



HITACHI

GE Hitachi Nuclear Energy

Richard E. Kingston
Vice President, ESBWR Licensing

PO Box 780
3901 Castle Hayne Road, M/C A-65
Wilmington, NC 28402 USA

T 910 819 6192
F 910 362 6192

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Subject: **Response to Portion of NRC Request for Additional Information
Letter No. 296 Related to ESBWR Design Certification Application
– Electrical Power - RAI Numbers 8.1-20, 8.1-21, 8.2-15, and 8.2-16**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) responses to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAIs) sent by NRC letter No. 296, dated January 13, 2009 (Reference 1).

GEH responses to RAIs 8.1-20, 8.1-21, 8.2-15, and 8.2-16 are provided in Enclosure 1. Enclosure 2 provides any affected DCD Sections.

Sincerely,

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 09-052 - Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 296 Related To ESBWR Design Certification Application*, dated January 13, 2009

Enclosure:

1. MFN 09-101 -Response to Portion of NRC Request for Additional Information Letter No. 296 Related to ESBWR Design Certification Application – Electrical Power - RAI Numbers 8.1-20, 8.1-21, 8.2-15, and 8.2-16
2. MFN 09-101 -Response to Portion of NRC Request for Additional Information Letter No. 296 Related to ESBWR Design Certification Application – Electrical Power - RAI Numbers 8.1-20, 8.1-21, and 8.2-16 DCD markups.

cc: AE Cabbage USNRC (with enclosure)
RE Brown GEH/Wilmington (with enclosure)
DH Hinds GEH/Wilmington (with enclosure)
RM Wachowiak GEH/Wilmington (with enclosure)

eDRFs 0000-0098-7224 (RAI 8.1-20)
0000-0098-7229 (RAI 8.1-21)
0000-0098-7222 (RAI 8.2-15)
0000-0098-7231 (RAI 8.2-16)

Enclosure 1

MFN 09-101

Response to Portion of NRC Request

for Additional

Information Letter No. 296 Related to ESBWR

Design Certification Application

Electrical Power

RAI Numbers

8.1-20, 8.1-21, 8.2-15, and 8.2-16

NRC RAI 8.1-20

The response to NRC RAI 14.3-394 S01 states that the ESBWR design complies with GDC 17 and the preferred power supply definition per IEEE 765. In addition, DCD Tier 2, Table 1.9-22 states that IEEE 765 is applicable to the ESBWR design. However, DCD Tier 1, Figure 8.1-1, "Electrical Power Distribution System " incorrectly identifies offsite and onsite power boundaries. Clarify the offsite and onsite power boundaries by revising Figure 8.1-1 and DCD Tier 2, Section 8 to be consistent with GDC 17, IEEE 765 and SRP 8.2. Also, modify Tier 1 Section 2.13 as necessary.

GEH Response

To avoid future confusion, GEH will remove "Onsite Power" and "Offsite Power" from the existing boundary shown on DCD Tier 2, Figure 8.1-1 and DCD Tier 1, Figure 2.13.1-1. The boundary will remain in the location presently shown, but will be marked to read only "Switchyard" and "Turbine Island/Transformer Yard."

As GEH described in the response to RAI 14.3-394 S01 (MFN 08-917), GEH has incorporated the Preferred Power Supply (PPS) definition into DCD Tier 2, Chapter 8 per IEEE 765. This was done to clarify the applicability of GDC 17, as the response to RAI 14.3-394 S01 went on to clarify that GDC 17 applies to the entire PPS. Further, the response to RAI 14.3-394 S01 detailed that the PPS is comprised of both offsite and onsite portions, and the interface between the ESBWR certified onsite design and the site specific offsite design for both the Normal Preferred Power Supply and the Alternate Preferred Power Supply was clarified in the response's enclosed Revision 6 markup to DCD Tier 2, Chapter 8, Subsection 8.1.2.2.

Concurrent with the response to RAI 14.3-394 S01, GEH remains compliant with GDC 17 and the PPS definition per IEEE 765. However, the description of which portions of the PPS are "offsite" and which are "onsite" is not prescribed by IEEE 765. The boundary between "onsite power" and "offsite power" in the ESBWR design is meant to distinguish which portions of the design are part of the ESBWR standard plant (included in DCD Tier 2, Section 8.3) and which portions are site specific (included in DCD Tier 2, Section 8.2). No further changes to DCD Tier 2, Chapter 8 text or DCD Tier 1 ITAAC will be made at this time.

