CHAPTER 8

ELECTRIC POWER

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CHAPTER 8

ELECTRIC POWER

8.1 INTRODUCTION

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

8.1.1 UTILITY GRID DESCRIPTION

Replace the existing information in DCD Subsection 8.1.1 with the following:

HAR SUP 8.1-1 Progress Energy Carolinas, Inc. (PEC) is an investor-owned electric utility serving a 30,000 square mile area of North and South Carolina. PEC maintains multiple direct interconnections with neighboring utilities. PEC participates as a member of the Virginia-Carolinas Reliability Subregion (VACAR) of the Southeastern Electric Reliability Corporation (SERC). These interconnections with neighboring utilities serve to increase the reliability of PEC's electrical grid. The PEC power grid consists of nuclear, fossil, and hydro generating facilities and an extensive bulk power transmission system.

HAR 2 and 3 are connected to the PEC 230 kV transmission system through 230 kV switchyards. These switchyards also serve as the units' preferred and maintenance source. The switchyards are a composite breaker-and-a-half/double breaker scheme. There are seven existing and one planned 230 kV transmission lines connected in the HNP and HAR 2 switchyard. There are three 230 kV transmission lines connected in the HAR 3 switchyard.

8.1.2 ON-SITE POWER SYSTEM DESCRIPTION

HAR SUP 8.1-2 Add the following information between the second and third paragraphs of this subsection.

The reserve auxiliary transformers for HAR 2 and HAR 3 also serve as sources of maintenance power.

The HAR 2 reserve auxiliary transformers RAT A and RAT B are supplied from the modified 230 kV HNP and HAR 2 switchyard.

The HAR 3 reserve auxiliary transformers RAT A and RAT B are supplied from the new 230 kV HAR 3 switchyard.

8.1.4.3 Design Criteria, Regulatory Guides, and IEEE Standards

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HAR SUP 8.1-3 Add the following information between the second and third paragraphs of this subsection.

Off-site and on-site ac power systems' conformance to Regulatory Guides and IEEE Standards is identified by DCD Table 8.1-1 as site-specific, and to other applicable Regulatory Guides is as indicated in Table 8.1-201.

HAR SUP 8.1-3

Table 8.1-201
Site-Specific Guidelines for Electric Power Systems

Criteria				Applicability (FSAR[a] Section/Subsection) 8.2	8.3.1	8.3.2	Remarks
1.	Regulatory Guides						
	a.	RG 1.129	Maintenance, Testing, and Replacement of Vented Lead-Acid Storage Batteries for Nuclear Power Plants			G	Battery Service tests are performed in accordance with the Regulatory Guide.
	b.	RG 1.155	Station Blackout				Not Applicable [b]
	c.	RG 1.204	Guidelines for Lightning Protection of Nuclear Power Plants	G	G		Implemented via IEEE-665, "IEEE Guide for Generating Station Grounding" (DCD Section 8.3, Reference 18)
	d.	RG 1.206	Combined License Applications for Nuclear Power Plants (LWR Edition)	G	G	G	
2.	Branch Technical Positions						
	a.	BTP 8-3 (BTP ICSB-11 in DCD)	Stability of Off-Site Power Systems	G			Stability Analysis of the Off-Site Power System is performed in accordance with the BTP.

a) "G" denotes guidelines as defined in NUREG-0800, Rev. 3, Table 8-1 (SRP). No Letter denotes "Not Applicable".

b) Station Blackout and the associated guidelines were addressed as a design issue in the DCD.

8.2 OFFSITE POWER SYSTEM

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

8.2.1 SYSTEM DESCRIPTION

Delete the first, second, and sixth paragraphs, and the first and last sentences of the fourth paragraph of DCD Subsection 8.2.1. Add the following information before the fifth paragraph of DCD Subsection 8.2.1.

HAR COL 8.2-1 The Progress Energy Carolinas (PEC) transmission network (grid) system supplies the off-site ac power for the existing Shearon Harris Nuclear Power Plant (HNP), as well as HAR 2 and HAR 3. The connection of HAR 2, HAR 3, the switchyards, and the 230 kV transmission system is shown in Figures 8.2-201, 8.2-202 and 8.2-203 respectively.

The common 230 kV HNP and HAR 2 switchyard provides a 230 kV circuit feed to the HAR 2 main step-up transformer. The reserve auxiliary transformers are each provided with a separate 230 kV circuit feed. Figure 8.2-204 shows the switchyard connections to the main step-up and reserve auxiliary transformers for HAR 2.

