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FROM: Frank J. Mascitelli PHONE: 610-765-5512
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RE: Docket ID NRC-2011-0013
Exelon Comments on Draft RIS 2011-xx,
Adequacy of Station Electric Distribution
System Voltages

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February 16, 2011

Ms. Cindy Bladey, Chief
Rules, Announcements and Directives Branch (RADB)
Division of Administrative Services
Office of Administration
Mail Stop: TWB-05-B01M
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Comments Concerning "Proposed Generic Communication; Draft NRC Regulatory Issue Summary 2011-XX; Adequacy of Station Electric Distribution System Voltages" (76FR2924, dated January 18, 2011) (Docket ID NRC-2011-0013)

This letter is being submitted in response to the U.S. Nuclear Regulatory Commission (NRC) request for comments concerning "Proposed Generic Communication; Draft NRC Regulatory Issue Summary 2011-XX; Adequacy of Station Electric Distribution System Voltages."

Under this Proposed Generic Communication, the NRC clarifies the staff's technical position on existing regulatory requirements and voltage studies necessary for Degraded Voltage Relay setting bases and the Transmission Network/Offsite/Onsite station electric power system design bases.

Exelon Generation Company, LLC (Exelon) appreciates the opportunity to comment on these Petitions for Rulemaking, which are contained in the attachment to this letter.

In addition, Exelon is participating in a Nuclear Energy Institute (NEI) working group reviewing the subject draft Regulatory Issue Summary and plans to endorse the output from this group.

If you have any questions or require additional information, please do not hesitate to contact me at (610) 765-5525.

Respectfully,

D. P. Helker
Manager – Licensing
Exelon Generation Company, LLC

Attachment: Exelon Comments on Draft RIS 2011-XX, Adequacy of Station Electric Distribution System Voltages

ATTACHMENT

Exelon Comments on Draft RIS 2011-XX,
Adequacy of Station Electric Distribution System Voltages
Page 1 of 5

The Regulatory Information Summary (RIS) is a great effort to clarify the requirements to help the industry understand this issue better. While a good initial step, there is still need for more detail either in this RIS or some other document that has a regulatory basis (i.e., Regulatory Guide). Ideally, two examples that demonstrate one acceptable means of performing the required analyses would assist the industry in gaining a proper understanding: one for a station without transformer load tap changers (LTCs) and one with LTCs demonstrating the required analysis and other associated requirements.

General

The RIS uses terms such as "LVR (loss-of-voltage relay) voltage setting," "DVR (degraded voltage relay) settings" and "DVR dropout setting" without clarifying the intent or highlighting the differences. IEEE 741-2006, Annex A (Reference 1), has a discussion on the tolerances to be considered and recommends following ANSI/ISA 67.04.01 (Reference 2) treating the voltage relays and associated time delays as instruments. For the DVR, one example might be represented as follows:

✓ Analytical limit:	Minimum voltage that assures actuation of the relay
✓ Allowable value, Lower:	Higher than analytical limit to allow for drift and test equipment tolerance; abbreviated AVDO. Tech Spec value.
✓ Dropout setpoint:	Lower voltage band of nominal setpoint. Abbreviated SPc DO (Setpoint calculated Drop Out)
✓ Pickup setpoint:	Upper voltage band of nominal setpoint. Abbreviated SPc PU (Setpoint calculated Pick Up)
✓ Allowable value, Upper:	Higher than SPc PU to allow for drift and test equipment tolerance; abbreviated AVPU. Tech Spec value.
✓ Maximum Dropout	Highest voltage that relay could actuate. Only importance is for establishing reset voltage.
✓ Maximum Pickup	The voltage required to assure DVR resets.

The RIS states that two sets of calculations are required. It appears that at least three (3) distinctly different calculations are required (four if the site has different DVR time delays for accident and normal conditions). These would be at different bus voltage values. The "degraded voltage relaying design calculations" would be a load flow performed at the DVR analytical limit; the "plant voltage analysis" would be load flows and motor starting performed at the minimum transmission contingency voltage with an acceptance criterion of greater than relay maximum pickup (the voltage where DVR reset is assured) at the bus where the degraded voltage relays are connected (generally the medium voltage bus where the Emergency Diesel Generator is connected); finally, the evaluation of protective device actuation would be performed at the analytical limit of the loss of voltage relay setting comparing the motor running current to the thermal damage curve and protective device characteristic curve.

Page 2, criteria b) – Some approved DVR designs sense and trip at an emergency bus level, and take advantage of inherent redundancy of the emergency buses. It should be an owner's option with respect to coincident logic. Change the "shall" to "may."

Page 2/3 – The listed 6 criteria are good for setting the DVR. Early correspondence of the issue also included a second function for the DVR in that the design should minimize the effects of spuriously disconnecting the offsite sources. Although criteria b) and c)(2) are intended to add robustness to the design, a few sentences should be added to the discussion to accentuate the point.

