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RULES AND DIRECTIVES BRANCH

Ms. Cindy K. Bladey
Chief, Rules, Announcements, and Directives Branch
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Supplemental Industry Comments on Draft Regulatory Issue Summary, "Adequacy of Station Electric Distribution System Voltages" (Docket ID NRC-2011-0013)

Project Number: 689

Dear Ms. Bladey:

Enclosed are supplemental comments on the subject draft regulatory information summary. These comments supplement and support our comments provided in a March 2, 2011, letter. We encourage further discussion on the draft RIS prior to finalization.

If you have any questions, please feel free to contact me at 202-739-8108; jcb@nei.org or Gordon Clefton at 202-739-8086; gac@nei.org.

Sincerely,

John C. Butler

Attachments

c: Mr. Patrick L. Hiland, NRR, NRC
Ms. Louise A. Lund, NRR, NRC
Mr. Kenn A. Miller, NRR, NRC
Mr. Roy K. Mathew, NRR, NRC
Ms. Jennifer L. Uhle, CRGR, NRC

SUNSI Review Complete

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Template=ADM-013

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Comments on RIS 2011-xx, "Adequacy of Station Electric Distribution System Voltages" (ML102950322)

ID	Page, Location	RIS 2011-xx text	Comment
1	General	Omission	The RIS should identify that plant compliance with the regulation (GDC 17) is by each plant operating within its Licensing Basis.
2	General	Omission	Definitions vary for the same words used with respect to this topic. The RIS should include definitions for key terms, e.g. normal grid operation, sustained degraded voltage, etc.
3	General	Omission	There are various documents that address the Adequacy of Station Electric Distribution System Voltages. These documents have differences in the methodology, terminology, and level of detail. Such differences challenge the users of these guidance documents when they conflict. Attachment 2 to the NEI supplemental comment letter provides a table that shows the differences between GL 79-36, (BTP) PSB-1, IEEE 741, and the draft RIS. The RIS should identify the guidance document differences, establish the NRC position on each conflicting topic, and provide the basis for each change in previously accepted guidance.

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4	Page 1, 3rd Paragraph	"The U.S. Nuclear Regulatory Commission (NRC) is issuing this Regulatory Issue Summary (RIS) to clarify the NRC staff's technical position on existing regulatory requirements and voltage studies necessary for Degraded Voltage Relay (second level undervoltage protection) setting bases and Transmission Network/Offsite/Onsite station electric power system design bases."	No regulatory requirements are referenced except for a generic reference to GDC 17. Reword the paragraph to read: 'The U.S. Nuclear Regulatory Commission (NRC) is issuing this Regulatory Issue Summary (RIS) to clarify the NRC staff's technical position on Degraded Voltage Relay (second level undervoltage protection) setting bases and Transmission Network/Offsite/Onsite station electric power system design bases appropriate for meeting the regulatory requirements specified in GDC 17.'
5	Page 2, Paragraph a)	"The selection of voltage and time delay setpoints shall be determined from an analysis of the operating voltage requirements of safety related loads at all onsite system distribution levels"	Requirements for DVR settings have never used the term "operating voltage". They instead used "sustained voltage" which by definition would be steady state voltage, running voltage, or voltage held at a constant value. (BTP) PSB-1 and BTP 8-6 are silent on operating/running voltage in the DVR settings section; however, running is implied by using the term "sustained" in the Time Delay settings section. To be consistent with (BTP) PSB-1, NRC letter, and BTP 8.6 remove the word "operating".
6	Page 3, Arkansas	"...assuming all onsite sources of AC power are not available, the offsite power system and the onsite	This sentence implies that the NRC use of the term "operate" does not mean the same thing as 'start', i.e.,

