GE Energy

James C. Kinsey
Project Manager, ESBWR Licensing

PO Box 780 M/C J-70
Wilmington, NC 28402-0780
USA

T 910 675 5057
F 910 362 5057
jim.kinsey@ge.com

MFN 07-024

Docket No. 52-010

January 18, 2007

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. 77 Related to ESBWR Design Certification Application – Technical Specifications – RAI Numbers 16.2-33, 16.2-52, 16.2-75, 16.2-90 through 16.2-94, and 16.2-97 through 16.2-109**

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

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

Sincerely,

Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

D068

Reference:

1. MFN 06-391, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 77 Related to ESBWR Design Certification Application,* October 11, 2006

Enclosure:

1. MFN 07-024 – Response to Portion of NRC Request for Additional Information Letter No. 77 Related to ESBWR Design Certification Application – Technical Specifications – RAI Numbers 16.2-33, 16.2-52, 16.2-75, 16.2-90 through 16.2-94, and 16.2-97 through 16.2-109

cc: AE Cubbage USNRC (with enclosures)
GB Stramback GE/San Jose (with enclosures)
eDRFs 60-4196/1, 60-4198, 60-4199

Enclosure 1

MFN 07-024

Response to Portion of NRC Request for

Additional Information Letter No. 77

Related to ESBWR Design Certification Application

- Technical Specifications -

RAI Numbers 16.2-33, 16.2-52, 16.2-75, 16.2-90 through 16.2-94, and 16.2-97 through 16.2-109

NRC RAI 16.2-33

In RAI 15.0-2, the staff requested that General Electric (GE) provide a table in the DCD listing all of the non-safety grade related systems and components used for mitigating transients and accidents analyzed in DCD Tier 2, Chapter 15. GEs response to RAI 15.0-2, MFN 06-331, dated September 25, 2006, was submitted after the response to RAI 16.0-1, MFN 06-263, August 8, 2006, which provided a systematic evaluation of the information in the DCD against the requirements of 10 CFR 50.36(c)(2)(ii). GE is requested to review the response to RAI 16.0-1 in light of the information in the response to RAI 15.0-2 and identify any changes to the response to RAI 16.0-1 or to the Technical Specifications (TS).

GE Response

The nonsafety-related systems used for mitigating transients (anticipated operational occurrences and infrequent events) and accidents are addressed in the response to RAI 15.0-2 and were considered in the response to RAI 16.0-1 as described below.

Control Rod Drive (CRD) System – Makeup Water was discussed in the response to RAI 16.0-1 in Enclosure 1, Attachment 3, "RAI 16.0-1 Response 10 CFR 50.36 Criterion 3 Analysis," line items 5, 13, 23, 28, 31, 42, 50, 60, 67, 73, 74, 81, 112, 139, 167, 192, 214, 235, 257, 264, and 301. Both the RAI 15.0-2 and the RAI 16.0-1 responses indicated that this function is not in the primary success path for mitigating transients and accidents because the safety-related isolation condenser and gravity-driven cooling system will ensure water inventory is maintained within the acceptance criteria for the applicable event even if the nonsafety-related CRD system makeup water function failed. The response to RAI 16.0-1 also evaluated this function in Enclosure 1, Attachment 4, "RAI 16.0-1 Response 10 CFR 50.36 Criterion 4 Analysis," line item 13, and concluded that the function was not risk-significant. Therefore, the function does not meet any of the four criteria in 10 CFR 50.36(c)(2)(ii) and is not included in the DCD Tier 2, Chapter 16, Technical Specifications.

Control Rod Drive System – Selected Control Rod Run-In (SCRRI) Function was discussed in the response to RAI 16.0-1 in Enclosure 1, Attachment 3, "RAI 16.0-1 Response 10 CFR 50.36 Criterion 3 Analysis," line items 1, 4, and 12. The responses to RAI 15.0-2 and RAI 16.0-1 indicated that this function is in the primary success path for mitigating transients (but not accidents). Therefore, the response to RAI 16.0-1 stated that the SCRRI function of the Rod Control and Information System (RC&IS) met 10 CFR 50.36(c)(2)(ii) Criterion 3, and that a new LCO for SCRRI will be added to the ESBWR TS. This is consistent with the response to RAI 15.0-2.