The off-site power sources to the 230 kV HNP and HAR 2 common switchyard consist of eight transmission lines listed in Table 8.2-201. The seven transmission lines that are currently in service, are the 230 kV lines to the Cape Fear Plant (North and South lines), Fort Bragg Woodruff St, Siler City, Erwin, Wake and Apex US 1 substations. The new line is to the Research Triangle Park (RTP) substation.

The new RTP line is being added to enhance transmission reliability, independent of the addition of HAR 2 and HAR 3.

The new and current transmission line routing near the plant is shown in Figure 8.2-203. The lines originate from different substations and approach the HNP and HAR 2 common switchyard from different directions. As they enter the plant area, five existing circuits share a common right-of-way. The HNP FSAR Section 8.2, Figure 8.2.1-2 illustrates an overview of the area near the 230 kV Switchyard where common corridors are shared.

The off-site power sources to the HAR 3 switchyard consist of three new transmission lines to the Fort Bragg Woodruff St., Wake and Erwin substations listed in Table 8.2-202. The new lines originate from the substations and approach the HAR 3 switchyard as shown in Figure 8.2-203. The new 230 kV transmission line routes near the plant are shown in Figure 8.2-204.

The HAR 3 switchyard provides a 230 kV circuit feed for the HAR 3 main step-up transformer. The reserve auxiliary transformers, for HAR 3, are each provided with a separate 230 kV circuit feed. Figure 8.2-204 shows the switchyard connections to the main step-up transformer and reserve auxiliary transformers for HAR 3.

The HAR 2 and HAR 3 related transmission structures and support structures and systems are designed to withstand standard loading conditions for the HAR site as provided in DCD Section 8.2.

The existing transmission lines are designed with an insulation level that will minimize lightning flashover. Historically, the Piedmont area of North Carolina has experienced an average of 44.3 thunderstorm days per year (Subsection 2.3.1.2.1). Experience with over 2,000 miles of 230 kV lines indicates that PEC's transmission lines are subjected to one lightning outage per year per 100 miles. The new transmission lines will have similar operating characteristics.

The new HAR 2 and HAR 3 transmission lines are designed to meet NESC C2-2007, “National Electrical Safety Code”.

Galloping conductors are not anticipated at the HAR site and should not affect the reliability of the existing and new transmission lines. The conductor configuration reduces the probability of flashover resulting from galloping conductors.

Both the HAR 2 and HAR 3 switchyards have multiple off-site power sources from the transmission network (refer to Tables 8.2-201 and 8.2-202). The off-site sources have sufficient capacity and capability to support normal and abnormal conditions for HAR 2 and HAR 3. The AP 1000 passive plant design does not require an off-site source for accident conditions.

HAR CDI

A transformer area containing the main step-up transformers, unit auxiliary transformers (UAT), and reserve auxiliary transformers (RAT) is located next to each turbine building (DCD Figure 1.2-2).

8.2.1.1 Transmission Switchyard

Replace the information in the DCD Subsection 8.2.1.1 with the following information.

HAR COL 8.2-1

8.2.1.1.1 HNP and HAR 2 Switchyard

HNP and HAR 2 units are served by a 230 kV Switchyard, modified to accommodate the addition of HAR 2. The 230 kV Switchyard has two main buses. Each of the eight (8) incoming 230 kV transmission lines are normally connected to both buses.

The circuit breakers associated with the HNP and HAR 2 modified switchyard are rated 3000A, 60 Hz, 3-pole gas type with interrupting capability of 63,000 amperes RMS.

The HNP and HAR 2 modified switchyard also has new disconnect switches for HAR 2, which are 3-pole and are rated on the same continuous current basis as the associated circuit breakers.

The various elements of the HNP and HAR 2 modified switchyard are connected via a composite breaker-and-a-half/double breaker scheme as shown in Figure 8.2-201.

There are two 125 Vdc battery systems. Each system consists of 125 Vdc battery and battery charger.

The HNP and HAR 2 modified switchyard includes surge protective devices, grounding, and a lightning protection system in accordance with standard industry practice.

8.2.1.1.2 HAR 3 Switchyard

HAR 3 is served by a new 230 kV switchyard designed to accommodate the addition of this unit to the PEC transmission system. The 230 kV switchyard has two main buses. Each of the three (3) incoming 230 kV lines are normally connected to both buses.

The circuit breakers associated with the new 230 kV switchyard for HAR 3 are rated 3000A, 60 Hz, 3-pole gas type with interrupting capability of 63,000 amperes RMS.

