Enclosure 2

MFN 15-073

GEH Revised Response to RAI 08.02-2

ABWR DCD Revision 6 Markups

Tier 1, Subsection 2.12.1 (cont.)

micro-processor based

relays

(2) Controls and status indication for the UAT, RAT(s), CTG and DG Class 1E feeder circuit breakers to the Division I and II medium voltage M/C switchgear, the load circuit breakers from the Class 1E Division I and II medium voltage M/C switchgear to their respective low voltage P/C switchgear, and the low voltage feeder circuit breakers to the Class 1E Division I and II low voltage P/C switchgear.

Class 1E equipment is classified as Seismic Category I.

Class 1E equipment which is located in areas designated as harsh environment areas is qualified for harsh environments.

Monitoring of the normal and alternate power feeds on the high voltage side of the UAT and RAT using ~~the potential and current transformers of the~~ protective ~~relaying used for transformer protection is provided~~ to detect open phase conditions, whether one, two, or three phases, with or without accompanying ground fault.

All three phases of all the UAT or RAT shall be monitored for undervoltage, open phase, and ground faults by the ~~specific transformer~~ protective ~~relay~~. When an undervoltage, open phase or ground fault is detected in any combination of one, two or three phases by the designated UAT or RAT protective relay, the protective relay shall sen
the Main Control Room.

~~The UAT and RAT protective system relay automatically se~~
~~buses from the off-site power source and transfers safety-rel~~
~~power source or the emergency diesel generators.~~

The class 1E safety related bus protection relay on the breaker feeding UAT Normal Preferred Power (NPP) power to the bus will automatically separate the class 1E safety related bus from the UAT source with detection of OPC or ground faults and fast transfer the bus to the APP source. The class 1E safety related bus protection relay on the breaker feeding RAT Alternate Preferred Power (APP) power to the bus will automatically separate the class 1E safety related bus from the RAT source with detection of OPC or ground faults and fast transfer the bus to the NPP source. If the protection relays determine the bus remains faulted, both (NPP and APP) feeds will be separated and the emergency diesel generators started.

Interface Requirements

The portions of the EPD System which are not part of the C
following requirements:

The offsite system shall consist of a minimum of two indepe
from the TN.

Voltage variations of the offsite TN during steady state ope
variations at the loads of more than plus or minus 10% of th

The normal steady state frequency of the offsite TN shall be within plus or minus 2 hertz of 60 hertz during recoverable periods of system instability.

The offsite transmission circuits from the TN through and including the main step-up power transformers and RAT(s) shall be sized to supply their load requirements, during all design operating modes, of their respective Class 1E divisions and non-Class 1E load groups.

The impedances of the main step-up power transformers and RAT(s) shall be compatible with the interrupting capability of the plant's circuit interrupting devices.

micro-processor based protective relay

micro-processor based protective relay

Table 2.12.1 Electric Power Distribution System (C[illegible])

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
26. Monitoring of the high voltage side of the normal power feed (attached to the UATs) and the alternate power feed (attached to the RAT) using the ~~potential and current transformers of the protective relaying~~ used for transformer protection is provided to detect open phase conditions, whether one, two, or three phases, with or without accompanying ground fault.	26. An analysis of the transformer protection scheme will be performed to verify the following: a. ~~Protective relay current and potential transformers~~ have been correctly located. b. Relay set points can provide adequate detection.	26. An analysis demonstrates: a. The correct location of the ~~current and potential transformers~~ for each UAT and RAT transformer protection relay. b. Protective relay set points ensure that the monitoring systems can adequately detect open phase conditions in any combination of the three phases, with or without accompanying ground faults, on the high-voltage side of the UAT and RAT transformers. c. The trip setpoint is sufficient to provide detection of open phase conditions while minimizing spurious indications under conditions which may be normally expected in the transmission system.
27. All three phases of ~~all~~ the UATs ~~or~~ RAT shall be monitored for undervoltage, open phase, and ground faults by the ~~specific transformer~~ protective relay. When an undervoltage, open phase or ground fault is detected in any combination of one, two or three phases by the designated UATs ~~or~~ RAT protective relay, the protective relay shall send an alarm via the alarm system to the Main Control Room.	27. A test will be performed on the as-built monitoring system, using simulated signals, to demonstrate that, at the designated protective relay set points, each UAT and RAT monitoring system alarms in the Main Control Room.	27. Using simulated signals, at the designated protective relay set points in any combination of the three phases, the as-built UAT and RAT monitoring systems initiate an alarm in the Main Control Room.
28. Each UAT and RAT protective system relay automatically separates the Class 1E safety-related buses from the offsite power source and transfers safety-related loads to the unaffected offsite power source or the emergency diesel generators.	28. A test will be performed on each as-built UAT and RAT protective system relay, using simulated signals, to demonstrate that, at the designated protective relay set points, each UAT and RAT monitoring system transfers loads.	28. Using simulated signals, at the designated protective relay set points in any combination of the three phases, the as-built UAT and RAT monitoring systems initiate a transfer of loads.

