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10 CFR 52.79

August 28, 2014

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

Subject: Duke Energy Carolinas, LLC
William States Lee III Nuclear Station – Docket Nos. 52-018 and 52-019
AP1000 Combined License Application for the William States Lee III Nuclear Station Units 1 and 2
Supplemental Response to Request for Information (eRAI 6751)
Ltr#: WLG2014.08-02

References:
1. Letter from Christopher M. Fallon (Duke Energy) to NRC Document Control Desk, Response to Request for Additional Information Letter No. 108 (eRAI 6751), dated October 23, 2012, WLG2012.10-03 (ML12299A185)
2. Letter from Christopher M. Fallon (Duke Energy) to NRC Document Control Desk, Supplement 2 to Response to Request for Additional Information Letter No. 114 (eRAI 7208), dated March 21, 2014, NPD-NRC-2014-009 (ML14086A656)

This letter provides a supplemental response to Duke Energy's response (Reference 1) to the Nuclear Regulatory Commission's request for additional information (RAI) Letter No. 108. The latest NRC questions concerning the design vulnerability in the electric power system described in NRC Bulletin 2012-01 are documented in NRC RAI Letter 114 issued on the Levy Nuclear Plant docket, dated August 14, 2013 (ML13226A124). Therefore, this letter provides responses to the NRC staff's request for additional information in RAI Letter 114 with respect to the Lee Nuclear Station combined license application. The responses in this submittal are equivalent to those documented in the Levy Nuclear Plant submittal to the NRC (Reference 2).

The supplemental response to the NRC information request documented in Reference 1 is addressed in Enclosure 1, which also identifies associated changes to be made in a future revision of the COLA.

If you have any further questions, or need additional information, please contact Bob Kitchen at (704) 382-4046.

D093
NRO

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

Executed on August 28, 2014

Sincerely,

Christopher M. Fallon

Christopher M. Fallon
Vice President
Nuclear Development

Enclosure:

1) Lee Nuclear Station Units 1 and 2 Supplemental Response to Request for Additional Information (RAI) Letter No. 108, RAI 08-1 (eRAI 6751)

xc (w/o enclosure):

Frederick Brown, Deputy Regional Administrator, Region II

xc (w/ enclosure):

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Enclosure 1

Lee Nuclear Station Units 1 and 2 Supplemental Response to Request for Additional Information (RAI) Letter No. 108

RAI 08-1 (eRAI 6751)

Lee Nuclear Station Supplemental Response to Request for Additional Information (RAI)

RAI Letter No. 108

Subject: SRP Section 08-03 – Stability of Offsite Power Systems

Reference NRC RAI Number(s): 08-1 (eRAI 6751)

Introduction

The initial Lee Nuclear Station response (ML12299A185) was to NRC RAI Letter No. 108, dated September 27, 2012 (ML12271A505). However, the latest NRC questions concerning the design vulnerability in the electric power system described in NRC Bulletin 2012-01 are documented in NRC RAI Letter 114 issued on the Levy Nuclear Plant docket, dated August 14, 2013 (ML13226A124). Therefore, the following provides responses to the NRC staff's request for additional information in RAI Letter 114 with respect to the Lee Nuclear Station combined license application. These responses are equivalent to those documented in the Levy Nuclear Plant submittal to the NRC, dated March 21, 2014 (ML14086A656). All emphasis is copied from the original request (NRC RAI Letter 114). Additional clarification concerning terminology is provided as follows.

- The terminology "Class 1E," "safety-related," "nonsafety-related," and "important to safety" are used several times in the staff's requests and in the Bulletin. For the purposes of this discussion of the AP1000 plant electrical design capabilities, the terms "Class 1E," and "important to safety" are interpreted to mean "safety-related." The terms "defense-in-depth" and "nonsafety-related" are used to refer to "nonsafety-related" components.

RAI Question 1

Identify which offsite circuit is credited to meet the GDC 17 requirements, considering the partial exemption for AP1000 plants.

Duke Energy Response to Question 1

The credited GDC 17 offsite power supply for the AP1000 plant is the Preferred AC Power Supply shown in Figure 1. The Preferred AC Power Supply is backfed through the three single phase main step-up transformers (MSUs), labeled "MAIN STEP-UP XFMR" as shown on Figure 1. The Preferred AC Power Supply is connected to the main generator bus and through the unit auxiliary transformers (UATs) 2A and 2B to the plant electrical distribution system.

