

8.3 Onsite Power Systems

The information in this section of the reference ABWR DCD including all subsections, tables, and figures is incorporated by reference with the following departures and supplements.

STD DEP T1 2.4-2

STD DEP T1 2.12-2

STP DEP 1.1-2

STD DEP 8.3-1

STP DEP 8.3-3 (replaced Figures 8.3-1 sheets 1, 2, 3 & 4 and Figure 8.3-2)

STD DEP Admin

The plant medium voltage electrical system alternate design description was provided in ABWR Licensing Topical Report (LTR) NEDO-33335, dated May 2007, titled "Advanced Boiling Water Reactor (ABWR) Plant Medium Voltage Electrical System Design." Marked up DCD pages 8.3-1 through 8.3-3, 8.3-7 through 8.3-10, 8.3-14 through 8.3-21, 8.3-25, 8.3- 27, 8.3-29, 8.3-32, 8.3-42 through 8.3-44, 8.3-56, 8.3-59, 8.3-62 and Figure 8.3-1 (sheet 1 of 4) of this LTR are incorporated by reference.

Deletion of the FCS heater and blower loads from Table 8.3-1 (Reference STD DEP T1 2.14-1) was provided in ABWR Licensing Topical Report (LTR) NEDE-33330P, dated May 2007, titled "Hydrogen Recombiner Requirements Elimination." Page C-62 of this LTR is incorporated by reference.

8.3.1 AC Power Systems

STP DEP 1.1-2

Standby power is provided to plant investment protection non-Class 1E loads in all three load groups by a combustion turbine generator located in the turbine building. CTG Bus 1 can be tied to CTG Bus 2 by the manual closing of the CTG bus tie breaker. When the plant conditions are beyond the design basis, the plant operators have the capability to cross-connect the combustion turbine generator from each unit. The cross-tie breakers can only be closed after complying with the shedding requirements and loads limitations in accordance with off-normal/emergency procedures.

8.3.1.1 Medium Voltage Class 1E Power Distribution System

STP DEP 8.3-3

The Division I Class 1E bus supplies power to three separate groups of non-Class 1E fine motion control rod drive (FMCRD) motors (see Figure 8.3-1, ~~sheet 3~~ sheet 4). Although these motors are not Class 1E, the drives may be inserted as a backup to scram and are of special importance because of this. It is important that the first available standby power be available for the motors, therefore, a diesel supplied bus

was chosen as the first source of standby AC power and a combustion turbine supplied PIP bus as the second backup source. Division I was chosen because it was the most lightly loaded diesel generator.

The design minimizes the probability of a single failure affecting more than one FMCRD group by providing three independent Class 1E feeds (one for each group) directly from the Division I Class 1E 6.9 kV bus (see ~~sheet 3~~sheet 4 of Figure 8.3-1).

STD DEP T1 2.4-2

The containment analysis (see Section 6.2) requires the condensate pumps to be tripped when a feedwater line break inside the drywell is detected. The Safety System Logic and Control (SSLC) initiates a trip of the condensate pumps when a feedwater line break is detected in the drywell. In order to trip the condensate pumps, a provision of 13.8 kV medium voltage safety-related breaker in series with the non-safety 13.8 kV feeder breaker exists for each condensate pump. The trip circuit of each safety-related 13.8 kV breaker includes two independent trip coils. Each trip coil is powered from a separate division of Class 1E 125V DC system. Two separate divisions of safety-related control signals for feedwater line break are provided to initiate the trip of each breaker. This dual breaker in series arrangement ensures that the condensate pumps will trip on a feedwater line break.

The 13.8 kV breakers (both safety-related and nonsafety-related) are located in the Turbine Building. The procurement and design of the safety-related breakers are required to meet the criteria for performing the safety function of tripping the condensate pump breakers in case of the feedwater line break design basis event. The 125V DC control power and trip circuits of the safety-related breakers are also required to meet the independence criteria per RG 1.75. In addition, the safety-related breakers and its components are required to be seismically installed and missile protected at their location in the Turbine Building. Although the breaker control power and trip circuits will not fully meet the seismic Category I installation and RG 1.75 separation requirements, the following considerations provide reasonable assurance for tripping of condensate pumps during a feedwater line break in the drywell:

- The control power and SSLC circuits are provided with isolation devices.
- The control power cables are installed in dedicated raceways. Adequate separation exists between control circuit raceways and other non-safety raceways.
- The design of the raceway supports is performed considering seismic loads throughout their routing.
- The safety-related breakers are located in separate electrical rooms.
- The design of the safety-related breaker supports is performed considering seismic loads.
- The probability of trip and control power circuit failure is very low. Even in case of failure of non-safety power cable, the breaker trip circuit is expected to perform the

safety function of tripping the condensate pump feeder breakers due to redundancy of trip coils, trip signals and control power supply.

