



GE Energy

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MFN 06-214

Docket No. 52-010

July 11, 2006

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

**Subject: Response to Portion of NRC Request for Additional Information
Letter No. 6 Related to ESBWR Design Certification Application –
Instrumentation and Control Systems – RAI Number 7.8-1**

Enclosure 1 contains GE's response to the subject NRC RAI 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

Reference:

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

Enclosure:

1. MFN 06-214 – Response to Portion of NRC Request for Additional Information Letter No. 6 Related to ESBWR Design Certification Application – Instrumentation and Control Systems – RAI Number 7.8-1

cc: WD Beckner USNRC (w/o enclosures)
AE Cabbage USNRC (with enclosures)
LA Dudes USNRC (w/o enclosures)
GB Stramback GE/San Jose (with enclosures)
eDRF 0000-0052-8747

ENCLOSURE 1

MFN 06-214

**Response to Portion of NRC Request for Additional
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NRC RAI 7.8-1

In DCD section 7.8, describe the diverse I&C system characteristics such as diverse hardware and software, different designer, diverse actuation methods, different power source etc. The DCD also should identify which accidents (refer to DCD Chapter 15 analyses) are covered by the diverse I&C systems as the backup protection to the primary protection system (systems described in DCD 7.2 and 7.3).

GE Response

A description of the diverse I&C system characteristics, including ATWS mitigating system, Diverse Protection System (DPS), and manual controls and displays, is provided in Revision 1 of DCD Section 7.8 (Diverse Instrumentation and Control Systems). Subsection 7.1.2.2 (Conformance to Regulatory Requirements and Industry Standards), also includes a discussion on ESBWR design conformance to applicable diversity requirements including the design position called out in Branch Technical Position HICB-19, Guidance for Evaluation of Defense-in-Depth and Diversity in Digital Computer-Based Instrumentation and Control Systems.

DCD subsection 7.8.1 (System Description) discusses common mode failure defenses.

- The ESBWR DPS triple modular redundant design employs a different hardware and software platform (and different vendor) from the primary protection systems (i.e., the Reactor Protection System and Engineered Safety Features actuation systems). The DPS provides backup reactor trip function using a subset of the RPS scram signals. The DPS provides backup ESF function using a redundant path to actuate ESF emergency core cooling components.
- The ATWS mitigation functions use diverse control logics from the primary protection system. The safety related portions of the ATWS mitigation logic, which provides an alternate means of emergency plant shutdown (via soluble boron injection), uses discrete (non-microprocessor based) logic instead of software-based logic.

The attached figure depicts the diversity between the I&C systems discussed.

In DCD Chapter 15 (Safety Analyses), the Nuclear Safety Operational Analysis applies the most limiting failure to provide the worst-case impact on the principal safety barriers and to demonstrate that the associated acceptance criteria are satisfied. In certain cases, credit for specific trips are not taken creating a more severe transient for analysis purposes. Redundant systems or diverse protection systems are not explicitly credited unless safety limits are exceeded by the existing configuration as in ATWS scenarios (reference DCD subsection 15.5.4). DCD subsection 15.5.4 discusses ATWS events which explicitly credit diverse I&C systems for mitigation. The events analyzed are:

- Main Steamline Isolation Valve (MSIV) Closure (limiting event)
- Loss of Condenser Vacuum (limiting event)
- Loss of Feedwater Heating (limiting event)
- Loss of Normal AC Power to Station Auxiliaries (moderate event)

Enclosure 1

- Loss of Feedwater Flow (moderate event)
- Generator Load Rejection with a Single Failure in the Turbine Bypass System (moderate event)
- Inadvertent Isolation Condenser Initiation (minimum effect event)
- Turbine Trip with Full Bypass (minimum effect event)
- Opening of One Control or Turbine Bypass Valve (minimum effect event)

As part of the ESBWR defense-in-depth and diversity evaluation, a review to assess a digital protection system common mode failure impact on events discussed in DCD Chapter 15, Safety Analyses, has been performed.

NEDO-33251, ESBWR Instrumentation and Control Defense in Depth and Diversity Evaluation Report, will document the coverage of the DPS with respect to the DCD Chapter 15 events. NEDO-33251, which is scheduled to be submitted by July 14, 2006, will discuss the backup functions provided by the DPS for mitigation of Chapter 15 events. DCD Revision 2 will be updated to include changes to the DPS that result from the evaluation discussed in NEDO-33251.