Because of its passive safety features, the AP1000 passive plant does not require AC power to place the plant in a safe, stable shutdown condition. The AP1000 design was granted a partial exemption from GDC 17, specifically exempting the AP1000 plant from the requirement for a second GDC 17 credited offsite power source. Therefore, a second credited source of AC power from the power grid is not required. The Onsite Standby Power System (ZOS), powered by onsite standby diesel generators 2A and 2B, provides an alternate source of AC power to the plant electrical distribution system through medium voltage buses ES-1 and ES-2 for defense-in-depth shutdown loads.

Because of the partial GDC 17 exemption, the Maintenance Power Supply, fed through reserve auxiliary transformers (RATs) 4A and 4B, is not considered a credited GDC 17 power source. However, the medium voltage buses ES-1 and ES-2 can be manually aligned to receive power through the RATs. The medium voltage buses will automatically transfer from the UATs to the RATs in the event the credited Preferred AC Power Supply becomes unavailable due to an

electrical fault at either the MSU, the isophase bus, the UATs or the 6.9 kV nonsegregated bus duct.

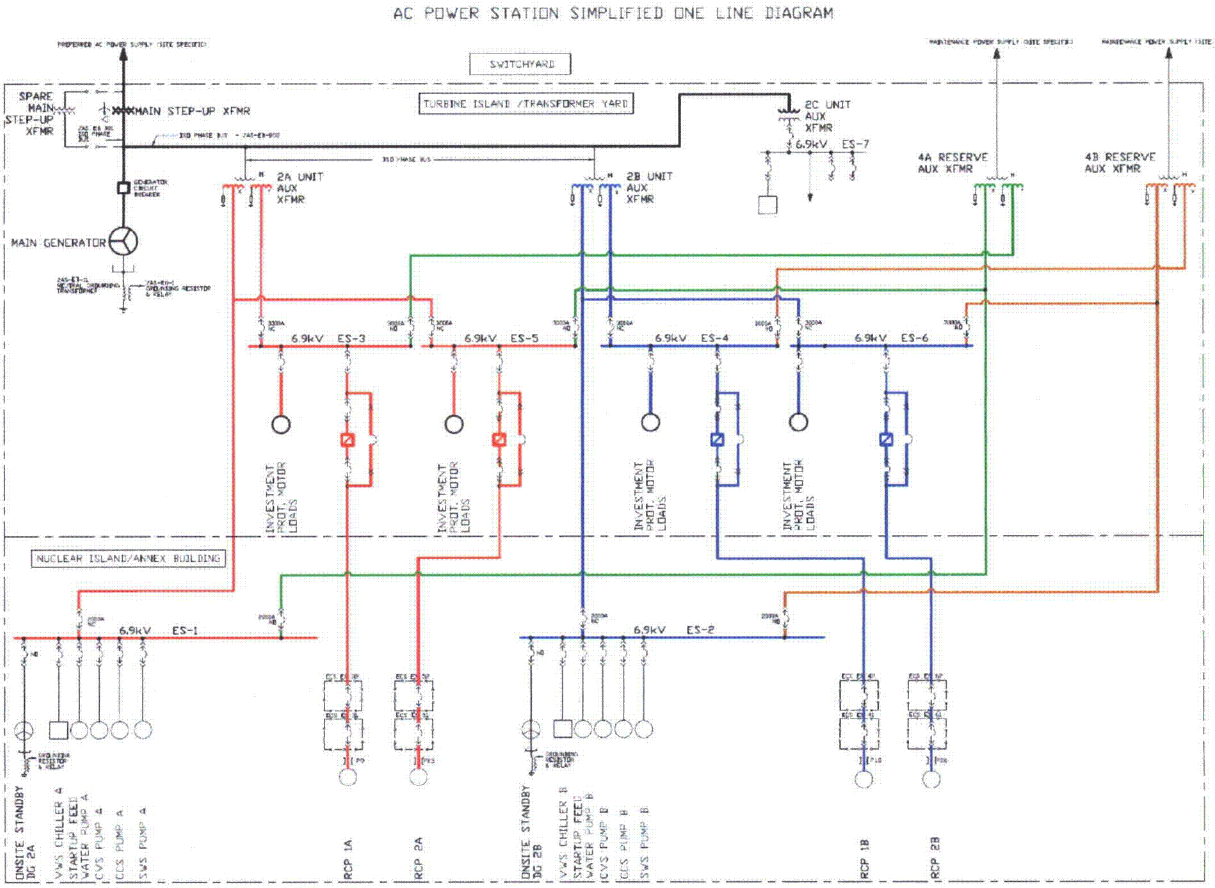

Figure 1: Main AC Power Station Simplified One-Line Diagram

RAI Question 2

Provide details of the analyses and relay settings which can detect voltage unbalance on high voltage (HV) side of main transformer and reserve auxiliary transformer (RAT) due to the open phase condition (without and with concurrent high impedance ground on HV side of transformers) under all loading conditions including the light load conditions, and under all operating configurations. If analyses and setting of relays are not readily available, explain how these actions will be completed prior to fuel load.

