October 11, 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. 76 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 Instrumentation and Control Systems in Chapter 7 and Communications Systems in Chapter 9 of the ESBWR Design Control Document (DCD). Also included in this enclosure are five follow up questions related to RAIs to which you had previously responded.

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

If you have questions or comments concerning this matter, please contact me at (301) 415-1446 or dba@nrc.gov or you may contact Amy Cubbage at (301) 415-2875 or aec@nrc.gov.

Sincerely,

/RA/

Donald B. Allen, Project Manager
ESBWR/ABWR Projects Branch
Division of New Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 52-010

Enclosure: As stated

cc w/encl: See next page

October 11, 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. 76 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 Instrumentation and Control Systems in Chapter 7 and Communications Systems in Chapter 9 of the ESBWR Design Control Document (DCD). Also included in this enclosure are five follow up questions related to RAIs to which you had previously responded.

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

If you have questions or comments concerning this matter, please contact me at (301) 415-1446 or dba@nrc.gov or you may contact Amy Cubbage at (301) 415-2875 or aec@nrc.gov.

Sincerely,

/RA/

Donald B. Allen, Project Manager
ESBWR/ABWR Projects Branch
Division of New Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 52-010

Enclosure: As stated

cc w/encl: See next page
ACCESSION NO. ML062830185

OFFICE	NESB/PM	NESB/BC(A)
NAME	DAllen	JColaccino
DATE	10/10/2006	10/11/2006

OFFICIAL RECORD COPY

Distribution for DCD RAI Letter No. 76 dated October 11, 2006

Hard Copy

PUBLIC
NESB R/F
ACubbage
DAllen

E-Mail

MGavrilas
JDanna
ACRS
OGC
ACubbage
TKevern
DAllen
MBarillas
JGaslevic
LQuinones
LRossbach
SGreen
GWilson
GMorris
PGill
KCorp
VGoel
MMcConnell

Requests for Additional Information (RAIs)
ESBWR Design Control Document (DCD), Revision 1, Tier 2, Chapter 7 and Section 9.5

RAI Number	Reviewer	Question Summary	Full Text
7.1-6	Li H	Update the DCD Section 7.1 to demonstrate that the ESBWR design has complied with RG 1.152, Positions 2.1 through 2.9	NRC has issued a Regulatory Guide (RG) 1.152, Revision 2, "Criteria for Use of Computer in Safety System of Nuclear Power Plants," January 2006. This regulatory guide also provides guidance regarding security measures for computer-based system equipment and software systems. Update the DCD, Tier 2, Section 7.1 to demonstrate that the ESBWR design has complied with RG 1.152, Positions 2.1 through 2.9. Position 2.1, Concepts Phase, Position 2.2, Requirement Phase, Position 2.3, Design Phase, Position 2.4, Implementation Phase, Position 2.5, Test Phase, Position 2.6, Installation, Checkout, and Acceptance Testing Phase, Position 2.7, Operation Phase, Position 2.8, Maintenance Phase, Position 2.9, Retirement Phase. If some of the activities will be performed beyond the design certification stage, then the DCD should identify the COL action requirements.
7.1-7	Li H	Update the DCD Table 7.1-1, "Regulatory Requirements Applicability Matrix".	Some of information on DCD, Tier 2, Revision 1, Table 7.1-1 needs to be updated. For example: 50.55a(h) should refer to IEEE-603-1991, Regulatory Guide (RG) 1.97, Revision 4, should refer to IEEE-497-2002. Applicable RGs should include RG 1.180-1/2000, "Guidelines for Evaluating Electromagnetic and Radio-frequency Interference in Safety-related I&C Systems" and RG 1.204-11/2005,"Guidelines for Lightning Protection of Nuclear Power Plants."

Enclosure

RAI Number	Reviewer	Question Summary	Full Text
7.1-8	Li H	Update the DCD to address how the ESBWR design is in conformance with Regulatory Guides.	In DCD, Tier 2, Revision 1, Table 7.1-1 (pages 7.1-37 & 38), there is a footnote that states " * These criteria are addressed in conjunction with the Safety System Logic and Control System (SSLC)." However, there is no such discussion in the SSLC section of the DCD, Tier 2, Revision 1. Please provide detailed discussion how the ESBWR design is in conformance with Regulatory Guides 1.152, 1.168, 1.169, 1.170, 1.171, 1.172, 1.173, 1.180, and 1.204.
7.1-9	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.1, Single-Failure Criterion?	IEEE-603-1991, Safety System Criterion 5.1, Single-Failure Criterion: The application document (DCD, Tier 2) should confirm that any single failure within the safety system shall not prevent proper protective action at the system level when required. The analysis should confirm that the requirements of the single-failure criterion are satisfied. The Failure Modes and Effects Analysis (FMEA) is one of the acceptable method to analyze the protection system meets the single failure criterion. The FMEA is a systematic procedure for identifying the modes of failure and for evaluating their consequences. The essential function of a FMEA is to consider each major part of the system, how it may fail, and what the effect of the failure on the system would be. The staff recognizes that detailed design of the ESBWR protection system has not been completed. However, for design certification application, the applicant should provide methodology for FMEA, and in DCD, Tier 2, Section 7.2.4 should identify performance of FMEA for protection system as an Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) item.
7.1-10	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.2, Completion of Protective Action?	IEEE-603-1991, Safety System Criterion 5.2, Completion of Protective Action: The application document (DCD, Tier 2) should include functional and logic diagrams indicating "seal-in" features that are provided to enable system-level protective actions to go to completion. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.

RAI Number	Reviewer	Question Summary	Full Text
7.1-11	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.3, Quality?	IEEE-603-1991, Safety System Criterion 5.3, Quality: The application document (DCD, Tier 2) should confirm that the safety protection system conforms to the quality assurance provisions of Appendix B to 10 CFR Part 50. For digital computer-based systems, the DCD should address the quality requirements described in Section 5.3 of IEEE Std 7-4.3.2-2003. EPRI TR-106439 “Guideline on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications,” provides guidance to COL applicant for the evaluation of existing commercial computers and software to comply with Section 5.3.2 of IEEE Std 7-4.3.2. The guidance of Branch Technical Position (BTP) 7-14, Revision 4-06/1997, or the guidance of EPRI TR-106439 may be applied to the qualification of software tools, as discussed in Section 5.3.3 of IEEE Std 7-4.3.2. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.

RAI Number	Reviewer	Question Summary	Full Text
7.1-12	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.4, Equipment Qualification?	IEEE-603-1991, Safety System Criterion 5.4, Equipment Qualification: The application document (DCD, Tier 2) should confirm that the safety system equipment is designed to meet the functional performance requirements over the range of normal and worst case (e.g., any transient, accident or anticipated operational occurrence) environmental conditions where the equipment is expected to operate. The DCD, Tier 2, should address mild environment qualification and electromagnetic interference (EMI) qualification of safety system I&C equipment. The DCD should confirm that there is independence between environmental control systems and sensing systems that would indicate the failure or malfunctioning of environmental control systems. The application also should include confirmation that the environmental protection for instrument sensing lines conforms with the guidance of RG 1.151-07/1983, “Instrument Sensing Lines” and EMI qualification conforms with the guidance of RG 1.180, Rev.1, “Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation Control Systems.” If some of the activities will be performed beyond the design certification stage, then the DCD should identify the COL action requirements. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.

RAI Number	Reviewer	Question Summary	Full Text
7.1-13	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.5, System Integrity?	IEEE-603-1991, Safety System Criterion 5.5, System Integrity: The application document (DCD, Tier 2) should confirm that tests have been conducted on safety system equipment components and the system racks and panels to demonstrate that the safety system performance is adequate to ensure completion of protective actions over the range of transient and steady-state conditions of both the energy supply and the environment. Where tests have not been conducted, the applicant should confirm that the safety system components are conservatively designed to operate over the range of service conditions. For digital computer-based systems, the confirmation of system real-time performance is adequate to ensure completion of protective action within the critical points of time identified as required. The application should confirm that the design provides for protection systems to fail into a safe state, or into a state demonstrated to be acceptable on some other defined basis, if conditions such as disconnection of the system, loss of energy, or adverse environments are experienced. The application document should include a failure modes and effects analysis. The analysis should justify the acceptability of each failure effect. Failure of computer system hardware or software should not inhibit manual initiation of protective functions or the operator performance of preplanned emergency or recovery actions. Lightning protection should be addressed as part of the electromagnetic compatibility. Lightning protection features should conform with the guidance of RG 1.204, 11/2005, “Guidelines for Lightning Protection of Nuclear Power Plants.” If some of the activities will be performed beyond the design certification stage, then the DCD, Tier 2, should identify the COL action requirements. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.

RAI Number	Reviewer	Question Summary	Full Text
7.1-14	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.6, Independence?	IEEE-603-1991, Safety System Criterion 5.6, Independence: The application document (DCD, Tier 2) should demonstrate the independence between (a) redundant portions of a safety system, (b) safety systems and the effects of design basis events, and (C) safety systems and other systems. Three aspects of independence should be addressed in each case: • Physical independence, • Electrical independence, and • Communications independence. If some of the activities will be performed beyond the design certification stage, then the DCD, Tier 2, should identify the COL action requirements. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.
7.1-15	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.7, Capability for Test and Calibration?	IEEE-603-1991, Safety System Criterion 5.7, Capability for Test and Calibration: The application document (DCD, Tier 2) should describe the Capability for Test and Calibration of both the automatic and manual circuitry. The capability should be provided to permit testing during power operation. When this capability can only be achieved by overlapping tests, the test scheme must be such that the tests do, in fact, overlap from one test segment to another. Test procedures that require disconnecting wires, installing jumpers, or other similar modifications of the installed equipment during power operation should be avoided. If some of the activities will be performed beyond the design certification stage, then the DCD, Tier 2, should identify the COL action requirements. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.