The new 230 kV switchyard also has disconnect switches for HAR 3, which are 3-pole and are rated on the same continuous current basis as associated circuit breakers.

The various elements of the HAR 3 switchyard are connected via a composite breaker-and-a-half/double breaker scheme as shown in Figure 8.2-202.

There are two 125 Vdc battery systems. Each system consists of 125 Vdc battery and battery charger.

The HAR 3 switchyard includes surge protection devices, grounding and lightning protection system in accordance with standard industry practice.

The new 230 kV switchyard for HAR 3 will have station-service transformers to serve the HAR 3 switchyard control building auxiliary system including circuit breakers, disconnect switches, busses, transformers, and associated systems.

HAR SUP 8.2-1

8.2.1.1.3 Failure Modes and Effects Analysis (FMEA)

The design of the off-site power system provides for a robust system that supports reliable power production. While off-site power is not required to meet any safety function, and physical independence is obviated by this lack of safety function and by the certified design's partial exemption to GDC 17 granted by the NRC, multiple, reliable transmission circuits are provided to support operation of the HAR 2 and HAR 3 facilities. Neither the accident analysis nor the Probabilistic Risk Assessment has identified the non-safety related off-site power system as risk significant for normal plant operation.

The HNP and HAR 2 modified switchyard is connected to eight (seven existing plus one planned) transmission lines and the HAR 3 switchyard is connected to three transmission lines. For both HAR 2 and HAR 3, no single transmission line is designated as the preferred circuit. Each of the unit's transmission lines has sufficient capacity and capability from the transmission network to power the HAR house loads under normal and abnormal conditions. The AP 1000 passive plant design does not require an off-site source for accident conditions.

A failure modes and effects analysis (FMEA) of the HAR 2 and HAR 3 switchyards confirms that a single initiating event, such as transmission line fault plus a single breaker not operating, does not cause failure of more than one single off-site transmission line, or a loss of off-site power to either HAR 2 and HAR 3 on-site buses via the main step-up transformer. This evaluation recognizes that a single failure of some switchyard components could directly cause the loss of the HAR 2 and HAR 3 switchyard feeds to each unit's main step-up transformer such as a fault on this feed. Evaluated events include a breaker not operating during a fault condition; a fault on a switchyard bus; a spurious relay trip; and a loss of control power supply. In summary:

- In the event of a fault on a 230 kV transmission line, the associated switchyards' bus breakers trip and both buses stay energized and HAR 2 and HAR 3 continue operation.
- In the event of a fault on a 230 kV transmission line with a stuck bus - breaker, the affected bus differential relays cause all circuit breakers on the affected bus to trip and thereby isolate the faulted bus. HAR 2 and HAR 3 continue operation through the non-affected bus.
- In the event of a 230 kV bus fault, bus differential relays sense the fault and the breakers associated with the affected bus trip, thereby isolating the faulted bus. In this event, HAR 2 and HAR 3 continue normal operation through the non-affected bus.

- In the event of a 230 kV bus fault with a stuck breaker, the adjacent - breaker will sense the fault and trip, which will isolate the faulted bus. If the stuck breaker is associated with either the HAR 2 or HAR 3 main step up transformer output, opening of the adjacent breaker will interrupt power to the associated main step-up transformer and unit auxiliary transformers resulting in the loss of both preferred and normal sources of power to the unit. The switchyard feeds to the reserve auxiliary transformers will still be available.

- In the event of a transmission line relay spurious operation, the associated switchyards' breakers trip, isolating the transmission line from the respective yards. In this event, switchyard buses stay energized for HAR 2 and HAR 3 and the units continue normal operation.

- In the event of a loss of DC control power, the loss of control power to a breaker or to a transmission line primary relay is compensated for by redundant trip coils powered from a different source which allow the protective function to occur. This design feature is common for the HAR 2 and HAR 3 switchyard control systems to ensure no interruption in operation of the units.

The analysis demonstrates that with a single event failure, one of the two 230 kV buses at HAR 2 and HAR 3 switchyard as a minimum will be available to power the plant buses. A bus fault with a stuck breaker associated with either the HAR 2 or HAR 3 main step-up transformer output will cause the loss of normal and preferred power to the associated unit. The switchyard feeds to the reserve auxiliary transformers will still be available. A bus fault concurrent with any other stuck breaker will not cause a loss of power to either HAR 2 or HAR 3.

