September 26, 2006

Mr. David H. Hinds, Manager, ESBWR
General Electric Company
P.O. Box 780, M/C L60
Wilmington, NC 28402-0780

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 65 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Hinds:

By letter dated August 24, 2005, General Electric Company (GE) submitted an application for final design approval and standard design certification of the economic simplified boiling water reactor (ESBWR) standard plant design pursuant to 10 CFR Part 52. The Nuclear Regulatory Commission (NRC) staff is performing a detailed review of this application to enable the staff to reach a conclusion on the safety of the proposed design.

The NRC staff has identified that additional information is needed to continue portions of the review. The staff's request for additional information (RAI) is contained in the enclosure to this letter. This RAI concerns Chapters 3, 8, and 9 of the ESBWR Design Control Document.

Chapter 3:	3.2-63 through 3.2-65; 3.10.7
Chapter 8:	8.1-1 through 8.1-14; 8.2-1 through 8.2-12; 8.3-1 through 8.3-48; 8.4-1 through 8.4-10; and 8.5-6 through 8.5-15
Chapter 9:	9.5-27 through 9.5-42

To support the review schedule, you are requested to respond to this RAI by November 22, 2006.

If you have questions or comments concerning this matter, please contact me at (301) 415-0224 or tak@nrc.gov or you may contact Amy Cubbage at (301) 415-2875 or aec@nrc.gov.

Sincerely,

/RA/

Thomas A. Kevern, Sr. Project Manager
ESBWR/ABWR Projects Branch
Division of New Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 52-010

Enclosure: As stated

cc: See next page

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Chapter 3:	3.2-63 through 3.2-65; 3.10.7
Chapter 8:	8.1-1 through 8.1-14; 8.2-1 through 8.2-12; 8.3-1 through 8.3-48; 8.4-1 through 8.4-10; and 8.5-6 through 8.5-15
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cc: See next page
ACCESSION NO. ML062680110

OFFICE	NESB/PM	NESB/BC(A)
NAME	TKevern	JColaccino
DATE	09/25/2006	09/26/2006

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Requests for Additional Information (RAIs)
ESBWR Design Control Document (DCD) Tier 2, Revision 1, Chapter 3, 8, and 9

RAI Number	Reviewer	Question Summary	Full Text
3.2-63	Morris G Gill P	Classification of non-safety SSCs required to support safety-related components - components required following discharge of batteries.	Table 3.2-1, Classification Summary, indicates that the Medium Voltage Distribution System, R11, the Low Voltage Distribution System, R12, and the Standby alternating current (ac) Power Supply, R21, are non safety-related and non-seismic. Describe how the batteries will be recharged following their design basis discharge if the non safety-related systems R11, R12 and R21 have been destroyed in a seismic event. All paths and components required to maintain the plant shutdown and provide residual core cooling following the discharge of the batteries should be seismic category I.
3.2-64	Morris G Gill P	Classification of non-safety SSCs required to support safety-related components - physical separation between safety and non-safety components.	Table 3.2-1, Classification Summary, differentiates between electrical modules and cables with and without safety functions. Is it your intent to have the safety-related modules separated in different racks from the non safety-related modules? Is it your intent to have separate safety-related and non safety-related cable raceway systems? Note that electrical modules and cables, if identified for treatment by the Regulatory Treatment of Non-Safety Systems (RTNSS) process, should be treated as seismic category I.
3.2-65	Morris G Gill P	Classification of non-safety SSCs required to support safety-related components	What is the analyzed basis for arriving at a 10-hour margin in qualified life for the environmental quality components when it is required to perform its function during and after the accident? Recognize that the accident environment, classified as harsh environment due to temperature, pressure or radiation, etc., cannot be converted to a mild environment in a period of 10 hours. The precedence had been to qualify the equipment for 90 days or more to provide sufficient time to develop back up provisions as necessary to protect the health and safety of the public following a design basis accident.
3.10-7	Morris G Gill P	Dynamic effects of water storage on elevations above electrical switchgear	The passive design uses water stored at the high elevations in the reactor building. Has the seismic analysis addressed the hydro-dynamic effects of these volumes of water in order to ensure that the water will not cascade down to electrical components supporting safety-related or RTNSS systems.

RAI Number	Reviewer	Question Summary	Full Text
8.1-1	Morris G Gill P	Section 8.1 Address station blackout.	In DCD Tier 2, Rev. 1, Section 8.1 please describe the capability of the ESBWR design to withstand and recover from a station blackout lasting a specified minimum duration.
8.1-2	Morris G Gill P	Address AC system requirements after 72 hours following a loss of offsite power.	DCD Tier 2, Rev. 1, Figure 8.1-3, Direct Current Power Supply - Class 1E, indicates that four batteries are designed for a 24 hour discharge and two batteries are designed for 72-hour discharge. Confirm that no direct current (dc) power is required following discharge of the batteries or identify the safety-related power supply that will be used to recharge the batteries while at the same time supplying the dc load through the battery chargers and/or directly to the 120 volts alternating current (Vac) instrument buses.
8.1-3	Morris G Gill P	Clarify function of standby onsite AC power supply.	DCD Tier 2, Rev. 1, Section 8.1.5.2.1 describes the standby on-site ac power supply system which can provide power to achieve cold shutdown in the event of a loss of preferred power. This statement appears to contrast with Section 8.3.1.1.8 which states that the standby on-site ac power supply system is not relied upon to perform any safety-related function. Is the standby on-site ac power supply system considered a mitigating system that is important to safety?
8.1-4	Morris G Gill P	In Section 8.1.5.2.2.1, clarify the term “upset.” Class 1E Uninterruptible	On page 8.1-5, DCD Tier 2, Rev. 1, states that the Class 1E UPS support the safety-related logic and control functions during normal, upset, and accident conditions. Describe what is meant by ‘upset.’
8.1-5	Morris G Gill P	Clarify standards for diesel generator availability/ reliability.	In Section 8.1.5.2.4, the DCD states that the standby diesel generators are not safety-related, and by inference, that RG 1.9 (and therefore Institute of Electrical and Electronics Engineers Standard 387 (IEEE 387)) does not apply to the ESBWR. If the ESBWR design will not commit to the requirements of IEEE 387 and the guidance in RG 1.9 to demonstrate the capacity and capability of the standby diesel generators, identify what industry consensus standard will be used to demonstrate the availability and reliability of the standby diesel-generator units. (Note that Regulatory Guide (RG) 1.108 was withdrawn in 1993 and the original content of RG 1.108 was assumed into RG 1.9, Selection, Design, Qualification and Testing of Emergency Diesel Generator Units Used As Class 1E Onsite Emergency Power Systems At Nuclear Power Plants, Rev. 3.)

