 2000 | 23 | Kothenbeutel, Rick |
| 12/01/2014 | 0800 | 23 | Smeby, Lee |

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**Attachment 03** – Excerpt of 2010 Ops Log for D10, D20 charger output current, Dec. 2014 and July, 2015 page 5 of 8

Turbine Building East (2010) OWI-02.03 Operator Rounds

**D-20 VOLTAGE-FLOAT #12 BATTERY**

| D20 | | Min: 130.5 Max: 134.5 Units: Volts | | BATTERIES | Seq: 11 | Rec: 30 |
|---|---|---|---|---|---|---|
| 07/02/2015 | 2000 | 133 | Casey, Joe | | | |
| 07/02/2015 | 0800 | 133 | Broich, Cory | | | |
| 07/01/2015 | 2000 | 133 | West, Alex | | | |
| 07/01/2015 | 0800 | 133 | Petersen, Gary | | | |

**125VDC CHARGER FOR #12 BATTERY CURRENT** Normal = 20 Amps

| D20 | | Max: 50 Units: Amps | | BATTERIES | Seq: 12 | Rec: 39 |
|---|---|---|---|---|---|---|
| 07/31/2015 | 2000 | 24 | Ramaley, Mike | | | |
| 07/31/2015 | 0800 | 24 | Kovanen, Quinten | | | |
| 07/30/2015 | 2000 | 24 | Kovanen, Quinten | | | |
| 07/30/2015 | 0800 | 24 | Kovanen, Quinten | | | |
| 07/29/2015 | 2000 | 24 | Petersen, Gary | | | |
| 07/29/2015 | 0800 | 24 | Casey, Joe | | | |
| 07/28/2015 | 2000 | 24 | Petersen, Gary | | | |
| 07/28/2015 | 0800 | 24 | Casey, Joe | | | |
| 07/27/2015 | 2000 | 24 | Petersen, Gary | | | |
| 07/27/2015 | 0800 | 24 | Casey, Joe | | | |
| 07/26/2015 | 2000 | 24 | Kranz, Neil B | | | |
| 07/26/2015 | 0800 | 24 | Karkhoff, Corey | | | |
| 07/25/2015 | 2000 | 24 | Kranz, Neil B | | | |
| 07/25/2015 | 0800 | 24 | Karkhoff, Corey | | | |
| 07/24/2015 | 2000 | 24 | Kranz, Neil B | | | |
| 07/24/2015 | 0800 | 24 | Karkhoff, Corey | | | |
| 07/23/2015 | 2000 | 24 | Kranz, Neil B | | | |
| 07/23/2015 | 0800 | 24 | Karkhoff, Corey | | | |
| 07/22/2015 | 2000 | 24 | Patterson, Scott | | | |
| 07/22/2015 | 0800 | 24 | Albold, Nic | | | |
| 07/21/2015 | 2000 | 24 | Patterson, Scott | | | |
| 07/21/2015 | 0800 | 24 | Albold, Nic | | | |
| 07/20/2015 | 2000 | 24 | Patterson, Scott | | | |
| 07/20/2015 | 0800 | 24 | Albold, Nic | | | |
| 07/19/2015 | 2000 | 24 | Patterson, Scott | | | |
| 07/19/2015 | 0800 | 24 | Lawrence, Bill | | | |
| 07/18/2015 | 2000 | 24 | Smeby, Lee | | | |
| 07/18/2015 | 0800 | 24 | Smeby, Lee | | | |
| 07/17/2015 | 2000 | 24 | Smeby, Lee | | | |
| 07/17/2015 | 0800 | 24 | Lawrence, Bill | | | |
| 07/16/2015 | 2000 | 24 | Smeby, Lee | | | |
| 07/16/2015 | 0800 | 24 | Lawrence, Bill | | | |
| 07/15/2015 | 2000 | 24 | Casey, Joe | | | |
| 07/15/2015 | 0800 | 24 | Kothenbeutel, Rick | | | |
| 07/14/2015 | 2000 | 24 | Casey, Joe | | | |
| 07/14/2015 | 0800 | 24 | Kothenbeutel, Rick | | | |
| 07/13/2015 | 2000 | 24 | Casey, Joe | | | |
| 07/13/2015 | 0800 | 24 | Kothenbeutel, Rick | | | |
| 07/12/2015 | 2000 | 24 | Broich, Cory | | | |
| 07/12/2015 | 0800 | 24 | Petersen, Gary | | | |
| 07/11/2015 | 2000 | 24 | Broich, Cory | | | |
| 07/11/2015 | 0800 | 24 | Smeby, Lee | | | |
| 07/10/2015 | 2000 | 24 | Broich, Cory | | | |
| 07/10/2015 | 0800 | 24 | Petersen, Gary | | | |
| 07/09/2015 | 2000 | 24 | Broich, Cory | | | |
| 07/09/2015 | 0800 | 24 | Petersen, Gary | | | |
| 07/08/2015 | 2000 | 24 | Albold, Nic | | | |
| 07/08/2015 | 0800 | 24 | Petersen, Gary | | | |
| 07/07/2015 | 2000 | 24 | Albold, Nic | | | |
| 07/07/2015 | 0800 | 24 | Waaraniemi, Ben | | | |
| 07/06/2015 | 2000 | 24 | Albold, Nic | | | |
| 07/06/2015 | 0800 | 24 | Patterson, Scott | | | |