RAI Number	Reviewer	Question Summary	Full Text
7.1-16	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.8, Information Displays?	IEEE-603-1991, Safety System Criterion 5.8, Information Displays: The application document (DCD, Tier 2) should describe the information displays for manually controlled actions and include confirmation that displays will be functional (e.g., power will be available and sensors are appropriately qualified) during plant conditions under which manual actions may be necessary. Safety system bypass and inoperable status indication should conform with the guidance of RG 1.47, 05/1973, "Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems." Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.
7.1-17	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.9, Control of Access?	IEEE-603-1991, Safety System Criterion 5.9, Control of Access: The application (DCD, Tier 2) should confirm that design features provide means to control physical access to protection system equipment, including access to test points and the means for changing setpoints. Typically the access controls should include provisions such as alarms and locks on safety system panel doors, or control of access to rooms in which safety system equipment is located. The digital computer-based systems should have controls over electronic access to safety system software and data. Controls should address access via maintenance equipment. If some of the activities will be performed beyond the design certification stage, then the DCD, Tier 2, should identify the COL action requirements. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.
7.1-18	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.10, Repair?	IEEE-603-1991, Safety System Criterion 5.10, Repair: Digital safety systems may include self-diagnostic capabilities to aid in troubleshooting. The application (DCD, Tier 2) should describe the characteristics of the digital computer-based diagnostic capabilities. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.

RAI Number	Reviewer	Question Summary	Full Text
7.1-19	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.11, Identification?	IEEE-603-1991, Safety System Criterion 5.11, Identification: The application (DCD, Tier 2) should describe the identification method for components, cables, and cabinets. For computer-based systems, the configuration management plan should describe the identification process for computer software. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.
7.1-20	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.12, Auxiliary Features?	IEEE-603-1991, Safety System Criterion 5.12, Auxiliary Features: The application (DCD, Tier 2) should describe that auxiliary supporting features should meet all requirements of IEEE-603-1991. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.
7.1-21	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.14, Human Factors Considerations?	IEEE-603-1991, Safety System Criterion 5.14, Human Factors Considerations: The application (DCD, Tier 2) should describe that the safety system human factors design features are consistent with the commitments documented in Chapter 18 of the DCD. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.
7.1-22	Li H	How is the ESBWR design in conformance with IEEE-603 Safety System Criterion 5.15, Reliability?	IEEE-603-1991, Safety System Criterion 5.15, Reliability: The application (DCD, Tier 2) should describe that the degree of redundancy, diversity, testability, and quality provided in the safety system design is adequate to achieve functional reliability commensurate with the safety functions to be performed. For computer systems, both hardware and software reliability should be analyzed. RG 1.152, Revision 2, describes the NRC position on software reliability determination. If some of the activities will be performed beyond the design certification stage, then the DCD, Tier 2, should identify the COL action requirements. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.

RAI Number	Reviewer	Question Summary	Full Text
7.1-23	Li H	How is the ESBWR design in conformance with IEEE-603 Sense and Command Features 6.1, Automatic Control?	IEEE-603-1991, Sense and Command Features 6.1, Automatic Control: The application document (DCD, Tier 2) should include an analysis to confirm that the safety system has been qualified for the requisite performance requirements. The evaluation of the precision of the protection system should be addressed to the extent that setpoints, margins, errors, and response times are factored into the analysis. For digital computer-based systems, the application should confirm that the general functional requirements have been appropriately allocated into hardware and software requirements. The application should also confirm that the system's real-time performance is deterministic and known. If some of the activities will be performed beyond the design certification stage, then the DCD, Tier 2, should identify the COL action requirements. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.
7.1-24	Li H	How is the ESBWR design in conformance with IEEE-603 Sense and Command Features 6.2, Manual Control?	IEEE-603-1991, Sense and Command Features 6.2, Manual Control: The application (DCD, Tier 2) should include confirmation that the features for manual initiation of protective action will conform with RG 1.62, 10/1973, "Manual Initiation of Protection Action." Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.

RAI Number	Reviewer	Question Summary	Full Text
7.1-25	Li H	How is the ESBWR design in conformance with IEEE-603 Sense and Command Features 6.3, Interaction Between the Sense and Command Features and Other Systems?	IEEE-603-1991, Sense and Command Features 6.3, Interaction Between the Sense and Command Features and Other Systems: The application (DCD, Tier 2) should confirm that non-safety system interactions with protection systems are limited such that the requirements of 10 CFR Part 50 Appendix A, General Design Criteria (GDC) 24, "Separation of Protection and Control System," are met. Where the event of concern is single failure of a sensing channel shared between control and protection functions, previously accepted approaches have included: • Isolating the protection system from channel failure by providing additional redundancy. • Isolating the control system from channel failure by using data validation techniques to select a valid control input. • Design the communications path to be a broadcast only from the protection system to the control system. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.
7.1-26	Li H	How is the ESBWR design in conformance with IEEE-603 Sense and Command Features 6.4, Derivation of System Inputs?	IEEE-603-1991, Sense and Command Features 6.4, Derivation of System Inputs: The application (DCD, Tier 2) should verify that the characteristics (e.g., range, accuracy, resolution, response time, sample rate) of the instruments that produce the protection system inputs are consistent with the analysis provided in Chapter 15 of the SAR. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.

RAI Number	Reviewer	Question Summary	Full Text
7.1-27	Li H	How is the ESBWR design in conformance with IEEE-603 Sense and Command Features 6.5, Capability for Testing and Calibration of System Inputs?	IEEE-603-1991, Sense and Command Features 6.5, Capability for Testing and Calibration of System Inputs: The most common method used to verify the availability of the input sensors is by cross checking between redundant channels that have available instrumentation signal displays. When only two channels of signal displays are provided, the DCD, Tier 2, should state the basis used to ensure that an operator will not take incorrect action when the two channel signals differ. The DCD, Tier 2, should state the method to be used for checking the operational availability of non-indicating sensors. Standard Review Plan, Chapter 7, BTP 7-17, Revision 4 - 06/1997, "Guidance on Self-Test and Surveillance Test Provisions," discusses issues that should be considered in sensor checks and surveillance tests for digital computer I&C systems. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.
7.1-28	Li H	How is the ESBWR design in conformance with IEEE-603 Sense and Command Features 6.6, Operating Bypasses?	IEEE-603-1991, Sense and Command Features 6.6, Operating Bypasses: The requirement of the execute features in IEEE 603-1991 for automatic removal of operational bypasses requires that the reactor operator shall have no role in such removal. The operator may take action, however, to prevent the unnecessary initiation of a protective action. The application document (DCD, Tier 2) should address this issue. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.
7.1-29	Li H	How is the ESBWR design in conformance with IEEE-603 Sense and Command Features 6.7, Maintenance Bypass?	IEEE-603-1991, Sense and Command Features 6.7, Maintenance Bypass: The application document (DCD, Tier 2) should address the provision of any maintenance bypass and confirm that the required action is consistent with the proposed plant technical specifications. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.

RAI Number	Reviewer	Question Summary	Full Text
7.1-30	Li H	How is the ESBWR design in conformance with IEEE-603 Sense and Command Features 6.8, Setpoints?	IEEE-603-1991, Sense and Command Features 6.8, Setpoints: The application document (DCD, Tier 2) analysis should confirm that an adequate margin exists between operating limits and setpoints, such that there is a low probability for inadvertent actuation of the system. The application document should include an analysis to confirm that an adequate margin exists between setpoints and safety limits, such that the system initiates protective actions before safety limits are exceeded. Regulatory Guide 1.105, Revision 3, 12/1999, "Setpoint for Safety-Related Instrumentation," provides guidance for setpoint determination. If some of the activities will be performed beyond the design certification stage, then the DCD, Tier 2, should identify the COL action requirements. Appropriate ITAAC acceptance criteria should be proposed to verify this commitment.
7.1-31	Li H	Describe the ESBWR's "Soft-control" design.	DCD, Tier 2, Revision 1, Figure 7.1-1, "ESBWR Instrumentation and Control Simplified Block Diagram" shows that the ESBWR design has Flat Panels with Soft-controls for both safety-related and non-safety-related instrumentation. Please provide detailed design description (include interface diagrams, hardware and software requirements) of the Flat Panels with Soft-controls design.
7.1-32	Li H	Clarify the safety classification of the ATWS mitigation systems.	DCD, Tier 2, Revision 1, Figure 7.1-1 indicated the ATWS Standby Liquid Control (SLC) Logic is located in safety-related cabinets, while DCD, Tier 2, Revision 1, Section 7.8.1.1.3 stated that the Alternate Rod Insertion (ARI) function, which is part of the ATWS mitigation logic, is nonsafety-related and physically located in the Diverse Protection System (DPS). Clarify the safety classification of the ATWS mitigation systems.
7.1-33	Li H	Describe the ESBWR's "Gateway" design.	DCD, Tier 2, Revision 1, Figure 7.1-1 indicated the Gateway Cabinets provides interface between safety-related I&C systems and the nonsafety-related I&C systems. Please provide detailed design description (include hardware and software requirements) of this Gateway system.