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8.1-6	Morris G Gill P	Clarify use of diesel generators for peaking service.	In Section 8.1.5.2.4, identify what limits will be placed on the standby diesel-generators for use other than powering the plant investment protection (PIP) buses. Describe what effects the use of the standby diesel units for peaking service will have on their availability and reliability. The response to branch technical position (BTP) ICSB-8, Use of Diesel-Generator Units for Peaking, implies that the standby diesel-generator units will be used for peaking.
8.1-7	Morris G Gill P	Clarify diesel generator reliability goals.	Identify the reliability goals for the standby diesel-generators and describe how these goals will be monitored and maintained. (Reference: NUREG/CR 0660, Enhancement of Onsite Diesel Generator Reliability)
8.1-8	Morris G Gill P	Clarify equipment required to maintain safe shutdown.	Equipment to Achieve Safe-Shutdown (DCD Tier 2, Rev. 1, Section 8.1.6.3). The COL should not only identify equipment required to achieve safe-shutdown but also the equipment required to maintain safe-shutdown.
8.1-9	Morris G Gill P	Clarify the applicable standards/references for electric power systems.	DCD Tier 2, Rev. 1, References (8.1.7). The only IEEE standard referenced in this section, IEEE-944, has been withdrawn by IEEE. Identify all other American National Standards Institute, IEEE, National Electrical Manufacturers Association, National Fire Protection Association and any other industry consensus standard used to demonstrate the capability, capacity and reliability of the electric power systems.
8.1-10	Morris G Gill P	Clarify applicability of 10CFR50 Appendices A and B.	DCD Tier 2, Rev. 1, References (8.1.7). Clarify why Title 10 of the *Code of Federal Regulations*, Part 50 (10 CFR 50) Appendices A and B have not been included in this reference section.
8.1-11	Morris G Gill P	In Figure 8.1-1, clarify the presence of a circuit breaker.	DCD Tier 2, Rev. 1, Figure 8.1-1, One-Line Diagram (High Voltage Circuit Breaker). Clarify why there is no circuit breaker required between the unit auxiliary transformer and the line between the switchyard and the main generator. It appears that a unit auxiliary transformer fault would unnecessarily challenge the switchyard.
8.1-12	Morris G Gill P	Clarify margin between transformer rating and load.	DCD Tier 2, Rev. 1, Figure 8.1-1, One-Line Diagram (Auxiliary Transformer Ratings). All auxiliary transformers are shown with a 100 MVA forced oil, forced air rating. Identify the expected margin between the connected load and the transformer rating.
8.1-13	Morris G Gill P	Clarify diesel generator rating and loads.	DCD Tier 2, Rev. 1, Figure 8.1-1, One-Line Diagram (Standby Diesel-Generator). Confirm the indicated rating of the standby diesel-generator rating of 15 MVA. Identify the total PIP bus loads connected to the standby diesel-generators. Describe the experience history of stationary diesel-generators used in standby service at this rating.

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8.1-14	Morris G Gill P	Clarify defense-in-depth philosophy relative to diesel generators and/or AC power systems.	Compliance of Regulatory Requirements and Guidelines (DCD Tier 2, Rev. 1). Section 8.1.6.3 states in part that ..."Several criteria pertaining to safety-related diesel generators and/or Ac power systems are not applicable for the ESBWR because the ESBWR does not require Ac power to achieve safe shutdown, and its two diesel generators are not safety related. However, defense-in-depth principles such as redundancy and diversity are incorporated in the design and integration of ESBWR systems." To obtain defense-in-depth, the reliability of the Ac power system and the standby diesel generators should be demonstrated through surveillance testing. Since surveillance requirements for these systems are not included in Section 3.8 of the technical specifications, nor licensing conditions specified to monitor the performance or condition of these systems against established goals in accordance with 10 CFR 50.65(a)(1), please explain how the defense-in-depth philosophy is validated?
8.2-1	Morris G Gill P	Clarify reserve auxiliary transformer loading.	Auxiliary Transformer Sizing Margins. The description of the offsite power system notes that the reserve auxiliary transformers are the same size as the unit auxiliary transformers and function as a backup source for each other. DCD Tier 2, Rev. 1, Figure 8.1-1 shows that both transformers feed two 13.8 kilovolt (kV) buses and two 6.9 kV buses. However, the figure also shows that both reserve auxiliary transformers also feed a third common 13.8 kV bus (Bus AB). Describe the loading on bus AB and compare the maximum combined connected loading on the reserve auxiliary transformers to their load ratings.
8.2-2	Morris G Gill P	Clarify feed for the PIP buses.	Clarify whether the PIP buses are fed with a non-segregated phase bus (page 8.2-2) or from an underground cable per DCD Tier 2, Rev. 1, Section 8.2.4.4 (page 8.2-5.)
8.2-3	Morris G Gill P	Clarify generator breaker reliability.	Inspection and Testing of Generator Breaker Reliability (General Design Criterion (GDC) 18). DCD Tier 2, Rev. 1, Section 8.2.2, Analysis, of the DCD states the reliability of the generator breakers compares favorably with the probability of failure of the normal preferred offsite supply due to other causes. Provide a comparison of generator breaker reliability with the probability of failure of the normal preferred supply. Provide the basis for this assessment. Confirm that the comparison is between the 500 kV circuit breakers and the 500 kV system.
8.2-4	Morris G Gill P	Clarify reliance on offsite power.	Loss of All ac Power (10 CFR 50.63). The statement that the ESBWR does not rely on offsite power does not appear to agree with the statement in Appendix 8B which implies that the control rod drive (CRD) pumps are required for inventory control. Please clarify.