Fuel and Auxiliary Pool Cooling System – Suppression Pool Cooling was discussed in the response to RAI 16.0-1 in Enclosure 1, Attachment 3, "RAI 16.0-1 Response 10 CFR 50.36 Criterion 3 Analysis," line items 103, 110, 111, and 273. The responses to RAI 15.0-2 and RAI 16.0-1 indicated that this function is not in the primary success path for mitigating transients and accidents because the containment pressure design limit will be met if this system is not placed in service, although use of the system will provide additional margin. The response to RAI 16.0-1 also evaluated this function in Enclosure 1, Attachment 4, "RAI 16.0-1 Response 10 CFR 50.36 Criterion 4 Analysis," line item 10, and concluded that the function is not risk-significant. Therefore, the function does not meet any of the four criteria in

10 CFR 50.36(c)(2)(ii) and is not included in the DCD Tier 2, Chapter 16, Technical Specifications.

Feedwater Control System was discussed in the response to RAI 16.0-1 in Enclosure 1, Attachment 3, "RAI 16.0-1 Response 10 CFR 50.36 Criterion 3 Analysis," line items 38, 59, and 268. The responses to RAI 15.0-2 and RAI 16.0-1 indicated that this system is not in the primary success path for mitigating transients and accidents because operation of this nonsafety-related system provides protection of the turbine and provides only additional margin to the acceptance criteria for applicable events. The response to RAI 16.0-1 also evaluated this function in Enclosure 1, Attachment 4, "RAI 16.0-1 Response 10 CFR 50.36 Criterion 4 Analysis," line item 12, and concluded that the system was not found to be risk-significant. Therefore, the system does not meet any of the four criteria in 10 CFR 50.36(c)(2)(ii), and is not included in the DCD Tier 2, Chapter 16, Technical Specifications.

Rod Control and Information System was discussed in the response to RAI 16.0-1 in Enclosure 1, Attachment 3, "RAI 16.0-1 Response 10 CFR 50.36 Criterion 3 Analysis," line items 1, 4, 12, 53, 88, 89, 90, 92, 93, 94, 97, 249, and 293. Line items 1, 4, and 12 address the SCRRI Function which has already been addressed. For the other line items, the responses to RAI 15.0-2 and RAI 16.0-1 indicated that this system is used to implement control rod blocks in response to specific transients (but not accidents). Therefore, the control rod block function meets one of the four criteria in 10 CFR 50.36(c)(2)(ii) and is included in the DCD Tier 2, Chapter 16, Technical Specifications.

Steam Bypass and Pressure Control System was discussed in the response to RAI 16.0-1 in Enclosure 1, Attachment 3, "RAI 16.0-1 Response 10 CFR 50.36 Criterion 3 Analysis," line items 2, 3, 8, 11, 16, 24, 29, 30, 39, 40, 41, 57, 58, 78, 85, 102, and 106. Line items 2, 3, 8, 16, and 40 address opening the turbine bypass valves (TBVs) for mitigation of specific transients (but not accidents). For these line items, the responses to RAI 15.0-2 and the RAI 16.0-1 indicated that this function is credited for mitigation of specific transients (but not accidents). For the other line items, the response to RAI 16.0-1 indicated that the system closes or opens the TBVs. Operation of the turbine stop valves (TSVs) and turbine control valves (TCVs) is not credited for mitigating any transient or accident. The response RAI 16.0-1 also evaluated the various functions of this system in Enclosure 1, Attachment 4, "RAI 16.0-1 Response 10 CFR 50.36 Criterion 4 Analysis," line item 17, and concluded that the controls to close or open the TBVs for other events, or otherwise operate the TSVs and TCVs, are not risk-significant. Therefore, the system TBV opening function for the specific transients discussed in the response to RAI 16.0-1 meets one of the four criteria in 10 CFR 50.36(c)(2)(ii), and is included in the DCD Tier 2, Chapter 16, Technical Specifications. The other system functions do not meet any of the four criteria in 10 CFR 50.36(c)(2)(ii) and are not included in the DCD Tier 2, Chapter 16, Technical Specifications.

As described above, the responses to RAI 15.0-2 and RAI 16.0-1 are consistent and no changes to the response to RAI 16.0-1 or to the Technical Specifications are required.

DCD Impact

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

NRC RAI 16.2-52

RAI 15.0-16 explained the staff policy for the safety limit for minimum critical power ratio (SLMCPR). Since the staff policy is to include a numerical value for the SLMCPR, the following statement from the BWR/6 Standard Technical Specifications (STS), NUREG-1434, Revision 3, Volume 2, Bases 2.1.1.2a MCPR [GE Fuel], needs to be added if it is correct: "The MCPR SL is determined using a statistical model that combines all the uncertainties in operating parameters and the procedures used to calculate critical power."

GE Response

The response to RAI 15.0-16 provides GE's justification for using "Number Of Rods Subject To Boiling Transition (NRSTBT)" as the ESBWR Fuel Cladding Integrity Safety Limit (FCISL) in Technical Specification 2.1.1.2 instead of a Safety Limit Minimum Critical Power Ratio (SLMCPR) with a corresponding numerical limit. The response to RAI 16.2-14 provides a detailed description of proposed changes to the Bases for TS 2.1.1.2 use of the NRSTBT as the FCISL. The proposed Bases changes provide a description of the statistical modeling and uncertainties used in determining these limits.