RAI Number	Reviewer	Question Summary	Full Text
7.1-34	Li H	Describe the ESBWR's "1E Communication Interface" design."	DCD, Tier 2, Revision 1, Figure 7.1-1 indicated the "1E Communication Interface" connected between safety-related I&C systems. DCD, Tier 2, Revision 1, Section 7.9.1 has limited information. Please provide detailed design description (include system configuration, hardware and software requirements, qualification status) of this "1E Communication Interface" system.
7.1-35	Li H	Describe the ESBWR's "Ethernet Network Switches" design.	DCD, Tier 2, Revision 1, Figure 7.1-1 indicated the "Ethernet Network Switches" connected between nonsafety-related I&C systems. Please provide detailed design description (include hardware and software requirements) of this "Ethernet Network Switches" design. If the system will use the existing commercial computer product, provide the qualification requirements.
7.1-36	Li H	Explain the design to allow the communication from nonsafety-related systems to safety-related E-DCIS system.	DCD, Tier 2, Revision 1, Section 7.9.2.2 provided the Non-essential Distributed Control and Information System (NE-DCIS) system description. There is a statement that the communication from nonsafety-related systems to the Essential Distributed Control and Information System (E-DCIS) is limited to communication from the 3D Monicore function of the NE-DCIS to the PRNM (LPRM and APRM) function of the Neutron Monitoring System. This is not consistent with the E-DCIS design that only allows one-way communication from divisional E-DCIS network to the NE-DCIS. Please explain this exception.
7.1-37	Li H	Provide a copy of the reference documents listed in DCD Section 7.1.4, items 5 through 8.	DCD, Tier 2, Revision 1, Section 7.1.4, "References," listed 8 documents. Item 1 is the NRC NUREG-0800, "Standard Review Plan." Items 2, 3, and 4 were provided for information on 12/15/2005. The staff needs a copy of documents listed as items 5 through 8 for information.

RAI Number	Reviewer	Question Summary	Full Text
7.1-38	Li H	Address GL 96-01, “Testing of Safety-Related Logic Circuits,” requirements.	NRC Generic Letter 96-01, “Testing of Safety-Related Logic Circuits,” requested licensees to compare electrical schematic drawings and logic diagrams for the reactor protection system, and the actuation logic for the ESF systems against plant surveillance test procedures to ensure that all portions of the logic circuitry, including the parallel logic, interlocks, bypasses and inhibit circuits are adequately covered in the surveillance procedure to fulfill the technical specification requirements. DCD, Tier 2, Revision1, Table 1C-1 for item GL 96-01 “Evaluation Result” does not sufficiently addressing this issue. If the plant surveillance test procedures are not available at the design certification stage, then the DCD should identify that this is a COL action item.
7.1-39	Li H	Address 10 CFR 50.34(f)(2)(v), TMI item I.D.3, “Provide for automatic indication of the bypassed and inoperable status of safety systems.	DCD, Tier 2, Revision 1, Table 1A-1, “TMI Action Plan Item,” referred to DCD, Tier 2, Sections 7.1.2.2, 7.2.1.3, and Table 7.1-1 to address this item. However, there is no discussion of how this item will be implemented in the ESBWR design in these DCD sections. Provide detailed description of how this TMI item will be implemented.

RAI Number	Reviewer	Question Summary	Full Text
7.1-40	Beacom R	Address two generic issue or provide DCD reference sections that addresses these issues.	A. Issue 50 of NUREG-0933, Reactor Vessel Level Instrumentation in BWRs, Revision 1 -June 21, 2004. One of the two factors that could improve water level instrumentation is precluding temperature effects which could cause decalibration and flashing. The applicant should identify how the ESBWR design addresses this issue or provide reference to the DCD section that addresses this issue. B Issue 67.3.4 of NUREG-0933, Reactor Vessel Inventory Measurement. The applicant references Appendix 1A, which addresses TMI Action Plan, item II.F.2. In the resolution of that item, the ESBWR design of the water level instrumentation is referenced. It states that the design "includes a constant metered addition of purge water from the Control Rod Drive (CRD) hydraulic system to prevent the build-up of dissolved gasses in the fixed leg." This design feature, which is a resolution of a TMI action item, should be included in Section 7 as part of the I&C design.
7.1-41	Beacom R	Identify and describe the validation of innovative means of accomplishing I&C system safety functions. Clarify the discrepancy in DCD related to this issue .	Your response to the Staff's RAI question 7.1-2 stated "The ESBWR is designed with innovative means of accomplishing safety functions as described in DCD Tier 2 Section 1.5. Validations of those innovative means are summarized in Sections 7.2 through Section 7.9 for the specific system. The degree of applicability and conformance, along with any clarifications or justification for exceptions, are presented in the evaluation sections for each specific system." However, the staff finds the following contradicting reference to this issue in the DCD, Tier 2, Revision 1, Section 7.1, page 7.1-19: "The validation of innovative means of accomplishing I&C system safety-related functions does not apply to the ESBWR safety I&C design submitted for this certification application." Please clarify the applicable portions of the DCD.

RAI Number	Reviewer	Question Summary	Full Text
7.1.42	Beacom R	Define fault tolerant features of the triplicate digital controllers and the architecture of the SSLC	Define what is meant by the “fault tolerant” features of both the Fault Tolerant Digital Controller and the SSLC architecture that is specified to be fault tolerant. Identify these features as software, hardware or both and describe the system responses to each type.
7.1-43	Beacom R	Describe what is meant by Plant Computer Functions shown on the block diagram in Figure 7.1-1.	Describe the block on Figure 7.1-1 of DCD, Tier 2, Revision 1, identified as “Plant Computer Functions”. Identify if this block is a separate hardware component or representative of the gateway to the various plant computers or is this a self contained system or component of the NE-DCIS.
7.1-44	Beacom R	Provide clarification for “Most sensors have a provision for actual testing and calibration during reactor operation.”	In DCD, Tier 2, Revision 1, Section 7.1.2.3.6, in Capability for Test and Calibration, this statement is provided: “Most sensors have a provision for actual testing and calibration during reactor operation.” Two exceptions are defined: - Confirm operation of MSIV and turbine stop valve limit switches; - Independent functional testing of the air header dump valves during each refueling outage (not operation) and operation of at least one valve can be confirmed following each scram. Please confirm all temperature, pressure, differential pressure sensors plus remaining limit switches and instrument valves would have this provision (i.e. testing and calibration during reactor operation). Otherwise, please provide a listing of those that actually will have this capability.

RAI Number	Reviewer	Question Summary	Full Text
7.1-45	Beacom R	Provide differences between SSLC/RTIF used in ABWR versus SSLC/RTIF used in ESBWR	DCD, Tier 2, Revision 1, Section 7.1.1.2.1: It is stated that the "ESBWR SSLC/RTIF architecture concept is identical to that of the ABWR SSLC/RTIF," and "Such RTIF hardware and software platform structure concept is identical to that of the ESBWR." In order to take any credit for the ABWR Safety System Logic and Control/Reactor Trip and Isolation Function (SSLC/RTIF) the following will have to be explained: 1) What is meant by "architectural concept" and "hardware and software platform structure concept" 2) The exact differences between the ESBWR and the ABWR SSLC/RTIF would have to be identified. Also, these differences substantiated in terms of design specifications as well as application and procurement documents. 3) Most importantly, the safety significance of the differences would have to be addressed by the applicant.
7.1-46	Beacom R	Provide the reason for the difference in the definition of "Division" for ESBWR in DCD Section 1.2 versus IEEE Std 603 criteria definition	In DCD, Tier 2, Revision 1, Section 1.2.1, page 1.2-2, the definition of Division is "refers to safety related electrical and/or instrumentation and control (I&C) equipment connected to a common electrical power source." Per IEEE-603 - 1991, the definition of division is: " The designation applied to a given system or set of components that enables the establishment and maintenance of physical, electrical, and functional independence from other redundant sets of components." Please update the DCD to use the standard's definition or propose a substantiation to differ from the IEEE standard.

RAI Number	Reviewer	Question Summary	Full Text
7.2-21	Singh G	Please provide the basis for the statement regarding very low failure rate for the gamma thermometers (GTs).	DCD, Tier 2, Revision 1, Section 7A.1.2 makes a statement, “With their simple operating principles, gamma thermometers (GTs) have a very low failure rate (Reference 7A-1). The historical failure data of the similarly installed GTs in nuclear power plants is limited. Provide basis for this statement with regard to the limited similar plant operational data. What is the criteria for replacing GT/LPRM (Local Power Range Monitor) assembly i.e. failure of two or more sensors?
7.2-22	Singh G	What is the expected life of GTs?	DCD, Tier 2, Revision 1, Section 7A: What is the expected life of GTs and how does it compare with the qualified life of local power range monitors (LPRMs)?
7.2-23	Singh G	GT heater heating rate and the associated fission density.	DCD, Tier 2, Revision 1, Section 7A.2.1 states, “the range in gamma heating rate should be 0.0 to 2.4 W/g for typical BWR.” What is the corresponding range for fission density/thermal power.
7.2-24	Singh G	Recommended frequency of calibration of GT.	DCD, Tier 2, Revision 1, Section 7A: The GT sensitivity varies significantly with the age of the sensor. Since LPRM calibration is based on the calibration corrected GT data, what is the recommended calibration interval for new GT sensors and the interval after the first refueling outage? Provide the basis for the recommended duration.
7.2-25	Singh G	Communication interfaces between GT and LPRM systems.	DCD, Tier 2, Revision 1, Section 7A: GT neutron monitoring system is passing calibration data to the safety related LPRM system. GT neutron monitoring system is not a safety related system but the LPRM system is. Does the communication between the two systems meet the IEEE-603-1991 Section 5.6.3.(1) criterion: Equipment that is used for both safety and non-safety functions shall be classified as part of the safety system. Isolation devices used to effect a safety system boundary shall be classified as part of the safety system. (The term “equipment” should include both software and hardware of the digital systems.) Please describe how this criterion for communication between the two systems is met?

