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

Subject: Brunswick Steam Electric Plant, Unit Nos. 1 and 2
Renewed Facility Operating License Nos. DPR-71 and DPR-62
Docket Nos. 50-325 and 50-324
Response to Request for Additional Information - Request for License Amendment - Technical Specification 3.3.8.1, *Loss of Power (LOP) Instrumentation*

References:

1. Letter from William R. Gideon (Duke Energy) to the U.S. Nuclear Regulatory Commission Document Control Desk, Request for License Amendment - Technical Specification 3.3.8.1, *Loss of Power (LOP) Instrumentation*, dated October 18, 2018, ADAMS Accession Number ML18291A628

2. E-Mail Capture from Dennis Galvin (NRC) to Art Zaremba (Duke Energy), Brunswick RAIs – LAR to Revise Allowable Value for TS 3.3.8.1 Time Delay on Loss of Voltage (EPID L 2018-LLA-0281), dated March 6, 2019, ADAMS Accession Number ML19065A096

Ladies and Gentlemen:

By letter dated October 18, 2018 (i.e., Reference 1), Duke Energy Progress, LLC (Duke Energy), submitted a license amendment request (LAR) for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The proposed change revises the Allowable Value associated with Function 1.b, (i.e., 4.16 kV Emergency Bus Undervoltage (Loss of Voltage) – Time Delay) of Table 3.3.8.1-1, *Loss of Power Instrumentation*.

On March 6, 2019 (i.e., Reference 2), the NRC provided a request for additional information (RAI) regarding the LAR. Duke Energy's response to the RAI is included in the enclosure.

This document contains no new regulatory commitments.

I declare, under penalty of perjury, that the foregoing is true and correct. Executed on April 3, 2019.

Sincerely,

William R. Gideon

MAT/mat

Enclosure:

Response to Request for Additional Information

cc (with Enclosure):

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Response to Request for Additional Information

By letter dated October 18, 2018, Duke Energy Progress, LLC (Duke Energy), submitted a license amendment request (LAR) for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The proposed change revises the Allowable Value associated with Function 1.b, (i.e., 4.16 kV Emergency Bus Undervoltage (Loss of Voltage) – Time Delay) of Table 3.3.8.1-1, Loss of Power Instrumentation.

On March 6, 2019, the NRC provided a request for additional information (RAI) regarding the LAR. Duke Energy's response to the RAI is provided below.

RAI-1

The LAR Section 3 states: "Time Delay shall be less than the assumed time for the emergency diesel generator (EDG) restoring bus voltage and frequency. The time assumed for 4.16 kV [kilovolt] emergency bus restoration is 13 seconds. Calculation 04KV-0001 conservatively uses 3.5 seconds as the Upper Design Limit."

The LAR provides details on the setpoint methodology but does not discuss the consequences of an additional time delay in starting the EDGs and the required accident mitigation equipment. Brunswick UFSAR Section 8.3.1.1.6.5.1 'Automatic Starting' states in part, "The diesels are capable of achieving rated speed and voltage within ten seconds of receipt of a start signal. The analytical limit for restoring bus voltage and frequency is based on supporting accident analyses and design basis calculations. The 13 seconds for bus restoration assumed in the Reactor Building Environmental Report (Reference 8-11) is more limiting than the 15 seconds assumed in the LOCA [Loss of Coolant Accident] analyses (References 8-10, 8-12, and 8-13)."

If the EDG start time is 10 seconds and the calculation assumes 3.5 seconds for the instrument actuation lag time to initiate the EDG start signal, then the analytical limit of 13 seconds assumed in accident analysis is exceeded. Alternatively, it can be considered that if the EDG restoration time is 10 seconds and the calculation assumes 3.5 seconds for the instrument actuation lag time to initiate the EDG that would leave only 9.5 seconds for restoring the diesel voltage and frequency, which is less than the required 10 seconds.

a) Please describe the purpose of the 13 seconds bus restoration time assumption in the Reactor Building Environmental Report.

b) Please address the discrepancy between the 13.5 seconds and the 13 seconds total response time for instrumentation and diesel restoration.

c) If the 15 second time delay for LOCA analyses has been revised, please include a discussion on how the proposed time of 13.5 seconds impacts the existing licensing basis for response time of equipment (pumps and valves), as assumed in accident analyses, sequenced after the 4.16 kV bus is re-energized.

