HITACHI

GE Hitachi Nuclear Energy

James C. Kinsey
Vice President, ESBWR Licensing

PO Box 780 M/C A-55
Wilmington, NC 28402-0780
USA

T 910 675 5057
F 910 362 5057
jim.kinsey@ge.com

Proprietary Notice
This letter forwards proprietary information in accordance with 10CFR2.390. Upon the removal of Enclosure 1, the balance of this letter may be considered non-proprietary.

MFN 06-455
Supplement 1

Docket No. 52-010

April 18, 2008

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: Response to Portion of NRC Request for Additional Information Letter Number 37 Related to ESBWR Design Certification Application – Siting Issues – RAI Number 2.3-9 S01

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Supplemental Request for Additional Information (RAI) sent by NRC e-mail dated May 30, 2007 (Reference 1). The response to RAI Number 2.3-9 S01 is addressed in Enclosures 1 and 2. The original RAI Number 2.3-9 was provided in Reference 2 to which the GEH response was provided in Reference 3.

Enclosure 1 contains GEH proprietary information as defined by 10 CFR 2.390. GEH customarily maintains this information in confidence and withholds it from public disclosure. A non-proprietary version is provided in Enclosure 2.

The affidavit contained in Enclosure 3 identifies that the information contained in Enclosure 1 has been handled and classified as proprietary to GEH. GEH hereby requests that the information of Enclosure 1 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17.

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The markup pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markups may not be fully developed and approved for inclusion in DCD Revision 5.

D068
NRO

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

Sincerely,

James C. Kinsey
Vice President, ESBWR Licensing

References:

1. E-mail from NRC (A. Johnson) to GE, RAI 2.3-9 S01, dated May 30, 2007

2. MFN 06-201, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, GE, *Request for Additional Information Letter Number 37 Related to ESBWR Design Certification Application*, June 21, 2006

3. MFN 06-455, *Response to Portion of NRC Request for Additional Information Letter Number 37 Related to ESBWR Design Certification Application – Siting Issues – RAI Number 2.3-9*, November 13, 2006

Enclosures:

1. Response to Portion of NRC Request for Additional Information Letter No. 37 Related to ESBWR Design Certification Application – Siting Issues - RAI Number 2.3-9 S01– Proprietary Information

2. Response to Portion of NRC Request for Additional Information Letter No. 37 Related to ESBWR Design Certification Application – Siting Issues - RAI Number 2.3-9 S01 – Non-Proprietary Version

3. Affidavit – David H. Hinds

cc:	AE Cubbage	USNRC (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	eDRF	0000-0081-1706 R1

MFN 06-455 S01

Enclosure 2

Response to Portion of NRC Request for Additional Information Letter No. 37 Related to ESBWR Design Certification Application

Siting Issues

RAI Number 2.3-9 S01

Public Version

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The markup pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markups may not be fully developed and approved for inclusion in DCD Revision 5.

Original response previously submitted under MFN 06-455 is included to provide historical continuity during review. Tables and figures from the original RAI response are not included.

NRC RAI 2.3-9

Provide figures drawn to scale and a description from which distance and heights may be approximated, highlighting postulated release locations to the environment, the location of the control room intake(s) and assumed unfiltered inleakage location(s). Include consideration of potential release locations resulting from loss of offsite power or other single failure. Are any of the straightline horizontal distances from a release location to the environment to a receptor less than 10 meters?

Response to RAI

The X/Q values assumed in DCD, Revision 1 did not take into account any ESBWR specific design considerations. Recently GE has performed a more detailed review of the ESBWR design and its impact to potential on-site dispersion factors (i.e., control room). GE has recently initiated design changes to ensure that the distance between the Reactor Building and the Control Building is at least 10 m.

Two locations were considered as potential unfiltered inleakage locations. The first is the louver located on the west wall on the 4650 mm elevation (Point "A"). These louvers are intended to provide cooling through natural circulation for the non-safety related equipment located on the 4650 mm elevation. For leakage from the turbine building (and condenser) the assumed inleakage is the closest point on the Control Building (Point "B"). [[

]]

The Control Room Air Intake location assumed for dispersion analyses was 3m west of line CA, located at the center of the building (Line C3). Control Building HVAC specification will be revised to ensure the intake location is within 3 m of

line CA. The Control Room Air Intakes are assumed to be located on the Control Building roof (Elevation 13500 mm). See Figure 2.
Several release locations were reviewed for the various events:

- Loss of Coolant Accident
  - Containment leakage to the Reactor Building was assumed to be a diffuse source released through the east face of the building. The Reactor Building face was projected to the east side of the stairwell in accordance with Regulatory Guide 1.194 guidance. [[ ]] As discussed previously, GE is pursuing design changes to ensure this distance is at least 10 m. See Figure 3.
  - Containment leakage though the PCCS was assumed to be released through the moisture separators located on the 27500 mm elevation. GE is implementing design changes to route the leakage through Seismic Category I ductwork to the Reactor Building roof. See Figure 4.
  - MSIV Leakage is released via the main Condenser, which is located in the Turbine Building. Two separate release scenarios are evaluated. First a diffuse release is assumed from the main Condenser. [[ ]] A second scenario is evaluated which assumes the Turbine Building remains intact. This scenario evaluates a diffuse source over the entire area of the Turbine Building [[ ]]
- Fuel Handling Accident
  - One potential release location for a FHA is the Reactor Building, which was previously discussed for the LOCA.
  - The other postulated release location for a FHA is the Equipment (Cask) Doors that are located on the west side of the Fuel Building. [[ ]]
- Main Steam Line Break
  - The MSLB release location is assumed to be the Turbine Building [[ ]]
- Liquid Radwaste Tank Failure
  - The release point assumed for this event is the Radwaste Building, which is west of the Turbine Building. [[ ]]
- Instrument Line Break
  - The Instrument Line Break release location is assumed to be the Turbine Building [[ ]]

- Feedwater Line Break
  - The Feedwater Line Break release location is assumed to be the Turbine Building [[ ]].
- Reactor Water Cleanup Line Break
  - The RWCU line break is assumed to occur in the Reactor Building [[ ]]
- 1000 Failed Fuel Rods Analysis
  - There are two release locations for this event. One is the main condenser [[ ]] and the other is the off-gas system that vents through the main plant stack. Dispersion factors are only calculated for the main condenser, therefore those values are used in the analysis.
- Depressurization Valve Opening Event
  - The DPV event release is assumed from the Reactor Building [[ ]]

Table 1 contains inputs to evaluate dispersion factors using the ARCON96 computer code. A number of inputs are not included in the list since they will require site-specific information. The inputs are

- Direction of receptor to source (since the ESBWR "plant" north may not correspond to "true" north),
- Meteorological instrumentation information.

No changes to the DCD will be made as a result of this RAI.

NRC RAI 2.3-9 S01

Full Text [[Contains PROPRIETARY / SENSITIVE information]]:

j. One of the release pathways discussed in the response to RAI 2.3-9 dated November 13, 2006, is the main plant stack, which is not part of the ESBWR standard plant design. Because the main plant stack is not part of the ESBWR standard plant design, the DCD should explicitly state that the COL applicant should confirm at the COL stage that the main plant stack EAB and LPZ X/Q site characteristic values are less than or equal to the ESBWR EAB and LPZ X/Q standard plant site design parameters.

k. The response to RAI 2.3-9 dated November 13, 2006 discusses potential release pathways to the environment (e.g., reactor building leakage; reactor building roof; turbine building condenser; turbine building leakage; fuel building cask door; radwaste building) and control room receptors (e.g., control room air intake; CB inleakage locations) for various infrequent events and accidents.

- *(i) Please provide one scaled general arrangement drawing showing all potential release pathways and receptors. Plant north should be indicated on this drawing.*
- *(ii) Please provide bounding control room X/Q values for all source/receptor combinations as standard plant site design parameters in DCD Tier 1 Table 5.1-1 and Tier 2 Table 2.0-1.*

l. The response to RAI 2.3-9 dated November 13, 2006 provides a table of source/receptor inputs to the ARCON96 computer code for each source/receptor combination.

