Southern Nuclear

Hatch Degraded Grid Public Meeting
March 1, 2018

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Agenda Items

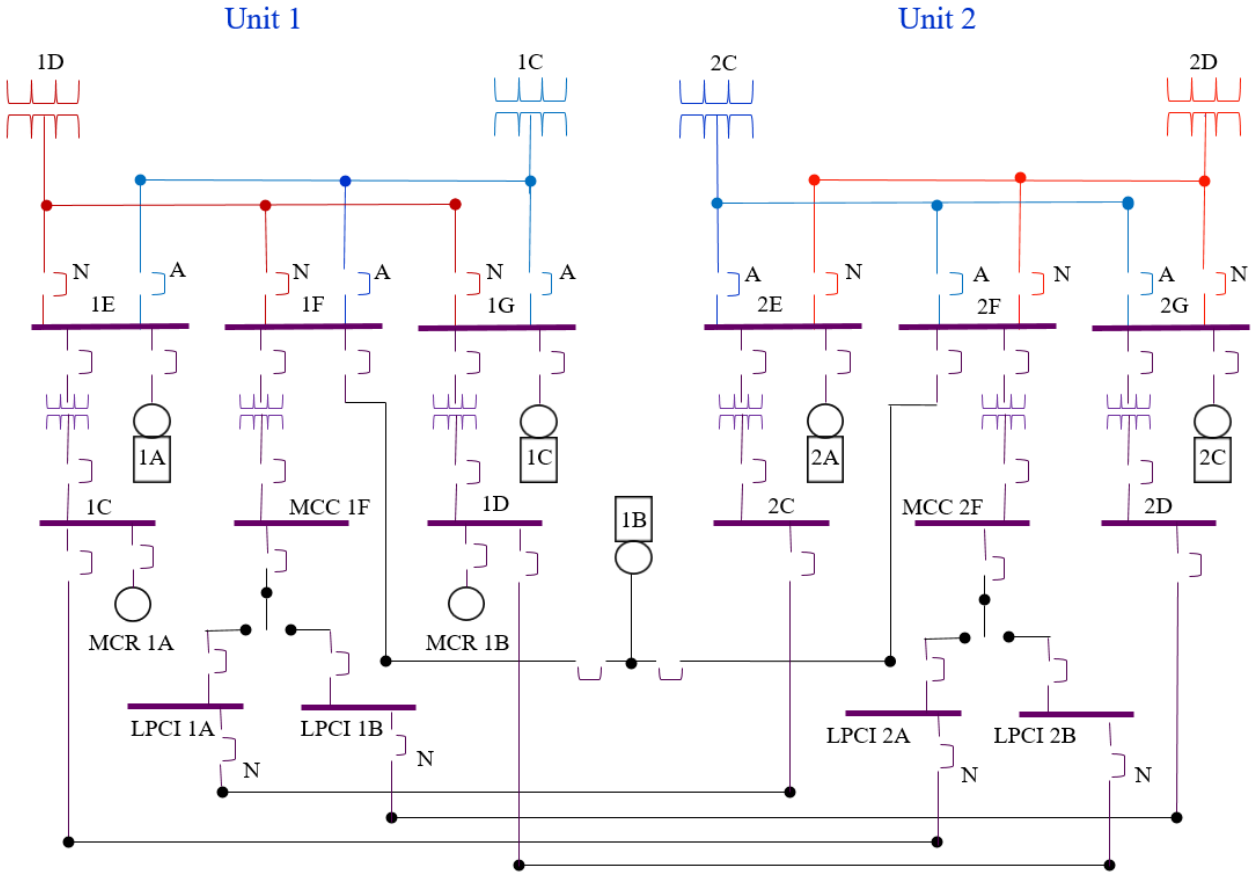
1. Introductions
2. Meeting Kick-off
3. Overview of Plant Modifications (Brian McGregor)
4. License Amendment Request Content (Ryan Joyce)
5. Summary of Calculational Methodology (Jason Bellamy)
6. Facility Operating License Change to Extend Unit 2 Implementation (Amy Hazelhoff)

Overview of Plant Modifications

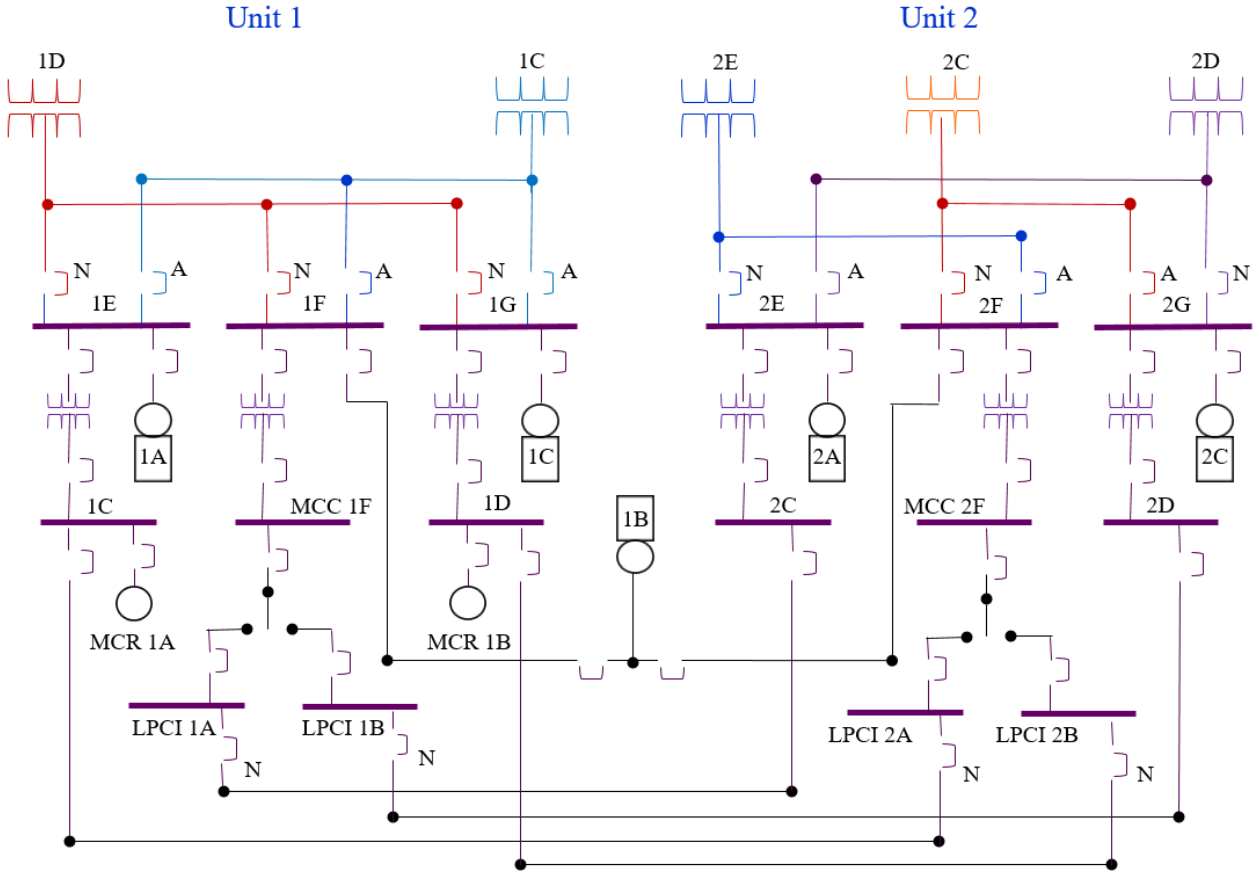
Physical Change Highlights

- Replace existing SATs and add a 3rd SAT per unit
- Expand 4 kV cable bus system and realign busses supplied by the 3 SATs
- Replace 4 kV breakers and upgrade bus bar supports
- Replace induction disc DVRs with new solid-state DVRs (3 per bus)

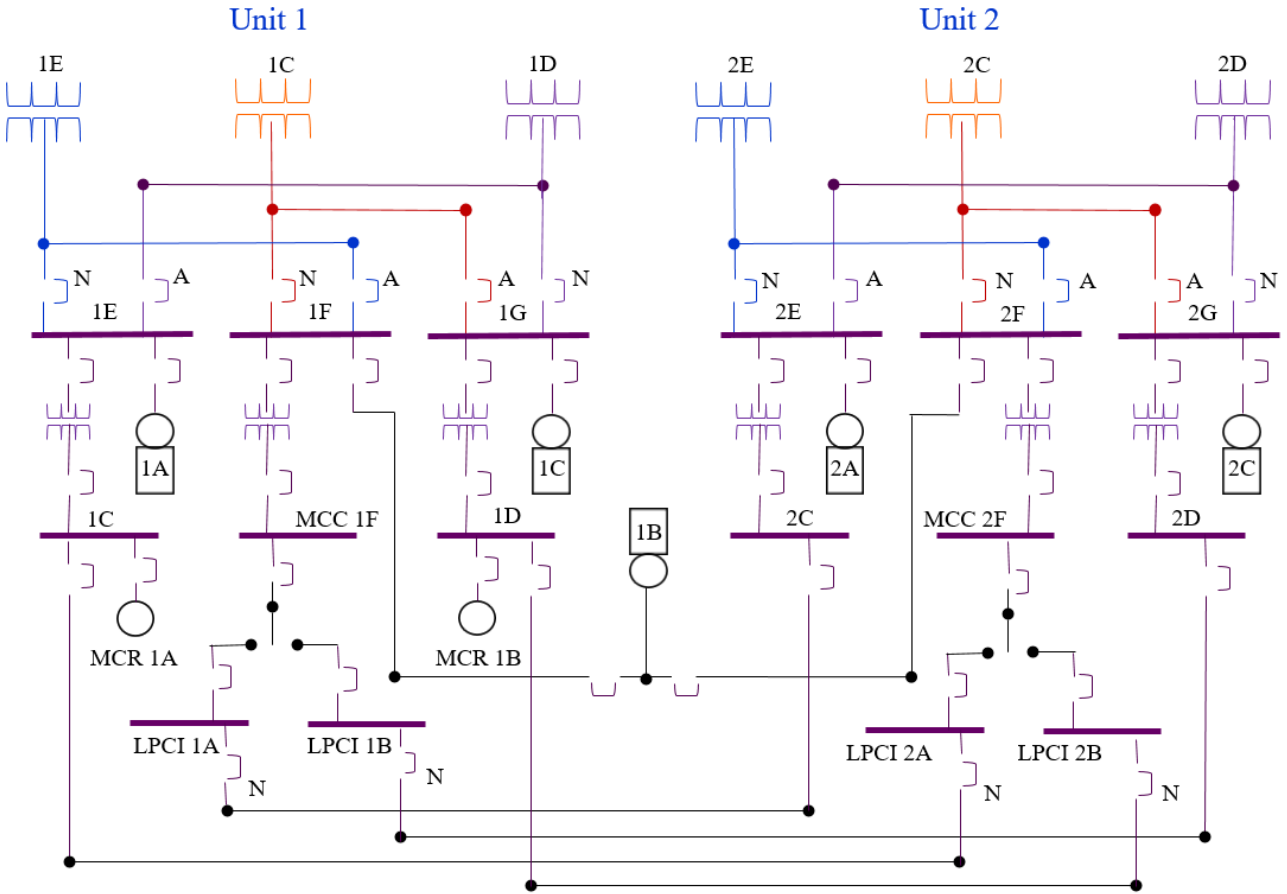
Simplified HNP Electrical System – Current Configuration



Simplified HNP Electrical System – “Interim Configuration” (Between 2R25 & 1R29)



Simplified HNP Electrical System – Final Configuration



Electrical Power System Modifications

- Installation of third startup transformer increases reliability of offsite sources
- Modifications will eliminate use of manual actions as part of Hatch degraded voltage protection scheme
- SNC has evaluated the modifications against the criteria in 10 CFR 50.59(c), and determined facility modifications do not require a license amendment pursuant to 10 CFR 50.90
- Modifications require changes to TS Table 3.3.8.1-1 Allowable Values for Bus Undervoltage and Time Delay
- As discussed in upcoming slides, License Amendment Request scope limited to TS 3.3.8.1 changes and changes to correct misleading wording in current Unit 2 Facility Operating License (FOL) Condition

License Amendment Request Content

License Amendment Request Content

Enclosure 1:

1. Summary Description
2. Detailed Description
    1. System Design and Operation
    2. Current Operating & TS Requirements
    3. Reason for Proposed Change
    4. Description of Change
3. Technical Evaluation
    1. Applicability of Proposed Change
    2. Degraded Voltage Instrument Setpoints and Allowable Values
    3. Human Factors Impacts
4. Regulatory Evaluation
5. Environmental Considerations
6. References

License Amendment Request Content (continued)

1. HNP Unit 2 Facility Operating License and Unit 1 and Unit 2 Technical Specifications Marked-Up Pages
2. HNP Unit 1 and Unit 2 Technical Specifications Clean-Typed Pages
3. HNP Unit 1 and Unit 2 Technical Specifications Bases Marked-Up Pages (Information Only)
4. Summary of the HNP Loss of Power Instrumentation Setpoint Methodology

Required Facility Operating License Changes

- Proposed Unit 2 FOL change states:

  SNC shall implement the Degraded Voltage modifications to eliminate the manual actions in lieu of automatic degraded voltage protection to assure adequate voltage to safety-related equipment during design basis events **for the Unit 2 4.16 kV emergency buses** by completion of the Unit 2 2019 Spring Outage, U2R25 **and for the required Unit 1 4.16 kV emergency buses by completion of the Unit 1 2020 Spring Outage, U1R29**

- Changes necessary due to Unit 2 reliance on Unit 1 emergency buses for certain systems (standby gas treatment, main control room environmental control system, control room air condition system, low pressure coolant injection (LPCI) valve load center)
- Unit 2 will not be in full compliance until both units' modifications are complete.

Changes to TS 3.3.8.1

- LCO 3.3.8.1 is revised to state, “The LOP instrumentation for each Function in Table 3.3.8.1-1 shall be OPERABLE **for each diesel generator (DG) required by LCO 3.8.1, "AC Sources – Operating,” and LCO 3.8.2, "AC Sources – Shutdown**.”
- Applicability is revised to state, “~~MODES, 1, 2, and 3, When the associated diesel generator (DG) is required to be OPERABLE. by LCO 3.8.2., "AC Sources - Shutdown."~~
  - Provides clarification for when LOP instrumentation is required
  - Revised Table 3.3.8.1-1 specifies different allowable values and time delays for different buses
  - Since LOP instrumentation is a support system for the EDGs, it’s only required to be OPERABLE when associated DG is required to be operable.

Changes to TS 3.3.8.1 ACTIONS

- Condition A revised to state “One or more **required** channels inoperable for Functions 1 and 2”
  - Only two of three Unit 2 degraded voltage instrument channels will be required to be Operable per Table 3.3.8.1-1 Function 2 for LCO to be met
- Required Action B.1 revised to state “Verify voltage on associated **Unit 1** 4.16 kV bus is ≥ 3825 V”
  - Function 3 will only apply to Unit 1 during interim configuration where Unit 2’s modifications are complete and Unit 1’s are not

Changes to Table 3.3.8.1-1

- Column heading revised to state “REQUIRED CHANNELS PER ~~FUNCTION~~ **BUS**”
  - More accurately reflects instrumentation design
  - Consistent with Improved Standard Technical Specifications, NUREG-1433
- Function 2 now lists separate Allowable Values for the Bus Undervoltage and Time Delays for each bus
  - Previously, all buses had the same Allowable Values for Bus Undervoltage and Time Delay
- Function 3 revised to specify it only applies to Unit 1 buses
  - Function 3 will only apply to Unit 1 during interim configuration where Unit 2’s modifications are complete and Unit 1’s are not

Summary of Calculational Methodology

Definitions

- AL - Analytical Limit
- DVR - Degraded Voltage Relay – senses voltage on 4 kV Emergency Bus
  – provides contacts for automatic action

- LOCA – Loss of Coolant Accident – requires group starting of Class 1E equipment

- MEV – Minimum Expected Voltage on 4 kV bus concurrent with
  a) steady-state LOCA loading, and
  b) offsite supply at minimum normal voltage, 101.3% of 230 kV

- MRV – Minimum Required Voltage on 4 kV bus; is the greater of
  a) Min voltage for operation of Class 1E loads,
  b) Min pre-start voltage for LOCA group motor starting
  c) Min start/run voltage for individual motors under max accident loading
  d) Min control voltage for Class 1E loads