Response to RAI-1

Background

Calculation 04KV-0001 discusses three different instrument lag times.

1. The 27/59E loss-of-voltage relay, which initiates emergency bus load shedding and actuates CL-A/CL-B relays to enable emergency diesel generator (EDG) output breaker closure, has a time delay of greater than 3.5 seconds.

2. Referenced calculation BNP-MECH-RBER-001, "Reactor Building Environmental Report," assumes 3.0 seconds for EDG output breaker closure following engine startup, yielding a 4.16 kV bus reenergization time of 13.0 seconds.

3. BNP-MECH-RBER-001 also assumes a 3.0 second instrument lag for certain instruments associated with the high energy line break (HELB) scenario. Assumption 3.2.d states:

   > Branch Technical Position (BTP)-ASB-3-I (Ref. 4) requires that a loss of offsite power be assumed if a reactor or turbine trip occurs as a direct result of the HELB. In order to be conservative, a loss of offsite power was assumed for all events; therefore, a 13 second diesel starting time was incorporated into the break isolation time delay. In addition, a 3 second delay was assumed for instrument lag time (with the exception of temperature switches in the MS Pit area) and a 13 second time delay was assumed for the high-flow trip instrumentation time delay relays."

a) *Please describe the purpose of the 13 seconds bus restoration time assumption in the Reactor Building Environmental Report.*

The typical response to a HELB event is to close isolation valves, some of which may require AC power. As discussed above, the Reactor Building Environmental Report (RBER), assumes 3.0 seconds for EDG output breaker closure following engine startup, yielding a 4.16 kV bus re-energization time of 13.0 seconds (i.e., the EDG start time of 10 seconds plus 3 seconds to re-energize the 4.16 kV bus). The 13 seconds assumed in the RBER for restoration of power is not challenged by the proposed LAR. An analytical limit of 3.5 seconds was chosen for the 27/59E time delay, which is well below the 13 second constraint.

b) *Please address the discrepancy between the 13.5 seconds and the 13 seconds total response time for instrumentation and diesel restoration.*

It is not necessary to consider the 3.5 second time delay in sequence with the 10 second engine start. The 27/59E does not initiate the EDG start signal. Its purpose is to strip the emergency bus loads, which in turn, is a close permissive for the EDG output breaker. This function is in parallel with, not sequential to, the 10 second engine start. If the 27/59E time delay were excessively long (greater than 13 seconds), emergency bus stripping and EDG output breaker closure would be delayed, and the 13 second requirement would not be met.

c) *If the 15 second time delay for LOCA analyses has been revised, please include a discussion on how the proposed time of 13.5 seconds impacts the existing licensing basis for response time of equipment (pumps and valves), as assumed in accident analyses, sequenced after the 4.16 kV bus is re-energized.*

The 15 second EDG start time assumed for loss-of-coolant accident (LOCA) analysis is not impacted because the subject time delay of 3.5 seconds is much less than 15 seconds. The 3.5 second time delay for load stripping occurs in parallel with the start sequence of the engine.

RAI-2

TS 3.3.8.1-1, "Loss of Power Instrumentation" has setpoints for 4.16 kV Emergency Bus Degraded Voltage Relays (DVRs). The time delay associated with actuation of these relays is ≥ 9 seconds and ≤ 11 seconds. Considering the upper analytical limit for DVR actuation, please provide a discussion on how the proposed time delay of 3.5 seconds impacts the existing licensing basis for total response time of 1) LOV instrumentation and 4.16 kV bus re-energization and 2) the response time of equipment (pumps and valves), as assumed in accident analyses, sequenced after the 4.16 kV bus is re-energized.