RAI Number	Reviewer	Question Summary	Full Text
7.2-26	Singh G	Blocking transmittal of GT signals in calibration from the 3D simulator.	DCD, Tier 2, Revision 1, Section 7A: GT signals, associated with GT strings that are being calibrated are blocked from transmittal to the 3D simulator (or are otherwise marked unusable). Are these totally excluded from the 3D simulation model or is the last good value substituted in its place. Provide response with rationale for the option used. How many signals can be placed in a blocked mode at any given time?
7.2-27	Singh G	Describe the sensitivity changes in the gamma thermometer (GT) over time.	DCD, Tier 2, Revision 1, Section 7A: The GT calibration sensitivity is based on the time for which the GT has been in use. From the data provided it appears that sensitivity increases at first and then decreases over time. Will it settle to a fixed value? Is there a long term plan to check and confirm the changes in sensitivity of the GTs? The current data provided in NEDE-33179P regarding sensitivity is limited to a duration of less then 4.6 years.
7.2-28	Li H	Identify the I&C systems for which the design acceptance criteria (DAC) process will be followed.	10 CFR 52.47 requires that the application must contain a level of design information sufficient to enable the Commission to judge the applicant's proposed means of assuring that the construction conforms to the design. As defined in SECY-92-053, dated February 19, 1992, the advanced I&C system is one of the review areas that can use the design acceptance criteria (DAC) as part of the design review and certification process. The DAC are "a set of prescribed limits, parameters, procedures, and attributes upon which the NRC relies, in a limited number of technical areas, in making a final safety determination to support a design certification." The DAC are objective, and must be verified as part of the inspections, tests, analyses, and acceptance criteria (ITAAC) performed to demonstrate that the as-built facility conformed to the certified design. Identify the I&C systems for which the design acceptance criteria (DAC) process will be followed.

RAI Number	Reviewer	Question Summary	Full Text
7.2-29	Li H	Provide topical report describing the hardware configuration for the instrumentation and control architecture for the reactor trip system .	During July 26 and 27, 2006 I&C meeting, the applicant presented the NUMAC E-DCIS Platform Family. The RPS instrumentation and control architecture is significantly different from the architecture presented in DCD, Tier 2, Revision 1, Figure 7.2-1. The staff considers this a major design change of the RPS. This new proposed design, that involves the inter-division communication, may not meet the IEEE-603-1991 requirements. The applicant should provide a topical report describing the detailed hardware configuration that will implement the instrumentation and control architecture for the ESBWR reactor trip system (RPS). The report should address how the ESBWR reactor trip system design is in conformance with IEEE Std 603 requirements.
7.2-30	Li H	Provide detailed description of the “N–2" Design.	During July 26 and 27, 2006 I&C meeting, the applicant presented the “N–2" design concept. Additional design information, basis for compliance with regulations, and the technical specification requirements should be provided.
7.2-31	Li H	Describe the Scram arrangement between hydraulic insertion and FMCRD.	ESBWR design introduces the fine motion control rod drive mechanism (FMCRD) as a non-safety, diverse backup provision for the Scram function. In addition, there is a non-safety-related Alternate Rod Insertion (ARI) system for ATWS mitigation. Provide a schematic diagram and describe the interface between FMCRD, ARI, and normal hydraulic scram systems. The discussion should include but not be limited to separation between safety and non-safety circuits, reset provision, display provision, and inadvertent actuation prevention.

RAI Number	Reviewer	Question Summary	Full Text
7.2-32	Li H	Describe the “Paired-control-rods Scram Tests,” and “SCRAM follow” function.	DCD, Tier 2, Revision 1, Section 7.2.1.4 stated that “switches are installed in the main control room to permit testing of the fast scram operation of the individual pairs of control rods and to confirm that the individual control rods have scrammed.” Provide description and a schematic diagram to illustrate this test provision. Also in NEDO-33251, Section 5.3 stated that “Although the operator must usually initiate the process, it can also be automatically initiated by the “SCRAM follow” function of RC&IS or by the ATWS/SLCS logic through the DPS.” Provide description and a schematic diagram to illustrate all the circuitry (all solenoids) related to scram function.
7.2-33	Li H	Provide a summary table in the DCD for automatic and manual bypasses of scram function. Provide logic diagrams.	DCD, Tier 2, Revision 1, Section 7.2.1.5.2, “Automatic and Manual Bypass of Selected Scram Functions,” addresses more than 20 cases for various automatic and manual bypasses of selected scram functions. It is not clear how many bypasses are automatic by the protection system, and how many bypasses are required by operator action. How many switches on the control console will perform reactor trip system related function? Provide logic diagrams showing these bypasses, and permissive circuits.
7.2-34	Li H	Provide a summary table in the DCD for Mode switch functions that relate to the bypass and reset functions of the protection system.	DCD, Tier 2, Revision 1, Section 7.2.1.5.2, “Automatic and Manual Bypass of Selected Scram Functions,” describes “Mode Switch” as a multi-function, multi-bank, control switch provides mode selection for the necessary interlocks associated with the various plant modes. It is not clear what specific position of the mode switch that relate to the bypass and reset functions of the protection system.
7.2-35	Li H	Provide detailed design information for the Oscillation Power Range Monitor (OPRM).	DCD, Tier 2, Revision 1, Section 7.2.2.2.4, Oscillation Power Range Monitor (OPRM), does not provide sufficient information to describe its compliance with IEEE Std. 603-1991 and its setpoint determination. Provide design information to address the hardware and software design of the ESBWR’s OPRM system. Table 7.2-3, APRM Trip Function Summary, indicated typical analytical limit for APRM trip setpoints. Provide similar information for the OPRM system.

RAI Number	Reviewer	Question Summary	Full Text
7.2-36	Li H	Clarify "Typical Analytical Limit" in Tables 7.2-2 and 7.2-3.	DCD, Tier 2, Revision 1, Table 7.2-2 and Table 7.2-3 listed "Typical Analytical Limit For Trip Setpoint (Note 1)." Note 1 stated that values in this table are typical, instrument accuracy will be considered based on the instrument setpoint methodology. It is the staff's understanding that the analytical limit should be based on the ESBWR's accident analysis, therefore, it is not a "typical" value. The trip setpoint will be determined based on plant-specific instrument selected that will be specified in the plant technical specification. Clarify "Typical Analytical Limit" in Tables 7.2-2 and 7.2-3.
7.2-37	Li H	Provide detailed design information for the Startup Range Neutron Monitor (SRNM) Subsystem trip functions.	DCD, Tier 2, Revision 1, Section 7.2.2.1.1, "Startup Range Neutron Monitor (SRNM) Subsystem," does not provide detailed discussion of the SRNM trip functions listed in Table 7.2-2, "SRNM Trip Function Summary." Provide detailed design information for the Startup Range Neutron Monitor (SRNM) Subsystem trip functions. If these SRNM trip functions are addressed in other sections of the DCD, please provide cross reference to the related DCD section.
7.2-38	Li H	Provide detailed discussion of the NMS basic control logic requirements.	DCD, Tier 2, Revision 1, Section 7.2.2.5.2, Basic Control Logic Requirements does not provide sufficient detailed information to demonstrate that the control logic of the safety-related subsystems in the NMS is designed as "fail-safe." Provide detailed discussion of the NMS basic control logic with a logic diagram. Also explain the function of "Coincidence/Non-Coincidence switch."
7.2-39	Li H	Provide detailed description of the Essential Distributed Control and Information System (E-DCIS).	DCD, Tier 2, Revision 1, Section 7.2.1.2.4.2 stated that many process systems provide outputs to the reactor protection system (RPS) through the Essential Distributed Control and Information System (E-DCIS). Provide detailed discussion with drawings to address how the E-DCIS design satisfies the IEEE-603 criterion 5.6 (and IEEE 7-4.3.2) requirements. The response should also demonstrate that data communication between safety channels or between safety and non-safety system shall not inhibit the performance of the safety function, and shall be in conformance with IEEE-603 criterion 5.6 requirements.

RAI Number	Reviewer	Question Summary	Full Text
7.2-40	Li H	Provide detailed description of the Safety System Logic and Control (SSLC) system.	DCD, Tier 2, Revision 1, Section 7.2.1.2.4.1 stated that digital trip modules (DTMs) and trip logic units (TLUs) are microprocessor-based modules of the Safety System Logic and Control (SSLC) system. The software associated with RPS channel trip and trip system coincident logic decisions that are installed in these SSLC modules are RPS unique. Provide detail discussion with drawings to show how the DTMs and the TLUs performing their functions and address how the SSLC system design satisfy the IEEE-603 requirements (and IEEE 7-4.3.2 criteria). The response should also demonstrate that data communication between safety channels or between safety and non-safety system shall not inhibit the performance of the safety function, and shall be in conformance with IEEE-603 criterion 5.6 requirements.
7.2-41	Beacom R	Describe the Bypass function shown in Figure 7.2-1, RPS Functional Block Diagram	Describe the Bypass function shown in DCD, Tier 2, Revision 1, Figure 7.2-1 “RPS Functional Block Diagram.” Please identify the inputs and outputs of the bypass unit.
7.2-42	Beacom R	Describe the Communication Interface Module application in the RPS and how it is satisfactorily meeting IEEE 603 requirements	The text of DCD, Tier 2, Revision 1, Section 7.2, Reactor Trip System, does not provide any information on this application of the Communication Interface Module. The staff requests the following: a) Is this a 2-way communication link? b) Identify the data, by functional description, that passes through this component. c) Show how this communication provision is consistent with safety system separation and isolation requirements of IEEE-603 with regards to data transmission and cyber security, as well as electrical isolation, between a safety and non-safety system.
7.2-43	Beacom R	Describe the relay arrangement for backup scram logic circuitry	In DCD, Tier 2, Revision 1, Section 7.2.1.2.4, “Divisions of Trip Actuators”, normally open relay contacts are described for the ESBWR, for energization of the air header dump valve solenoids to energize. Provide a Power Distribution Diagram which shows the normally closed scheme for that design.