- *(i) For each source/receptor combination, please add to the table of ARCON96 source/receptor inputs the building vertical cross-sectional area perpendicular to the wind for the buildings that have the largest impact on building wakes as discussed in the fifth item listed in Table A-2 of Regulatory Guide 1.194. This building area is used by ARCON96 to account for enhanced dispersion in the wake of buildings and may be different from the building area used to establish the initial diffusion coefficients for a diffuse area source.*
- *(ii) For each source/receptor combination, please add the direction from the receptor to the source in degrees from plant north to the table of ARCON96 source/receptor inputs.*
- *(iii) Please confirm that the "calculated distance to receptor" parameter identified in the table of ARCON96 source/receptor inputs is the horizontal distance to the release point.*
- *(iv) Please add the table of ARCON96 source/receptor inputs to the DCD for use by future COL applicants. A non-proprietary version of this table should be included in the DCD.*

m. *Several accidents are assumed to have release pathways to the environment through a diffuse area source (e.g., the FHA, LOCA containment leakage, and instrument line break are assumed to be diffuse source releases from the reactor building; the LOCA MSIV leakage, MSLB, and instrument line break are assumed to be diffuse source releases from the turbine building). Regulatory position 3.2.4.1 of Regulatory Guide 1.194 states that diffuse source modeling should be used only for those situations in which the activity being released is homogeneously distributed throughout the building and when the assume release rate from the building surface would be reasonably constant over the surface of the building.*

(i) *Regulatory position 3.2.4.5 of Regulatory Guide 1.194 states that the height and width of the diffuse area source (e.g., the building surface) should be the maximum vertical and horizontal dimensions of the above-grade building cross-sectional area perpendicular to the line of sight from the building center to the control room intake. These dimensions should projected onto a vertical plane perpendicular to the line of sight and located at the closest point on the building surface to the receptor. Please confirm that this is the approach used to calculate the diffuse area sources for the reactor building and turbine building leakage pathways. [[*

]]

(ii) *Since leakage is more likely to occur at a penetration, consideration should be given to the potential impact of building penetrations exposed to the environment. If the penetration release would be more limiting, the diffuse area source model should not be used. In particular, one of the assumed release pathways for the LOCA inside containment radiological analysis is MSIV leakage to the turbine building condenser. DCD Tier 2 Chapter 15.4.4.5.2.4 states that the two major points of release from the turbine building are expected to be (1) the truck doors at the far end of the turbine building and (2) the turbine building vent panels located midway on the turbine building on the side away from the reactor building. In contrast, the response to RAI 2.3-9 states that one of the release scenarios evaluated for MSIV leakage to the turbine building condenser is a diffuse release over the entire area of the turbine building. Please resolve this apparent conflict in the assumed MSIV leakage pathways to the environment by identifying all potential release pathways from the turbine building for all those accidents that have airborne releases in the turbine building and provide the appropriate ARCON96 source/receptor inputs.*

(iii) The response to RAI 2.3-9 dated November 13, 2006 states that one potential release location for the FHA is the reactor building which was assumed to be a diffuse source. ESBWR Technical Specification 3.6.3.1 does not require the reactor building to be operable during Mode 6 (refueling). Please confirm that there are no other potential release pathways from the reactor building during refueling (e.g. an open equipment hatch or personnel air lock) which could result in control room X/Q values that are higher than assuming a diffuse source release from the reactor building. If such release pathways are possible, provide the appropriate ARCON96 source/receptor inputs.

n. *Airborne radiological releases from a number of the infrequent events (e.g., 1000 failed fuel rods, liquid containing tank failure) and accidents (e.g., FHA, instrument line break, MSLB) are assumed to occur in buildings (e.g., reactor building, turbine building, fuel building, radwaste building) whose exhaust may be discharged to the main plant stack. Please identify these infrequent event and accident scenarios and state in the DCD that the COL applicant should calculate and compare the main plant stack control room X/Q values to the control room X/Q values for all the other possible release pathways to ensure the bounding control room X/Q values are identified.*

o. *The response to RAI 2.3-9 dated November 13, 2006 states that the instrument line break release location is assumed to be the turbine building whereas DCD Tier 2 Chapter 15.4.8.5.1 and Table 15.4-7 state that the release location for the instrument line break is assumed to be via the reactor building. Please clarify this apparent discrepancy.*

p. *[[*

]]

q. *One of the three potential unfiltered inleakage locations identified in the response to RAI 2.3-9 dated November 13, 2006 is the closest point from the turbine building and condenser to the control building (e.g., point "B" or the northwest corner of the control building). Please explain why this receptor location was not used to define the source/receptor configuration information presented in Table 1 to the response to RAI 2.3-9 for the turbine building condenser and turbine building leakage release pathways.*

r. *DCD Tier 2 Chapter 6.4.4 states that the initiation of the emergency mode of operation of the control room habitability area HVAC subsystem consists of (1) isolating the normal outside air intake and restroom exhaust and (2) starting one of the two emergency filter units which delivers filtered air from one of the two unique safety-related outside air intake locations. Please describe the relative location of these three outside air intakes (i.e., the normal mode air intake and the two emergency mode air intakes) to determine if they should be modeled as* *one or more separate receptors. Also discuss whether the isolated normal outside air intake and restroom exhaust can be potential inleakage locations during the emergency mode of operation.*

GEH Response:

Item a.
Since the issuance of MFN-06-455 (dated November 13, 2006), an ESBWR design change has occurred which removes the main plant stack and replaces it with three ventilation stacks. DCD Revision 5 will include detailed descriptions of the three ventilation stacks in the HVAC system description. Given that the three ventilation stacks are now part of the ESBWR standard plant design the reasoning for including an explicit statement about confirming the main plant stack X/Q is precluded. The locations and heights of the stacks are shown below.

Building Stack	Above Grade Stack Heights	Stack Location (Column-Line)

]]

The ARCON96 inputs associated with the three stacks have been included in Revision 5 of the DCD, Appendix 2A for use by future COL applicants in the confirmation of ESBWR bounding X/Q values. Appendix 2A directs the COL applicant to model all source\receptor pairs listed in Table 2A-2 in order to ensure that the X/Q values provided in DCD Tier 1 Table 5.1-1 and Tier 2 Table 2.0-1 are bounding.

It is important to note that there is an existing COL applicant instruction provided in Subsection 2.0-1A of the DCD Tier 2 Revision 4 which states, "A COL applicant referencing the ESBWR DCD demonstrates that site characteristics for a given site fall within the ESBWR DCD site parameter values per 10 CFR 52.79 (Section 2.0)." In order to comply with 10 CRF 52.79 the COL applicant must confirm that site-specific X/Q values fall within corresponding values in DCD Tier 1 Table 5.1-1 and Tier 2 Table 2.0-1 of Revision 5 of the DCD.

Item b.(i)
A scaled drawing showing all potential release pathways and receptors for use with Control Room radiological dose evaluations indicating ESBWR Plant North based on General Arrangement Drawing in Figure 2A-1 of DCD will be provided in Revision 5 of the DCD in Appendix 2A.

Item b.(ii)
The assumed bounding control room X/Q values used for all dose consequence analyses presented in Chapter 15 of the DCD were included in Revision 4 of the in DCD Tier 1 Table 5.1-1 and Tier 2 Table 2.0-1. Not all X/Q values for all of the source/receptor combinations are appropriate to include in DCD Tier 1 Table 5.1-1 and Tier 2 Table 2.0-1 as they are bounded by the values already provided in those tables and are not utilized in a DBA analysis in Chapter 15 of the DCD. Revision 5 of the DCD Tier 1 Table 5.1-1 and Tier 2 Table 2.0-1 will include the addition of the X/Q values for the Technical Support Center.

Item c.(i through iv)
The DCD Tier 2 Table 2A-3 providing ARCON96 inputs has been revised to include the following.

- The building vertical cross-sectional areas perpendicular to the wind for the building that has the largest impact on building wakes as described in the fifth item listed in Table A-2 of Regulatory Guide 1.194.
- The direction from the receptor to the source in degrees from ESBWR Plant North.
- A clarification that the distance to receptor inputs are the horizontal distances to the release points in Appendix 2A Subsection 2A.2.3.

Revision 5 of the DCD will include Appendix 2A for use by future COL applicants.

Item d.(i)
The values provided in MFN 06-455 submitted on November 13, 2006, reported the ARCON96 default value of [[

]] The plume-spread parameters (σ_y and σ_z) were conservatively established based on the length and height of the shortest face of the buildings containing the diffuse sources.

While the previous approach to the diffuse sources was conservative, in response to this RAI the heights and widths of the diffuse sources have been refined as described in Regulatory position 3.2.4.5 of Regulatory Guide 1.194 for accuracy and consistency with the guidance. The refined values for the diffuse source widths, areas, and initial diffusion coefficients will not change bounding ESBWR X/Q values, however, they will be listed in the associated ARCON96 inputs for use by future COL applicants for verification of the ESBWR X/Q values that are to be provided in DCD Revision 5 Appendix 2A. Diffuse source areas are established based on dominant intake location. The diffuse sources modeled for DCD dose analyses for the Control Room are depicted in the figures below.