8.2.1.1.4 Transmission System Provider/Operator (TSP/TSO)

HAR SUP 8.2-2

The interfaces between HAR and PEC's Transmission Operations and Planning Department are managed via a formal Interface Agreement. PEC conducts transmission system operations under a vertically integrated utility business model. Under this business model, the transmission system is not in an RTO (Regional Transmission Organization) or operated by an ISO (Independent System Operator). Instead, under a vertically integrated utility business model, the System Operators (Grid Operators) are the TSO, and operate both the transmission and generation systems (nuclear and non-nuclear) and work in the same company that will hold the license to operate HAR. HAR off-site power reliability is jointly managed by the System Operators, Transmission Personnel, and licensed Nuclear Plant Personnel through communications and actions governed and coordinated by the formal Interface Agreement.

The Interface Agreement specifies the responsibilities and lines of communication for the various organizations responsible for the operation, maintenance, and engineering of facilities associated with HAR, as well as, the consideration of the impact their activities may have on the plant's facilities. The requirements for communication of planned activities and changes in plant structures, systems, and components (SSC) status which may affect grid stability/reliability are clearly defined. HAR operators are directed to notify the TSO of any plant activity that may impact generation capability. The TSO is also required to monitor system conditions to ensure adequate voltage is maintained to support HAR, and promptly notify the HAR operators of existing, or anticipated conditions which would result in inadequate voltage support. The agreement, along with the operating procedures used by the TSOs, ensures that early notification of worsening grid conditions takes place.

The TSO and HAR plant operators coordinate operations to maintain the switchyard voltage such that the steady state voltage on the 26 kV isophase bus is within 0.95 – 1.05 pu of its nominal value.

The TSO coordinates transmission system maintenance activities that can have an impact on plant operation with the HAR operators and the Plant Transmission Activities Coordinator (PTAC). The Interface Agreement defines and controls the interfaces for Operations, Maintenance, and Engineering Activities at HAR. The PTAC serves as the single point of contact at the plant for transmission engineering, construction, and maintenance personnel performing activities impacting HAR. In addition, the TSO communicates directly with the HAR operators regarding operational interfaces as required by the Interface Agreement.

HAR procedures address the criteria used to determine when the main control room (MCR) is required to contact the TSO.

Per the Interface Agreement requirements, the TSO monitors key grid parameters and uses predictive analysis tools. The procedures used by the TSOs direct them to promptly notify the HAR operators of conditions for which there would not be adequate switchyard voltage, including predicted post HAR trip conditions. These procedures include separate steps that address both current and anticipated conditions. The intent of these separate steps is to provide, to the extent possible, early warning to the HAR operators of problem conditions.

The TSO uses procedures based on enveloping transmission planning analyses to operate the grid. As long as the grid configuration is within that allowed by the procedure under various system loading conditions, adequate plant voltage support is assured. Specific case studies are also used to support planned grid configurations when not clearly bounded by existing analyses. In addition to the transmission system analysis-based procedures, the TSO also use monitoring/predictive analysis computer programs that can predict HAR switchyard voltages expected to occur upon realization of any one of a number of possible losses to the grid, including a trip of the HAR generator, a trip of another large generator, or the loss of an important transmission line. This monitoring/predictive analysis computer program tool operates based on raw data from transducers across the system which is processed through a state estimator to generate a current state of the system snapshot. The output is then processed through a contingency analysis program that generates a set of new results with various single elements of the system out of service. These results are then screened against a predetermined set of acceptance limits. Postulated scenarios which then do not meet the acceptance limits are listed for review by the TSO. Notifications are made based on grid configurations being outside of predefined procedure requirements or based on unsatisfactory monitoring/predictive analysis computer program tool results. The predictive analysis computer program updates approximately every 10 minutes. Also, the grid operating procedures that are based on enveloping transmission system analyses are updated when transmission system or plant changes require it.

Procedural guidance is provided regarding a target switchyard voltage schedule and operation of the main generator voltage regulator. Operation of the main generator within the plant voltage schedule ensures that a trip of the generator does not result in an unacceptable voltage drop in the switchyard. The TSO procedure for HAR voltage support and coordination defines the TSO's actions and requirements during high load conditions relative to HAR voltage support. These actions are based on transmission system enveloping analyses wherein the worst-case loss of a generating station (including HAR) on the PEC system is considered relative to HAR voltage support. In the event system conditions are outside the guidelines of the analysis-based procedure, the TSO will alert the HAR operators to that effect.

8.2.1.2 Transformer Area

Add the following paragraph at the end of the first paragraph of DCD Subsection 8.2.1.2.