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	Nuclear One	distribution system is of sufficient capacity and capability to automatically start as well as operate all required safety related loads."	operate/start/running are not synonymous. NEI supports this interpretation; however, it conflicts with the words "proper voltage for starting and running in all operational configurations" in the 1st paragraph of page 6.
7	Page 6, 1st Paragraph	"...components are provided adequate voltage based on the design of the Class 1E distribution system in the plant and its most limiting operating configuration."	There is a need to better define "most limiting operating configuration", since experience shows that a component is most limiting. Reword the RIS to: '...components are provided adequate voltage based on the design of the Class 1E distribution system in the plant.'
8	Page 6, 1st Paragraph	"The Offsite/Onsite Design Interface Calculations specify the voltage operating parameters of the plant electrical distribution system based on the transmission system (Offsite) operating parameters."	This paragraph could be interpreted to require the LOCA sequence to be modeled at the DVR dropout setting. LOCA sequencing modeled at the DVR dropout setting would result in separation of the buses from the Preferred Power Source (off-site power) as the voltage would not recover above the DVR reset value. The RIS should state that the intent is to show safety related equipment will function at the selected DVR dropout setting voltage and that it is not expected to start the LOCA sequence from this voltage level. The RIS should state that LOCA sequencing is typically evaluated using minimum switchyard voltage as starting point.
9	Page 6, 1st	"This interface calculation establishes operating voltage	This statement needs clarification in that not all non-

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	Paragraph	bands for all plant electrical buses, which ensures that all plant components and systems (Class IE and Non Safety Related) have proper voltage for starting and running in all operational configurations (expected operational and accident conditions)."	safety load voltages need to be evaluated. The statement that the DVR ensures adequate operational (starting and running) is the first time in NRC correspondence that starting equipment at the DVR setpoint is expected. Having a sustained degraded voltage just above the LVR voltage setting (70%) is not practical without grid collapse and does not exist in Branch Technical Position #1 ((BTP) PSB-1). Typically, large motors (like reactor coolant pumps) need to be evaluated for starting impact on the safety bus. Once a motor is found to be small enough to not impact safety bus operation, further evaluation is unnecessary. The statement in the RIS can easily be interpreted as requiring evaluation of all non-safety loads down to the lowest levels of distribution. Technical compliance with determining the degraded voltage relay setpoint would not be achievable because the RIS requires the DVR dropout setpoint to be based on the starting voltage required for motors. Basing the DVR setpoint (dropout setting) on starting voltage requirements (rather than steady-state operating voltage) appears to be a new NRC requirement/position. It is technically flawed in that it would not actually provide the required protection for the Class-1E loads. It

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			also appears to disagree with the intended purpose of the existing regulations (1977 NRC Letters on degraded voltage protection and (BTP) PSB-1). The letter sent to Peach Bottom in June 1977 did not require starting of equipment at the DVR setpoint. This new requirement should be removed from the RIS, since it is not possible to start equipment at the DVR setpoint and not subsequently separate from offsite power. If the equipment starts at the DVR setpoint, the voltage will dip during the transient and must then recover above the reset point to avoid separation from offsite power. Since the reset point will always be above the DVR dropout point, it will be impossible to reset the relay.
10	Page 6, 2nd Paragraph	"The staff considers degraded voltage conditions coincident with a postulated design basis accident to be a credible event. DVRs should be set to protect the safety related equipment from sustained degraded voltage conditions."	GDC 17 should be identified as the regulatory requirement. This RIS is creating conditions in excess of GDC 17. The RIS concludes that the staff considers degraded voltage conditions coincident with a postulated design basis accident to be a credible event; however, this is not consistent with GDC 17. The RIS should identify that plant compliance with the regulation (GDC 17) is by each plant operating within its Licensing Basis that was developed from available NRC and industry guidance.

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			Most licensees are committed to a version of IEEE 308, Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations. This Standard defines the malfunctions, accidents, environmental events, and operating modes (i.e., design basis events) that could physically damage Class 1E power systems or lead to degradation of system performance and for which provisions shall be incorporated. A degraded voltage condition coincident with a postulated design basis accident is not among the identified design basis events; however, the Standard does include a requirement for the protection from common mode failure.
11	Page 6, 2nd Paragraph	"The Class 1E buses should separate from the offsite power system within a few seconds if an accident occurs coincident with a sustained degraded voltage conditions."	GDC 17 describes the requirements for onsite and offsite power systems. One of its requirements is that they each provide sufficient capacity and capability to mitigate postulated events. The events are described in Chapter 15 "Accident Analysis". These analyses assume Loss of offsite Power simultaneous with the event. They do not require assuming degraded grid voltage condition prior to an event occurring. In addition, because of FERC and NERC requirements for voltage control, the likelihood of a chapter 15 accident occurring concurrent with a serious degraded grid voltage condition is so low that it is believed to be not credible. Remove or clarify this statement, since proper offsite