DCD Impact

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

NRC RAI 16.2-75

Add DCD Sections 15.3.8 and 15.3.9 to the references for TS Bases 3.1.1.

GE Response

Revision 2 of the Design Control Document (DCD) Tier 2, Section 15.3.8 applies to a Control Rod Withdrawal Error During Startup, while Section 15.3.9 applies to a Control Rod Withdrawal Error During Power Operation.

For the Control Rod Withdrawal Error During Startup, the analysis described in DCD Tier 2, Section 15.3.8 demonstrates that the transient is terminated upon a reactor scram based on a high source range neutron monitor period. Therefore, SDM requirements would ensure for this event that the reactor will be made subcritical even if the highest worth control rod or control rod pair does not insert, similar to all other analyzed transients that assume reactor scram as a mitigative function. However, there are many other transients and accidents analyzed in the DCD Tier 2, Chapter 15 that result in reactor scram as a mitigative function, similar to that for the typical BWR/6. Specific references for all of these other events are not included in the NUREG-1434, Revision 3.1, Technical Specification 3.1.1 Bases. Therefore, not providing this reference is consistent with NUREG-1434, Revision 3.1, and the reference will not be added to the DCD Tier 2, Chapter 16B Bases.

For the Control Rod Withdrawal Error During Power Operation, DCD Tier 2, Section 15.3.9 specifically justifies not analyzing this event, because there is no postulated set of circumstances for which this event could occur. Therefore, not providing this reference is consistent with the DCD Tier 2, Chapter 15, and the reference will not be added to the DCD Tier 2, Chapter 16B Bases.

DCD Impact

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

NRC RAI 16.2-90

Why was the following statement from the BWR/6 STS, NUREG-1434, Revision 3, Volume 2, Bases, deleted from DCD Tier 2, Revision 1, Chapter 16, TS Bases 3.1.3, A.1, A.2, A.3 and A.4? "A control rod is considered stuck if it will not insert by either CRD drive water or scram pressure."

GE Response

GE will revise the Design Control Document (DCD) Tier 2, Chapter 16B Bases for Technical Specification 3.1.3, "Control Rod OPERABILITY," to provide a definition for stuck control rods that is consistent with the design of the fine motion control rod drives (FMCRDs) used in the ESBWR design. Specifically, the Bases for Technical Specification 3.1.3, Required Actions A.1, A.2, A.3, and A.4 will be revised to include the following: "A control rod is stuck if it will not insert by either FMCRD motor torque or hydraulic scram pressure. A control rod is not made inoperable by a failure of the FMCRD motor if the rod is capable of hydraulic scram."

DCD Impact

DCD Tier 2, Chapters 16 and 16B, will be revised as described above.

NRC RAI 16.2-91

DCD Tier 2, Revision 1, Chapter 16, TS Table 3.1.4-1, Control Rod Scram Times: Confirm that the scram times given in DCD Tier 2, Revision 1, Tables 15.2-2 and 15.2-3 are consistent with those given in DCD Tier 2, Revision 1, Chapter 16, TS Table 3.1.4-1. It seems that the scram times are given for different reactor pressures in these Tables, i.e., 950 psig and 1050 psig reactor steam dome pressure in the TS Tables and 1085 psig and between 1085 and 1250 psig bottom vessel pressure in the DCD Section 15.2 Tables. What is the significance of these different pressures?

GE Response

Revision 2 of Design Control Document (DCD) Tier 2, Chapter 16, Table 3.1.4-1, "Control Rod Scram Times," is consistent with DCD Tier 2, Chapter 15, Tables 15.2-2 and 15.2-3, except that Chapter 16, Table 3.1.4-1 is based on reactor steam dome pressure (i.e., the pressure instrumentation available during test performance) versus the equivalent reactor vessel bottom pressure used in the safety analyses.

Revision 2 of DCD Tier 2, Chapter 16B, 3.1.4 Bases, "Control Rod Scram Times," explains the significance of the different pressures used in Chapter 15, Tables 15.2-2 and 15.2-3. Specifically, for reactor vessel bottom pressures above 7.481 MPaG (1085 psig) (and less than the reactor vessel bottom pressure design limit of 8.618 MPaG (1250 psig)), the scram function is designed to insert negative reactivity at a rate fast enough to prevent the Fuel Cladding Integrity Safety Limit being exceeded during the analyzed limiting power transient. The Chapter 16, Table 3.1.4-1 values of {6.55 MPaG (950 psig)} and {7.239 MPaG (1050 psig)} reactor steam dome pressure are intended to be conservative to the safety analyses assumed reactor vessel bottom pressure of {7.481 MPaG (1085 psig)} and 8.618 MPaG (1250 psig). For reactor vessel bottom pressures below {7.481 MPaG (1085 psig)} the scram function is assumed to function during the Rod Withdrawal Error event and, therefore, also provides protection against violating fuel damage limits during reactivity insertion accidents as described in the DCD Tier 2, Chapter 16B, 3.1.6 Bases, "Rod Pattern Control." Additionally, as described in the Chapter 16B, 3.1.4 Bases for Surveillance Requirement, when work is performed on a control rod or the control rod drive system that could affect the scram insertion time, testing must demonstrate adequate scram performance before declaring the control rod operable prior to reactor startup. Applying the scram time limits for reactor pressures < {6.55 MPaG (950 psig)} provides a high probability of meeting the acceptance criteria at reactor pressures ≥ {6.55 MPaG (950 psig)}.