Response to RAI-2

The Loss of Power (LOP) instrumentation monitors emergency bus voltage at two levels, which can be considered as two different functions; Loss of Voltage Function and Undervoltage / Degraded Voltage Function. Each of these functions is separate and independent of the other, and each is constrained by different analytical limits. For each emergency bus, the Loss of Voltage Function is monitored by one inverse time delay undervoltage relay (27/59E) and the Degraded Voltage Function is monitored by three different time undervoltage relays (27DVA, 27DVB, and 27DVC). Revising the time delay on relay 27/59E has no impact on the effective actuation times of the degraded-voltage relays.

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 insufficient offsite power is available, the LOP instrumentation allows the onsite EDG to connect to the emergency bus. The initiation of the EDGs for loss of offsite power or degraded voltage conditions is not a function of the LOP instrumentation. The initiation of the EDGs for loss of offsite power or degraded voltage conditions is performed by the 27HS relay, as well as other non-safety related relays on the balance-of-plant (BOP) bus. Initiation of the EDGs is also performed by the opening of the feeder and incoming line breakers between respective normal BOP and emergency buses with the diesel engine shut down.

As previously discussed, the 27/59E (LOV) relay time delay applies to load stripping of the emergency bus, which occurs in parallel with the EDG start sequence. This relay does not initiate, and is not a permissive for, the EDG start signal. Since stripping loads from the emergency bus occurs much faster than the engine start (i.e., between 3.5 seconds and less than 10 seconds), this relay will not delay EDG output breaker closure, which occurs after the engine reaches full speed. This assumes that the EDG is not initially running at the time of the loss of offsite power (LOOP) or LOCA signal.

If the EDG is initially running in manual when a LOOP or LOCA start signal is received, then the output breaker closure timing would be determined by the 27/59E time-delay. The ability to achieve the required timing remains bounded by the case of engine initially in standby. The time required to clear the bus loads is driven primarily by the 27/59E, since this is the only relay in sequence with any intentional time delay. With the time delay set equal to the analytical limit, breaker closure would be initiated in less than 4 seconds. Note that in this scenario the real concern is early closure, since actuation ahead of the RCR-X relay results in breaker lockout. This is the issue being addressed by the proposed LAR.

After the emergency bus is energized, the automatic emergency bus load sequence is initiated by the 27E1 and 27E2 relays, which are independent of the 27/59E (LOV) relay. The timing of the load sequence for the various pumps and valves is, therefore, not affected by the additional time required for the 27/59E to reset.

Failure of the 27/59E to reset cannot prevent automatic loading of the emergency bus, nor can it trip these loads, when powered by the associated EDG. While the 27/59E can strip loads when the emergency bus is connected to the offsite grid, this logic is bypassed when the EDG output breaker is closed. When the breaker closes, a mechanism operated switch contact, in series with 27/59E logic, opens, causing the stripping relays to immediately reset. Only indications and the emergency bus cross-tie relays are affected by the 27/59E after EDG breaker closure.

RAI-3

The LAR proposes a change to the 'Allowable Value' for the LOV relay time delay from ≥ 0.5 seconds and ≤ 2.0 seconds to ≥ 1.35 seconds and ≤ 3.0 seconds. The NRC staff notes that the change to a minimum time delay of ≥1.35 seconds should resolve the design vulnerability impacting the EDG output breaker logic. It is not clear what the reason for the change in the upper allowable time delay is. Please provide a discussion on the need to change in the upper allowable time delay from ≤2.0 seconds to ≤3.0 seconds and why this proposed change is acceptable.

Response to RAI-3

The time delay upper limit has been raised to provide an Allowable Value range comparable to the existing range. The intent was to select a workable range of values with enough robustness to accommodate minor calibration challenges, using the applicable design process, without having to revisit the selected Allowable Values. The existing range is 1.5 seconds (i.e., 2.0 seconds – 0.5 seconds). Applying this same range with the new lower limit of 1.35 seconds gives an upper limit of 2.85 seconds, which rounds to 3.0 seconds.

