GE Energy

David H. Hinds
Manager, ESBWR

PO Box 780 M/C L60
Wilmington, NC 28402-0780
USA

T 910 675 6363
F 910 362 6363
david.hinds@ge.com

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Subject: **Partial Response to NRC Request for Additional Information Letter No. 6 Related to ESBWR Design Certification Application – Instrumentation and Control Systems – RAI Numbers 7.1-1 through 7.1-5 and 7.4-1**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the Reference 1 letter.

If you have any questions about the information provided here, please let me know.

Sincerely,

David H. Hinds
Manager, ESBWR

D068

Enclosure:

1. MFN 06-097 - GE Response to Request for Additional Information Letter No. 6 Related to ESBWR Design Certification Application – Instrumentation and Control Systems – RAI Numbers 7.1-1 through 7.1-5 and 7.4-1

Reference:

1. MFN 06-045, Letter from U. S. Nuclear Regulatory Commission to Mr. David Hinds, *Request for Additional Information Letter No. 6 Related to ESBWR Design Certification Application,* January 31, 2006

cc:

WD Beckner	USNRC (w/o enclosures)
AE Cubbage	USNRC (with enclosures)
LA Dudes	USNRC (w/o enclosures)
GB Stramback	GE/San Jose (with enclosures)
eDRF	0052-3683, 0052-4112, 0052-6281, 0052-3836

ENCLOSURE 1

MFN 06-097

GE Response to Request for Additional Information Letter No. 6 Related to ESBWR Design Certification Application – Instrumentation and Control Systems RAI Numbers 7.1-1 through 7.1-5 and 7.4-1

MFN 06-097
Enclosure 1

NRC RAI 7.1-1

With respect to level of detail for design certification application under 10 CFR Part 52, Section B.3.2 of BTP HICB-16 describes material that should be provided in addition to that identified by Reg. Guide 1.70. In DCD Section 7.1, describe the resolution of unresolved and generic safety issues applicable to the instrumentation and control (I&C) systems.

GE Response

Unresolved and generic safety issues applicable to the ESBWR design are described in DCD Tier 2, Subsection 1.11. There are several new generic issues that are related to ESBWR I&C systems, such as failure of protective devices on essential equipment, Electromagnetic pulse, identification of protection system instrument sensing lines, and protection system testability that are also addressed in that section.

NRC RAI 7.1-2

With respect to level of detail for design certification application under 10 CFR Part 52, Section B.3.2 of BTP HICB-16 describes material that should be provided in addition to that identified by Reg. Guide 1.70. In DCD Section 7.1, identify and describe the validation of innovative means of accomplishing I&C system safety functions.

GE Response

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. For those safety I&C systems that are identical or very similar in architecture design to those previously reviewed by NRC (ABWR Certification), or those where the adequacy of the system is based upon prior NRC approval, such architecture design of those systems are identified in the system description sections of each specific system.

NRC RAI 7.1-3

With respect to level of detail for design certification application under 10 CFR Part 52, Section B.3.2 of BTP HICB-16 describes material that should be provided in addition to that identified by Reg. Guide 1.70. In DCD Section 7.1, describe the computer system development process when the application proposes using digital I&C systems.

GE Response

The description of computer system development process that addresses compliance to BTP HICB-14 is explained and summarized in Appendix 7B of Chapter 7.0 of DCD Tier 2 Rev 01. NEDO-33229, Rev 1, "ESBWR I&C Software Development Plan" (GE Letter # MFN 06-083) was submitted on 3/10/06. Additional software plans will be submitted as specified by BTP HCIB-14 as part of the ESBWR Certification activity. The detailed software design implementation of digital I & C systems will follow the guidelines specified by those software development plans as part of the DAC process.

NRC RAI 7.1-4

With respect to level of detail for design certification application under 10 CFR Part 52, Section B.3.2 of BTP HICB-16 describes material that should be provided in addition to that identified by Reg. Guide 1.70. In DCD Section 7.1, provide a defense-in-depth analysis for the I&C system design. BTP HICB-19 describes the characteristics of such analyses.

GE Response

ESBWR safety I&C systems (RPS and SSLC/ESF) use microprocessors for their logic functions. Description of the safety I&C systems design with respect to defense-in-depth and diversity and defense against common mode failures is included in Section 7.8 of DCD Tier 2, together with the description of the Diverse Protection system, which specifically addresses the issues of defense-in-depth and diversity and defense against common mode failures.