As described in the introduction to DCD Tier 2, Chapter 16, information enclosed in curly brackets { } indicates that the information will be provided by GE as part of Design Certification. Therefore, the values for reactor steam dome pressure used in Chapter 16, Table 3.1.4-1, will be verified by GE to bound the values of reactor vessel bottom pressure used in the Chapter 15 safety analyses.

DCD Impact

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

NRC RAI 16.2-92

DCD Tier 2, Revision 1, Chapter 16, TS 3.1.7 uses the term "Trains" for the Standby Liquid Control System (SLCS) whereas the BWR/6 STS, NUREG-1434, Revision 3, uses the term "Subsystems." Why was the term "Subsystems" changed to "Trains" for ESBWR?

GE Response

Design Control Document (DCD) Tier 2, Chapter 16, LCO 3.1.7, "Standby Liquid Control (SLC) System," establishes requirements using the phrase 'SLC trains' to be consistent with the descriptions in DCD 9.3.5.2, "System Description,' and DCD Figure 9.3-1, "Standby Liquid Control System Simplified Diagram."

DCD Impact

No changes will be made to the DCD as a result of this RAI.

NRC RAI 16.2-93

(A) Why isn't the flow test required by the current BWR/6 STS, NUREG-1434, Revision 3, SR 3.1.7.8 to verify flow through one SLCS subsystem included in the proposed TS?

(B) The BWR/6 STS, NUREG-1434, Revision 3, bases for SR 3.1.7.8 and 3.1.7.9 includes firing of an explosive SLCS squib valve. DCD Tier 2, Revision 1, Chapter 16, bases for the TS 3.1.7 SR includes verification of the SLCS squib valve actuation by the Inservice Test (IST) Program. Describe how the IST program verifies SLCS squib valve actuation, whether the IST program includes tests similar to this SR from the BWR/6 STS, and if it doesn't include similar tests, why can't such tests be performed for the ESBWR?

GE Response

General Electric (GE) has revised Design Control Document (DCD) Tier 2, Chapter 16, LCO 3.1.7, "Standby Liquid Control (SLC) System," in revision 2 to add Surveillance Requirement (SR) 3.1.7.8, which requires periodic verification of the flow path from the SLC accumulators to the RPV, including the actuation of the squib valve. Each SLC train includes two parallel flow paths, each controlled by an injection squib valve. The Frequency for SR 3.1.7.8, 24 months on a staggered test basis for each flow path, ensures that one flow path is tested every 24 months and that each of the four flow paths is tested every 96 months.

As described in the response to RAI 16.2-35 (General Electric Letter MFN 06-431, dated November 13, 2006), squib actuated valves in the SLC system are subject to the requirements of 10 CFR 50.55a, Codes and Standards. 10 CFR 50.55a requires that these squib valves be subject to an Inservice Testing Program that is performed in accordance with the latest approved version of "ASME/ANSI, Operations and Maintenance Standards, Part 10 (OM-10), "Inservice Testing of Valves in Light-Water Reactor Power Plants." Tier 2, DCD Table 3.9-8, In-Service Testing, provides details for implementation of the Inservice Testing Program for the squib.

DCD Impact

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

NRC RAI 16.2-94

SR 3.5.2.1, Confirm that the Gravity-Driven Cooling System (GDCS) pool level of 21.65 ft specified for each pool is equivalent to the minimum total drainable inventory of 62,150 ft^3 as given in DCD Tier 2, Revision 1, Table 6.3-2.

GE Response

Consistent with the response to RAI 6.3-17 (General Electric Letter MFN 06-241, dated July 28, 2006), Design Control Document (DCD) Tier 2, Revision 1, Table 6.3-2, "GDCS Design Basis Information," has been revised to specify that the minimum total drainable inventory (for 3 GDCS Pools) at the GDCS pool low water level of 6.5 meters is 1746 m^3 (61,659 ft^3).