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8.2-5	Morris G Gill P	Confirm acceptance by NERC/RTO/ISO of ESBWR connection to the grid.	In Section 8.2.4, identify a COL item to address the following: (A) In Section 8.2.4.10, provide a statement confirming that the unit addition to the grid is reviewed and accepted by the applicable grid reliability organization such as the North American Reliability Council (NERC), recognized Regional Transmission Organization (RTO), and/or the Independent System Operator (ISO). (Reference: Stability of Offsite Power (BTP ICSB-11).) (B) In Section 8.2.4.10, provide a statement that the stability analysis is coordinated, reviewed and accepted by the applicable grid reliability organization such as the NERC recognized RTO or the ISO. (C) In Section 8.2.4.6, provide a statement that the protective relaying between the unit and the grid is coordinated, reviewed and accepted by the applicable grid reliability organization such as NERC recognized RTO or the ISO.
8.2-6	Morris G Gill P	Clarify sizing of transmission paths.	Design Basis Interface Requirements (Section 8.2.3). DCD Tier 2, Rev. 1, Section 8.2.3 of the DCD states that a minimum of two transmission lines must be sized for the shutdown electrical loads. The auxiliary transformer size noted in Figure 8.1-1, sheet 1, indicates an auxiliary transformer rated for a maximum of 100 MW. Each transmission path must be sized for the full 1600 MW rated output of the unit. Is this statement implying that a sub-transmission system could be used as the source of the normal or alternate preferred offsite power?
8.2-7	Morris G Gill P	Clarify location of fire barriers.	Transformer Fire Barrier. DCD Tier 2, Rev. 1, Section 8.2.3, page 8.2-4, states that fire barriers exist between the reserve auxiliary transformer and the unit auxiliary transformer. Confirm that fire barriers are also provided between the three phases of the main transformer.
8.2-8	Morris G Gill P	Clarify ESBWR auxiliary loads.	Maximum House (Auxiliary) Loads. DCD Tier 2, Rev. 1, Sections 8.2.4.3 and 8.2.4.4, state that the auxiliary load is 210 MW and 0.9 pf. Confirm this value and explain why it is so high compared with conventional boiling water reactors (BWRs). Clarify the apparent discrepancy with DCD Tier 2, Rev. 1, Section 8.2.3 which indicates the transformers are rated for 100 MW.

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8.2-9	Morris G Gill P	Clarify design and attributes of generator circuit breakers.	Generator Circuit Breaker (8.2.4.12). Standard Review Plan (NUREG 0800), Section 8.2, Appendix A, Guidelines for Generator Circuit Breakers/Load Break Switches, was written for medium voltage circuit breakers (typically rated less than 25 kV) between the generator and the main (step-up) transformer. DCD Tier 2, Rev. 1, Figure 8.1-1, Electrical Power Distribution System One Line Diagram, shows the generator on the high voltage side of the main transformer. A 500 kV circuit breaker is a completely different design than a 25 kV circuit breaker. Describe what attributes from Appendix A will be applied to the generator circuit breakers for ESBWR units. Identify unique characteristics, if any, that may be required to be different than standard 500 kV switchyard transmission circuit breakers.
8.2-10	Morris G Gill P	Clarify degraded voltage protection for PIP buses.	Degraded Voltage (8.2.4.13). Confirm that those 6.9 kV PIP buses that ultimately power the safety-related Class 1E battery chargers and the Class 1E uninterruptible power supplies will have degraded voltage protection.
8.2-11	Morris G Gill P	Clarify applicable references..	DCD Tier 2, Rev. 1, References (8.2.5). Identify additional applicable reference to standards for high voltage circuit breakers, station and switchyard grounding and station and switchyard lightning protection.
8.3-1	Morris G Gill P	Clarify transfer scheme from normal preferred to alternate preferred.	Bus Transfer - Power Generation (PG). DCD Tier 2, Rev. 1, Section 8.3.1.1, Description, refers to the transfer of power sources for the PG buses. Describe the type of transfer scheme for the 13.8 kV PG buses from normal preferred to alternate preferred off-site power source (i.e., fast bus transfer, dead bus transfer, etc.). Describe if the transfer has the capability of transferring back to the original source.
8.3-2	Morris G Gill P	Clarify fast transfer from normal preferred to alternate preferred.	Bus Transfer - PIP. Please confirm whether the fast transfer from preferred normal to preferred alternate source at 6.9 kV PIP buses is backed by the delayed transfer before automatic transfer to the standby diesel generators.