- The design does not impact or degrade any other safety-related equipment or function.
- A probability assessment for this design is intended to be performed prior to detailed design and implementation.

8.3.1.1.4.1 120 VAC Class 1E Instrument Power System

STD DEP T1 2.12-2

Individual regulating transformers supply 120 VAC to the four divisions of instrument power (Figure 8.3-2). Each Class 1E divisional transformer is supplied from a 480V MCC in the same division, except for the Division IV transformer, which is supplied from the 480V MCC of Division II. There are three divisions (I, II, and III), each backed up by its associated divisional diesel generator as the source when offsite source is lost. Division IV is backed up by the Division II diesel generator, when the offsite source is lost. Power is distributed to the individual loads from distribution panels, and to logic level circuits through the control room logic panels. Transformers are sized to supply their respective distribution panel instrumentation and control loads.

8.3.1.1.8.2 Ratings and Capability

STP DEP 8.3-3

- (12) *The maximum loads expected to occur for each division (according to nameplate ratings) do not exceed ~~90%~~ 95% of the continuous power output rating of the diesel generator. See Table 8.3-1 for diesel generator loads applicable to each division.*

8.3.1.2 Analysis

STP DEP 1.1-2

- (1) *General Design Criteria (GDC)*
- (a) *Criteria: GDCs 2, 4, 5, 17, 18 and 50.*
- (2) *Regulatory Guides (RGs)*
- (l) *RG 1.81 - Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants*

STP 3 & 4 is a dual-unit station. GE Licensing Topical Report (LTR) NEDO-33325, dated May 2007, titled "Common Equipment and Structures" addresses the sharing of structures, systems and components important to safety between the two units.

8.3.2.1.3.5 Station Blackout

STD DEP Admin

Station blackout performance is discussed in Subsection 8.3.1.1.7(9) and Appendix 1C. See Subsections 9.5.13.19, 9.5.13.20, ~~and 9.5.13.21~~, and 1C.4.1 for COL license information.

8.3.2.2 Regulatory Requirements

STP DEP 1.1-2

(2) *Regulatory Guides (RGs)*

(l) RG 1.81 - Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants

STP 3 & 4 is a dual-unit station. GE Licensing Topical Report (LTR) NEDO-33325, dated May 2007, titled "Common Equipment and Structures" addresses the sharing of structures, systems and components important to safety between the two units.

8.3.4 COL License Information

8.3.4.1 Not Used

8.3.4.2 Diesel Generator Design Details

The following site-specific supplement addresses COL License Information Item 8.8.

Procurement documents for the emergency diesel generators will specify that the diesel generators will be capable of reaching full speed and voltage within 20 seconds after the signal to start and that the vendor's testing that demonstrates this capability will be witnessed by QA. Procedure(s) which implement the testing guidance provided in RG 1.9 and IEEE 387 will be developed before fuel load to test that each emergency diesel generator meets the requirement to reach full speed and voltage within 20 seconds after the start signal is initiated. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." In addition, the Technical Specifications (see Chapter 16) require periodic retesting and verification that each emergency diesel generator meets this requirement. (COM 8.3-1)

8.3.4.3 Not Used

8.3.4.4 Protective Devices for Electrical Penetration Assemblies

The following site-specific supplement addresses COL License Information Item 8.10.

Procedure(s) will be developed before fuel load that demonstrates the functional capability of the electrical penetration assembly protective devices to perform their

required safety functions. These procedures include periodic testing and calibration of the protective devices (except for fuses which will be inspected) to demonstrate their functional capability for the safety-related circuits that pass through the containment electrical penetrations assemblies. A sample of each different type of over current device is selected for periodic testing during refueling outages. The 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 air circuit breakers; and verification of long time, short time, and instantaneous trips of low voltage air circuit breakers. The procedures will be developed before fuel load consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-2)

8.3.4.5 Not Used

8.3.4.6 Not Used

8.3.4.7 Not Used

8.3.4.8 Not Used

8.3.4.9 Offsite Power Supply Arrangement

The following site-specific supplement addresses COL License Information Item 8.15.