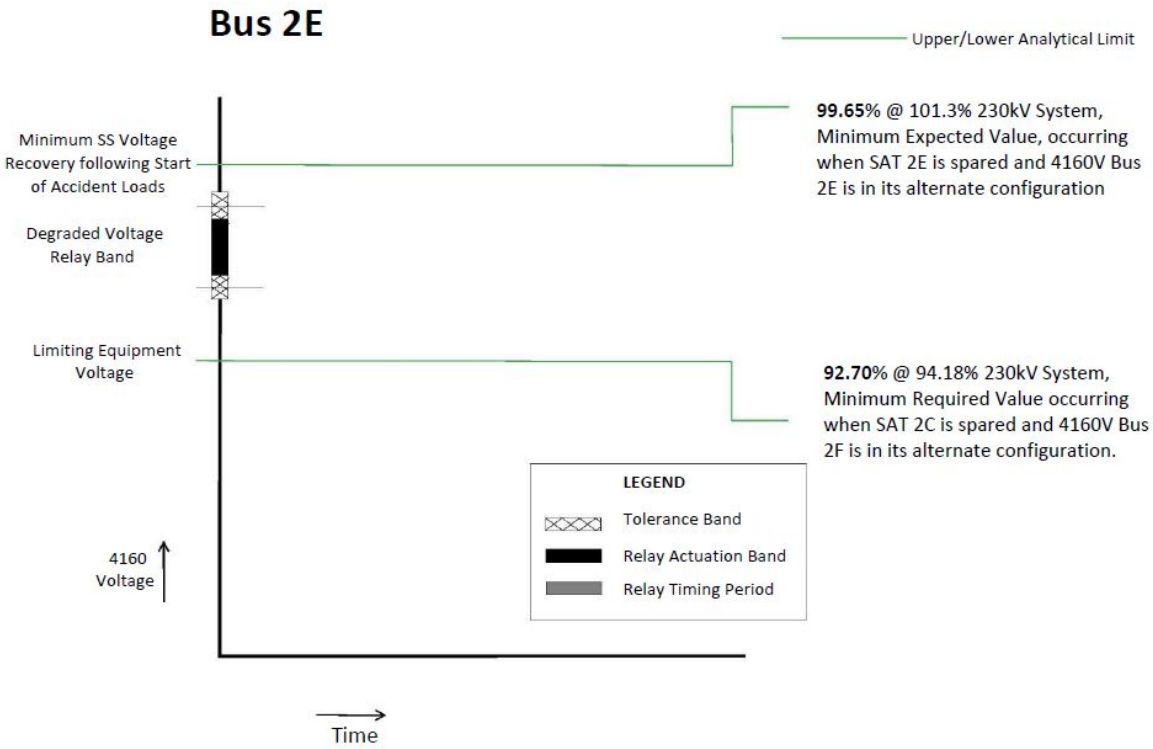
- NTSP - Nominal Trip Set Point

- SAT – Startup Auxiliary Transformer – supplies 4 kV buses from 230kV grid

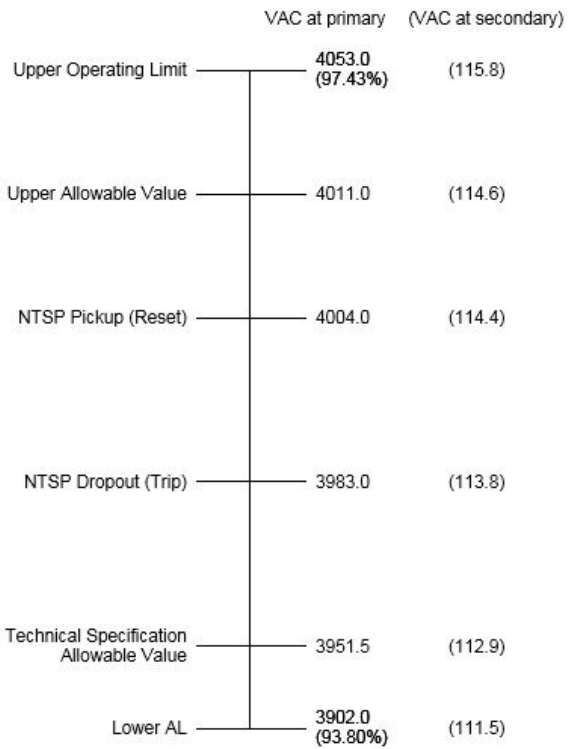
Methodology for Relay Setpoints (Voltage and Time Delay)

- Degraded Voltage Relays (DVRs) shall be set such that offsite power will be automatically disconnected and transferred to onsite power during an extended degraded grid condition (any voltage dip having a longer duration than expected for normal or accident operations).
- The MRV is determined with a “bottom up” approach. All voltage requirements for the safety-related equipment must be preserved by the DVR circuit(s). This evaluation includes but is not limited to the minimum voltage level during steady-state or pre-start individual or group motor starting at the safety-related 4.16kV buses required to maintain adequate voltage for operation (running and starting) of all safety-related loads. Motors shall be able to successfully start during design basis accident conditions with pre-start voltage values at the minimum required voltage. Motor Control Center contactors have minimum pickup and operating voltages.
- The DVRs on each Class 1E 4KV bus will be set so that, including tolerances, voltage dropout value will be above the MRV value.
- The DVR voltage reset value, including tolerances, will be set below the MEV to avoid spurious trips.

Example of MRV and MEV



Limiting Values Diagram



Note: Bus 2E is shown; other buses are similar

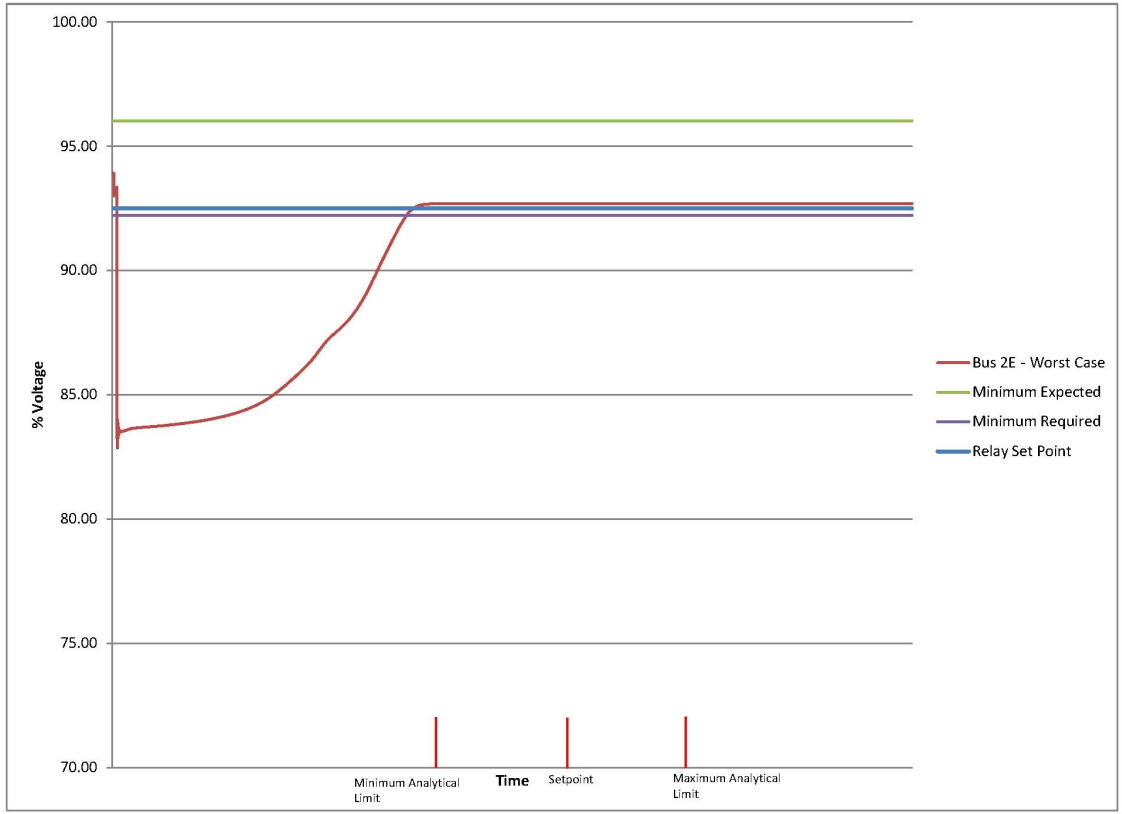
Time Delay Methodology

- With the 4kV bus pre-start voltage at or below the MRV, the LOCA Motor Starting transient time should be less than the DVR time delay setting, with tolerances, to mitigate spurious trips.

- The DVR time delay setting, with tolerances, should be less than the diesel generator start time of 12 seconds, per FSAR Table 8.3-3 (Reference 5), to prevent an extended degraded grid condition.

- The DVR time delay setting, with tolerances, should be less than the minimum overcurrent relay trip time to prevent safety-related equipment from tripping during a degraded voltage condition.

Time Delay Diagram



Facility Operating License Change to Extend Unit 2 Implementation

Facility Operating License Change to Extend Unit 2 Implementation

- HNP Unit 2 Degraded Grid Voltage Protection Modification Implementation is required per license condition 2.C.3(i) to be implemented during the Spring 2019 refueling outage
  - Outage planning has revealed that due to the complexity of this modification combined with the detailed testing requirements, high risk situations could result during the 2019 outage
  - SNC planning for full implementation of this modification at HNP Unit 2 during Spring 2019 outage, however, due to these complexities and the resulting high risk situations, SNC is submitting a LAR to extend license condition 2.C.3(i) to the Spring 2021 outage

Facility Operating License Change to Extend Unit 2 Implementation

- Facility Operating License Change to Extend Unit 2 Implementation currently being drafted
  - LAR administrative in nature
  - LAR expected to be submitted in ~April 2018
  - NRC approval requested no later than ~November 2018

Facility Operating License Change to Extend Unit 2 Implementation

- Proposed Unit 2 FOL change:

  SNC shall implement the Degraded Voltage modifications to eliminate the manual actions in lieu of automatic degraded voltage protection to assure adequate voltage to safety-related equipment during design basis events by completion of the Unit 2 ~~2019~~ 2021 Spring Outage, ~~U2R25~~ U2R26.

- If approved, Unit 2 FOL page change in the interim configuration TS 3.3.8.1 LAR will no longer be necessary and will be withdrawn.

Possible Scenarios

1. Extension is approved, Unit 2 modifications during 2R25 are successful
   - Interim configuration TS 3.3.8.1 changes will be implemented during 2R25
   - Final configuration TS 3.3.8.1 changes will be implemented during 1R29

2. Extension is approved, Unit 2 modifications during 2R25 are not successful
   - Interim configuration TS 3.3.8.1 changes are not implemented during 2R25
     - Note: Implementation period specified in the interim configuration LAR for TS 3.3.8.1 pages currently specified to be in accordance with FOL requirements
   - Unit 1 becomes “lead plant” - revisions to interim configuration TS 3.3.8.1 based on Unit 1 configuration will be submitted for approval prior to 1R29 including Unit 1 FOL clarification change
   - Final configuration TS 3.3.8.1 changes will be implemented during 2R26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(date) – this is added after executive signature is obtained

Docket Nos.: 50-321
50-366

NL-18-0074

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

Edwin I. Hatch Nuclear Plant Units 1 and 2
License Amendment Request for
Technical Specification 3.3.8.1 Regarding Degraded Voltage Protection

Ladies and Gentlemen:

Pursuant to the provisions of Section 50.90 of Title 10 of the Code of Federal Regulations (10 CFR), Southern Nuclear Operating Company (SNC) hereby requests an amendment to the Technical Specifications (TS) for Edwin I. Hatch Nuclear Plant (HNP) Unit 1 Renewed Facility Operating License DPR-57 and Unit 2 Renewed Facility Operating License NPF-5 and includes the results of the no significant hazards determination. The proposed amendment would revise TS 3.3.8.1, "Loss of Power (LOP) Instrumentation" to modify the instrument Allowable Values for the Unit 2 4.16 kV emergency bus degraded voltage instrumentation and delete the annunciation requirements for the Unit 2 4.16 kV emergency bus undervoltage instrumentation. In addition, this amendment revises Unit 2 License Condition 2.C(3)(i) to more accurately reflect its intent.

Revision of the requirements in TS 3.3.8.1 for LOP instrumentation functions is needed to be consistent with an electrical power system modification required to satisfy Unit 1 License Condition 2.C(11) and Unit 2 License Condition 2.C(3)(i). These license conditions require SNC to implement modifications that will eliminate use of manual actions as part of the HNP degraded voltage protection scheme, and specify the schedule by which the modifications must be implemented. The proposed license amendment is an interim license change to support implementation of the Unit 2 portion of the electrical power system modification. An additional license amendment request will be submitted at a later date to support the final license change needed to support full implementation of the electrical power system modification.

SNC requests approval of the proposed license amendment by December 31, 2018 to support the implementation schedule of the electrical power system modification as specified in the respective license conditions.

Enclosure 1 provides a description of the proposed change, the supporting technical and regulatory analysis, and the no significant hazards determination. Attachment 1 provides the marked-up TS pages and the marked-up Unit 2 facility operating license page. Attachment 2 provides the clean-typed TS pages. Attachment 3 contain the marked-up TS Bases pages showing the accompanying proposed changes for information only. Attachment 4 provides a

summary of the HNP loss of power instrumentation setpoint methodology that supports the proposed instrumentation Allowable Value changes.

This letter contains no NRC commitments.

In accordance with 10 CFR 50.91, SNC is notifying the State of Georgia of this license amendment request by transmitting a copy of this letter and enclosures to the designated State Official.

If you have any questions, please contact Ken McElroy at (205) 992-7369.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the { } day of {Month} 2018.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

_____

J. J. Hutto
Director, Regulatory Affairs
Southern Nuclear Operating Company

JJH/RMJ

Enclosure: 1. Basis for Proposed Changes

Attachments: 1. HNP Unit 2 Facility Operating License and Unit 1 and Unit 2 Technical Specifications Marked-Up Pages
2. HNP Unit 1 and Unit 2 Technical Specifications Clean-Typed Pages
3. HNP Unit 1 and Unit 2 Technical Specifications Bases Marked-Up Pages (Information Only)
4. Summary of the HNP Loss of Power Instrumentation Setpoint Methodology

cc: Regional Administrator, Region II
NRR Project Manager – Hatch
Senior Resident Inspector – Hatch
Director, Environmental Protection Division – State of Georgia
RType: CHA02.004

Edwin I. Hatch Nuclear Plant, Units 1 and 2
License Amendment Request for
Technical Specification 3.3.8.1 Regarding
Degraded Voltage Protection

Enclosure 1

Basis for Proposed Changes

1.0 Summary Description

This proposed amendment to the Edwin I. Hatch Nuclear Plant (HNP) Units 1 and 2 operating licenses would revise Technical Specification (TS) 3.3.8.1, "Loss of Power (LOP) Instrumentation" to modify the instrument Allowable Values (AVs) for the Unit 2 4.16 kV emergency bus degraded voltage instrumentation and delete the annunciation requirements for the Unit 2 4.16 kV emergency bus undervoltage instrumentation. This amendment is needed to reflect an electrical power system modification required to satisfy Unit 1 License Condition 2.C(11) and Unit 2 License Condition 2.C(3)(i). In addition, the proposed amendment revises the Unit 2 license condition to more accurately reflect its intent.

2.0 Detailed Description

2.1 System Design and Operation

Offsite power is the preferred source of power for the 4.16 kV emergency buses which power the required components. The LOP protection instrumentation monitors voltage on the safety related 4.16 kV buses of each HNP unit. Each 4.16 kV emergency bus has independent LOP instrumentation and relay actuation logic for detecting degraded grid or loss of voltage conditions and initiating an LOP diesel generator (DG) start signal. As described, in part, in HNP Unit 1 Final Safety Evaluation Report (FSAR), Section 8.4.3 and Unit 2 FSAR, Section 8.3.1.1.3, automatic starting of the DGs is initiated by undervoltage on 4.16 kV emergency buses 1E, 1F, 1G, 2E, 2F, and 2G as a result of a complete loss-of-offsite power, a sustained degraded voltage condition, or a failure in any of the redundant instrument train's sensing voltage.

The current degraded voltage instrumentation protection scheme causes an automatic transfer from the primary source to the alternate or emergency source and disconnects certain electrical loads following a time delay. Figure 1, "Current Degraded Voltage Protection Scheme," shows the degraded voltage instrumentation logic for the 2E 4.16 kV emergency bus and associated DG 2A. The current degraded voltage instrumentation logic for each Unit 1 and Unit 2 4.16 kV emergency bus is consistent with that shown in Figure 1. As shown in Figure 1, bus degraded voltage for each 4.16 kV emergency bus is monitored by two induction disk type undervoltage relays with inverse time delay and a logic output arranged in a two-out-of-two logic configuration for supported components except the DGs. The DG start logic is arranged in a one-out-of-two configuration.