DCD Impact

DCD Tier 2, Figure 8.1-1 and DCD Tier 1, Figure 2.13.1-1 will be revised in Revision 6 as noted in the attached markup.

NRC RAI 8.1-21

ESBWR DCD Rev.5, Table 8.1-1 indicates that RG 1.155 (NUMARC 8700) is not applicable to offsite power system and AC (onsite) power system. The staff finds that RG 1.155, Section 3.4, "Procedures and Training To Cope with Station Blackout (SBO)," is applicable to passive plants. 10 CFR 50.63 (c) (1) (ii) requires a description of the procedures that will be implemented for station blackout events and recovery therefrom. Procedures include: Station Blackout Response Guidelines, AC Power Restoration, and Severe Weather Guidelines per NUMARC 8700 which is endorsed by RG 1.155. Revise Table 8.1-1 to indicate that RG 1.155 is applicable to offsite power system and AC (onsite) power system with respect to SBO procedures and training. COL applicant should address SBO procedures and training. This should be a COL action item in the DCD.

GEH Response

The passive ESBWR design does not credit any AC power or operator action for 72 hours following an event. Thus, the ESBWR meets the intent of RG 1.155 with power from its 72-hour safety-related batteries. The Staff in SECYs 94-084 and 95-132 addressed the improved SBO coping of passive plants. The ESBWR Station Blackout evaluation may be found in DCD Tier 2, Section 15.5.

After 72 hours, required loads will be powered from the Ancillary Diesel Generators, or the Standby Diesel Generators or offsite power if available. Emergency Procedures will cover the starting and connection of the diesels and restoration of AC power, as required by Section 3.4 of RG 1.155. The development of procedures is described in DCD Tier 2, Subsection 13.5.2 and is covered by COLA items found in DCD Tier 2, Subsection 13.5.3. Training is described in DCD Tier 2, Section 13.2, and COLA items for training are covered in DCD Tier 2, Subsection 13.2.5. Training Program Development is addressed in DCD Tier 2, Section 18.10.

However, these subsections do not specifically address SBO events. Instead, they commit to procedures and training for all plant normal, abnormal, and emergency events. This would include SBO. To mark this commitment, a note will be added to DCD Tier 2, Table 8.1-1 to state that procedures and training for coping with and recovering from an SBO are developed per Sections 13.2 and 13.5. This note will specify procedures for SBO Response Guidelines, AC Power Restoration, and Severe Weather Guidelines.

No additional COLA items to address SBO are required in DCD Tier 2, Chapter 8.

DCD Impact

DCD Tier 2, Table 8.1-1 will be revised in Revision 6 as noted in the attached markup.

NRC RAI 8.2-15

DCD Table 8.1-1 indicates that GDC 18 is applicable to offsite power system and AC (onsite) power system. Therefore both the COL applicant and the DC Applicant are responsible for the offsite power system . Include a COL item for the testing and maintenance of the offsite power system . Additionally, provide a discussion how the GDC 18 (including testing frequency) will be met for the portion of the offsite system (Motor Operated Disconnect (MOD), Unit Auxiliary Transformer (UAT) high side breaker, UAT, Plant Investment Protection (PIP) bus, 6.9/0.48 kV transformer for normal preferred power supply and MOD, (Reserve Auxiliary Transformer) RAT, PIP bus, 6.9/0.48 kV transformer for alternate preferred power supply) that is with the DCD's scope.

GEH Response

GEH agrees that both the COL applicant and the DC applicant are responsible for the Preferred Power System (offsite and onsite power systems) and the requirements of GDC 18. However, as explained in paragraphs below, GEH believes that placement of another COL item for maintenance and testing frequency in Chapter 8 of the DCD is redundant to COL items already in place and may cause confusion during the COLA item closure process.

The ESBWR does not require AC power (other than that provided by the uninterruptible power supplies) to achieve safe shutdown or to perform any safety-related function. All safety-related loads are normally supplied directly through DC-to-AC inverters. Capability is provided for testing each battery, rectifier, battery charger, and inverter without disrupting power to the safety-related loads. Refer to DCD Chapter 14, Subsection 14.2.8.1.35 for description of DC Power Supply System Preoperational Test and DCD Tier 2, Chapter 16, Sub-section 3.8 (Electrical Power Systems) for surveillance test requirements and the frequency of these tests.