**Attachment 03** – Excerpt of 2010 Ops Log for D10, D20 charger output current, Dec. 2014 and July, 2015 page 6 of 8

Turbine Building East (2010) OWI-02.03 Operator Rounds

125VDC CHARGER FOR #12 BATTERY CURRENT Normal = 20 Amps

D20 Max: 50 Units: Amps BATTERIES Seq: 12 Rec: 39

| | | | |
|---|---|---|---|
| 07/05/2015 | 2000 | 24 | Casey, Joe |
| 07/05/2015 | 0800 | 24 | Patterson, Scott |
| 07/04/2015 | 2000 | 24 | Casey, Joe |
| 07/04/2015 | 0800 | 24 | Patterson, Scott |
| 07/03/2015 | 2000 | 24 | Casey, Joe |
| 07/03/2015 | 0800 | 24 | Patterson, Scott |
| 07/02/2015 | 2000 | 24 | Casey, Joe |
| 07/02/2015 | 0800 | 24 | Brokh, Cory |
| 07/01/2015 | 2000 | 24 | West, Alex |
| 07/01/2015 | 0800 | 24 | Petersen, Gary |

D-20 NEG TO GROUND VOLT Normal = 65V

D20 Min: 60 Units: Volts BATTERIES Seq: 13 Rec: 40

| | | | |
|---|---|---|---|
| 07/31/2015 | 2000 | 66 | Ramaley, Mike |
| 07/31/2015 | 0800 | 66 | Kovanen, Quinten |
| 07/30/2015 | 2000 | 66 | Kovanen, Quinten |
| 07/30/2015 | 0800 | 66 | Kovanen, Quinten |
| 07/29/2015 | 2000 | 66 | Petersen, Gary |
| 07/29/2015 | 0800 | 66 | Casey, Joe |
| 07/28/2015 | 2000 | 66 | Petersen, Gary |
| 07/28/2015 | 0800 | 66 | Casey, Joe |
| 07/27/2015 | 2000 | 66 | Petersen, Gary |
| 07/27/2015 | 0800 | 66 | Casey, Joe |
| 07/26/2015 | 2000 | 66 | Kranz, Neil B |
| 07/26/2015 | 0800 | 66 | Karlhoff, Corey |
| 07/25/2015 | 2000 | 66 | Kranz, Neil B |
| 07/25/2015 | 0800 | 66 | Karlhoff, Corey |
| 07/24/2015 | 2000 | 66 | Kranz, Neil B |
| 07/24/2015 | 0800 | 66 | Karlhoff, Corey |
| 07/23/2015 | 2000 | 66 | Kranz, Neil B |
| 07/23/2015 | 0800 | 66 | Karlhoff, Corey |
| 07/22/2015 | 2000 | 66 | Patterson, Scott |
| 07/22/2015 | 0800 | 66 | Albold, Nic |
| 07/21/2015 | 2000 | 66 | Patterson, Scott |
| 07/21/2015 | 0800 | 66 | Albold, Nic |
| 07/20/2015 | 2000 | 66 | Patterson, Scott |
| 07/20/2015 | 0800 | 66 | Albold, Nic |
| 07/19/2015 | 2000 | 66 | Patterson, Scott |
| 07/19/2015 | 0800 | 67 | Lawrence, Bill |
| 07/18/2015 | 2000 | 66 | Smeby, Lee |
| 07/18/2015 | 0800 | 67 | Smeby, Lee |
| 07/17/2015 | 2000 | 66 | Smeby, Lee |
| 07/17/2015 | 0800 | 67 | Lawrence, Bill |
| 07/16/2015 | 2000 | 67 | Smeby, Lee |
| 07/16/2015 | 0800 | 67 | Lawrence, Bill |
| 07/15/2015 | 2000 | 66 | Casey, Joe |