DCD Tier 2, Chapter 16, "Technical Specifications," LCO 3.5.2, "Gravity-Driven Cooling System (GDCS) – Operating," has been revised to be consistent with revision 2 of DCD, Table 6.3-2. Surveillance Requirement 3.5.2.1 will require periodic verification that the water level in each GDCS pool is $\geq$ 6.5 meters (21.3 feet).

DCD Impact

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

NRC RAI 16.2-97

Confirm that all Automatic Depressurization System (ADS) and Depressurization Valve (DPV) timers are included in the TS.

GE Response

The ESBWR Design Control Document (DCD), Tier 2, Revision 1, Chapter 16B, Technical Specification (TS) 3.3.5.2, "Emergency Core Cooling System (ECCS) Actuation," Bases indicates that TS 3.3.5.2 does include the timers associated with the Automatic Depressurization System (ADS) and the Depressurization Valves (DPVs). However, in the Revision 1 Bases, this was shown as a bracketed item as a result of a lack of detail contained in DCD Chapter 7, "Instrumentation." The TS 3.3.5.2 Bases also state that a detailed description of the ECCS instrumentation and ECCS actuation logic is provided in the Bases for Limiting Condition for Operation (LCO) 3.3.5.1, "Emergency Core Cooling System (ECCS) Instrumentation." A review of the Bases associated with LCO 3.3.5.1 shows that the ADS and DPV timers are implicitly included in the TS. Surveillance Requirement (SR) 3.3.5.1.4 requires a periodic verification that the response time of the ECCS instrument channels is within limits. To provide assurance that the ADS and DPV timers are operable, GE revised TS 3.3.5.2 and the associated Bases, in Revision 2, to include a response time test of the actuation logic.

DCD Impact

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

NRC RAI 16.2-98

TS 3.5.2 Bases: Action A.1 states "If one GDCS injection branch line is inoperable, [at least [4] GDCS injection branch lines will be available to respond... " There are 8 injection branch lines so at least 7 injection branch lines will be available.

(A) Clarify why only 4 GDCS injection lines are specified.

(B) Clarify Action B.1, since there are 4 equalizing lines and if one equalizing line is inoperable the remaining 3 are operable.

(C) Clarify Action C.1 for two GDCS injection branch lines inoperable and Action D.1 for two GDCS equalizing lines inoperable.

GE Response

Design Control Document (DCD) Tier 2, Revision 2, Chapter 16, LCO 3.5.2, "Gravity-Driven Cooling System (GDCS) – Operating," requires operability of the following: a) eight branch lines of the injection subsystem; and, b) four trains of the equalizing subsystem.

LCO 3.5.2, Condition A, Bases explain that a minimum of 4 GDCS injection branch lines will function as required when 1 of the 8 GDCS injection branch lines is inoperable at the start of a loss of coolant accident (LOCA). Only 4 GDCS injection branch lines may function because 1 of the 8 branch lines is inoperable, a second branch line is lost to a random single failure, and two additional branch lines are potentially lost if the break location is an injection branch line, which, as explained in DCD Tier 2, Revision 2, Section 6.3.1.1.2, could prevent injection flow through two injection branch lines.

LCO 3.5.2, Condition B, Bases explain that a minimum of 1 GDCS equalizing train will function as required when 1 of the 4 GDCS equalizing trains is inoperable at the start of a LOCA. Only 1 GDCS equalizing train may function because 1 of the 4 equalizing trains is inoperable, a second equalizing train is lost to a random single failure, and a third equalizing train is potentially lost if the break location is a GDCS equalizing train. This is consistent with DCD Tier 2, Revision 2, Section 6.3.2.7.1, which states that the LOCA analysis assumes a double ended-guillotine-break in one GDCS equalizing train and a worst single failure, which is the failure of a second equalizing train.

LCO 3.5.2, Condition C, applies when 2 of the 8 GDCS injection branch lines are inoperable. Based on the discussions above, the minimum required number of GDCS injection branch lines assumed in the LOCA analysis would function when in Conditions C; however, the ability to tolerate a random single failure is lost. Therefore, at least 1 of the 2 inoperable GDCS injection branch lines must be restored to operable within the specified limit.

LCO 3.5.2, Condition D, applies when 2 of the 4 GDCS equalizing trains are inoperable. Based on the discussions above, the minimum required number of GDCS equalizing trains assumed in the LOCA analysis would function when in Conditions D; however, the ability to tolerate a random single failure is lost. Therefore, at least 1 of the 2 inoperable GDCS equalizing trains must be restored to operable within the specified limit.

GE has revised the Bases for LCO 3.5.2, Conditions A, B, C and D, to clarify the explanation of the Conditions and Required Actions.

