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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 221 Related to ESBWR Design Certification Application ESBWR RAI Numbers 14.3-174 S01, and 14.3-175 S01**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letter dated July 15, 2008 (Reference 1).

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in the DCD.

Enclosure 1 contains the GEH response to each of the subject RAIs. Previous RAIs and responses were transmitted in References 2 through 4. The enclosed changes will be incorporated in an upcoming DCD Revision.

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

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References:

1. MFN 08-588, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 221 Related To ESBWR Design Certification Application*, dated July 15, 2008.

2. MFN 07-718, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 126 Related To ESBWR Design Certification Application*, dated December 20, 2007.

3. MFN 08-086, Supplement 21 Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application RAI Numbers 14.3-174 and 14.3-263, dated April 2, 2008.

4. MFN 08-086, Supplement 23 Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application RAI Numbers 14.3-175, 14.3-356 and 14.3-378. April 17, 2008.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 221 Related to ESBWR Design Certification Application DCD Tier 1 RAI Numbers 14.3-174 S01 and 14.3-175 S01

cc:

AE Cubbage	USNRC (with enclosure)
RE Brown	GEH/Wilmington (with enclosure)
eDRF Section	0000-0090-6319 RAI 14.3-174 S01
	0000-0090-6431 RAI 14.3-175 S01

Enclosure 1

MFN 08-086, Supplement 73

Response to Portion of NRC Request for

Additional Information Letter No. 221

Related to ESBWR Design Certification Application

DCD Tier 1

RAI Numbers 14.3-174 S01 and 14.3-175 S01

*** Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 6.**

***Original Responses previously submitted are included without DCD updates to provide historical continuity during review.**

NRC RAI 14.3-174

NRC Summary:

Provide ITAAC for the inplant airborne radioactivity monitoring system, including a description of system sensitivity and provision of local alarms

NRC Full Text:

Although DCD Tier 1, Revision 4, Table 3.4-1 is entitled "ITAAC for Ventilation and Airborne Monitoring and Shielding," the ITAAC for airborne radioactivity monitoring has been removed from Table 3.4-1. Provide ITAAC for the in-plant airborne radioactivity monitoring system that state that airborne radioactivity monitoring is provided for those normally occupied areas of the plant in which there exists a significant potential for airborne contamination. The airborne radioactivity monitoring system should have the capability of detecting the time integrated concentrations of the most limiting internal dose particulate and iodine radionuclides in each area equivalent to the occupational concentration limits in 10 CFR 20, Appendix B for 10 hours. The airborne radioactivity monitoring system should also provide local audible alarms (visual alarms in high noise areas) with variable alarm set points, and readout/annunciation capability.

GEH Response

ESBWR Process Radiation Monitoring Systems, (PRMS), encompass Airborne Radioactivity Monitoring Systems as described in DCD Tier 2 Sections11.5 and 12.3. Area Radiation Monitoring Systems and Airborne Radioactivity Monitoring Systems provide local audible and visual alarms as described DCD Tier II, Section 12.3. Both systems are designed to minimize occupational exposure.

DCD Tier 1 Revision 4, Table 3.4-1 as described did not have the ITAAC section for Airborne Radioactivity Monitoring removed from the table. The table was revised to more accurately reflect the requirements as described per SRP 12.3-12.4. The ESBWR Ventilation and Radiation Monitoring Systems encompass those requirements including provisions for audible and visual alarms as required for personnel protection.

The current DCD Tier 1 table 3.4-1 "ITAAC for Ventilation and Airborne Monitoring and Shielding" is configured consistent with the requirements of SRP 14.3.8 for Radiation Protection. The SRP states that Tier 1 identifies and describes, commensurate with their safety significance, those SSC's that provide radiation shielding, confinement or containment of radioactivity, ventilation of airborne contamination, or radiation (or radioactivity concentration) monitoring for normal operations and during accidents. This is further reflected per DCD Tier 2, subsection 14.3.7.

Currently DCD Tier 1, subsection 3.4 "Radiation Protection", describes the application of the design and radiation control principles, which include ventilation of airborne contamination, radiation monitoring, and shielding. For "radiation" monitoring, Tier 1 subsection 2.3.2 is referenced. Subsection 2.3.2 is for Area radiation monitoring which contains the relevant ITAAC to show sufficient monitoring and alarm capability to alert operating personnel to avoid unnecessary or inadvertent radiation exposures.

The Process Radiation Monitoring Systems, (PRMS), ITAAC are contained in DCD Tier 1, subsection 2.3.1 and include airborne radioactivity monitoring systems as described in DCD Tier 2, subsection 12.3.4 paragraph 4. The ITAAC for the PRMS are described in Table 2.3.1-2 and contain the systems, which provide continuous monitoring of exhausted air within the facility. The ITAAC described in Table 2.3.1-2 and Table 3.4-1, DC 1 contain the applicable requirements and is commensurate with the defined safety significance of the in-plant airborne radioactivity monitoring system as described in DCD Tier 2, subsection 12.3.4 bullet 4. This Tier 2 subsection will be revised to address visual alarms in high noise areas.