| 07/15/2015 | 0800 | 66 | Kothenbeutel, Rick |
| 07/14/2015 | 2000 | 66 | Casey, Joe |
| 07/14/2015 | 0800 | 66 | Kothenbeutel, Rick |
| 07/13/2015 | 2000 | 66 | Casey, Joe |
| 07/13/2015 | 0800 | 66 | Kothenbeutel, Rick |
| 07/12/2015 | 2000 | 66 | Brokh, Cory |
| 07/12/2015 | 0800 | 66 | Petersen, Gary |
| 07/11/2015 | 2000 | 66 | Brokh, Cory |
| 07/11/2015 | 0800 | 66 | Smeby, Lee |
| 07/10/2015 | 2000 | 66 | Brokh, Cory |
| 07/10/2015 | 0800 | 66 | Petersen, Gary |
| 07/09/2015 | 2000 | 67 | Brokh, Cory |
| 07/09/2015 | 0800 | 66 | Petersen, Gary |

**Attachment 03** – Excerpt of 2010 Ops Log for D10, D20 charger output current, Dec. 2014 and July, 2015 

Turbine Building East (2010) OWI-02.03 Operator Rounds

| D-10 VOLTAGE-FLOAT #11 BATTERY | | | | Normal = 130V | | |
|---|---|---|---|---|---|---|
| D10 | | Min: 128 Max: 132 Units: Volts | | BATTERIES | Seq: 40 | Rec: 29 |
| 07/14/2015 | 2000 | 131 | Casey, Joe | | | |
| 07/14/2015 | 0800 | 131 | Kothenbeutel, Rick | | | |
| 07/13/2015 | 2000 | 131 | Casey, Joe | | | |
| 07/13/2015 | 0800 | 131 | Kothenbeutel, Rick | | | |
| 07/12/2015 | 2000 | 131 | Brokch, Cory | | | |
| 07/12/2015 | 0800 | 131 | Petersen, Gary | | | |
| 07/11/2015 | 2000 | 130 | Brokch, Cory | | | |
| 07/11/2015 | 0800 | 130 | Smeby, Lee | | | |
| 07/10/2015 | 2000 | 130 | Brokch, Cory | | | |
| 07/10/2015 | 0800 | 131 | Petersen, Gary | | | |
| 07/09/2015 | 2000 | 130 | Brokch, Cory | | | |
| 07/09/2015 | 0800 | 131 | Petersen, Gary | | | |
| 07/08/2015 | 2000 | 131 | Albold, Mic | | | |
| 07/08/2015 | 0800 | 131 | Petersen, Gary | | | |
| 07/07/2015 | 2000 | 131 | Albold, Mic | | | |
| 07/07/2015 | 0800 | 131 | Waaraniemi, Ben | | | |
| 07/06/2015 | 2000 | 131 | Albold, Mic | | | |
| 07/06/2015 | 0800 | 131 | Patterson, Scott | | | |
| 07/05/2015 | 2000 | 131 | Casey, Joe | | | |
| 07/05/2015 | 0800 | 131 | Patterson, Scott | | | |
| 07/04/2015 | 2000 | 131 | Casey, Joe | | | |
| 07/04/2015 | 0800 | 131 | Patterson, Scott | | | |
| 07/03/2015 | 2000 | 131 | Casey, Joe | | | |
| 07/03/2015 | 0800 | 130 | Patterson, Scott | | | |
| 07/02/2015 | 2000 | 130 | Casey, Joe | | | |
| 07/02/2015 | 0800 | 130 | Brokch, Cory | | | |
| 07/01/2015 | 2000 | 131 | West, Alex | | | |
| 07/01/2015 | 0800 | 131 | Petersen, Gary | | | |