HAR COL 8.2-1 The transformer area for each unit contains the main step-up transformer (the GSU) (three single phase transformers plus one spare), three unit auxiliary transformers (the UATs), and two reserve auxiliary transformers (the RATs). The two RATs are connected to the 230 kV switchyard. The high side (230 kV) winding of the GSUs is connected in wye configuration to the 230 kV switchyard.

Add the following paragraph and subsections at the end of the DCD Subsection 8.2.1.2.

HAR COL 8.2-1 Each transformer is connected to the switchyard by an offsite circuit beginning at the switchyard side of the breaker(s) within the switchyard and ending at the high voltage terminals of the GSU and RATs.

8.2.1.2.1 Switchyard Protection Relay Scheme

HAR COL 8.2-2

The switchyards are designed as a double-bus, composite breaker-and-half/double breaker arrangement for reliability and flexibility. This arrangement allows for isolation of components and buses, while preserving the Plant's connection to the grid.

Under normal operating conditions, all 230 kV circuit breakers and all bus sectionalizing motor operated disconnect switches are closed; all bus sections are energized.

Transmission line protection consists of two different high speed schemes with impedance backup non-pilot schemes and directional comparison blocking schemes with (as necessary) permissive over reach trip schemes used for bus fault protection. Breaker failure protection schemes are also used.

HAR SUP 8.2-4

The protective devices controlling the switchyard breakers are set with consideration given to preserving the plant grid connection following a turbine trip.

HAR COL 8.2-1

8.2.1.3 Switchyard Control Building

A control building is included in the design to serve the needs of the HAR 3 switchyard. The control building houses switchyard batteries (redundant battery systems are housed in separate battery rooms and appropriately ventilated) and accommodates a sufficient number of relay/control panels. For HAR 2, the existing control building for HNP is used to serve the needs of HAR 2 switchyard additions.

The 230 kV switchyard breakers associated with the main step-up and reserve auxiliary transformers are under the administrative control of the plant. Transmission line circuit breakers in the HAR 2 and 3 230 kV switchyards are under the administrative control of TSO.

8.2.1.4 Switchyard and Transmission Lines Testing and Inspection

The Switchyard and Transmission Lines Testing and Inspection Program ensures that equipment, components, and systems are proactively maintained at intervals that promote safety and reliability. Results of an effective maintenance program include extended equipment life, lower total life cycle cost, enhanced system reliability, and improved customer satisfaction. Substation Maintenance, Transmission Line Maintenance, and Relay Maintenance procedures have been developed to achieve these goals.

An interface agreement between Transmission Operations and Planning and HAR 2 and 3 for development, maintenance, calibration, testing, and modification of transmission lines, switchyards, transformer yards, and associated transmission equipment, provides the procedure, policy, and organization to carry out maintenance, calibration, testing, and inspection of transmission lines and switchyards.

An individual is assigned from the HAR engineering organization to serve as the HAR PTAC. The PTAC's oversight responsibilities extend beyond the switchyard boundary to include the transmission lines, structures, and relaying from the nuclear plant out to and including the circuit breakers at the opposite end of the transmission lines. The PTAC's responsibilities include, but are not limited to the following:

- Serve as the single point of contact for transmission engineering, construction, and maintenance activities impacting HAR 2 and 3.
- Interface with the local transmission maintenance organization and Transmission Asset Management personnel.
- Monitor inspection schedules, results of inspections and tests, material conditions, and maintenance backlogs to ensure that:
  - Appropriate inspections and testing are performed on schedule to ensure reliability.
  - Results are analyzed and appropriately prioritized actions are taken to resolve any negative findings.
  - Defective equipment is replaced or repaired before reliability is affected.
- Serve as the liaison regarding transmission system interfaces between the nuclear plant organizations and other organizations.
- Coordinate transmission system activities requiring pre-planning and scheduling among various nuclear and non-nuclear organizations including, but not limited to:
  - Transmission Engineering
  - Transmission Area Maintenance
  - System Planning and System Operations
- Provide system oversight of the switchyard, off-site transmission lines through the next remote circuit breakers, and on-site equipment (transformers, circuit breakers, etc.) that Transmission services.

For performance of maintenance, testing, calibration, and inspection, PEC follows its own field test guidelines, vendor manuals and drawings, and industry maintenance practices to ensure compliance with applicable North American Electric Reliability Corporation (NERC) reliability standards including but not limited to the following:

- PRC-005-1 Transmission and Generation Protection System Maintenance and Testing.
- PRC-008-0 Under Frequency Load Shedding Equipment Maintenance Program.