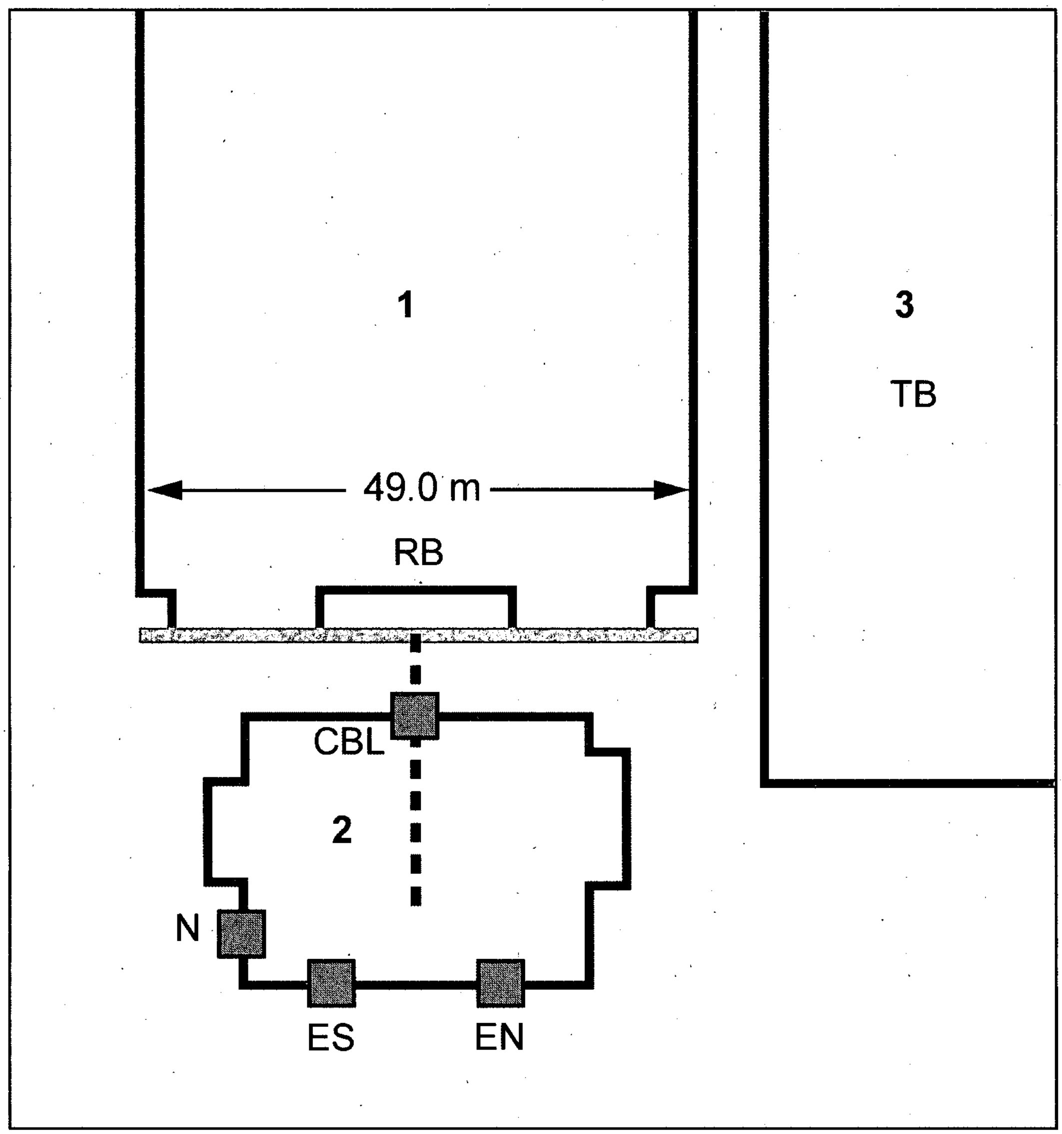

Figure 1 – Reactor Building Diffuse Source Plane Figure 1

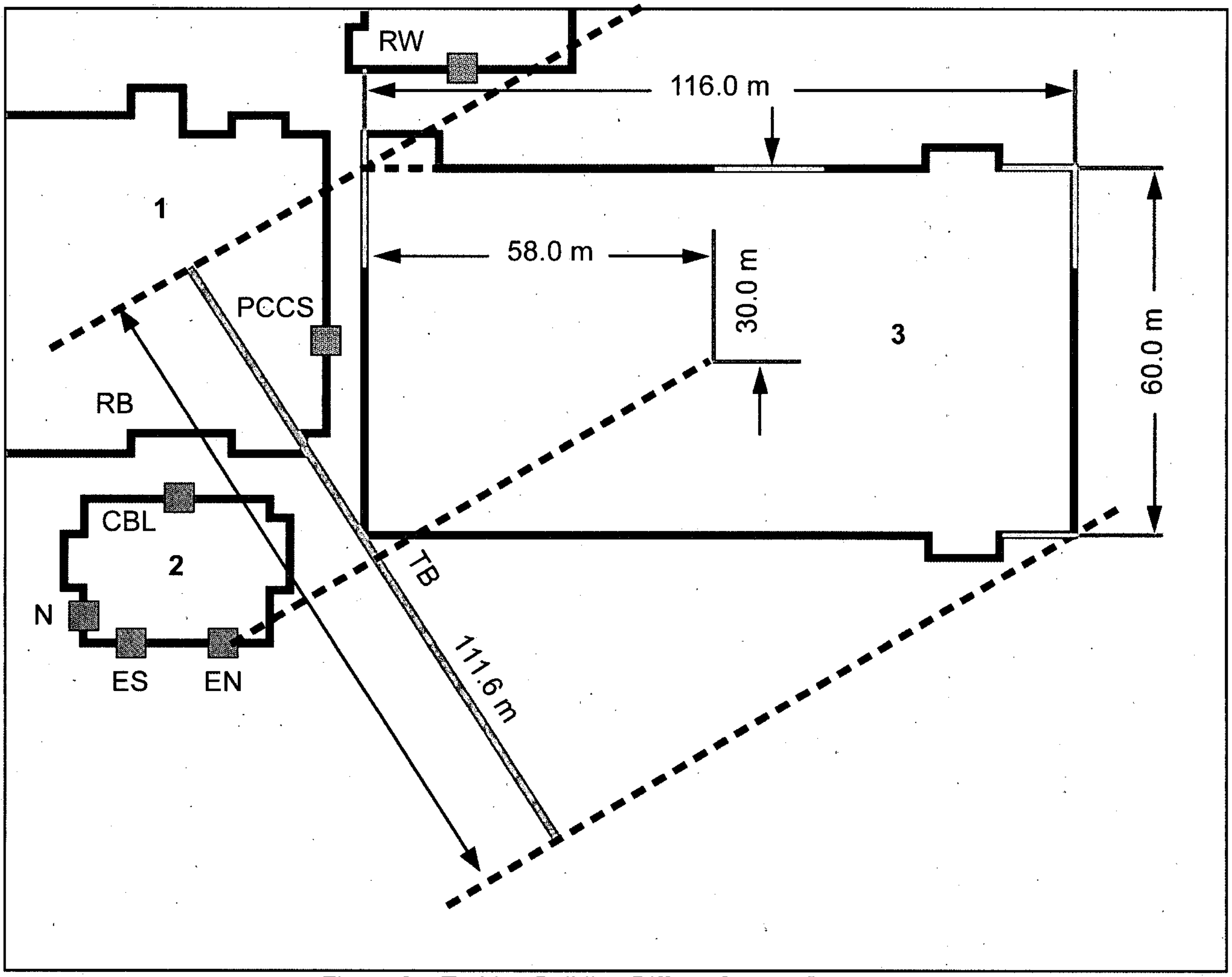

Figure 2 – Turbine Building Diffuse Source Plane

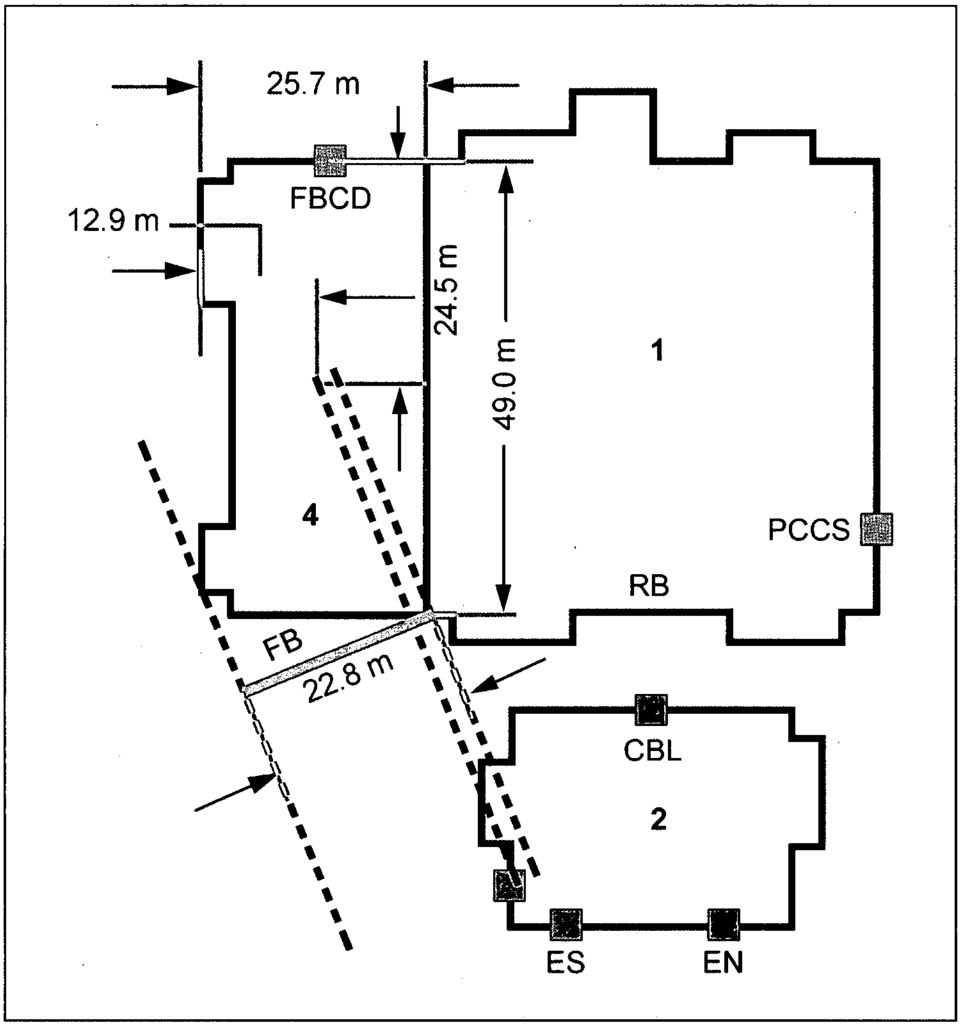

Figure 3 – Fuel Building Diffuse Source Plane

Item d.(ii)
During preparation of this RAI response, it was confirmed that the TB vent panels are not part of the ESBWR design. The text in DCD Subsection 15.4.4.5.2.4 was incorrectly stated. The TB truck doors have been included in Figure 2A-1 and in Table 2A-2, and the bounding TSC receptor (TSCW)/ TB truck door pair has been included in Table 2A-3.