| 125VDC CHARGER FOR #11 BATTERY CURRENT | | | | Normal = 25 Amps | | |
|---|---|---|---|---|---|---|
| D10 | | Max: 50 Units: Amps | | BATTERIES | Seq: 41 | Rec: 30 |
| 07/31/2015 | 2000 | 23 | Ramaley, Mike | | | |
| 07/31/2015 | 0800 | 23 | Kovanen, Quinten | | | |
| 07/30/2015 | 2000 | 23 | Kovanen, Quinten | | | |
| 07/30/2015 | 0800 | 23 | Kovanen, Quinten | | | |
| 07/29/2015 | 2000 | 23 | Petersen, Gary | | | |
| 07/29/2015 | 0800 | 23 | Casey, Joe | | | |
| 07/28/2015 | 2000 | 23 | Petersen, Gary | | | |
| 07/28/2015 | 0800 | 23 | Casey, Joe | | | |
| 07/27/2015 | 2000 | 23 | Petersen, Gary | | | |
| 07/27/2015 | 0800 | 23 | Casey, Joe | | | |
| 07/26/2015 | 2000 | 23 | Kranz, Neil B | | | |
| 07/26/2015 | 0800 | 23 | Karkhoff, Corey | | | |
| 07/25/2015 | 2000 | 23 | Kranz, Neil B | | | |
| 07/25/2015 | 0800 | 23 | Karkhoff, Corey | | | |
| 07/24/2015 | 2000 | 23 | Kranz, Neil B | | | |
| 07/24/2015 | 0800 | 23 | Karkhoff, Corey | | | |
| 07/23/2015 | 2000 | 23 | Kranz, Neil B | | | |
| 07/23/2015 | 0800 | 23 | Karkhoff, Corey | | | |
| 07/22/2015 | 2000 | 23 | Patterson, Scott | | | |
| 07/22/2015 | 0800 | 23 | Albold, Mic | | | |
| 07/21/2015 | 2000 | 23 | Patterson, Scott | | | |
| 07/21/2015 | 0800 | 23 | Albold, Mic | | | |
| 07/20/2015 | 2000 | 23 | Patterson, Scott | | | |
| 07/20/2015 | 0800 | 23 | Albold, Mic | | | |
| 07/19/2015 | 2000 | 23 | Patterson, Scott | | | |
| 07/19/2015 | 0800 | 23 | Lawrence, Bill | | | |
| 07/18/2015 | 2000 | 23 | Smeby, Lee | | | |
| 07/18/2015 | 0800 | 23 | Smeby, Lee | | | |