PEC's maintenance and testing program covers the following equipment as required by NERC Reliability Standards:

- Protective Relays
- Instrument Transformers
- Communications Systems
- Batteries

The protective relay maintenance program includes the necessary verification to ensure proper calibration of protective relays. Maintenance of protective relays is accomplished through procedures which address visual and mechanical inspections, protective and auxiliary relays, and other relay protective schemes. The relay testing program includes the functional testing of the relay protection system to insure operations as designed. Functional testing of relays is performed periodically and in accordance with a functional guideline procedure.

Maintenance and testing interval schedules have been developed for maintenance of substation equipment. The equipment/programs included are as follows:

- Circuit switchers, air break switches and ground switches
- Structures
- Ground system
- Transformers
- Circuit breakers
- Neutral grounding equipment
- Batteries
- Infrared scan

- Instrument class transformers

Transmission verifies that these test results demonstrate compliance with design requirements and takes corrective actions as necessary. Transmission plans and schedules maintenance activities, notifying the plant and internal organizations in advance. Transmission also procures and stores necessary spare parts prior to the commencement of inspection, testing, and maintenance activities.

Transmission's surveillance and maintenance procedures include requirements for transmission line inspections through an aerial inspection program usually twice per year. These procedures include checks for encroachments, broken conductors, broken or leaning structures, and signs of trees burning, any of which would be evidence of clearance problems. Ground inspections conducted once every two years include examination for clearance at questionable locations, integrity of structures, and surveillance for dead or diseased trees that might fall on the transmission lines. Problems noted during any inspection are brought to the attention of the appropriate organization(s) for corrective action.

The interconnecting switchyard, as well as other substation facilities, has multiple levels of inspection and maintenance. They include the following:

- Monthly visual inspections of the entire substation facility.
- Relay functional tests.
- Oil sampling of large power transformers. Dissolved gas tests, oil quality analyses, and power factor tests are regularly performed.
- Power circuit breakers are subjected to time based and operational based maintenance requirements. The program includes the use of external visual inspection of all functional systems, external tests, and internal inspections. Information required for performing specific equipment maintenance is obtained from manufacturer's instruction books, service bulletins, and/or specification data.
- A power factor test performed on circuit breakers, power transformers, and transmission class instrument transformers.
- A thermography (infrared scan) program is used to identify potential thermal heating issues on buses, conductors, connectors and switches.

8.2.2 GRID STABILITY

Add the following information at the end of DCD Subsection 8.2.2.

HAR COL 8.2-2 A transmission system study of the off-site power system was completed for the addition of HAR 2 and HAR 3 which evaluated the following:

- Overloads and voltage impact on the transmission system
- Short circuit impact on the transmission system
- Transient and dynamic stability of HAR 2 and 3 (and existing HNP)
- Voltage and frequency response during a turbine trip followed by a generator Trip
- Frequency decay rate for large, regional generation/load mismatches

Computer simulations were used to perform the powerflow dynamics (stability and turbine trip) and short circuit analyses. The computer simulation base cases were derived from the NERC Multiregional Modeling Working Group (MMWG) base cases for the Eastern Interconnection utilizing peak summer loading conditions.

The powerflow analysis indicates that the transmission system, with the planned transmission system changes, will accommodate the addition of HAR 2 and 3. The study also indicates that transient and dynamic stability performance of HAR 2, HAR 3, and HNP is within acceptable limits for the proposed configuration.

In order to maintain Reactor Coolant Pump (RCP) operation for three seconds following a turbine trip as specified in DCD Subsection 8.2.2, the grid voltage at the high side of the main step-up and reserve auxiliary transformers can not drop from the pre-trip steady-state value by more than 15 percent of the rated voltage. The results of turbine trip simulations demonstrate that the voltage and frequency of the 26 kV generator buses and 230 kV switchyard buses will remain within the required limits for at least 3 seconds following the turbine trip of either HAR 2 or HAR 3.

Additionally, simulations performed as part of joint studies within SERC demonstrate that the rate of frequency decay for large generation/load mismatches is well within acceptable limits.

Table 8.2-203 confirms that the interface requirements for steady state load, nominal voltage, allowable voltage regulation, nominal frequency, allowable frequency fluctuation, maximum frequency decay rate, and limiting under frequency values for RCP have been met.

Preliminary assessment indicates that the plant interface requirement for inrush kVA for motors has been met.