As noted in the response to RAI 16.2-32 (General Electric Letter MFN 06-431, dated November 13, 2006), DCD Tier 2, Revision 2, Chapter 16, LCO 3.5.2 is written based on an assumption that pending analyses will demonstrate that the ECCS safety function is maintained with the simultaneous failure of two GDCS injection branch lines and two trains of the GDCS equalizing subsystem. The Conditions, Required Actions, and Completion Times for LCO 3.5.2 are enclosed in brackets indicating that additional analysis or justification is required prior to approval. These sections of LCO 3.5.2 will remain enclosed in brackets until the DCD changes that provide the required justification are approved.

DCD Impact

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

NRC RAI 16.2-99

Bases 3.9.2, Refuel Position One-Rod/Rod Pair-Out Interlock, Background:

Why was the following portion of the TS 3.9.2 bases from the BWR/6 STS, NUREG-1434, Revision 3, deleted for the ESBWR? "This specification ensures that the performance of the refuel position one-rod-out interlock in the event of a DBA meets the assumptions used in the safety analysis...".

GE Response

For the BWR/6, a rod withdrawal error during refueling is classified as a Design Basis Accident. For the ESBWR, the design basis accident (DBA) safety analyses do not assume operation of the refuel position one-rod/rod-pair-out interlock to prevent or mitigate the consequences of any credible event. As indicated in Control Document (DCD) Tier 2, Section 15.3.7, the ESBWR credits this interlock for a control rod withdrawal error during refueling, which is classified as Infrequent Event. DCD Tier 2, Section 15.0.1 specifies "An infrequent event is defined as a DBE [Design Basis Event] (with or without assuming a single active component failure or single operator error) with probability of occurrence of < 1/100 per year, and a radiological consequence less than an accident." DCD Tier 2, Chapter 16B 3.9.2 Bases correctly identifies the event associated with this interlock (i.e., a control rod withdrawal error during refueling) but, consistent with DCD Tier 2, Chapter 15, does not describe this event as a Design Basis Accident for the ESBWR.

DCD Impact

No DCD changes will be made at this time in response to this RAI.

NRC RAI 16.2-100

SR 3.9.2.1 Bases: Change "Mode 5" to " Mode 6" to agree with ESBWR Modes.

GE Response

This typographical error was corrected in Design Control Document (DCD) Tier 2, Chapter 16B, Revision 2, provided in letter MFN 06-526, dated December 15, 2006.

DCD Impact

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

NRC RAI 16.2-101

TS 3.9.6, Reactor Pressure Vessel (RPV) Water Level, addresses only movement of the irradiated fuel assemblies. Why was TS 3.9.7, RPV Level for new fuel assemblies and control rods, from BWR/6 STS, NUREG-1434, Revision 3, deleted for the ESBWR? Add new fuel assemblies to the Applicability section.

GE Response

Design Control Document (DCD) Tier 2, Section 15.4.1, "Fuel Handling Accident," limits the design basis fuel handling accident to a drop of an irradiated fuel assembly onto a core of irradiated fuel assemblies. DCD Tier 2, Chapter 16, Technical Specification 3.9.6, "Reactor Pressure Vessel (RPV) Water Level," ensures that the water level assumed as initial condition for this event is maintained.

DCD Tier 2, Section 9.1.4, "Light Load Handling System (Related to Refueling)," addresses dropping loads other than an irradiated fuel assembly, including new fuel and control rods. DCD Tier 2, Section 9.1.5, "Overhead Heavy Load Handling Systems (OHLHS)," addresses dropping loads weighing more than one fuel assembly. These DCD sections address the controls and mechanisms for establishing the necessary bounding conditions for, in part, the non-design basis drop of new fuel assemblies and control rods. The controls outlined in these DCD sections satisfy the recommendations of Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis," and the guidelines of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." In addition, these DCD sections address the requirements of NRC Bulletin 96-02, "Movement Of Heavy Loads Over Spent Fuel, Over Fuel In The Reactor Core, Or Over Safety-Related Equipment."

Dropping a new fuel assembly and dropping a control rod are not design basis accidents. Therefore, any water level used as an initial condition for these events does not meet Criterion 2 of 10 CFR 50.36(c)(2)(ii) for the ESBWR and is not included in the Technical Specifications. As noted above, DCD Sections 9.1.4 and 9.1.5 establish appropriate controls for the movement of loads other than irradiated fuel assemblies.

DCD Impact

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

NRC RAI 16.2-102

Create a footnote for each bracketed item currently in the ESBWR TS to indicate whether the bracketed item will be filled in with standard value during the design certification (DC) review, or the value will remain bracketed to be filled in later by the COL applicant or holder. Please provide a table listing all of the bracketed items indicating DC, COL applicant, or COL holder responsibility.

GE Response

GE previously provided a response to Request for Additional Information (RAI) 16.0-2 which requested an explanation of the purpose of each bracket and that reviewer's notes be provided when necessary.