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8.3-3	Morris G Gill P	Clarify voltage and frequency protection for the Class 1E isolation power centers.	Voltage and Frequency Protection. In DCD Tier 2, Rev. 1, Section 8.1.5.2.1, it is stated that input power voltage and frequency is monitored at Class 1E Isolation Power Centers, and the input breaker tripped if either voltage or frequency is out of the specified limits for predetermined time. DCD Tier 2, Rev. 1, Section 8.3.1.1.2, Low Voltage AC Distribution System, describes the Isolation Power Centers as provided with electrical protection and isolation devices, which prevent degradation of the Class 1E power system by the non-Class 1E power system. Provide the following details: (1) At what exact location of the Class 1E Isolation Power Centers where the voltage and frequency are measured, (2) Details of the transfer scheme at 480 volt (V) double-ended power centers, normal to alternate source, (3) Details of protection and isolation devices which prevent degradation of the Class 1E power system by the non Class 1E power system.
8.3-4	Morris G Gill P	Provide additional information regarding the transportable AC generator(s).	Transportable AC Generator In DCD Tier 2, Rev. 1, Section 8.3.1.1.2, Low Voltage ac Power Distribution, states that a transportable ac generator can be connected to each PIP 480V isolation power center. Provide the details of the transportable ac generator(s) such as whether one generator for each PIP isolation power center; fuel details; generator rating and basis for the rating; whether located on the site; allowable time delay before the Ac generator will be available for its operation in a working condition after a design basis accident to allow the battery chargers to supply the safety-related instrument type loads when the onsite non safety-related 6.9 kV diesel generators are not available.

RAI Number	Reviewer	Question Summary	Full Text
8.3-5	Morris G Gill P	Clarify interrupting capability of switchgear and load centers.	Fault Interrupting Capability of Switchgear and Load Centers. DCD Tier 2, Rev. 1, Section 8.2.1.2, Offsite Power System, addresses the interrupting capability of the generator breaker. DCD Tier 2, Rev. 1, Section 8.3.1.1.5, Class 1E Electric Equipment Considerations, addresses motor control centers. Confirm that low voltage switchgear (power centers), medium voltage switchgear (6.9 kV and 13.8 kV) switchgear will also have the interrupting capacity at least equal to the maximum available fault current to which it can be exposed to under all modes of operation, and whether the actual switchgear ratings will be provided as part of COL application.
8.3-6	Morris G Gill P	Clarify over-current protection for UPS.	DCD Tier 2, Rev. 1, Section 8.3.1.1.3, UPS System. Describe the over-current protection for the Class 1E vital ac inverters. Describe how the capability of the over-current protection is verified.
8.3-7	Morris G Gill P	Clarify location of electric distribution system components.	Confirm that the electric distribution system single line diagrams (plant specific bus arrangements and relaying schemes) showing the location of instrument current transformers, voltage transformers, relays described in DCD Tier 2, Rev. 1, Section 8.3.1.1.6 will be a requirement for the COL applicant to provide as part of the application.
8.3-8	Morris G Gill P	Clarify undervoltage protection.	Motor Undervoltage Protection. In DCD Tier 2, Rev. 1, Section 8.3.1.1.7, it is stated that in case of loss of offsite power (LOOP), should the bus voltage decay to below 70 percent of its nominal rated voltage for a predetermined time, the large pump motor breakers are tripped. Please confirm the allowable time at 70 percent voltage and the basis on which this value is determined.
8.3-9	Morris G Gill P	Clarify transfer process following restoration of normal preferred power.	Restoring Normal Preferred Power to PIP Buses. In DCD Tier 2, Rev. 1, Section 8.3.1.1.7, it is stated that upon restoration of off-site power, the 6.9 kV PIP buses can be transferred back to the off-site source by manual operation only. Please confirm mode of the manual transfer back to the preferred power source - whether dead bus transfer or live bus through synchronization.
8.3-10	Morris G Gill P	Clarify degraded voltage protection.	The description of the protection against 6.9 kV degraded voltage is provided in DCD Tier 2, Rev. 1, Section 8.3.1.1.7. However, in Section 8.3.4.4, this protection at 6.9 kV buses is described as a COL item. Please resolve the conflict. Also, describe the basis for the 90 percent undervoltage setpoint. Provide the basis for the “Predetermined” time delay.

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8.3-11	Morris G Gill P	Clarify functions of onsite AC power supply.	Standby Onsite ac Power Supply Safety Classification (8.3.1.1.8). DCD Tier 2, Rev. 1, Section 8.3.1.1.8 of the DCD indicates that the standby On-site ac Power Supply System performs no safety-related function. Confirm that the 24-hour and 72-hour safety-related batteries must be recharged after 24 and 72 hours following their discharge. If dc power is required to maintain safe shutdown after 72 hours then the standby on-site power supply does perform a safety function.
8.3-12	Morris G Gill P	Clarify restoration of voltage and frequency.	Diesel Generator Capability. In DCD Tier 2, Rev. 1, Section 8.3.1.1.8, it is stated that voltage and frequency will be restored to within 10 and 20 percent, respectively, in no more than 60 percent of the planned load sequence time interval following a load step of 110 percent greater than the most severe load step in its profile. Confirm the frequency will be restored to within 2 percent, (20 percent stated in the DCD appears to be a typo).
8.3-13	Morris G Gill P	Clarify rating of diesel generators.	Diesel Generator Capacity. Confirm the continuous and short-term rating of the standby diesel generator. Provide the basis for selecting short term rating of the Diesel Generator instead of the continuous rating equal to the sum of the loads of its load group of PIP loads and safety-related battery chargers. Please confirm the calculation for sizing the diesel generator will be required COL information and provided as part of the COL application.
8.3-14	Morris G Gill P	Clarify loading of the standby onsite AC power supply.	Standby Onsite ac Power Supply Loading (DCD Tier 2, Rev. 1, Section 8.3.1.1.8). Identify the detailed loading of the standby on-site ac power supply including the safety-related loads, important-to-safety loads, PIP loads and any other class of loads connected to the PIP buses. Confirm that the largest combination of loads is less than the continuous rating of the power supply (e.g. the diesel-generator continuous rating.)
8.3-15	Morris G Gill P	Clarify loading time for the standby onsite AC power supply.	Standby Onsite ac Power Supply Loading (DCD Tier 2, Rev. 1, Section 8.3.1.1.8). Clarify why it takes 600 minutes to load the standby onsite ac power supply.
8.3-16	Morris G Gill P	Clarify industry standards applicable to the standby onsite AC power supply.	Standby Onsite ac Power Supply Consensus Standards (DCD Tier 2, Rev. 1, Section 8.3.1.1.8). Identify the industry consensus standards that will be used for the design, installation, pre-op testing, operation maintenance and surveillance testing. In particular, address each of the surveillance requirements of IEEE 387 and Regulatory Guide 1.9.