GEH agrees that if the point source release from a penetration would be more limiting, the TB diffuse area source model should not be used. It has been assumed that the ESBWR Turbine Building should be conservatively treated as a diffuse source because preliminary analysis of the Turbine Building using ARCON96 indicated that the diffuse source model was more limiting than releases from the TB truck doors. The validity of the TB diffuse source model can be demonstrated by performing ARCON96 runs for point sources in the TB at those locations. Since Appendix 2A directs the COL applicant to model all source\receptor pairs listed in Table 2A-2 in order to ensure that the X/Q values provided in DCD Tier 1 Table 5.1-1 and Tier 2 Table 2.0-1 are bounding, the table of ARCON96 inputs includes parameters for the TB truck doors.

Since Appendix 2A contains the aforementioned instructions and parameters, DCD Revision 5 Chapter 15, Subsection 15.4.4.5.2.4, has been reworded to simply state that the releases from the Condenser/Turbine Building pathway are assumed to be ground level releases from a diffuse source in the Turbine Building.

Item d.(iii)
GEH agrees that if the point source release from a Reactor Building opening (an open equipment hatch, personnel air lock, open door, etc.) would be more limiting then the RB diffuse area source model should not be used.

The access doors are designed with self-closing devices, which close and latch the doors automatically. They are double door air locks for access and egress, and as such would not likely act as a point source for releases in the Reactor Building. The air locks are designed to withstand the same loads, temperatures, and peak design internal and external pressures as the containment. Each of the doors contains double seals and local leakage rate testing capability to ensure pressure integrity. To obtain a leak tight seal, the air lock design uses pressure-seated doors (i.e., an increase in containment internal pressure results in increased sealing force on each door).

[[

]]

For that reason, the COL applicant is instructed as shown below which is included in Subsection 2A.2.5 in Appendix 2A which will be included in DCD Revision 5.

"The COL applicant shall confirm that there are no doors or personnel air locks on the East sides of the Reactor Building or Fuel Building during refueling which could result in control room X/Q values that are higher than the ESBWR X/Q values for a diffuse source release in the Reactor Building. If the X/Q values for a point source release from any door on the East sides of the Reactor Building and Fuel Building are not bounded, then the Reactor Building and Fuel Building doors during Mode 6 must be closed and administratively controlled when moving irradiated fuel bundles."

Item e.
The main plant stack was considered as a release location for the Fuel Assembly Loading Error and the 1000 Failed Fuel Rod Analyses discussed in DCD Revision 4 Subsections 15.3.10 and 15.3.10 respectively. The main plant stack is no longer part of the ESBWR design (see the response to Item a).

The COL applicant is instructed to confirm all X/Q values provided in DCD Tier 1 Table 5.1-1 and Tier 2 Table 2.0-1 as previously discussed in Item a of this response, and executed by the instructions in Appendix 2A in Subsection 2A.2.4 which states how the confirmation should be performed.

Item f.
The response to RAI 2.3-9 incorrectly identified the release location as the Turbine Building. The release location for the instrument line break (ILB) is the Reactor Building as a diffuse source. The response to RAI 2.3-9 (MFN-06-455 dated November 13, 2006) is superseded by this response.

Item g.
[[

]]

Item h.
As a result of refinements to the ARCON96 modeling of the ESBWR, the Control Building louvers are considered to be the dominant inleakage pathway for all releases. The assumption is valid for the following reasons.

- Based on a review of CRHA Boundary penetration locations [[

]]

- [[

]]

- [[

]]

Item i.

It has been judged that the three intakes should be modeled separately. The locations of the three outside intakes are as described in MFN-07-687 dated December 21, 2007. Based on the description provided there, the EFU intakes are assumed to be approximately [[ ]]. The Control Room Habitability Area HVAC (CRHAVs) is described in DCD Subsection 9.4.1.1, which states the following.

"The CRHAVS provides the following safety-related design basis functions:

- Monitors the CRHA air supply for smoke and radioactive particulate and/or iodine concentrations;
- Isolates the normal CRHA air supply and restroom exhaust, starts an EFU fan, and aligns the air supply through an EFU, upon a high radiation detection signal in the CRHA normal air supply, or upon an extended loss of AC power to support operation of a CRHA normal air supply fan; and
- Isolates the normal CRHA air supply and restroom exhaust upon detection of smoke in the CRHA normal air supply."

DCD Subsection 9.4.1.2 further states that the CRHAVS consists of two trains. Each train consists of one 100% capacity recirculation AHU, one 100% capacity outside air supply fan, one 100% capacity safety-related EFU, one 100% capacity safety-related EFU fan, and a redundant set of safety-related CRHA isolation dampers. While it is possible to have both trains running at the same time, it would not be necessary to ever do so as either of them can supply 100% capacity.

In addition, the X/Q values provided for the Control Building louver location bound the potential normal intake vent and bathroom exhaust inleakage locations (see Item g.).

The CRHAVS is the subject of Technical Specification 3.7.2, which has the following surveillance requirements.

- SR 3.7.2.4 Verify CRHA isolation dampers and each CRHAVS train actuate.
- SR 3.7.2.6 Perform required CRHA unfiltered air inleakage testing in accordance with the Control Room Habitability Area (CRHA) Boundary Program.

The COL applicant will identify any other possible inleakage locations during the tracer gas test performed for Technical Specification 5.5.13, as provided by DCD Chapter 16.

DCD IMPACT

DCD Tier 1, Table 5.1-1, and DCD Tier 2, Table 2.0-1 and Subsection 15.4.4.5.2.4 will be revised in Revision 5 as noted in the attached markup pages. In addition, new Appendix 2A will be added to DCD Tier 2 as noted in the attached markup pages.

Meteorological Dispersion (X/Q):	EAB X/Q:		
	0-2 hours:	2.00E-03 s/m^3	
	LPZ X/Q:		
	0-8 hours:	1.90E-04 s/m^3	
	8-24 hours:	1.40E-04 s/m^3	
	1-4 days:	7.50E-05 s/m^3	
	4-30 days:	3.00E-05 s/m^3	
* First value is for unfiltered inleakage. Second value is for air intakes (emergency and normal)	Control Room X/Q: *		
** Due to symmetry, Turbine Building X/Q values are identical for unfiltered inleakage and air intakes.	Reactor Building – Diffuse Source		
NA Values are not required for any dose analysis.	0-2 hours:	1.90E-03 s/m^3	1.50E-03 s/m^3
	2-8 hours:	1.30E-03 s/m^3	1.10E-03 s/m^3
	8-24 hours:	5.90E-04 s/m^3	5.00E-04 s/m^3
	1-4 days:	5.00E-04 s/m^3	4.20E-04 s/m^3
	4-30 days:	4.40E-04 s/m^3	3.80E-04 s/m^3
	Passive Containment Cooling System / Reactor Building Roof		
	0-2 hours:	3.40E-03 s/m^3	3.00E-03 s/m^3
	2-8 hours:	2.70E-03 s/m^3	2.50E-03 s/m^3
	8-24 hours:	1.40E-03 s/m^3	1.20E-03 s/m^3
	1-4 days:	1.10E-03 s/m^3	9.00E-04 s/m^3
	4-30 days:	7.90E-04 s/m^3	7.00E-04 s/m^3
	Blowout Panels/Reactor Building Roof		
	0-2 hours:	7.00E-03 s/m^3	5.90E-03 s/m^3
	2-8 hours:	5.00E-03 s/m^3	4.70E-03 s/m^3
	8-24 hours:	2.10E-03 s/m^3	1.50E-03 s/m^3
	1-4 days:	1.70E-03 s/m^3	1.10E-03 s/m^3
	4-30 days:	1.50E-03 s/m^3	1.00E-03 s/m^3
	Turbine Building **		
	0-2 hours:	1.20E-03 s/m^3	1.20E-03 s/m^3
	2-8 hours:	9.80E-04 s/m^3	9.80E-04 s/m^3
	8-24 hours:	3.90E-04 s/m^3	3.90E-04 s/m^3
	1-4 days:	3.80E-04 s/m^3	3.80E-04 s/m^3
	4-30 days:	3.20E-04 s/m^3	3.20E-04 s/m^3
	Fuel Building		
	0-2 hours:	2.80E-03 s/m^3	2.80E-03 s/m^3
	2-8 hours:	2.50E-03 s/m^3	2.50E-03 s/m^3
	8-24 hours:	1.250E-03 s/m^3	1.25E-03 s/m^3
	1-4 days:	1.10E-03 s/m^3	1.10E-03 s/m^3
	4-30 days:	1.00E-03 s/m^3	1.00E-03 s/m^3
	Fuel Building – Diffuse Source		
	0-2 hours:	NA	2.80E-03 s/m3
	2-8 hours:	NA	2.50E-03 s/m3
	8-24 hours:	NA	1.25E-03 s/m3
	1-4 days:	NA	1.10E-03 s/m3
	4-30 days:	NA	1.00E-03 s/m3