**Attachment 03** – Excerpt of 2010 Ops Log for D10, D20 charger output current, Dec. 2014 and July, 2015 page 8 of 8

Turbine Building East (2010) OWI-02.03 Operator Rounds

125VDC CHARGER FOR #11 BATTERY CURRENT Normal = 25 Amps

D10 Max: 50 Units: Amps BATTERIES Seq: 41 Rec: 30

| | | | |
|---|---|---|---|
| 07/17/2015 | 2000 | 23 | Smeby, Lee |
| 07/17/2015 | 0800 | 23 | Lawrence, Bill |
| 07/16/2015 | 2000 | 23 | Smeby, Lee |
| 07/16/2015 | 0800 | 23 | Lawrence, Bill |
| 07/15/2015 | 2000 | 23 | Casey, Joe |
| 07/15/2015 | 0800 | 23 | Kothenbeutel, Rick |
| 07/14/2015 | 2000 | 23 | Casey, Joe |
| 07/14/2015 | 0800 | 23 | Kothenbeutel, Rick |
| 07/13/2015 | 2000 | 23 | Casey, Joe |
| 07/13/2015 | 0800 | 23 | Kothenbeutel, Rick |
| 07/12/2015 | 2000 | 23 | Broich, Cory |
| 07/12/2015 | 0800 | 23 | Petersen, Gary |
| 07/11/2015 | 2000 | 23 | Broich, Cory |
| 07/11/2015 | 0800 | 22 | Smeby, Lee |
| 07/10/2015 | 2000 | 22 | Broich, Cory |
| 07/10/2015 | 0800 | 23 | Petersen, Gary |
| 07/09/2015 | 2000 | 23 | Broich, Cory |
| 07/09/2015 | 0800 | 23 | Petersen, Gary |
| 07/08/2015 | 2000 | 23 | Albold, Nic |
| 07/08/2015 | 0800 | 23 | Petersen, Gary |
| 07/07/2015 | 2000 | 23 | Albold, Nic |
| 07/07/2015 | 0800 | 23 | Waaraniemi, Ben |
| 07/06/2015 | 2000 | 23 | Albold, Nic |
| 07/06/2015 | 0800 | 23 | Patterson, Scott |
| 07/05/2015 | 2000 | 23 | Casey, Joe |
| 07/05/2015 | 0800 | 23 | Patterson, Scott |
| 07/04/2015 | 2000 | 23 | Casey, Joe |
| 07/04/2015 | 0800 | 23 | Patterson, Scott |
| 07/03/2015 | 2000 | 23 | Casey, Joe |
| 07/03/2015 | 0800 | 23 | Patterson, Scott |
| 07/02/2015 | 2000 | 23 | Casey, Joe |
| 07/02/2015 | 0800 | 23 | Broich, Cory |
| 07/01/2015 | 2000 | 23 | West, Alex |
| 07/01/2015 | 0800 | 23 | Petersen, Gary |

D-10 NEG TO GROUND VOLT Normal = 65V

D10 Min: 60 Units: Volts BATTERIES Seq: 42 Rec: 31

| | | | |
|---|---|---|---|
| 07/31/2015 | 2000 | 64 | Ramaley, Mike |
| 07/31/2015 | 0800 | 64 | Kovanen, Quinten |
| 07/30/2015 | 2000 | 63 | Kovanen, Quinten |
| 07/30/2015 | 0800 | 63 | Kovanen, Quinten |
| 07/29/2015 | 2000 | 63 | Petersen, Gary |
| 07/29/2015 | 0800 | 63 | Casey, Joe |
| 07/28/2015 | 2000 | 63 | Petersen, Gary |
| 07/28/2015 | 0800 | 63 | Casey, Joe |
| 07/27/2015 | 2000 | 63 | Petersen, Gary |
| 07/27/2015 | 0800 | 63 | Casey, Joe |
| 07/26/2015 | 2000 | 63 | Kranz, Neil B |
| 07/26/2015 | 0800 | 63 | Karkhoff, Corey |
| 07/25/2015 | 2000 | 63 | Kranz, Neil B |
| 07/25/2015 | 0800 | 64 | Karkhoff, Corey |
| 07/24/2015 | 2000 | 63 | Kranz, Neil B |
| 07/24/2015 | 0800 | 64 | Karkhoff, Corey |
| 07/23/2015 | 2000 | 63 | Kranz, Neil B |
| 07/23/2015 | 0800 | 63 | Karkhoff, Corey |
| 07/22/2015 | 2000 | 63 | Patterson, Scott |
| 07/22/2015 | 0800 | 64 | Albold, Nic |
| 07/21/2015 | 2000 | 64 | Patterson, Scott |
| 07/21/2015 | 0800 | 64 | Albold, Nic |