Procedure(s) that require one of three divisional buses to be fed from an alternate source during normal operation to prevent the simultaneous de-energization of all divisional buses on the loss of one offsite power supply, will be developed prior to fuel load. Technical Specifications limit operation when both of the reserve auxiliary transformers or all three (3) unit auxiliary transformers are inoperable. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-3)

8.3.4.10 Not Used

8.3.4.11 Not Used

8.3.4.12 Not Used

8.3.4.13 Load Testing of Class 1E Switchgear and Motor Control Centers

The following site-specific supplement addresses COL License Information Item 8.19.

The availability of adequate voltage (+/-10%) at the device load from Class 1E switchgear and motor control centers for different operating scenarios will be determined by analysis. The electrical model for the analysis will be validated by site testing prior to fuel load. The capability of critical electrical equipment to operate within

+/- 10% of nominal voltage will also be confirmed by vendor testing of the system components before shipment. (COM 8.3- 4)

8.3.4.14 Administrative Controls for Bus Grounding Circuit Devices

The following site-specific supplement addresses COL License Information Item 8.20.

Plant operating procedures will provide appropriate administrative controls to assure that bus grounding circuit devices remain in the disconnect position whenever the corresponding buses are energized. Operation and maintenance procedures, that provide directions to energize or deenergize high voltage electrical equipment, will also include instructions regarding bus grounding devices to assure that they are in the correct position. These procedures will be developed prior to fuel load and be consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-5)

8.3.4.15 Administrative Controls for Manual Interconnections

The following site-specific supplement addresses COL License Information Item 8.21.

Plant operating procedure(s) to prevent paralleling of redundant onsite Class 1E power supplies from different buses and sources to power plant loads will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-6)

8.3.4.16 Not Used

8.3.4.17 Common Industrial Standards Referenced in Purchase Specifications

The following site-specific supplement addresses COL License Information Item 8.23.

The appropriate industrial standards, such as those listed in Subsection 8.3.5, for the assurance of quality manufacturing of both Class 1E and non-Class 1E equipment, will be referenced in the purchase documents.

8.3.4.18 Administrative Controls for Switching 125 VDC Standby Charger

The following site-specific supplement addresses COL License Information Item 8.24.

Plant operating procedure(s) and administrative key controls will be developed prior to fuel load to assure that all input and output circuit breakers for the standby battery charger are in the open position when the charger is not in use, and at least two circuit breakers in series are verified to be open between redundant divisions when the standby charger is placed into service (Section 8.3.2.1.3). The interlocks are also addressed in the single line diagrams (Figures 8.3-1). These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated

January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." The only exception is an emergency condition when one division's loads are assumed by a redundant division by manual connection via the standby charger interface. (COM 8.3-7)

8.3.4.19 Control of Access to Class 1E Power Equipment

The following site-specific supplement addresses COL License Information Item 8.25.

Procedure(s) that contain appropriate administrative controls to limit access to Class 1E power equipment areas and Class 1E distribution panels, will be developed prior to fuel load. Class 1E power system power supplies and distribution equipment (including diesel generators, batteries, battery chargers, CVCF power supplies, 4.16 kV switchgear, 480 V load centers, 480 V motor control centers) are all located within the Vital Area areas and access is controlled accordingly. In addition, AC and DC distribution panels are located in the same areas or similar areas as Class 1E power supplies and distribution equipment or the distribution panels are capable of being locked, so that access to circuit breakers can be administratively controlled. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-8)

8.3.4.20 Periodic Testing of Voltage Protection Equipment

The following site-specific supplement addresses COL License Information Item 8.26.

Procedure(s) which implement the testing requirements of RG 1.118 and IEEE 338 for the periodic testing of instruments, timers, and other electrical equipment designed to protect the distribution system from: (1) loss of offsite voltage, and (2) degradation of offsite voltage, will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-9)

8.3.4.21 Diesel Generator Parallel Test Mode

The following site-specific supplement addresses COL License Information Item 8.27.

Procedure(s) will be developed prior to fuel load which provide for the periodic testing of the diesel generator interlocks which restore units to emergency standby in the event of a LOCA or LOPP. Such procedures shall require that each diesel generator set be operated independently of the other sets, and be connected to the utility power system only by manual control during testing or for bus transfer. Also, such procedures shall require that the duration of the connection between the preferred power supply and the standby power supply shall be minimized in accordance with Section 6.1.3 of IEEE-308. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing

Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-10)

8.3.4.22 Periodic Testing of Diesel Generator Protective Relaying

The following site-specific supplement addresses COL License Information Item 8.28.

Procedure(s) which implement the testing requirements of RG 1.9 and IEEE 387 for periodic testing of diesel generator protective relaying, bypass circuitry, and annunciation will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-11)

8.3.4.23 Periodic Testing of Diesel Generator Synchronizing Interlocks

The following site-specific supplement addresses COL License Information Item 8.29.

