GE Hitachi Nuclear Energy

Richard E. Kingston
Vice President, ESBWR Licensing

PO Box 780 M/C A-65
Wilmington, NC 28402-0780
USA

T 910 819 6192
F 910 362 6192
rick.kingston@ge.com

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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 282 Related to ESBWR Design Certification Application – Radioactive Waste Management Systems – RAI Numbers 11.0-1 S01, 11.3-13 S01 and 11.3-14**

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAIs transmitted via the Reference 1 letter. RAIs 11.0-1 and 11.3-13 were received via Reference 2 and responded to via Reference 3. Enclosure 2 contains DCD markups associated with this response.

If you have any questions about the information provided here, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

References:

1. MFN 08-953, *Letter from the U.S. Nuclear Regulatory Commission to Robert E. Brown, Request for Additional Information Letter No. 282, Related To ESBWR Design Certification Application*, dated December 4, 2008
2. MFN 08-648, *Letter from the U.S. Nuclear Regulatory Commission to Robert E. Brown, Request for Additional Information Letter No. 233, Related To ESBWR Design Certification Application*, dated August 15, 2008 (RAI 11.0-1)
3. MFN 08-899, *Response to Portion of NRC Request for Additional Information Letter No. 233 Related to ESBWR Design Certification Application - Radioactive Waste Management Systems - RAI Numbers 11.0-1 and 11.3-13* dated November 13, 2008

Enclosures:

1. Response to Portion of NRC Request for Additional Information Letter No. 282 Related to ESBWR Design Certification Application – Radioactive Waste Management Systems – RAI Numbers 11.0-1 S01, 11.3-13 S01 and 11.3-14
2. Response to Portion of NRC Request for Additional Information Letter No. 282 Related to ESBWR Design Certification Application – Radioactive Waste Management Systems – RAI Numbers 11.0-1 S01, 11.3-13 S01 and 11.3-14 - DCD Markups

cc:	AE Cubbage	USNRC (with enclosures)
	RE Brown	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	eDRF	0000-0096-4385 (RAI 11.0-1 S01)
		0000-0095-7699 (RAI 11.3-13 S01)
		0000-0095-7703 Revision 1 (RAI 11.3-14)
		0000-0098-0857 (DCD Markups)

Enclosure 1

MFN 09-084

Response to Portion of NRC Request for

Additional Information Letter No. 282

Related to ESBWR Design Certification Application

Radioactive Waste Management Systems

RAI Numbers 11.0-1 S01, 11.3-13 S01 and 11.3-14

NRC RAI 11.0-1 S01:

The intended purpose of proposed Footnote 9 to Table 11.5-5 of DCD Tier 2, is inconsistent with DCD Section 9.2.6 regarding the design features of the condensate storage tank and retention basin in the event of a CST rupture or overflow.

The staff has reviewed GEH's response to RAI 11.0-1, item (d) (MFN 08- 889). The intended purpose of Footnote 9 in Table 11.5-5 of DCD Tier 2 is acceptable, but its defined objective is wrongly stated. The purpose of the RAI was to ensure that sampling of contaminated condensate water in the retention basin would be accomplished following a tank rupture or overflow. DCD Tier 2, Section 9.2.6 clearly acknowledges the possibility of such an event and states that sampling would be performed to assess is condensate water retained in the retention basin could be released to the storm drain or pumped back to the LWMS depending on radioactivity levels. However, the proposed Footnote 9 refers to sampling following a "rain event." Given the design features of the condensate storage and transfer system and purpose of the retention basin, reference to a "rain event" is inconsistent with the system's design bases and underlying radiological concerns. The applicant is requested to remove "rain event" from Footnote 9 as the rationale for sampling and instead indicate that manual sampling will be performed following the observation of water in the retention basin. Also, Footnote 9 should be consistent in its terminology, "CST Containment Dike," while DCD Section 9.2.6 refers to a "retention area" and retention basin." Accordingly, the applicant is requested to revise proposed Footnote 9 to Table 11.5-5 for consistency with the system description and design basis of DCD Section 9.2.6.

GEH Response:

"Rain event" will be removed from Table 11.5-5, Note 9. Additionally, in this same note, "containment dike" will be replaced with "retention area."

DCD Impact:

DCD Table 11.5-5, Note 9 is revised as noted above in the GEH Response, as shown in Enclosure 2.