of the primary and secondary sides

micro-processor based

and

Add Item 27(a) per insert (A)

Insert (A)

Table 2.12.1 Electric Power Distribution System (Continued)

Inspections, Tests, Analyses and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
27(a) All three phases of the high voltage side of the MPT shall be monitored for undervoltage, open phase, and ground faults by the micro-processor based protective relay. When an undervoltage, open phase or ground fault is detected in any combination of one, two or three phases by the MPT protective relay, the protective relay shall send an alarm via the alarm system to the Main Control Room.	27(a) A test will be performed on the as-built monitoring system, using simulated signals, to demonstrate that, at the designated protective relay set point, MPT monitoring system alarms in the Main Control Room.	27(a). Using simulated signals, at the designated protective relay set points in any combination of the three phases, the as-built MPT monitoring systems initiate an alarm in the Main Control Room.

Table 1.9-1 Summary of ABWR Standard Plant COL License Information (Continued)

Item No.	Subject	Subsection
8.4	Offsite Power Systems Design Bases	8.2.4.3
8.5	Offsite Power Systems Scope Split	8.2.4.4
8.6	Capacity of Auxiliary Transformers	8.2.4.5
8.7	Monitoring and Protection Against Design Vulnerabilities	8.2.4.6
8.8	Diesel Generator Design Details	8.3.4.2
8.9	Not Used	8.3.4.3
8.10	Protective Devices for Electrical Penetration Assemblies	8.3.4.4
8.11	Not Used	8.3.4.5
8.12	Not Used	8.3.4.6
8.13	Not Used	8.3.4.7
8.14	Not Used	8.3.4.8
8.15	Offsite Power Supply Arrangements	8.3.4.9
8.16	~~Not Used~~	8.3.4.10
8.17	~~Not Used~~	8.3.4.11
8.18	Not Used	8.3.4.12
8.19	Load Testing of Class 1E Switchgear and Motor Control Centers	8.3.4.13
8.20	Administrative Controls for Bus Grounding Ci	8.3.4.14
8.21	Administrative Controls for Manual Interconne	8.3.4.15
8.22	Not Used	8.3.4.16
8.23	Common Industrial Standards Referenced in Purchase Specifications	8.3.4.17
8.24	Administrative Control for Switching 125Vdc Standby Charger	8.3.4.18
8.25	Control of Access to Class 1E Power Equipment	8.3.4.19
8.26	Periodic Testing of Voltage Protection Equipment	8.3.4.20
8.27	Diesel Generator Parallel Test Mode	8.3.4.21
8.28	Periodic Testing of Diesel Generator Protective Relaying	8.3.4.22
8.29	Periodic Testing of Diesel Generator Synchronizing Interlocks	8.3.4.23
8.30	Periodic Testing of Thermal Overloads and Bypass Circuitry	8.3.4.24
8.31	Periodic Inspection/Testing of Lighting System	8.3.4.25
8.32	Controls for Limiting Potential Hazards Into Cable Chases	8.3.4.26
8.33	Periodic Testing of Class 1E Equipment Protective Relaying	8.3.4.27

Mitigation of Open Phase Condition on RAT and UATs

Mitigation of Open Phase Condition on Main Power Transformer (MPT)

8.3.1.1.6.2 Grounding Methods

Station grounding and surge protection is discussed in Section 8A.1. The medium voltage (6.9 kV) system is low resistance grounded except that each diesel generator is high resistance grounded to maximize availability.

See Subsection 8.3.4.14 for COL license information pertaining to administrative control for bus grounding circuit breakers.