DCD Impact

DCD Tier 2, subsection 12.3.4 will be revised as noted in the attached markup.

NRC RAI 14.3-174 S01

Rev. 2 of Tier 1, Table 3.4-1 (Item 2) contained an ITAAC for the airborne radioactivity monitoring system. This ITAAC included a design commitment for:

- *the location criteria ("airborne radioactivity monitoring is provided for those normally occupied areas of the plant in which there exists a significant potential for airborne contamination")*
- *the sensitivity ("airborne radioactivity monitoring has the capability of detecting the time integrated concentrations of the most limiting internal dose particulate and iodine radionuclides in each area equivalent to the occupational concentration limits in 10 CFR 20, Appendix B for 10 hours")*
- *alarms ("airborne radioactivity monitoring provides local audible alarms (visual alarms in high noise areas) with variable alarm set points, and readout/annunciation capability")*

In Rev. 3 of Tier 1, the location and sensitivity criteria for airborne radioactivity monitoring were removed from the ITAAC in Table 3.4-1.

In Rev. 4 of Tier 1, all mention of airborne radioactivity monitoring (except for the name in the table title) was removed entirely from the ITAAC in Table 3.4-1.

1. *10 CFR Part 20.1201 states that licensees shall control the occupational dose to individual adults to specified annual dose limits. Airborne radioactivity monitors can be used to determine the internal dose contribution to these dose limits. The acceptance criteria in SRP 12.3-12.4 state that the airborne radioactivity monitoring system should be capable of detecting 10 DAChours of particulate and iodine radioactivity from any compartment that has a possibility of containing airborne radioactivity and that normally may be occupied by personnel, taking into account dilution in the ventilation system.*

   DCD Tier 2, subsection 12.3.4 bullet 4 describes both the location criteria ("The in-plant airborne radiation monitoring instrumentation is located so that selective local areas and ventilation paths are monitored") and the sensitivity requirements ("The instruments used for monitoring airborne radioactivity are specified to detect the time integrated change of the most limiting particulate and iodine species equivalent to those concentrations specified in Appendix B of 10 CFR Part 20 (one derived air concentration (DAC) in each monitored plant area within 10 hours") for airborne radioactivity monitors.

   It is not clear, however, from the description in bullet 4 of Tier 2 subsection 12.3.4 which airborne radioactivity monitors meet the sensitivity and location criteria described in this bullet (i.e., do these sensitivity and location criteria apply to some of the airborne

radioactivity monitors listed in Tier 1 Table 2.3.1-1 or only to the portable air samplers mentioned in bullet 3 of Tier 2 subsection 12.3.4?).

It is the staff's position that the airborne radioactivity monitors which are used to monitor airborne radioactivity levels (at those normally occupied areas of the plant where there exists a significant potential for airborne contamination) to ensure that the annual dose limits contained in Part 20 are not exceeded be covered by an ITAAC.

Provide a table in the appropriate part of the DCD specifying which of the airborne radioactivity monitors meet these sensitivity and location criteria and verify that there will be an ITAAC in Tier 1 of the DCD which includes a listing of these airborne radioactivity monitors.

2. *The second paragraph of GEH's response to RAI 14.3-173 states that Table 3.4-1 was revised to more accurately reflect the requirements as described per SRP 12.3-12.4. State which of the criteria contained in SRP 12.3-12.4 are currently addressed in Tier 1 Table 3.4-1.*

3. *The third paragraph of GEH's response to RAI 14.3-173 states that the current DCD Tier 1 Table 3.4-1 is configured consistent with the requirements of SRP 14.3.8 for Radiation Protection. The acceptance criteria in SRP 14.3-8 state that Tier 1 should ensure that once the concentrations of airborne radioactivity are determined, the required airborne monitors are placed in the appropriate locations in the plant.*

   Describe where this location acceptance criterion for the airborne radioactivity monitoring system is mentioned in Tier 1, Section 3.4 or Section 2.3.1.

