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Subject: **Revised Response to Portion of NRC Request for Additional Information Letter No. 221 Related to ESBWR Design Certification Application – Airborne Radioactivity Monitoring – RAI Number 14.3-174 S01**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) revised (Revision 1) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) 14.3-174 S01, sent by NRC Letter No. 221 (Reference 1).

The GEH revised response to RAI 14.3-174 S01 is provided in Enclosure 1. This response replaces the response to RAI 14.3-174 S01 previously provided in MFN 08-086, Supplement 73 (Reference 2). The response to RAI 14.3-175 S01 stands as provided in Reference 2.

Enclosure 2 contains the DCD markups associated with this revised response.

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

References:

1. MFN 08-588, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 221 Related to ESBWR Design Certification Application*, July 15, 2008
2. MFN 08-086, Supplement 73, 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, October 16, 2008

Enclosures:

1. Revised Response to Portion of NRC Request for Additional Information Letter No. 221 Related to ESBWR Design Certification Application – Airborne Radioactivity Monitoring – RAI Number 14.3-174 S01
2. Revised Response to Portion of NRC Request for Additional Information Letter No. 221 Related to ESBWR Design Certification Application – Airborne Radioactivity Monitoring – RAI Number 14.3-174 S01 – DCD Markups

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Enclosure 1

MFN 10-178

Revised Response to Portion of NRC Request for Additional Information Letter No. 221 Related to ESBWR Design Certification Application

Airborne Radioactivity Monitoring

RAI Number 14.3-174 S01

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 DAC hours 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 Revised Response

Background:

GEH first responded to RAI 14.3-174 S01 in October 2008 (Reference MFN 08-086, Supplement 73). Subsequently, the NRC approved an industry template for referencing in Combined License Applications ("COLA"). In a letter dated May 21, 2009, NEI 07-03A, "Generic FSAR Template Guidance for Radiation Protection Program Description," submitted the version approved by the NRC and reissued as the "A" version (i.e., the version with the NRC Safety Evaluation Report included within the document), which is in ADAMS as ML091490684. NEI 07-03A is referenced as resolution of COL information item 12.3-2-A, as will be discussed further below. *See* DTE COLA FSAR Section 12.3.4.

COL Item 12.3-2-A information from the ESBWR DCD Tier 2, Section 12.3.4, Rev. 7, is as follows:

> The radiation instrumentation that monitors airborne radioactivity is classified as nonsafety-related. Airborne radiation monitoring operational considerations, such as the procedures for operation and calibration of the monitors, as well as the placement of the portable monitors, are the COL Applicant's responsibility (COL 12.3-2-A).

> **12.3.7 COL Information**
> ***…***
> ***12.3-2-A Operational Considerations***
> Airborne radiation monitoring operational considerations such as the procedures for operations and calibration of the monitors, as well as the placement of the portable monitors, are the COL Applicant's responsibility (Subsection 12.3.4).

Considering the industry developments for the Radiation Protection Program since GEH's original response to RAI 14.3-174 S01, GEH submits this revised response to reflect that the portable airborne radiation monitors provide the airborne radioactivity monitoring to meet requirements for worker protection in the local areas. These portable air samplers provide compliance with 10 CFR 20 restrictions to check for airborne radioactivity in work areas prior to entry where potential radiation level may exceed the allowable limits.

Discussion of Changes:

Item 1 of the RAI refers to 10 CFR 20.1201 and the NRC Standard Review Plan 12.3 - 12.4 as establishing that airborne radioactivity monitoring is important for controlling

occupational dose and that the monitors should be capable of detecting 10 DAC hours of particulate and iodine radioactivity for occupied areas. It also discusses DCD Tier 2, Subsection 12.3.4 bullet 4 related to “in-plant” monitors. GEH originally responded (MFN 08-086, Supplement 73) that bullet 4 addresses a subset of the PRMS. At the time, GEH considered that there would be monitors that could be installed in a permanent location that would meet this requirement. In further discussions with the NRC and in further review of NEI 07-03A regarding airborne radioactivity monitors, GEH has determined that the bullet 4 should refer to “portable” monitors rather than “in-plant” as the NRC questioned in Item 1 of RAI 14.3-174 S01. The rationale for this change is based on the following considerations:

DCD Tier 2, Chapter 12:

DCD Tier 2, Subection 12.3.4, bullet 4, is revised to be consistent with NEI 07-03A regarding portable airborne monitors, as follows and as shown on the attached DCD markups:

- Portable continuous air monitors (CAMs) provide a means to observe trends in airborne radioactivity concentrations. CAMs equipped with local alarm capability are used in occupied areas where needed to alert personnel to sudden changes in airborne radioactivity concentrations. Surveys to assess airborne radioactivity levels are performed with continuous air monitors (CAMs) and by taking grab samples (using portable low or high volume air samplers) with appropriate media for collecting particulate, iodine, gas, or tritium samples. In order to warn personnel of changing airborne conditions, CAM alarm set points are set at a fraction of the concentration values given in 10 CFR Part 20, Appendix B, Table 1, Column 3, for radionuclides expected to be encountered.

GEH has determined that COL 12.3-2-A need not be revised, and has reviewed the information in the DTE Fermi 3 COLA and has verified that the CAMs information is included in the actions and information related to COL 12.3-2-A.

DCD Tier 1, Subsection 3.4:

Since only portable radiation monitoring instrumentation will be used to conduct airborne radioactivity sampling and monitoring to meet requirements for worker protection in radiological work areas, Item 4 and ITAAC 3.4-1 No. 4, in Section 3.4 of ESBWR DCD Tier 1 are deleted. ITAAC do not apply to portable equipment, such as CAMs, which will be initially supplied and calibrated by the COL applicant or holder.

Note that Items 2 and 3 of the RAI are no longer applicable since the ITAAC for airborne radioactivity monitors for which these RAI items apply (ITAAC 3.4-1 No. 4) were removed from ESBWR DCD Tier 1 Table 3.4-1 for the reasons discussed above.

DCD Impact

The following DCD sections and table will be revised as shown in the attached markups:

- DCD Tier 1, Section 3.4,
- DCD Tier 1, Table 3.4-1, and
- DCD Tier 2, Subsection 12.3.4.

Enclosure 2

MFN 10-178

Revised Response to Portion of NRC Request for Additional Information Letter No. 221 Related to ESBWR Design Certification Application

Airborne Radioactivity Monitoring

RAI Number 14.3-174 S01

DCD Markups

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:

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

(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) (Deleted)

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

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

b. ~~The airborne radioactivity monitoring system 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 Derived Airborne Concentration (DAC) hours in each monitored plant area.~~ (Deleted)

Inspections, Tests, Analyses, and Acceptance Criteria

Table 3.4-1 provides definitions of the inspections, tests and analyses, together with associated acceptance criteria for ventilation and airborne ~~monitoring~~containment and shielding.

Table 3.4-1

ITAAC For Radiation Protection

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
4a. ~~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 provides local alarms (visual alarms in high noise areas) with variable alarm setpoints, and readout/alarm capability.~~ Deleted	~~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.~~	~~The as-built airborne radioactivity monitors have visual and audible alarm capability.~~
4b. ~~The airborne radioactivity monitoring system 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 Derived Airborne Concentration (DAC) hours in each monitored plant area.~~ Deleted	~~An as-built inspection will be performed for the Airborne radioactivity monitoring systems.~~	~~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.~~

Guide 1.183 (Reference 12.3-16). To ensure conservatism, a 1 cfm (0.028 m^3/min) leak rate from the RB was used.

The source term of the CB EFU for accident dose assessment is the LOCA inventory at the EFU intakes obtained following the assumptions of Reference 12.3-16. To ensure conservatism, a 300 cfm (8.5 m^3/min) leak rate from the RB was used. The activity retained in the filters over 30 days corrected for radioactive decay is shown in Table 12.3-9.

In order to maintain the exposure from filter maintenance ALARA, the shielding wall thickness between RB HVAC filter cubicles is sized so that the dose contribution in any cubicle from the filter in the adjacent one does not exceed 250 μSv/hr (25 mrem/hr) under normal operation.

For the CB EFU and the RB filters, the dose rates in the filter and adjacent rooms in accident conditions are shown in Tables 12.3-10a and 12.3-10b.