8.3.1.1.6.3 Bus Protection

Bus protection is as follows:

(1) 6.9 kV bus incoming circuits have inverse time over-current, ground fault, bus differential, unbalanced phase condition and under-voltage protection. The undervoltage and unbalanced phase monitoring is responsive to all three phases. The monitoring is effective for both load shedding and emergency diesel start and protection of the safety-related bus loads for grounds and loss of one or more phases.

(2) 6.9 kV feeders for power centers have instantaneous, inverse time over-current and ground fault protection.

Micro-processor based relays will be added to the protection scheme that automatically sense loss of a single, or multiple phases, and loss of phase with ground during all plant operating scenarios and loading conditions. In addition to detecting open phase condition (OPC), alarm function in the main control room (MCR) will be provided. The protective relay schemes will be designed to add specific algorithms that will be utilized via the microprocessor based relays to detect and isolate downstream circuit breaker(s) that feed the class 1E busses thereby protecting safety-related equipment.

ger building substations have inverse time over-
tion.

arters have instantaneous, inverse time over-current,
on.

eder circuits have inverse time over-current and

(6) Nonsafety-related buses A4, B4, C4, and the new H bus are monitored by their own protective relays and will trip power to the safety-related buses on detection of abnormal voltages and frequency, including loss of one or more phases and ground conditions.

8.3.1.1.6.4 Protection Requirements for Diesel Generators

Protective devices of the diesel generators meet all requirements of IEEE-603. When the diesel generators are called upon to operate during LOCA conditions, the only protective devices which shut down the diesel are the generator differential relays, and the engine over-speed trip. These protection devices are retained under accident conditions to protect against possible, significant damage. Other protective relays, such as loss of excitation, anti-motoring (reverse power), over-current voltage restraint, low jacket water pressure, high jacket water temperature, and low lube oil pressure, are used to protect the machine when operating in parallel with the

(7) The Main Power Transformer (MPT), RAT and the UATs will be monitored on the primary side for OPC, over-current, ground fault, under voltage and unbalance phase on all three phases. In addition, the RAT and the UATs will be monitored on the secondary side for OPC, over-current, ground fault, under voltage and unbalance phase on all three phases. Alarms in the MCR will alert the operator to an abnormal condition. The COL applicant will develop procedures and train operators on how to respond to MCR alarms indicating abnormal conditions including OPC on the MPT, RAT and the UATs as stated in Sections 8.3.4.10 and 8.3.4.11.

Mitigation of Open Phase Condition on RAT and UATs
The COL applicant shall develop procedures and train operators on how to detect, respond and mitigate MCR alarms indicating Open Phase Conditions (OPC) and other abnormal conditions on the RAT and the UATs.

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 COL applicant operating procedures shall require one of the three divisional buses of Figure 8.3-1 be fed by the alternate power source during normal operation; in order to prevent simultaneous de-energization of all divisional buses on the loss of only one of the offsite power supplies. The selection of that division should be based on the Class 1E bus loads, the reliability/stability of the offsite circuits, and on the separation of the offsite feeds as they pass through the divisional areas.

Continued plant operation will be appropriately limited when the reserve auxiliary transformer is inoperable. See 8.2.4 for COL license information requirements.

Mitigation of Open Phase Condition on Main Power Transformer (MPT)
The COL applicant shall describe instrumentation, develop procedures and train operators on how to detect and respond to MCR alarms indicating Open Phase Conditions (OPC) and other abnormal conditions on the high voltage side of the MPT.

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 COL applicant will provide procedures for load testing the Class 1E switchgear and motor control centers by operating connected Class 1E loads at 9% to 10% above, and 9% to 10% below design voltage.

8.3.4.14 Administrative Controls for Bus Grounding Circuit Breakers

Figure 8.3-1 shows bus grounding circuit breakers, which are intended to provide safety grounds during maintenance operations. Administrative controls shall be provided by the COL applicant to keep these circuit breakers racked out (i.e., in the disconnect position) whenever corresponding buses are energized (Subsection 8.3.1.1.6.2).

8.3.4.15 Administrative Controls for Manual Interconnections

As indicated in Subsection 8.3.1.2(4)(b), the ABWR has capability for manually connecting any plant loads to receive power from any of the six sources. Appropriate plant operating procedures shall prevent paralleling of the redundant onsite Class 1E power supplies.