The majority of the current bracketed items in the ESBWR Technical Specifications (TS) and Bases are expected to be resolved, and brackets eliminated, by the issuance of the final draft DCD Chapters 16 and 16B revision. Any bracketed information remaining in the final draft DCD Chapters 16 and 16B will be provided with Reviewer's Notes to clarify the purpose of the brackets.

At this time, summary lists of the remaining types of brackets are pending future revisions of the ESBWR TS and Bases. These future revisions are expected to significantly reduce the scope and number of bracketed information items in the ESBWR TS and Bases.

DCD Impact

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

NRC RAI 16.2-103

BWR/6 STS, NUREG-1434, Revision 3, includes for TS 3.1.1 Shutdown Margin, LCO 3.1.1 Required Action D.4 "Initiate action to restore isolation capability in each required [secondary containment] penetration flow path not isolated" and Required Action E.5 "Initiate action to restore isolation capability in each required [secondary containment] penetration flow path not isolated." These Required Actions are not in the proposed ESBWR TS. Provide the basis for exclusion of these Required Actions.

GE Response

This RAI is a duplicate of RAI 16.2-18. GE responded to RAI 16.2-18 by letter MFN 06-431, dated November 13, 2006.

DCD Impact

No changes will be made to DCD Tier 2, Chapter 16 or Chapter 16B as a result of this RAI.

NRC RAI 16.2-104

The BWR/6 STS, NUREG-1434, Revision 3, SR 3.1.3.5 Frequency includes "Each time the control rod is withdrawn to 'full out' position." This portion of the SR Frequency was excluded from ESBWR STS. The overtravel position feature in the BWR/6 provides a positive check on the coupling integrity, since only an uncoupled CRD can reach the overtravel position. Provide basis for the exclusion of this SR Frequency from the ESBWR STS.

GE Response

GE will revise the Design Control Document (DCD) Tier 2, Chapter 16 and 16B, Technical Specification 3.1.3, "Control Rod OPERABILITY," to include "Each time the control rod is withdrawn to 'full out' position" as a required Frequency for SR 3.1.3.5.

DCD Impact

DCD Tier 2, Chapters 16 and 16B, will be revised as described above.

NRC RAI 16.2-105

In ESBWR TS Table 3.1.4-1, Control Rod Scram Times, the column listing "Control Rod Percent Insertion" should list notch positions as is done in the BWR/6 STS, NUREG-1434, Revision 3. It is noted that in certain locations of 3.1.1 and 3.1.4 percent rod position is listed in brackets, with the assumption that these would be converted to notch position in later revisions of the TS. However, the column in Table 3.1.4-1 indicates that Control Rod Percent Insertion may be the means by which notch position is described in ESBWR STS. Provide a discussion of how control rod percent insertion versus notch position will provide benefit to licensed operators.

GE Response

Design Control Document (DCD) Tier 2, Chapters 16 and 16B, consistently use the term "control rod percent insertion" when specifying a specific control rod position, and uses the term "notch(es)" when specifying movement or distance between defined specific control rod position locations. Based on that convention, and the design of the automated instrumentation used to perform scram time testing of the control rods in the ESBWR, the use of "control rod percent insertion" in DCD Tier 2, Chapter 16, Table 3.1.4-1 is consistent with the ESBWR nomenclature used in other DCD Tier 2 Chapters as further discussed below.

Surveillance Requirements (SRs) in DCD Tier 2, Chapter 16, Technical Specification 3.1.4, "Control Rod Scram Times," require periodic verification that assumptions for control rod insertion rate used in design basis transient and accident analyses, as specified in Revision 2 of the DCD Tier 2, Table 15.2-3, are met. DCD Tier 2, Chapter 16, Table 3.1.4-1, "Control Rod Scram Times," establishes the acceptance criteria as 'Rod Insertion (%)' for specific time intervals following de-energization of the scram solenoids, which is identical to the presentation used in DCD Tier 2 Table 15.2-3.

As described in DCD Tier 2, Revision 2, Section 7.7.2, control rod position for scram time testing will be established by control rod position reed switch status. Scram time recording panels (STRPs) and the Scram Time Recording and Analysis Panel (STRAP), designed to facilitate surveillance testing, will monitor the status of the reed switches located at the 0%, 10%, 40%, 60%, and 100% rod insertion positions to provide required input for the SRs in DCD Tier 2, Chapter 16, Technical Specification 3.1.3, "Control Rod OPERABILITY," and DCD Tier 2, Chapter 16, Technical Specification 3.1.4.

Therefore, the use of "control rod percent insertion" in DCD Tier 2, Chapters 16 and 16B, is appropriate for the design of the ESBWR.