NUREG 0800 designates DCD Tier 2 Chapter 13 to addresses plant operations and maintenance procedures. DCD Tier 2 Chapter 13, Subsection 13.5 states in part, “ Plant procedures are developed to provide control for activities that are for safe operation of the facility. The applicable portions of Regulatory Guide 1.33 Rev. 2 (Reference 13.5-5) concerning plant procedures shall be followed.”

Appendix A, section 4 (w) of Regulatory Guide 1.33 identifies the procedure requirement for various systems and paragraph 4(w) states in part as follows:

“4 (w). Electrical System

(1) Offsite (access circuits)

(2) Onsite

(a) Emergency Power Source (e.g., diesel generator, batteries)

(b) A.C. System

(c) D.C. System”

In compliance to above requirements, DCD, Subsection 13.5.3 COL Information states in part:

“13.5-2-A - Plant Operating Procedures Development Plan
The development of Operating and Maintenance Procedures is the responsibility of the COL Applicant....”

“13.5-6-H - Procedures for Calibration, Inspection and Testing
The COL Holder shall develop Calibration, Inspection and Testing Procedures....”

Motor Operated Disconnects (MODs), Unit Auxiliary Transformer (UAT) high side breaker, UAT, Plant Investment Protection (PIP) bus, 6.9/0.48 kV transformer for normal preferred power supply, (Reserve Auxiliary Transformer) RAT, PIP bus, 6.9/0.48 kV transformer for alternate preferred power supply are within the AC electrical system.

This equipment is part of the preferred power supply as described in response to RAI 14.3-394 S01 (Ref: MFN 08-917, dated 12/9/08) and will be covered by procedures for testing and maintenance as described by COL actions above. These procedures will state the frequency requirements for tests and maintenance.

Based on the discussion above, ESBWR standard plant design complies with the requirements of GDC 18 for both the offsite and onsite Preferred Power System. Therefore, no duplicate COL item will be added in Chapter 8 of the DCD.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 8.2-16

ESBWR DCD Rev. 5, Section 8.2.4, indicates that COL applicant will address switchyard transformer protection. The main transformer, unit auxiliary transformers (UAT) and reserve auxiliary transformers (RAT) are not located in the switchyard. Per SRP 8.2 and discussed in RAI 8.1-21, these transformers are part of the offsite circuits. Discuss the protection of these transformers and isolated phase bus and non-segregated bus. Additionally, provide the rating of these devices.

GEH Response

GEH has addressed the boundary between onsite and offsite power in the response to RAI 8.1-20. However, GEH recognizes the SRP requirement to address the protection of the Preferred Power Supply (PPS) components, and the importance of this transformer protection to ensure that loss of one preferred system circuit will not cause or result in the loss of its redundant counterpart. Therefore, DCD Tier 2, Subsection 8.3.1.1, Revision 6 will be modified to add that the main transformers, UATs, and RATs have protection for overcurrent, differential current, ground overcurrent, and sudden overpressure. Subsection 8.3.1.1 will also add that the isolated phase bus and non-segregated bus are protected against overcurrent and bus differential.

The ratings of the requested devices will not be known until the completion of ESBWR detailed design, and therefore cannot be provided at this time. However, the response to RAI 14.3-394 S01 (MFN 08-917) added ITAAC #9 to DCD Tier 1, Subsection 2.13.1 to ensure the equipment within the onsite portion of the PPS is rated to supply necessary load requirements including power, voltage, and frequency during design basis operating modes. This ITAAC will confirm that the transformers and buses are sized and rated appropriately.

DCD Impact

DCD Tier 2, Subsection 8.3.1.1 will be revised in Revision 6 as noted in the attached markup.