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			system design and operation renders such simultaneous postulated events as incredible. This position assumes (BTP) PSB-1 (BTP 8-6) is part of the license and design basis for all licensees. An equivalent position was not identified in the NRC letters issued following the Millstone event. Specifically, this requirement is more stringent than the position stated on Page 2, Item d) and may constitute a backfit to some licensees. Care must be exercised with regards to the scope of this position. It does not apply to Section 2, "Offsite/Onsite Design Interface Calculations" of the RIS. This is confirmed in the draft RIS on Page 8, Paragraph d) which states all electric system action occur "as designed". It would be beneficial to clarify the scope limitations associated with this or any revised position.
12	Page 6, 2nd Paragraph	". . .Position (BTP) PSB-1 (revised later to become BTP-6), is to protect Class 1E safety related buses and components from sustained degraded voltage conditions on the offsite power system coincident with an accident as well as during non-accident conditions."	A definition of the word "protect" is needed. It is not clear what is being protected: the components (MOV, motor, etc.) or the class 1E function or something else. The word "coincident" should read "subsequent to" or "followed by", per (BTP) PSB-1 and BTP 8-6.
13	Page 6, 2nd Paragraph	"The Class 1E buses should separate from the offsite power system within a few seconds if an accident occurs coincident with a sustained degraded voltage condition."	Per (BTP) PSB-1, the text should read: 'The Class 1E buses should separate from the offsite power system immediately if an accident occurs

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			subsequent to a sustained degraded voltage condition.'
14	Page 6, 2nd Paragraph	". . .Class 1E safety related buses should automatically separate from the power supply within a short interval (typically less than 60 seconds)..."	There is no basis for "typically less than 60 seconds". In the original context of the time delay section, it was "sufficient time for an operator to intervene" which is much greater than 60 seconds. Remove the parenthesis section of the sentence. With this guidance during normal plant operation, the degraded grid relay settings may be overly conservative; automatic separation from the preferred power supply may occur under conditions where this action is inappropriate. The RIS should allow Transmission Operators time to correct the degraded voltage condition while Plant Operators monitor the safety bus voltages for adequate voltage.
15	Page 6, 3rd Paragraph	DVR Setting Design Calculations	This section would be a good place to describe this type of analysis as having a "bottom-up" approach. Such calculations would prevent confusion of crediting anything above the DVR voltage sensors' values. In the context of DVR Setting Design Calculations, using a steady state or sustained voltage analysis is the only way that can result in a voltage 'setting' requirement.
16	Page 6, 3rd	". . . DVR ensures adequate operational (starting and	The "operational voltage" cannot define both starting and

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	Paragraph	running) voltage..."	running voltages. The only place "operational voltage" is referenced in the associated documents is in the tap setting section of (BTP) PSB-1 and BTP 8-6 when a plant is connected to the offsite power supply. The only qualifying term used in the protection of the equipment is 'sustained' which is synonymous with steady state or running. Reword the RIS to: '. . . DVR ensures adequate sustained voltage...'
17	Page 6, 3rd Paragraph	"Licensee voltage calculations should provide the basis for their DVR settings, ensuring safety related equipment is supplied with adequate operating voltage (typically a minimum of 0.9 per unit voltage at the terminals of the safety related equipment per equipment manufacturers requirements), based on bounding conditions for the most limiting safety related load (in terms of voltage) in the plant."	Equipment manufacturers do not provide the same voltage requirement to perform both running and starting a motor. The 0.9 per unit in this context refers to the typical running voltage requirement of a motor; whereas, 0.85 per unit is typical for a starting voltage requirement. The RIS should identify that voltages other than 90% voltage are common based on detailed plant analysis. For example, motors below 90% voltage continue to have plenty of margin in torque but may encroach on long time thermal limits. Unless a motor is fully into its service factor (typically1.15) and below 90% voltage, operation will be acceptable.
18	Page 6, 3rd Paragraph	"In this manner, the DVR ensures adequate operational (starting and running) voltage to all safety related	The draft RIS suggests the DVR dropout setpoint to be based on the starting voltage required for motors.