Duke Energy Response to Question 2

MSU and RAT Protection:

The protection for the MSUs and the RATs is accomplished with a primary and a backup multifunction microprocessor-based relay. Each multifunction relay actuates a different lockout device (86), which in turn energizes a separate set of trip coils on each transformer breaker to isolate the affected zone.

Current transformers (CTs) on each phase of the MSUs provide indication of current unbalance resulting from load imbalance, high impedance faults (which occur concurrent with an open phase on the high side of the transformer) or low impedance faults (which occur concurrent with an open phase on the high side of the transformer) during all conditions except lightly loaded

conditions. Although the existing electrical protection scheme can detect a loss of phase during heavily or moderately loaded operating conditions, detection of a loss of phase during lightly loaded conditions is improbable as the current draw approaches magnetizing currents.

The AP1000 electrical protection relay setpoints and supporting analyses have not yet been completed. These will be completed prior to fuel load.

The Maintenance Power Supply fed through the RATs is not a GDC 17 credited offsite power supply and is not required for safe shutdown of the plant. The Maintenance Power Supply serves as an alternate/maintenance source of AC power and was incorporated into the AP1000 design as an enhancement. Although they are not powered by the GDC 17 credited power supply, the RATs are fitted with protective features similar to those provided for the MSUs.

Open Phase Condition Monitoring System:

Duke Energy will also provide an MSU transformer HV input power source open phase condition monitoring system to address the vulnerabilities described in NRC Bulletin 2012-01. The dedicated MSU transformer HV source open phase condition monitoring system will provide an alarm to the operators in the control room should an open phase condition occur on one or more phases under any transformer loading condition. The open phase condition monitoring system will be designed considering the type of open phase condition monitoring systems implemented worldwide on operating nuclear plants, particularly considering the open phase condition monitoring system(s) selected for and implemented on the Duke Energy operating nuclear fleet plants. The system design will utilize commercially available components including state of the art digital relaying equipment and input parameters as required to provide continuous open phase condition detection and alarm capability.

RAI Question 3

Describe the design features provided for Lee in detail and the analysis performed to verify that, in the event of a single high voltage open phase and/or high impedance fault condition, the input voltage to the safety-related IDS equipment would be detected and alarmed in the main control room and the IDS chargers would automatically isolate from the degraded nonsafety-related input voltage condition <u>for all loading conditions and operating configurations</u>. Also, explain the design features provided and analysis performed to verify the applicant's statement that one or more main control room alarms would be generated from the safety related subsystems as a result of an undervoltage condition at the input of each IDS charger.

Duke Energy Response to Question 3

There are two parts to this question that cover the medium voltage and low voltage portions of the AP1000 electrical distribution system.

Medium Voltage:

The design features provided for detecting unacceptable input voltage conditions at the ES-1 and ES-2 medium voltage buses have changed. At the time of the initial response to NRC Bulletin 2012-01 (October 2012), the AP1000 plant used an open-delta undervoltage detection scheme with 2-out-of-2 logic to provide alarm and protection functions for the 6.9 kV medium voltage buses (ES-1 thru ES-7). In response to operating experience and lessons learned since the Byron event, a design modification was made to supplant the existing open-delta undervoltage detection scheme with a phase-to-ground detection scheme. This upgraded connection method allows monitoring of all three phases for each medium voltage bus, and detection of an unacceptable bus voltage on any phase. The ES-1 and ES-2 buses use 3 potential transformers (PTs) per phase, and an automatic electrical protection action occurs in

the event unacceptable voltage is sensed by 2 out of 3 PTs on any single phase. In addition, an alarm is annunciated in the main control room (MCR) in the event unacceptable voltage is sensed by 1 out of 3 PTs on any single phase.