MFN 09-101

Enclosure 2

**Response to Portion of NRC Request for Additional
Information Letter No. 296 Related to ESBWR**

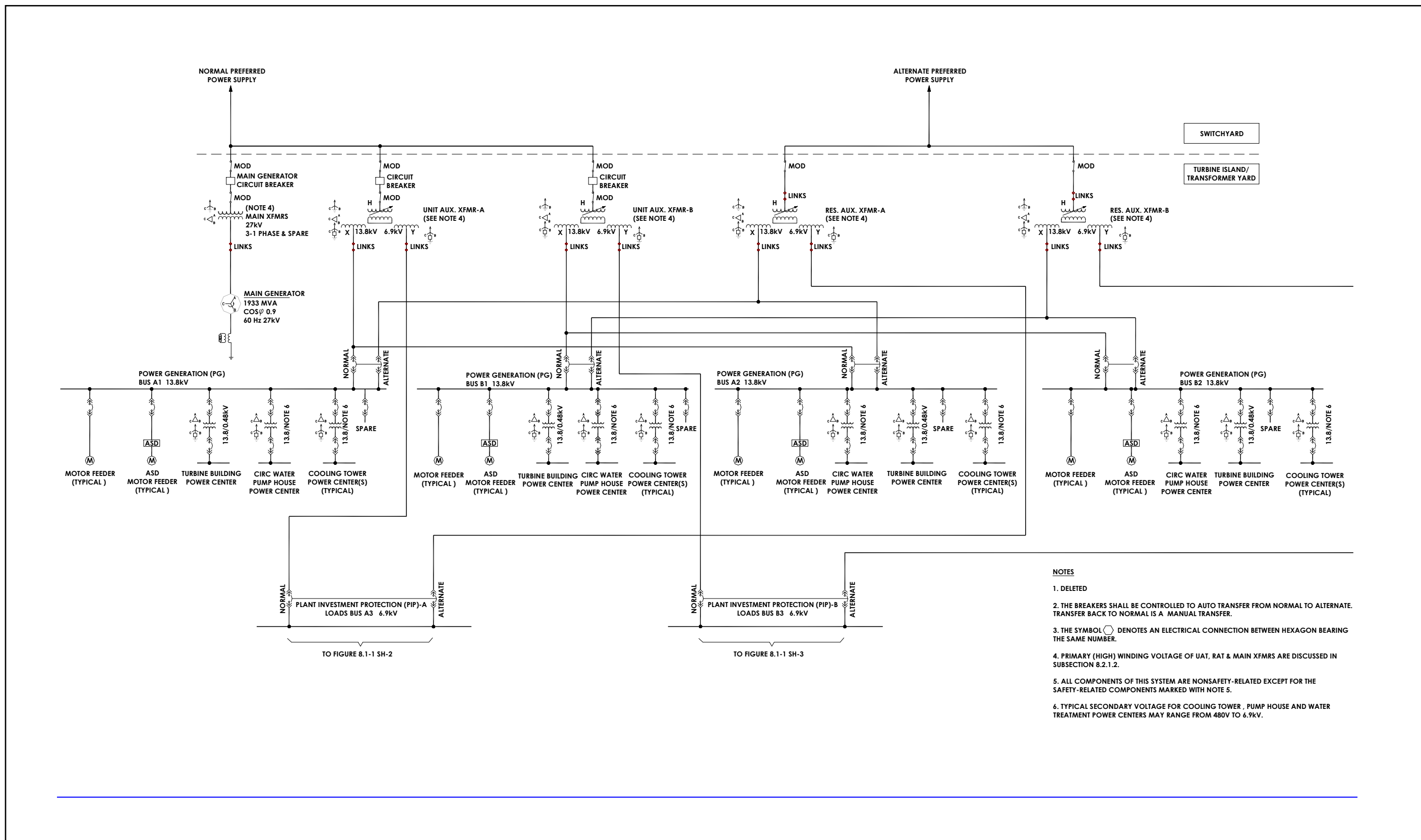
Design Certification Application

Electrical Power

RAI Numbers

8.1-20, 8.1-21, and 8.2-16

DCD Markups



- NOTES**
1. DELETED
 2. THE BREAKERS SHALL BE CONTROLLED TO AUTO TRANSFER FROM NORMAL TO ALTERNATE. TRANSFER BACK TO NORMAL IS A MANUAL TRANSFER.
 3. THE SYMBOL \square DENOTES AN ELECTRICAL CONNECTION BETWEEN HEXAGON BEARING THE SAME NUMBER.
 4. PRIMARY (HIGH) WINDING VOLTAGE OF UAT, RAT & MAIN XFMRs ARE DISCUSSED IN SUBSECTION 8.2.1.2.
 5. ALL COMPONENTS OF THIS SYSTEM ARE NONSAFETY-RELATED EXCEPT FOR THE SAFETY-RELATED COMPONENTS MARKED WITH NOTE 5.
 6. TYPICAL SECONDARY VOLTAGE FOR COOLING TOWER, PUMP HOUSE AND WATER TREATMENT POWER CENTERS MAY RANGE FROM 480V TO 6.9kV.