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		equipment, independent of voltage controlling equipment external to the plant safety related electrical distribution system."	Basing the DVR dropout setpoint on starting voltage requirements rather than steady-state operating voltage appears to be a new NRC requirement/position. It also appears to disagree with the intended purpose of the existing requirements and guidance (1977 NRC Letters on degraded voltage protection and (BTP) PSB-1). As suggested, the approach incorrectly implies that the load(s) should start from the lowest DVR dropout setting. A specific example for illustration is as follows: If the initial voltage value is at the lowest possible value above dropout actuation, starting a load will cause the DVR dropout. Since the new steady state voltage will be lower than the initial value because of the added loads, the DVR reset will never occur. Many utilities use the ABB 27N with harmonic filter which has a minimum 0.5% reset. Thus, with a setting of 93.6% +/- 0.9%, the dropout value could be as low as 92.7%. For motors causing more than 0.5% voltage dip at initial start, even if the voltage at the beginning of the event was 93.2% and a load was started, the DVR will dropout and never reset. This will lead to a grid separation. Reword the RIS to remove "(starting and running)"
19	Page 6, 3rd Paragraph	"For the purposes of this calculation, no credit should be taken for voltage controlling equipment external to the	The intent of the position appears to ensure that the DVR setpoint(s) protect against the potential loss of ESF

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	(continues on Page 7)	Class 1E distribution system such as automatic load tap changers and capacitor banks."	equipment, regardless of the component mode of operation. It does not imply that the Class 1E bus must remain connected to offsite power after starting a large motor with an initial bus voltage corresponding to the DVR setpoint and no voltage regulation capability. Actually, the calculation should be performed with the DVR monitored bus voltage at the TS limit, not the DVR setpoint. All that is required is that under motor starting conditions, separation from offsite power occurs before starting loads trip on overload. The intent could be conveyed in more detail. The RIS should allow reasonable assumptions for the status of equipment external to the Class 1E distribution system. For example it is unclear how to perform motor starting calculations without taking credit for some Non 1E voltage controlling equipment. Additionally, normal transmission grid switching should be allowed to prepare for the next grid event, so that minimum expected transmission system voltages are maintained.
20	Page 7, 1st Paragraph	"Voltage-time settings for DVR's should be selected so as to avoid spurious separation of the safety buses from the offsite power system during unit startup, normal operation and shutdown."	This position is new and contrary to the NRC historical position stated on Page 2, Item (c)(3). Either the DVR protection scheme favors ESF-equipment-protection or connectivity-to-offsite-power. Otherwise, this position would result in a mutually exclusive requirement. The prevention of spurious separation is addressed by coincident logic channels (Page 2, Item (b)), not the

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			setpoint. If no credit is to be taken for voltage controlling equipment external to the Class 1E distribution system for the establishing the degraded voltage relay (DVR) settings, then the RIS should state that credit may be taken for minimum switchyard voltage/voltage drop calculations (Offsite/Onsite Design Interface Calculations).
21	Page 7, 1st Paragraph	"These DVRs should disconnect the Class 1E buses from any power source other than the emergency diesel generators (onsite sources) if the degraded voltage condition exists for a time interval that could prevent the Class 1E safety related loads from achieving their safety function."	This position ensures ESF functionality, should an undervoltage condition persist. (BTP) PSB-1 was written before the application of voltage regulating devices within the nuclear power plant offsite power circuit boundary. The RIS should clarify that if the calculations necessary to support RIS positions in Section 1, "Degraded Voltage Relaying Design Calculations" and Section 2, "Offsite/Onsite Design Interface Calculations" demonstrate completion of ESF functions within accident analysis assumptions, then immediate separation per (BTP) PSB-1, Section B(1)(b)(i), is no longer the preferred NRC position. (BTP) PSB-1 (BTP 8-6) states: "The subsequent occurrence of a safety injection actuation signal (SIAS) [after an undervoltage condition longer than a motor starting transient] should

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			immediately separate the Class 1E distribution system from the offsite power system." The RIS should state that this (BTP) PSB-1 position is not included in the draft RIS because it provides no added protection in terms of establishing the DVR setpoint(s) or in establishing operability of the offsite power interface. To the contrary, this (BTP) PSB-1 increases the probability of separation from offsite power.
22	Page 7, Paragraph 2 a)	"Guidelines for voltage drop calculations a) The plant voltage analysis, while supplied from the transmission network, should be based on the operating voltage range of the transmission network connection."	It is recommended that the first sentence of Paragraph 2(a) be deleted. It is covered by Paragraph 2(b), as the switchyard is the "power source" for the offsite power circuits. Paragraph 2(a) addresses both plant and transmission operator analyses. The purpose is to identify that the switchyard voltage results from the transmission operator analysis should be used as an input to the power plant analysis. From the nuclear power plant point of view, the determination as to whether each offsite power circuit is individually capable of performing its design function is based on a postulated post-trip switchyard voltage for the present grid configuration and operating level (i.e. RIS Paragraph 2(b)). As written, it is conceivable that a reader of this paragraph could conclude that the transmission "contingency analysis" is a factor in the nuclear plant

