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

Shearon Harris Nuclear Power Plant, Unit 1
Docket No. 50-400/Renewed License No. NPF-63

Subject: Response to Request for Additional Information #4 Regarding License Amendment Request to Revise Technical Specification Table 3.3-4 Loss of Offsite Power 6.9 kV Emergency Undervoltage Primary Setpoints (TAC No. MF4294)

Ladies and Gentlemen:

By letter dated June 19, 2014, Duke Energy Progress, Inc. (Duke Energy), requested an amendment to the Technical Specifications (TSs) for Shearon Harris Nuclear Power Plant, Unit 1 (HNP). Duke Energy proposed to revise TS 3.3.2, “Engineered Safety Features Actuation System Instrumentation,” Table 3.3-4, “Engineered Safety Features Actuation System Instrumentation Trip Setpoints.” Specifically, the Functional Unit 9.a, Loss of Offsite Power 6.9 kV Emergency Bus Undervoltage Primary, instrument trip setpoint and associated allowable value are being revised to correct a non-conservative TS. The proposed change incorporates portions of Technical Specification Task Force Traveler TSTF-493-A, Option A, related to the loss of offsite power instrumentation surveillance requirements.

The NRC staff reviewed the request and determined that additional information is needed to complete their review. The staff transmitted a draft request for additional information on March 11, 2015, which was discussed in a public teleconference on March 30, 2015. The formal request for additional information was transmitted on April 13, 2015. The Duke Energy response to the request is enclosed.

The additional information provides clarification and does not impact the validity of the original Significant Hazards Consideration or the Environmental Consideration.

This document contains no new Regulatory Commitments.

Please refer any questions regarding this submittal to John Caves at (919) 362-2406.

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

Executed on May 13, 2015.

Sincerely,

Benjamin C. Waldrep

Enclosure: Response to Request for Additional Information #4

cc: Mr. J. D. Austin, NRC Sr. Resident Inspector, HNP (email)
Mr. W. L. Cox, III, Radiation Protection Section Chief, N.C. DHSR (email)
Ms. M. Barillas, NRC Project Manager, HNP (email)
Mr. V. M. McCree, NRC Regional Administrator, Region II (EIE)

Shearon Harris Nuclear Power Plant, Unit 1
Docket No. 50-400/Renewed License No. NPF-63

Response to Request for Additional Information #4
License Amendment Request to Revise Technical Specification Table 3.3-4
Loss of Offsite Power 6.9 kV Emergency Undervoltage Primary Setpoints

By letter dated June 19, 2014, Duke Energy Progress, Inc. (Duke Energy), requested an amendment to the Technical Specifications (TSs) for Shearon Harris Nuclear Power Plant, Unit 1 (HNP). Duke Energy proposed to revise TS 3.3.2, “Engineered Safety Features Actuation System Instrumentation,” Table 3.3-4, “Engineered Safety Features Actuation System Instrumentation Trip Setpoints.” Specifically, the Functional Unit 9.a, Loss of Offsite Power (LOOP) 6.9 kilovolt (kV) Emergency Bus Undervoltage Primary, instrument trip setpoint and associated allowable value are being revised to correct a non-conservative TS. The proposed change incorporates portions of Technical Specification Task Force Traveler TSTF-493-A, Option A, related to the LOOP instrumentation surveillance requirements.

The NRC staff reviewed the request and determined that additional information is needed to complete their review. The staff transmitted a draft request for additional information on March 11, 2015, which was discussed in a public teleconference on March 30, 2015. The formal request for additional information was transmitted on April 13, 2015. The Duke Energy response to the request is enclosed.

EICB RAI 2

Title 10 of the Code of Federal Regulations (10 CFR) Section 50.36(c)(1)(ii)(A), states, "Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded. If, during operation, it is determined that the automatic safety system does not function as required, the licensee shall take appropriate action, which may include shutting down the reactor."

Additionally, 10 CFR 50.36(c)(3) states, "Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met."

General Design Criterion 13, "Instrumentation and Control," of Appendix A to 10 CFR Part 50 requires that instrumentation be provided to monitor variables and systems and that controls be provided to maintain these variables and systems within prescribed operating ranges.