Degraded Voltage Relaying Design Calculations:
Under "Degraded Voltage Relaying Design Calculations," the RIS states in part "During normal plant operation, the Class 1E safety related buses should automatically separate from the power supply within a short interval (typically less than 60 seconds) if sustained degraded voltage conditions are detected." Branch Technical Position PSB-1 clause B.1.b.2 included provisions for operator manual actions to restore bus voltage on the Class 1E distribution system. The sixty second time delay would not allow operator actions. This appears to be a new NRC position.

Page 6 – The next to last sentence under item 1 states: "The staff considers degraded voltage conditions coincident with a postulated design basis accident to be a credible event. The event is credible in that it has occurred previously (although nonaccident). It is acknowledged that safety loads combined with loss of generator reactive power support will cause a decrease in bus voltage. However, if the plant is operated within the bounds of the operating procedures (which are reflected in the voltage regulation calculations as described under the subsequent section), then the Class 1E equipment should not experience a degraded voltage condition. The sentence can be removed without diminishing the need for the DVR, or without changing the intent of this section.

Page 6, DVR Setting Design Calculations – Add a sentence "The model should utilize loads on the plant distribution system consistent with the specific transient or accident being analyzed."

In addition, Branch Technical Position (BTP) PSB-1 clause B.1.b.2 (Reference 4) included provisions for operator manual actions to restore bus voltage on the Class 1E distribution system. The RIS specifically excludes manual load shedding under the Offsite/Onsite Design Interface Calculations whereas the BTP allows for manual actions to avoid separation from offsite power. Please clarify if manual actions taken to restore voltages now require prior NRC approval.

Under "DVR Setting Design Calculations," the RIS states in part "...would allow calculation of voltages at terminals or contacts of all safety related equipment with the voltage at the DVR monitored bus at the DVR dropout setting." It is not clear what "contacts" are in this context. It is assumed that the concern is motor control center contactors and/or motor starting control circuits.

Under discussion of DVR setting calculations, the RIS states that setting cannot cause any degradation of the safety related components, including actuation of their protective devices. The BTP only stated damage to normally operating safety related equipment. The RIS

language seems broader then BTP and appears to open up the position that the DVR studies have to consider starting of loads under non-accident conditions.

The DVR time delay seems to be considering operation down to LVR setting for evaluations. However, there is no discussion on LVR setting considerations in any original requirements or the RIS. Under Guidelines for Voltage Drop Calculations, the summary states that the plant voltage analysis, while supplied from the transmission network, should be based on the operating voltage range of the transmission network connection. Grid operating voltage ranges do not allow operation down to levels that would cause sustained operation at LVR levels. Therefore, consideration for operation at the LVR setpoint would be inconsistent with this guidance. The condition that occurred at Arkansas Nuclear One (ANO) in 1978 would appear to be related to inadequate operating procedures and a lack of a rigorous analysis of the AC power distribution system. It would not be credible for present day operation. In addition, the operator would be alerted by an alarm on degraded voltage conditions (less than the analytical limit) as required by Branch Technical Position PSB- B.1.b.1.

DVR Setting Design Calculation:
In Section "DVR Setting Design Calculation" reference is made to 0.9 per unit voltage for adequate operating voltage. This would only apply for the most part to rotating equipment (motors). Motor Control Center (MCC) contactors, battery chargers, Motor Operated Valves (MOVs) all have less than a 90% operating voltage requirement. This distinction should be made and/or clarified.

The Degraded Voltage Relaying Design Calculations section should include a statement to emphasize that only steady state loading and steady state acceptable voltages at the class IE equipment are to be considered in determining the DVR drop out settings including the allowable tolerances. The paragraph does mention 0.9 per unit voltages at the terminals which is steady state but a positive statement about steady state loading and steady state acceptable voltages would be helpful. Also, there are alternatives to the 90% terminal voltage criterion. The concern is heating, causing a temperature rise, which decreases useful life of the insulation. Inspectors may read too much into the 90% criterion; a motor loaded to less than nameplate will draw less than service factor current at a lower terminal voltage. Therefore, a lower voltage would prove adequate as long as adequate torque is available.

MOVs are not steady state loads. MOVs have traditionally been considered transient loads and, therefore, not included in the steady state voltage analysis. GL 89-10 (Reference 3) programs perform these calculations. A statement in this section that MOVs loads are not to be considered in this calculation will be helpful if NRC agrees with this interpretation.

The starting voltage requirement is unclear. Some sites have evaluated the capability of starting each required safety related motor individually at the degraded voltage analytical limit. Other sites use a "block start analysis" where multiple motors are started simultaneously on the offsite source. There have been violations associated with both approaches. The RIS should describe an acceptable methodology for determination of motor starting voltage adequacy.