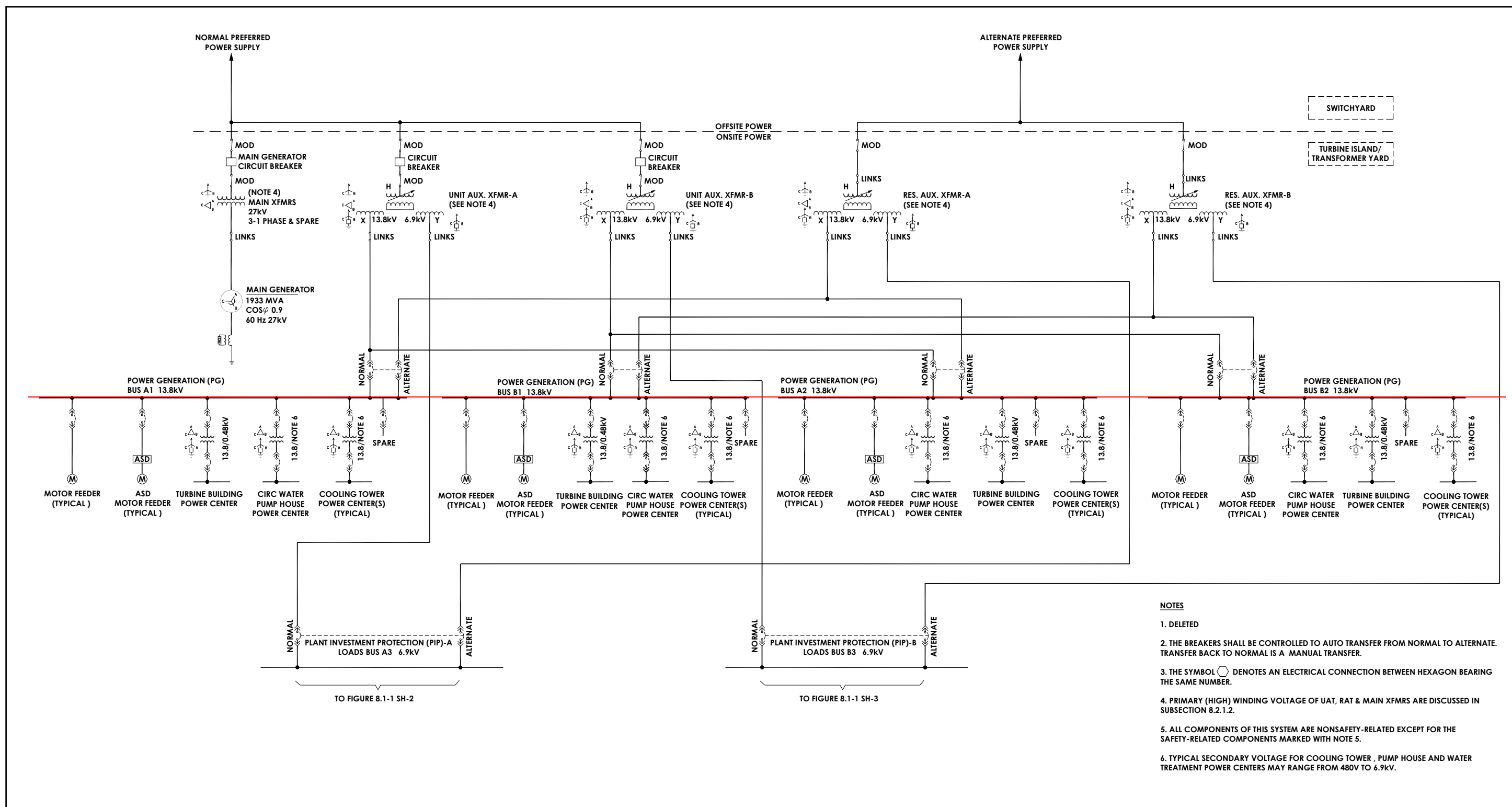