General Design Criteria 20, "Protection System Functions," of Appendix A to 10 CFR Part 50 requires that the protection system be designed to initiate the operation of appropriate systems to ensure that specified acceptable fuel design limits are not exceeded.

The licensee calculated the maximum pickup of the primary undervoltage relay. As per the vendor's manual, the pickup voltage of the primary undervoltage relay is 110 percent or less of the dropout setpoint. With this condition, the licensee stated the maximum pickup of the primary undervoltage relay can be as high as 105.23 volts (V). This was calculated by multiplying the maximum as left tolerance (ALT) by a factor of 1.1 (110 percent) and adding the total loop uncertainty.

The U.S. Nuclear Regulatory Commission (NRC) staff notes that including drift by using the as found tolerance (AFT) value to calculate the maximum dropout for the primary relay would result in a dropout occurring at 106.519 V, which is also less than the minimum secondary level degraded voltage actuation level of 106.73 V. The NRC staff noted that using the AFT value for calculating the maximum dropout value yields a higher voltage than using the ALT value.

Please explain the reason for using the ALT instead of the AFT for determining the maximum reset voltage for the primary undervoltage relay. Please confirm adequate separation between the settings of the undervoltage and degraded voltage relays.

EICB RAI 2 Response

Duke Energy has determined that using the ALT and adding the total loop uncertainty is more appropriate for evaluating the maximum pickup value than using the AFT. If the AFT is used, this value already account for items such as drift and maintenance and test equipment impact, and by adding in the Total Loop Uncertainty (TLU), these factors would be accounted for twice.

As defined in 0054-JRG the AFT is:

$$\text{AFT} = \text{Set point} + \text{GAFT} = 92.1 + 2.09 = 94.19\ \text{V}$$

The GAFT is

$$\text{GAFT} = (\text{DR}^2 + \text{MTE}^2)^{1/2} = 2.09\ \text{V}$$

The TLU is

$$\text{TLU} = (\text{PE}^2 + \text{TDU}^2)^{1/2} \text{ where } \text{TDU} = (\text{RA}^2 + \text{MTE}^2 + \text{DR}^2)^{1/2}$$

If the AFT were used in the relay pickup evaluation the DR and MTE values would need to be backed out of the uncertainties used. This would give one a adjusted TLU of:

$$\text{TLU}_{adj} = (\text{PE}^2 + \text{RA}^2)^{1/2} = (0.36^2 + 2^2)^{1/2} = 2.03\ \text{V}$$

This would yield a maximum pick up of:

$$1.1 \text{ X } (94.19) \text{ AFT} + 2.03 = 105.63\ \text{V}$$

Although this result would still yield a result slightly higher than the 105.23 V used in the 0054-JRG calculation, following the standard methodology is preferred.

Using the ALT is the preferred method based on the following reasoning. The relays are calibrated and would be left no higher than the maximum as left value (ALT). After calibration it is anticipated that the maximum error would be the TLU. Adding these together would yield a maximum reset value. The AFT is used to evaluate how far the relay has drifted and if any corrective action or a condition report is needed. There is no correlation between the AFT and the future state of the relay. If the AFT is found above the ALT the relay is recalibrated below the ALT. Therefore, one should never see a value for the pickup setting greater than AFT + TLU since it is the as found condition which would account for the drift.

The difference between the 105.23 pickup voltage of the loss of voltage (LOV) and the minimum drop out of 106.73 V for the degraded grid voltage (DGV) do not overlap and are considered to be acceptable. In order for these values to be this close the LOV relay would need to be set high and the DGV relay set low. The pickup voltage for the LOV is only applicable if the dropout value has been exceeded. The upper analytical drop out limit for this relay is 96.22 V. Therefore, voltage between the 106.73 of the DGV and the 96.22 of the LOV is acceptable. This allows adequate margin between the LOV reset and DGV settings.

EEEB RAI 2:

General Design Criterion 17 states that provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies.

EEEB RAI 2, Request 1

The staff finds that the methodology considered by the licensee to calculate analytical voltage values of loss of voltage (LOV) relay has resulted in lower analytical voltage value of 5279 V (76.5 percent of 6900 V) and upper analytical voltage value of 5773 V (83.7 percent of 6900 V), with a nominal voltage setpoint of 5526 V (80.0 percent of 6900 V). The staff finds that these voltage values are high, which can result in unnecessary separation of safety-related buses from offsite power on transient transmission faults.