DCD Impact

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

NRC RAI 16.2-106

ESBWR TS SR 3.1.7.6 Frequency requires verification of boron solution concentration every 92 days, increased from the 31 days in BWR/6 STS, NUREG-1434, Revision 3, SR 3.1.7.5. Provide justification for the frequency change.

GE Response

General Electric has revised Surveillance Requirement (SR) 3.1.7.6 in Design Control Document (DCD) Tier 2, Revision 2, Chapter 16, LCO 3.1.7, "Standby Liquid Control (SLC) System," to adopt a Frequency of 31 days for the periodic verification of the sodium pentaborate concentration in the SLC accumulators.

DCD Impact

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

NRC RAI 16.2-107

BWR/6 STS, NUREG-1434, Revision 3, SR LCO 3.5.1, Required Action G.2 "Reduce reactor steam dome pressure..." is omitted from ESBWR TS 3.5.1 Condition C, two ADS safety-relief valves (SRVs) inoperable, Condition D, two DPVs inoperable, and Condition E, three or more ADS SRVs or DPVs inoperable. Explain in detail why depressurization is not required for conditions C, D and E.

GE Response

Consistent with the response to RAI 16.0-7 (General Electric Letter MFN 06-431, dated November 13, 2006), a requirement to proceed to Mode 5 has been added to Design Control Document (DCD) Tier 2, Revision 2, Chapter 16, LCO 3.5.1, "Automatic Depressurization System (ADS) – Operating," if [three] or more ADS safety-relief valves (SRVs) are inoperable, or if [three] or more Depressurization Valves (DPVs) are inoperable, or if Required Action or associated Completion Time for Condition C or D is not met.

LCO 3.5.1 Condition C, two ADS safety-relief valves (SRVs) inoperable, and Condition D, two DPVs inoperable, were written based on an assumption that pending analyses will demonstrate that the ECCS safety function is maintained with the simultaneous failure of two ADS SRVs and two DPVs. Therefore, Actions for Conditions C and D do not require proceeding to Mode 5 until the Completion Time for restoration is not met because these Conditions describe a loss of single failure tolerance but not a loss of the safety function. As noted in the response to RAI 16.2-32 (General Electric Letter MFN 06-431, dated November 13, 2006), the Conditions, Required Actions, and Completion Times for LCO 3.5.1, and the associated Bases are enclosed in brackets indicating that additional analysis or justification is required prior to approval. These sections of LCO 3.5.2 will remain enclosed in brackets until the DCD changes that provide the required justification are approved.

DCD Impact

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

NRC RAI 16.2-108

The Bases for TS 3.5.2, GDCS - Operating, Action D, Two equalizing lines inoperable, on page B 3.5.2-5 of DCD Tier 2, Revision 1, states that "This completion time is acceptable because the analysis described in Reference 5 (ECCS Topical Report- TBD) determined that [1] equalizing line is sufficient to respond to the design basis LOCA". Please submit the reference to justify this conclusion.

GE Response

As noted in the response to RAI 16.2-32 (General Electric Letter MFN 06-431, dated November 13, 2006), Design Control Document (DCD) Tier 2, Revision 1, Chapter 16, LCO 3.5.2, "Gravity-Driven Cooling System (GDCS) – Operating," is written based on an assumption that pending analyses will demonstrate that the ECCS safety function is maintained with the simultaneous failure of two GDCS injection branch lines and two trains of the GDCS equalizing subsystem. The Conditions, Required Actions, and Completion Times for LCO 3.5.2, the associated Bases, and references to the analyses supporting this conclusion in the Bases are enclosed in brackets indicating that additional analysis or justification is required prior to approval. These sections of LCO 3.5.2 will remain enclosed in brackets until the DCD changes that provide the required justification are approved.

DCD Impact

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

NRC RAI 16.2-109

In TS Bases 3.1.1, and 3.1.3, the control rod drop accident (CRDA) discussion was deleted from the bases. In TS Bases 3.1.3, A.1, A.2, A.3 and A.4, 3.1.6, 3.10.7, and 3.10.8, the CRDA is replaced by Rod Withdrawal Error (RWE) analyses.

The treatment on the CRDA in the DCD is currently an open question (see NRC RAI 4.6-23). The treatment of CRDA in the TS Bases may need to be revised depending on the resolution of this issue.

GE Response

Design Control Document (DCD) Tier 2, Chapter 16B, does not reference the control rod drop accident (CRDA) because this event has been determined as not credible based on the design of the fine motion control rod drive (FMCRD) and control rods used in the ESBWR. NRC RAI 4.6-23 addresses issues regarding the classification of CRDA based on the ESBWR design. The GE response to NRC RAI 4.6-23 is still being developed. Changes to discussion of the CRDA in DCD Tier 2, Chapter 16B, will be based on the response to NRC RAI 4.6-23.

DCD Impact

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