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MFN 08-301

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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 122 Related to ESBWR Design Certification Application - Engineered Safety Feature Materials - RAI Number 6.1-16 S01**

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAI originally transmitted via the Reference 1 letter and supplemented by an NRC request for clarification in Reference 2. DCD Markups related to this response are provided in Enclosure 2.

If you have any questions or require additional information, please contact me.

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

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NRO

References:

1. MFN 07-317, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 98 Related to ESBWR Design Certification Application*, May 29, 2007
2. MFN 07-659, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 122 Related to ESBWR Design Certification Application*, December 6, 2007

Enclosures:

1. MFN 08-301 - Response to Portion of NRC Request for Additional Information Letter No. 122 Related to ESBWR Design Certification Application - Engineered Safety Feature Materials - RAI Number 6.1-16 S01
2. MFN 08-301 - Response to Portion of NRC Request for Additional Information Letter No. 122 Related to ESBWR Design Certification Application - Engineered Safety Feature Materials - RAI Number 6.1-16 S01 - DCD Markups

cc:		
	AE Cubbage	USNRC (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	GB Stramback	GEH/San Jose (with enclosures)
	RE Brown	GEH/Wilmington (with enclosures)
	eDRF	0000-0082-5178

Enclosure 1

MFN 08-301

Response to Portion of NRC Request for Additional Information Letter No. 122 Related to ESBWR Design Certification Application

Engineered Safety Feature Materials

RAI Number 6.1-16 S01

NRC RAI 6.1-16 S01:

In response to RAI 6.1-16, GEH stated that "the total amounts of organic materials that do not meet requirements cannot be determined at the beginning of the COL Applicant stage."

The DCD, Tier 2, Revision 4, Section 6.1.3, COL Information Item 6.1.3-1-A, states:

The COL Applicant will:

1. *Describe the approach to be taken to identify and quantify all organic materials that exist within the containment building in significant amounts that do not meet the requirements of ASTM D-5144 and Regulatory Guide 1.54 as per Section 6.1.2.*
2. *Provide the milestone when evaluations will be complete to determine the generation rate, as a function of time, of combustible gases that can be formed from these unqualified organic materials under DBA conditions.*
3. *As part of these evaluations, provide the technical basis and assumptions used.*

The intended purpose of the original question was for the COL Applicant to provide the total amount of organic materials that do not meet the requirements of Regulatory Guide 1.54.

A. *Given that this information is not going to be available before the procurement of the components, the staff requests that you revise the DCD to provide a bounding value for the amount of unqualified coatings. Provide the technical basis and assumptions for this bounding value including evaluation of the generation rate, as a function of time, of combustible gases that can be formed from these unqualified organic materials under DBA conditions.*

B. *In addition, please provide ITAAC in DCD Tier 1 to verify the total amount of protective coatings and organic materials used inside containment that do not meet the requirements of ASTM D 5144 and Regulatory Guide 1.54.*

GEH Response:

The specification, procurement, and application of coatings used inside the containment for the ESBWR, will be in accordance with the requirements of Regulatory Guide 1.54, without exception.

A. For equipment and surfaces located within the Service Level I area, the ASTM standards referenced in Regulatory Guide 1.54 will be imposed, as applicable, and no "unqualified" coatings will be permitted. For this reason, no Design Basis Accident (DBA) time-based bounding values or analysis for "unqualified" coatings will be required for use by the COL Holder.

B. There will be no coatings in the Service Level I area not meeting the requirements of Regulatory Guide 1.54 and ASTM D 5144. Therefore no Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) will be added to DCD Tier 1.

DCD Impact:

DCD Tier 2, Subsection 6.1.2, Table 1.9-6, Table 1.9-21, Table 1.9-21b, and Table 17.0-1 will be revised as shown in the attached markup.

Enclosure 2

MFN 08-301

Response to Portion of NRC Request for Additional Information Letter No. 122 Related to ESBWR Design Certification Application

Engineered Safety Feature Materials

RAI Number 6.1-16 S01

DCD Markups

Table 1.9-6

Summary of Differences from SRP Section 6

SRP Section	Specific SRP Acceptance Criteria	Summary Description of Difference	Subsection Where Discussed
6.1.1		None	
6.1.2	~~A coating system to be applied inside a containment is acceptable if it meets the regulatory positions of Regulatory Guide 1.54 and the standards of ASTM D3842 and ASTM D3911~~	~~Due to impracticability of using these special coatings on all equipment, exception is made on small-size equipment where, in case of a LOCA, the paint debris is not a safety hazard. Exceptions include such items as electronic/electrical trim, covers, face plates and valve handles.~~None	~~6.1.2.1~~
6.2.1	Listed in acceptance criteria of 6.2.1.1.C, 6.2.1.2, 6.2.1.3 and 6.2.1.4	Not applicable	
6.2.1.1C	Design provision for automatic actuation of wetwell spray 10 minutes following a LOCA signal	The ESBWR does not need wetwell sprays	6.2.1.1
6.2.1.1C	Monthly vacuum valve operability test	Operability tests only performed during refueling outages	6.2.1.1
6.2.1.2		None	
6.2.1.3	Sources of energy during LOCA	All sources considered, but ESBWR analysis uses different correlations than stated in 10 CFR 50, Appendix K, for decay heat and metal-water reaction rate.	
6.2.1.4		Not applicable to the ESBWR	
6.2.1.5		Not applicable to the ESBWR	