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Enclosure 1

NRC RAI 7.1-5

Demonstrate how the ESBWR safety-related protection systems meet the requirements of IEEE Std. 603-1991 and correction sheet dated January 30, 1995. The staff needs detailed information how these protection systems meet each of the sections of IEEE Std. 603-1991 with applicable correction sheet.

GE Response

A description of how ESBWR safety-related protection systems meet each of the sections of IEEE Std. 603-1991 has been added to Revision 1 of DCD Tier2, Section 7.1.2.3. In this section, a summary description is included to demonstrate how the overall ESBWR safety I&C systems are in compliance with IEEE Std. 603, according to the guidelines described in NUREG 0800, SRP Appendix 7.1-C. For specific descriptions of functional compliances of the IEEE Std. 603 criteria by various safety-related systems, the discussions refer to the various subsections of that section.

NRC RAI 7.4-1

Provide remote shutdown system (RSS) visual display unit (VDU) control capabilities and demonstrate separation/ isolation between safety and nonsafety.

The DCD states that the remote shutdown system (RSS) has two redundant and independent panels, each contain 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 nonsafety-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.

GE Response

The remote shutdown system (RSS) described in DCD Tier 2, Section 7.4.2 consists of two panels (reference figure ZZ) located in the reactor building. Separation and isolation is preserved both mechanically and electrically in accordance with IEEE 279 and RG 1.75. Each of the two panels is compartmentalized (similar to the main control room benchboards) into a safety related and non-safety related section; the safety related section in one of the panels contains a division 1 safety related Visual Display Unit (VDU) and the other panel contains a division 2 safety related VDU. The safety related VDUs are part of the appropriate divisional Essential Distributed Control and Information System (E-DCIS) and connected to the DCIS via fiber optics to the appropriate divisional safety related DCIS in the division 1 (2) DCIS room. The panels are located in the quadrant of the reactor building corresponding to the division of the safety related VDU.

As shown on Figure DCD Tier 2, Figure 7.4.1 and the attached figure ZZ, the nonsafety-related section in each of the two RSS panels contains a non-safety related VDU; the VDU is part of the non-safety Non-Essential DCIS. The RSS panel containing the division 1 VDU houses a non-safety VDU in the non-safety compartment of the Plant Investment Protection (PIP) segment of the non-safety DCIS and the RSS panel containing the division 2 VDU houses a non-safety VDU in the non-safety compartment of the PIP equipment segment of the non-safety DCIS. The non-safety VDUs are connected to the PIP segment in the non-safety DCIS room A (B) via fiber optics.

The main control room environment/HVAC/fire zone is separate from the safety and non-safety DCIS rooms and the connections to the control room VDUs are also via fiber optics. The design bases described in DCD Tier 2, Subsection 7.4.2.1 is such that the main control room can be lost to fire or evacuated without affecting the continuing automatic or manual operation of the safety and non-safety DCIS. As a result all of the safety and non-safety capability of the control room VDUs is duplicated at the RSS VDUs. Specifically if offsite power is available the non-safety displays enable the operator to perform a controlled shutdown using normal heat sinks.

If offsite power is lost but the diesel generators have started, the non-safety displays can control PIP equipment such that the operator can perform (for example) a controlled shutdown using Reactor Water Cleanup/Shutdown Cooling via Reactor Coolant System and Plant Service Water System.

If all non-safety power is lost, the operator can control everything in division 1 (2) including the isolation condensers, Automatic Depressurization System, Gravity-Driven Cooling System, the equalizing valves and the deluge valves; automatic or manual actions in these systems can shut down the reactor and leave it in a safe state. In all cases the operator will control and monitor the various systems in the same way it would normally be done in the control room and no interlocks are lost requiring special manipulation.