GEH Response

1. GEH concurs with the Staff's request to include the appropriate ITAAC for the Airborne Radioactivity Monitors as was previously included in the ESBWR Design Control Document (DCD). GEH agrees to reinstate the ITAAC requirements for the Airborne Radioactivity Monitors. The monitors are described in DCD Section 11.5 Process Radiation Monitoring System. The installed in-plant monitors as described in subsection 12.3.4 bullet 4 are a subset of the Process Radiation Monitoring Systems (PRMS) listed in Tier 1 Table 2.3.1-1. These monitors are described in detail in Tier 2 Section 11.5. The portable monitors that are described in Tier 2, Subsection 12.3.4 bullets 3 and 5 are used to determine airborne radioactivity in work areas prior to entry for areas that are not normally accessed by personnel. The PRMS contains several monitoring subsystems that have the capability to monitor iodine, particulate, and noble gases. Tier 2 Section 11.5 Table 11.5-2 contains the Gaseous and Airborne Monitors of the PRMS along with the listed Dynamic Detection Ranges. The Airborne radioactivity monitors include the ventilation exhaust monitors that

are not effluent monitors and contain the capability to monitor iodine, particulate, and noble gases.

2. The subsequent Staff question 2 from this RAI is no longer applicable as GEH has agreed that the requested ITAAC will be included in Tier 1 for the sensitivity and location criteria of the Airborne Radioactivity Monitoring Systems.
3. The subsequent Staff question 3 from this RAI is no longer applicable as GEH has agreed that the requested ITAAC will be included in Tier 1 for the sensitivity and location criteria of the Airborne Radioactivity Monitoring Systems

DCD Impact

DCD Tier #1, Section 3.4 and Table 3.4-1 will be revised as noted in the attached markup.

NRC RAI 14.3-175

NRC Summary:

Modify DCD Tier 1, Revision 4, Table 2.3.2-1 to provide a listing of each individual ARM so that the table is consistent with the ITAAC in Table 2.3.2-2.

NRC Full Text:

In DCD Tier 1, Revision 4, Table 2.3.2-1 (Arm Locations) was modified to delete the elevation of each ARM and to no longer list the number of individual area radiation monitors (ARMs) located in each location (e.g., Revision 4 lists a single listing for the ARMs in the Instrument Rack Area in the Reactor Building while Revision 3 had eight separate listings (numbered 1 – 8) for ARMs in the Instrument Rack Area in the Reactor Building). This modification to the data in Table 2.3.2-1 makes this table inconsistent with the ITAAC for the Area Radiation Monitoring System shown in DCD Tier 1, Revision 4, Table 2.3.2-2, since the ITAAC is based on inspections, tests, and analysis being performed on each ARM channel and Table 2.3.2-1 in DCD Tier 1, Revision 4, no longer lists each individual ARM location (as was indicated in the Revision 3 version of Tier 1, Table 2.3.2-1). In order to make the ITAAC consistent with the table, modify Table 2.3.2-1 to provide a listing of each individual ARM.

GEH Response

1. a) DCD Tier 1, Revision 4, Table 2.3.2-1, will be revised to list each individual ARM (as was indicated in the Revision 3 version of Tier 1, Table 2.3.2-1), so that this table is consistent with the ITAAC of Table 2.3.2-2. The revision will also delete ten (10) ARMs that were inadvertently duplicated and one ARM that was inadvertently omitted.

The ten (10) ARMs being deleted are located in the Turbine Building:

- Filters and Demineralizers Area
- Turbine Operating Floor Areas (Quantity: 2)
- Crane Travel Area (Various)
- Equipment Main Access Area
- RCCW System Area Entrance
- Offgas Charcoal Adsorber Room Entrance Area
- Backwash Transfer Pumps Furnace Area
- Condensate Hollow Fiber Valve Room
- Sample Room Area

The one ARM added is located in the FAPCS Heat Exchangers Area in the Fuel Building.

b) The revised Table 2.3.2-1 will use an asterisk (*) to identify ARMs located in accessible areas where abnormal plant evolutions or anticipated operational occurrences can potentially result in dose rate increases of 1 mSv/hr (100mRem/hr) or more. This is to be

consistent with the response to RAI 14.3-136 submitted via MFN 07-355 dated July 25, 2007.

2. DCD Tier 2, Revision 4, Tables 12.3-2, 12.3-3, 12.3-4, 12.3-5, and 12.3-6 will be revised as shown in the attached tables so that they are in agreement with above response for Table 2.3.2-1.

DCD Impact

1. DCD Tier 1, Revision 4, Table 2.3.2-1 will be revised as shown in the Attachment.

2. DCD Tier 2, Revision 4, Tables 12.3-2, 12.3-3, 12.3-4, 12.3-5, and 12.3-6 will be revised as shown in the Attachment.

NRC RAI 14.3-175 S01

NRC Summary:

Clarify numbering system for ARMS and define acronyms used in Tables 12.3-2 thru 12.3-6.

NRC Full Text:

In response to RAI 14.3-175, GEH modified Tier 1 Table 2.3.2-1 to be consistent with the ITAAC of Table 2.3.2-1. GEH also modified Tier 2 Tables 12.3-2, 12.3-3, 12.3-4, 12.3-5 and 12.3-6 to be consistent with the response for Tier 1 Table 2.3.2-1.