When a single high voltage open phase and/or high impedance fault condition manifests itself as an unacceptable voltage on the medium voltage buses, multiple alarms will be provided in the MCR. Multiple alarms associated with the same phase on different medium voltage buses would support operator diagnosis and recovery actions including:

- Isolate the affected medium voltage bus from the electrical distribution system, and
- Enable the onsite standby diesel generators to restore AC power to the ES-1 and ES-2 buses and associated defense-in-depth loads, or
- Perform a controlled transfer of the affected medium voltage bus to the associated RAT (although not a credited GDC 17 offsite power supply and not required for safe shutdown of the plant).

Since the AP1000 plant does not require AC power to achieve safe shutdown, the operator is allowed up to 72 hours to initiate mitigating strategies, i.e., starting and loading the ancillary diesels.

During a single high voltage open phase and/or high impedance fault condition where the plant is lightly loaded to a point an unacceptable voltage on the high voltage side of the MSUs is undetectable by the medium voltage bus undervoltage protection and relaying scheme, then either high negative sequence motor trips or other running load trips would provide alarms in the MCR to support operator diagnosis and recovery actions.

Low Voltage:

The IDS battery chargers would continue to supply power to the Class 1E DC electrical system unless the battery charger input or output monitored electrical parameters are unacceptable. At that point, the Class 1E DC electrical system would receive power from the applicable IDS battery and the battery charger would continue to maintain isolation between the AC system and the DC system. This would subsequently result in one or more alarms in the MCR.

The AP1000 electrical protection relay setpoints and supporting analyses have not yet been completed. These will be completed prior to fuel load.

RAI Question 4

Explain the design features provided and analyses performed to verify the applicant's statement that if the undervoltage condition manifests down to the 480 V load centers/motor control centers (MCCs) fed from ES-1 and ES-2, the safety related IDS battery charger would detect an unacceptably low input phase voltage and isolate the Class 1E system from the Non 1E power system.

Duke Energy Response to Question 4

The IDS battery charger has conventional input voltage monitoring of each input phase using two redundant Class 1E undervoltage relays per phase (27D and 27E). In Chapter 7 of the AP1000 Design Control Document (DCD), Revision 19, Figure 7.2-1 shows the interface of these relays to the safety-related Protection and Safety Monitoring System (PMS) functional logic.

The 27D and 27E relays are included in the system design to detect “loss of acceptable input voltage” from the non-safety low voltage electrical distribution system. This design feature detects loss of AC power events.

In addition, the IDS battery charger employs several design features which provide protection and downstream DC bus support when the battery charger input or output monitored electrical parameters are unacceptable.

Plant electrical analyses, once completed, will demonstrate the voltage level imposed by normal operations (e.g., motor start transient) that the battery charger will be required to ride through without taking protective action or causing nuisance alarms.

There are no plant electrical analyses planned that will demonstrate the magnitude of voltage at the charger input terminals under a high voltage grid-side open phase with or without a ground fault condition across varying levels of fault impedance. Such analyses are not necessary since the isolation features of the IDS battery chargers and the proper operation of safety-related components are not adversely influenced by AC system parameters. A formal type test will be performed on an IDS battery charger to verify expected AC input and charger DC output voltage characteristics. This data will provide input into final equipment protection setpoints.

When MCR alarms are actuated from multiple IDS battery chargers, the condition provides indication of an electrical power disturbance for a range of events, including a high voltage MSU transformer open phase condition. In the event that IDS input or output monitored electrical parameters do not fall below any of the alarm/action setpoints during an unacceptable electrical system voltage condition, the IDS battery charger will continue to provide its normal charging function with no adverse charger or Class 1E DC system impacts.

RAI Question 5

In the event that an open phase condition on the high side of the transformer results in Unit trip and the plant house loads are supplied through the same transformer with no bus transfer or clear indication of degraded power source, provide details on the consequences on operating equipment and any impact on safe shut down capability. Explain how the defense in depth systems perform their intended design functions in this situation.

Duke Energy Response to Question 5

Given that the assumed high voltage open phase condition results in a unit trip and plant house loads are supplied from the same transformer (GDC 17 source), the following conditions would exist:

- The plant would be in Mode 3; therefore, the auxiliary electrical system would not be lightly loaded
- House loads would be supplied from the MSUs via the UATs

When the phase is lost, several of the electrical system undervoltage protective relays would be expected to sense an undervoltage condition and initiate alarms in the MCR indicating that an unacceptable phase voltage exists on one or more 6.9 kV buses.

If the transformer load level is not sufficient to cause bus voltage imbalances that result in automatic protective action from the 6.9 kV bus undervoltage detection devices, then individual motor loads (including the Component Cooling Water System (CCS) and Service Water System (SWS) defense-in-depth motor loads) may begin to trip due to negative sequence motor currents higher than the trip/alarm setpoint of the motor current imbalance protective relay. These motor trips initiate alarms in the MCR and prompt operator response.