RAI Number	Reviewer	Question Summary	Full Text
7.2-44	Beacom R	Provide functional description of the Load Drivers	In DCD, Tier 2, Revision 1, Section 7.2.1.2.4, “Divisions of Trip Actuators”, a brief hardware description of the load drivers explains it as an isolating feature of the system. Explain how this device performs the isolation function in the safety-related protection system.
7.2-45	Beacom R	Clarification of RPS output types	In DCD, Tier 2, Revision 1, Section 7.2.1.2.4.2, “Initiating Circuits”, in order to understand the statement “... and Manual Scram outputs, which are provided directly to the RPS by dedicated fiber optics or hardwire signals, the rest ...”, reword the statement to identify which outputs are fiber optic and which are electric wired.
7.2-46	Beacom R	Clarify the discrepancy between Tier 1 and Tier 2 information.	As in DCD, Tier 1, Revision 1, Section 2.2.7, Reactor Protection System, the conditions "Short period power increase" and "Main Condenser Vacuum Low" are listed. These conditions are not listed in Section 7.2.1.2.4.2 which causes the RPS logic to initiate a reactor scram. Clarify the discrepancy between Tier 1 and Tier 2 information.
7.2-47	Beacom R	Add RPS Scram variables, Condenser Pressure and NMS outputs, to list of safety-related status and alarm signals	In DCD, Tier 2, Revision 1, Section 7.2.1.2.4.2, Initiating Circuits, “Outputs to Main Control Room Panels”, *Displays*, Add or please explain why Condenser Pressure and NMS outputs should not be added to the list of RPS scram variables.
7.2-48	Beacom R	Identify dedicated and soft alarms as final outputs to Main Control Panels	In DCD, Tier 2, Revision 1, Section 7.2.1.2.4.2, Initiating Circuits, “Outputs to Main Control Room Panels”, *Alarms*, page 7.2-12, please identify which alarms, related to RPS status, are dedicated and which are soft alarms.

RAI Number	Reviewer	Question Summary	Full Text
7.2-49	Beacom R	Alarms missing from alarms related to RPS status list	Please explain if the following alarms should be included for providing RPS status, in DCD, Tier 2, Revision 1, Section 7.2.1.2.4.2, “Outputs to Main Control Room Panels”, *Alarms*, page 7.2-12: Neutron Flux High High Control Rod Not Inserted Suppression Pool water level Drywell Temperature High
7.2-50	Beacom R	Please provide Commercial Dedication Process for staff review	In DCD, Tier 2, Revision 1, section 7.2.1.3, Safety Evaluation, compliance to BTP HICB-18 reads "Any portions of RPS and SSLC design that will use commercial grade programmable logic controllers (PLCs) for safety-related functions conform to this BTP (and to BTPs 14, 17, and 21). Such PLCs will be qualified to a level commensurate with safety system requirements." This will require Tier 1 ITAAC which stipulates the Commercial Dedication Process for review.

RAI Number	Reviewer	Question Summary	Full Text
7.3-1	Li H	Provide failure modes and effects analysis (FMEA) for the engineered safety features systems.	During July 26 and 27, 2006 I&C meeting, the applicant presented the E-DCIS Platform Family. The ECCS/ESF Platform will be design by a separate vendor. In order to demonstrate the ECCS/ESF design is in conformance with GDC 23, "Protection system failure modes," please provide a failure modes and effects analysis for each of the following engineered safety features systems: 1) Emergency Core Cooling System (ADS and GDCS) 2) Passive Containment Cooling System 3) Leak Detection and Isolation System 4) Safety System Logic and Control. The staff recognizes that specific hardware design of the ESBWR protection system has not been completed. However, for design certification application, the applicant should provide methodology for FMEA, and in DCD Section 7.3.5 should identify performance of FMEA for protection system as a COL action item when the plant-specific hardware is determined.
7.3-2	Li H	Update DCD Section 7.3.	The staff finds that many design features described during the July 26 and 27 I&C meeting were not clearly documented in DCD, Tier 2, Revision 1, Section 7.3. A general update of DCD Section 7.3 is required. For example, ECCS/ESF Platform was never discussed in DCD. If a referenced platform will be implemented for the ESF function, it should be listed at DCD Section 7.3.6, "References." Figures 7.3.1A and 7.3.1B have not shown manual actuation which was discussed in DCD Section 7.3.1.1.2. The "joystick bypass switch" information, which was discussed in response to Staff RAI 7.2-3, should be documented in the DCD.

RAI Number	Reviewer	Question Summary	Full Text
7.3-3	Li H	Identify the diversity characteristics between the ECCS-SSLC circuitry and the DPS circuitry in Figure 7.3-1A.	DCD, Tier 2, Revision 1, Figure 7.3-1A, "SRV Initiation Logics," indicates diverse means to actuate Safety Relieve Valve. However, three circuits look the same. Please identify the diversity characteristics between the ECCS-SSLC circuitry and the DPS circuitry in Figure 7.3-1A.
7.3-4	Li H	Identify the instrument location and equipment qualification requirement of the reactor vessel level and drywell pressure instrumentation.	DCD, Tier 2, Revision 1, Section 7.3.1.1.3, "Safety Evaluation," stated that ECCS initiating instrumentation must respond to the potential inadequacy of core cooling regardless of the location of the breach in the reactor coolant pressure boundary. Identify the instrument location and the equipment qualification requirement of the reactor vessel level and drywell pressure instrumentation that will perform the mitigation function. Are these sensors qualified to function in harsh environment? Discuss the response time of these instrument channels in response to various pipe break locations.
7.3-5	Li H	Address 10 CFR 50.34(f)(2)(vii), TMI item II.K.3.18.-Optimum ADS	Address 10 CFR 50.34(f)(2)(vii), TMI item II.K.3.18, "Perform a feasibility and risk assessment study to determine the optimum automatic depressurization system (ADS) design modifications that would eliminate the need for manual activation to ensure adequate core cooling." This item was not listed on DCD, Tier 2, Revision 1, Table 1A-1, TMI Action Plan Items. If this TMI Action Plan item is not applicable to ESBWR design or is addressed in other DCD section, then DCD Table 1A-1 should provide justification or reference section number for this item.

RAI Number	Reviewer	Question Summary	Full Text
7.3-6	Li H	Address 10 CFR 50.34(f)(2)(x), TMI item II.K.3.28.-ADS requirements	Address 10 CFR 50.34(f)(2)(x), TMI item II.K.3.28, "Perform a study to ensure that the ADS valves, accumulators, and associated equipment and instrumentation will be capable of performing their intended functions during and following an accident situation, taking no credit for non-safety related equipment or instrumentation, and accounting for normal expected air (or nitrogen) leakage through valves." This item was not listed on DCD, Tier 2, Revision 1, Table 1A-1, TMI Action Plan Items. If this TMI Action Plan item is not applicable to ESBWR design or is addressed in other DCD section, then DCD Table 1A-1 should provide justification or reference section number for this item.
7.3-7	Li H	Address IE Bulletin 80-06 concerns.	IE Bulletin 80-06, Engineered Safety Feature (ESF) Reset Controls, requested to review the ESF design to determine whether or not, following the reset of an ESF actuation signal, all associated safety-related equipment remains in its emergency mode. In DCD, Tier 2, Revision 1, Table 1C-1, Operating Experience Review Results Summary, the evaluation result for item 80-06 addresses an unrelated subject. Please provide correct response to this subject.
7.3-8	Li H	Provide a logic or schematic diagram for both automatic and manual control of squib valves in the Gravity-Driven Cooling System (GDCS).	DCD, Tier 2, Revision 1, Section 7.3.1.2.2, GDCS System Description stated that once the initial start signal is given to both ADS and GDCS (starting the various timers), the sequence is sealed in and cannot be aborted by the plant operator. It is also possible for the operator to manually initiate the equalizing valves or to individually fire the various squib initiators independently by injecting trip signals to the automatic logic. Please provide a logic or schematic diagram to illustrate the provisions of both automatic and manual control of the squib valves in the GDCS.