NRC RAI 11.3-13 S01:

Steam supply temperature is not included in the table design parameters in DCD Tier 2, Rev. 5, Table 11.3-1.

GEH's Response to RAI 11.3-13, item (a) (MFN 08-889), discuss Turbine Auxiliary Steam System (TASS) design temperature and operating temperature. However, a review of DCD Tier 2, Rev. 5, Table 11.3-1, Offgas System Design Parameters, shows that steam supply temperature is not given in the design parameters in that table. Therefore, GEH is requested to include the TASS temperature design value in Table 11.3-1.

GEH Response:

ESBWR DCD, Table 11.3-1, "Off Gas System Design Parameters" has been revised to include the approximate saturation temperature of the nominal (operating) pressure TASS steam used to preheat the Off Gas stream and the approximate saturation temperature of the design pressure TASS steam.

DCD Impact:

DCD Tier 2, Table 11.3-1 will be revised as noted in the attached markup, shown in Enclosure 2.

NRC RAI 11.3-14:

The description of OGS system components under process facilities is incomplete in DCD Tier 2, Rev. 5, Section 11.3.2.3.

The description of OGS components in DCD Tier 2, Rev. 5, Section 11.3.2.3 under process facilities is incomplete as it does not include all equipment described in DCD Section 11.3.2.2. Specifically, the text of DCD Section 11.3.2.3, beyond the first paragraph, repeats some of the information already presented in DCD Section 11.3.2.1 and does not include a discussion of process equipment and their locations in process facilities. For example, DCD Section 11.3.2.3 does not address the OGS preheaters, recombiners, dryers, and monitoring instrumentation and controls. Accordingly, GEH is requested to revise the discussions in DCD Section 11.3.2.3 to include all equipment described in DCD Section 11.3.2.2.

GEH Response:

ESBWR DCD, sub-Section 11.3.2.3, “Process Facility” has been rewritten to more thoroughly describe the facility in which the Off Gas System components are housed with consideration of operation and maintenance of the equipment.

The information that was removed from sub-Section 11.3.2.3 is contained in the following sub-Sections: 11.3.2.1, Process Functions; 11.3.2.5.3, Condensing; 11.3.2.6.7, Recombiners; 11.3.2.6.9, Charcoal Adsorber Vault; 11.3.2.6.12, Maintenance Access; or Table 12.2-10b, Offgas System Isotopic Inventory for Preheater through Charcoal Tanks.

DCD Impact:

DCD Tier 2, Section 11.3.2.3 will be revised as noted in the attached markup, as shown in Enclosure 2.

Enclosure 2

MFN 09-084

Response to Portion of NRC Request for

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Radioactive Waste Management Systems

RAI Numbers 11.0-1 S01, 11.3-13 S01 and 11.3-14
DCD Markups

Table 11.5-5

Provisions for Sampling Liquid Streams

No.	Process Systems as listed in NUREG-0800, SRP 11.5 Table 2 (Draft Rev. 4)	ESBWR System (s) that Perform the Equivalent SRP 11.5 Function (Note 1)	In Process	In Effluent	
			Grab Notes 2 & 7	Grab Notes 2 & 7	Continuous Notes 2 & 7
15.	Liquid Radioactive Waste Processing Systems (Includes Reverse Osmosis Systems)	COL Applicant Notes 3 & 4	S & A	(S&A, H3)	(S&A) Notes 6 & 8

Notes:

1. Table 11.5-5 addresses sampling provisions for BWRs as identified in Table 2 of SRP 11.5. For process systems identified for BWRs in Table 2, but not shown in Table 11.5-5, those systems are not applicable to ESBWR. In some cases, there are multiple subsystems that are used to perform the overall equivalent SRP function and are listed as such in the column.
2. S&A=Sampling & Analysis of radionuclides, to include gross radioactivity, identification and concentration of principal radionuclides and concentration of alpha emitters; R=Gross radioactivity (beta radiation, or total beta plus gamma); H3=Tritium
3. Liquid Radwaste is processed on a batch-wise basis. The Liquid Waste Management System sample tanks can be sampled for analysis of the batch. See Subsection 11.2.2.2 for more information on Liquid Radwaste Management.
4. The COL Applicant will describe provisions for monitoring wastewater systems in the plant specific Offsite Dose Calculation Manual (COL 11.5-2-A).
5. The ESBWR does not include ultrasonic resin cleanup waste system at this time. Should one be installed, the Liquid Waste Management System would provide sampling and monitoring provisions.
6. The use of parenthesis indicates that these provisions are required only for the systems not monitored, sampled, or analyzed (as indicated) prior to release by downstream provisions.
7. The sensitivity of detection, also defined here as the Lower Limit of Detection (LLD), for each indicated measured variable, is based on the applicable radionuclide (or collection of radionuclides as applicable) as given in ANSI/IEEE N42.18 (Reference 11.5-19).
8. Processed through radwaste Liquid Waste Management System (LWMS) prior to discharge. Therefore, this process system is monitored, sampled, or analyzed prior to release by downstream provisions. See Note 6 above. Depending on Utility's discretion, additional sampling lines may be installed. Continuous Effluent sampling is not required per Standard Review Plan 11.5 Draft Rev. 4, April 1996, Table 2 for this system function.
9. CST retention area can either be drained to the Storm Water System or to the LWMS as determined by manual sampling. If clean, as determined by ODCM guidelines, storm water will be released to the Storm Water System. Water requiring reprocessing will be recycled to Radwaste Floor Drain Collection Tanks.

Table 11.3-1

Offgas System Design Parameters*(1)

Design Parameter	Design Value
Design basis noble radiogas release rate	3700 MBq/s (100,000 µCi/s)
Assumed air in-leakage	51 m^3/h standard (30 scfm)
Xenon delay	60-day**(2)
Krypton delay	78.6 hours**(2)
Argon delay	27.2 hours**(2)
Iodine removal efficiency	99.99**(2) and ***(3)
Maximum gaseous waste stream temperature	67°C (153°F)
Charcoal temperature (approximate)	35°C (95°F)
Maximum cooler condenser temperature	18°C (65°F)
Chilled water temperature (approximate)	7°C (45°F)
Gaseous waste stream temperature (approximate)	35°C (95°F)
Nominal ~~recombiner~~ off gas preheater temperature	177°C (351°F)
Maximum ~~recombiner~~ off gas preheater temperature	210°C (410°F)
Nominal preheater steam supply temperature	192°C (378°F)(5)
Design preheater steam supply temperature	208°C (406°F)(5)
Out-of-service hydrogen/oxygen catalytic recombiner minimum temperature	121°C (250°F)
Minimum activated charcoal ignition temperature	156°C (313°F)
Minimum air bleed supply rate(4)****	0.17 m^3/min (6 scfm)
Air bleed to standby recombiner train at startup and normal operation	0.17 m^3/min (6 scfm)
Radiolytic gas flow range	0 to 8.6 m^3/min (302 scfm)
Charcoal adsorber vault temperature range	29°C (84°F) to 40°C (104°F)

Table 11.3-1

Offgas System Design Parameters*(1)

Design Parameter	Design Value
Charcoal particle size	8–16 mesh United States Standard (USS) with less than 0.5% under 20 mesh
Charcoal moisture content	< 5% by weight
Maximum offgas activity input concentration	5.9E+6 Bq/cm^3
Charcoal Guard Bed Mass	33,000 lbs (15 metric tons)
Charcoal Bed Mass	490,000 lbs (222 metric tons)

(1)* For additional information on radioactive releases, refer to Sections 11.1 and 12.2.
(2)** Offgas processing equipment will meet or exceed these values.
***(3) No Iodine is assumed to be released.
(4)**** Minimum 6 scfm refers to leakage plus bleed air.
(5) These are approximate temperatures based upon saturated steam.

11.3.2.2 Process Equipment

Major process equipment of the OGS consists of the following:

- ~~Recombiners, including a preheater section, a catalyst section, and a condenser section;~~
- OGS Preheaters;
- Catalytic Recombiners;
- OGS Condensers;
- Cooler~~-~~ condensers;
- Dryers;
- Activated charcoal adsorbers;
- Monitoring instrumentation; and
- Process instrumentation and controls.