Table 5.1-1
Envelope of ESBWR Standard Plant Site ~~Design~~ Parameters (continued)

Meteorological Dispersion (X/Q): (continued)	~~Fuel Building Cask Doors~~		
	~~0-2 hours:~~	~~NA~~	~~1.50E-03 s/m3~~
	~~2-8 hours:~~	~~NA~~	~~1.30E-03 s/m3~~
	~~8-24 hours:~~	~~NA~~	~~6.80E-04 s/m3~~
	~~1-4 days:~~	~~NA~~	~~5.60E-04 s/m3~~
	~~4-30 days:~~	~~NA~~	~~4.30E-04 s/m3~~
	Radwaste Building		
	0-2 hours:	NA	1.50E-03 s/m^3
	2-8 hours:	NA	1.30E-03 s/m^3
	8-24 hours:	NA	6.80E-04 s/m^3
	1-4 days:	NA	5.60E-04 s/m^3
	4-30 days:	NA	4.30E-04 s/m^3
	Technical Support Center X/Q:*		
	Reactor Building		
	0-2 hours:	1.00E-03 s/m^3	1.00E-03 s/m^3
	2-8 hours:	6.00E-04 s/m^3	6.00E-04 s/m^3
	8-24 hours:	3.00E-04 s/m^3	3.00E-04 s/m^3
	1-4 days:	2.00E-04 s/m^3	2.00E-04 s/m^3
	4-30 days:	1.00E-04 s/m^3	1.00E-04 s/m^3
	Turbine Building		
	0-2 hours:	2.00E-03 s/m^3	2.00E-03 s/m^3
	2-8 hours:	1.50E-03 s/m^3	1.50E-03 s/m^3
	8-24 hours:	8.00E-04 s/m^3	8.00E-04 s/m^3
	1-4 days:	6.00E-04 s/m^3	6.00E-04 s/m^3
	4-30 days:	5.00E-04 s/m^3	5.00E-04 s/m^3
	Passive Containment Cooling System / Reactor Building Roof		
	0-2 hours:	2.00E-03 s/m^3	2.00E-03 s/m^3
	2-8 hours:	1.10E-03 s/m^3	1.10E-03 s/m^3
	8-24 hours:	5.00E-04 s/m^3	5.00E-04 s/m^3
	1-4 days:	4.00E-04 s/m^3	4.00E-04 s/m^3
	4-30 days:	3.00E-04 s/m^3	3.00E-04 s/m^3

Notes:

(1) The design of the Radwaste Building uses a set of design parameters that are specified in Regulatory Guide 1.143, Table 2, Class RW-IIa instead of the corresponding values given in this table for all parameters except as follows: (1) Tornado: Wind Speeds, Radius, Pressure Drop, and Rate of Pressure Drop; (2) Seismology: Horizontal and Vertical Ground Spectra: See Figures 5.1-1 and 5.1-2.

(2) At foundation level of Seismic Category I structures. For minimum dynamic bearing capacity site-specific application, use the larger value or a linearly interpolated value of the applicable range of shear wave velocities at the foundation level. The shear wave velocities of soft, medium and hard soils are 300 m/sec (1000 ft/sec), 800 m/sec (2600 ft/sec) and greater than or equal to 1700 m/sec (5600 ft/sec), respectively.

- Seismology (SSE response spectra, using figures)
- Hazards in Site Vicinity
- Required Stability of Slopes
- Meteorological Dispersion (Values at Exclusion Area Boundary [EAB] and Low Population Zone [LPZ] at appropriate time intervals for short and long term)

The site parameters include a requirement that liquefaction not occur underneath Seismic Category I structures, systems, and components (SSCs) resulting from a site-specific SSE. In addition, although the ESBWR design is independent of a particular site and takes into consideration the 0.3g Regulatory Guide 1.60 spectra and representative high frequency ground spectra in Central and Eastern U.S., the evaluation of each site for liquefaction potential and slope stability uses the site-specific SSE.

The design basis for protection against missiles is specified in the DCD Tier 2 Section 3.5, such that external missiles are adequately addressed in the design for buildings and structures, and the building/structure design is verified by appropriate ITAAC.

The site characteristics information for each site is addressed in the Combined License (COL) applicant's final safety analysis report (FSAR) in accordance with 10 CFR 52.79. See Subsection 2.0.1, Item 2.0-1-A. Appendix 2A provides ARCON96 source/receptor inputs for use by COL applicants in the confirmation of site-specific X/Q values.

The guidance in NUREG-0800 identifies information needed for evaluation of a proposed site. See Subsection 2.0.1, Items 2.0-2-A through 2.0-30-A.

2.0.1 COL ~~Unit-Specific~~ Information

2.0-1-A Site Characteristics Demonstration

A COL applicant referencing the ESBWR DCD demonstrates that site characteristics for a given site fall within the ESBWR DCD site parameter values per 10 CFR 52.79. (Section 2.0)

2.0-2-A through 2.0-30-A Standard Review Plan Conformance

A COL applicant will provide information in accordance with NRC guidance in NUREG-0800, Standard Review Plan (SRP) sections for site characteristics. A COL applicant follows applicable NRC guidance for preparing the COL application, depending upon whether the applicant will reference an Early Site Permit or not. (Section 2.0 and Table 2.0-2 – see Table 2.0-2 for detailed COL item numbering by SRP section)

2.0.2 References

2.0-1 GE Nuclear Energy, "ESBWR Certification Probabilistic Risk Assessment," NEDO-33201, Class I (Non-proprietary), Revision 1, September 2006.

2.0-2 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures, ASCE 7-02, 2002.

2.0-3 National Weather Service Publication Hydrometeorology Report No. 52 (HMR-52)

Table 2.0-1

Envelope of ESBWR Standard Plant Site ~~Design~~ Parameters (continued)

Meteorological Dispersion (X/Q): (11)	EAB X/Q:		
	0-2 hours:	2.00E-03 s/m^3	
	LPZ X/Q:		
	0-8 hours:	1.90E-04 s/m^3	
	8-24 hours:	1.40E-04 s/m^3	
	1-4 days:	7.50E-05 s/m^3	
	4-30 days:	3.00E-05 s/m^3	
	Control Room X/Q: *		
	Reactor Building ~~— Diffuse Source~~		
	0-2 hours:	1.90E-03 s/m^3	1.50E-03 s/m^3
	2-8 hours:	1.30E-03 s/m^3	1.10E-03 s/m^3
	8-24 hours:	5.90E-04 s/m^3	5.00E-04 s/m^3
	1-4 days:	5.00E-04 s/m^3	4.20E-04 s/m^3
	4-30 days:	4.40E-04 s/m^3	3.80E-04 s/m^3
	Passive Containment Cooling System / Reactor Building Roof		
	0-2 hours:	3.40E-03 s/m^3	3.00E-03 s/m^3
	2-8 hours:	2.70E-03 s/m^3	2.50E-03 s/m^3
	8-24 hours:	1.40E-03 s/m^3	1.20E-03 s/m^3
	1-4 days:	1.10E-03 s/m^3	9.00E-04 s/m^3
	4-30 days:	7.90E-04 s/m^3	7.00E-04 s/m^3
	Blowout Panels / Reactor Building Roof		
	0-2 hours:	7.00E-03 s/m^3	5.90E-03 s/m^3
	2-8 hours:	5.00E-03 s/m^3	4.70E-03 s/m^3
	8-24 hours:	2.10E-03 s/m^3	1.50E-03 s/m^3
	1-4 days:	1.70E-03 s/m^3	1.10E-03 s/m^3
	4-30 days:	1.50E-03 s/m^3	1.00E-03 s/m^3
	Turbine Building ~~**~~		
	0-2 hours:	1.20E-03 s/m^3	1.20E-03 s/m^3
	2-8 hours:	9.80E-04 s/m^3	9.80E-04 s/m^3
	8-24 hours:	3.90E-04 s/m^3	3.90E-04 s/m^3
	1-4 days:	3.80E-04 s/m^3	3.80E-04 s/m^3
	4-30 days:	3.20E-04 s/m^3	3.20E-04 s/m^3

* First value is for unfiltered inleakage. Second value is for air intakes (emergency and normal)

~~** Due to symmetry, Turbine Building X/Q values are identical for unfiltered inleakage and air intakes.~~

NA Values are not required for any dose analysis.