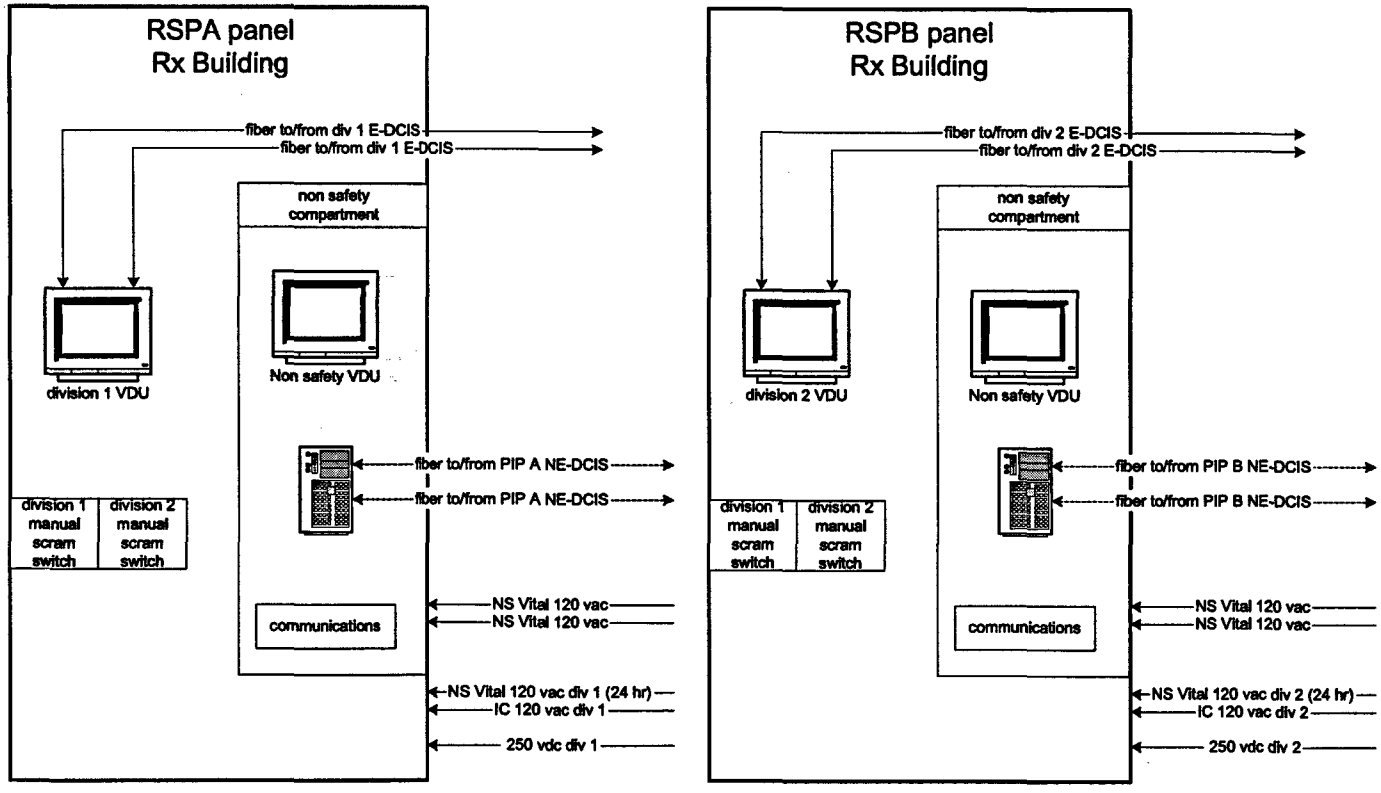
DCD Tier 2, Subsection 7.4.2.2 specifies that if all non-safety power is lost, than the operator can monitor non-safety information from the RSS for the two-hour battery capacity of the non-safety vital AC system. The safety related section of each RSS panel is powered for 72 hours, as is all other safety related division 1 and 2 monitoring equipment. Should the diesels start or offsite power become available, the RSS panels will be powered indefinitely.

DCD Tier 2, Subsection 7.4.2.2 discusses that access to both the reactor building and specifically to the RSS rooms is controlled and the doors to the RSS rooms are alarmed in the main control room. The VDUs are part of the safety and non-safety DCIS self-diagnostics as discussed in DCD Tier 2, subsection 7.9.2.2.

Each RSS panel has a division 1 and 2 hard wired manual scram switch, DCD Tier 2, Subsection 7.4.2.2, which may be used to scram the reactor from the RSS whatever the

state of the MCR. The switches are appropriately compartmentalized and the wiring is fail-safe.

Figure ZZ
ESBWR DCIS Remote Shutdown Panels



Notes:

1. Each RSS panel can control the entire set of PIP/BOP systems using the same controls/displays as in the main control room
2. Each RSS panel can control the entire set of corresponding divisional systems using the same controls/displays as in the main control room