1. *In Tables 12.3-2, 12.3-3, 12.3-4, 12.3-5 and 12.3-6 the ARMs listed for each building are numbered consecutively beginning with number 1. Using this numbering system, in Figures 12.3-23 to 12.3-42, there are ARMs which have the same numbering in the five different buildings containing ARMs. To avoid potential confusion associated with identically numbered ARMs located in different buildings, show that you have some sort of system (such as using letter prefixes with monitor numbers to identify building locations) to differentiate radiation monitors having the same numbers but located in different buildings from each other.*

2. *It is unclear from looking at Tables 12.3-2, 12.3-3, 12.3-4, 12.3-5 and 12.3-6 what the acronyms used in the table column entitled "Monitoring Range" stand for. Add a reference (either in the text or as a footnote to each table) relating these tables to Table 12.3-7.*

GEH Response

1. In the final design, component ID numbers are uniquely assigned for ESBWR using GEH design control procedures. The unique component ID identifies the system and building so that each radiation monitor is uniquely differentiated. The initial assignment of component number is sequential in each building without skipping numbers. If there are 5 radiation detectors in each of five buildings, there would be detectors with numbers –0001 through –0005 in each of the buildings.

   Examples:

   SR3-1-1-D21-ARM-0001 is a monitor 1 located in the Reactor building.

   SR3-1-2-D21-ARM-0002 is a monitor 2 located in the Fuel Building.

   SR3-1-4-D21-ARM-0003 is a monitor 3 located in the Turbine Building.

2. DCD Tier 2 Subsection 12.3.4.2, ARM Detector Location and Sensitivity, identifies that the channel monitoring range and acronym of each area radiation channel is found in Table 12.3-7. Since this description is in the DCD prior to Tables 12.3-2 through 12.3-6, a clarification in each table is not necessary.

DCD Impact:

No changes required to DCD Tier 2 Rev. 5.

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Attachment 1

DCD Revision 6 Markup DCD Tier 1

Section 3.4 RADIATION PROTECTION

Table 3.4-1 ITAAC For Radiation Protection

3.4 RADIATION PROTECTION

Design Description

The ESBWR Standard Plant is designed to maintain radiation exposures to plant personnel As Low As Reasonably Achievable (ALARA). Radiation protection is provided by application of the design and radiation control principles:

(1) Plant design provides for containment of airborne radioactive materials, and the ventilation system ensures that concentrations of airborne radionuclides are maintained at levels consistent with personnel access needs.

(2) Area radiation monitoring provides local alarms (visual alarms in high noise areas) with variable alarm setpoints and readout/alarm capability.

(3) The plant design provides radiation shielding for rooms, corridors and operating areas commensurate with their occupancy requirements.

(4) Airborne radioactivity monitoring is provided for areas of the plant in which there exists a significant potential for airborne contamination. The airborne radioactivity monitoring system:

a. provides local alarms (visual alarms in high noise areas) with variable alarm setpoints, and readout/alarm capability.

b. has the capability of detecting the time integrated concentrations of the most limiting internal dose particulate and iodine radionuclides in each area equivalent to the occupational concentration limits in 10 CFR20 Appendix B, Table 1, column 3 (Occupational Values) for ten DAC hours in each monitored plant area.

Inspections, Tests, Analyses and Acceptance Criteria

Table 3.4-1 provides definitions of the inspections, test and/or analyses, together with associated acceptance criteria for ventilation and airborne monitoring and shielding.

Table 3.4-1

ITAAC For Radiation Protection

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
4. Airborne radioactivity monitoring is provided for areas of the plant in which there exists a significant potential for airborne contamination. The airborne radioactivity monitoring system:		
a. provides local alarms (visual alarms in high noise areas) with variable alarm setpoints, and readout/alarm capability.	a. Tests will be performed to confirm the Airborne radioactivity monitoring system's as-built audible and visual alarm function is met upon exceeding a preset setpoint value.	a. A report exists and concludes that the as-built Airborne radioactivity monitors have visual and audible alarm capability.
b. has the capability of detecting the time integrated concentrations of the most limiting internal dose particulate and iodine radionuclides in each area equivalent to the occupational concentration limits in 10 CFR 20 Appendix B, Table 1, column 3 (Occupational Values) for ten DAC hours in each monitored plant area.	b. An as-built inspection will be performed for the Airborne radioactivity monitoring systems.	b. A report exists and concludes that Airborne radioactivity monitors are capable of detecting the time integrated concentrations of the most limiting internal dose particulate and iodine radionuclides in each area equivalent to the occupational concentration limits in 10 CFR 20 Appendix B, Table 1, column 3 (Occupational Values) for ten DAC hours in each monitored plant area.