HAR SUP 8.2-3 From 1992 to 2007, average grid availability for the seven 230 kV transmission lines looped into the HNP site is approximately 99.99 percent, with 28 forced outages. The average frequency of forced line outages since 1992 is approximately 1.7 per year for the involved lines, with the majority due to lightning strikes causing momentary outages. Leading causes of forced outages of significant duration are customer equipment trouble, relay misoperation, and lightning.

8.2.5 COMBINED LICENSE INFORMATION FOR OFF-SITE ELECTRICAL POWER

HAR COL 8.2-1 This COL item is addressed in Subsections 8.2.1, 8.2.1.1.1, 8.2.1.1.2, 8.2.1.2, 8.2.1.3, and 8.2.1.4.

HAR COL 8.2-2 This COL item is addressed in Subsections 8.2.1.2.1 and 8.2.2.

HAR COL 8.2-1

Table 8.2-201
Transmission Lines Connecting HAR 2 to PEC Transmission System

Termination	Nominal Voltage (kV)	Rated MVA	Approximate Length
Cape Fear (North Line)	230	793 MVA	7 miles
Cape Fear (South Line)	230	797 MVA	6 miles
Apex US 1	230	797 MVA	3 miles
Ft. Bragg Woodruff St.	230	1077 MVA	36 miles
Erwin	230	797 MVA	30 miles
Siler City	230	793 MVA	32 miles
Wake	230	637 MVA	38 miles
Research Triangle Park (RTP) (NEW LINE)	230	1195 MVA	22 miles

HAR COL 8.2-1

Table 8.2-202
Transmission Lines Connecting HAR 3 to PEC Transmission System

Termination	Nominal Voltage (kV)	Rated MVA	Approximate Length
Ft. Bragg Woodruff St. (NEW LINE)	230	1256 MVA	36 miles
Wake (NEW LINE)	230	1256 MVA	38 miles
Erwin (NEW LINE)	230	1256 MVA	30 miles

HAR COL 8.2-2

Table 8.2-203
Grid Stability Interface Evaluation

DCD Table 1.8-1 Item 8.2 Parameter	WEC AC Requirements	HAR Value Assumed
Stead-state load	"normal running values provided as input to grid stability"	"normal running values provided as input to grid stability"
Inrush kVA for motors	56,712 KVA*	56,712 KVA
Nominal voltage	Not provided	1.0 pu
Allowable voltage regulation	0.95-1.05 pu steady state ±20% total for transient	0.95-1.05 pu steady state ±20% total for transient
Nominal frequency	60 Hz	assumed 60 Hz
Allowable frequency fluctuation	±½ Hz indefinite	±½ Hz indefinite
Maximum frequency decay rate	5 Hz/sec	5 Hz/sec

* Based on the inrush of a single 10,000 HP feedwater pump assuming efficiency = 0.95, pf= 0.9, and inrush = 6.5 x FLA.

DCD Table 1.8-1 Item 8.2 Parameter	WEC Acceptance Criteria	HAR Value Calculated
Limiting under frequency value for RCP	≥57.7 Hz	>59 Hz

8.3 ONSITE POWER SYSTEMS

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

8.3.1.1.1 On-Site AC Power System

Add the following to the end of the fourth paragraph of DCD Subsection 8.3.1.1.1.

HAR SUP 8.3-2 The site specific switchyard and transformer voltage is shown in Figures 8.2-201 and 8.2-202.

8.3.1.1.2.3 On-Site Standby Power System Performance

Add the following text between the second and third paragraphs of DCD Subsection 8.3.1.1.2.3.

HAR SUP 8.3-1 The HAR site conditions provided in Sections 2.1 and 2.3 are bounded by the standard site conditions used to rate both the diesel engine and the associated generator in DCD Subsection 8.3.1.1.2.3.

Add the following subsection after DCD Subsection 8.3.1.1.2.3.

8.3.1.1.2.4 Operation, Inspection, and Maintenance

STD COL 8.3-2 Operation, inspection and maintenance (including preventive, corrective, and predictive maintenance) procedures consider both the diesel generator manufacturer’s recommendations and industry diesel working group recommendations.

8.3.1.1.6 Containment Building Electrical Penetrations

Add the following text at the end of DCD Subsection 8.3.1.1.6.

STD COL 8.3-2 Procedures implement periodic testing of protective devices that provide penetration overcurrent protection. A sample of each different type of overcurrent device is selected for periodic testing during refueling outages. Testing includes:

- Verification of thermal and instantaneous trip characteristics of molded case circuit breakers.

