Charles R. Pierce
Regulatory Affairs Director

Southern Nuclear Operating Company, Inc.
40 Inverness Center Parkway
Post Office Box 1295
Birmingham, Alabama 35201

Tel 205.992.7872
Fax 205.992.7601

SOUTHERN COMPANY

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

Joseph M. Farley Nuclear Plant
Response to Request for Additional Information
Concerning Degraded Voltage Compensatory Measures

Ladies and Gentlemen:

By letter dated December 21, 2012, Southern Nuclear Operating Company (SNC), submitted a license amendment request for the Joseph M. Farley Nuclear Plant (FNP) (ML 12356A470). This request would include the proposed degraded grid modification schedule into the Farley operating license. This modification would eliminate the need for manual actions in the event of a degraded grid voltage condition.

On March 22, 2013, the Nuclear Regulatory Commission provided SNC with a Request for Additional Information (RAI) concerning compensatory measures that the licensee intends to keep in place until completion of the proposed modifications by the end of refueling outage currently scheduled for April of 2018. The enclosure of this letter provides the responses to the RAI.

This letter contains no NRC Commitments. If you have any questions, please contact B. D. McKinney at 205-992-5982.

A001
NRR

Mr. C. R. Pierce states he is Regulatory Affairs Director of Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and, to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

C. R. Pierce

C. R. Pierce
Regulatory Affairs Director

CRP/EMW/md

Sworn to and subscribed before me this 21st *day of* May, *2013.*

Nancy Louise Henderson
Notary Public

My commission expires: March 23, 2014

Enclosure: Response to Request for Additional Information

cc: Southern Nuclear Operating Company
Mr. S. E. Kuczynski, Chairman, President & CEO
Mr. D. G. Bost, Executive Vice President & Chief Nuclear Officer
Mr. T. A. Lynch, Vice President – Farley
Mr. B. L. Ivey, Vice President – Regulatory Affairs
Mr. B. J. Adams, Vice President – Fleet Operations
RTYPE: CFA04.054

U. S. Nuclear Regulatory Commission
Mr. V. M. McCree, Regional Administrator
Ms. E. A. Brown, NRR Project Manager - Farley
Mr. P. K. Niebaum, Senior Resident - Farley
Mr. J. R. Sowa, Senior Resident - Farley

Joseph M. Farley Nuclear Plant
Response to Request for Additional Information
Concerning Degraded Voltage Compensatory Measures

Enclosure

NRC EEEB Questions

RAI 1. In the event of ESF actuation during degraded voltage conditions, provide details on:

a) Equipment/components that may not have adequate voltage to operate;
b) Equipment that may trip due to automatic protection such as overload relay actuations;
c) Equipment that may trip but will require manual action to reset the protective device; and,
d) Equipment that may degrade and may not be able to perform its required function.

SNC Response:

The SNC response is based on evaluating voltages above the degraded grid relay setting (3675V) that automatically separates the A and B train emergency buses from the grid and below the degraded grid voltage alarm setting (3850V) requiring plant shutdown. This voltage range is approximately 4.2% or 175 V on the 4160V bus.

a) The Unit 2 'B' Train Spent Fuel Pool Ventilation Radiation Monitor (RE0025B) motor may not have adequate voltage to operate below a 4kV bus voltage of 3702V. At the degraded grid relay setting, Monitor RE0025B is calculated to have 89.22% of the rated motor voltage which is marginally less than the required 90% of rated motor voltage.

   The Unit 1 and 2 (i.e. shared) 'B' Train Control Room Radiation Monitor (RE0035B) motor may not have adequate voltage to operate below a 4kV bus voltage of 3676V. At the degraded grid relay setting, monitor RE0035B is calculated to have 88.42% of the rated motor voltage which is marginally less than the required 90% of rated motor voltage.

b) The 'B' Train Spent Fuel Pool Ventilation Radiation Monitor (RE0025B) motor and 'B' Train Control Room Radiation Monitor (RE0035B) motor may trip due to the overload relay.

c) The 'B' Train Control Room Radiation Monitor (RE0035B) motor will require manual action to reset the protective device. In the event of an ESF actuation the control room ventilation isolation would operate on containment isolation signal and therefore will not require signal from the 'B' Train Control Room radiation monitor.