The IDS battery chargers continue to perform their normal charging function unless the battery charger input or output monitored electrical parameters are unacceptable. When the input or output monitored electrical parameters are unacceptable and the battery charger no longer provides sufficient DC bus voltage, the Class 1E electrical system DC bus receives power from the applicable IDS battery and the battery charger maintains isolation between the Non-Class 1E AC and Class 1E DC power systems. This condition results in one or more alarms in the MCR.

The AP1000 passive safety systems can adequately remove core decay heat for 72 hours, without operator intervention, after a reactor trip due to a loss of phase event. This time frame is considered adequate for the operator to diagnose a phase imbalance and perform the appropriate recovery actions. There are no adverse impacts to the AP1000 safe shutdown capabilities due to the loss of an AC phase.

Once power is restored to ES-1 and ES-2, the defense-in-depth loads are restarted manually or automatically via the diesel sequencer, depending on whether the buses are powered from the Maintenance Power Supply or the onsite standby diesel generators, respectively.

RAI Question 6

In the event of an open phase condition occurring during a refueling outage, provide details on consequences on equipment supporting decay heat removal. Provide details if the events were to occur during mid loop operations and any malfunctions are being evaluated.

Duke Energy Response to Question 6

During a refueling outage, normal decay heat removal is provided by the Normal Residual Heat Removal System (RNS) pumps, which are supported by the CCS and SWS. During a refueling outage, electrical system bus configurations and defense-in-depth loads are managed considering shut down risks as evaluated in the regulatory treatment of nonsafety systems. Failure of the RNS (whether due to loss of offsite power, failure of a supporting system or due to direct RNS pump trip) is considered in the design, as the RNS and its supporting systems are nonsafety-related. System response is dependent on whether the 6.9 kV bus undervoltage condition can be detected.

If the bus loading levels are adequate to cause voltage imbalances sufficient to actuate the 6.9 kV bus undervoltage detection devices, then the bus undervoltage alarms annunciate in the MCR. The supply breaker for the ES-1 and ES-2 buses will open, disconnecting them from the faulted power source. The onsite standby diesel generators will start, the diesel load sequencers will initiate, and loads will be stripped from the ES-1 and ES-2 buses. The load sequencers subsequently restart defense-in-depth loads in groups as shown in the AP1000 DCD, Revision 19, Table 8.3.1-1 and Table 8.3.1-2 once the diesel generators are tied to the ES-1 and ES-2 buses.

If the transformer loading level is not sufficient to cause bus voltage imbalances that result in the actuation of the 6.9 kV bus voltage undervoltage detection devices, then motor trips due to negative sequence motor currents higher than the trip/alarm setpoint of the motor current imbalance protective relay would provide alarms in the MCR and prompt operator response.

Regardless of whether the undervoltage condition is detected, the IDS battery chargers would continue to perform their normal charging function unless the battery charger input or output monitored electrical parameters are unacceptable. When the input or output monitored electrical parameters are unacceptable and the battery charger no longer provides sufficient DC bus voltage, the Class 1E electrical system DC bus receives power from the applicable IDS

battery and the battery charger maintains isolation between the Non-Class 1E AC and Class 1E DC power systems. This condition results in one or more alarms in the MCR.

During refueling operations, the reactor vessel head is removed and the containment refueling cavity is flooded as described in the AP1000 DCD, Revision 19, subsection 6.3.3.4.4. If normal decay heat removal capability by the nonsafety-related RNS is lost, the containment is closed prior to reactor cavity steaming, and containment recirculation maintains core decay heat removal indefinitely.

During midloop operations, the plant is again designed to remove core decay heat in the event the nonsafety-related RNS system is lost due to an AC power system disturbance. In the event that normal residual heat removal by the defense-in-depth RNS pumps is interrupted, core decay heat removal is achieved by the safety-related passive core cooling system, using gravity injection of the in-containment refueling water storage tank and venting of the RCS through the automatic depressurization system valves as described in the AP1000 DCD, Revision 19, subsection 6.3.3.4.3. This operation continues until such time as the in-containment refueling water storage tank level drops and containment recirculation begins.