Table 1.9-21

NRC Regulatory Guides Applicability to ESBWR

RG No.	Regulatory Guide Title	Appl. Rev.	Issued Date	ESBWR Appli-cable?	Comments
1.43	Control of Stainless Steel Weld Cladding of Low-Alloy Steel Components	0	05/1973	Yes	Special testing requirements not applicable due to materials selected.
1.44	Control of the Use of Sensitized Stainless Steel	0	05/1973	Yes	
1.45	Reactor Coolant Pressure Boundary Leakage Detection Systems	0	05/1973	Yes	
1.47	Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems	0	05/1973	Yes	
1.49	Power Levels of Nuclear Power Plants	1	12/1973	Part	Power limitation outdated. Power multiplier of 1.02 still applicable.
1.50	Control Preheat Temperature for Welding of Low-Alloy Steel	0	05/1973	Yes	
1.52	Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants	3	06/2001	Yes	Applies to Control Room HVAC. URD optimization – see Table 1.9-21a
1.53	Application of the Single-Failure Criterion to Safety Systems	2	11/2003	Yes	
1.54	Service Level I, II, and III Protective Coatings Applied to Water-Cooled Nuclear Power Plants	1	07/2000	Yes	~~See Table 1.9-21b.~~

Table 1.9-21b

ESBWR Compliance with Quality Related Regulatory Guides

Regulatory Guide No.	Revision	Comments
1.8	3	Not applicable to GEH QA Program
1.21	1	Not applicable to GEH QA Program
1.26	3	Except for the alternate Quality Group Classification for the Hydraulic Control Unit per Note 8 of Table 3.2-1.
1.28	3	Except for NRC accepted alternate positions as documented in Table 2-1 of Reference 1.9-2.
1.29	3	Except for Main Steam Piping from seismic interface restraint to turbine stop valves as identified in Table 3.2-1 and Figure 3.2-1.
1.30	0	No exceptions.
1.33	2	Not applicable to GEH QA Program
1.37	0	Except for NRC accepted alternate positions as documented in Table 2-1 of Reference 1.9-2.
1.38	2	Except for NRC accepted alternate positions as documented in Table 2-1 of Reference 1.9-2.
1.39	2	No exceptions.
1.54	1	~~Except for certain small size equipment where paint debris is not a post LOCA hazard as described in Subsection 6.1.2.1.~~No exceptions.
1.58	withdrawn	Superseded by Reg. Guide 1.28, Rev. 3.
1.64	withdrawn	Superseded by Reg. Guide 1.28, Rev. 3, except for NRC accepted alternate positions as documented in Table 2-1 of Reference 1.9-2.
1.74	withdrawn	Superseded by Reg. Guide 1.28, Rev. 3.
1.88	withdrawn	Superseded by Reg. Guide 1.28, Rev. 3.
1.94	1	Not applicable to GEH QA Program
1.97	4	No exceptions.
1.116	0-R	No exceptions.
1.123	withdrawn	Superseded by Reg. Guide 1.28, Rev. 3.
1.143	2	No exceptions.

6.1.1.4 Composition, Compatibility and Stability of Containment and Core Coolants

Demineralized water from the condensate storage tank or the suppression pool, with no additives is employed in the core cooling water and containments sprays (see Subsections 9.2.3 and 9.2.6). One exception is that the sodium pentaborate liquid control solution, which if used, enters through the Standby Liquid Control system sparger system.

The post-LOCA ESF coolant, which is high-purity water, comes from one of two sources. Water in the 304L stainless steel-lined Gravity-Driven Cooling System (GDCS) pools and suppression pool is maintained at high purity (low corrosion attack) by the Fuel and Auxiliary Pools Cooling System (FAPCS). See Subsection 9.1.3 for further details. Because impurity levels in the water are controlled and the design pH range (5.6-8.6) is maintained, corrosive attack on the pool liner (304L SS) will be insignificant over the life of the plant (Subsection 3.8.1.4).

Because of the methods described above (coolant storage provisions, insulation materials requirements, and the like), as well as the fact that the containment has no significant stored quantities of acidic or basic materials, the post-LOCA aqueous phase pH in all areas of containment will have a flat time history. In other words, the liquid coolant will remain at its design basis pH throughout the event. As a result, post-LOCA hydrogen generation due to corrosion is considered negligible.

6.1.2 Organic Materials

Relevant to organic materials, this subsection addresses or references to other DCD locations that address the relevant requirements of Appendix B to 10 CFR Part 50 as it relates to the quality assurance requirements for the design, fabrication and construction of safety-related structures, systems and components. The coating systems applied inside the containment meet the regulatory positions of Regulatory Guide 1.54 and the standards of ASTM D 5144, as applicable.

6.1.2.1 Protective Coatings

The use of organic protective coatings within the containment has been kept to a minimum. The major use of such coatings is on the carbon steel containment liner, internal steel structures, equipment and pipe supports inside the drywell and wetwell.