RAI Number	Reviewer	Question Summary	Full Text
7.3-9	Li H	Provide topical report for hardware configuration of the I&C architecture for the ECCS/ESF Functions	During July 26 and 27, 2006 I&C meeting, the applicant presented the proposed ECCS/ESF Platform Family. A topical report describing the detailed hardware configuration that implements the instrumentation and control architecture for the ESBWR ECCS/ESF Functions should be provided. The report should address how the ESBWR ECCS/ESF actuation system design is in conformance with IEEE Std 603-1991 requirements.
7.3-10	Beacom R	Clarify the discrepancy between Tier 1 and Tier 2 information regarding the non-safety design basis for ADS	The non-safety design basis for the ADS instrumentation identifies the status of SRVs and DPVs in the main control room. However, the safety requirements of Tier 1, Section 2.1, Nuclear Boiler System, page 2.1-12, identifies indication of the status of these valves as a safety related function.
7.3-11	Beacom R	Provide a piping and instrumentation diagram (P&ID) for the Gravity-Driven Cooling System (GDCS) and proper reference to the P&ID	Several places within DCD, Tier 2, Revision 1, Section 7.3.1.2 reference Figure 6.3-2 as the piping and instrumentation diagram. Per the DCD, Rev. 1, this figure is “Typical GDCS Squib Valve” 1) Please identify what is meant by the term “Typical” for this particular diagram. This is an item that must be of fixed design, tested with a report of the final product identified in Tier 1 if it is not available now. 2) The only figure close to a piping and instrumentation diagram is Figure 6.3-1, “GDCS Configuration”. However, this diagram requires updating to include the instrumentation for the GDCS identified in the text of 7.3.1.2. 3) For the ADS and GDCS, provide a thorough and complete piping and instrumentation diagram including the logics for both the ADS and the GDCS. This would begin with the inclusion of the ECCS start signal, include all sensors, interlocks, start signals and time delays.

RAI Number	Reviewer	Question Summary	Full Text
7.3-12	Beacom R	Identify the differences of the Remote Mulitplexing Units (RMU) and provide the specifications	In DCD, Tier 2, Revision 1, Section 7.3.1.2, Gravity-Driven Cooling System, reference is made to multiple deluge valve thermocouple signals feeding the reactor building remote multiplexing units (RMUs). Please provide the following with regards to these units: 1) Identify which RMUs this refers to. Will the RMUs in the reactor building be all the same, including manufacturer, or will that depend on the platform (i.e. ECCS or RTS)? 2) Will the RMUs be built to the same hardware and software specifications, or will that depend on platform? If so provide a set of hardware and software specifications, including logic diagrams, and identify the anticipated differences between platforms.
7.4-2	Li H	Provide detailed information of the Isolation Condenser System (ICS), and address its conformance to TMI item II.K.2.10.	DCD, Tier 2, Revision 1, Table 1A-1, "TMI Action Plan Items," item II.K.2.10 stated that a reactor trip and initiation of the Isolation Condenser Systems (ICS) will occur in response to a loss of all feedwater event. Please provide logic diagram of the ICS and discuss the testability provisions of this system to perform channel functional tests at power.
7.4-3	Li H	Update DCD Section 7.4 to describe the "Safe Shutdown" conditions of ESBWR (a passive plant).	Update DCD, Tier 2, Revision1, Section 7.4 to describe the "Safe Shutdown" conditions of a passive plant. Discuss how to achieve the safe shutdown conditions either from the main control room or the remote shutdown station.
7.4-4	Li H	Discuss the capability to achieve and maintain safe shutdown condition under the station blackout scenario.	Discuss the capability to achieve and maintain safe shutdown condition under the station blackout scenario. The maximum capacity of the Class IE battery is 72-hours. Discuss the provisions to recharge the battery after 72-hours, and to maintain the safe shutdown condition.

RAI Number	Reviewer	Question Summary	Full Text
7.4-5	Li H	Update DCD Table 7.4-1, "Remote Shutdown System Interface," to identify which parameters are safety-related or not.	Update DCD Table 7.4-1, "Remote Shutdown System Interface," to identify which parameters are safety-related and which parameters are non-safety-related.
7.4-6	Beacom R	Provide logic diagram for SLC system which indicates origination of SSLC initiating signal	DCD, Tier 2, Revision 1, Section 7.4: Provide logic diagram for Standby Liquid Control (SLC) system which indicates origination of Safety System Logic and Control (SSLC) signal as well as identification of what portions of the control logic are safety related.
7.4-7	Beacom R	In the SLC Testing and Inspection Requirements, explain what is meant by "Normal surveillances"	In DCD, Tier 2, Revision 1, Section 7.4.1.4, Testing and Inspection Requirements, of the SLC System, the statement is made "Normal surveillances assure operability with an acceptably low probability of demand failure." Please explain what is meant by "Normal surveillance".
7.5-5	Li H	Address 10 CFR 50.34(f)(2)(xix), TMI Item II.F.3, requirements.	Update DCD, Tier 2, Revision 1, Section 7.5.2.3, "Safety Evaluation," to describe how the ESBWR design provides instrumentation adequate for monitoring plant conditions following an accident that includes core damage.
7.5-6	Li H	Updated DCD Section 7.5 to include an "ESBWR Network Diagram" and provide a description.	During the July 26 and 27 I&C meeting, the applicant presented the ESBWR I&C Network discussion and provided an ESBWR Network Diagram (draft). The staff found that the diagram is very helpful to understand the overall design of the ESBWR I&C systems. This diagram should be included in the DCD, Tier 2, Section 7.5. A description of major components on the network should be provided.

RAI Number	Reviewer	Question Summary	Full Text
7.6-1	Li H	Clarify the interlock systems design implemented at ESBWR and address in Section 7.6.	DCD, Tier 2, Revision 1, Section 7.6 described two types of interlock functions: (1) high pressure/ low pressure interlock, and (2) interlocks to isolate safety-related systems from nonsafety-related systems. HP/LP interlock functions include (a) RWCU to FAPCS, and (b) GDCS design pressure to GDCS pool. DCD, Tier 2, Section 7.6 should contain information related to interlock systems important to safety. For example, in DCD Section 7.3.1.2.2, DGCS system description stated that to operate the GDCS valves, the manual logic is interlocked with a low reactor pressure signal. For the deluge valves, the manual control is interlocked with a high drywell pressure signal. Many squib valves initiation are controlled by time delay logic. All interlock systems important to safety should be addressed in DCD, Tier 2, Section 7.6.
7.6-2	Li H	Clarify the interlock systems design implemented at ESBWR.	There is no interlock to isolate safety-related systems from non-safety-related systems identified in DCD, Tier 2, Revision 1, Section 7.6. Discuss the arrangement between the safety-related protection system functions and the nonsafety-related diverse actuation functions described in DCD, Tier 2, Revision 1, Section 7.8.
7.7-2	Beacom R	Calibration and test signals to be applied to the sensors during reactor operation	In DCD, Tier 2, Revision 1, Section 7.7.1.4, it is stated that various sensors “are located outside the drywell so that calibration and test signals can be applied during reactor operation.” To what level of involvement will this require the technician or operator at the sensor location and if this would be done any differently than current outage calibrations which include the sensors.
7.7-3	Beacom R	Safety-related and nonsafety related Wide Range Water Level.	In DCD, Tier 2, Revision 1, Section 7.7.1.2, it is stated that the wide range level instrumentation is both safety and nonsafety related (for Diverse Protection System (DPS)) . Please confirm that the boundary difference begins with the level transmitters. Also, will the level transmitters for the DPS be seismically qualified?

RAI Number	Reviewer	Question Summary	Full Text
7.7.4	Beacom R	Explain functional necessity of RPV low temperature alarm.	In DCD, Tier 2, Revision 1, Section 7.7.1.5, it is stated that the reactor pressure vessel (RPV) temperature has a low temperature alarm in the control room. Please explain the functional requirement for a low temperature alarm.
7.7-5	Beacom R	Explain the different functional scope of the FTDC versus the redundant system controllers which perform the PAS functional logic	In DCD, Tier 2, Revision 1, Section 7.7.4.2, the simple statement is made that the fault-tolerant digital controllers (FTDC), and the redundant system controllers perform the Plant Automation System (PAS) control functional logic. Explain the different functional scope of the FTDC versus the redundant system controllers which both perform the PAS functional logic.
7.8-2	Li H	Updated DCD Section 7.8 with NEDO-33251 information	The staff finds that many design features described in the NEDO-33251, "ESBWR I&C Defense-In-Depth and Diversity Report," were not clearly documented in DCD, Tier 2, Revision 1, Section 7.8. DCD Section 7.8 needs to be updated to include all new information provided in the NEDO-33251. DCD, Tier 2, Revision 1, Section 7.8 should provide a summary table identifying all the input signals to the Diverse Protection System (DPS) and identifying all the outputs from the DPS. For manual DPS action, a summary table should identify all the related parameters that will guide the operator in performing manual DPS actions.
7.8-3	Li H	Provide selection criteria for DPS-ESF functions and define the scope of the DPS.	Topical report NEDO-33251, "ESBWR I&C Defense-In-Depth and Diversity Report," Section 4.4 stated that the DPS provides a diverse means to actuate some ESF functions. Please identify those DPS-ESF functions. DCD, Tier 2, Revision 1, Section 5.8, Event Scenarios, stated that Appendix A provides a discussion of the DCD Chapter 15 accidents and transients evaluated to determine the effectiveness and scope of the DPS. Appendix A also listed five items for DPS scope expansion. Define the scope of the DPS in DCD Section 7.8.