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8.3-17	Morris G Gill P	Clarify the time response of the standby diesel generator.	Standby Onsite ac Power Supply Starting Circuits (DCD Tier 2, Rev. 1, Section 8.3.1.1.8). Clarify the time response of the standby diesel generator (SDG). The DCD states that the SDG will come up to speed within one minute. It also states that the loads will be applied and accelerated in sequence "within the time requirements." Identify where these time requirements are defined and identify the maximum motor acceleration time.
8.3-18	Morris G Gill P	Provide additional information regarding electrical heat tracing.	In DCD Tier 2, Rev. 1, Section 8A.3.1, the applicant described the electrical heat tracing system. Provide a list of safety-related and non safety-related components which needs to be heat traced, and also provide the corresponding Class 1E and Non-Class 1E power sources for the electric heat tracing.
8.3-19	Morris G Gill P	Clarify containment penetrations for electrical circuits.	Electrical Penetration Protection. Please provide a listing of electrical circuits (other than instrumentation) which will pass through containment penetrations and which will be protected by primary and backup protection.
8.3-20	Morris G Gill P	Clarify grounding of the main generator.	In DCD Tier 2, Rev. 1, Section 8A.1.1, it is stated that the plant's main generator is grounded with a neutral grounding device. The impedance of that device limits the maximum phase current under short-circuit conditions to a value not greater than that for a three-phase fault at its terminals. Typically per industry practice, the neutral of main generator is grounded through a neutral grounding transformer which limits the single phase to ground fault to a few amperes. Please confirm the design of main generator neutral grounding.
8.3-21	Morris G Gill P	Clarify the design of low voltage ac system grounding.	In DCD Tier 2, Rev. 1, Section 8A.1.1, it is stated that the neutral point of the low-voltage ac distribution systems is either solidly or impedance grounded, as necessary, to ensure proper coordination of ground fault protection. This statement is different from that in Section 8.3.1.12 which states that the low voltage (480 V and lower) ac system is solidly grounded. Please confirm the design of low voltage ac system grounding. Confirm if this will be required COL Information to be supplied by the COL applicant.
8.3-22	Morris G Gill P	Clarify lightning protection.	In DCD Tier 2, Rev. 1, Section 8A.1.2, it is stated that no SRP or regulatory guidance is provided for grounding and lightning protection. RG 1.204 for lightning protection was issued by the U.S. Nuclear Regulatory Commission (NRC) in November 2005. Describe your conformance to RG 1.204 for the lightning protection design.

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8.3-23	Morris G Gill P	Clarify V3 and V2 cable information.	Low Voltage Power Cable. According to the description provided for Class 1E Electric Equipment Arrangement in DCD Tier 2, Rev. 1, Section 8.3.1.4.1, both V3 and V2 raceways appear to carry 250 volts direct current (Vdc) and 120 Vac control and power cables. Provide the criterion to distinguish between the V3 and V2 cables.
8.3-24	Morris G Gill P	Clarify measures for main steam line instrumentation and control circuits.	DCD Tier 2, Rev. 1, Section 8.3.1.4.1, Power Systems, states for cable routing in potentially harsh environmental area, the circuits of different safety-related divisions will not be routed through the same potentially harsh environmental area, with the exception of main steam line instrumentation and control circuits, and main steam line isolation valves circuits, which can be exposed to possible steam line break and turbine missiles, respectively. Describe what measures will be taken in case of main steam line instrumentation and control circuits, and main steam line isolation valves circuits, so that different safety-related divisions will not be subjected to simultaneous failures.
8.3-25	Morris G Gill P	Clarify applicable standards for medium voltage switchgear.	Medium Voltage Switchgear (DCD Tier 2, Rev. 1, Section 8.3.1.1.1). Identify the industry consensus standards used in the selection and specification of the medium voltage switchgear. Identify the type of medium voltage switchgear, the circuit breaker momentary and interrupting ratings and the capability to resist internal arcing faults.
8.3-26	Morris G Gill P	Clarify time delay related to loss of preferred power.	Loss of Preferred Power (LOPP) (DCD Tier 2, Rev. 1, Section 8.3.1.1.7). The Design Control Document indicates that there is a time delay with the bus voltage below the 70 percent LOPP setpoint. At this value most induction motors will stall and trip on overcurrent. Justify the use of a time delay
8.3-27	Morris G Gill P	Clarify diesel generator loading for a LOCA following LOPP.	Loss-of-Coolant Accident (LOCA) Following LOPP. Confirm that the LOPP loads already running on the standby diesel generator are the same loads required for a LOCA. If this is not the case, describe the load shedding and resequencing of LOCA required loads onto the standby diesel generator.
8.3-28	Morris G Gill P	Clarify diesel generator response for LOPP.	LOPP During Standby On-site Power Source Paralleling Test. Describe how the standby diesel generator responds before the preferred power supply breaker opens and clears the path to the grid. Confirm that the diesel will not trip on overcurrent, underfrequency or overexcitation.