**Attachment 04** – DCSDM software sizing report showing calculation 02-192 Time Step 53 loads at a battery node voltage of 130.5 VDC. page 1 of 6

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**Attachment F**
**Node Voltages**

By: ______________________ Date: ____________
Check: ______________________ Date: ____________

**Attachment 04** – DCSDM software sizing report showing calculation 02-192 Time Step 53 loads at a battery node voltage of 130.5 VDC. 

## Node Voltages

*Generation Date: 08/25/2015 03:46 pm*

**Battery:** D2
**Scenario:** D2DBA
**Scenario Description:** D2 Battery Composite Scenario

| | | Time Step: | 1. | 2 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Time Step Range: | 0:00:00.0 to 3:45:00.0 | 3:45:00.0 to 3:58:00.0 | | | | | | | | | | | | |
| Node | Name | Description | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) |
| 1 | D2 | BATTERY D2 | 132.769 | 130.501 | | | | | | | | | | | | |
| 2 | D21 | 125V DC DIST PANEL D21 | 132.753 | 130.352 | | | | | | | | | | | | |
| 3 | BC-12 | BATTERY CHARGER 12 | 132.753 | 130.352 | | | | | | | | | | | | |
| 4 | D211 | 125V DC DIST PANEL D211 | 132.753 | 129.662 | | | | | | | | | | | | |
| 5 | C03 | RX & CONT. COOLING & ISOL BENCH BD | 132.753 | 129.872 | | | | | | | | | | | | |
| 6 | ATWS CAB | DIV 2 ATWS CABINET | 132.753 | 130.167 | | | | | | | | | | | | |
| 7 | C05-ANN | C05 ANNUNCIATORS | 132.753 | 128.420 | | | | | | | | | | | | |
| 8 | C06 | FW & CONDENSATE BENCH BD | 132.753 | 130.251 | | | | | | | | | | | | |
| 9 | C08 | GEN & AUX PWR BENCH BD | 132.753 | 130.208 | | | | | | | | | | | | |
| 10 | C295B | DIV 2 COMBUSTIBLE GAS CONTROL SYSTEM (CGCS) | 132.753 | 129.638 | | | | | | | | | | | | |
| 11 | C17 | CHANNEL B PRIMARY ISOL & RP VERT BD | 132.753 | 130.301 | | | | | | | | | | | | |
| 12 | C32/C33 | CHANNEL B RHR-CS AUTO BD VERT BD | 132.753 | 129.234 | | | | | | | | | | | | |
| 13 | ATWS INV | DIV 2 ATWS INVERTER | 132.753 | 129.852 | | | | | | | | | | | | |
| 14 | C39 | HPCI RELAY VERTICAL BD | 132.753 | 130.044 | | | | | | | | | | | | |
| 15 | C20 | TURBINE PLANT INST VERTICAL BD | 132.753 | 130.073 | | | | | | | | | | | | |
| 16 | C292 | OUTBD ISOL VLV RELAY PANEL | 132.760 | 127.522 | | | | | | | | | | | | |
| 17 | C91 | EDG # 11 CONTROL PANEL | 132.753 | 129.507 | | | | | | | | | | | | |
| 18 | 84 | 480V LOAD CENTER #104 | 132.753 | 129.674 | | | | | | | | | | | | |
| 19 | C326 | 480V LOAD CENTER #108 | 132.753 | 129.131 | | | | | | | | | | | | |
| 20 | C92-CTL | EDG #12 CONTROL PANEL | 132.753 | 129.283 | | | | | | | | | | | | |
| 21 | 13kV Swgr | 13 kV SWITCHGEAR #12 | 132.753 | 129.084 | | | | | | | | | | | | |
| 22 | A407 | 4KV SWITCHGEAR #14 | 132.753 | 129.597 | | | | | | | | | | | | |
| 23 | A408 | 4KV SWITCHGEAR #16 | 132.753 | 129.515 | | | | | | | | | | | | |
| 24 | C92-FF | EDG #12 FIELD FLASH | 132.753 | 129.659 | | | | | | | | | | | | |
| 25 | G-2009 | RECIRC PUMP MG SET G-2009 | 132.753 | 129.735 | | | | | | | | | | | | |
| 26 | TG-MRB | TURBINE GENERATOR METER RLY BD | 132.753 | 130.130 | | | | | | | | | | | | |
| 28 | C84A | RADWASTE PANEL C84A | 132.747 | 126.740 | | | | | | | | | | | | |
| 29 | B300 MCC | MCC for B300 | 132.753 | 129.430 | | | | | | | | | | | | |
| 30 | C07 | TURBINE BENCH BOARD | 132.753 | 130.099 | | | | | | | | | | | | |

