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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 334 Related to ESBWR Design Certification Application – RAI Numbers 11.3-15 and 11.3-16**

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAIs transmitted via the Reference 1 letter.

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

Sincerely,

Richard E. Kingston

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Vice President, ESBWR Licensing

Reference:

1. MFN 09-274, Letter from the U.S. Nuclear Regulatory Commission to Jerald G. Head, Request for Additional Information Letter No. 334, Related To ESBWR Design Certification Application, dated April 16, 2008

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 334, Related to ESBWR Design Certification Application – RAI Numbers 11.3-15 and 11.3-16

cc:	AE Cubbage	USNRC (with enclosure)
	J G Head	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	eDRF Section	0000-0101-6399

Enclosure 1

MFN 09-275

Response to Portion of NRC Request for Additional Information Letter No. 334 Related to ESBWR Design Certification Application

RAI Numbers 11.3-15 and 11.3-16

NRC RAI 11.3-15:

Explain if back pressure was taken into consideration in the design, since excessive back pressure in the condenser can affect relief setting and relieving capacity.

A review of DCD Tier 2, Rev. 5, Section 11.3.2.6.2 indicates that radioactive gaseous pressure relief discharge is piped to the main condenser. The staff is concerned about back pressure effects on relief setting and capacity. Specifically, the DCD should explain if back pressure was taken into consideration in the design, since excessive back pressure in the condenser can affect relief setting and relieving capacity. The DCD should confirm that back pressure spikes will not compromise pressure relief setting and relieving capacity.

Note: The response to this RAI and any proposed changes to DCD Rev. 6 should confirm whether corresponding changes need to be made to newly proposed DCD Rev. 6, Table 12.3-18 (see page 12.3-95 of MFN 09-076, dated February 4, 2009).

GEH Response:

The relief valves in question provide over-pressure protection for the Turbine Auxiliary Steam Supply (TASS) line, which supplies steam to the Off Gas Preheater, and those protecting the Off Gas Preheater tubes and shell. The set points of these relief valves have not been established; however, based on the design pressures involved, the lowest set point would be on the order of 250 psig. Note that the TASS is normally supplied by steam from the Main Steam System via a pressure-reducing valve.

The main condenser normally operates at a vacuum between 0.98 and 1.7 psia. If condenser vacuum degrades, a high condenser pressure alarm will actuate at approximately 2.5 psia. At approximately 3.4 to 4.9 psia the turbine will trip and the reactor will scram, and finally at approximately 9.8 to 11.3 psia the main steam isolation valves and bypass valves close. (Note, these values can be found in DCD Table 10.4-1.)

When the relief valve set points are formally established the backpressure will be considered as this is standard engineering practice; however, from the above it can be seen that the most “excessive” pressure (11.3 psia) is still a vacuum and there is no issue in the ability of the relief valves to adequately discharge.

Based on the above response, Table 12.3-18 does not need to be changed.

DCD Impact:

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

<u>NRC RAI 11.3-16</u>:

Section 11.3.2.6.8 indicates that channeling is prevented by a high charcoal bed height-to- particle diameter ratio. The staff believes that the word "particle" should be changed to "bed".

A review of DCD Tier 2, Rev. 5, Section 11.3.2.6.8 indicates that channeling is prevented by a high charcoal bed height-to-particle diameter ratio. The word "particle" is deemed to be incorrect in the proposed context. Specifically, "particle" should be changed to read "diameter" since flow channeling is affected by bed-height to bed-diameter ratio of the vessel. The applicant should clarify this point in the DCD. The word "particle" should be changed to "bed" instead.

Note: The response to this RAI and any proposed changes to DCD Rev. 6 should confirm whether corresponding changes need to be made to newly proposed DCD Rev. 6, Table 12.3-18 (see page 12.3-96 of MFN 09-076, dated February 4, 2009).

<u>GEH Response</u>:

Currently, DCD Subsection 11.3.2.6.8 states: "Channeling in the charcoal adsorbers is prevented by supplying an effective flow distributor on the inlet and by a high bed-to-particle diameter ratio."

If the sentence were reworded to say: "…high bed diameter to particle diameter ratio" the meaning and intent of the sentence would not change.

In regard to bed design to prevent channeling, a high bed-to-particle diameter ratio is the more important parameter. As an example, consider the case of a vessel 10 feet in diameter with charcoal "particles" that are 1 cubic foot in size. The airflow up through the bed would find a few paths of least resistance. The flow velocity profile at the top of the bed would be very erratic with a few sharp spikes and little or no flow in other places. This is a clear case of channeling and is unacceptable because a lot of the charcoal does not contact the process stream to fulfill its function.

As particle size decreases (thus increasing the bed-to-particle diameter ratio) the flow paths through the bed become more numerous. The flow velocity profile at the top of the bed evens out showing numerous smaller spikes, indicating that more charcoal is in contact with the process stream. This yields a more efficient process and reduces the possibility of channeling.

The charcoal particle sizes in the ESBWR Off Gas Charcoal Beds are between 8 and 16 U.S. Standard Mesh (See DCD Table 11.3-1). That's between approximately one-tenth and one-twentieth of an inch, which yields a very high bed-to-particle diameter ratio. The flow velocity profile at the top of the bed would be very even. Furthermore, it must be recalled from the DCD, that a flow distributor initially disperses the flow into the bed. The flow distributor in conjunction with a high bed-to-particle diameter ratio prevents channeling. As such, the DCD is correct as it stands and no further changes are necessary.

<u>DCD Impact</u>:

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