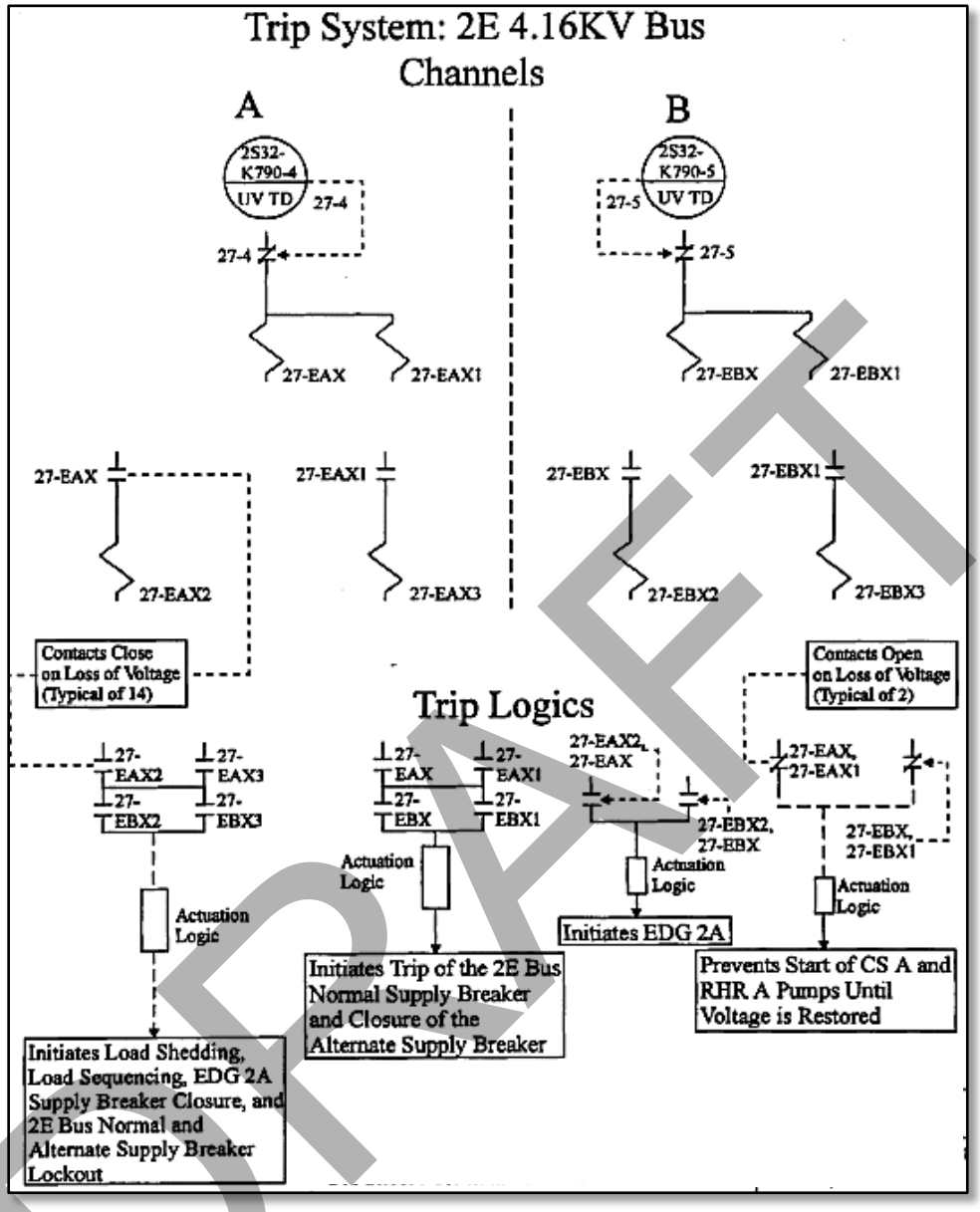


Figure 1 – Current Degraded Voltage Protection Scheme

The current low voltage instrumentation protection scheme is similar to the degraded voltage instrumentation scheme with separate loss of voltage relays with different voltage and time delay characteristics. Each emergency bus also has a dedicated low voltage annunciator with signal provided from two relays and associated time delays. Figure 2, "Unit 1 4.16 kV Bus Low Voltage Alarm Scheme," shows the annunciation instrumentation logic for the Unit 1 4.16 kV emergency buses. The logic for the Unit 1 annunciation functions is arranged in a two-out-of-two configuration as shown in Figure 2. The logic for the Unit 2 annunciation instrumentation functions is arranged in a one-out-of-two configuration.

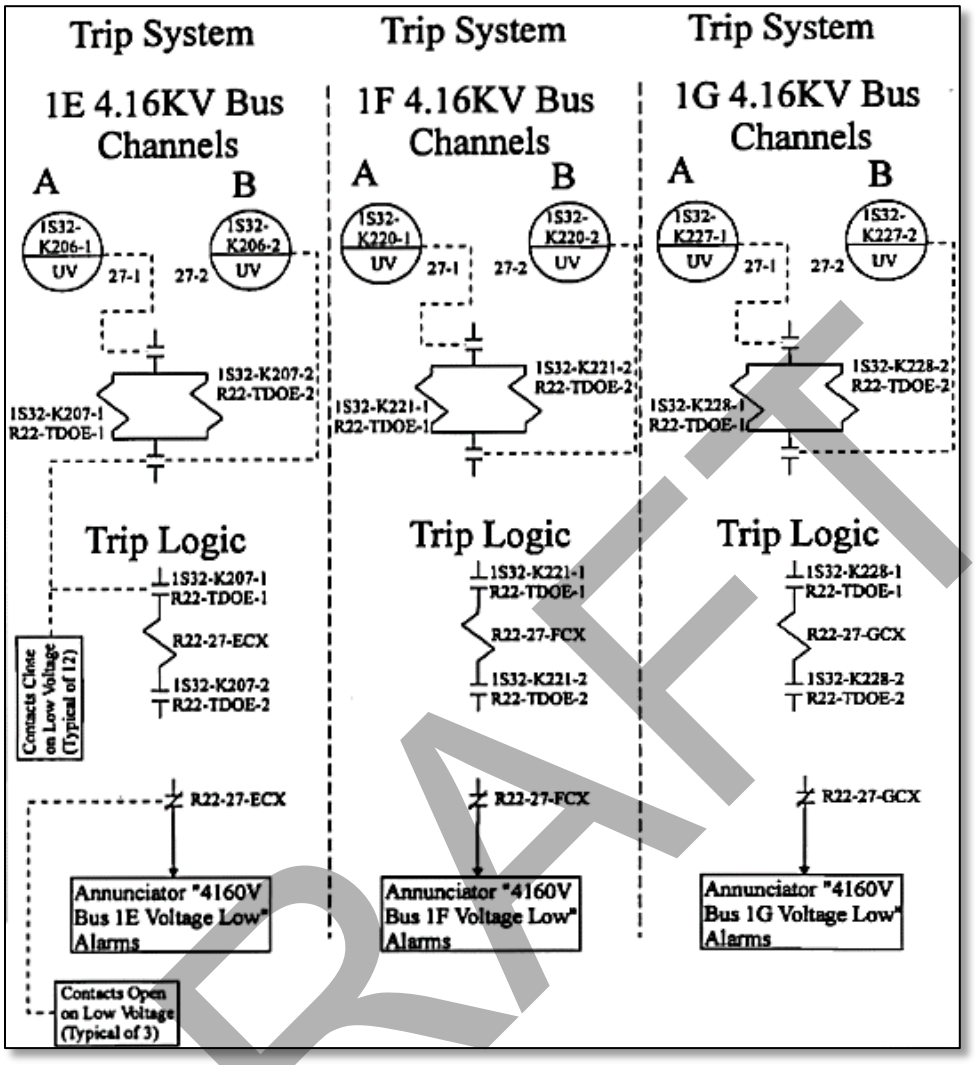


Figure 2 – Unit 1 4.16 kV Bus Low Voltage Alarm Scheme

The current degraded voltage relays (DVRs) are intended to protect plant equipment from a sustained degraded voltage condition when the 4.16 kV emergency buses are powered from the offsite grid. The existing margins available between the minimum expected bus voltage and the voltage level required by the safety-related equipment, coupled with the inverse time operating characteristics of the existing DVRs, do not allow for resolution of the issue addressed in NRC Regulatory Issue Summary (RIS) 2011-12, “Adequacy Of Station Electric Distribution System Voltages,” (Reference 1) through DVR setpoint adjustment alone. Therefore, the existing HNP degraded voltage protection scheme relies in part on manual actions to assure adequate voltage is supplied to safety-related equipment during design basis events.

In the existing protection scheme, manual action is supported by the low voltage alarm. This alarm alerts plant operators of a degraded grid voltage condition so that they can coordinate with the transmission system operators on actions to restore grid voltage. At present, these manual actions are the means relied on to protect safety-related equipment from inadequate voltages in the range where automatic protection is not provided by the DVRs.

The modified LOP instrumentation design includes two loss of voltage relays per bus (i.e., 6 per Function per unit) and three solid state DVRs per bus (i.e., 9 per Function per unit). Figure 3, "Modified Degraded Voltage Protection Scheme," shows the modified degraded voltage instrumentation logic for the 2E 4.16 kV emergency bus and associated DG 2A. The modified degraded voltage instrumentation logic for each 4.16 kV emergency bus will be consistent with that shown in Figure 3 upon completion of the electrical power system modification for each unit. As shown in Figure 3, bus degraded voltage is monitored by the three DVRs with fixed time delay for each emergency bus and a logic output arranged in a two-out-of-three configuration for supported components except the DGs. The DG start logic is arranged in a one-out-of-three configuration.

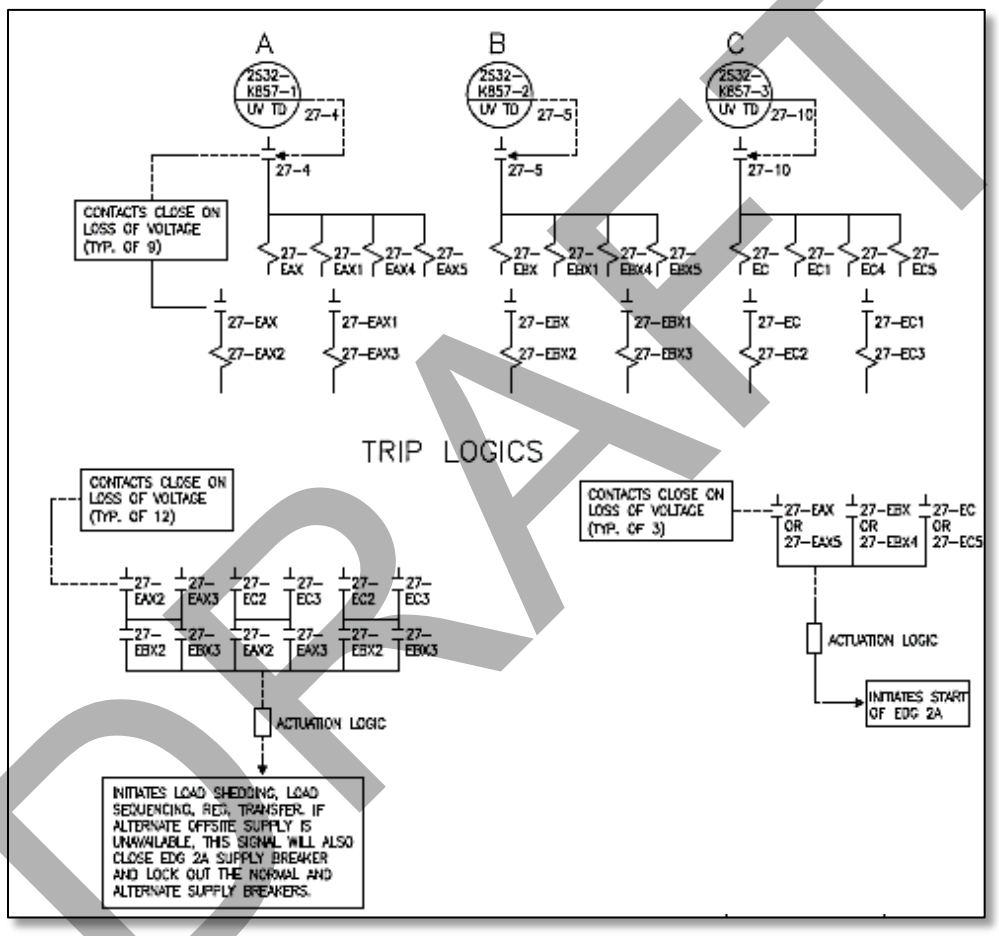


Figure 3 – Modified Degraded Voltage Protection Scheme

2.2 Current Operating License and Technical Specifications Requirements

HNP Unit 1 License Condition 2.C(11) states: "SNC shall implement the Degraded Voltage modifications to eliminate the manual actions in lieu of automatic degraded voltage protection to assure adequate voltage to safety-related equipment during design basis events by completion of the Unit 1 2020 Spring Outage, U1R29."

HNP Unit 2 License Condition 2.C(3)(i) states: "SNC shall implement the Degraded Voltage modifications to eliminate the manual actions in lieu of automatic degraded voltage protection

to assure adequate voltage to safety-related equipment during design basis events by completion of the Unit 2 2019 Spring Outage, U2R25."

LCO 3.3.8.1 requires the instrumentation for each Function in Table 3.3.8.1-1 to be Operable in Modes 1, 2, 3, and when the associated diesel generator (DG) is required to be Operable by TS 3.8.2, "AC Sources – Shutdown." Table 3.3.8.1-1 provides requirements for three LOP instrument functions:

- Function 1, 4.16 kV Emergency Bus Undervoltage (Loss of Voltage);
- Function 2, 4.16 kV Emergency Bus Undervoltage (Degraded Voltage); and
- Function 3, 4.16 kV Emergency Bus Undervoltage (Annunciation).

For each LOP instrument function, Table 3.3.8.1-1 lists applicable number of required channels, surveillance requirements, and AVs. When one or more channels of Function 1 or 2 are inoperable, TS Actions require restoring the channel to Operable status within 1 hour or declare the associated DG inoperable. When one or more channels of Function 3 are inoperable, TS Actions require verifying voltage on the associated emergency bus is ≥ 3825 V once per hour or to declare the associated DG inoperable.

2.3 Reason for Proposed Change

Revision of the requirements in TS 3.3.8.1 for LOP instrumentation is needed to reflect an electrical power system modification required to satisfy Unit 1 License Condition 2.C(11) and Unit 2 License Condition 2.C(3)(i). Unit 1 License Condition 2.C(11) and Unit 2 License Condition 2.C(3)(i) require implementation of degraded voltage modifications that will eliminate use of manual actions as part of the HNP degraded voltage protection scheme.

A plant electrical power system modification will be performed to satisfy the license conditions per the implementation schedule specified in the Units 1 and 2 license conditions. The electrical power system modification, including the installation of the new degraded voltage instrumentation will be implemented for each unit's 4.16 kV emergency buses during the respective unit's refueling outage. SNC has evaluated the modification against the criteria of 10 CFR 50.59(c) and determined the facility modification does not require a license amendment pursuant to 10 CFR 50.90. However, a change to TS 3.3.8.1 is required as part of the implementation of that plant modification. Revision to HNP Unit 1 and Unit 2 TS 3.3.8.1 will be made in two stages to coincide with the staggered installation of the electrical power system modification over two refueling outages.

2.4 Description of Proposed Change

The proposed amendment would revise Unit 2 License Condition 2.C(3)(i) and Unit 1 and Unit 2 TS 3.3.8.1 as follows (deleted text in ~~strikeout~~ and added text in *italics*):

- Unit 2 License Condition 2.C(3)(i) states: "SNC shall implement the Degraded Voltage modifications to eliminate the manual actions in lieu of automatic degraded voltage protection to assure adequate voltage to safety-related equipment during design basis events *for the Unit 2 4.16 kV emergency buses* by completion of the Unit 2 2019 Spring Outage, U2R25 *and for the required Unit 1 4.16 kV emergency buses by completion of the Unit 1 2020 Spring Outage, U1R29*."

- LCO 3.3.8.1 is revised to state, “The LOP instrumentation for each Function in Table 3.3.8.1-1 shall be OPERABLE *for each diesel generator (DG) required by LCO 3.8.1, "AC Sources – Operating," and LCO 3.8.2, "AC Sources – Shutdown.*”

- Applicability is revised to state, “~~MODES, 1, 2, and 3,~~ When ~~the~~ associated ~~diesel generator (~~DG~~)~~ is required to be OPERABLE. ~~by LCO 3.8.2., "AC Sources - Shutdown."~~

- Condition A is revised to state, “One or more *required* channels inoperable for Functions 1 and 2.”

- Required Action B.1 is revised to state, “Verify voltage on associated *Unit 1* 4.16 kV bus is ≥ 3825 V.”

- Table 3.3.8.1-1 Column title is revised to, “Required Channels per ~~Function~~ *Bus.*”

- Function 2.a, 4.16 kV Emergency Bus Undervoltage (Degraded Voltage) – Bus Undervoltage, is revised to explicitly list the required emergency buses; and the AVs associated with Functions 2.a, “Bus Undervoltage” and 2.b, “Time Delay,” are revised with new calculated values individually specifying the bus undervoltage AV for each required 4.16 kV emergency bus.

- Title of Function 3 is revised to, “*Unit 1* 4.16 kV Emergency Bus Undervoltage (Annunciation),” and the number of required channels for Function 3 in Unit 2 Table 3.3.8.1-1 is changed from 1 to 2.

The proposed changes are shown in the marked-up and clean typed Unit 1 and Unit 2 TS pages provided in Attachments 1 and 2. Attachment 1 also provides a Unit 2 facility operating license marked-up page showing the associated license condition change. In addition, Attachment 3 provides, for information only, mark-ups of anticipated corresponding changes to affected TS Bases pages.

3.0 Technical Evaluation

3.1 Discussion of Changes

The proposed change to Unit 2 License Condition 2.C(3)(i) is being made to address the staggered installation of the electrical power system modification that will eliminate the need for manual actions in lieu of automatic degraded voltage protection. Two of the Unit 1 4.16 kV emergency buses and associated DGs are required to support safety-related equipment (i.e., low pressure coolant injection subsystems and the Standby Gas Treatment System) during design basis accidents. The degraded voltage instrumentation upgrade associated with these required buses will not be completed within the implementation schedule specified in the Unit 2 license condition. Therefore, the proposed change revises the Unit 2 license condition to include the implementation schedule for both units. The Unit 1 license condition is not affected by the proposed change because both units’ degraded voltage instrumentation will be upgraded within the implementation schedule currently specified in the Unit 1 license condition. The additional text to the license condition is a clarification, does not alter the intent of the current license condition, and is considered administrative.