**Attachment 04** – DCSDM software sizing report showing calculation 02-192 Time Step 53 loads at a battery node voltage of 130.5 VDC. page 3 of 6

## Node Voltages

*Generation Date: 08/25/2015 03:46 pm*

**Battery:** D2
**Scenario:** D2DBA
**Scenario Description:** D2 Battery Composite Scenario

| | | Time Step: | 1 | 2 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Time Step Range: | 0:01:00.0 to 3:45:00.0 | 3:45:00.0 to 3:58:00.0 | | | | | | | | | | | | |
| Node | Name | Description | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) | Node Voltage (VDC) |
| 31 | C44B | RADWASTE PANEL C44B | 132.747 | 126.573 | | | | | | | | | | | | |
| 32 | C03-ANN | C03 ANNUNCIATORS | 132.753 | 125.813 | | | | | | | | | | | | |
| 33 | C04-ANN | C04 ANNUNCIATORS | 132.753 | 127.137 | | | | | | | | | | | | |

**Attachment 04** – DCSDM software sizing report showing calculation 02-192 Time Step 53 loads at a battery node voltage of 130.5 VDC. page 4 of 6

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**Attachment G**
**Node Currents**

**By:** ______________________ **Date:** ______________

**Check:** ______________________ **Date:** ______________

**Attachment 04** – DCSDM software sizing report showing calculation 02-192 Time Step 53 loads at a battery node voltage of 130.5 VDC. page 5 of 6