RAI Number	Reviewer	Question Summary	Full Text
8.3-29	Morris G Gill P	Clarify the impact of loss of the transmission system.	GDC 17, Electric Power System (Loss of the Transmission System). The DCD states that loss of the transmission system does not affect the ability of the main generator... to provide power to the Class 1E system. Confirm that the main generator will not trip on a 100 percent load rejection. Also address loss of the common switchyard which, from DCD Tier 2, Rev. 1, Figure 8.1-1, appears to be required for the main generator to power either auxiliary transformer.
8.3-30	Morris G Gill P	Clarify the impact of loss of the main generator.	GDC 17, Electric Power System (Loss of the Main Generator). Describe any limits on the main generator MVAR output such that loss of the main generator will not result in unacceptable voltage in the local switchyard. Describe any auxiliary transmission system equipment, such as capacitor banks, that may be required to offset loss of MVAR support on loss of the main generator.
8.3-31	Morris G Gill P	Provide clarification regarding cable separation.	Physical Identification of Safety-Related Equipment (DCD Tier 2, Rev. 1, Section 8.3.1.3). Clarify the discussion on cable separation implies that there will be nine raceway separation classes: four Divisions, four Division-Associated and one non-Class 1E raceway.
8.3-32	Morris G Gill P	Clarify identification of fiber-optic cables.	Cable Identification (DCD Tier 2, Rev. 1, Section 8.3.1.3). The discussion refers to the identification of non-fiber cables. No discussion was provided for cable identification of fiber-optic cables. Describe how different divisions of fiber-optic cables will be identified.
8.3-33	Morris G Gill P	Clarify electric loads.	DCD Tier 2, Rev. 1, Section 8.3.1.4.1, Power Systems. Identify the loads that are associated with the medium and low voltage power penetrations.
8.3-34	Morris G Gill P	Clarify battery sizing.	Class 1E Batteries (DCD Tier 2, Rev. 1, Section 8.3.2.1.1). The design control document states that the batteries are sized so that the sum of the required loads does not exceed 80 percent of the battery ampere-hour rating, or warranted capacity at end-of-installed-life with 100 percent design demand. Batteries are sized for the dc load in accordance with IEEE Standard 485. Confirm that the battery sizing will also contain specific margins for minimum temperature and design margin (as defined in IEEE 485).
8.3-35	Morris G Gill P	Battery terminal voltage	Class 1E Batteries. Provide the basis for the dc minimum battery terminal voltage at the end of the discharge period (i.e., 210 volts).
8.3-36	Morris G Gill P	Equalizing charge voltage	Class 1E Batteries. Provide the basis for the maximum equalizing charge voltage for the Class 1E batteries (i.e., 280 volts).

RAI Number	Reviewer	Question Summary	Full Text
8.3-37	Morris G Gill P	Pre-operational testing requirements	Class 1E Batteries. Describe the preoperational testing requirements for initial Class 1E battery installation and future battery replacements.
8.3-38	Morris G Gill P	Additional Class 1E battery information	Class 1E Batteries. Provide the type (e.g., vented lead-acid), ampere-hour capacity, and load profiles for each Class 1E battery.
8.3-39	Morris G Gill P	Battery loads during design basis accident	Class 1E Batteries. List the safety-related loads, with ratings, that will be supplied power by the Class 1E batteries during the design basis accident.
8.3-40	Morris G Gill P	Battery charger capacity	Class 1E Battery Chargers Capability (DCD Tier 2, Rev. 1, Section 8.3.2.1.1). The design control document states that the Class 1E battery chargers are capable of recharging its battery from the design minimum charge to 95 percent of fully charged condition within 12 hours. Confirm that the battery chargers also have the capacity and capability to carry the dc system load while at the same time recharging the discharged batteries.
8.3-41	Morris G Gill P	Design voltage of dc equipment	Class 1E Battery Chargers Voltage (DCD Tier 2, Rev. 1, Section 8.3.2.1.1). The design control document states that the Class 1E battery chargers are capable of maintaining a constant voltage in the range of 240 Volts up to 290 Volts. Confirm that the connected dc equipment is designed to operate up to this maximum voltage.
8.3-42	Morris G Gill P	Battery charger sizing criteria	Class 1E Battery Chargers. IEEE Standard 308, "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations," as endorsed by Regulatory Guide 1.32, "Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants," recommends that the size (i.e., capacity and capability) of the safety-related battery chargers be based on the largest combined demands of the various steady-state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the plant during which these demands occur. Describe and justify any differences between the proposed ESBWR safety-related battery charger sizing criterion and IEEE Standard 308.
8.3-43	Morris G Gill P	Clarify the separation scheme to non-safety-related buses.	Class 1E Battery Chargers. Describe the separation scheme that will be provided for the connection of the Class 1E battery chargers to the non-safety-related buses.
8.3-44	Morris G Gill P	Clarify battery design limits.	Regulatory Requirements - RG 1.129 (Battery Monitoring) (DCD Tier 2, Rev. 1, Section 8.3.2.2.2). Describe the minimum design limits for battery electrolyte level, temperature and individual cell voltage. Describe your justification that the batteries will remain capable of performing their minimum designed safety function at these limits.