Table 2.0-1

Envelope of ESBWR Standard Plant Site ~~Design~~ Parameters (continued)

Meteorological Dispersion (X/Q): (11) **(continued)**	Fuel Building ~~– Diffuse Source~~		
	0-2 hours:	2.80E-03 s/m^3 ~~NA~~	2.80E-03 s/m^3
	2-8 hours:	2.50E-03 s/m^3 ~~NA~~	2.50E-03 s/m^3
	8-24 hours:	1.25E-03 s/m^3 ~~NA~~	1.25E-03 s/m^3
	1-4 days:	1.10E-03 s/m^3 ~~NA~~	1.10E-03 s/m^3
	4-30 days:	1.00E-03 s/m^3 ~~NA~~	1.00E-03 s/m^3
	~~Fuel Building Cask Doors~~		
	~~0-2 hours:~~	~~NA~~	~~1.50E-03 s/m^3~~
	~~2-8 hours:~~	~~NA~~	~~1.30E-03 s/m^3~~
	~~8-24 hours:~~	~~NA~~	~~6.80E-04 s/m^3~~
	~~1-4 days:~~	~~NA~~	~~5.60E-04 s/m^3~~
	~~4-30 days:~~	~~NA~~	~~4.30E-04 s/m^3~~
	Radwaste Building		
	0-2 hours:	NA	1.50E-03 s/m^3
	2-8 hours:	NA	1.30E-03 s/m^3
	8-24 hours:	NA	6.80E-04 s/m^3
	1-4 days:	NA	5.60E-04 s/m^3
	4-30 days:	NA	4.30E-04 s/m^3
	Technical Support Center X/Q:*		
	Reactor Building		
	0-2 hours:	1.00E-03 s/m^3	1.00E-03 s/m^3
	2-8 hours:	6.00E-04 s/m^3	6.00E-04 s/m^3
	8-24 hours:	3.00E-04 s/m^3	3.00E-04 s/m^3
	1-4 days:	2.00E-04 s/m^3	2.00E-04 s/m^3
	4-30 days:	1.00E-04 s/m^3	1.00E-04 s/m^3
	Turbine Building		
	0-2 hours:	2.00E-03 s/m^3	2.00E-03 s/m^3
	2-8 hours:	1.50E-03 s/m^3	1.50E-03 s/m^3
	8-24 hours:	8.00E-04 s/m^3	8.00E-04 s/m^3
	1-4 days:	6.00E-04 s/m^3	6.00E-04 s/m^3
	4-30 days:	5.00E-04 s/m^3	5.00E-04 s/m^3
	Passive Containment Cooling System / Reactor Building Roof		
	0-2 hours:	2.00E-03 s/m^3	2.00E-03 s/m^3
	2-8 hours:	1.10E-03 s/m^3	1.10E-03 s/m^3
	8-24 hours:	5.00E-04 s/m^3	5.00E-04 s/m^3
	1-4 days:	4.00E-04 s/m^3	4.00E-04 s/m^3
	4-30 days:	3.00E-04 s/m^3	3.00E-04 s/m^3
Long Term Dispersion Estimates: (12)	X/Q:	2.0E-06 s/m^3	
	D/Q:	4.0E-09 m^{-2}	

Appendix 2A ARCON96 SOURCE/RECEPTOR INPUTS

2A.1 SCOPE

This appendix provides ARCON96 source/receptor inputs for use in the confirmation of site-specific X/Q values per 10 CFR 52.79 (as required by Subsection 2.0.1, Item 2.0-1-A).

2A.2 METHODOLOGY

On-site X/Q values, such as those for the Control Room, are typically determined using the ARCON96 computer code. Acceptable guidance and methodology for use with ARCON96 are documented in Regulatory Guide (RG) 1.194 (Reference 2A-1). In order to determine bounding X/Q values, various nuclear plant sites have provided GEH with the meteorological data in the required ARCON96 format. Additionally, raw meteorological data was obtained for sites pursuing Early Site Permits (ESPs). Control Room X/Q values were calculated with the ARCON96 computer code using the ESBWR plant layout and the available site meteorological data. Once completed, the results were reviewed and the X/Q values provided in Table 2.0-1 were selected to bound those results.

2A.2.1 Meteorological Data

The meteorological data sets used as ARCON96 inputs for the ESBWR X/Q determination were taken from various published meteorological data sets. ARCON96 also requires the height of the instruments used for input in conjunction with the meteorological data. The heights of the upper and lower instruments used to record the raw data are unique to any meteorological data set taken at a nuclear power site.

2A.2.2 ARCON96 Default Values

Many of the ARCON96 inputs used for the determination were constant for each plant site evaluated. Table 2A-1 provides a list of the standard ARCON96 inputs applicable for the ESBWR that are constant for all the source receptor pairs evaluated.

2A.2.3 ARCON96 ESBWR Inputs

Table 2A-2 provides a list of the onsite receptor and source locations considered. Table 2A-3 provides the ARCON96 inputs that are specific for ESBWR. The values presented in Table 2A-3 have been determined in accordance with RG 1.194 and are described as follows.

Source Type

Indication of whether the source associated with a line item in Table 2A-1 should be considered a point source or a diffuse source. This has been determined based on the nature of the postulated releases in accordance with RG 1.194.

Distance

These distances are the source-to-receptor distances and are the shortest horizontal distances between the release points and the intakes.

Release Height

For diffuse sources in Table 2A-1, the release height is set at the vertical center of the projected diffuse source plane above grade. For point sources the release heights are taken to be the vertical distance from plant grade to the release points.

Building Area

Areas are provided for the buildings that have the largest impact on the building wakes within the wind direction window for a given source/receptor pair. With regard to the ESBWR diffuse area sources, the building areas entered here are different from the dimensions used to establish the diffuse sources.

Intake Height

The actual intake heights are provided in Table 2A-1, and are taken to be the vertical distance from plant grade to the center of the intakes.

Total Height

The total heights are the above grade heights of the buildings where diffuse sources are modeled. For point sources this parameter is not applicable (N/A). Building heights are not directly used by ARCON96. They are used to calculate σ_Y and σ_Z as well as to determine the diffuse source area and release heights.

Total Width

The "total width" column of Table 2A-3 provides widths of the area sources that are the maximum horizontal dimensions of the above-grade building cross-sectional areas perpendicular to the lines of sight from the building centers to the closest emergency or normal air control room intakes. For point sources this parameter is not applicable (N/A).

σ_{Y0} and σ_{Z0}

These values are the initial lateral and vertical plume spread parameters calculated using Formulas 3 and 4 of RG 1.194.

Direction (degrees from plant North)

The values provided are the directions from the receptors to the sources in degrees from ESBWR Plant North.

2A.2.4 Confirmation of the ESBWR X/Q Values

When referencing the ESBWR DCD to confirm that site characteristics at a given site are bounded by the ESBWR DCD site parameter values per 10 CFR 52.79, the COL applicant shall perform ARCON96 determinations for all source/receptor pairs provided in Table 2A-3 using site-specific meteorological data (as defined in Regulatory Guide 1.23, Reference 2A-2). (Section 2A.3, Item 2A.2-1-A) Figure 2A-1 shows the locations of the sources and receptors for ESBWR Control Room determinations. The dimensions of the diffuse source planes provided in Table 2A-1 were determined as directed by Regulatory Position 3.2.4.5 of Regulatory Guide 1.194 for the nearest receptor locations.

2A.2.5 Confirmation of the Reactor Building X/Q Values

The COL applicant shall confirm that there are no doors or personnel air locks on the East sides of the Reactor Building or Fuel Building during refueling that could result in control room X/Q values that are higher than the ESBWR X/Q values for a diffuse source release in the Reactor Building. If the X/Q values for a point source release from any door on the East sides of the Reactor Building and Fuel Building are not bounded, then the Reactor Building and Fuel Building doors must be closed and administratively controlled during refueling when moving irradiated fuel bundles. (Section 2A.3, Item 2A.2-2-A)

2A.3 COL INFORMATION

2A.2-1-A Confirmation of the ESBWR X/Q Values

When referencing the ESBWR DCD to confirm that site characteristics at a given site are bounded by the ESBWR DCD site parameter values per 10 CFR 52.79, the COL applicant shall perform ARCON96 determinations for all source/receptor pairs provided in Table 2A-3 using site-specific meteorological data. (Subsection 2A.2.4)

2A.2-2-A Confirmation of the Reactor Building X/Q Values

The COL applicant shall confirm that there are no doors or personnel air locks on the East sides of the Reactor Building or Fuel Building during refueling that could result in control room X/Q values that are higher than the ESBWR X/Q values for a diffuse source release in the Reactor Building. (Subsection 2A.2.5)

2A.4 REFERENCES

2A-1 US Nuclear Regulatory Commission, “Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants,” Regulatory Guide 1.194, Revision 0.

2A-2 US Nuclear Regulatory Commission, "Onsite Meteorological Programs," Regulatory Guide 1.23, Revision 0.

