



GE Energy

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Subject: **Response to Portion of NRC Request for Additional Information  
Letter No. 76 – Instrumentation and Control – RAI Numbers 7.4-5,  
7.4-6, 7.4-7, 7.8-5, 7.8-6, and 7.8-7**

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

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

A handwritten signature in cursive script that reads "Kathy Sedney for".

James C. Kinsey  
Project Manager, ESBWR Licensing

Reference:

1. MFN 06-388, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 76 Related to ESBWR Design Certification Application*, October 11, 2006

Enclosures:

1. MFN 06-472—Response to Portion of NRC Request for Additional Information Letter No. 76 – Related to ESBWR Design Certification Application Instrumentation and Control—RAI Numbers 7.4-5, 7.4-6, 7.4-7, 7.8-5, 7.8-6, and 7.8-7

cc: AE Cabbage USNRC (with enclosures)  
GB Stramback GE/San Jose (with enclosures)  
eDRF 0000-0061-9753  
0000-0060-5326  
0000-0060-5328  
0000-0060-5316  
0000-0060-5324  
0000-0060-5325

**Enclosure 1**

**MFN 06-472**

**Response to Portion of NRC Request for**

**Additional Information Letter No. 76**

**Related to ESBWR Design Certification Application**

**Instrumentation and Control**

**RAI Numbers 7.4-5, 7.4-6, 7.4-7, 7.8-5, 7.8-6, and 7.8-7**

**NRC RAI 7.4-5**

*Update DCD Table 7.4-1, "Remote Shutdown System Interface," to identify which parameters are safety-related and which parameters are non-safety-related.*

**GE Response:**

The functional design requirements of the Remote Shutdown System (RSS) panels as described in Section 7.4.2 of DCD Tier 2 Rev 2 have been enhanced. While the Rev 1 requirements for the RSS panels were to provide a set of display/control functions limited to the parameters identified in Table 7.4-1, the enhancement requires the RSS VDUs to have the same control/display capabilities as the safety-related Division 1 & 2 VDUs and the nonsafety-related VDUs at the MCR.

Table 7.4-1 will be deleted in Rev 3 of DCD Tier 2 since the VDU display/control capabilities at the RSS panels are no longer limited to this list.

Safety classifications for all ESBWR components are documented in Table 3.2-1 of DCD Tier 2.

**DCD/LTR Impact**

DCD Tier 2 Section 7.4 will be revised in Revision 3 as described above.

**NRC RAI 7.4-6**

*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.*

**GE Response**

As part of the design process, a Standby Liquid Control (SLC) system simplified logic diagram is in the final development process stage. The SLC system simplified logic diagram is scheduled for submittal by December 29, 2006.

The SLC system initiation logic is safety-related, except for initiation inputs from the nonsafety-related diverse protection system (DPS) – diverse emergency core cooling system. The nonsafety-related DPS diverse emergency core cooling system initiation signals are processed through qualified isolation devices to the SLC system squib valve initiators. Alarms are nonsafety-related and are provided through qualified isolation devices for safety-related to nonsafety-related interfaces.

**DCD/LTR Impact**

No DCD or LTR changes are required as a result of this RAI response.

**NRC RAI 7.4-7**

*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".*

**GE Response**

The term normal surveillances refer to performance monitoring of SLC system components and covers periodic sampling of the SLC accumulator sodium pentaborate solution to verify acceptable solution characteristics, monitoring of satisfactory accumulator nitrogen pressure, satisfactory accumulator level, and satisfactory accumulator room temperature. Verification of the SLC squib injection valve initiator circuit continuity is also considered a normal surveillance.

Normal surveillances also refers to the periodic testing of system valves (including the accumulator isolation valves, the accumulator vent valves, the accumulator relief valves and system check valves) to assure operability. Routine in-service inspection (ISI) to satisfy American Society of Mechanical Engineers (ASME) requirements for SLC system piping and components are also considered part of the normal surveillances. As discussed in DCD Tier 2, Subsection 9.3.5, pyrotechnic charges from the injection line squib valves are removed and tested in a laboratory to confirm end of life functional capability.

Specific SLC system Technical Specification surveillance requirements (including frequency information) are addressed in DCD Tier 2 Chapter 16, Rev. 1.

**DCD/LTR Impact**

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

**NRC RAI 7.8-5**

*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.*

**GE Response**

The confirmatory analyses to validate the assessment documented in NEDO-33251, "ESBWR I&C Defense-In-Depth and Diversity Report," will be included as an ITAAC in ESBWR DCD Tier 1, as part of the Revision 3 update.

**DCD/LTR Impact**

DCD Tier 1 will be revised in Revision 3 as described above.

### **NRC RAI 7.8-6**

*In DCD, Tier 2, Revision 1, Section 7.8.1.1.1.1, 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).*

### **GE Response**

Since ESBWR procurement specification details for this device have not been approved at this phase in the project life cycle, the following discussion provides general design information on the Analog Trip module (ATM). The ATM used in the ESBWR ATWS mitigation system design will be of a design similar to a Rosemount Model 710DU Trip/Calibration system.

The Analog Trip Module is an analog bistable or comparator circuit card that monitors a sensor input signal and provides sensor channel trip processing based on comparison against a predetermined setpoint. Each ATM processes one channel of one sensed parameter. For the safety-related portions of the ATWS mitigation logic, the ATMs are qualified, class 1E devices.

Features of the ATM are as follows:

- Trip action and reset differential are adjustable. Calibration of the unit can be performed on line.
- A bistable "tripped" condition is processed as logic output (corresponding to a discrete output voltage). The typical arrangement being considered for the ESBWR is: 24Volts = logic 1 and <1 Volt = logic 0).
  - The logic output is used to drive a logic gate optocoupler. (In this configuration, the output of the optocoupler is used as an input to the respective division voting logic and can also be transmitted fiber-optically (as an isolated signal) to the voting logic of the other three divisions.)
  - The logic output can also be used to drive an external output relay.
- An analog output (proportional to sensor signal) is also provided.
- The ATM provides local trip status capability.
- The ATM also provides gross failure (high/low) indication capability.
- An ATM removed from its (plug-in) chassis will cause a (card out of file) fault and a self test alarm.

### **DCD/LTR Impact**

No DCD or LTR changes are required as a result of this RAI response.



**NRC RAI 7.8-7**

*DCD, Tier 2, Revision 1, Section 7.8.1.1.1 (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.)*

**GE Response**

The "LOCA start signal" listed under ATWS mitigation conditions and trips in DCD Tier 2 revision 1, 7.8.1.1.1, is a self-identified error in the DCD. This error has been corrected in DCD Tier 2, Revision 2. The ESBWR conditions indicative of an ATWS event are based on a persistent neutron monitoring system power permissive signal coincident with either high reactor pressure vessel dome pressure or low reactor water level.

Conversely, loss of coolant accidents (i.e., LOCAs) are mitigated by the engineered safety features (ESF) actuation system as described in DCD Tier 2, Revision 2, Section 7.3.1. As part of the ESBWR defense-in-depth and diversity strategy, the Diverse Protection System also provides diverse ESF functions for LOCA mitigation as described in Licensing Topical Report NEDO-33251, "ESBWR I&C Defense-In-Depth And Diversity Report," and DCD Tier 2, Revision 2, Section 7.8.

**DCD/LTR Impact**

No DCD or LTR changes are required as a result of this RAI response.