This demonstrates AC power disturbances due to a loss of phase will not affect the ability of the plant to meet the requirements of GDC 34, "Residual Heat Removal," during refueling or midloop operations, as the safety-related core decay heat removal capability does not depend on the normal, AC powered residual heat removal systems. Whether the voltage imbalance is detected and the Class 1E systems receive power from the batteries, or the plant motor loads begin to trip in response to negative sequence current, the safety-related systems will be available to remove decay heat.

RAI Question 7

The AP1000 accident analyses assumes DC power is available for the first 72 hours of the accident and safe shutdown conditions are maintained for extended period using the onsite or offsite AC power systems. Provide a detailed explanation of impact on maintaining shutdown conditions if the offsite power source is used to support safe shutdown condition, the offsite source transformer is lightly loaded and has a loss of phase, the proposed protective relaying does not detect the adverse condition and induced voltage at the 480V level maintains the battery charger system with no alarm condition.

Duke Energy Response to Question 7

If the plant is maintained in a safe shutdown condition supported by offsite power, the nonsafety-related defense-in-depth RNS system (supported by the CCS and SWS) is the preferred means of residual heat removal.

If the transformer loading level is not sufficient to cause bus voltage imbalances that result in undervoltage protective actions or alarms, then motor loads are expected to trip due to negative sequence motor currents higher than the trip/alarm setpoint of the motor current imbalance protective relay, which would create alarms in the MCR and prompt operator response.

Even if the high-voltage open phase condition is disguised by impressed voltages at the IDS battery chargers, the battery chargers will continue to perform their charging function. That is, if the IDS charger DC output voltage does not fall below the monitored alarm/action setpoint, the IDS battery chargers will continue to supply power to the IDS system. The IDS battery charger maintains isolation between the Class 1E and Non-Class 1E electrical power systems and the IDS safety functions remain operational.

In the event of loss of normal RNS cooling after a safe shutdown, the passive residual heat removal heat exchanger provides the safety-related heat removal flow path. The AP1000 passive plant design allows at least 72 hours for the operator to recognize such indications and perform the appropriate actions. There are no adverse impacts to the AP1000 safe shutdown capabilities due to phase imbalance events. Long-term plant response and recovery guidance would be provided to the operating staff by the Technical Support Center.

Duke Energy's Response to Question 4 provides a detailed description of the IDS response to an unacceptable voltage condition due to a high-voltage open phase condition.

RAI Question 8

Explain what is meant by expected voltage imbalances on the HV side of main transformer and RAT under normal operating conditions.

Duke Energy Response to Question 8

Expected voltage imbalances are defined as the average of 0-3.0 percent from approximately 98 percent of electrical supply systems surveyed per data gathered from NEMA C84.1-2011, "Electric Power Systems and Equipment – Voltage Ratings (60 Hertz)," 01/01/2011.

RAI Question 9

Explain what is meant by light load conditions. Identify loads (important to safety) expected to be running under light load conditions.

Duke Energy Response to Question 9

Light loading is defined as a loading condition under which the magnitude of the MSU transformer high-voltage current is equal to or less than the magnitude required for direct detection by the protective equipment of the system, described in Duke Energy's Response to Question 2. This definition is independent of whether a high impedance fault exists.

There are no loads or systems associated with the AP1000 passive plant that are specifically categorized as "important to safety." There are only "safety-related" and "nonsafety-related" loads. There are several safety-related components that could be operating under lightly loaded conditions. However, these systems do not require AC power to align to their safe positions or maintain their safety function.

Conclusion

Open phase condition monitoring of the MSU transformer HV input power source that can detect an open phase condition on one or more phases under any transformer loading condition will be provided. The open phase condition monitoring system design will provide an alarm to the operators in the control room should an open phase condition on the HV source to the MSU transformers occur.

If an unacceptable electrical distribution system voltage condition occurs due to a loss of phase at the high voltage side of the GDC 17 credited MSUs or the non-credited RATs, the AP1000 plant design has means to preserve the onsite standby electrical system for defense-in-depth loads and to detect, alarm and protect safety-related systems and components from adverse effects of unacceptable electrical distribution system voltage conditions including:

- Three phase voltage sensing, alarm, and protection on the 6.9 kV medium voltage buses ES-1 thru ES-7,

- Motor management relays for the medium voltage motors that sense, alarm and protect individual nonsafety-related motors from damage due to high negative sequence currents,
- Electrical protection relays on the IDS battery chargers that sense AC input voltage out-of-tolerance and generate alarms in the MCR, and
- Electrical monitoring and protection features on the IDS battery chargers to alert operators to other unacceptable operating conditions.