Table 2A-1

ARCON96 Assumed Inputs Used for the Determination of Bounding X/Q Values

Parameter	**Source of Input (or Reasoning)**	Value
Wind Speed Units Flag (1=m/s, 2=mph, 3=knots)	RG 1.194, App. A (if meteorological data is in m/s)	1
Vertical Velocity (m/s)	RG 1.194, App. A (default value/conservatism)	0
Stack Flow (m/s)	RG 1.194, App. A (default value/conservatism)	0
Stack Radius (m)	RG 1.194, App. A (default value/conservatism)	0
Wind Direction Window (degrees)	RG 1.194, App. A (default value)	90
Elevation Difference (m)	RG 1.194, App. A (All information was normalized to the plant grade elevation, therefore no adjustments for elevation differences are required for ARCON96 input)	0
Surface Roughness Length (m)	RG 1.194, App. A (default value)	0.2
Minimum Wind Speed (m/s)	RG 1.194, App. A (default value)	0.5
Averaging Sector Width Constant	RG 1.194, App. A (default value)	4.3
Hours in Averages	RG 1.194, App. A (default value)	ARCON96 Default
Minimum Number of Hours	RG 1.194, App. A (default value)	ARCON96 Default

Table 2A-2

Onsite Receptor/Source Locations

Receptors	***Designation***
Control Building Louvers	CB Louvers
Normal and Emergency Air Intakes on the East face of Control Building near the North end	EN
Normal and Emergency Air Intakes on the East face of Control Building near the South end	ES
Normal Air Intake on South Face of Control Building	N
Technical Support Center (TSC) Intake on North Face of Electrical Building near the West end	TSCW
Technical Support Center (TSC) Intake on North Face of Electrical Building near the East end	TSCE
Sources	***Designation***
Reactor Building	RB
Passive Containment Cooling System (Vent on Reactor Building Roof)	PCCS
Turbine Building	TB
Turbine Building Truck Doors on the West side of the TB near the North end.	TB-TD
Fuel Building	FB
Radwaste Building	RW
Reactor Building/Fuel Building Ventilation Stack	RB-VS
Turbine Building Ventilation Stack	TB-VS
Radwaste Building Ventilation Stack	RW-VS
North RB blowout panel near the East edge of the Reactor Building Roof [1]	BPN
South RB blowout panel near the East edge of the Reactor Building Roof [1]	BPS

Note:

[1] There are four blowout panels near the corners of the Reactor Building roof. ARCON96 parameters for the two blowout panels nearest to the Control Building are included in Table 2A-3 as they are bounding based on the minimum distance criterion with respect to the receptors.

Table 2A-3

ARCON96 Design Inputs Used for the Determination of Bounding X/Q Values

Source/Receptor	Source Type	Distance (m)	Release Height (m)	Building Area (m^3) [2]	Intake Height (m)	Total Height (m) [3]	Total Width (m) [3]	σ_Y [4]	σ_z [4]	Direction (degrees from plant North)
RB to CB Louvers	Diffuse	10	24.0	2945	2.5	48.1	49.0 [1]	8.17	8.01	270
RB to EN	Diffuse	33	24.0	2945	7.5	48.1	49.0 [1]	8.17	8.01	260
RB to ES	Diffuse	33	24.0	2945	7.5	48.1	49.0 [1]	8.17	8.01	280
RB to N	Diffuse	29	24.0	2945	7.5	48.1	49.0 [1]	8.17	8.01	284
RB to TSCE	Diffuse	131	24.0	2726	22.4	48.1	65.7 [1]	10.95	8.01	212
RB to TSCW	Diffuse	118	24.0	2726	22.4	48.1	65.7 [1]	10.95	8.01	200
PCCS to CB Louvers	Point	38	47.8	2945	2.5	N/A	N/A	N/A	N/A	309
PCCS to EN	Point	54	47.8	2945	7.5	N/A	N/A	N/A	N/A	285
PCCS to ES	Point	63	47.8	2945	7.5	N/A	N/A	N/A	N/A	304
PCCS to N	Point	62	47.8	2945	7.5	N/A	N/A	N/A	N/A	308
PCCS to TSCE	Point	138	47.8	2726	22.4	N/A	N/A	N/A	N/A	214
PCCS to TSCW	Point	122	47.8	2726	22.4	N/A	N/A	N/A	N/A	201
TB to CB Louvers	Diffuse	31	24.7	5513	2.5	49.4	111.6 [1]	18.60	8.23	343
TB to EN	Diffuse	29	24.7	5513	7.5	49.4	111.6 [1]	18.60	8.23	324
TB to ES	Diffuse	46	24.7	5513	7.5	49.4	111.6 [1]	18.60	8.23	331
TB to N	Diffuse	49	24.7	5513	7.5	49.4	111.6 [1]	18.60	8.23	336
TB to TSCE	Diffuse	40	24.7	3853	22.4	49.4	78.0 [1]	13.00	8.23	232

Table 2A-3

ARCON96 Design Inputs Used for the Determination of Bounding X/Q Values

Source/Receptor	Source Type	Distance (m)	Release Height (m)	Building Area (m^3) [2]	Intake Height (m)	Total Height (m) [3]	Total Width (m) [3]	σ_Y [4]	σ_z [4]	Direction (degrees from plant North)
TB to TSCW	Diffuse	10	24.7	3853	22.4	49.4	78.0 [1]	13.00	8.23	214
TB-TD to CB Louvers	Point	152	1.0	7320	2.5	N/A	N/A	N/A	N/A	338
TB-TD to EN	Point	155	1.0	7320	7.5	N/A	N/A	N/A	N/A	328
TB-TD to TSCW	Point	72	1.0	7320	22.4	N/A	N/A	N/A	N/A	270
FB to CB Louvers	Diffuse	28	11.4	2945	2.5	22.9	22.8 [1]	3.81	3.81	228
FB to EN	Diffuse	51	11.4	2945	7.5	22.9	22.8 [1]	3.81	3.81	234
FB to ES	Diffuse	40	11.4	2945	7.5	22.9	22.8 [1]	3.81	3.81	248
FB to N	Diffuse	34	11.4	2945	7.5	22.9	22.8 [1]	3.81	3.81	252
RW to N	Point	112	7.5	2945	7.5	N/A	N/A	N/A	N/A	304
RB-VS to CB Louvers	Point	66	54.3	2945	2.5	N/A	N/A	N/A	N/A	247
RB-VS to ES	Point	86	54.3	2945	7.5	N/A	N/A	N/A	N/A	261
RB-VS to N	Point	81	54.3	2945	7.5	N/A	N/A	N/A	N/A	262
TB-VS to CB Louvers	Point	122	55.4	5513	2.5	N/A	N/A	N/A	N/A	356
TB-VS to EN	Point	118	55.4	5513	7.5	N/A	N/A	N/A	N/A	341
TB-VS to N	Point	141	55.4	5513	7.5	N/A	N/A	N/A	N/A	348
RW-VS to CB Louvers	Point	96	18.2	2945	2.5	N/A	N/A	N/A	N/A	302
RW-VS to EN	Point	111	18.2	2945	7.5	N/A	N/A	N/A	N/A	290
RW-VS to N	Point	120	18.2	2945	7.5	N/A	N/A	N/A	N/A	304

Table 2A-3

ARCON96 Design Inputs Used for the Determination of Bounding X/Q Values

Source/Receptor	Source Type	Distance (m)	Release Height (m)	Building Area (m^3) [2]	Intake Height (m)	Total Height (m) [3]	Total Width (m) [3]	σ_Y [4]	σ_z [4]	Direction (degrees from plant North)
BPN to CB Louvers	Point	27	47.8	2945	2.5	N/A	N/A	N/A	N/A	322
BPN to EN	Point	40	47.8	2945	7.5	N/A	N/A	N/A	N/A	285
BPN to ES	Point	49	47.8	2945	7.5	N/A	N/A	N/A	N/A	306
BPN to N	Point	50	47.8	2945	7.5	N/A	N/A	N/A	N/A	315
BPS to CB Louvers	Point	27	47.8	2945	2.5	N/A	N/A	N/A	N/A	219
BPS to EN	Point	49	47.8	2945	7.5	N/A	N/A	N/A	N/A	229
BPS to ES	Point	41	47.8	2945	7.5	N/A	N/A	N/A	N/A	255
BPS to N	Point	36	47.8	2945	7.5	N/A	N/A	N/A	N/A	259

Notes for Table 2A-3:

[1] These are diffuse source widths determined in accordance with Regulatory Position 3.2.4.5 of Regulatory Guide 1.194 and are used to calculate σ_{Y0} and σ_{Z0}.

[2] The building vertical cross-sectional areas perpendicular to the wind for the building that has the largest impact on building wakes as described in the fifth item listed in Table A-2 of Regulatory Guide 1.194.

[3] Building heights and widths are not directly used by ARCON96. They are used to calculate the lateral and vertical plume spread parameters (σ_{Y0} and σ_{Z0}).

[4] Values calculated using Formulas 3 and 4 of RG 1.194.