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			analysis regarding "when" the contingency is postulated to occur relative to the postulated plant event. The alteration of the present basis to include concurrent grid/plant events is a change in position and would be subject to backfit consideration.
23	Page 8, Paragraph 2 c)	"For multi-unit stations, a separate analysis should be performed for each unit assuming (1) an accident in the unit being analyzed and simultaneous shutdown of all other units at the station; or (2) an anticipated transient (anticipated operational occurrence) in the unit being analyzed (e.g., unit trip) and simultaneous shutdown of all other units at that station, whichever presents the largest load situation.	The RIS wording should be revised to indicate "orderly or controlled safe shutdown of the remaining units, as per the station's licensing basis" instead of "simultaneous shutdown". Alternatively, the wording 'shutdown consistent with the station licensing basis" could be used instead of "simultaneous shutdown'. Most multi-unit station's Licensing Basis consider an "orderly or controlled safe shutdown" of the other unit(s) not being analyzed. NERC Std TPL-004-0; particularly Category D events per Table 1, where a "loss of all generating units at a station" may result in "portions or all of the interconnected systems may or may not achieve a new, stable operating point". IEEE Std 308-1974, Clause 8, sub-clause 8.1.1 "Capacity" describes this as a "concurrent safe shutdown on the remaining units". This RIS re-states part of GL 79-36, with an attempt to clarify "anticipated transient" by adding in parenthesis

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			"(anticipated operational occurrence)". It is not clear what the added parenthetical statement is meant to convey, other than unit trip (which already exists in GL 79-36). The RIS should remove this parenthetical addition or state '...an anticipated transient per station licensing basis...'
24	Page 8, Paragraph 2 d)	"All actions the electric power system is designed to automatically initiate should be assumed to occur as designed..."	This statement is consistent with GDC 17 in that the presumption is the onsite AC sources are lost. The postulation of concurrent malfunctions in both the onsite and offsite sources is not required. The RIS should retain this sentence, since it may not have been consistently applied during recent CDBI's.
25	Page 8, Paragraph 2 e) & f)	"e) Manual load shedding should not be assumed. f) For each event analyzed, the maximum load necessitated by the event and the mode of operation of the unit at the time of the event should be assumed in addition to all loads caused by expected automatic actions and manual actions permitted by administrative procedures."	These guidelines seem contradictory in that e) states that there may be no credit for procedurally controlled operator actions to reduce load but f) states that the manual action loads must be considered in the maximum load. The RIS should delete "e) Manual load shedding should not be assumed" or add allowance to credit procedurally controlled operator actions to decrease load.
26	Page 8, Paragraph 2 f)	Omission	After paragraph 2 f), the RIS leaves out the guidance in GL 79-36 concerning minimum expected values (item 6 of enclosure 2).

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			Add item 6 of enclosure 2 in GL 79-36 to the RIS: "6. The voltage at the terminals of each safety load should be calculated based on the above listed consideration and assumptions and based on the assumption that the grid voltage is at the "minimum expected value". The "minimum expected value" should be selected based on the least of the following: a. The minimum steady-state voltage experience at the connection to the offsite circuit. b. The minimum voltage expected at the connection to the offsite circuit due to contingency plans which may result in reduced voltage from this grid. c. The minimum predicted voltage from grid stability analysis. (e.g., load flow studies)."
27	Page 8, Paragraph 2 j)	"To provide assurance that actions taken to assure adequate voltage levels for safety related loads do not result in excessive voltages, assuming the maximum expected value of voltage at the connection to the offsite circuit, a determination should be made of the maximum voltage expected at the terminals of all safety related equipment and their starting circuits (if applicable). If this voltage exceeds the maximum voltage rating of any safety related equipment, immediate remedial action should be taken."	The RIS should remove the word "immediate" describing remedial action. Immediate remedial action could imply control room intervention. The control room has alarm procedures to address high voltage should it occur. Timeliness of remedial actions depends on how high actual voltage reaches and is addressed by procedures. Analyses of high grid voltage with light plant load are standard and provide insights as to what the grid voltage upper limit should be or what compensating activities might be required for light load operations (refueling). The RIS should provide examples of typical responses to

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			high grid voltages. For example: in those cases where unit trip can result in a step increase in grid voltage (most common on higher voltage connections like 765kv), anticipated excursions above desired voltages should be addressed by compensating measures (changing excitation for nearby units, switching in reactor banks, etc.).