For the Unit 2 4.16 kV emergency buses, the proposed change to eliminate the loss of voltage

annunciation requirements (i.e., TS Table 3.3.8.1-1, Function 3) and revise the degraded voltage instrumentation requirements (i.e., TS Table 3.3.8.1-1, Function 2) does not involve a physical change to the LOP instrumentation, nor does it change the safety function of the LOP instrumentation or the equipment supported by the LOP instrumentation. The AVs for Function 2a, "Bus Undervoltage," and Function 2b, "Time Delay," include new calculated values individually specified for each required Unit 2 4.16 kV emergency bus and are more restrictive than the current requirements. These more restrictive requirements continue to ensure process variables, structures, systems, and components are maintained consistent with the safety analyses and licensing basis. SNC considers the elimination of the loss of voltage annunciation instrumentation requirements for the Unit 2 4.16 kV emergency buses and adding more restrictive AV requirements for the degraded voltage instrumentation, as part of implementation of the electrical power system modification, an increase in the margin of plant safety.

The proposed change to add the phrase, "…for each diesel generator (DG) required by LCO 3.8.1, "AC Sources – Operating," and LCO 3.8.2, "AC Sources – Shutdown,"" at the end of LCO 3.3.8.1 provides clarification the LOP instrumentation that is required for each unit, since both units require a portion of the other unit's offsite and onsite electrical power system to support shared unit loads and low pressure coolant injection subsystems. Currently, TS Table 3.3.8.1-1 does not specify requirements for each 4.16 kV emergency bus individually because the requirements are the same for all of the 4.16 kV emergency buses. However, the calculated degraded voltage instrumentation AVs that support the electrical power system modification are different for each bus based on the loading characteristics. Therefore, Table 3.3.8.1-1 is revised to specify AV requirements for each bus individually. As a result, the additional text to the LCO statement to only require the requirements associated with DGs required per LCO 3.8.1 and LCO 3.8.2 is a presentation preference, does not alter the meaning or intent of the current TS LCO, and is considered administrative.

The proposed change to the TS Applicability is a concomitant change to the LCO revision and deletes Modes 1, 2, and 3 and reference to LCO 3.8.2. Because the LOP instrumentation supports the required DGs, the Applicability is revised consistent with the Applicability of TS 3.8.3, "Diesel Fuel Oil and Transfer, Lube Oil, and Starting Air," which also supports the required DGs. This proposed change is a presentation preference, does not alter the meaning or intent of the current TS Applicability, and is considered administrative.

Revising TS Table 3.3.8.1-1 Column title from Function to Bus more accurately reflects the LOP instrumentation design and is consistent with Table 3.3.8.1-1 of NUREG-1433, Revision 4 (Reference 2). The modified LOP instrumentation design includes two loss of voltage relays per bus (i.e., 6 per Function per unit) and three new solid state DVRs per bus (i.e., 8 per Function per unit). The proposed title change to the required channels column is considered administrative and has no effect on any safety analyses assumptions.

Function 3, 4.16 kV Emergency Bus Undervoltage (Annunciation) and associated requirements are revised to be applicable only to Unit 1 because manually transferring electrical power sources during a degraded voltage condition is no longer required for Unit 2 4.16 kV emergency buses to assure adequate voltage is supplied to safety-related equipment during design basis events. The proposed deletion of the Unit 2 loss of voltage annunciation requirements is offset by the more restrictive degraded voltage instrumentation AVs thereby providing an automatic emergency bus transfer to the alternate or emergency power supply in the event of a sustained degraded voltage condition. The number of required channels for Function 3 in Unit 2 Table 3.3.8.1-1 is changed from 1 to 2 consistent with the current Function 3 requirements in Unit 1 Table 3.3.8,1-1. This more restrictive change ensures adequate annunciation channels are

available to alert the operator of a degraded voltage condition on the required Unit 1 4.16 kV emergency buses.

The revision to TS 3.3.8.1 Condition A, revision to Required Action B.1, and revision to the title of Table 3.3.8.1-1, Function 3 are concomitant changes as a result of the deletion of the 4.16 kV Emergency Bus Undervoltage (Annunciation) requirements associated with Unit 2. The addition of the word "required" to Condition A reflects the revised Unit 2 degraded voltage instrumentation logic. Only two of three Unit 2 degraded voltage instrument channels are required to be Operable in accordance with Table 3.3.8.1-1 Function 2.

3.2 Degraded Voltage Instrument Setpoints and Allowable Values

The new AVs specified for the DVRs in Table 3.3.8.1-1 Function 2 have been chosen to assure adequate voltage to safety-related equipment during design basis events, eliminating reliance on manual actions from the degraded voltage protection scheme. Specifically, a loss of coolant accident (LOCA) signal concurrent with degraded bus voltage just below the DVR AV was assumed, such that sufficient voltage for proper operation of the safety-related loads is maintained until the DVRs actuate to separate the buses from the degraded offsite power source. The methodology used in determining the AV's follows the guidelines listed in Generic Letter 79-36, "Adequacy of Station Electric Distribution Systems Voltages," (Reference 3) as supplemented in RIS 2011-12 (Reference 1). The loss of voltage annunciators will continue to alert the operator of a degraded voltage condition, however, they do not initiate automatic separation of the 4.16 kV buses from offsite power upon a LOCA actuation signal. Automatic separation of the buses from offsite power upon a LOCA actuation is not needed because the proposed DVR actuation voltage AVs have been calculated to maintain adequate voltage on the Class 1E buses with LOCA loads assumed. The proposed degraded voltage time delay was optimized to ensure that the Class 1E buses are separated from the offsite power system prior to damaging the safety related loads during sustained degraded voltage conditions while avoiding an inadvertent separation of safety-related buses from the offsite power system. New, higher alarm setpoints have been calculated for each bus that do not overlap with the new DVR AVs; therefore, separating a Class 1E bus from the preferred offsite power source at the low voltage alarm setpoint is not warranted.

The DVR actuation voltage and delay time settings are chosen to minimize nuisance tripping during normal operating conditions but still ensure that the voltage requirements of the safety-related loads are met without exceeding the maximum time delay assumed in the safety analyses. To address the effects of test equipment harmonics on offsetting relay operating points as described in NRC Information Notice 95-05, "Undervoltage Protection Relay Settings Out of Tolerance Due to Test Equipment Harmonics," dated January 20, 1995 (NRC Agencywide Documents Access and Management System (ADAMS) Accession No. ML031060397), the new DVRs include harmonic filters to preclude spurious actuations due to electrical bus harmonics (Reference 4).

Calculations were performed to determine the acceptable voltage operating range at the 4.16 kV emergency buses during normal and LOCA conditions, including transients due to motor starting and bus transfer. As stated in the HNP Unit 2 FSAR, Section 8.2, "Offsite Power System," the normal offsite system operating voltage range for Units 1 and 2 is 101.3% to 104.9% of 230 kV. The minimum expected voltage was calculated as the 4.16 kV emergency bus voltage which would occur during worst-case steady-state loading with a minimum 230-kV switchyard voltage of 101.3%.

The minimum required voltage (MRV) was determined as the greater of: a) the minimum acceptable steady-state voltage for normal operation and LOCA conditions of Class 1E loads, using maximum expected non-accident bus loading, b) the minimum pre-start voltage providing acceptable Class 1E motor starting (e.g. during LOCA group motor starting, using maximum expected accident loading, c) the minimum steady-state voltage providing acceptable Class 1E motor starting and operation for individual motors, using maximum expected accident loading, or d) the minimum voltage to the Class 1E motor control centers necessary for motor controller contactor pickup and equipment operation.

Electrical system voltage evaluations encompassed both Class 1E normal offsite power configurations and alternate offsite power configurations to determine worst case loading conditions. Attachment 4 contains additional details on the methodology for determining the MRV.

The MRV value for each emergency bus was used in calculating the new DVR actuation voltage AVs proposed for Functions 2.a and 2.b of TS Table 3.3.8.1-1. Attachment 4 provides a description of the setpoint methodology from which the AVs were derived and includes criteria and assumptions used for determining the required voltage, voltage setpoints, and the time delay settings. The methodology follows the guidelines listed in Generic Letter 79-36 (Reference 3), as supplemented in RIS 2011-12 (Reference 1).

3.3 Human Factors Impacts

Control room operators currently respond to an electrical degraded voltage condition using applicable alarm response procedures and take action in accordance with the applicable abnormal operations procedure. Operator actions include, but are not limited to, coordinating with the electrical grid system operator to maintain voltage above the minimum value per TS 3.3.8.1, Required Action B.1, minimize activities that may have an impact of large load changes at the plant, and, if necessary, start the associated DG and transfer the affected 4.16 kV emergency buses to their associated DG.

Following implementation of the electrical power system modification, the alarm response procedures and the abnormal operations procedure associated with degraded system voltage will be modified to independently specify actions for alarm and automatic actuation response. Operator response to a low voltage alarm will continue to include minimizing activities that may have an impact of large load changes at the plant, coordinating with the electrical grid system operator to restore the system voltage to within an acceptable range and, if necessary, start the associated DG and transfer the affected 4.16 kV emergency buses to their associated DG. Following an automatic degraded voltage actuation, the applicable alarm response procedure will direct the operator to verify auto DG start, auto bus transfer to the DG, and verification of power available to the bus and associated loads.

The proposed license amendment changes the HNP licensing basis such that the degraded voltage protection design will rely upon the automatic actuation of the DVRs without crediting the current administrative controls, once the modifications are completed on each of the 4.16 kV emergency buses in each unit. HNP emergency operating procedures are not affected by the proposed change; therefore, SNC has determined that an emergency operating procedure control room task analysis is not required.

No changes to controls or displays in the control room are required to support the proposed

license amendment. The loss of voltage and degraded voltage automatic actuations are currently annunciated in the control room and not modified as a result of the degraded voltage instrumentation modification or the proposed license amendment.

As part of implementation of the electrical power system modification, the plant reference simulator will be updated to reflect the modified electrical power system as required by paragraph (c) of 10 CFR 55.46, including the revised degraded voltage protection scheme instrument logic configuration and revision of the LOP instrumentation degraded voltage and annunciation actuation and reset setpoints and applicable operator training programs assessed in accordance with the systems approach to training process as required by paragraph (b) of 10 CFR 50.120.

4.0 Regulatory Evaluation

4.1 Applicable Regulatory Requirements/Criteria

The loss of power (LOP) instrumentation associated with the Class 1E electrical power distribution system satisfies the criteria of 10 CFR 50.36, paragraph (c)(2)(ii), Criterion 3. Automatic transfer of the Class 1E buses from their normal power source to the alternate or emergency power sources in the event of a degraded voltage condition is considered a primary success path to mitigate design basis accidents while connected to offsite power. Upon LOP instrumentation sensing a sustained degraded voltage condition on a Class 1E bus, the normal power is automatically disconnected from the bus and the alternate or emergency power is automatically connected to assure adequate voltage to safety related equipment during design basis accidents.

The proposed amendment continues to maintain requirements associated with structures, systems, and components that are part of the primary success path and actuate to mitigate the related design basis accidents and transients, including the LOP instrumentation.

Following implementation of the electrical power system modification, which includes providing automatic degraded voltage protection in lieu of manual actions to assure adequate voltage to safety related equipment during design basis accidents, the modified LOP instrumentation design will continue to comply with the applicable requirements of 10 CFR 50.55a(h)(2), Protection and safety systems, and meet the requirements of the applicable Institute of Electrical and Electronics Engineers standards pursuant to 10 CFR 50.55a(2). The proposed amendment does not alter the design of the LOP instrumentation or any protection or safety system, rather, the proposed amendment incorporates concomitant changes as a result of the electrical power system modification. Therefore, the protection and safety system design continues to meet the requirements of 10 CFR 50.55a.

In addition, the following 10 CFR Part 50, Appendix A General Design Criteria (GDCs) are related to the LOP instrumentation design:

GDC 17: Electrical power systems. Following implementation of the electrical power system modification, which includes providing automatic degraded voltage protection in lieu of manual actions to assure adequate voltage to safety related equipment during design basis accidents, the LOP instrumentation design will comply with the applicable requirements of GDC-17 as described in NRC Branch Technical Position (BTP) 8-6 of NUREG-0800 (Reference 5). The proposed amendment does not alter the design of any onsite or offsite electric power system,

including the LOP instrumentation, rather, the proposed amendment incorporates concomitant changes as a result of the electrical power system modification. The modified HNP electrical power system design, including the LOP instrumentation design changes, continues to assure the safety function for the offsite and onsite electrical power systems continue 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 and the onsite electric distribution system will continue to have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure.

The proposed amendment does not alter the design of the offsite circuits and these circuits will continue to be available in sufficient time following a loss of all onsite alternating current power supplies and the other offsite electric power circuits, to assure that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. The design of these circuits ensure at least one is 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.

GDC 18: Inspection and testing of electric power systems. The proposed amendment does not alter the design of any onsite or offsite electric power system, including the LOP instrumentation, rather, the proposed amendment incorporates concomitant changes as a result of the electrical power system modification. Therefore, proposed amendment does not impact the HNP electrical power system design capability to test periodically; (1) the operability and functional performance of the components, including the loss of voltage and degraded voltage relays; and (2) the operability of the offsite and onsite electrical power systems as a whole and the full operation sequence that brings the systems into operation.

NUREG 0800, BTP 8-6, Position B.1 contains criteria for undervoltage protection for sustained degraded voltage conditions, referred to as a “second level of undervoltage protection” additional to loss of offsite power, which is the first level. Position B.1.b specifies two time delays for this second level of undervoltage protection. The first time delay is for a degraded voltage alarm in the control room (a function which the emergency bus undervoltage relays will continue to provide), but Position B.1.b.i also specifies immediate separation from offsite power in the event of the subsequent occurrence of a safety injection actuation signal (i.e., LOCA signal). The second time delay, per Position B.1.b.ii, is for automatic separation from offsite power after a duration, limited such that Class 1E loads will not be damaged.

Actuation of the alarm relays does not initiate separation of the bus from offsite power upon a LOCA actuation signal as specified in BTP 8-6, Position B.1.b.i, but this automatic function is not needed at HNP because the proposed DVR actuation voltage AVs have been calculated to maintain adequate voltage on the Class 1E buses with LOCA loads assumed. New, higher alarm setpoints have been calculated for each bus that do not overlap with the new DVR AVs; therefore, separating a Class 1E bus from the preferred offsite power source at the alarm setpoint voltage as discussed in BTP 8-6, Position B.1.b.i is not warranted.

The new DVR actuation voltage AV limits for each required 4.16 kV emergency bus, as proposed individually in Table 3.3.8.1-1 Function 2, are increased from the existing AV range specified in Table 3.3.8.1-1 so as to provide for fully automatic degraded voltage protection on

each bus, eliminating the need for manual actions that are used in the existing HNP degraded voltage protection scheme.

4.2 No Significant Hazards Consideration Analysis

Pursuant to 10 CFR 50.90, Southern Nuclear Operating Company (SNC) hereby requests an amendment to Edwin I. Hatch Nuclear Plant (HNP) Unit 1 Renewed Facility Operating License DPR-57 and Unit 2 Renewed Facility Operating License NPF-5. The proposed amendment revises Technical Specification (TS) 3.3.8.1, “Loss of Power (LOP) Instrumentation” to modify the instrument Allowable Values (AVs) for the Unit 2 4.16 kV emergency bus degraded voltage instrumentation and delete the annunciation requirements for the Unit 2 4.16 kV emergency bus undervoltage instrumentation. This proposed change is needed to reflect an electrical power system modification required to satisfy Unit 1 License Condition 2.C(11) and Unit 2 License Condition 2.C(3)(i). In addition, the proposed amendment revises the Unit 2 license condition to more accurately reflect its intent. The electrical power system modification, which SNC has evaluated independently, will eliminate use of manual actions as part of the HNP degraded voltage protection scheme.

SNC has evaluated whether a significant hazards consideration is involved with the proposed amendment(s) by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

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

   Response: No

   The proposed change incorporates concomitant changes to the LOP instrumentation requirements to reflect an electrical power system modification by deleting the unnecessary loss of voltage annunciation requirements and increasing the AVs for the degraded voltage protection instrumentation.

   The proposed license change does not involve a physical change to the LOP instrumentation, nor does it change the safety function of the LOP instrumentation or the equipment supported by the LOP instrumentation. Automatic starting of the DGs is assumed in the mitigation of a design basis event upon a loss of offsite power. This includes transferring the normal offsite power source to an alternate or emergency power source in the event of a sustained degraded voltage condition. The LOP instrumentation continues to provide this capability and is not altered by the proposed license change. The proposed change does not adversely affect accident initiators or precursors including a loss of offsite power or station blackout. The revised LOP degraded instrumentation setpoints ensure that the Class 1E electrical distribution system is separated from the offsite power system prior to damaging the safety related loads during sustained degraded voltage conditions while avoiding an inadvertent separation of safety-related buses from the offsite power system. Additionally, the degraded voltage instrumentation time delay will isolate the Class 1E electrical distribution system from offsite power before the diesel generators are is ready to assume the emergency loads, which is the limiting time basis for mitigating system responses to design basis accidents. As a result, the proposed change does not significantly alter assumptions relative to the mitigation of an accident or transient event

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

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

   Response: No

   With respect to a new or different kind of accident, the proposed license change does not alter the design or performance of the LOP instrumentation or electrical power system; nor are there any changes in the method by which safety related plant structures, systems, and components (SSCs) perform their specified safety functions as a result of the proposed license amendment. The proposed change deletes the loss of voltage annunciation requirements and increases the AVs for the degraded voltage protection instrumentation as a result of an electrical power system modification, which SNC has evaluated independently of this proposed license amendment. The proposed license amendment will not affect the normal method of plant operation or revise any operating parameters. Additionally, there is no a detrimental impact on the manner in which plant equipment operates or responds to an actuation signal as a result of the proposed license change. No new accident scenarios, transient precursor, failure mechanisms, or limiting single failures will be introduced as a result of this proposed change and the failure modes and effects analyses of SSCs important to safety are not altered as a result of this proposed change.