RAI Number	Reviewer	Question Summary	Full Text
14.3-94	Li H	Provide an ITAAC for DPS failure mode and effects analysis (FMEA).	Topical report NEDO-33251, "ESBWR I&C Defense-In-Depth and Diversity Report," Section 4.3.1 stated that Type 1 failures will be analyzed during detailed system design of the DPS. This item should be documented in DCD Tier 1, and provide a proposed ITAAC.
7.8-5	Li H	Provide analysis of the events that require supporting analyses or confirmatory assessment.	Topical report NEDO-33251, "ESBWR I&C Defense-In-Depth and Diversity Report," Appendix A has a Table that listed eight accident analyses subsections that may require further analysis to verify that the acceptance criteria (2.5 REM for AOOs and 25 REM for DBAs) can be met. Provide analysis of these events that require supporting analyses or confirmatory assessment.
7.8-6	Beacom R	Provide a description of ATM (Analog Trip Modules) modules	In DCD, Tier 2, Revision 1, Section 7.8.1.1.1, a device called an "Analog Trip Module" is mentioned but not described to any detail. Please provide complete information on this device. (i.e. specifications, diagrams & procurement specifications).
7.8-7	Beacom R	Explain the "LOCA start signal" listed in DCD Section 7.8.1.1.1.1 as ATWS mitigation conditions and trips	DCD, Tier 2, Revision 1, Section 7.8.1.1.1.1 (1), lists ATWS mitigation conditions and trips. Item (iii) is "LOCA start signal". Please identify where this signal comes from and the conditions involved (i.e., permissive, time delay etc.)
7.9-2	Singh G	Provide clarification on diverse means of indication and manual controls on loss of safety related video display units (VDUs) due to common cause.	DCD, Tier 2, Revision 1, Section 7.9.1.1 and Figure 7.9-1 describe the functionality of safety related VDUs. These descriptions do not indicate that the operating system and the application software used for manual control and display are diverse between various channels or divisions. A common cause failure can disable all safety related VDUs of all channels/divisions. Please provide a response to address what diverse means are available to overcome this common cause issue.

RAI Number	Reviewer	Question Summary	Full Text
7.9-3	Singh G	Gateways as isolation devices between E-DCIS and NE-DCIS	Gateways have been used as isolation mediums between E-DCIS and NE-DCIS (Reference: DCD, Tier 2, Revision 1, Sections 7.9.1.1 and 7.9.1.2). What type of gateways are envisioned and how do they achieve the isolation. Please confirm that all gateways have one way communication from essential (E) to non-essential (NE) only and no feedback, check back, time sync or similar signals are sent from NE to E side. Is there any credible event e.g seismic, design basis accident etc. which can cause a failure of the isolation barrier between E and NE parts of the isolator. Describe how the design meets IEEE 603 -1991, paragraph 5.6.3.1.
7.9-4	Singh G	Redundant ethernet and its connections to other parties, intranet, firewalls etc.	Non-safety redundant ethernet is envisioned in the system architecture for plant data highway (Reference: DCD, Tier 2, Revision 1, Section 7.9.1.2). Since ethernet serves as the communication network between safety related and non-safety related parts of the system, its loss can lead to unavailability of safety related data on the control room displays. The reliability of the ethernet is a concern by the staff. Is this ethernet network tied to any other systems such as intranet, firewalls, etc. Please confirm that no such connection exists. If such a connection exists then inform staff of the connections and address the safeguards to prevent any degradation of this network from outside influences.
7.9-5	Singh G	Seismic qualification of all safety related electronic components including essential to essential and essential to non-essential components.	Please confirm that all safety related electronic components including processors, video display units (VDUs), keyboard & mouse (if used), E to E (different divisions) gateways, E to NE gateways, I/O cards, cabinets, remote multiplexing units (RMUs), network interface modules, network communication modules, etc. are seismically qualified. What is the intended method of qualification for such electronic components and how does it conform to Regulatory Guide 1.100, Revision 2 - 06/1988. Provide a generic list of such electronic components.
7.9.6	Singh G	Instrumentation for earthquakes.	Regulatory Guide 1.12, Revision 2 - 03/1997, provides guidance for instrumentation to be provided to monitor the earthquake severity? How is this regulatory guide addressed?

RAI Number	Reviewer	Question Summary	Full Text
7.9-7	Singh G	Communication from non-essential distributed control and information system (NE-DCIS) to essential distributed control and information system (E-DCIS).	This communication exists from the 3D Monicore function of the NE-DCIS to the Power Range Neutron Monitoring (PRNM) function of the Neutron Monitoring System (NMS). Section 7.9.1.2 of the DCD, Tier 2, Revision 1, states that this data communication is a dedicated input to NMS and does not pass through the E-DCIS network. Please clarify and explain how separation between essential (E) and non-essential (NE) sections is met in light of the clarifications regarding classification of interconnected equipment noted in Regulatory Guide 1.152, Rev. 2, Part B. Regulatory Guide 1.152 in Part B references IEEE Std. 603-1991, paragraph 5.6.3.1, “Interconnect Equipment”, which requires that equipment that is used for both safety and nonsafety functions shall be classified as part of the safety systems. The term equipment includes both software and hardware of digital systems.
7.9-8	Singh G	Time tagging the safety related data and transfer of the time tag to the non-essential (NE) part of the system.	Where is the time tagging done for the safety related parameters and how is it passed through to the NE part of the network (Reference: DCD, Tier 2, Revision 1, Section 7.9.1.2)? What kind of time tagging delay is possible if the data is not time tagged at the source? How is time tagging synchronized between the essential distributed control and information system (E-DCIS) and the non-essential distributed control and information system (NE-DCIS)? Are separate Global Positioning System (GPS) clocks used for E-DCIS and NE-DCIS?
7.9-9	Singh G	Engineering Work Station and video display unit support processors/PCs.	Please provide the information to confirm that the reliability of the Engineering Work Station (EWS) and VDUs is commensurate with the reliability of the other parts of the safety related systems (General question, no specific paragraph to be referenced in Section 7.9). Is a separate EWS provided for the safety related parts of the system? If so how does it interface with various division signals? Are these computers provided with redundant power supplies, redundant processors/redundant motherboards to enhance reliability?
7.9-10	Singh G	Spare processor memory and network communication speed.	A large number of data may be exchanged quickly during transients and plant upset conditions. To prevent locking up of the processors and gateways, sufficient spare memory and speed are required. Please provide staff the design guidelines and design approach to these issues.

RAI Number	Reviewer	Question Summary	Full Text
7.9-11	Singh G	Analog to digital (A to D) converters will be used to digitize the field analog inputs. How about D to A converters?	In DCD, Tier 2, Revision 1, Section 7.9.1.4, it is stated that D to A converters, if used in the remote multiplexing units (RMUs) will require periodic calibration check. It is expected that some of the controlled devices will be analog in nature (e.g. control valves)? Are such devices envisioned or only D to D interfaces considered even in modulating type control loops? If so, update DCD accordingly.
7.9-12	Singh G	Formats of remote multiplexing unit (RMU) outputs to actuators.	DCD, Tier 2, Revision 1, Section 7.9.1.5 states that "E-DCIS does not include sensor inputs up to the RMUs and RMU outputs to actuators." Please confirm that the output formats will be compatible with the actuated device and that this functionality is part of the essential distributed control and information system (E-DCIS), where applicable to the essential (E) devices.
7.9-13	Singh G	Essential distributed control and information system (E-DCIS) network failure and recovery time.	DCD, Tier 2, Revision 1, Section 7.9.1.5 states that "When a network of the dual network system fails, operation continues automatically without operator intervention." Are there any time limitations to recover from failure of a single network?
7.9-14	Singh G	Integrated overview display.	Integrated overview displays are described in Section 7.9.2.1 of the DCD, Tier 2, Revision 1 document. Certain portions of the dedicated dynamic display are driven by dedicated microprocessor based controllers which are independent of the non-essential distributed control and information system (NE-DCIS). Certain safety related information is not from NE-DCIS. Are both safety related and non-safety related display processors utilized for the fixed dynamic displays? If so, how are they separated and updated from the process information networks?

RAI Number	Reviewer	Question Summary	Full Text
7.9-15	Singh G	Alarm management and first out alarms.	Alarm management is critical under plant upset, transients, and other conditions when a large number of simultaneous alarms may be generated. Large numbers of alarms can be confusing to an operator. The alarm system filtering, prioritization, and group should be handled in such a way that it enhances operator actions. A brief description of the alarm & annunciation is provided in Section 7.9.2.1 of the DCD, Tier 2, Revision 1 document. Please describe the philosophy of alarm management system, keeping in mind the human factor considerations. Is color coding of the alarms defined to enhance operator actions? Is determination of the first out alarm as a means of trip or transient analysis a part of the system design? Is the time tagging carried out at the millisecond level as part of the sequence of events (SOE) recording?
7.9-16	Singh G	Data offload, storage, and retrieval.	Please describe what type of provisions have been made for long term storage of historical data from safety as well as non-safety related systems and what provisions have been made for retrieving such data. Short term data storage and retrieval and intervals up to 3 months are addressed for the non-essential distributed control and information system (NE-DCIS) historian in DCD, Tier 2, Revision 1, Section 7.9.2.1. Please confirm if any of the safety related data is stored in a safety related historian. If so, provide the capability of this part of the system.
9.5-25	Li H	Please address Generic Letter (GL) 89-15, “Emergency Response Data System” concerns.	GL 89-15, “Emergency Response Data System” identifies that certain parameters need to be provided to NRC on an accurate and timely manner. Please discuss whether the ESBWR’s communication system has the capability to perform these functions. DCD, Tier 2, Section 9.5.2 should address GL 89-15 issue and identify COL action requirements.