Summary of Degraded Voltage Guidance Documents

Requirement	GL 79-036	BTP PSB-1	IEEE 741	Draft RIS
Sources to be analyzed	All available connections to the offsite network to be analyzed separately	A separate set of the above analyses should be performed for each available connection to the offsite power supply.	IEEE 741	All sources separately (same as GL79-036)
Nuclear Unit Conditions	Separate Analysis for each unit assuming an accident on one unit and the simultaneous shutdown of the other unit(s) or an anticipated transient in the unit being analyzed (e.g., unit trip) and simultaneous shutdown of all other units at that station, whichever presents the largest load situation.	Unit trip, loss-of-coolant accident, startup or shutdown; with the offsite power supply (grid) at minimum anticipated voltage and only the offsite source being considered available	Not addressed	Same as GL79-036
Process signals	All actions the electric power system is designed to automatically initiate should be assumed to occur as designed (e.g., automatic bulk or sequential loading or automatic transfers of bulk loads from one transformer to another). Included should be consideration of starting of large non-safety loads (e.g., condensate pumps).	Not addressed	"Various operating and accident loading conditions"	Same as GL79-036
Manual load shedding	Manual load shedding should not be assumed	Not addressed	Not addressed	Same as GL79-036
Loading	For each event analyzed, the maximum load necessitated by the event and the mode of operation of the plant at the time of the event should be assumed in addition to all loads caused by expected automatic actions and manual actions permitted by administrative procedures.	"The voltage levels at the safety-related buses should be optimized for the maximum and minimum load conditions that are expected throughout the anticipated range of voltage variations of the offsite power sources by appropriate adjustment of the voltage tap settings of the intervening transformers."	Not addressed	Bounding conditions for the most limiting safety related load in the plant.
Source Voltage	The grid voltage is at the "minimum expected value," selected based on the least of: a. The minimum steady-state voltage experience at the connection to the offsite circuit. b. The minimum voltage expected at the connection to the offsite circuit due to contingency plans which may result in reduced voltage from this grid c. The minimum predicted voltage from	"Minimum anticipated voltage"	"Limiting equipment voltage" – voltage at relay detects a condition that could prevent Class 1E equipment from achieving its safety function or from sustaining damage.	For DVR setting, bus voltage held at value that results in 90% voltage at the terminals of the load (need to read between the lines, but that's what I get from "DVR Setting Design Calculations") For "Offsite/Onsite Design Interface Calculations, switchyard voltage due to worst case transmission system contingency.

	grid stability analysis. (e.g., load flow studies).			
Terminal Voltage Adequacy	"The calculation voltages at the terminals of each safety load should be compared with the required voltage range for normal operation and starting of that load"	The selection of undervoltage and time delay setpoints shall be determined from an analysis of the voltage requirements of the Class 1E loads at all onsite system distribution levels	Detailed analytical basis for ensuring Class 1E equipment will perform the intended safety function, will not sustain damage, protective devices will not trip, and contactors will function, BUT must be balanced with need to avoid separation of offsite source.	Ensure safety equipment is supplied with adequate terminal voltage, typically 0.9 per unit at the terminals
Motor starting	Required, but not specific (see above)	Implied ("transient loads") but not specific	"The set-point calculations for degraded voltage relays should ensure that the limiting equipment voltage requirements of the Class 1E system are met."	"(The) DVR (minimum dropout) ensures adequate operational (starting and running) voltage to all safety related equipment"
Time delay	"The analysis should document the voltage setpoint and any inherent or adjustable (with nominal setting) time delay for relays which (1) initiate or execute automatic transfer of loads form one source to another; (2) initiate or execute automatic load shedding; or (3) initiate or execute automatic load sequencing." No mention made of separate accident / normal time delays	Specifically requires two delays, one for "safety actuation signal" and a second delay "of a limited duration" bypassed by SI. Implies that the second delay is intended to allow operator actions for restoration of adequate voltage.	"The capability to start motors, transfer buses, and ride through other momentary voltage dips should be evaluated. This evaluation should be performed at or below the lowest expected preferred power supply voltage."	"Time delays are adequate to protect and provide the required minimum voltage to all safety related equipment. The time-delay(s) chosen for DVRs during accident conditions should meet the accident analyses assumptions and allow for proper starting of all Class 1E safety related equipment. Also, the time delay chosen for DVRs during non-accident condition must not cause any degradation of the safety related components, including actuation of their protective devices." "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. The time delay chosen should be optimized to ensure that permanently connected Class 1E loads are not damaged under sustained degraded voltage conditions (such as sustained degraded voltage just above the LVR voltage setting for the duration of the DVR time delay setting)." Therefore, two time delays are required, one within the EDG start time (LOCA delay) and a longer normal delay, but no mention (or implication) of manual actions by operations staff.