   The process of operating and testing the LOP instrumentation uses current procedures, methods, and processes already established and currently in use and is not being altered by the proposed license amendment. Therefore, the proposed change does not constitute a new type of test.

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

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

   Response: No

   Margin of safety is provided by the performance capability of plant equipment in preventing or mitigating challenges to fission product barriers under postulated operational transient and accident conditions. The proposed license change deletes the loss of voltage annunciation requirements and increases the AVs for the degraded voltage protection instrumentation as a result of an electrical power system modification, which SNC has evaluated independently of this proposed license amendment. The proposed deletion of the loss of voltage annunciation requirements is offset by the more restrictive degraded voltage instrumentation AVs thereby providing an automatic emergency bus transfer to the alternate or emergency power supply in the event of a sustained degraded voltage condition.

   Therefore, the margin associated with a design basis or safety limit parameter are not adversely impacted by the proposed amendment and, thus the proposed change does

not involve a significant reduction in a margin of safety.

Based on the above, SNC concludes that the proposed change does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and accordingly, a finding of “no significant hazards consideration” is justified.

4.3 Precedent

This license amendment request is as a result of an electrical power system modification required to satisfy Unit 1 License Condition 2.C(11) and Unit 2 License Condition 2.C(3)(i) which were issued December 16, 2014 (Reference 6).

License amendments associated with degraded voltage and loss of voltage relay modifications were issued to Palo Verde Units 1, 2, and 3, dated April 27, 2017, (NRC ADAMS Accession No. ML17090A164) and Joseph M. Farley Nuclear Plant, Units 1 and 2, dated November 17, 2016 (NRC ADAMS Accession No. ML16196A161). License amendments for changes to the degraded voltage relays and timers at Byron Station and at Braidwood Station (Exelon Generation Company, LLC) were issued December 21, 2015 (NRC ADAMS Accession No. ML15307A776).

4.4 Conclusion

In conclusion, based on the considerations discussed herein: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner; (2) such activities will be conducted in compliance with the Commission's regulations; and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 Environmental Consideration

SNC has determined that the proposed amendment does not change a surveillance requirement. SNC has evaluated the proposed amendment to change the HNP Technical Specifications and determined that the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in the individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), an environmental assessment or environmental impact statement is not required for the proposed amendment.

6.0 References

1. NRC Regulatory Issue Summary (RIS) 2011-12, “Adequacy of Station Electric Distribution System Voltages,” Revision 1, dated December 29, 2011 (NRC ADAMS Accession No. ML113050583).

2. NRC NUREG-1433, “Standard Technical Specifications General Electric BWR/4 Plants,”

Volume 1 – Specifications, Revision 4.0 (NRC ADAMS Accession No. ML12104A192).

3. NRC Generic Letter 79-36, “Adequacy of Station Electric Distribution Systems Voltages,” dated August 8, 1979.

4. NRC Information Notice 95-05, “Undervoltage Protection Relay Settings Out of Tolerance Due to Test Equipment Harmonics,” dated January 20, 1995 (NRC ADAMS Accession No. ML031060397)

5. NRC Branch Technical Position 8-6, “Adequacy of Station Electric Distribution System Voltages,” Revision 3, dated March 2007 (NRC ADAMS Accession No. ML070710478).

6. Letter from R. E. Martin, USNRC, to C.R. Pierce, SNC, “Edwin I. Hatch Nuclear Plant, Unit Nos. 1 and 2, Issuance of Amendments for Degraded Voltage Protection Modification Schedule (TAC Nos. MF0412 and MF0413),” dated December 16, 2014 (NRC ADAMS Accession No. ML14328A323).

Edwin I. Hatch Nuclear Plant, Units 1 and 2
License Amendment Request for
Technical Specification 3.3.8.1 Regarding
Degraded Voltage Protection

Attachment 1

HNP Unit 2 Facility Operating License and Unit 1 and Unit 2 Technical Specifications Marked-Up Pages

(h) TSTF-448, Control Room Habitability

Upon implementation of the Amendments adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air inleakage as required by SR 3.7.4.4, in accordance with TS5.5.14.c.(i), the assessment of CFE habitability as required by Specification 5.5.14.c.(ii), and the measurement of CRE pressure as required by Specification 5.5.14.d, shall be considered met. Following implementation:

i) The first performance of SR 3.7.4.4, in accordance with Specification 5.5.14.c.(i), shall be within the next 18 months.

ii) The first performance of the periodic assessment of CFRE habitability, Specification 5.5.14.c.(ii), shall be within 3 years, plus the 9-month Allowance of SR 3.0.2, of the next successful tracer gas test.

iii) The first performance of the periodic measurement of CRE pressure, Specification 5.5.14.d, shall be within 24 months, plus the 6 months allowed by SR 3.0.2, from the date of the most recent successful pressure measurement test.

and for the required Unit 1 4.16 kV emergency buses by completion of the Unit 1 2020 Spring Outage, U1R29

(i) Degraded Voltage Protection

for the Unit 2 4.16 kV emergency buses

SNC shall implement the Degraded Voltage modifications to eliminate the manual actions in lieu of automatic degraded voltage protection to assure adequate voltage to safety-related equipment during design basis events by completion of the Unit 2 2019 Spring Outage, U2R25.

D. This renewed license is subject to the following antitrust conditions:

(1) As used herein:

(a) "Entity" means any financially responsible person, private or public corporation, municipality, county, cooperative, association, joint stock association or business trust, owning, operating or proposing to own or operate equipment or facilities within the state of Georgia (other than Chatham, Effingham, Fannin, Towns and Uniton Counties) for

3.3 INSTRUMENTATION

3.3.8.1 Loss of Power (LOP) Instrumentation

LCO 3.3.8.1 The LOP instrumentation for each Function in Table 3.3.8.1-1 shall be OPERABLE. for each diesel generator (DG) required by LCO 3.8.1, "AC Sources - Operating," and LCO 3.8.2, "AC Sources - Shutdown."

APPLICABILITY: ~~MODES 1, 2, and 3,~~
When ~~the~~ associated ~~diesel generator (~~DG~~)~~ is required to be OPERABLE ~~by LCO 3.8.2, "AC Sources - Shutdown."~~ .

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required channels inoperable for Functions 1 and 2.	A.1 Restore channel to OPERABLE status.	1 hour
B. One or more channels inoperable for Function 3.	B.1 Verify voltage on associated 4.16 kV bus is ≥ 3825 V. Unit 1	Once per hour
~~C~~. Required Action and associated Completion Time not met.	C.1 Declare associated DG inoperable.	Immediately

Table 3.3.8.1-1 (page 1 of 1)
Loss of Power Instrumentation

FUNCTION	BUS	REQUIRED CHANNELS PER ~~FUNCTION~~	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. 4.16 kV Emergency Bus Undervoltage (Loss of Voltage)				
a. Bus Undervoltage		2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≥ 2800 V
b. Time Delay		2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≤ 6.5 seconds
2. 4.16 kV Emergency Bus Undervoltage (Degraded Voltage)				
a. Bus Undervoltage	1) Bus 1E 2) Bus 1F 3) Bus 1G 4) Bus 2E 5) Bus 2G	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	~~≥ 3280 V~~ ≥ 3280 V ≥ 3280 V ≥ 3280 V ≥ 3952 V ≥ 3892 V
b. Time Delay	1) Unit 1 Buses 2) Unit 2 Buses	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	~~≤ 21.5 seconds~~ ≤ 21.5 seconds ≤ 9.8 seconds
3. 4.16 kV Emergency Bus Undervoltage (Annunciation)				
a. Bus Undervoltage		2	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≥ 3825 V
b. Time Delay		2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≤ 65 seconds

Unit 1

3.3 INSTRUMENTATION

3.3.8.1 Loss of Power (LOP) Instrumentation

LCO 3.3.8.1 The LOP instrumentation for each Function in Table 3.3.8.1-1 shall be OPERABLE. for each diesel generator (DG) required by LCO 3.8.1, "AC Sources - Operating," and LCO 3.8.2, "AC Sources - Shutdown."

APPLICABILITY: ~~MODES 1, 2, and 3,~~
When ~~the~~ associated ~~diesel generator (~~DG~~)~~ is required to be OPERABLE ~~by LCO 3.8.2, "AC Sources - Shutdown."~~ .

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required channels inoperable for Functions 1 and 2.	A.1 Restore channel to OPERABLE status.	1 hour
B. One or more channels inoperable for Function 3.	B.1 Verify voltage on associated 4.16 kV bus is ≥ 3825 V. Unit 1	Once per hour
C. Required Action and associated Completion Time not met.	C.1 Declare associated DG inoperable.	Immediately

Table 3.3.8.1-1 (page 1 of 1)
Loss of Power Instrumentation

FUNCTION	BUS	REQUIRED CHANNELS PER ~~FUNCTION~~	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. 4.16 kV Emergency Bus Undervoltage (Loss of Voltage)				
a. Bus Undervoltage		2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≥ 2800 V
b. Time Delay		2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≤ 6.5 seconds
2. 4.16 kV Emergency Bus Undervoltage (Degraded Voltage)				
a. Bus Undervoltage	1) Bus 2E 2) Bus 2F 3) Bus 2G 4) Bus 1E 5) Bus 1G	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	~~≥ 3280 V~~ ≥ 3952 V ≥ 3892 V ≥ 3892 V ≥ 3280 V ≥ 3280 V
b. Time Delay	1) Unit 2 Buses 2) Unit 1 Buses	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	~~≤ 21.5 seconds~~ ≤ 9.8 seconds ≤ 21.5 seconds
3. 4.16 kV Emergency Bus Undervoltage (Annunciation)	Unit 1			
a. Bus Undervoltage		~~1~~ 2	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≥ 3825 V
b. Time Delay		~~1~~ 2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≤ 65 seconds

Edwin I. Hatch Nuclear Plant, Units 1 and 2
License Amendment Request for
Technical Specification 3.3.8.1 Regarding
Degraded Voltage Protection

Attachment 2

HNP Unit 1 and Unit 2 Technical Specifications
Clean-Typed Pages

3.3 INSTRUMENTATION

3.3.8.1 Loss of Power (LOP) Instrumentation

LCO 3.3.8.1 The LOP instrumentation for each Function in Table 3.3.8.1-1 shall be OPERABLE for each diesel generator (DG) required by LCO 3.8.1, "AC Sources – Operating," and LCO 3.8.2, "AC Sources – Shutdown."

APPLICABILITY: When associated DG is required to be OPERABLE.

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required channels inoperable for Functions 1 and 2.	A.1 Restore channel to OPERABLE status.	1 hour
B. One or more channels inoperable for Function 3.	B.1 Verify voltage on associated Unit 1 4.16 kV bus is ≥ 3825 V.	Once per hour
C. Required Action and associated Completion Time not met.	C.1 Declare associated DG inoperable.	Immediately

Table 3.3.8.1-1 (page 1 of 1)
Loss of Power Instrumentation

FUNCTION	REQUIRED CHANNELS PER BUS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. 4.16 kV Emergency Bus Undervoltage (Loss of Voltage)			
a. Bus Undervoltage	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≥ 2800 V
b. Time Delay	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≤ 6.5 seconds
2. 4.16 kV Emergency Bus Undervoltage (Degraded Voltage)			
a. Bus Undervoltage	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	
1) Bus 1E			≥ 3280 V
2) Bus 1F			≥ 3280 V
3) Bus 1G			≥ 3280 V
4) Bus 2E			≥ 3952 V
5) Bus 2G			≥ 3892 V
b. Time Delay	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	
1) Unit 1 Buses			≤ 21.5 seconds
2) Unit 2 Buses			≤ 9.8 seconds
3. Unit 1 4.16 kV Emergency Bus Undervoltage (Annunciation)			
a. Bus Undervoltage	2	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≥ 3825 V
b. Time Delay	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≤ 65 seconds

3.3 INSTRUMENTATION

3.3.8.1 Loss of Power (LOP) Instrumentation

LCO 3.3.8.1 The LOP instrumentation for each Function in Table 3.3.8.1-1 shall be OPERABLE for each diesel generator (DG) required by LCO 3.8.1, "AC Sources – Operating," and LCO 3.8.2, "AC Sources – Shutdown."

APPLICABILITY: When associated DG is required to be OPERABLE.

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required channels inoperable for Functions 1 and 2.	A.1 Restore channel to OPERABLE status.	1 hour
B. One or more channels inoperable for Function 3.	B.1 Verify voltage on associated Unit 1 4.16 kV bus is ≥ 3825 V.	Once per hour
C. Required Action and associated Completion Time not met.	C.1 Declare associated DG inoperable.	Immediately

Table 3.3.8.1-1 (page 1 of 1)
Loss of Power Instrumentation

FUNCTION	REQUIRED CHANNELS PER BUS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. 4.16 kV Emergency Bus Undervoltage (Loss of Voltage)			
a. Bus Undervoltage	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≥ 2800 V
b. Time Delay	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≤ 6.5 seconds
2. 4.16 kV Emergency Bus Undervoltage (Degraded Voltage)			
a. Bus Undervoltage	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	
1) Bus 2E			≥ 3952 V
2) Bus 2F			≥ 3892 V
3) Bus 2G			≥ 3892 V
4) Bus 1E			≥ 3280 V
5) Bus 1G			≥ 3280 V
b. Time Delay	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	
1) Unit 2 Buses			≤ 9.8 seconds
2) Unit 1 Buses			≤ 21.5 seconds
3. Unit 1 4.16 kV Emergency Bus Undervoltage (Annunciation)			
a. Bus Undervoltage	2	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≥ 3825 V
b. Time Delay	2	SR 3.3.8.1.2 SR 3.3.8.1.3 SR 3.3.8.1.4	≤ 65 seconds

Edwin I. Hatch Nuclear Plant, Units 1 and 2
License Amendment Request for
Technical Specification 3.3.8.1 Regarding
Degraded Voltage Protection

Attachment 3

HNP Unit 1 and Unit 2 Technical Specifications Bases
Marked-Up Pages
(Information Only)

B 3.3 INSTRUMENTATION

B 3.3.8.1 Loss of Power (LOP) Instrumentation

BASES

BACKGROUND

Successful operation of the required safety functions of the Emergency Core Cooling Systems (ECCS) is dependent upon the availability of adequate power sources for energizing the various components such as pump motors, motor operated valves, and the associated control components. The LOP instrumentation monitors the 4.16 kV emergency buses. Offsite power is the preferred source of power for the 4.16 kV emergency buses. If the monitors determine that insufficient power is available, the buses are disconnected from the offsite power sources and connected to the onsite diesel generator (DG) power sources.

Each 4.16 kV emergency bus has its own independent LOP instrumentation and associated trip logic. The voltage for each bus is monitored at two levels: 4.16 kV Emergency Bus Undervoltage Loss of Voltage and Degraded Voltage~~, however, only the Loss of Voltage Function is part of this LCO~~. The Loss of Voltage Function causes various bus transfers and disconnects and is monitored by two undervoltage relays for each emergency bus, whose outputs are arranged in a two-out-of-two logic configuration for ~~all~~ affected components except the DGs. The DG start logic configuration is one-out-of-two (Ref. 1). The channels include electronic equipment (e.g., trip units) that compares measured input signals with pre-established setpoints. When the setpoint is exceeded, the channel output relay actuates, which then outputs a LOP trip signal to the trip logic.

<Insert B 3.3.8.1-1>

The Unit 1 LOP alarm instrumentation is required as part of the LCO. The Unit 2 LOP alarm instrumentation is not required as part of the LCO because the LOP degraded voltage protection scheme automatically protects safety related loads in the event of a sustained degraded electrical grid voltage condition.

Each 4.16 kV emergency bus has its own independent LOP alarm instrumentation to provide an anticipatory alarm and the initiation of corrective measures to restore emergency bus voltages. The alarms are set higher than the LOP trip relays. ~~The alarm setpoints are approximately midway between the calculated minimum expected voltage and the calculated minimum required voltage, based on the maximum expected operating (i.e., non-LOCA) load conditions. The alarm setpoints signify that adequate voltage is available for normal operations. The LOP anticipatory alarms provide a total time delay of 65 seconds to reduce the possibility of nuisance alarms, while permitting prompt detection of potential low voltage conditions.~~

Unit 1

Each 4.16 kV emergency bus has a dedicated low voltage annunciator fed by two relays and their associated time delays. The logic for the annunciation function is arranged in a two-out-of-two configuration.

(continued)

Insert B 3.3.8.1-1

The Degraded Voltage Function causes the same bus transfers and disconnects. The Unit 1 Degraded Voltage Function is monitored by two inverse time undervoltage relays for each emergency bus whose outputs are arranged in a two-out-of-two logic configuration for supported components except the DGs. The start logic for the Unit 1 DGs, including the swing DG (DG 1B) is arranged in a one-out-of-two configuration (Ref. 1). The Unit 2 Degraded Voltage Function is monitored by three solid state undervoltage relays with fixed time delay for each emergency bus whose outputs are arranged in a two-out-of-three logic configuration for supported components except the DGs. The start logic for the Unit 2 DGs and the swing DG (DG 1B) is arranged in a one-out-of-three configuration (Ref. 1).