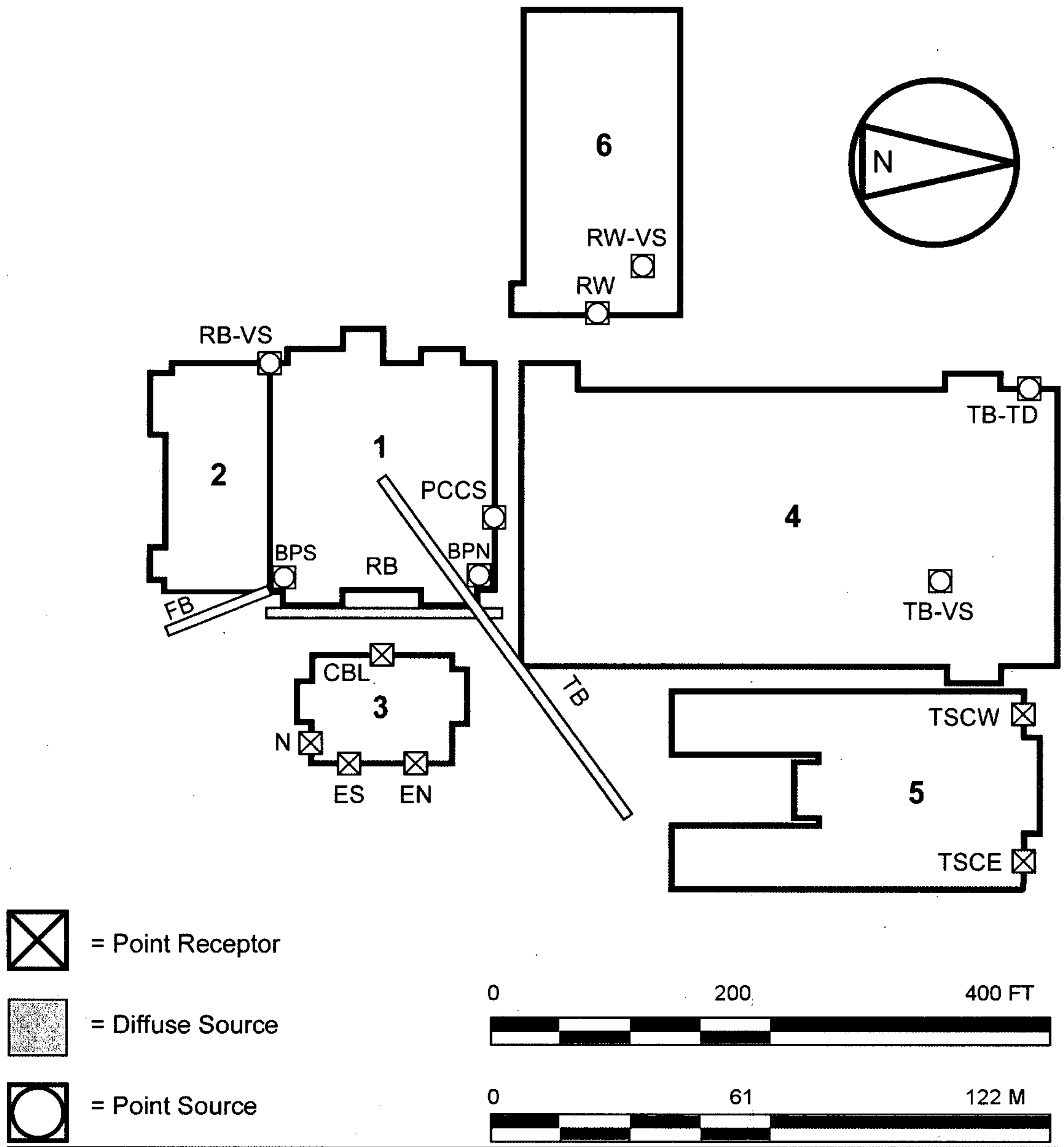

Figure 2A-1. Potential Radiological Sources and Receptors for the ESBWR Control Room

(see next page for explanation of designations used on figure)

The following designations are shown on Figure 2A-1.

Plant Structures

1 Reactor Building

2 Fuel Building

3 Control Building

4 Turbine Building

5 Electrical Building

6 Radwaste Building

Control Building Receptor Locations

CBL	Louvers located at the Centerline of Control Building on the West face
EN	Normal and Emergency Air Intakes on the East face of CB near the North end
ES	Normal and Emergency Air Intakes on the East face of CB near the South end
N	Normal Air Intake on the South face of Control Building
TSCW	Technical Support Center Intake on the North Face of Electrical Building near the West end
TCSE	Technical Support Center Intake on the North Face of Electrical Building near the East end

Source Locations

RB	Reactor Building East face
TB	Turbine Building South face
FB	Fuel Building East face
PCCS	Passive Containment Cooling System (Vents from the Reactor Building Roof)
RW	Radwaste Building (Assumed on the Radwaste Building Roof)
RB-VS	Reactor Building/Fuel Building Ventilation Stack
TB-VS	Turbine Building Ventilation Stack
RW-VS	Radwaste Building Ventilation Stack
BPN	Blowout panel on the Northeast corner of Reactor Building Roof
BPS	Blowout panel on the Southeast corner of Reactor Building Roof
TB-TD	Turbine Building Truck Doors on the West side of the TB near the North end

steam tunnel complex, an as-built inspection is required to verify that no damage could be expected from other components and structures in a SSE.

- The main steamlines and drain lines are required under normal conditions to function to loads at temperature and pressure far exceeding the loads expected from an SSE. This capability inherent in the basic design of these components furnishes a level of toughness and flexibility to ensure their survival under SSE conditions. A large database of experience in the survival of these types of components under actual earthquake conditions proves this contention (Reference 15.4-4). In the case of the ESBWR, further margin for survival can be expected, because the ESBWR lines are designed through dynamic analysis to survive such events, whereas in the case of the actual experience database, the lines shown to survive were designed to lesser standards to meet only normally expected loads.

Based upon the facts above, the main steamlines and drain lines are credited in that they direct potential leakage through the MSIVs to the main condenser. No credit is taken for plateout of fission products in either the main steam lines or main steam line drain lines.

15.4.4.5.2.4 Condenser Modeling

The condenser is modeled as detailed in Reference 15.4-4 with specific values used given in Table 15.4-5. The volume is modeled primarily as a stagnant volume assuming the shutdown of all active components. The condenser is used as a mitigative volume based upon the determination that such components, designed to standard engineering practice, are sufficiently strong to withstand SSE conditions (Reference 15.4-4). Credit is also taken for reduction of airborne iodine in the Condenser. The removal efficiency is assumed to be 99.3% based on the GE ABWR design. Detailed modeling of the Main Steam Lines, Main Steam Lines' Drain Lines, and Condenser confirms this value bounds the ESBWR.

Releases from the condenser/Turbine Building pathway are assumed to be ground level releases fromvia a diffuse sources in the Turbine Building. The two major points of release in the Turbine Building are expected to be the truck doors at the far end of the Turbine Building and the Turbine Building vent panels located midway on the Turbine Building on the side away from the Reactor Building. Releases are assumed to be ground level releases.

15.4.4.5.2.5 SRV Flow and Suppression Pool Scrubbing

As discussed previously, the accident scenarios reviewed include both low pressure (AS-1) and high pressure (AS-2 and AS-3) events. For low pressure events the RPV pressure quickly drops below the SRV lift pressure; therefore, there is negligible flow through the SRVs. However, for high pressure events the flow can be significant. Flow through the SRVs that would lift during this event is discharged through spargers in the suppression pool. The spargers are designed to maximize condensation of the steam blowdown. This condensation also provides an excellent mechanism for removal of fission products as well.

Only a fraction of the total flow is released via the SRVs. Releases through the other locations, such as the DPVs or the break itself, would not be scrubbed by the suppression pool. The fraction of the flow through the SRVs is determined using the MELCOR calculations for the containment removal coefficient. The fraction of flow is determined based on the start of the EIV release phase as show in Figures 15.4-6 and 15.4-7 for AS-2 and AS-3, respectively

MFN 06-455 S01

Enclosure 3

Affidavit

GE Hitachi Nuclear Energy

AFFIDAVIT

I, **David H. Hinds**, state as follows:

(1) I am the General Manager, New Units Engineering, GE Hitachi Nuclear Energy ("GEH") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GEH letter MFN 06-455, Supplement 1, Mr. James C. Kinsey to U.S. Nuclear Regulatory Commission, "Response to Portion of NRC Request for Additional Information Letter No. 37 Related to ESBWR Design Certification Application ESBWR – Siting Issues - RAI Number 2.3-9,Supplement 1," dated April 18, 2008. GEH Proprietary Information is identified in Enclosure 1, "Response to Portion of NRC Request for Additional Information Letter No. 37 Related to ESBWR Design Certification Application – Siting Issues - RAI Number 2.3-9, Supplement 1 – GEH Proprietary Information," in dark red font and a dashed underline inside double square brackets. [[This sentence is an example.{3}]] Figures and large equation objects are identified with double square brackets before, and after the object. In each case, the superscript notation {3} refers to paragraph (3) of this affidavit, which provides the basis of the proprietary determination. Specific information that is not so marked is not GEH proprietary. A non-proprietary version of this information is provided in Enclosure 2, "Response to Portion of NRC Request for Additional Information Letter No. 37 Related to ESBWR Design Certification Application – Siting Issues - RAI Number 2.3-9, Supplement 1 – Non-Proprietary Version."

(3) In making this application for withholding of proprietary information of which it is the owner, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a., and (4)b, above.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it identifies the models and methodologies GEH will use in evaluating the consequences of design basis accidents (DBAs) for the ESBWR. GEH and its partners performed significant additional research and evaluation to develop a basis

for these revised methodologies to be used in evaluating the ESBWR over a period of several years at a substantial cost.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 18th day of April 2008.

David H. Hinds
GE Hitachi Nuclear Energy