   The 'B' Train Spent Fuel Pool Ventilation Radiation Monitor (RE0025B) will require manual action to reset the protective device. The 'B' Train Spent Fuel Pool Ventilation Radiation Monitor (RE0025B) is used to initiate isolation of the normal ventilation system and starting of the Penetration Room Filtration ventilation system due to high-high radiation signal resulting from a fuel handling accident in the spent fuel pool area. In the event that the SPF radiation monitor motor trips on the overload relay, the isolation function would not be automatic and the radiation monitor sampler control panel would indicate low flow conditions so that appropriate action may be taken.

d) The 'B' Train Spent Fuel Pool Ventilation Radiation Monitor (RE0025B) motor and 'B' Train Control Room Radiation Monitor (RE0035B) motor are not expected to degrade as the overload relays will protect the motors from damage.

RAI 2. Explain the grid contingencies that were considered to ensure the switchyard voltages remain above the voltages required for safe shutdown of the plant.

SNC Response:

Five Year Actual Farley Grid Voltage

The actual bus voltage for the Farley 230kV bus from January 1, 2008 to April 25, 2013 (past five years) has been retrieved for each ten minute interval of available transmission operation data. This resulted in 279,476 ten minute points. In all cases, the voltage exceeded the degraded grid voltage alarm setting requiring plant shutdown (approximately 100% of 230kV). The actual 230kV voltage was within the desired 101.6 -104.5% 230kV range for the vast majority of the time. Seventeen points were less than 101.6% of 230kV with nine of those following a 2008 fault event. In all cases, the voltage was greater than 100.5% of 230kV for these seventeen points.

Required Voltages

The steady-state voltages required at the Farley Nuclear Plant (FNP) switchyard for safe shutdown of the plants during normal or design basis accident conditions are documented in plant calculations. This value changes slightly (a few tenths of a percent up or down) as modifications are made to the plant. The calculations are used to evaluate changes that can affect the load requirements prior to the implementation of any plant modifications.

The required minimum FNP switchyard voltages documented in the current plant calculations are:

Unit 1: 96.20% of 230kV
Unit 2: 96.48% of 230kV

Grid Contingencies

There are two primary processes used to ensure that the voltages for safe shutdown remain above the load requirements.

A. Voltage Projections

The first process involves voltage projections for the FNP 230kV switchyard voltage given various contingencies. The projections evaluate future system contingencies to ensure that the FNP 230kV switchyard voltage will not be less than 101.6% of 230kV. For FNP, this voltage is defined as the minimum expected operating voltage (MEOV). This projection process has two basic features:

1. Annually, prior to the summer peak loading conditions, Southern Company Transmission Planning studies defined cases (i.e. system configurations) to verify the MEOV conditions at FNP for the current and the subsequent 5-6 years.

To provide a conservative analysis, the following assumptions are included for each case:

- The Southern Control Area is at summer peak loading.
- Generation is dispatched as expected for each load condition.
- Local area generation that could significantly support the FNP 230kV bus is modeled off-line.
- The full expected load is supplied to the Florida Interchange.

The study cases also include, but are not limited to, the following system configurations:

- One unit in a LOCA, and the other unit tripped (i.e. Hot Shutdown)
- One unit in a LOCA, and 1 of 6 FNP transmission lines out of service
- One unit in a LOCA, and 1 of 2 FNP 230/500kV autobanks out of service
- Loss of the largest Southern Company generating unit
- One 230kV and one 500kV FNP transmission line on a common right-of-way out of service

2. The second feature of this projection process is related to actual system operations. Grid operators in two locations Power Coordination Center (PCC) and the Alabama Control Center (ACC) use a state estimator real-time contingency analysis (RTCA) tool based on input of the current system loading conditions, actual generation, and transmission line configuration data. Grid operators are alerted by the RTCA (updated every 10-20 minutes) if any next contingency (N-1) condition could result in a post-contingency 230kV grid voltage less than the MEOV.

   i. Based on the RTCA results, the grid operators will immediately take all necessary steps to eliminate any unacceptable N-1 condition. If such correction cannot be made within a few minutes, the grid operators will notify FNP of the condition and the expected time to eliminate the unacceptable contingency.

   ii. Any planned transmission or generation system outage is evaluated by grid operators prior to allowing the outage to ensure that an unacceptable N-1 voltage condition would not be created by the outage.

These voltage projection features in Transmission Planning and Operations are the primary means to ensure that FNP does not experience voltage conditions below the MEOV of 101.6% by alerting them to a potentially inadequate voltage condition before it can occur.