BASES (continued)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The LOP instrumentation is required for Engineered Safety Features to function in any accident with a loss of offsite power. The required channels of LOP instrumentation ensure that the ECCS and other assumed systems powered from the DGs, provide plant protection in the event of any of the References 2, 3, and 4 analyzed accidents in which a loss of offsite power is assumed. The initiation of the DGs on loss of offsite power, and subsequent initiation of the ECCS, ensure that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

Accident analyses credit the loading of the DG based on the concurrent loss of offsite power during a loss of coolant accident. The diesel starting and loading times have been included in the delay time associated with each safety system component requiring DG supplied power following a loss of offsite power.

<Insert B 3.3.8.1-7>

~~The LOP alarm instrumentation is required to initiate manual actions to restore the 4.16 kV emergency bus voltages or to initiate a plant shutdown. The required channels of LOP alarm instrumentation ensure the initiation of manual actions to protect the ECCS and other assumed systems from degraded voltage without initiating an unnecessary automatic disconnect from the preferred offsite power source. The occurrence of an undervoltage degraded voltage condition credits the manual actions to mitigate the condition and ensure plant safety is maintained.~~

10 CFR 50.36(c)(2)(ii)

The LOP instrumentation satisfies Criterion 3 of ~~the NRC Policy Statement (Ref. 5), except that credit is taken for manual actions.~~

The OPERABILITY of the LOP instrumentation is dependent upon the OPERABILITY of the individual instrumentation channel Functions specified in Table 3.3.8.1-1. Each Function must have a required number of OPERABLE channels per 4.16 kV emergency bus, with their setpoints within the specified Allowable Values. A channel is inoperable if its actual trip setpoint is not within its required Allowable Value. The setpoint is calibrated consistent with applicable procedures (nominal trip setpoint).

each Function in the Table

The Allowable Values are specified for ~~the 4.16 kV Emergency Bus Undervoltage Function~~. Nominal trip setpoints are specified in the setpoint calculations. The nominal setpoints are selected~~, based on engineering judgment,~~ to ensure that the setpoints do not exceed the Allowable Value between CHANNEL CALIBRATIONS. Operation with a trip setpoint less conservative than the nominal trip setpoint, but within the Allowable Value, is acceptable. Trip setpoints are those predetermined values of output and time delay at which an action

(continued)

Insert B 3.3.8.1-7

The Unit 1 LOP alarm instrumentation provides annunciation to alert operators of a degraded electrical grid voltage condition thereby ensuring initiation of manual actions to protect safety related equipment powered from Unit 1 4.16 kV emergency buses during a sustained degraded electrical grid voltage condition. The Unit 2 LOP degraded voltage instrumentation provides automatic protection of safety related equipment powered from Unit 2 4.16 kV emergency buses during a sustained degraded electrical grid voltage condition.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

should take place. The setpoints are compared to the actual process parameter (e.g., degraded voltage), and when the measured output value of the process parameter exceeds the setpoint and time delay, the associated device (e.g., trip relay) changes state.

<Insert B 3.3.8.1-3>

~~The 4.16 kV undervoltage degraded voltage trip setpoints~~ were determined in accordance with the NRC staff positions contained in an NRC letter dated June 2, 1977, except that manual actions are credited for restoring bus voltages or initiating a plant shutdown ~~in the range of 78.8 to 92% of 4.16 kV~~. The undervoltage degraded voltage setpoint represents a point on the inverse time characteristic curve for the relay. The anticipatory alarm setpoints are approximately midway between the calculated minimum expected voltage and the calculated minimum required voltage, based on maximum expected operating; i.e., non-LOCA, conditions.

Unit 1

The Specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below on a Function by Function basis.

1. 4.16 kV Emergency Bus Undervoltage (Loss of Voltage)

Loss of voltage on a 4.16 kV emergency bus indicates that offsite power may be completely lost to the respective emergency bus and is unable to supply sufficient power for proper operation of the applicable equipment. Therefore, the power supply to the bus is transferred from offsite power to DG power when the voltage on the bus drops below the Loss of Voltage Function Allowable Values (loss of voltage with a short time delay). This ensures that adequate power will be available to the required equipment.

The Bus Undervoltage Allowable Values are low enough to prevent inadvertent power supply transfer, but high enough to ensure that power is available to the required equipment. The Time Delay Allowable Values are long enough to provide time for the offsite power supply to recover to normal voltages, but short enough to ensure that power is available to the required equipment.

Two channels of 4.16 kV Emergency Bus Undervoltage (Loss of Voltage) Function per associated emergency bus are only required to be OPERABLE when the associated DG is required to be OPERABLE to ensure that no single instrument failure can preclude the DG function. ~~(Two channels input to each of the three DGs.)~~ (Refer to LCOs 3.8.1, "AC Sources - Operating," and 3.8.2, "AC Sources - Shutdown," for Applicability Bases for the DGs.)

(continued)

Insert B 3.3.8.1-3

The Allowable Values for the Unit 2 4.16 kV degraded voltage instrumentation are derived from the analytic limits, corrected for calibration, process, and some of the instrument errors. The trip setpoints are then determined accounting for the remaining instrument errors (e.g., drift). The trip setpoints derived in this manner provide adequate protection because instrumentation uncertainties, process effects, calibration tolerances, instrument drift, and severe environment errors (for channels that must function in harsh environments as defined by 10 CFR 50.49) are accounted for. The Allowable Values for the Unit 1 4.16 kV degraded voltage instrumentation

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2. 4.16 kV Emergency Bus Undervoltage (Degraded Voltage)

A reduced voltage condition on a 4.16 kV emergency bus indicates that, while offsite power may not be completely lost to the respective emergency bus, available power may be insufficient for starting large ECCS motors without risking damage to the motors that could disable the ECCS Function. Therefore, power supply to the bus is transferred from offsite power to onsite DG power when the voltage on the bus drops below the Degraded Voltage Function Allowable Values (degraded voltage with a time delay). This ensures that adequate power will be available to the required equipment.

Unit 1

The Bus Undervoltage Allowable Values are low enough to prevent inadvertent power supply transfer, but high enough to ensure that sufficient power is available to the large ECCS motors. The Time Delay Allowable Values are long enough for the offsite power supply to usually recover.

For Unit 1 power supplies, manual

This minimizes the potential that short duration disturbances will adversely impact the availability of the offsite power supply. ~~Manual~~ actions are credited ~~in the range of 78.8 to 92% of 4.16 kV~~ to restore bus voltages or to initiate a plant shutdown. ~~The range specified for manual actions indicates that sufficient power is available to the large ECCS motors; however, sufficient voltage for equipment at lower voltages required for LOCA conditions may not be available.~~

<Insert B 3.3.8.1-8>

Two channels of 4.16 kV Emergency Bus Undervoltage (Degraded Voltage) Function per associated bus are only required to be OPERABLE when the associated DG is required to be OPERABLE to ensure that no single instrument failure can preclude the DG function. ~~(Two channels input to each of the three emergency buses and DGs.)~~ Refer to LCO 3.8.1 and LCO 3.8.2 for Applicability Bases for the DGs.

Unit 1

Annunciation

3. 4.16 kV Emergency Bus Undervoltage (~~Anticipatory Alarm~~)

Unit 1

A reduced voltage condition on a 4.16 kV emergency bus indicates that, while offsite power is adequate for normal operating conditions, available power may be marginal for some equipment required for LOCA conditions. Therefore, the anticipatory alarms actuate when the 4.16 kV bus voltages approach the minimum required voltage for normal; i.e., non-LOCA conditions. This ensures that manual actions will be initiated to restore the bus voltages or to initiate a plant shutdown.

(continued)

Insert B 3.3.8.1-8

The Unit 2 Time Delay Allowable Values are long enough to provide time for the offsite power supply to recover to normal voltages, but short enough to ensure that sufficient power is available to the required equipment.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

3. 4.16 kV Emergency Bus Undervoltage (~~Anticipatory Alarm~~) (continued)

Annunciation

Unit 1

Annunciation

Two channels of 4.16 kV Emergency Bus Undervoltage (~~Anticipatory Alarm~~) Function per associated bus are only required to be OPERABLE when the associated DG is required to be OPERABLE. ~~(Two channels input to each of the three emergency buses.)~~

<Insert B 3.3.8.1-9>

ACTIONS

A Note has been provided to modify the ACTIONS related to LOP instrumentation channels. Section 1.3, Completion Times, specifies that once a Condition has been entered, subsequent divisions, subsystems, components, or variables expressed in the Condition, discovered to be inoperable or not within limits, will not result in separate entry into the Condition. Section 1.3 also specifies that Required Actions of the Condition continue to apply for each additional failure, with Completion Times based on initial entry into the Condition. However, the Required Actions for inoperable LOP instrumentation channels provide appropriate compensatory measures for separate inoperable channels. As such, a Note has been provided that allows separate Condition entry for each inoperable LOP instrumentation channel.

required

A.1

With one or more channels of Function 1 or 2 inoperable, the Function does not maintain initiation capability for the associated emergency bus. Therefore, only 1 hour is allowed to restore the inoperable channel to OPERABLE status. The Required Action does not allow placing a channel in trip since this action will result in a DG initiation.

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The 1 hour Completion Time is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

<Insert B 3.3.8.1-10>

B.1

~~Each 4.16 kV bus has a dedicated annunciator fed by two relays and their associated time delays in a two-out-of-two logic configuration. Both relays and their associated time delays are required to be OPERABLE. Therefore, the loss of either required relay or time delay renders Function 3 incapable of performing the intended function.~~

(continued)

Insert B 3.3.8.1-9

to ensure that adequate annunciation channels are available to alert the operator of a degraded voltage condition on the Unit 1 4.16 kV emergency buses.

Insert B 3.3.8.1-10

With one or more Function 3 channels per bus inoperable, annunciation capability may not be available to alert the operator of a degraded voltage condition on the Unit 1 4.16 kV emergency buses.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.8.1.4 (continued)

The system functional testing performed in LCO 3.8.1 and LCO 3.8.2 overlaps this Surveillance to provide complete testing of the assumed safety functions.

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

REFERENCES

1. FSAR, Section 8.4.
2. FSAR, Section 4.8.
3. FSAR, Section 6.5.
4. FSAR, Chapter 14.
5. ~~NRC No. 93-102, "Final Policy Statement on Technical Specification Improvements," July 23, 1993.~~

B 3.3 INSTRUMENTATION

B 3.3.8.1 Loss of Power (LOP) Instrumentation

BASES

BACKGROUND

Successful operation of the required safety functions of the Emergency Core Cooling Systems (ECCS) is dependent upon the availability of adequate power sources for energizing the various components such as pump motors, motor operated valves, and the associated control components. The LOP instrumentation monitors the 4.16 kV emergency buses. Offsite power is the preferred source of power for the 4.16 kV emergency buses. If the monitors determine that insufficient power is available, the buses are disconnected from the offsite power sources and connected to the onsite diesel generator (DG) power sources.

Each 4.16 kV emergency bus has its own independent LOP instrumentation and associated trip logic. The voltage for each bus is monitored at two levels: 4.16 kV Emergency Bus Undervoltage Loss of Voltage and Degraded Voltage~~, however, only the Loss of Voltage Function is part of this LCO~~. The Loss of Voltage Function causes various bus transfers and disconnects and is monitored by two undervoltage relays for each emergency bus, whose outputs are arranged in a two-out-of-two logic configuration for ~~all~~ affected components except the DGs. The DG start logic configuration is one-out-of-two (Ref. 1). The channels include electronic equipment (e.g., trip units) that compares measured input signals with pre-established setpoints. When the setpoint is exceeded, the channel output relay actuates, which then outputs a LOP trip signal to the trip logic.

<Insert B 3.3.8.1-1>

The Unit 1 LOP alarm instrumentation is required as part of the LCO. The Unit 2 LOP alarm instrumentation is not required as part of the LCO because the LOP degraded voltage protection scheme automatically protects safety related loads in the event of a sustained degraded electrical grid voltage condition.

Each 4.16 kV emergency bus has its own independent LOP alarm instrumentation to provide an anticipatory alarm and the initiation of corrective measures to restore emergency bus voltages. The alarms are set higher than the LOP trip relays. ~~The alarm setpoints are approximately midway between the calculated minimum expected voltage and the calculated minimum required voltage, based on the maximum expected operating (i.e., non-LOCA) load conditions. The alarm setpoints signify that adequate voltage is available for normal operations. The LOP anticipatory alarms provide a total time delay of 65 seconds to reduce the possibility of nuisance alarms, while permitting prompt detection of potential low voltage conditions.~~

Unit 1

Each 4.16 kV emergency bus has a dedicated low voltage annunciator fed by two relays and their associated time delays. The logic for the annunciation function is arranged in a ~~one~~-out-of-two configuration.

two

(continued)

Insert B 3.3.8.1-1

The Degraded Voltage Function causes the same bus transfers and disconnects. The Unit 1 Degraded Voltage Function is monitored by two inverse time undervoltage relays for each emergency bus whose outputs are arranged in a two-out-of-two logic configuration for supported components except the DGs. The start logic for the Unit 1 DGs, including the swing DG (DG 1B) is arranged in a one-out-of-two configuration (Ref. 1). The Unit 2 Degraded Voltage Function is monitored by three solid state undervoltage relays with fixed time delay for each emergency bus whose outputs are arranged in a two-out-of-three logic configuration for supported components except the DGs. The start logic for the Unit 2 DGs and the swing DG (DG 1B) is arranged in a one-out-of-three configuration (Ref. 1).

BASES (continued)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The LOP instrumentation is required for Engineered Safety Features to function in any accident with a loss of offsite power. The required channels of LOP instrumentation ensure that the ECCS and other assumed systems powered from the DGs, provide plant protection in the event of any of the Reference 2, 3, and 4 analyzed accidents in which a loss of offsite power is assumed. The initiation of the DGs on loss of offsite power, and subsequent initiation of the ECCS, ensure that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

Accident analyses credit the loading of the DG based on the concurrent loss of offsite power during a loss of coolant accident. The diesel starting and loading times have been included in the delay time associated with each safety system component requiring DG supplied power following a loss of offsite power.

<Insert B 3.3.8.1-2>

~~The LOP alarm instrumentation is required to initiate manual actions to restore the 4.16 kV emergency bus voltages or to initiate a plant shutdown. The required channels of LOP alarm instrumentation ensure the initiation of manual actions to protect the ECCS and other assumed systems from degraded voltage without initiating an unnecessary automatic disconnect from the preferred offsite power source. The occurrence of an undervoltage degraded voltage condition credits the manual actions to mitigate the condition and ensure plant safety is maintained.~~

10 CFR 50.36(c)(2)(ii)

The LOP instrumentation satisfies Criterion 3 of ~~the NRC Policy Statement (Ref. 5), except that credit is taken for manual actions~~.

The OPERABILITY of the LOP instrumentation is dependent upon the OPERABILITY of the individual instrumentation channel Functions specified in Table 3.3.8.1-1. Each Function must have a required number of OPERABLE channels per 4.16 kV emergency bus, with their setpoints within the specified Allowable Values. A channel is inoperable if its actual trip setpoint is not within its required Allowable Value. The setpoint is calibrated consistent with applicable procedures (nominal trip setpoint).

each Function in the Table

The Allowable Values are specified for ~~the 4.16 kV Emergency Bus Undervoltage Function~~. Nominal trip setpoints are specified in the setpoint calculations. The nominal setpoints are selected~~, based on engineering judgment,~~ to ensure that the setpoints do not exceed the Allowable Value between CHANNEL CALIBRATIONS. Operation with a trip setpoint less conservative than the nominal trip setpoint, but within the Allowable Value, is acceptable. Trip setpoints are those predetermined values of output and time delay at which an action

(continued)

Insert B 3.3.8.1-2

The Unit 2 LOP degraded voltage instrumentation provides automatic protection of safety related equipment powered from Unit 2 4.16 kV emergency buses during a sustained degraded electrical grid voltage condition. The Unit 1 LOP alarm instrumentation provides annunciation to alert operators of a degraded electrical grid voltage condition thereby ensuring initiation of manual actions to protect safety related equipment powered from Unit 1 4.16 kV emergency buses during a sustained degraded electrical grid voltage condition.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

should take place. The setpoints are compared to the actual process parameter (e.g., degraded voltage), and when the measured output value of the process parameter exceeds the setpoint and time delay, the associated device (e.g., trip relay) changes state.

<Insert B 3.3.8.1-3>

~~The 4.16 kV undervoltage degraded voltage trip setpoints~~ were determined in accordance with the NRC staff positions contained in an NRC letter dated June 2, 1977, except that manual actions are credited for restoring bus voltages or initiating a plant shutdown ~~in the range of 78.8 to 92% of 4.16 kV~~. The undervoltage degraded voltage setpoint represents a point on the inverse time characteristic curve for the relay. The anticipatory alarm setpoints are approximately midway between the calculated minimum expected voltage and the calculated minimum required voltage, based on maximum expected operating; i.e., non-LOCA, conditions.

Unit 1

The specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below on a Function by Function basis.

1. 4.16 kV Emergency Bus Undervoltage (Loss of Voltage)

Loss of voltage on a 4.16 kV emergency bus indicates that offsite power may be completely lost to the respective emergency bus and is unable to supply sufficient power for proper operation of the applicable equipment. Therefore, the power supply to the bus is transferred from offsite power to DG power when the voltage on the bus drops below the Loss of Voltage Function Allowable Values (loss of voltage with a short time delay). This ensures that adequate power will be available to the required equipment.