RAI Number	Reviewer	Question Summary	Full Text
8.3-45	Morris G Gill P	Battery monitoring instrumentation	Battery Monitoring (DCD Tier 2, Rev. 1, Section 8.3.2.2.2). Describe how the safety-related batteries will be instrumented for continuous on-line monitoring.
8.3-46	Morris G Gill P	Cable tray fill limitations.	Cables and Raceways (DCD Tier 2, Rev. 1, Section 8.3.3.2). The design control document states that the cable tray fill will be limited to 40 percent for power cables. Clarify why it is your intent to apply this restriction on cable tray fill for large 600 V power cables (e.g., greater than 250 kcm) or medium voltage cables, and not to maintain a physical separation (e.g. one cable diameter) and a single layer of cables to restrict heat buildup in the cable tray.
8.3-47	Morris G Gill P	Battery room environment	Class 1E Battery Rooms. Describe the environment of the Class 1E battery rooms during and following a design basis event.
8.3-48	Morris G Gill P	Clarify battery ratings.	Voltage Analysis (DCD Tier 2, Rev. 1, Section 8.3.4.8). The safety-related batteries are described on page 8.3-35 as having a 24 and 72 hour required discharge capability (Table 8.3-3, Battery Duty Cycle). The design control document requires the battery manufacturer's 2-hour ampere-hour rate, the 8-hour ampere-hour rate and the 1-minute ampere rating be provided. Describe the significance of providing the 1-minute ampere rating and 2 and 8-hour ampere-hour rates when the Class 1E batteries are to be sized to accommodate 24 and 72-hour duty cycles. Provide the 24 hour and 72 hour tested discharge rates for the type of Class 1E batteries proposed for this service.
8.4-1	Morris G Gill P	Clarify use of ASDs.	Adjustable Speed Drives (ASDs). The Acronym Lists includes ASD, Adjustable Speed Drive. Chapter 8 fails to identify any ASDs. Identify all ASDs and identify any special design requirements such as grounding, filtering, electrical protection and neutral conductor sizing required by ASDs. List the appropriate IEEE Standards.
8.4-2	Morris G Gill P	Address impact of ASDs on digital instrumentation and controls.	Adjustable Speed Drives. Confirm that the effects of conductive and radiated electro-magnetic interference generated by solid-state adjustable speed drives have been factored into the design requirements for the digital instrumentation and control systems.
8.4-3	Morris G Gill P	Address ASD power penetrations.	Adjustable Speed Drives. Identify any medium voltage and large low voltage power penetrations. Identify the loads that are associated with these large power penetrations.

RAI Number	Reviewer	Question Summary	Full Text
8.4-4	Morris G Gill P	Clarify valves requiring power lockout.	DCD Tier 2, Rev. 1, Section 8.4.3, Power Lockout to Motor-Operated Valves. Identify any electrically operated valves which require removal of power consistent with the guidelines of BTP ICSB-18 (PSB)? BTP ICSB-18 states that all valves that require power lockout to meet the single-failure criterion in the fluid systems and their required positions be listed in the TS, and that the position indications for these valves meet the single-failure criterion.
8.4-5	Morris G Gill P	Clarify equipment flooding protection.	DCD Tier 2, Rev. 1, Section 8.4.4, Submerged Class 1E Electrical Equipment as a Result of a Loss-of-Coolant-Accident. Is safety-related electrical and mechanical equipment qualified for submergence resulting from flooding/wetting? Or, as an alternative to protecting the equipment, will the equipment be evaluated to show that failure of the equipment because of flooding/wetting is acceptable, if its safety-related function is not required or has otherwise been accomplished?
8.4-6	Morris G Gill P	Address generic issues.	DCD Tier 2, Rev. 1, Appendix 1C-1. The following Generic Letters (GL), generic issues and operational experiences are either not addressed or information provided is incomplete: • GL 80-013 • GL 80-016 • GL 80-035 • GL 80-082 • GL 80-043 • GL 82-04 • GL 84-24 • GL 86-15 • GL 88-07 • GL 2006-2 • II.K.3(25) Provide a discussion how the above GLs, and Three Mile island Action Plan item are incorporated in to the ESBWR design.

RAI Number	Reviewer	Question Summary	Full Text
8.4-7	Morris G Gill P	Provide additional information regarding Class 1E bus tie breakers.	Operating experience review results summary (DCD Tier 2, Rev. 1, Table 1C-1) for GL 91-06 refers to DCD Tier 2, Rev. 1, Section 8.3.2 for evaluation result, however this Section does not discuss evaluation result for GL 91-06. Similarly, evaluation result of GL 91-11 refers to Action Plane Issue 128, however the discussion for issue 128 is incomplete in that it does not address interlocks and limited conditions for operation for Class 1E bus tie breakers. Please provide this information.
8.4-8	Morris G Gill P	Non-safety loads connected to batteries.	Are there any non-safety loads connected to safety-related batteries? If there are, identify these loads and describe how these non-safety loads satisfy the recommendations of Regulatory guide 1.75 with regard to isolation and physical separation. Also, demonstrate that connecting non-safety loads would not degrade Class 1E batteries.
8.4-9	Morris G Gill P	Task Action plan Item B-53	The resolution of Task Action plan Item B-53 (Load break switch) described in DCD Tier 2, Rev. 1, Table 1.11-1 is incomplete. Provide a discussion how ESBWR design satisfy the resolution of this issue.
8.4-10	Morris G Gill P	Charging Class 1E batteries from diesel generators	Justify charging the Class 1E batteries from chargers which are powered from non-safety-related diesel generators in the event of a loss of offsite power (LOOP). The staff believes that Class 1E batteries should be powered from a GDC 17 qualified source during normal operation and from a Class 1E power source in the event of a LOOP.
8.5-6	Morris G Gill P	Clarify absence of degraded voltage alarms.	Justify why there is no degraded voltage alarms on the 480 volt buses that are the direct power feed to the safety-related battery chargers and inverters or the indirect feed to the inverter bus through the regulating transformer. These voltage sensors and alarms should be in the RTNSS program.
8.5-7	Morris G Gill P	Clarify need for power following battery depletion.	Confirm that no ac or dc power will be required following depletion of the batteries.
8.5-8	Morris G Gill P	Loss of both ac and dc power.	Describe the basis for the minimum time the plant will remain safe without any ac or dc power.
8.5-9	Morris G Gill P	Power to CRD pumps	SBO Power Supply. DCD Tier 2, Rev. 1, Appendix 8B, Realistic Station Blackout Evaluation, Assumption 8b, assumes the CRD pumps are available. Identify the power source for the CRD pumps.