Consistent with the rationale of Regulatory Guide 1.54, the wetwell and attendant vertical vents are designated as a Service Level I area. All surfaces and equipment in this area are either uncoated, corrosion resistant stainless steel, or coated in accordance with Regulatory Guide 1.54 and referenced ASTM standards, as applicable.

The remainder of the containment, (i.e., the upper and lower drywell and annulus areas) are physically separated from the Service Level I area, such that there is no practicable method by which coating debris may reach the equalizing line strainers. Protective covers over the vertical vents, prevent debris from being swept directly into the wetwell. Debris which might originate inside, or be carried into the annulus and lower drywell, will have sufficient time to settle before water levels there can reach the spillover pipes to the vent wells and wetwell. Due to these design features, the failure of coatings in the upper and lower drywell, and areas in between, cannot adversely affect the operation of any post-accident fluid system.

~~The~~Regardless of service level designation, all field applied epoxy coatings ~~are specified to~~ inside containment meet the requirements of Regulatory Guide 1.54 and are qualified using the standard ASTM tests, as applicable to procurement, installation, and maintenance. ~~However,~~

~~because of the impracticability of using these special coatings on all equipment, certain exemptions are allowed. The exemptions are restricted to small-size equipment where, in case of a LOCA, the paint debris is not a safety hazard. Exemptions include such items as electronic/electrical trim, covers, face plates and valve handles. Other than these minor exemptions, all coatings within the containment are qualified to Regulatory Guide 1.54 and applicable reference standards including ASTM D 5144.~~

6.1.2.2 Other Organic Materials

Materials used in or on the ESF equipment have been reviewed with respect to radiolytic and pyrolytic decomposition and attendant effects on safe operation of the system. For example, fluorocarbon plastic (Teflon) is not permitted in environments that reach temperatures greater than 149°C (300°F), or radiation exposures above 10^4 rads.

Other organic materials in the containment are qualified to environmental conditions in the containment.

6.1.2.3 Evaluation

For each application, the materials have been specified to withstand an appropriate radiation dose for their design life, without suffering any significant radiation-induced damage. The specified integrated radiation doses are consistent with those listed in Section 3.11.

In addition, since the containment post-accident environment consists of mostly hot water, nitrogen, and steam, no significant chemical degradation of these materials is expected, nor should be because of strict application of inspection and testing. Solid debris from the organic materials discussed is not expected to be generated to any significant extent and cannot practicably reach the equalizing line strainers. ~~(See Subsection 6.1.3.1 for COL items.)~~

6.1.3 COL Information

6.1.3-1-A ~~Protective Coatings and Organic Materials~~ (Deleted)

~~The COL Applicant will:~~None.

- ~~Describe the approach to be taken to identify and quantify all organic materials that exist within the containment in significant amounts that do not meet the requirements of ASTM D 5144 and Regulatory Guide 1.54 as per section 6.1.2.~~
- ~~Provide the milestone when evaluations will be complete to determine the generation rate, as a function of time, of combustible gases that can be formed from these unqualified organic materials under DBA conditions.~~
- ~~As part of these evaluations, provide the technical basis and assumptions used.~~

6.1.4 References

None.

Table 17.0-1

Compliance With Quality Assurance Program Commitments

Commitment	Revision	Comments
RG 1.8	3	Not applicable for GEH QA Program
RG 1.21	1	Not applicable for GEH QA Program
RG 1.26	3	Except for the alternate Quality Group Classification for the Hydraulic Control Unit per Note 8 of Table 3.2-1
RG 1.28	3	Except for NRC-accepted alternate positions in Table 2-1 of Reference 17.0-1
RG 1.29	3	Except for Main Steam Piping from seismic interface restraint to turbine stop valves as identified in Table 3.2-1 and Figure 3.2-1
RG 1.30	0	No exception
RG 1.33	2	Not applicable for GEH QA Program
RG 1.37	0	Except for NRC-accepted alternate positions in Table 2-1 of Reference 17.0-1
RG 1.38	2	Except for NRC-accepted alternate positions in Table 2-1 of Reference 17.0-1
RG 1.39	2	No exception
RG 1.54	1	~~Except for certain small size equipment where paint debris is not a post-LOCA hazard as described in Subsection 6.1.2.1~~No exception
RG 1.58	Withdrawn	Superseded by Regulatory Guide 1.28, Rev. 3
RG 1.64	Withdrawn	Superseded by Regulatory Guide 1.28, Rev. 3, except for NRC-accepted alternate positions in Table 2-1 of Reference 17.0-1
RG 1.74	Withdrawn	Superseded by Regulatory Guide 1.28, Rev. 3
RG 1.88	Withdrawn	Superseded by Regulatory Guide 1.28, Rev. 3
RG 1.94	1	Not applicable for GEH QA Program
RG 1.97	4	No exception
RG 1.116	0-R	No exception
RG 1.123	Withdrawn	Superseded by Regulatory Guide 1.28, Rev. 3
RG 1.143	2	No exception
RG 1.144	Withdrawn	Superseded by Regulatory Guide 1.28, Rev. 3