The 27/59E relay does not initiate starting of the EDG engine. The 27/59E time delay setpoint does not affect the timing of emergency bus automatically sequenced loads. The primary function of the 27/59E is to strip the emergency bus loads prior to EDG output breaker closure. This function is performed in parallel with engine startup (10 seconds), and must be completed before the engine is ready to be loaded to avoid delaying breaker closure. Since the 10 second start time bounds 3 seconds, the selected upper limit value is conservative. The 27/59E time delay does affect logic associated with emergency bus cross tie function, but cross-tying of the emergency buses is not allowed under normal circumstances, and timely actuation of the 27/59E is not a concern with respect to this function. Extending the time delay upper limit to 3 seconds is, therefore, acceptable and does not adversely affect any design functions.

RAI-4

The calculation references include RG 1.105; ISA Standard S67-04.01-2000, "Setpoints for Nuclear Safety-Related Instrumentation"; and ISA Standard S604-02-2000, "Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation." All three of these documents are listed in the references section of the calculation as "Information Only" documents. It is not clear if Calculation 04KV-0001 follows the guidance of RG 1.105. The licensee is requested to confirm that it follows the guidance of RG 1.105 to prepare the setpoint calculations. If the guidance of RG 1.105 is not followed, then please describe the methodology and the basis for the methodology. In addition, please confirm that the guidance of Regulatory Information Summary (RIS) 2006-17, "NRC Staff Position on the Requirements of 10 CFR 50.36, "Technical Specifications," Regarding Limiting Safety System Settings During Periodic Testing and Calibration of Instrument Channels" (ADAMS Accession No. ML051810077), is also followed.

Response to RAI-4

Calculation 04KV-0001 is prepared in accordance with Duke Energy procedure EGR-NGGC-0153 *Engineering Instrument Setpoints*. EGR-NGGC-0153 is based upon ISA Standard S67-04.01-2000, *Setpoints for Nuclear Safety-Related Instrumentation*; and ISA Standard S604-02-2000, *Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation*. BSEP is not committed to Regulatory Guide (RG) 1.105; however, RG 1.105 was consulted to ensure the calculated instrument setpoints are, and will remain, within their technical specification limits. The as-found tolerance band established in Calculation 04KV-0001 accounts for instrument setting tolerance, drift, and calibration instrument uncertainty. This method is consistent with NRC guidance provided in RIS 2006-17.

RAI-5

Section 5.1.2 of calculation 04KV-0001 has calculated the primary element accuracy (PEA) error as ± 0.303 VAC. However, total device uncertainty (TDU) in Section 5.2.1.19 actually uses the PEA error as ± 0.294 VAC instead of the calculated value of ± 0.303 VAC. The calculation does not provide any explanation for this discrepancy. Please explain the rationale for using two different numbers for the same error.

Response to RAI-5

This is an inconsequential error, typographical in nature. In earlier iterations of this calculation, a relay setpoint of 98 VAC was considered and produced a ± PEA of 0.294 VAC. The PEA is ± 3.03 VAC as calculated in Section 5.1.2 of 04KV-0001. The resulting relay TDU is unchanged by this typographical error and remains ± 5.04 VAC.

RAI-6

Section 5.2.1.2 of calculation 04KV-0001 discusses uncertainty due to drift for the undervoltage function. The calculation uses a drift duration of 1 year with 25% margin. Please note the NRC approved the 24-month surveillance frequencies to support a 24-month fuel cycle as part of the Brunswick improved standard (TSs) amendments, issued on June 5, 1998 (ADAMS Accession No. ML12047A393). Please confirm that the current calibration interval of 1 year is not impacted due to change in refueling outage.

Response to RAI-6

The subject relay, over/undervoltage relay 27/59E, is calibrated on an annual interval. The calibration is currently performed while the unit is operating and not in a refueling outage. A drift value of ± 2.0% of full scale for an 18-month period is utilized in Section 5.2.1.2 of 04KV-0001. No technical basis is available (i.e., vendor literature, drift analysis) for a drift value corresponding to a calibration period of 12 months. Since drift is a random variation that may occur anytime between calibration, a drift value for a 1.25 year period (12 months plus its 25% grace period) cannot be interpolated from the 18-month period drift value of ± 2.0% full scale. Therefore, the uncertainty due to drift is maintained (Section 5.2.1.2 of calculation 04KV-0001).