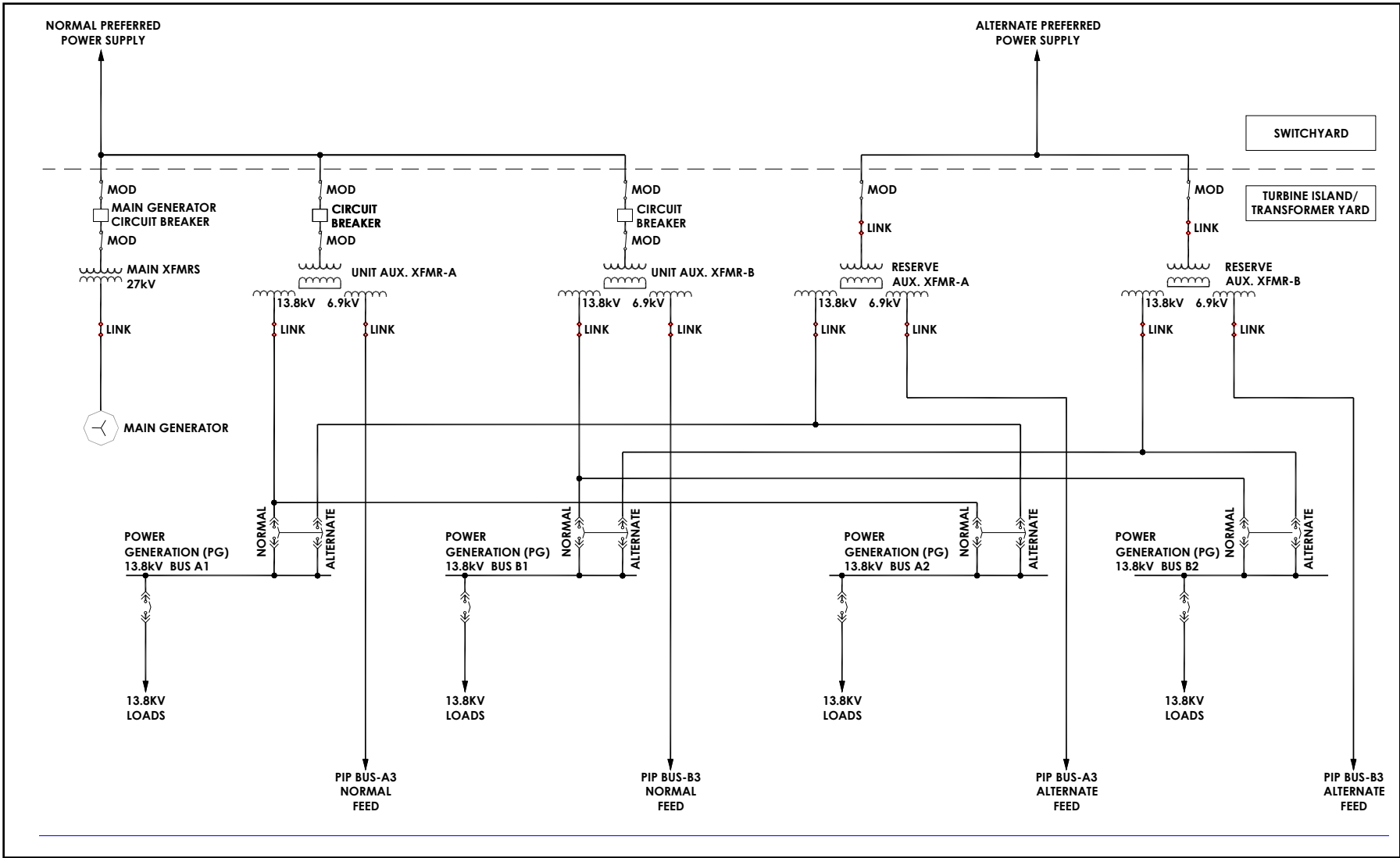