The Bus Undervoltage Allowable Values are low enough to prevent inadvertent power supply transfer, but high enough to ensure that power is available to the required equipment. The Time Delay Allowable Values are long enough to provide time for the offsite power supply to recover to normal voltages, but short enough to ensure that power is available to the required equipment.

Two channels of 4.16 kV Emergency Bus Undervoltage (Loss of Voltage) Function per associated emergency bus are only required to be OPERABLE when the associated DG is required to be OPERABLE to ensure that no single instrument failure can preclude the DG function. ~~(Two channels input to each of the three DGs.)~~ Refer to LCO 3.8.1, "AC Sources - Operating," and 3.8.2, "AC Sources - Shutdown," for Applicability Bases for the DGs.

(continued)

Insert B 3.3.8.1-3

The Allowable Values for the Unit 2 4.16 kV degraded voltage instrumentation are derived from the analytic limits, corrected for calibration, process, and some of the instrument errors. The trip setpoints are then determined accounting for the remaining instrument errors (e.g., drift). The trip setpoints derived in this manner provide adequate protection because instrumentation uncertainties, process effects, calibration tolerances, instrument drift, and severe environment errors (for channels that must function in harsh environments as defined by 10 CFR 50.49) are accounted for. The Allowable Values for the Unit 1 4.16 kV degraded voltage instrumentation

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2. 4.16 kV Emergency Bus Undervoltage (Degraded Voltage)

A reduced voltage condition on a 4.16 kV emergency bus indicates that, while offsite power may not be completely lost to the respective emergency bus, available power may be insufficient for starting large ECCS motors without risking damage to the motors that could disable the ECCS function. Therefore, power supply to the bus is transferred from offsite power to onsite DG power when the voltage on the bus drops below the Degraded Voltage Function Allowable Values (degraded voltage with a time delay). This ensures that adequate power will be available to the required equipment.

The Bus Undervoltage Allowable Values are low enough to prevent inadvertent power supply transfer, but high enough to ensure that sufficient power is available to the large ECCS motors. ~~The~~ Time Delay Allowable Values are long enough for the offsite power supply to usually recover.

<Insert B 3.3.8.1-4>

This minimizes the potential that short duration disturbances will adversely impact the availability of the offsite power supply. ~~Manual~~ actions are credited ~~in the range of 78.8 to 92% of 4.16 kV~~ to restore bus voltages or to initiate a plant shutdown. ~~The range specified for manual actions indicates that sufficient power is available to the large ECCS motors; however, sufficient voltage for equipment at lower voltages required for LOCA conditions may not be available.~~

For Unit 1 power supplies to Unit 2 required loads, manual

Two channels of 4.16 kV Emergency Bus Undervoltage (Degraded Voltage) Function per associated bus are only required to be OPERABLE when the associated DG is required to be OPERABLE to ensure that no single instrument failure can preclude the DG function. ~~(Two channels input to each of the three emergency buses and DGs.)~~ Refer to LCO 3.8.1 and LCO 3.8.2 for Applicability Bases for the DGs.

Unit 1

Annunciation

3. 4.16 kV Emergency Bus Undervoltage (~~Anticipatory Alarm~~)

Unit 1

A reduced voltage condition on a 4.16 kV emergency bus indicates that, while offsite power is adequate for normal operating conditions, available power may be marginal for some equipment required for LOCA conditions. Therefore, the anticipatory alarms actuate when the 4.16 kV bus voltages approach the minimum required voltage for normal; i.e., non-LOCA conditions. This ensures that manual actions will be initiated to restore the bus voltages or to initiate a plant shutdown.

(continued)

Insert B 3.3.8.1-4

The Unit 2 Time Delay Allowable Values are long enough to provide time for the offsite power supply to recover to normal voltages, but short enough to ensure that sufficient power is available to the required equipment. The Unit 1

BASES

Annunciation

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

3. 4.16 kV Emergency Bus Undervoltage (~~Anticipatory Alarm~~) (continued)

<Insert B 3.3.8.1-5>

~~One channel of the 4.16 kV Emergency Bus Undervoltage (Anticipatory Alarm) Function per the associated bus is only required to be OPERABLE when the associated DG is required to be OPERABLE. (Two channels input to each of the three emergency buses.)~~

ACTIONS

A Note has been provided to modify the ACTIONS related to LOP instrumentation channels. Section 1.3, Completion Times, specifies that once a Condition has been entered, subsequent divisions, subsystems, components, or variables expressed in the Condition, discovered to be inoperable or not within limits, will not result in separate entry into the Condition. Section 1.3 also specifies that Required Actions of the Condition continue to apply for each additional failure, with Completion Times based on initial entry into the Condition. However, the Required Actions for inoperable LOP instrumentation channels provide appropriate compensatory measures for separate inoperable channels. As such, a Note has been provided that allows separate Condition entry for each inoperable LOP instrumentation channel.

required

A.1

With one or more channels of Function 1 or 2 inoperable, the Function does not maintain initiation capability for the associated emergency bus. Therefore, only 1 hour is allowed to restore the inoperable channel to OPERABLE status. The Required Action does not allow placing a channel in trip since this action will result in a DG initiation.

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The 1 hour Completion Time is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

<Insert B 3.3.8.1-6>

B.1

~~Each 4.16 kV bus has a dedicated annunciator fed by two relays and their associated time delays in a one-out-of-two logic configuration. Only one relay and its associated time delay is required to be OPERABLE. Therefore, the loss of the required relay or time delay renders Function 3 incapable of performing the intended function.~~

(continued)

Insert B 3.3.8.1-5

Two channels of Unit 1 4.16 kV Emergency Bus Undervoltage (Annunciation) Function per associated required emergency bus are only required to be OPERABLE when the associated DG is required to be OPERABLE to ensure that adequate annunciation channels are available to alert the operator of a degraded voltage condition on the required Unit 1 4.16 kV emergency buses.

Insert B 3.3.8.1-6

With one or more Function 3 channels per required bus inoperable, annunciation capability may not be available to alert the operator of a degraded voltage condition on the required Unit 1 4.16 kV emergency buses.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.8.1.4 (continued)

The system functional testing performed in LCO 3.8.1 and LCO 3.8.2 overlaps this Surveillance to provide complete testing of the assumed safety functions.

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

REFERENCES

1. FSAR, Section 8.3.1.
2. FSAR, Section 5.2.
3. FSAR, Section 6.3.
4. FSAR, Chapter 15.
5. NRC No. 93-102, "Final Policy Statement on Technical Specification Improvements," July 23, 1993.

Edwin I. Hatch Nuclear Plant, Units 1 and 2
License Amendment Request for
Technical Specification 3.3.8.1 Regarding
Degraded Voltage Protection

Attachment 4

Summary of the HNP Loss of Power Instrumentation Setpoint Methodology

Hatch Nuclear Plant Loss of Power Instrumentation Setpoint Methodology and Summary Calculations

1.0 INTRODUCTION

The purpose of this document is to provide a summary description of the Hatch Nuclear Plant (HNP) setpoint methodology used to determine the limiting trip setpoint (LTSP), nominal trip setpoints (NTSPs), allowable values (AVs), and as-left tolerance (ALT) for the loss of power (LOP) instrumentation in support of the HNP degraded voltage instrumentation modification that eliminates manual action in lieu of automatic degraded voltage protection and change to the Unit 2 degraded voltage instrumentation requirements in Technical Specification (TS) 3.3.8.1, "Loss of Power (LOP) Instrumentation." The modified degraded voltage protection scheme is part of an electrical power system modification that includes installation of an additional startup auxiliary transformer (SAT) for each unit to distribute the electrical loading and reduce the reliance on one SAT supplying electrical power to three 4.16 kV emergency buses during normal or accident conditions with the other SAT unavailable. Installation of this plant modification will be performed over two refueling cycles. This degraded voltage instrumentation setpoint methodology summary report supports implementation of the Unit 2 portion of the electrical power system modification. An additional summary report will be developed at a later date to support the results of Unit 1 degraded voltage instrumentation setpoint calculations needed to support full implementation of the electrical power system modification. The Unit 1 degraded voltage instrumentation setpoint calculations will utilize the same methodology as described herein, unless otherwise described in the followup report.

The modified 4.16 kV emergency bus degraded voltage protection scheme consists of three initiation channels for each bus. Each channel consists of a degraded voltage relay (DVR) with fixed time delay. The logic output is arranged in a two-out-of-three logic configuration for supported components except the diesel generators (DGs). The DG start logic is arranged in a one-out-of-three configuration.

2.0 SETPOINT METHODOLOGY

2.1 Current Licensing Bases

Instrument Setpoint Uncertainties

As documented in the NRC Safety Evaluation (SE) for HNP Units 1 Amendment 232 and Unit 2 Amendment 174, dated July 12, 2002, which supported the extension of the operating cycle from 18 months to 24 months, the plant-specific instrument setpoint methodology is similar to that documented in General Electric topical report NEDC-31336, "General Electric Instrument Setpoint Methodology," (Reference 1). NEDC-31336 has been previously approved by the NRC staff.

Setpoint Drift Monitoring and Trending

As documented in the NRC SE for HNP Units 1 Amendment 232 and Unit 2 Amendment 174, Southern Nuclear Company (SNC) monitors and trends the HNP setpoint control program as follows:

- Instruments with TS calibration surveillance frequencies are monitored and trended.

- As-found and as-left calibration data are recorded for each calibration activity. This activity identifies occurrences of instruments found outside of their AV, or instruments whose performance is not as assumed in the drift or setpoint analysis.

- When as-found conditions are outside the AV, an evaluation is performed to determine if the assumptions made to extend the calibration frequency are still valid, to evaluate the effect on plant safety.

In addition, the HNP trending program addresses setpoints for TS calibration surveillance frequencies extended to 24 months found to be outside of their leave-alone tolerance (LAT). This LAT is based upon either added margin or a portion of the expected drift for the instruments. For the purposes of this document, the terms LAT and ALT are synonymous.

The HNP trending program requires that any time a setpoint value is found outside the LAT, an additional evaluation be performed to ensure that the instruments performance is still enveloped by the assumptions in the drift or setpoint analysis. The trending program also plots setpoint or transmitter as-found /as-left values to verify that the performance of the instruments is within expected boundaries and that adverse trends (i.e., repeated directional changes in as-found /as-left data of smaller magnitudes) are detected and evaluated.

2.2 General HNP Setpoint Methodology

The HNP setpoint methodology is described in SNC procedure, NMP-ES-033, “Setpoint Control Program,” and implemented in SNC procedure NMP-ES-033-005, “Setpoint Control Program Hatch Setpoint Uncertainty Methodology and Scaling Instructions.” (References 2 and 3). The SNC setpoint control program establishes three groups with Group 1 requiring the greatest rigor. Group 1 calculations are consistent with the calculation methodology of ISA-S67.04.01, “Setpoints for Nuclear Safety-Related Instrumentation,” (Reference 4) and ISA-RP67.04.02, “Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation,” (Reference 5) and meet the 95/95 tolerance limit as identified in NRC Regulatory Guide (RG) 1.105, “Setpoints for Safety-Related Instrumentation,” (Reference 6).

LOP instrumentation calculations associated with the 4.16 kV emergency bus degraded voltage and time delay instrument functions utilize Group 1 setpoint methodology. The degraded voltage and time delay instrument setpoints are derived from the design basis analysis values (i.e., analytical limit) and are corrected for sources of uncertainty as defined in the SNC Setpoint Control Program implementing procedure (Reference 3).

Consistent with the NRC approved HNP setpoint methodology and ISA Standard 67.04 (References 2 and 5); there are two required setpoint margins. These are also the margins specified in RG 1.105 (Reference 6). The first setpoint margin is between the analytical limit and the AV. This margin is dependent on the process measurement uncertainties, the inherent instrument accuracies and the calibration errors, but does not include error due to instrument drift. The analytical limit to AV margin corresponds to the required margin just after the instrument has been calibrated, and has no allowance for additional measurement errors that

may occur during the time period between calibrations. The second setpoint margin is that between the analytical limit and the minimum NTSP (or LTSP). This margin includes errors used to determine the AV margin and adds an additional margin for instrument drift. The AV and minimum NTSP margins represent the minimum margins required by the instrument setpoint methodology to meet the minimum probability demonstration margin.

A spurious trip avoidance (STA) test may be performed for an instrument setpoint where there is a significant practical consequence to spurious trips, such as inadvertent scram or inadvertent device actuation. In some cases, the STA test includes analyses of anticipated operational transients to establish setpoints that reduce the probability of a scram or safety system actuation. The STA test is performed to assure that there is a greater than 95% probability of avoiding a spurious trip when the setpoint is at its limiting NTSP (i.e., LTSP) value towards the operating envelope limit due to device LATs.

In summary, the setpoint calculation process provides margins to assure that, due to measurement uncertainties, the analytical limit is not exceeded during operation, and that the AV is not exceeded between calibrations. In addition, the methodology also includes a quantitative test to assure with at least a 95% probability that the setpoint is far enough from the parameter value for normal operating envelope limit to avoid spurious trips.

The setpoint methodology calculates the accuracy or uncertainty of the measurement for each device in the measurement channel including the trip unit, which gives the final trip signal. This includes, as applicable:

- Channel accuracy with trip environment conditions (AT)
- Calibration error (C)
- Channel drift (D)
- Process measurement accuracy (PMA)
- Primary element accuracy (PEA)
- Environmental allowances (EA)

The methodology used for combining uncertainties for LOP degraded voltage instrumentation setpoints utilizes the square root sum of the squares (SRSS) taken at 2 sigma (σ) confidence level for random uncertainties. Margins are obtained by combining the relevant channel random errors using SRSS, and adding bias errors, as follows:

$$\text{AV Margin} = (1.645/2) \times (AT^2 + C^2 + PMA^2 + PEA^2)^{1/2} + \text{Bias errors}$$

$$\text{Minimum NTSP Margin} = (1.645/2) \times (AT^2 + C^2 + D^2 + PMA^2 + PEA^2)^{1/2} + \text{Bias errors}$$

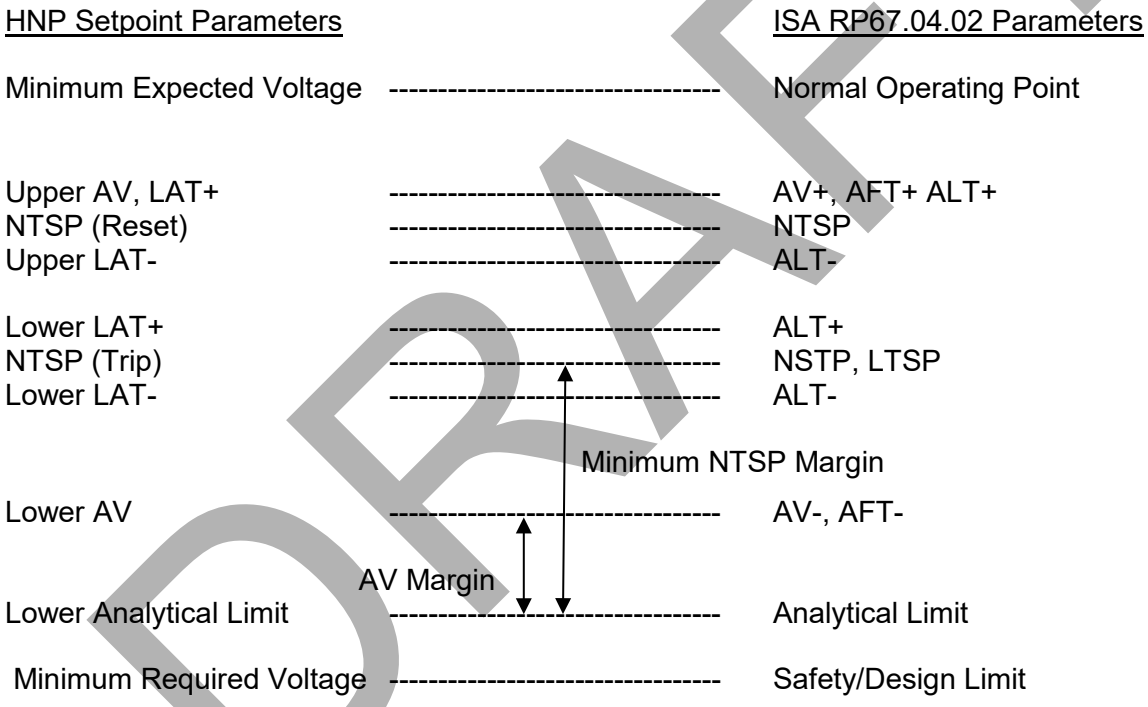
Random error values represent 2σ values, and the 1.645/2 factor is a statistical factor that converts a 2σ value to 1.645σ. Because setpoints are approached from one side (low to high for an increasing setpoint and high to low for a decreasing setpoint), 1.645σ corresponds to 95% probability for one-sided approaches for normal distributions. EA for environmentally qualified (EQ) components are obtained from the EQ datasheets and treated as a bias error.

The AV and NTSP are obtained by subtracting (or adding) the margin from the analytical limit, depending on whether the variable increases (or decreases) to the setpoint. Thus:

- AV = AL – AV Margin (for increasing setpoint).
- AV = AL + AV Margin (for decreasing setpoint).
- Minimum NTSP = AL – NTSP Margin (for increasing setpoint).
- Maximum NTSP = AL + NTSP Margin (for decreasing setpoint).

The AV is the limiting value at which an instrument trip setting may be found, when tested periodically, beyond which appropriate action must be taken. The AV is determined by the instrument calculations considering the maximum possible value for process measurement at which the analytical limit is protected. Maintaining the instrument channel within the AV ensures the analytical limit and associated design limits are protected. For the LOP degraded voltage instrumentation, the bounding upper and lower calculations is conservative with respect to the as-found tolerance (AFT) and therefore, the AFT is equal to the upper and lower AVs.