Procedure(s) which implement the testing requirements of RG 1.9 and IEEE 387 for periodic testing of diesel generator synchronizing interlocks, and to prevent incorrect synchronization whenever the diesel generator is required to operate in parallel with the preferred power supply will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-12)

8.3.4.24 Periodic Testing of Thermal Overloads and Bypass Circuitry

The following site-specific supplement addresses COL License Information Item 8.30.

Procedure(s) for the periodic testing of thermal overloads and associated bypass circuitry for Class 1E MOVs to the requirements of RG 1.106 will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-13)

8.3.4.25 Periodic Inspection/Testing of Lighting Systems

The following site-specific supplement addresses COL License Information Item 8.31.

Procedure(s) for periodic inspection of all lighting systems installed in safety-related areas and in passageways leading to and from these areas and for periodic inspection of the lighting systems which are normally de-energized (e.g., DC-powered lamps), will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-14)

8.3.4.26 Controls for Limiting Potential Hazards into Cable Chases

The following site-specific supplement addresses COL License Information Item 8.32.

Procedure(s) to control and limit the introduction of potential hazards into cable chases and control room areas will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-15)

8.3.4.27 Periodic Testing of Class 1E Equipment Protective Relaying

The following site-specific supplement addresses COL License Information Item 8.33.

Procedure(s) for the periodic testing of all protective relaying and thermal overloads associated with Class 1E motors and switchgear will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-16)

8.3.4.28 Periodic Testing of CVCF Power Supplies and EPAs

The following site-specific supplement addresses COL License Information Item 8.34.

Procedure(s) for the periodic testing of CVCF power supplies (including alarms) and associated Electrical Protection Assemblies (EPAs) which provide power to the Reactor Protection System will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-17)

8.3.4.29 Periodic Testing of Class 1E Circuit Breakers

The following site-specific supplement addresses COL License Information Item 8.35.

Procedure(s) for the periodic calibration and functional testing of the fault interrupt capability of all Class 1E breakers; the fault interrupt coordination between supply and load breakers for each Class 1E load and each Division I non-Class 1E load; and each zone selective interlock feature of the breaker for each non-Class 1E load, will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-18)

8.3.4.30 Periodic Testing of Electrical Systems & Equipment

The following site-specific supplement addresses COL License Information Item 8.36.

Procedure(s) for the periodic testing of all Class 1E electrical systems and equipment in accordance with surveillance and test requirements of Section 7 of IEEE 308, will be developed prior to fuel load consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-19)

8.3.4.31 Not Used

8.3.4.32 Class 1E Battery Installation and Maintenance Requirements

The following site-specific supplement addresses COL License Information Item 8.38.

Procedure(s) for the installation, maintenance, testing and replacement of Class 1E station batteries which meet the requirements of IEEE 484 and Section 5 of IEEE 946, will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-20)

8.3.4.33 Periodic Testing of Class 1E Batteries

The following site-specific supplement addresses COL License Information Item 8.39.

Procedure(s) for the periodic testing of Class 1E station batteries in accordance with the requirements of Section 7 of IEEE 308 to ensure sufficient capacity and capability to supply power to their connected loads will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-21)

8.3.4.34 Periodic Testing of Class 1E CVCF Power Supplies

The following site-specific supplement addresses COL License Information Item 8.40.

Procedure(s) for the periodic testing of Class 1E constant voltage constant frequency (CVCF) power supplies to ensure sufficient capacity to supply power to their connected loads, will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-22)

8.3.4.35 Periodic Testing of Class 1E Battery Chargers

The following site-specific supplement addresses COL License Information Item 8.41.

Procedure(s) for the periodic testing of Class 1E battery chargers to ensure sufficient capacity to supply power to their connected loads will be developed prior to fuel load. These procedures will be developed consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-23)

8.3.4.36 Periodic Testing of Class 1E Diesel Generators

The following site-specific supplement addresses COL License Information Item 8.42.

Procedure(s) for the periodic testing and/or analysis of Class 1E diesel generators to demonstrate their capability to satisfy the criteria in Subsection 8.3.1.1.8.2, to supply the actual full design basis load current for each sequenced load step, and to manually start each diesel generator will be developed prior to fuel load. These procedures will be developed prior to fuel load consistent with the plant operating procedure development plan, which was provided to the NRC in ABWR Licensing Topical Report (LTR) NEDO-33297, dated January 2007, titled "Advance Boiling Water Reactor (ABWR) Procedures Development Plan." (COM 8.3-24)