- Verification of long time, short time, and instantaneous trips of medium voltage vacuum circuit breakers.
- Verification of long time, short time, and instantaneous trips of low voltage air circuit breakers.
- Verification of Class 1E and non-Class 1E dc protective device characteristics (except fuses) per manufacturer recommendations, including testing for overcurrent interruption and/or fault current limiting.

Penetration protective devices are maintained and controlled under the plant configuration control program. A fuse control program, including a master fuse list, is established based on industry operating experience.

8.3.1.1.7 Grounding System

Replace the sixth paragraph of DCD Subsection 8.3.1.1.7 with the following information.

HAR COL 8.3-1 A Grounding Grid System design within the plant boundary includes determination of step and touch potentials and ensuring that they are within the acceptable limit for personnel safety. Available soil resistivity data from the existing HNP site were analyzed and used in the grounding grid system design. The ground grid conductor size was determined using methodology outlined in IEEE 80, "IEEE Guide for Safety in AC Substation Grounding" (Reference 201).

8.3.1.1.8 Lightning Protection

Replace the third paragraph of DCD Subsection 8.3.1.1.8 with the following information.

HAR COL 8.3-1 Lightning protection is included for HAR 2 and HAR 3 plant buildings in accordance with the guidelines in Regulatory Guide 1.204. The zone of protection is based on elevations and geometry of the structures. It includes the space covered by a rolling sphere having a radius sufficient enough to cover the building to be protected. The zone of protection method is based on the use of ground masts, air terminals, and shield wires. Either copper or aluminum is used for Lightning protection. Lightning protection grounding is interconnected with the station/switchyard grounding system.

8.3.1.4 Inspection and Testing

Add the following text at the end of DCD Subsection 8.3.1.4.

STD SUP 8.3-4 Procedures are established for periodic verification of proper operation of the Onsite AC Power System capability for automatic and manual transfer from the preferred power supply to the maintenance power supply and return from the maintenance power supply to the preferred power supply.

8.3.2.1.1.1 Class 1E DC Distribution

Add the following text at the end of DCD Subsection 8.3.2.1.1.1.

STD SUP 8.3-3 No site-specific non-Class 1E dc loads are connected to the Class 1E dc system.

8.3.2.1.4 Maintenance and Testing

Add the following text at the end of DCD Subsection 8.3.2.1.4.

STD COL 8.3-2 Procedures are established for inspection and maintenance of Class 1E and non-Class 1E batteries. Class 1E battery maintenance and service testing is performed in conformance with Regulatory Guide 1.129. Batteries are inspected periodically to verify proper electrolyte levels, specific gravity, cell temperature and battery float voltage. Cells are inspected in conformance with IEEE 450 and vendor recommendations.

The clearing of ground faults on the Class 1E dc system is also addressed by procedure. The battery testing procedures are written in conformance with IEEE 450 and the Technical Specifications.

Procedures are established for periodic testing of the Class 1E battery chargers and Class 1E voltage regulating transformers in accordance with the manufacturer recommendations.

- Circuit breakers in the Class 1E battery chargers and Class 1E voltage regulating transformers that are credited for an isolation function are tested through the use of breaker test equipment. This verification confirms the ability of the circuit to perform the designed coordination and corresponding isolation function between Class 1E and non-Class 1E components. Circuit breaker testing is done as part of the Maintenance Rule program and testing frequency is determined by that program.

- Fuses / fuse holders that are included in the isolation circuit are visually inspected.
- Class 1E battery chargers are tested to verify current limiting characteristic utilizing manufacturer recommendation and industry practices. Testing frequency is in accordance with that of the associated battery.

8.3.2.2 Analysis

STD DEP 8.3-1

Replace the first sentence of the third paragraph of DCD Subsection 8.3.2.2 with the following:

The Class 1E battery chargers are designed to limit the input (ac) current to an acceptable value under faulted conditions on the output side, however, the voltage regulating transformers do not have active components to limit current; therefore, the Class 1E voltage regulating transformer maximum current is determined by the impedance of the transformer.

8.3.3 COMBINED LICENSE INFORMATION FOR ONSITE ELECTRICAL POWER

HAR COL 8.3-1

This COL Item is addressed in Subsections 8.3.1.1.7 and 8.3.1.1.8.

STD COL 8.3-2

This COL Item is addressed in Subsections 8.3.1.1.2.4, 8.3.1.1.6 and 8.3.2.1.4.

8.3.4 REFERENCES

Add the following information at the end of DCD Subsection 8.3.4:

201. Institute of Electrical and Electronics Engineers (IEEE), "IEEE Guide for Safety in AC Substation Grounding," IEEE Std 80-2000, August 4, 2000.