Please confirm that:

(a) The lower analytical voltage limit for LOV relay is such that none of the safety-related, normally running motors would stall when subjected to this voltage.

(b) The upper analytical voltage limit for LOV relay is such that the minimum expected voltage during loss-of-coolant accident (LOCA) start of all safety-related loads remains above this voltage.

EEEB RAI 2, Request 1 Response

(a) HNP design basis document DBD-202 states that motors have the capability to run at 75% of rated voltage for 60 seconds. This value was a key design input to the HNP LOV settings. The associated motor specifications do not specifically list a motor stall requirement, however one can correlate that, since the motors are specified to start and run at 75% of rated voltage, the stall voltage would have to be less than 75%. It is noted that some other sites have used the motor stall value within their LOV calculation to specify a lower setting than HNP. Since HNP does not use an inverse time relay, the mechanism to ensure protection for safety-related motors when the voltage is in the region between the DGV setting and the LOV setting is to ensure the equipment has adequate voltage for the entire duration of a DGV condition. The DGV time delay is set at 54 seconds. To ensure a motor will never see 75% voltage for longer than 60 seconds, the LOV setting must ensure that the safety-related motors have adequate voltage for the entire duration of the condition. Therefore 0054-JRG selected 75% rated voltage as a minimum allowed voltage at the motor terminals. This will ensure the motors will not stall.

Therefore, the lower analytical voltage limit for the LOV relay is such that none of the normally running safety-related motors would stall.

(b) See the response to question 3 and associated chart. The chart plots the expected LOCA voltages against the set points. Calculation E-6000 Charts A1-1 & A1-2 and Tables A5-1 & A5-2 show a worst-case calculated voltage of 6370 V during LOCA sequencing. The maximum allowable drop out value for the LOV is 5773 V. Since the analytical limit is lower than the worst case voltage of 6370, this criterion is satisfied. In addition, the maximum expected “as-found” reset value of 105.23 V (approx. 6313.8 V) is also well below this value and would not be impacted by LOCA loading at minimum switchyard.

Duke Energy agrees that these values appear to be high. This is a result of applying instrument uncertain methodology to protective devices. These devices do not have the precision levels of instrumentation and require a wide range due to these inaccuracies. When the original values were selected, some objectivity was applied to allow reliability to be managed against protection. Using hard numbers requirements does not allow objectivity and requires these setting to be higher than desired. This could increase the likelihood of an accidental separation; however, the calculation shows that, with known conditions, the relay settings are acceptable.

EEEB RAI 2, Request 2

Please confirm that a momentary voltage dip lasting to clear a fault, lightning strike, or switching transient in the grid does not cause spurious separation of safety buses from offsite power. In addition, please confirm that the proposed LOV settings do not increase loss of offsite power frequency.

EEEB RAI 2, Request 2 Response

Final Safety Analysis Report, Section 8.2.2.3 “Analysis of Operating Voltages,” discusses the acceptability of expected HNP 230 kV Switchyard voltage and frequency fluctuations which could occur under transient conditions caused by worst-case analyzed Transmission System grid disturbances. This evaluation is based upon a postulated “worst case” fault event in conjunction with the assumed failure of the primary protective relaying. In the analyzed case, the primary protective relaying, if available, would have removed the faulted circuit in approximately 4 cycles. However, if the primary protective relaying is not functional, the secondary protective relaying would remove the faulted circuit in approximately 10 cycles.

A major Transmission System grid disturbance occurred in 2002 (as documented in HNP condition report 69088) where an open feeder to a faulted transformer was inadvertently re-closed due to human error while the primary protective relaying was out of service. In that event, the voltage dip was low enough to actuate the Emergency Bus LOV protective scheme undervoltage relays; however, the associated time delay was long enough to prevent bus tripping. (The grid disturbance lasted 0.63 seconds and the Emergency Bus loss-of-voltage undervoltage relaying scheme at that period of time had a 1 second nominal time delay). Due to that event occurring, the Transmission System secondary protective relay time delay was reduced to approximately 10 cycles (0.17 seconds) to increase reliability.