RAI Number	Reviewer	Question Summary	Full Text
9.5-26	Li H	DCD Section 9.5-2, "Communications Systems" should address design basis of the system	DCD, Tier 2, Revision 1, Section 9.5-2, "Communications Systems" should address design basis of the system that includes: ● Quality of components and modules ● Software quality ● Performance of protocol selected ● Reliability - potential hazards, error recovery, self-testing ● Control of access ● Single-failure-criterion ● Independence ● Failure modes ● EMI/RFI susceptibility
9.5-43	Li H	DCD Section 9.5-2, "Communications Systems" should address IE Bulletin 80-15 concerns.	IE Bulletin 80-15, "Possible Loss of Emergency Notification System (ENS) with Loss of Offsite Power", addresses concerns that the ENS station package is located at the site and is served by on-site power and has not been backed by emergency power. DCD, Tier 2, Revision 1, Section 9.5-2 and Table 1C-1 should be updated to address IE Bulletin 80-15 concerns.
7.2-4 Follow up	Beacom R	The applicant is requested to update DCD and provided functional logic diagrams for all the safety-related systems.	To followup Staff RAI question 7.2-4, DCD, Tier 2, Revision 1, Section 7.1.2.2 merely provides reference to Appendix 1A, "Response to TMI Related Matters". Section 7.1.2.2 also provides the systems are "generally designed to conform." The degree of conformance for each of the Chapter 7 sections should be updated to define the system features which make that system compliant and to be consistent with Appendix 1A. The applicant is requested to provided functional logic diagrams for all the safety-related systems. The functional logic diagram should include all provisions in the design such as interlocks, bypasses, permissive logic, and manual switches.

RAI Number	Reviewer	Question Summary	Full Text
7.4-1 Follow up	Beacom R	Followup on RAI 7.4-1: Provide remote shutdown system visual display unit control capabilities and separation	To followup Staff RAI question 7.4-1, the DCD, Tier 2, Revision 1, Section 7.4.2.2, states that the remote shutdown system (RSS) has two redundant and independent panels, each contains a safety related digital visual display unit (VDU), and a nonsafety related VDU. From these VDUs it is possible to control both safety-related and non-safety-related systems. Please provide detailed information of RSS control capabilities and provide drawings to demonstrate the separation/isolation between safety and nonsafety systems. Also provide the design basis to qualify the VDU for safety related application. RAI question 7.4-1 specifically requested “drawings to demonstrate the separation/isolation between safety and nonsafety systems.” Also, “the design basis to qualify the VDU for safety-related applications” was not specifically addressed. The DCD should be updated to include a simplified drawing and address the design basis to qualify the VDU for safety related application.
7.5-3 Follow up	Li H	Address IEEE Std. 497-2002, criteria and the relevant requirements stated in RG 1.97, Revision 4.	In response to NRC RAI 7.5-3, the applicant stated that GE will update the DCD, Tier 2, Section 7.5.1 and Table 7.5-1, to address the IEEE Std. 497-2002 criteria and the relevant requirements stated in RG 1.97, Revision 4, when published. Regulatory Guide 1.97, Revision 4 was published in June, 2006. Please update the DCD section 7.5 to address ESBWR’s design approach for post-accident monitoring systems.
7.5-4 Follow up	Beacom R	Provide the post accident monitoring (PAM) systems design acceptance criteria (DAC) and ITAAC for staff review.	To followup Staff RAI question 7.5-4, when digital systems are used for the post accident monitoring (PAM) function, the staff will follow the review process described in the Standard Review Plan (SRP), Revision 4 - 06/1997, Chapter 7, Appendix 7.0-A, “Review Process for Digital Instrumentation and Control Systems.” Discuss the ESBWR PAM systems software development process with respect to SRP Chapter 7, BTP- 14, “Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems.” GE’s response in enclosure 1 to MFN 06-137: The PAM (Post Accident Monitoring) function will be part of various systems and will follow the requirements of the associated systems. Therefore the systems providing a PAM function will have the software development process as described in 7B of Tier 2 of the DCD.

RAI Number	Reviewer	Question Summary	Full Text
7.5-4 Follow up			Staff's requested information: As requested by RAI question 7.5-4, please provide the proposed design acceptance criteria (DAC) including the Inspection, Tests, Analyses, and Acceptance Criteria (ITAAC) for PAM systems.
7.7-1 Follow up	Beacom R Li H	Address concerns and provide details as identified in SRP 7.7, Control Systems, for each of the control systems NOT listed in Section 7.7.0 of the DCD.	Address concerns of SRP Section 7.7, Revision 4 - 06/1997, Section II. Acceptance Criteria, and provide detailed information for the major design considerations identified in Section III of SRP 7.7, for each of the control systems NOT listed in 7.7.0 of the DCD. GE's response in enclosure 1 to MFN 06-074: The general design bases and acceptance criteria for some of the above control systems are addressed in Sections 1.2.2 and Tables 1.9-7 and 1.11-1 of DCD Tier 2. In addition, the specific system design bases of the appropriate control systems are discussed in the Tier 2 section that are listed below. These control systems will be controlled by a single failure proof DCIS with instrumentation that supports single failure proof for power generation and (where applicable) segmentation into PIP A and B such that either "half"can run independently of the other - complementing both the electrical power sources and physical separation. The design and acceptance criteria for software based control systems are addressed in DCD, Tier 2, Revision 1, Section 7B. (Also, a chart is provided cross referencing systems to DCD Tier 2 Sections). Staff's requested information: Particularly for those systems which are not part of Chapter 7, will still require the review methods and consideration of the topics listed in SRP Chapter 7, Appendix 7.1-A, Acceptance Criteria and Guidelines for Instrumentation and Control systems Important to Safety". In that appendix, Section 2.d references GDC Criterion 13, "Instrumentation and Controls" as applicable to all I&C systems and the necessary considerations. Example: HVAC - CBHVS (Control Building HVAC System) is a non-safety system except the CRHA (Control Room Habitability Area) envelope and EBAS (Emergency Breathing Air System) which are safety related. A safety design basis should identify the safety related instrumentation and how they are used and in what events. The interface to the safety communication system should be defined. In the response, the statement on control systems should be extrapolated and used in the design basis for this and all the control systems listed in DCD Section 7.7.

ESBWR Mailing List

cc:

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

Mr. George B. Stramback
Manager, Regulatory Services
GE Nuclear Energy
1989 Little Orchard Street, M/C 747
San Jose, CA 95125

Mr. David Lochbaum, Nuclear Safety Engineer
Union of Concerned Scientists
1707 H Street, NW., Suite 600
Washington, DC 20006-3919

Mr. Paul Gunter
Nuclear Information & Resource Service
1424 16th Street, NW, Suite 404
Washington, DC 20036

Mr. James Riccio
Greenpeace
702 H Street, Suite 300
Washington, DC 20001

Mr. Adrian Heymer
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Mr. Paul Leventhal
Nuclear Control Institute
1000 Connecticut Avenue, NW
Suite 410
Washington, DC 20036

Mr. Ron Simard
6170 Masters Club Drive
Suwanne, GA 30024

Mr. Brendan Hoffman
Research Associate on Nuclear Energy
and Environmental Program
215 Pennsylvania Avenue, SE
Washington, DC 20003

Mr, Jay M. Gutierrez
Morgan, Lewis & Bockius, LLP
1111 Pennsylvania Avenue, NW
Washington, DC 20004

Mr. Glenn H. Archinoff
AECL Technologies
481 North Frederick Avenue
Suite 405
Gaithersburg, MD 20877

Mr. Gary Wright, Director
Division of Nuclear Facility Safety
Illinois Emergency Management Agency
1035 Outer Park Drive
Springfield, IL 62704

Mr. Charles Brinkman
Westinghouse Electric Co.
Washington Operations
12300 Twinbrook Pkwy., Suite 330
Rockville, MD 20852

Mr. Ronald P. Vijuk
Manager of Passive Plant Engineering
AP1000 Project
Westinghouse Electric Company
P. O. Box 355
Pittsburgh, PA 15230-0355

Mr. Ed Wallace, General Manager
Projects
PBMR Pty LTD
PO Box 9396
Centurion 0046
Republic of South Africa

Mr. Russell Bell
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Ms. Sandra Sloan
Areva NP, Inc.
3315 Old Forest Road
P.O. Box 10935
Lynchburg, VA 24506-0935

Mr. Robert E. Sweeney
IBEX ESI
4641 Montgomery Avenue
Suite 350
Bethesda, MD 20814

Mr. Eugene S. Grecheck
Vice President, Nuclear Support Services
Dominion Energy, Inc.
5000 Dominion Blvd.
Glen Allen, VA 23060

Mr. George A. Zinke
Manager, Project Management
Nuclear Business Development
Entergy Nuclear, M-ECH-683
1340 Echelon Parkway
Jackson, MS 39213

E-Mail:
tom.miller@hq.doe.gov or
tom.miller@ nuclear.energy.gov
sfrantz@morganlewis.com
ksutton@morganlewis.com
jgutierrez@morganlewis.com
mwetterhahn@winston.com
whorin@winston.com
gcesare@enercon.com
jerald.holm@framatome-anp.com
erg-xl@cox.net
joseph_hegner@dom.com
mark.beaumont@wsms.com
steven.hucik@ge.com
patriciaL.campbell@ge.com
bob.brown@ge.com
david.hinds@ge.com
chris.maslak@ge.com
James1.Beard@ge.com
kathy.sedney@ge.com
mgiles@entergy.com
tansel.selekler@nuclear.energy.gov or
tansel.selekler@hq.doe.gov
Frostie.white@ge.com
David.piepmeyer@ge.com
george.stramback@gene.ge.com