The IDS battery chargers will perform their normal charging function until equipment input or output monitored electrical parameters are sensed out-of-tolerance. When the equipment input or output monitored electrical parameters become unacceptable and the battery charger no longer provides sufficient DC bus voltage, the Class 1E electrical system DC bus receives power from the applicable IDS battery and the battery charger maintains isolation between the Non-Class 1E AC and Class 1E DC power systems. This condition results in one or more alarms in the MCR. The IDS battery chargers include additional design features that monitor critical electrical operating conditions, and are designed to create alarms in the MCR in the event electrical operating conditions do not meet acceptance criteria.

There may be auxiliary equipment loading levels, depending on plant conditions, which impede the ability of the AP1000 electrical protective relaying system to automatically isolate the Main AC Power System (ECS) 6.9 kV buses from the offsite power supply in response to an open phase condition on the high-voltage side of the MSU transformer with or without a high impedance fault. In such cases, other indications, such as battery charger trouble or medium voltage motor high negative sequence current protective relay trip alarms within the MCR would be available to alert plant operators to an abnormal condition. The AP1000 passive plant design inherently provides at least 72 hours for the operator to recognize unacceptable electrical system conditions and perform appropriate actions. There are no adverse impacts to the AP1000 safe shutdown capabilities in any operating mode, including refueling and midloop operation, due to an unacceptable voltage condition on the GDC 17 credited Preferred AC Power Supply.

In addition to the responses to the nine items requested to be addressed by the NRC, changes to the Lee COLA have been developed and are identified below. A future revision of the Lee COLA will reflect the changes discussed in this response.

Associated Revisions to the Lee Nuclear Station Final Safety Analysis Report:

1) FSAR Subsection 8.2.1.2.3
2) FSAR Subsection 8.2.6

Associated Revision to the Lee Nuclear Station Proposed License Conditions

1) Appendix B, Section 2.6.1 and Table 2.6.1-4
2) Appendix B, Table 2.6.12-1

Attachments:

1) Attachment 1, Revision to FSAR Chapter 8, Newly Added Subsections 8.2.1.2.3 and 8.2.6
2) Attachment 2, Revision to Part 10, Appendix B, Revision to DCD Tier 1 Section 2.6.1 and Table 2.6.1-4 and Revision to DCD Tier 1 Table 2.6.12-1

Attachment 1

Lee Nuclear Station Units 1 and 2 Response to Request for Additional Information (RAI)

Revision to FSAR Chapter 8

Newly Added FSAR Subsection 8.2.1.2.3

Newly Added FSAR Subsection 8.2.6

1) COLA Part 2, FSAR Chapter 8, Subsection 8.2.1.2.3 is added as follows:

WLS SUP 8.2-6

8.2.1.2.3 Plant Response to High Voltage Open Phase Condition

A monitoring system is installed on the credited GDC 17 offsite power circuit that provides continuous open phase condition monitoring of the MSU transformer HV input power supply (see Reference 201). The system detects an open phase condition (with or without a concurrent high impedance ground on the HV side of the transformer) on one or more phases under all transformer loading conditions. The open phase condition monitoring system provides an alarm to the operators in the control room should an open phase condition occur on the HV source to the MSU transformers. The system design utilizes commercially available components including state of the art digital relaying equipment and input parameters as required to provide loss of phase detection and alarm capability.

Additionally, a high-voltage open phase condition with or without a ground fault can manifest itself as an unacceptable voltage on the 6.9 kV medium voltage ES-1 and ES-2 buses during normal loading conditions. The presence of unacceptable voltages on the ES-1 and ES-2 buses results in isolation of the affected medium voltage bus from the offsite power supply and enables the onsite standby diesel generators to start and restore AC power to the ES-1 and ES-2 buses and associated defense-in-depth loads. The onsite AC power system is described in DCD Section 8.3.1.

Motor management relays for the medium voltage motors on ES-1 and ES-2 provide detection of unacceptably high negative sequence currents. High negative sequence current motor trips or other running load trips provide alarms in the MCR, which can assist in the detection of a high-voltage open phase condition with or without a ground fault. Electric circuit protection for the medium voltage system and equipment is described in DCD Section 8.3.1.1.1.1.

A high-voltage open phase condition with or without a ground fault can also manifest itself as an unacceptable voltage on the 480 VAC low-voltage buses powered from ES-1 and ES-2. The safety-related IDS battery chargers are powered from the low-voltage buses and continue to charge the IDS batteries unless the battery charger input or output monitored electrical parameters are unacceptable. If the monitored electrical parameters degrade to the point that the battery charger no longer provides sufficient DC bus voltage, the Class 1E electrical system DC bus receives power from the applicable IDS battery and the battery charger maintains isolation between the Non-Class 1E AC and Class 1E DC power systems which generates alarms in the MCR. The onsite AC power system is described in DCD Section 8.3.1 and the Class 1E DC power system is described in DCD Section 8.3.2.1.1.