B. Continuous Monitoring

As stated in the Voltage Projections section above, the predictive tools are intended to avoid operation below MEOV. In addition to those activities, the actual real-time voltage is also monitored to ensure the tools are providing the intended results. This second process involves continuous monitoring of the state of the Southern Company system and, in particular, the voltages at the FNP 230kV switchyard and 4kV Class 1E buses. Grid operators have continuous monitoring and alarm features for the FNP 230kV bus voltage. Plant operators have continuous monitoring and

alarm features for the 230kV and 4kV systems to alert them if voltage conditions are actually degrading.

1. The 230kV switchyard voltage at FNP normally operates between approximately 102% and 104%. Grid operators will notify FNP if the 230kV switchyard voltage is at or below the MEOV (101.6%) even though the local in-plant buses may not be experiencing inadequate conditions.

   The procedures for coordinating the operation of the bulk power systems of the Southern Company establish the nuclear plants as a high priority for maintaining each nuclear plant's MEOV. If the voltage at FNP's 230kV switchyard were to degrade, the following actions would typically be initiated by grid operators:

   - Notify the plant control room.
   - Capacitor banks at the plant or elsewhere on the grid are switched on as necessary.
   - Shunt reactors are switched off as necessary.

2. Plant operators monitor the voltages at the 4160V Class 1E buses. Each of the redundant Class 1E trains (two/unit) has a Degraded Grid Voltage Alarm that is set at 3850V to detect a Class 1E bus voltage that would be indicative of a system voltage below the Minimum Expected Voltage (MEV). The MEV is 100% of 230kV. The MEV is 1.6% lower than the MEOV and approximately 3.5% above the Class 1E loads' current steady-state safe shutdown voltage requirements (~96.5%) as noted above.

   FNP has an abnormal operation procedure to provide specific actions to plant operations. Plant procedure FNP-1/2- AOP-5.2 (Degraded Grid) addresses specific actions during degraded voltage conditions. These actions are delineated for conditions where:
   - The Transmission System is one contingency (or event) away from a degraded grid condition, or
   - The Transmission System is in a degraded grid condition (below 101.6% of 230kV), or
   - The 4160V bus degraded voltage alarm occurs (below 3850V on 4160V Class 1E Bus F or G).

RAI 3. Provide technical basis including supporting data or analysis to show that the degraded voltage relay alarm settings would provide enough time to take operator actions in order to protect all Class 1E equipment from the consequences of a sustained degraded voltage condition.

SNC Response:

Based on the SNC response to EEEB RAI 1.d, no operator actions are required since the overload relays would protect RE0025B and RE0035B.

RAI 4. The implementation schedule proposes Technical Specification amendment request after completion of Design. In order to expedite the schedule, explain why a concurrent amendment request is not considered to resolve any staff questions associated with proposed setpoints.

SNC Response:

The amendment request will be to change the degraded grid relay setpoints in the Farley Unit 1 and 2 Technical Specifications. The design to support the setpoint changes will provide the technical basis for automatic separation from the grid during degraded grid events and must be completed to provide the technical basis for an amendment request.

RAI 5. The submittal indicates that two outages are necessary to complete the modifications on each unit based on SNC's philosophy that limits electrical modifications to one electrical train per outage. In view of the high consequences of degraded voltage conditions concurrent with an ESF actuation (impact on redundant trains of ESF equipment), explain why the modification cannot be implemented in one outage with non-intrusive work performed online.

SNC Response

The modification to both electrical trains could physically be implemented during one outage window; however, this would require both safety related electrical 4kV buses to be removed from service in the same outage. SNC's outage scheduling philosophy is to perform major work on a single train. Performing modifications on a single train during an outage improves outage safety risks by focusing resources on single train protection and avoiding multiple evolutions of safety related electrical source transfer.

NRC APHB Questions

RAI 1. Identify the compensatory actions that will be relied upon to support the proper operation of equipment identified in Question 1 above. Include in the response details of the consequences on accident analyses as a result of any delay in equipment restoration by the proposed manual actions.

SNC Response:

Compensatory actions are contained within FNP procedures FNP-1/2-AOP-5.2 (Degraded Grid). Steps in these procedures utilize manual operator actions to accomplish the required automatic actions performed by the two radiation monitors that may have inadequate voltage (Unit 2 RE0025B and the shared RE0035B). These manual actions are performed if the voltage on the 4kV bus supporting the radiation monitors drops below 3.8kV.