The existing TS allowed value for LOV scheme time delay is ≤ 1.5 seconds. The allowed value is NOT being changed. The existing T/S setpoint for time delay is ≤ 1.0 seconds. The T/S setpoint value is proposed to be increased from ≤ 1.0 seconds to ≤ 1.46 seconds which, of course, is within the allowed value. The actual field setpoint is then proposed to be increased from the existing 1.0 second setpoint to 1.2 seconds. This will increase the margin with respect to ensuring that spurious actuation will not occur during Transmission System grid disturbances.

EEEB RAI 2, Request 3

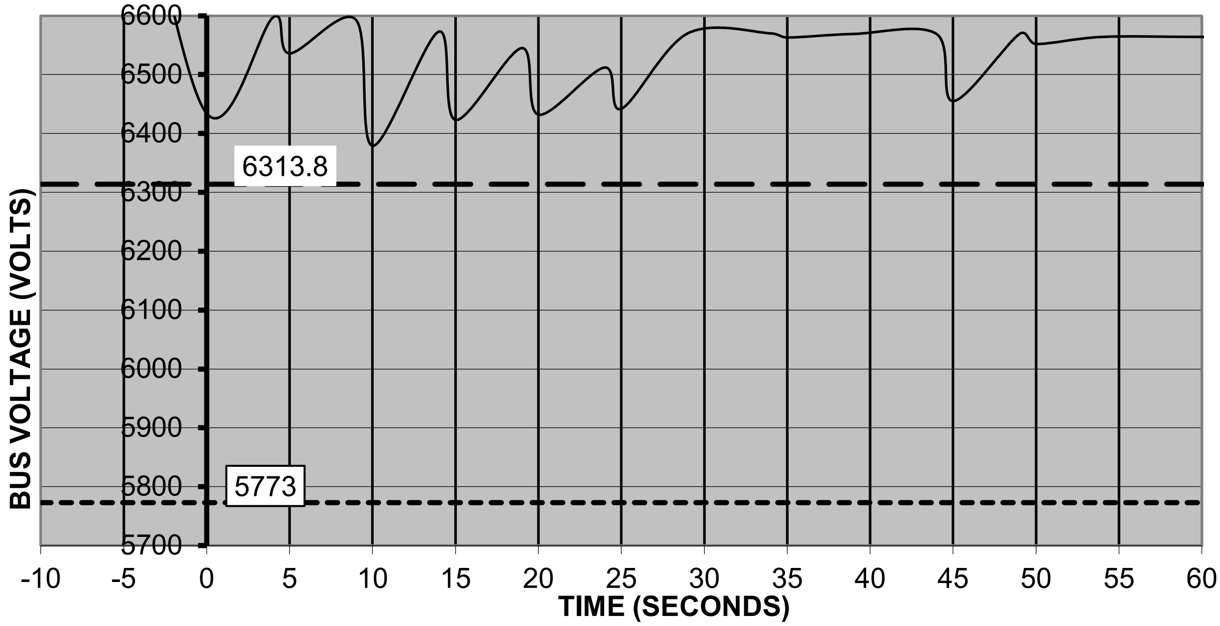
In the calculation No. 0054-JRG attached to LAR, the licensee calculated a maximum pickup/reset value of LOV as high as 105.23 V. The licensee stated that a pickup value of 105.23 V is acceptable because it is less than the minimum degraded voltage relay dropout setting of 106. 73 V.

The staff finds the pickup (reset) voltage value as 105.23 V of 120 V = 87.7 percent very high, which does not provide an adequate margin from the degraded voltage relay dropout setting of 106.73 of 120 V = 88.9 percent. The staff considers that the analytical and reset voltage values of LOV relay should be lower than the minimum voltage calculated at the 6.9 kilovolts (kV) safety-related buses during starting of LOCA sequencing loads any time after the safety injection signal, based on the minimum switchyard voltage (after the unit trip). Please provide a curve showing the minimum voltages at the 6.9 kV safety-related buses during 55 seconds of starting of LOCA loads after the safety injection signal based on the minimum switchyard voltage. Super-impose on this curve the analytical and reset voltage values of LOV relay settings to confirm that adequate margin exists so that the motors would not trip out by the LOV relay during LOCA loads sequencing.