Figure 8.1-1. Electrical Power Distribution System

Sh 1 of 3



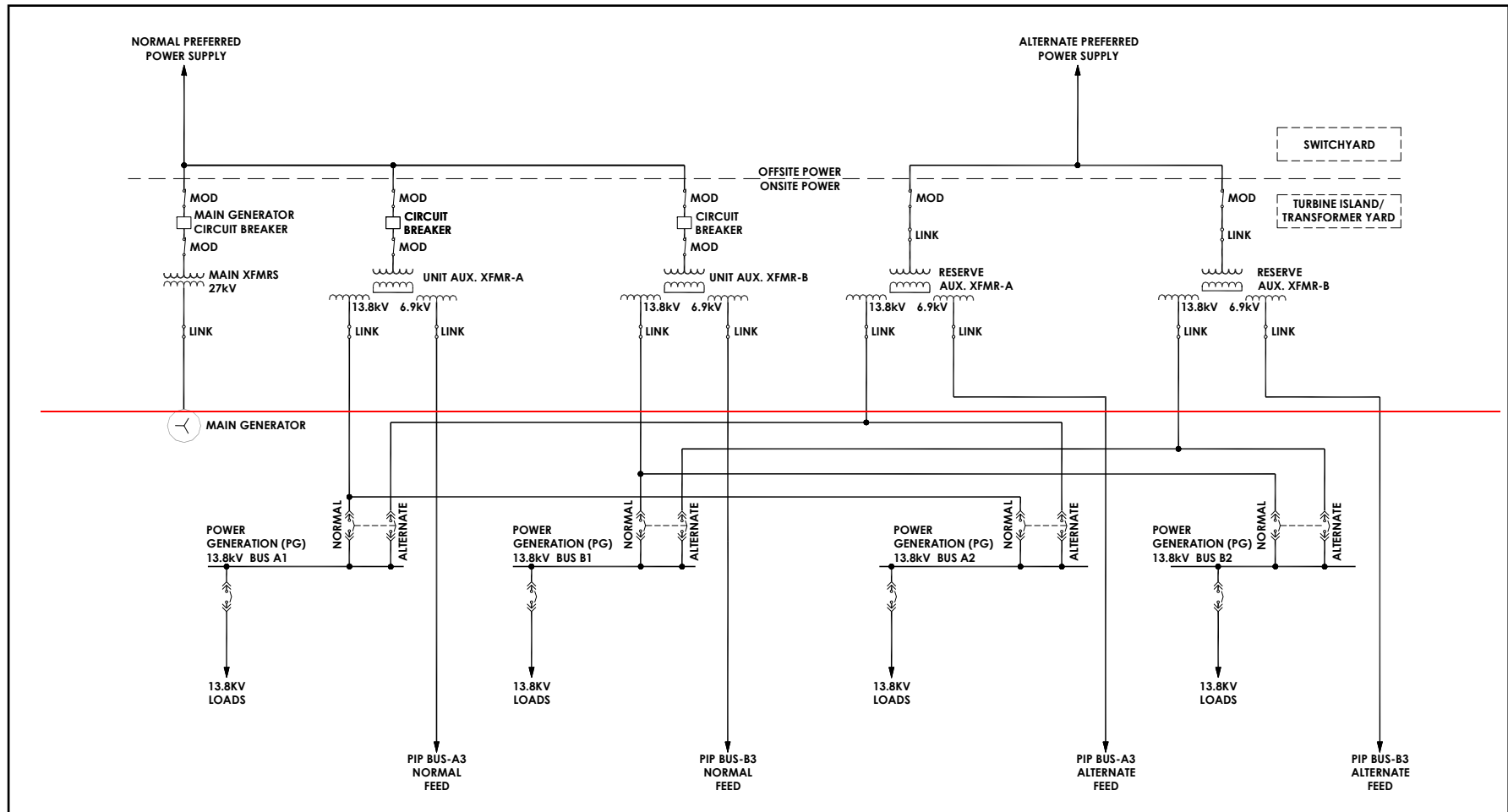


Figure 2.13.1-1 Sh 1.
~~Onsite AC Power System~~ Electric Power Distribution System Functional Arrangement

**Table 8.1-1
Onsite Power System SRP Criteria Applicability Matrix**

Applicable Criteria		IEEE Standard	Notes	Offsite Power System	AC (Onsite) Power System	DC (Onsite) Power System
GDC	2		7			X
GDC	4		7			X
GDC	5		1			
GDC	17		7, 8	X	X	X
GDC	18		7	X	X	X
GDC	50				X	X
10 CFR	50.34(f)(2)(v)		6			
10 CFR	50.34(f)(2)(xiii)		2			
10 CFR	50.34(f)(2)(xx)		2			
10 CFR	50.63		7			X
RG	1.6			X	X	X
RG	1.9		3			
RG	1.32	308, 1188	7			X
RG	1.47		7			X
RG	1.53	379,603	7			X
RG	1.63	242, 317, 741			X	X
RG	1.75	384	7			X
RG	1.81		1			
RG	1.106					
RG	1.118	338, 603	7			X
RG	1.128	485, 344, 323, 1187				X
RG	1.129	1188				X
RG	1.153	603	7			X
RG	1.155 (NUMARC 8700)		7.9			X
RG	1.160 (NUMARC 93-01)			X	X	X
RG	1.204	665, 666, 1050, C62.23		X	X	
BTP	ICSB 4		2			