Overvoltage	To provide assurance that action taken to assure adequate voltage levels for safety loads do not result in excessive voltage, assuming the maximum expected value of voltage at the connection to the offsite circuit, a determination should be made of the maximum voltage expected at the terminals of each safety load and its starting circuit.	Maximum voltages should be analyzed with the offsite power supply (grid) at maximum expected voltage concurrent with minimum unit loads (e.g. cold shutdown, refueling).	Two delays discussed: accident and normal operation. Accident delay should be within the accident analysis timing (typically considered to be the EDG start time by the industry – that is not in 741). "The second time delay should be of a limited duration such that the permanently connected Class 1E loads are not damaged or become unavailable due to protective device actuation." Goes on to have same statement as PSB-1 that offsite power should trip if the operator cannot restore voltage.	Similar to GL79-036. "To provide assurance that actions taken to assure adequate voltage levels for safety related loads do not result in excessive voltages, assuming the maximum expected value of voltage at the connection to the offsite circuit, a determination should be made of the maximum voltage expected at the terminals of all safety related equipment and their starting circuits (if applicable). If this voltage exceeds the maximum voltage rating of any safety related equipment, immediate remedial action should be taken."
Protective devices	Not addressed (1)	Not addressed, however, it does require that "The second time delay should be of a limited duration such that the permanently connected Class 1E loads will not be damaged."	Clause A.6; minimum loads in conjunction with maximum expected system voltage.	Must not trip given bus voltage at loss of voltage relay dropout for duration of the DVR time delay(s).
Control circuits	Not addressed (1)	Not explicit. However, licensees held to control voltage adequacy by the requirement that "The selection of undervoltage and time delay setpoints shall be determined from an analysis of the voltage requirements of the Class 1E loads at all onsite system distribution levels."	Explicit, second time delay	RIS requires calculation of voltages at terminals and contacts of all safety related equipment at the DVR dropout setting – it is assumed that the NRC intended "contactors."
Verification of Load Flow model	"The adequacy of the onsite distribution of power from the offsite circuits shall be verified by test to assure that analysis results are valid. Please provide: (1) a description of the method for performing this verification, and (2) the test results."	Loading down to 120Vac verified to within 30% prior to full power operation; requires comparison of the analytically derived voltage values against field measurements within 3% but not less than "Class 1E equipment rated voltages" (assume this means minimum voltage, i.e., 414V for a low voltage motor).	Not addressed	Not addressed
DVR "setpoint"	Does not discuss minimum dropout (what the absolute minimum sustained bus voltage could be that ensures trip of offsite source), does not discuss reset.	Acknowledges improper logic or overly conservative settings should not challenge offsite power availability, but only has "undervoltage and time delay setpoints" and that "The voltage sensors shall automatically initiate the disconnection of offsite power sources whenever the voltage setpoint and time delay limits ... have been exceeded."	Includes graphic (figure A.1); "Limiting Equipment Voltage," shows DVR band with tolerances for dropout and reset; discusses tolerances to be considered, recommends ANSI/ISA 67.04.01-2000 methodology for setpoint uncertainty calculation. "Limiting Equipment Voltage" should probably be interpreted as the Analytical Limit (ISA terminology)	"DVR Settings" ensure adequate operating voltage; "...voltage at the terminals ... of all safety related equipment with the voltage at the DVR monitored bus at the DVR dropout setting" "DVR dropout setting" should probably be interpreted as the Analytical Limit (ISA terminology)

Notes
(1) Mentioned in passing in the D.K. Davis letter, but no specifics.