EEEB RAI 2, Request 3 Response

Chart A1-1, shown on page 6 of this enclosure, was developed using Chart A1-1 out of E-6000, Revision 12. This chart was initially developed to demonstrate adequate margin for the DGV settings which are higher than the LOV settings. The DGV values from this table were then replaced with the LOV values to develop a similar plot to show the LOV setting as compared to the LOCA response profile. From this graph, it is shown that the voltages seen during LOCA sequencing are well above the LOV dropout and pickup values. Chart A1-1 shows that there is adequate margin and the LOV setting would not be reached during a LOCA at the minimum switchyard value.

CHART A1-1
BUS 1A-SA VOLTAGE DURING SEQUENCING
(At Switchyard Voltage Limit - 222.00 kV)



________	Bus 1A-SA LOCA Sequencing Voltage Response at Min Swyd Voltage
__ __ __	LOV RESET (Relay resets at 110% of set point)
_ _ _ _ _	LOV DROPOUT (Max Field Setpoint With TLU Added)

Note: The chart above is for the A train. The B train is similar and the conclusions are the same, so only one representative graph is being provided. The worst-case voltage dip considering both trains is down to 6370 V (during Load Block 3 on Bus 1B-SB).

The DGV undervoltage (UV) relays (secondary UV relays) are set at 6420 V (dropout). There are two time-delay relays. The first is set at 12 seconds, which will separate the emergency power system from the degraded offsite source if the 6.9 kV emergency bus voltage drops below 6420 V for a minimum of 12 seconds if there is a LOCA. The second time delay is set at 54 seconds, which will separate the emergency power system in 54 seconds if there is no LOCA. The degraded voltage protection scheme is “definite time” (not inverse time). Therefore, if the voltage goes below 6420 V, the emergency power system will separate in 12 seconds if a LOCA is present or in 54 seconds if a LOCA is not present, no matter how low the voltage goes below the 6420 V setpoint.

The Loss of Offsite Power undervoltage relays (primary UV relays) are proposed to be set at 5526 V (dropout). There is only one time-delay relay with a proposed setpoint of 1.2 seconds.

Therefore (with offsite power supplying the emergency power system):

1. If the 6.9 kV emergency bus voltage is above the 6420 V dropout setting of the degraded voltage relay, all safety-related equipment will be operating within the manufacturer's specified voltage range (e.g. at or above 90% terminal voltage for motors). This is demonstrated by Tables A6-1 (Train A) and A6-2 (Train B) of Calculation E-6000.

2. If the 6.9 kV emergency bus voltage drops to between 5526 V (proposed primary UV relay dropout setting) and 6420 V (secondary UV relay dropout setting), the degraded voltage relay protection scheme will become activated. Motor terminal voltages will be at or above 75% of rated during this time and this condition will not persist for more than the 1 minute capability of the motors. If there is a LOCA present, the emergency power system will separate from the degraded offsite source in 12 seconds. The 12 second time delay will allow voltage recovery during safeguards sequencing to ensure that Sequencer-started motors will not cause spurious actuation of the logic. DGV Setpoint Calculation E2-0005.09 provides an evaluation to demonstrate safety system response times will be met considering concurrent LOCA and degraded grid event with the 12-second delay. If there is no LOCA signal present, annunciation will occur at 12 seconds and if the condition persists, separation will occur at 54 seconds. The 54-second time delay will provide some amount of time for the condition to be resolved (either naturally or by operator action) and will ensure that running motors will not be damaged (since they are specified to be capable of running for a minimum of 60 seconds at 75% voltage without incurring damage).

3. If the 6.9 kV emergency bus voltage drops below the proposed 5526 V dropout setting of the loss of offsite power relay, separation of the emergency bus from the offsite source will occur in 1.2 seconds (proposed setting). The 1.2-second time delay ensures separation is as short a time as possible while ensuring that transients occurring during fault clearing will not cause spurious actuation. (Note that the proposed LOV relay setpoint is low enough such that voltage sags during worst-case motor starting under worst-case conditions will not actuate the UV relay).

Based on these factors and although higher than other plants, Duke Energy has determined that these values are adequate to prevent an accidental separation while providing adequate motor protection.