The RIS implies this portion of the calculations require that the licensee demonstrate that all class IE motors can be started with the voltages just above the analytical limit of the DVR setpoint. However, with voltage just above the DVR drop out value, any load addition (starting

or running) will result in separating from the offsite source if no credit for external voltage controlling equipment is taken. Therefore, the purpose of this requirement is not clear. The intent of the starting voltage evaluation should be clarified.

Some stations have evaluated the performance of protective devices during degraded grid conditions by mechanisms other than calculations (e.g., technical evaluations or computations). It is suggested that the NRC add a statement for acceptability of the same.

Offsite/Onsite Design Interface Calculations:
Under Offsite/Onsite Design Interface Calculations, Guidelines for voltage drop calculations item 2i, the acceptance criteria for demonstrating voltage adequacy would appear to be DVR Maximum Pickup (the voltage required to assure relay reset) and not component level voltage values.

Item 2 (Offsite/Onsite Design Interface Calculations) appears to be additional requirements for those sites licensed to the Standard Review Plan (NUREG 0800) Chapter 8 Appendix A Branch Technical Position PSB-1, "Adequacy of Station Electric Distribution System Voltages."

Page 7 – The phrase "...all operating configurations of transmission network and plant systems..." appears in a few sentences. The station interface agreement with the transmission provider integrates the considerations among the transmission network, the operability of the offsite sources, and the voltage regulation (drop) calculations. The calculations identify certain controlling parameters for the transmission network. These controlling parameters are then incorporated into the Bases for the operability of the offsite source(s). If the plant configuration or transmission network parameters are not bounded by the calculations, then the operability of the offsite sources needs to be examined. In most cases, the plant operator has no control over the "configuration" of the transmission network, but does have agreements with the transmission system operator that normal operating voltages and post unit trip contingency voltages are controlled within established bounds. Add a few sentences detailing that the intent of the phrase "all operating conditions of the transmission network" means that the controlling parameters from the transmission network that are used in the calculations are consistent with those utilized in the Bases for operability of the offsite sources.

Page 7, item a) – Change the last sentence to read "... include voltage drop due to all transmission system contingencies that are a direct result of the transient or accident being analyzed (typically this will include tripping of the nuclear power unit)."

Page 7, item a) – Either add to a) or add another section immediately after a). "The transmission system controlling parameters are assumed to remain unchanged throughout the initial stages of the event with the exception of those effects resulting from the event (contingency due to the loss of the unit). For purposes of the calculation, the Unit trip contingency can be coincident with the accident, or at a later time consistent with the assumptions in the plant accident sequence analyses."

Page 7, item b) – Delete the tabulation of sources of power to the emergency buses and replace with a simple statement of "all credited sources of offsite power to the emergency buses."

Page 8, item c) – Change to read: "...(1) an accident in the unit being analyzed and shutdown of all other units at the station consistent with the licensing basis of the station; ... in the unit being analyzed (e.g., unit trip) and shutdown of all other units at that station consistent with the licensing basis of the station, whichever represents the largest load situation." Typically, the licensing basis for multi-units site allow for an orderly shutdown of the unit not being analyzed, and do not require a "simultaneous" shutdown.

It is recommended that the NRC provide a positive statement for allowing the credit for voltage controlling equipment external to the class 1E equipment for this calculation. Licensees perform LOCA load sequencing under this section of the calculations and take credit for LTCs (or other voltage regulating devices) to demonstrate the adequacy of the offsite sources. In addition, please clarify if MOVs are to be modeled during this scenario, even though it appears from the RIS that MOVs and other equipment like contactors are to be evaluated with voltages obtained from the Degraded Voltage Relaying Design Calculations with voltage just above the lowest set point of DGV relays.

Under Item a), for units with LTCs, please clarify if the analysis is to be performed with the grid at minimum expected voltage, maximum expected voltage, or at both.

In general the clarifications contained in the draft RIS appear to be more restrictive and prescriptive then the cited historical regulatory documentation, and do not support plant unique design and current licensing bases that have been developed and accepted in previous licensing activities. Unique design and licensing bases that have previously been accepted and approved that may not be strictly aligned with the clarifications in the draft RIS may include use of an inverse time under voltage relay set between the DVR and LVR relays (such as .875 to 0.70 PU for a maximum of 60 seconds). Some sites may not provide coincident logic to preclude spurious trips; rather, the logic may include alternate design features to conform to the intent of the requirements of BTP PSB-1.

References:

1. IEEE 741-2007, "IEEE Standard Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power generating Stations," Annex A, "(informative) Illustration of concepts associated with degraded voltage protection"
2. ANSI/ISA 67.04.01-2000, "Setpoints for Nuclear Safety-Related Instrumentation"
3. GL 89-10, Safety Related Motor-Operated Valve Testing and Surveillance
4. Standard Review Plan (NUREG 0800) Chapter 8, Appendix A, Branch Technical Position PSB-1, "Adequacy of Station Electric Distribution System Voltages" Rev. 0, July 1981