11.3.2.3 Process Facility

The OGS process equipment is housed in a reinforced-concrete structure adjacent to the Main Turbine Condenser in the Turbine building ~~provide adequate shielding. Charcoal adsorbers are installed in a temperature monitored and controlled vault. The facility is located in the TB~~ to minimize piping. ~~Power cycle condensate is used as the coolant for the offgas condensers.~~

Two trains, consisting of a Steam Jet Air Ejector set (Subsection 10.4.2) and an OGS Recombiner train, are housed in each of two separate rooms. The OGS Recombiner train consists of the preheater, recombiner, cooler and cooler/condenser. This arrangement provides for 100% redundancy and shielding between each train such that while one train is in service, the idled train is available for maintenance.~~The gaseous waste stream is then cooled in the cooler condenser. Chilled water is provided at the temperature shown in Table 11.3-1. The cooler condenser is located adjacent to the offgas condenser and is designed to allow the condensed moisture from the gaseous waste stream to drain back into the offgas condenser, from which it is sent to the main turbine condenser.~~

The refrigerant dryers are located in separate rooms which are adjacent to the Charcoal Adsorber Tank vault.

The Charcoal Adsorber Tanks are located in an adjacent vault that is temperature monitored and controlled. Operation of these passive tanks requires a minimum of maintenance by personnel within the enclosure. Changes in flow pathways are controlled remotely by operations personnel.~~The gaseous waste stream is heated to the value shown in Table 11.3-1 by ambient heating in the charcoal vault.~~

Effluent from the Charcoal Adsorber Tanks passes through the Turbine Building HVAC (Subsection 9.4.4) and exhausts via the Turbine Building Vent Stack, which is a controlled and monitored release point.~~Chapter 12 provides the radioactivity inventories of the major OGS components during normal plant operation. The radiation shielding design provides adequate protection of instrumentation and plant personnel required to monitor and operate the system.~~

OGS monitoring instrumentation are located in separate rooms adjacent to the dryer rooms. All controls, status, alarms and indications required for system operation are located in the main control room.

11.3.2.4 Releases

The significant gaseous wastes discharged to the OGS during normal plant operation are radiolytic hydrogen and oxygen, power cycle injected gasses and air in-leakage, and radioactive isotopes of krypton, xenon, iodine, nitrogen, and oxygen. The radiation dose from gaseous discharge is primarily external, rather than ingestion or inhalation. When releasing gases from the plant, the plume or cloud is the source of radiation to the ground. The maximum radiation corresponds to the zone of maximum ground concentration. This, in turn, is a function of wind velocity and direction, the presence of building obstructions in the wake and other meteorological conditions in the area. As indicated in DCD Subsection 12.2.2.2 and Table 12.2-1~~8b~~7, releases from the turbine building exhaust ventilation stack do not exceed the maximum permissible concentration to the environment.

Radioactive particles are present as a result of radioactive decay from the noble gas parents. These particulates are removed from the offgas stream by the condensation and adsorption equipment. Therefore, the release of radioactive particulates are minimized from the OGS to the turbine building exhaust ventilation stack.

Radioiodines (notably I-131) may be present in significant quantities in the reactor steam and to some extent carried over through the condensation stages of the OGS. Adsorption of iodine takes place in the passage of process gas through the activated charcoal adsorbers, so that essentially no iodine is released from the OGS to the turbine building exhaust ventilation stack.

The criterion for release of gaseous wastes to the atmosphere, excluding accident sequences, is that maximum external radiation dosage to the environment be maintained below the maximum dose objectives of Appendix I to 10 CFR 50 (Reference 11.3-1) in terms for doses to individuals in unrestricted areas. An instantaneous release rate, established by 10 CFR 20 (Reference 11.3-2), of several times the annual average permissible release rate limit is permitted as long as the annual average is not exceeded. Every reasonable effort has been made to keep radiation exposures and release of radioactive materials "as low as reasonably achievable" (ALARA). The OGS discharge is routed to the turbine building exhaust ventilation stack.

11.3.2.5 Process Design

Primary design features are shown on the simplified offgas diagram (Figure 11.3-1).

The Steam Jet Air Ejectors (SJAE) are described in Subsection 10.4.2.

11.3.2.5.1 Preheating

~~Recombiner p~~Preheaters ~~pre~~heat gases to provide for efficient catalytic recombiner operation and to ensure the absence of liquid water that suppresses the activity of the recombiner catalyst. Maximum preheater temperature does not exceed the value shown in Table 11.3-1 should gas flow be reduced or stopped. This is accomplished by using steam from the ~~main~~Turbine Auxiliary Steam System (TASS)~~ steam~~. During startup, steam at ~~this~~ TASS pressure, is available before the process offgas is routed through the preheater ~~section~~ to the catalytic