Table 8.1-1
Onsite Power System SRP Criteria Applicability Matrix

Applicable Criteria		IEEE Standard	Notes	Offsite Power System	AC (Onsite) Power System	DC (Onsite) Power System
BTP	ICSB 8		3			
BTP	ICSB 11			X		
BTP	ICSB 18					
BTP	ICSB 21		7			X
BTP	PSB 1				X	
BTP	PSB 2		3			
NUREG-0718			6			
NUREG-0737			5			
NUREG/CR-0660			3			
TMI Action Item II.E.3.1			2			
TMI Action Item II.G.1			2			

Notes:

- (1) Noted criteria are applicable to multiple unit plants only, and are not applicable to the single-unit ESBWR.
- (2) The criterion is only applicable to PWRs, and thus, is not applicable to the ESBWR.
- (3) The ESBWR Standard Plant does not have safety-related diesel-generators, and thus, this criterion is not applicable to the ESBWR.
- (4) (Deleted)
- (5) Covered by 10 CFR 50.34(f)(2)(xiii) and 50.34(f)(2)(xx).
- (6) Not applicable to the ESBWR: 10 CFR 50.34 (f) and NUREG 0718 apply only to the pending applications at February 16, 1982.
- (7) The safety-related UPS system and the safety-related 480 VAC Isolation Power Centers are included in the DC onsite applicability column.
- (8) Refer to Subsection 8.1.5.2.4, GDC 17, for electric power source availability requirements.

(9) Procedures and training for SBO Response Guidelines, AC Power Restoration, and Severe Weather Guidelines are developed per Sections 13.2 and 13.5.
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8.3 ONSITE POWER SYSTEMS

8.3.1 AC Power Systems

8.3.1.1 Description

The main power transformer is within the onsite power system and consist of three single-phase transformers and an installed spare.

The UATs consist of two, three-phase transformers. The UATs provide normal preferred offsite power or main generator island mode power to each of the plant's two power generation and plant investment protection load groups.

The RATs consist of two three-phase transformers fed from the alternate preferred offsite power source. The RATs provide alternate preferred power to the plant's two power generation and plant investment protection load groups.

The RATs are of the same size as the UATs, and each functions as a backup power source in the event of a UAT failure.

The UAT and RAT are physically separated by distance or physical barriers so as to minimize to the extent practical the likelihood of their simultaneous failure under design basis conditions.

The main power transformers, UATs and RATs, are designed and constructed to withstand the mechanical and thermal stresses produced by external short circuits, and meet the corresponding requirements of IEEE Standard C57.12.00 (Reference 8.3-12). The main power transformers, UATs, and RATs have protective devices for overcurrent, differential current, ground overcurrent, and sudden overpressure.

An onsite main generator circuit breaker is provided with capability of interrupting the maximum available fault current. The main generator circuit breaker is sized and designed in accordance with IEEE Standard C37.010 (Reference 8.3-28). The main generator circuit breaker allows the generator to be taken off line and the main grid to be utilized as an immediate access power source for the onsite AC power system. Start-up power is normally provided through the UATs from the offsite power system.

The onsite isolated phase bus duct provides the electrical interconnection between the main generator output terminals and the low voltage terminals of the main transformers. The isolated phase bus duct is protected against overcurrent and bus differential.

Onsite non-segregated phase bus duct provide for the electrical interconnection between the RATs and the 13.8 kV and 6.9 kV switchgear buses and are physically separated from the bus ducts provided for the interconnection of the UATs and the switchgear buses to minimize to the extent practical the likelihood of simultaneous failure under design basis conditions. The non-segregated phase bus duct is protected against overcurrent and bus differential.

Disconnect links are provided for the main transformers so that a failed transformer may be taken out of service and the installed spare connected.

Input isolation breakers (Reference 8.3-26), MODs, and disconnect links are provided for the UATs so that a failed transformer may be taken out of service. On loss of power from the UATs,