The following provides a simplified visual presentation of the above terms similar to the guidance of RG 1.105 (Reference 6):



3.0 SUMMARY OF LOP DEGRADED VOLTAGE INSTRUMENT CALCULATIONS

The methodology used in determining the 4.16 kV emergency bus degraded voltage and time delay AV's uses the guidance in the SNC Setpoint Control Program procedures to the extent practicable and is consistent with the guidelines listed in NRC Generic Letter 79-36, "Adequacy of Station Electric Distribution Systems Voltages," (Reference 7) as supplemented in NRC

Regulatory Issue Summary 2011-12, “Adequacy of Station Electric Distribution System Voltages,” (Reference 8).

3.1 Minimum Expected Voltage and Minimum Required Voltage Determination

The safety-related 4.16 kV emergency bus voltage is maintained such that the resulting voltage at the safety-related loads powered downstream from each respective 4.16kV bus is between the minimum and maximum allowable device voltage during undervoltage grid conditions.

The modified electrical power system improves the operating voltage at the 4.16 kV emergency buses due to the additional transformer loading margin afforded by the modified power configuration to the Class 1E electrical distribution system. Based on a minimum 230-kV switchyard voltage of 101.3% specified in the HNP Unit 2 FSAR, Section 8.2, “Offsite Power System,” the minimum expected voltage (MEV) of the safety related 4.16 kV emergency buses is determined assuming the worst-case steady-state loading condition. In addition, the minimum required voltage (MRV) is determined to ensure the safety related equipment can successfully actuate during design basis events.

The postulated electrical grid voltage is lowered until the safety-related equipment undervoltage limit is reached, at which point the corresponding 4.16kV emergency bus voltage is at the MRV. Degraded voltage instrumentation calculations confirm the actuation setpoint is above the calculated MRV, which ensures voltages at safety-related equipment powered downstream from each respective safety-related 4.16kV bus remain above their minimum level during steady-state and motor starting conditions. Motors shall be able to successfully start and operate during design basis accident conditions with 4.16kV emergency bus voltage at the MRV. Additionally, minimum voltage to the Class 1E motor control centers necessary for motor controller contactor pickup and equipment operation was considered to determine the MRV.

ETAP, Version 12.6.0N, power system software was used to simulate loss of coolant accident (LOCA) conditions with a concurrent degraded grid condition. The model was based on the modified electrical power system configuration of three SATs per unit and included loading from safety and non-safety-related loads. To determine worst case electrical loading conditions during a LOCA, multiple ETAP cases were simulated using various offsite power configurations to supply the Class 1E electrical distribution system including normal and alternate offsite power configurations. In each postulated MRV ETAP case, the power grid was set to a specific value, as low as possible, such that relevant criteria are met. The specific power grid values were determined iteratively. Postulated grid voltage was lowered until the safety-related equipment undervoltage limit was reached, at which point the corresponding voltages at the 4.16kV emergency buses are at the MRVs.

Each safety-related 4.16kV emergency bus was evaluated separately with regards to the equipment powered by that bus and downstream distribution buses. The resulting MEV and MRV for each Unit 2 4.16 kV emergency bus is shown in Table 3.1-1 assuming the worst case LOCA loading conditions.

Table 3.1-1 –MRV for Unit 2 4160 V Safety Related Buses

	MEV		MRV	
4160 V Emergency Bus	**(% 4160V)**	**(VAC)**	**(% 4160V)**	**(VAC)**
2E	99.65	4145.44	92.70	3856.32
2F	99.75	4149.60	89.12	3707.39
2G	99.65	4145.44	91.20	3793.92

3.2 4.16 kV Emergency Bus Degraded Voltage - Bus Undervoltage Function

Calculation Acceptance Criteria

The undervoltage trip function shall be set as low as possible while maintaining a margin of at least 0.2% setting (in addition to the required AV margin) between the lower analytical limit and TS 3.3.8.1, Function 2.a Allowable Value.

The goal for determining the NTSP (trip) and NTSP (reset) for the undervoltage trip function is to set these values as low as possible while allowing a margin of at least 0.2% setting (in addition to the AV margin) between the lower analytical limit and lower AV.

Calculation Assumptions

- DVRs have been operating for at least 10 minutes (warmup).
- Conservatively convert the bias term associated with the calibration equipment to % setting based on 120 VAC and applying it as a non bias term yields an instrument calibration accuracy of ±0.584% setting
- Drift analysis was performed on the as-found/as-left data gathered from past calibrations of the DVR alarm relays located in the same operating environment as the relays being addressed by this calculation. The result of this analysis was extended to 22.5 months in accordance with guidelines provided in industry standard ISA-RP67.04.02 (Reference 5).
- No calibration accuracy associated with the PTs monitoring the bus voltage.
- PMA and PEA are not applicable to this application.
- Test source used in calibrating the relays has less than 0.3% harmonic distortion.
- Room temperature effect of 0.75% setting is used, which bounds the temperature range that the relays will be exposed to.
- LAT for the undervoltage trip and reset is assumed to be equal to the reference accuracy for the undervoltage function.
- Maximum voltage drop on the cables between the PT secondary and the DVR is determined to be negligible based on the nominal voltage of 120V.
- Minimum control voltage is calculated to be available for the closing coils of the 4.16KV buses 1E, 1F, 1G, 2E, 2F and 2G breakers. Maximum control voltage is the maximum acceptable voltage specified for the close and trip function of the circuit breakers.

- Radiation and seismic effects are assumed to be negligible (zero).
- Vendor does not specify either humidity or pressure environmental requirements. Therefore, variations in humidity or pressure are assumed to have no effect on the relay's performance.
- Accuracy of the PTs monitoring the bus voltage is included.
- Calibration methodology and maintenance and test equipment (M&TE) used to calibrate the subject DVRs will be the same as those currently used to calibrate the degraded grid alarm relays.
- Calibration interval for the DVRs do not exceed 22.5 months (18 months + 25%).
- Undervoltage function of the relays will be set to reset at their minimum reset value of 0.5% of setting.

Methodology Overview

The uncertainty terms in this calculation are based on % setting. Because of this, an iterative process is used to determine the controlling settings for the relay. The goal for determining the LTSP (trip) and LTSP (reset) for the undervoltage trip function is to set the value as low as possible with margin between the lower analytical limit and lower AV. The total margin criterion is at least 0.2% setting plus the calculated AV margin.

Using the formulas described in Section 2.0, the undervoltage uncertainty terms (transformer accuracy, relay accuracy, loop accuracy, calibration accuracy and loop drift) are calculated and the minimum NTSP margin and AV margin are determined. The lower AV and NTSP (trip) are determined using the resulting AV margin and NTSP margin, respectively. The equations in Section 2.0 for determining the NTSP and AV for an increasing process are then used to determine the NTSP (reset) and upper AV.

At this point, the derived NTSP (reset) is analyzed to determine that enough margin exists between this setpoint and the upper AV to accommodate the LAT. This is accomplished by adding the LAT to the NTSP (reset) and verifying that the sum does not exceed the calculated upper AV. Because the sum of LAT and NTSP (reset) exceeds the calculated upper AV, the NTSP (reset) is adjusted to account for the LAT. This is done by subtracting the LAT from the upper AV, which results in an adjusted NTSP.

A STA check is conducted to assure with at least 95% probability that the NTSP (trip) is far enough from the normal operating envelope limit to avoid spurious trips. The resulting STA loop uncertainty was calculated and confirmed to satisfy the 95% probability criterion and therefore the NTSP (trip) is considered low enough to avoid spurious trips.

Additionally, the upper and lower degraded voltage instrumentation analytical limits were evaluated against the MEV and MRV, respectively to ensure the degraded voltage instrument AVs did not exceed these voltage boundaries.

Allowable Values for Degraded Voltage – Bus Undervoltage

Using the methodology and assumptions provided herein, the following shows the results of the Unit 2 4.16 kV bus degraded voltage instrument calculations. Table 3.2-1 shows the LAT for the

PT primary and secondary voltages, which were derived from the instrument reference accuracy and rounded up. The LATs apply to each Unit 2 4.16 kV emergency bus.

Table 3.2-1, Bus Undervoltage Tolerances

Calculation	Voltage	LAT
Primary Voltage	4160	±7.0 VAC , ±0.1%
Secondary Voltage	120	±0.2 VAC , ±0.1%

The calculated lower analytical limit, trip and reset AVs and NTSPs, and upper operating limit for the 4.16 kV safety related degraded voltage instrumentation loops associated with Unit 2 4.16 kV emergency buses are shown in Table 3.2-2:

Table 3.2-2 –Allowable Values and Nominal Setpoints (Bus Undervoltage Function)

Bus Degraded Voltage – Undervoltage Trip	2E Primary Voltage	2E Secondary Voltage	2F Primary Voltage	2F Secondary Voltage	2G Primary Voltage	2G Secondary Voltage
Upper Operating Limit (VAC)	4053.0	115.8	3993.5	114.1	3993.5	114.1
Upper Operating Limit (% setting)	97.43		96.00		96.00	
AV Reset (VAC)	4011	114.6	3952	112.9	3952	112.9
NTSP Reset (VAC)	4004	114.4	3945	112.7	3945	112.7
NTSP Trip (VAC)	3983	113.8	3924	112.1	3924	112.1
AV Trip (VAC)	**3952**	112.9	**3892**	111.2	**3892**	111.2
Lower Analytical Limit (VAC)	3902.0	111.5	3843.0	109.8	3843.0	109.8
Lower Analytical Limit (% setting)	93.80		92.38		92.38	

As shown in Tables 3.1.1 and 3.2-2, the calculated MEV and MRV bound the upper and lower analytical limits. Therefore, the degraded voltage instrument upper AV (reset) is below the MEV and the lower AV (trip) is above the MRV.

3.3 4.16 kV Emergency Bus Degraded Voltage - Time Delay Function

Calculation Acceptance Criteria

- Voltages at the safety-related equipment powered downstream from each respective safety-related 4.16kV emergency bus must remain above the MRV during steady-state and motor starting conditions.

- With the 4160 V bus pre-start voltage at or below the MRV, LOCA motor starting transient time must be less than the DVR time delay setting, with tolerances, to mitigate spurious trips.
- DVR time delay setting, with tolerances, must be less than the DG start time of 12 seconds to prevent an extended degraded grid condition.
- DVR time delay setting, with tolerances, must be less than the minimum overcurrent relay trip time to prevent safety-related equipment from tripping during a degraded voltage condition.

Calculation Assumptions

- DVR calibration limits are determined to be ±0.5 seconds from the HNP surveillance test procedure for the degraded voltage alarm relays.
- LOCA group motor safe stall times are greater than the DG start time and therefore not considered as a limiting criteria.
- Loading on control power fuses from indicating lights is negligible.
- Motor starters are assumed to draw inrush current continuously until the DVR trips or the control power fuse blows. This is conservative because actual inrush current would be reduced by a degraded voltage condition.

Methodology Overview

ETAP Version 12.6.0N software package was used to develop the HNP electrical power system computer model used for the HNP Units 1 and 2 station auxiliary system and 4.16 kV emergency bus transfer studies. The results of these calculations were used as design inputs in the degraded voltage time delay calculations. Dynamic motor starting cases were developed using the modified HNP electrical system configuration. The LOCA group motor start study case was re-analyzed as a dynamic motor starting case to determine the LOCA motor starting transient time for each safety-related 4kV emergency bus.

LOCA motor starting transient time was calculated as the minimum time for the LOCA group motors to start and reach steady-state with the 4kV emergency bus pre-start voltage below the MRV.
Motor protection settings were analyzed during the time period for which the voltage dropped below the MRV, but remains above the loss of site power alarm relay setpoint.

The 230 kV source was used to model the grid voltage along with a Thevenin equivalent grid impedance of 100MVA base. This source voltage feeds the 230kV swing bus “System” and was set to 92% to obtain the desired voltage below the MRV at the 4160 V emergency bus being studied for each case.

Overcurrent relays (OCRs) at the 4160 V LOCA group motors (i.e., low pressure coolant injection (LPCI) pump and core spray pump motors) were analyzed to verify degraded voltage effects on these motors during starting will not cause an OCR trip prior to a DVR trip. To account for degraded voltage, the locked rotor amperes (LRA) associated with each LOCA group motor was adjusted by multiplying the LRA times a percentage of 4160 V at or less than the motor’s respective electrical bus MRV. Each starting motor is conservatively assumed to

stall continuously at this current until the time at which the OCR would trip. This time is determined from OCR plots using SKM software. Table 3.3-1 shows the overcurrent trip time of the Unit 2 LOCA group motors based on the adjusted LRA.

Table 3.3-1 – Unit 2 LOCA Group Motors Overcurrent Trip Times

Motor Name	4.16 kV Bus	Motor HP	LRA (amperes)	≤ MRV (% 4160 V)	Adjusted LRA (amperes)	OCR Trip Time (secs.)
LPCI Pump 2A	2E	1000	825	91.10	752	9.94
Core Spray Pump 2A		1000	825		752	9.94
LCPI Pump 2C	2F	1000	825	92.03	759	9.89
LPCI Pump 2D		1000	825		759	9.89
LPCI Pump 2B	2G	1060	746	92.21	688	10.60
Core Spray Pump 2B		1000	825		761	9.89

Thermal overloads for LOCA group motor operated valves (MOVs) were not analyzed because the thermal overloads are permanently bypassed to avoid a protective device trip. It has been determined that MOVs motors less than 10 HP, including five LOCA group MOVs, will not be damaged before 17 seconds. Other safety-related equipment is assumed to have a full load ride-through capability of at least 75% of nameplate voltage with duration of at least 30 seconds. Below 75%, the loss of voltage relay is set to protect the safety-related equipment. Control power fuses for starting MOVs were also evaluated to ensure that they will not blow before the DVR trips.

Allowable Values for Degraded Voltage – Time Delay

From the LOCA group motor transient plots, the motors were capable of starting and reaching full speed within 2.00 seconds. Therefore, a DVR time delay of 2.00 seconds is determined to be minimum time to avoid unnecessary automatic transfer of the loads to the DGs. The calculated analytical limits, AVs, NTSP, and LAT for the 4.16 kV safety related degraded voltage relay time delay associated with Unit 2 4.16 kV emergency buses are shown in Table 3.3-2.

Table 3.3-2 –Allowable Values and Nominal Setpoints (Time Delay Function)

Bus Degraded Voltage – Time Delay	**2E**	**2F**	**2G**
Upper Analytical Limit (sec)	9.89	9.89	9.89
Upper AV (sec)	**9.81**	**9.81**	**9.81**
NTSP (sec)	9.00	9.00	9.00
Lower AV (sec)	2.02	2.02	2.02
Lower Analytical Limit (sec)	2.00	2.00	2.00
LAT (sec)	± 0.5	± 0.5	± 0.5

4.0 TECHNICAL SPECIFICATION APPLICATION OF INSTRUMENT SETPOINTS

The AVs for the Unit 2 4.16 kV Degraded Voltage Bus Undervoltage and Time Delay Functions in TS Table 3.3.8.1-1 (Functions 2.a and 2.b) were selected from the DVR trip AVs specified in Table 3.2-2 and the upper time delay AV specified in Table 3.3-2. These AVs ensure that the voltage requirements of the safety-related loads are met during a design basis accident without exceeding the maximum time delay assumed in the safety analyses. The 4.16 kV Degraded Voltage Bus Undervoltage and Time Delay Functions are demonstrated Operable by applying the following guidance during instrument Channel Calibrations:

If the instrument setting is found within the LAT, the results are recorded in the surveillance procedure and no further action is required for the instrument surveillance. If the instrument setting is found outside the LAT but conservative with respect to the TS AV, the channel is Operable and the instrument setting must be calibrated to the NTSP (within the LAT). If the instrument setting is found non-conservative to the TS AV, the channel is inoperable until the instrument setting is calibrated to the NTSP (within the LAT) and any evaluations necessary to return the channel to service are completed. The instrument setting may be more conservative than the LTSP provided the AFT (i.e., minimum NTSP margin) and LAT are applied to the actual instrument setting (i.e., actual NSTP) used to confirm channel performance.

5.0 REFERENCES

1. Letter from L. N. Olshan (NRC) to H. L. Sumner, Jr. (SNC), “Edwin I. Hatch Nuclear Plant, Units 1 and 2 Re: Issuance of Amendments (TAC Nos. MB2965 and MB2967),” dated July 12, 2002 (NRC ADAMS Accession No. ML022040085).

2. SNC procedure NMP-ES-033, “Setpoint Control Program,” Version 7.0.

3. SNC procedure NMP-ES-033-005, “Setpoint Control Program Hatch Setpoint Uncertainty Methodology and Scaling Instructions,” Version 6.1.

4. ISA-S67.04.01, “Setpoints for Nuclear Safety-Related Instrumentation,” 2000.

5. ISA-RP67.04.02, “Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation,” 2000.

6. NRC Regulatory Guide 1.105, “Setpoints for Safety-Related Instrumentation,” Revision 3, December 1999.

7. NRC Generic Letter 79-36, “Adequacy of Station Electric Distribution Systems Voltages,” dated August 8, 1979.

8. NRC Regulatory Issue Summary (RIS) 2011-12, “Adequacy of Station Electric Distribution System Voltages,” Revision 1, dated December 29, 2011 (NRC ADAMS Accession No. ML113050583).