A high radiation signal from Unit 2 RE0025B (B-Train Spent Fuel Pool Ventilation Radiation Monitor) automatically isolates the Spent Fuel Pool Ventilation and starts the B-Train Penetration Room Filtration (PRF) system. FNP-2-AOP-5.2 directs the control room operators to secure Fuel Handling Area HVAC if and when 4kV bus voltage becomes less than 3.8kV. One train of PRF will be started when SFP ventilation is secured.

Upon receiving a high radiation signal (Alert) on RE0035B, the control room ventilation supply and return lines from the computer room air handling unit will

automatically isolate and TSC ventilation shifts to recirculation (filtration mode). FNP-1/2-AOP-5.2 directs the control room operators to manually perform these ventilation alignments if and when the 4kV bus voltage becomes less than 3.8kV.

These procedures have additional steps for securing the radiation monitor motor and declaring the radiation monitor inoperable after completion of the ventilation alignments.

Since the above actions place the ventilation systems in their post-accident alignment, there are no consequences to the accident analyses for operating with the ventilation systems aligned as described above and there are no consequences to the accident analyses with the radiation monitors removed from service.

RAI 2. How long have the existing manual actions that respond to degraded voltage conditions been in place? If not since initial licensing, what were the circumstances that led to allocation of this function to operators rather than automatic systems?

SNC Response:

Plant procedure FNP-1/2-AOP-5.2 has had the requirement to shutdown the plant during a degraded grid event since May 1992.

NRC Safety Evaluation Report dated November 21, 1995 and referenced in the Improved Technical Specification Safety Evaluation Report (SER) dated November 30, 1999 documents the NRC staff conclusion that the undervoltage relay settings for the Farley Units are adequate and are acceptable.

The November 21, 1995 NRC SER included a discussion of the control room degraded grid alarm relay setpoint and attendant operator actions. These operator actions included plant shutdown based on the degraded grid alarm.

RAI 3. Discuss the alarms, annunciators, etc., that are provided to notify personnel that manual action(s) to respond to degraded voltage conditions is/are required.

SNC Response:

There are annunciators in the shared control room at the Emergency Power Board (EPB) which indicate a degraded bus condition for both unit's A-Train (1F & 2F) and B-Train (1G & 2G) 4160V ESF Buses supplied by the Start-Up Transformers. Also, voltage indicators for each 4160V ESF bus are available to the operators on the EPB. For an under voltage condition on one of these A-Train or B-Train ESF buses of less than 3850V for greater than 10 seconds, the applicable annunciator will alarm informing the control room operators of the degraded voltage condition on that bus. Each Annunciator Response Procedure (ARP) directs the control room team to the degraded grid abnormal operating procedure (AOP) for further actions. Also, the ARP directs the team to return electrical and component lineups to normal as soon as possible.

Another method to notify personnel that manual actions to respond to degraded voltage conditions are required is for the control room to receive a notification

(phone call) from the Power Control Center (PCC) that the offsite grid has become degraded. Receiving that notification is another entry condition into the degraded grid AOP where further actions will be performed based on the symptoms observed.

Other methods to indicate a potential degraded grid condition are discussed in this paragraph and in the response to EEEB RAI 2. Plant operators continually monitor grid voltage from the control room, and lower than normal voltage indications would alert the operator to a potential abnormal grid condition. Also, generator capability is continually monitored in the Digital Electro-Hydraulic (DEH) Controls system and will alarm an annunciator in the control room when VARs exceeds the calculated capability curve. Although this alarm was created to notify Operations of possible problems with the Power System Stabilizer or the Main Generator regulator, the symptom of exceeding the limits of the generator capability curve could be indicative of grid degradation.

RAI 4. Discuss the alarms, annunciators, etc ... that are provided to notify personnel that the manual action(s) to respond to degraded voltage conditions is/are no longer required.

SNC Response:

The annunciators discussed in APHB RAI 3 Response above will reset when the degraded condition is no longer sensed. This will clear the annunciator(s), and the clearing of the annunciator will notify the control room operators that the degraded grid condition no longer exists.

Throughout the degraded grid AOP discussed in APHB RAI 3 Response, the control room operators log and evaluate the 4160V ESF buses voltages to determine the appropriate actions. When the grid condition improves and the 4160V ESF bus voltages are no longer less than the degraded grid alarm voltage, the procedure directs the control room operators to confirm with the grid operator that no notification exists before exiting to the procedure and step previously in effect. If a PCC notification does exist, the operators are directed back to the front of the degraded grid AOP, and the operators will remain in the AOP until both the PCC notification clears and the 4160V ESF bus voltages are not degraded.