## Node Currents

*Generation Date: 08/26/2015 03:46 pm*

**Battery:** D2
**Scenario:** D2DBA
**Scenario Description:** D2 Battery Composite Scenario

| | | Time Step: | 1 | 2 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Time Step Range: | 0:00:00.0 to 3:15:00.0 | 3:45:00.0 to 7:58:00.0 | | | | | | | | | | | | |
| Node | Name | Description | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) |
| 1 | D2 | BATTERY D2 | 6.51 | 60.25 | | | | | | | | | | | | |
| 2 | D21 | 125V DC DIST PANEL D21 | 6.51 | 1.42 | | | | | | | | | | | | |
| 3 | BC-12 | BATTERY CHARGER 12 | 0.00 | 0.00 | | | | | | | | | | | | |
| 4 | D211 | 125V DC DIST PANEL D211 | 0.00 | 1.61 | | | | | | | | | | | | |
| 5 | C03 | RX & CONT. COOLING & ISOL BENCH BD | 0.00 | 2.39 | | | | | | | | | | | | |
| 6 | ATWS CAB | DIV 2 ATWS CABINET | 0.00 | 0.15 | | | | | | | | | | | | |
| 7 | C05 ANN | C05 ANNUNCIATORS | 0.00 | 2.65 | | | | | | | | | | | | |
| 8 | C06 | FW & CONDENSATE BENCH BD | 0.00 | 0.38 | | | | | | | | | | | | |
| 9 | C08 | GEN & AUX PWR BENCH BD | 0.00 | 1.10 | | | | | | | | | | | | |
| 10 | C2059 | DIV 2 COMBUSTIBLE GAS CONTROL SYSTEM (CGCS) | 0.00 | 1.78 | | | | | | | | | | | | |
| 11 | C17 | CHANNEL B PRIMARY ISOL & RP VERT BD | 0.00 | 0.95 | | | | | | | | | | | | |
| 12 | C32/C33 | CHANNEL B RHR-CS AUTO BD VERT BD | 0.00 | 3.17 | | | | | | | | | | | | |
| 13 | ATWS INV | DIV 2 ATWS INVERTER | 0.00 | 3.69 | | | | | | | | | | | | |
| 14 | C39 | HPCI RELAY VERTICAL BD | 0.00 | 2.54 | | | | | | | | | | | | |
| 15 | C20 | TURBINE PLANT INST VERTICAL BD | 0.00 | 1.97 | | | | | | | | | | | | |
| 16 | C292 | OUTBD ISOL VLV RELAY PANEL | 0.00 | 1.60 | | | | | | | | | | | | |
| 17 | C91 | EDG # 11 CONTROL PANEL | 0.00 | 0.42 | | | | | | | | | | | | |
| 18 | B4 | 480V LOAD CENTER #104 | 0.00 | 0.45 | | | | | | | | | | | | |
| 19 | C328 | 480V LOAD CENTER #108 | 0.00 | 1.30 | | | | | | | | | | | | |
| 20 | C92-CTL | EDG #12 CONTROL PANEL | 0.00 | 3.96 | | | | | | | | | | | | |
| 21 | 13kV Swgr | 13 kV SWITCHGEAR #12 | 0.00 | 4.60 | | | | | | | | | | | | |
| 22 | A407 | 4KV SWITCHGEAR #14 | 0.00 | 1.45 | | | | | | | | | | | | |
| 23 | A408 | 4KV SWITCHGEAR #16 | 0.00 | 2.93 | | | | | | | | | | | | |
| 24 | C92-FF | EDG #12 FIELD FLASH | 0.00 | 0.05 | | | | | | | | | | | | |
| 25 | G-2000 | RECIRC PUMP MG SET G-2000 | 0.00 | 1.00 | | | | | | | | | | | | |
| 26 | TG-MRB | TURBINE GENERATOR METER RLY BD | 0.00 | 4.64 | | | | | | | | | | | | |
| 28 | C84A | RADWASTE PANEL C84A | 0.00 | 1.69 | | | | | | | | | | | | |
| 29 | D4300 MCC | MCC for D4300 | 0.00 | 0.95 | | | | | | | | | | | | |
| 30 | C07 | TURBINE BENCH BOARD | 0.00 | 2.20 | | | | | | | | | | | | |

**Attachment 04** – DCSDM software sizing report showing calculation 02-192 Time Step 53 loads at a battery node voltage of 130.5 VDC.



## Node Currents

*Generation Date: 08/25/2015 03:46 pm*

**Battery:** D2
**Scenario:** D2DBA
**Scenario Description:** D2 Battery Composite Scenario

| | | Time Step: | 1 | 2 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Time Step Range: | 0:00:00.0 to 3:45:00.0 | 3:45:00.0 to 3:46:01.0 | | | | | | | | | | | | |
| Node | Name | Description | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) | Node Currents (ADC) |
| 31 | C849 | RADWASTE PANEL C849 | 0.00 | 1.40 | | | | | | | | | | | | |
| 32 | C03-ANN | C03 ANNUNCIATORS | 0.00 | 2.81 | | | | | | | | | | | | |
| 33 | C04-ANN | C04 ANNUNCIATORS | 0.00 | 2.50 | | | | | | | | | | | | |

| MONTICELLO NUCLEAR GENERATING PLANT | | CA-91-006 |
|---|---|---|
| **TITLE:** | 125 VDC Battery Charger Sizing | Revision 4 |
| | | Page 33 of 33 |

**Attachment 05** – Rammeter web page showing 0.33% accuracy for current shunt model F150A50. page 1 of 1