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8.5-10	Morris G Gill P	Clarify applicability of CRD pumps.	On page 8B-1, DCD Tier 2, Rev. 1, Section 8B.3, “Analysis Assumptions,” states that the CRD pumps are one of the systems assumed available for initial vessel inventory and pressure control, containment/temperature control and suppression pool temperature control. This description is in conflict with information provided in DCD Tier 2, Rev. 1, Section 15.5.5.2, “Analysis Assumptions,” which states that the CRD pumps are assumed unavailable due to loss of all ac power. Clarify the apparent discrepancy.
8.5-11	Morris G Gill P	SBO coping analysis	It is stated in DCD Tier 2, Rev. 1, Appendix 1D, Criterion A, that the duration of a station blackout for the ESBWR is assumed to be 8 hours. Provide an analysis based on Regulatory Guide 1.155/NUMARC 8700 guidance for determining coping duration. In addition, state whether the plant utilizes an ac independent approach or an alternate ac power source approach for demonstrating capability to cope for the period of coping duration. If an ac independent approach is utilized, do the Class 1E dc systems have sufficient capacity to supply dc loads during a SBO event for the entire duration without the charger support? What kind of margin will be available in the Class 1E batteries? Provide a list of loads with power requirements and duration.
8.5-12	Morris G Gill P	Clarify equipment power supplies and requirements.	In DCD Tier 2, Rev. 1, Section 8B, it is stated that CRD pumps, Safety Relief Valves, Depressurization Valves, and Gravity-Driven Cooling System squib valves will be available for initial vessel inventory and pressure control, containment pressure/temperature control and suppression pool temperature control. Please provide the power supply and power requirements and duration for the above mentioned pumps and valves.
8.5-13	Morris G Gill P	Clarify operator action for SBO event.	Would there be any operator action to cope with a SBO event? If yes, please provide information on (1) control room temperature and temperatures for other rooms containing equipment requiring manual actions, (2) lighting system, and (3) communication.
8.5-14	Morris G Gill P	Address temperature effects on equipment operability during SBO.	Provide a discussion on the effect of temperature on the operability of equipment required during an SBO event. Discussion should include all the areas including containment, auxiliary building, control room, battery rooms, etc., containing equipment required during an SBO event.
8.5-15	Morris G Gill P	Clarify electrical power beyond 72 hours following SBO event.	It is the staff’s understanding that recovery of offsite ac power and diesel generators could take longer than 72 hours. Provide a discussion how the required SBO loads (i.e., battery charger, UPS, instrumentations, indicating lights etc.) will be powered beyond the 72 hours.

RAI Number	Reviewer	Question Summary	Full Text
9.5-27	Morris G Gill P	Voice communication systems power supplies.	Backup Power Supply. Clarify how the three independent voice communication systems will be powered from the two separate standby diesel-generator-backed power supplies.
9.5-28	Morris G Gill P	Clarify communication systems.	Other Communication Systems (1) Describe the communication systems available in the Emergency Operations Facility and the Plant Simulator. (2) Describe the communication links available with the grid transmission operator.
9.5-29	Morris G Gill P	Aluminum lighting fixtures.	Lighting System Restrictions. Clarify if there is any need for restricting the use of aluminum fixtures in containment.
9.5-30	Morris G Gill P	Illumination during fire fighting.	Lighting is required during all modes of plant operation. Provide a discussion on which lighting system will provide the adequate illumination in areas required for fire fighting?
9.5-31	Morris G Gill P	Battery recharging by diesel generators	Clarify when the diesel generators are required to be connected to recharge the batteries. (See related RAI in Section 8.3 (8.3-11).)
9.5-32	Morris G Gill P	Standards applicable to diesel generators	Although the diesel generators are identified as non-safety-related, they are defined as Plant Investment Protection (PIP). Confirm that the diesel generator systems will adhere to IEEE 387 or identify what standards will be used to maintain diesel generator reliability, availability, functionality and operability.
9.5-33	Morris G Gill P	Diesel generator fuel supply.	Confirm each diesel generator will have a dedicated 7 day fuel oil tank.
9.5-34	Morris G Gill P	Diesel generator fuel pump power supply	Identify the power supply for the fuel oil transfer pumps.
9.5-35	Morris G Gill P	Diesel generator rapid start	Clarify why the diesel generators have a rapid start requirement.
9.5-36	Morris G Gill P	Diesel generator fuel oil system	Clarify whether the underground piping for the fuel oil system is coated (per DCD Tier 2, Rev. 1, 9.5.4.2) or protected with a cathodic protection system (per DCD Tier 2, Rev. 1, 9.5.4.4)
9.5-37	Morris G Gill P	Diesel generator support systems	Clarify the requirement for diesel generator jacket cooling water system makeup and describe the provisions to support this requirement.

RAI Number	Reviewer	Question Summary	Full Text
9.5-38	Morris G Gill P	Diesel generator support systems	Describe what pump circulates the engine coolant in the normal standby mode.
9.5-39	Morris G Gill P	Diesel generator support systems	Identify the motive power for the diesel starting air compressors.
9.5-40	Morris G Gill P	Diesel generator support systems	Clarify the capability and capacity of the starting air tanks. How many seconds of starting air is required for each of the 5 automatic or manual starts? What controls the discharge time for each start attempt.
9.5-41	Morris G Gill P	Diesel generator support systems	Clarify the low-pressure alarm setpoint criteria. Will the setpoint allow the 5 starting attempts previously described?
9.5-42	Morris G Gill P	Diesel generator support systems	Clarify the statement that the COL applicant will specify the (diesel) lubrication system. Is this not a function of the diesel vendor?

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