RAI 5. Describe the administrative controls in place to ensure that when the action(s) is/are no longer required, and the plant configuration is restored in the correct configuration for the plant status.

SNC Response:

FNP-1/2-AOP-5.2 directs the control room operators to restore ventilation systems to their normal alignment and restore the radiation monitors to service when the plant has recovered from the degraded voltage condition.

RAI *6a. Describe any manual actions in the normal and the emergency operating procedures in addition to those discussed in Q2 that are needed to prevent or mitigate degraded voltage conditions.*

SNC Response:

A Shunt Reactor and Capacitor Bank are located in the High Voltage Switchyard and are used to either lower the 230kV voltage or raise the 230kV voltage. Operations personnel do not operate either the Shunt Reactor or Capacitor Bank. To assist in voltage control for the site, Operations request ACC either place the Shunt Reactor in service or remove it from service. The Capacitor Bank normally operates in the 'Automatic' mode, and cycles on or off based on pre-set voltages. ACC can stop the Capacitor Bank from operating by placing it in 'Manual'. The guidance for Operations is found in FNP-0-SOP-36.8 Precautions and Limitations, Sections 3.7 and Section 4.8 (Voltage Management). There are no manual actions in either the normal or emergency operating procedures in addition to those discussed in APHB RAI 2 response that are needed to prevent or mitigate degraded voltage conditions.

RAI 6b. If the Emergency Operating Procedures are involved, describe any verification and validation that was done to confirm that the existing manual actions are feasible, reliable, and effective, e.g.. initial start-up testing, V&V performed as part of the Detailed Control Room Design Review, Post-mod or post-maintenance testing, or cyclical testing done as part of a Time-Critical Action Program.

SNC Response:

There are no manual operator actions in the Emergency Operating Procedures that are needed to prevent or mitigate degraded voltage conditions.

The existing manual actions to remove the units from the grid and place them in lower modes of operation are contained within an Abnormal Operating Procedure (AOP), which are provided to the operators in two column format that promotes ease of use. For degraded voltage conditions, there has been no verification and validation performed for these particular manual actions. The actions to remove the units from the grid and place them in lower modes of operation are required by Technical Specifications (TS) when bus voltage remains less than 3850V for greater than one hour. To aid in compliance with the applicable TS, the AOP directs the operators to utilize normal operating procedures to perform these actions. There is no formal verification and validation process for development of normal operating procedures. The administrative procedural process for the development and control of the normal operating procedures is such that the guidance developed and provided to the operators is feasible, reliable, and effective for the given task. Through the operation of the units and through Licensed Operator Continuing Training (LOCT), these action's feasibility, reliability, and effectiveness are continually performed with both nominal and minimum TS staffing. As the time restraints of the AOP are equal to the applicable TS, there is adequate time for the operators to perform the actions required in response to a degraded voltage condition.

The effectiveness of the existing manual actions to remove the units from the grid and place them in lower modes of operation is well documented in the history of both units at Farley, and continues to be displayed in LOCT and normal operation. For both units at Farley, placing the units in lower modes of operation reduces the number of equipment required to operate during degraded voltage conditions. For

the effectiveness of the actions to maintain the grid voltage, refer to SNC Response 2.B.1 for EEEB RAI 2.

RAI 7. Regarding the V&V or testing discussed in Q6.b. (sic) above, did the validation include a representative sample of operators and was it done with Technical Specification (TS) minimum staffing and nominal staffing? Discuss the time required to perform manual actions versus time available.

SNC Response:

There has been no verification and validation for manual operator actions. There is no associated analysis that identifies a minimum time requirement for performing these actions.

Based on the limited equipment impacts (RE0025B and RE0035B), the actual grid voltage history, grid contingencies, and continuous monitoring, verification and validation of manual operator actions is not warranted before the modifications are implemented in 2018. The current familiarity with the equipment impacted, as well as the grid voltage history also supports the continued operation of the units in this manner.

RAI 8. Describe any controls or displays (including annunciators and alarms) needed to respond to degraded voltage conditions until implementation of the proposed modifications.

SNC Response:

Refer to items described in the SNC response to APHB RAI 3 above.