12.3.4 Area Radiation and Airborne Radioactivity Monitoring Instrumentation

The following systems are provided to monitor area radiation and airborne radioactivity within the plant:

- The Area Radiation Monitoring System (ARMS) continuously measures, indicates and records the gamma radiation levels at strategic locations throughout the plant except within the primary containment, and activates alarms in the MCR as well as in local areas to warn operating personnel to avoid unnecessary or inadvertent exposure to radiation. This system is classified as nonsafety-related.
- The Containment Monitoring System (CMS) continuously measures, indicates, and records the gamma radiation levels within the primary containment (drywell and suppression chamber), and activates alarms in the main control room on a high radiation level. As described in Subsection 7.5.2, four gamma-sensitive ion chambers are provided within the primary containment to monitor gamma rays during normal, abnormal and accident conditions. Two redundant sensors are located in the drywell and two in the wetwell. The monitors are located, such that they are widely separated to provide independent measurements with a large fraction of the containment volume considered in both the wetwell and drywell. Further, the selection of the location considers reasonable access for personnel to allow for replacement, maintenance and calibration of equipment. The range of each monitor covers seven decades from 0.01 Gy/hr (1R/hr) to 10^5 Gy/hr (10^7 R/hr) as required by Regulatory Guide 1.97 (Reference 12.3-13). The CMS is classified as safety-related. The radiation monitors have been designed in accordance with NUREG-0737, Item II.F.1 (Reference 12.3-17).
- Airborne radioactivity in effluent releases and ventilation air exhausts is continuously sampled and monitored by the Process Radiation Monitoring System (PRMS) for noble gases, air particulates and halogens. As described in Section 11.5, airborne contamination is sampled and monitored at each stack, in the offgas releases, and in the ventilation exhaust from the RB, RW and TB. Samples are periodically collected and analyzed for radioactivity. In addition to this instrumentation, portable air samplers are used for compliance with 10 CFR 20 restrictions to check for airborne radioactivity in work areas prior to entry where potential radiation levels may exceed the allowable limits.

- Portable continuous air monitors (CAMs) provide a means to observe trends in airborne radioactivity concentrations. CAMs equipped with local alarm capability are used in occupied areas where needed to alert personnel to sudden changes in airborne radioactivity concentrations. Surveys to assess airborne radioactivity levels are performed with continuous air monitors (CAMs) and by taking grab samples (using portable low or high volume air samplers) with appropriate media for collecting particulate, iodine, gas, or tritium samples. In order to warn personnel of changing airborne conditions, CAM alarm set points are set at a fraction of the concentration values given in 10 CFR Part 20, Appendix B, Table 1, Column 3, for radionuclides expected to be encountered.

~~The in-plant airborne radiation monitoring instrumentation is located so that selected local areas and ventilation paths are monitored. Each location monitored is supplied with a local audible alarm (visual alarm in high noise areas) and the monitor has variable alarm set points. When appropriate, selected airborne radioactivity sampling points are located upstream of any ventilation filter trains to monitor representative radioactivity concentrations from the areas being sampled. Plant operating personnel are supplied with continuous information about the airborne radioactivity levels throughout the plant. 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 in each monitored plant area within 10 hours. Locations are selected based on the potential for leakage into rooms and areas that contain radioactive processes that become airborne and where ersonnel occupancy is required for operation of the reactor plant.~~

- The radiation instrumentation that monitors airborne radioactivity is classified as nonsafety-related. Airborne radiation monitoring operational considerations, such as the procedures for operation and calibration of the monitors, as well as the placement of the portable monitors, are the COL Applicant's responsibility (COL 12.3-2-A).

12.3.4.1 ARM System Description

Every ARM channel consists of a gamma-sensitive detector and a digital area radiation processor; all channels are provided with local visual and audible alarms and local readouts. Where appropriate, additional readouts and alarms provided by local auxiliary units are utilized. The output signals from the detectors are digitized and multiplexed for transmission to digital radiation monitors for measurement and display. Also, the radiation signals are transmitted to the process computer for recording. Each radiation monitoring channel has two adjustable trip alarm circuits, one for high radiation and the other for downscale indication (loss of sensor input). Also, each area radiation monitor has a built-in self test capability that checks for gross failures and activates an alarm on a power failure or an inoperative monitor. Auxiliary units with local audible alarms are provided in selected local areas to provide for immediate warning in order to minimize occupational exposure. Each area radiation monitor is powered from a non-1E vital 120 VAC power source, which is continuously available during loss of offsite power.

12.3.4.2 ARM Detector Location and Sensitivity

The detector locations are shown on plant layout drawings for each building (Figures 12.3-23 through 12.3-42). The area radiation channels for each building are listed in Tables 12.3-2