Operator actions and maintenance and testing activities are addressed in procedures, as described in Section 13.5. Plant operating procedures, including off-normal operating procedures associated with the monitoring system will be developed prior to fuel load. Maintenance and testing procedures, including calibration, surveillance testing, setpoint determination and troubleshooting procedures associated with the monitoring system will be developed prior to fuel load.

Control Room operator and maintenance technician training associated with the operation and maintenance of the monitoring system will be conducted in accordance with the milestones for Non Licensed Plant Staff and Reactor Operator Training Programs in Table 13.4-201.

2) COLA Part 2, FSAR Chapter 8, Subsection 8.2.6 is added as follows:

8.2.6 References

201. NRC Bulletin 2012-01, "Design Vulnerability in Electric Power System," July 27, 2012.

Attachment 2

Lee Nuclear Station Units 1 and 2 Response to Request for Additional Information (RAI)

Revision to Part 10, Appendix B

Revision to DCD Tier 1 Section 2.6.1 and Table 2.6.1-4

Revision to DCD Tier 1 Table 2.6.12-1

1) COLA Part 10, Appendix B. Inspections, Tests, Analyses and Acceptance Criteria, insert the following after Section 2.5.12, Closed Circuit TV System and before the discussion on DCD Tier 1 Section 2.6.11:

Add the following information to the information provided in the referenced DCD Tier 1 Section 2.6.1, as new item 4.g under the Design Description section:

4.g) The ECS provides an alarm in the MCR and automatic protection actuation if an undervoltage condition is detected on any one or more AC phases of either switchgear ECS-ES-1 or ECS-ES-2.

Add the following information to the information provided in the referenced DCD Tier 1 Section 2.6.1, as new item 4.g in Table 2.6.1-4:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
4.g) The ECS provides an alarm in the MCR and automatic protection actuation if an undervoltage condition is detected on any one or more AC phases of either switchgear ECS-ES-1 or ECS-ES-2.	i) Testing of the as-built ECS will be conducted by simulating an undervoltage condition on ECS-ES-1 and ECS-ES-2 to confirm that an MCR alarm is generated when one or more ECS bus phase voltages is below setpoint on either switchgear ECS-ES-1 or ECS-ES-2. ii) Testing of the as-built ECS will be conducted by simulating an undervoltage condition on ECS-ES-1 and ECS-ES-2 to confirm that loss of one or more ECS bus phases automatically actuates the electrical protection function logic.	i) Undervoltage relays on ECS-ES-1 and ECS-ES-2 provide alarm when one or more AC phases on the 6.9 kV buses are below setpoint. ii) Undervoltage relays on ECS-ES-1 and ECS-ES-2 initiate protective action when one or more AC phases on the 6.9 kV buses are below setpoint.

2) COLA Part 10, Appendix B. Inspections, Tests, Analyses and Acceptance Criteria, add the following information as a new line item 7 in DCD Tier 1 Table 2.6.12-1:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. The credited GDC 17 off-site power source is monitored by an open phase condition monitoring system that can detect the following at the high voltage terminals of the transformer connecting to the off-site source, over the full range of transformer loading from no load to full load: (1) loss of one of the three phases of the offsite power source a. with a high impedance ground fault condition, or b. without a high impedance ground fault condition; or (2) loss of two of the three phases of the offsite power source a. with a high impedance ground fault condition, or b. without a high impedance ground fault condition. Upon detection of any condition described above, the system will actuate an alarm in the main control room.	i) Analysis shall be used to determine the required alarm set points for the open phase condition monitoring system to indicate the presence of open phase conditions described in the design commitment. ii) Testing of the credited GDC-17 off-site power source open phase condition monitoring system will be performed using simulated signals to verify that the as-built open phase condition monitoring system detects open phase conditions described in the design commitment and at the established set points actuates an alarm in the main control room.	i) Alarm set points for the open phase condition monitoring system to indicate the presence of open phase conditions as described in the design commitment have been determined by analysis. ii) Testing demonstrates the credited GDC 17 off-site power source open phase condition monitoring system detects open phase conditions described in the design commitment and at the established set points actuates an alarm in the main control room.