Enclosure 2

MFN 09-569

Response to NRC Request for

Additional Information Letter No. 361

Related to ESBWR Design Certification Application

Radiation Protection

RAI Numbers 12.2-27

Non-Proprietary Version

NRC RAI 12.2-27

In the response to staff RAI 12.2-19 (MFN 06-528), GEH stated that a worker located in the upper drywell during a worst case fuel drop accident (from a fuel assembly with a burn-up of 35 GWd/MTU) would be exposed to a dose rate of 470 rem/hr. In it's response to supplement 2 of staff RAI12.2-19, GEH stated that the 470 rem/hr dose rate calculated in response to RAI 12.2-19 had been found to be in error and the revised dose rate estimate from this accident was 706 rem/hr (from a fuel assembly with the same burn-up), or 50% higher than calculated in GEH's response to the initial RAI.

1) In GEH's April 15, 2008 response (MFN 06-499 Supplement 1 and 06-512, Supplement 2) to staff RAI 12.4-19S01 and S02, GEH used the QAD-CGGP shielding code to calculate the expected dose rates and radiation zoning designations for the accessible areas adjacent to the inclined fuel transfer tube (IFTT) during IFTT operation. These calculated dose rates and radiation zoning designations, which are based on the assumption that two fuel elements are transferred simultaneously in the IFTT, were provided in Table 2 of GEH's response. Using the revised fuel element source term calculated in GEH's response to supplement 2 of staff RAI 12.2-19, describe what effect this increase in the fuel assembly source term will have on the dose rates and radiation zoning designations in the each of the areas surrounding the IFTT listed in Table 2 (of GEH's response to RAI12.4-19 S01 and S02). Note that this analysis should assume that the resulting dose rates are from the simultaneous transfer in the IFTT of two fuel elements with the revised source term.

In the response to staff RAI 9.1-50 S03 (MFN 09-427), GEH provided information on the expected dose rates above the spent fuel pool from the movement of a spent fuel assembly in the spent fuel pool.

2) Using the revised fuel element source term calculated in GEH's response to supplement 2 of staff RAI12.2-19, describe what effect this increase in the fuel assembly source term will have on the dose rates and radiation zoning designations above the spent fuel pool during fuel movement.

In GEH's response to staff supplement 2 of RAI 12.2-19 (MFN 06-528 supplement 3), GEH stated that the dose rate values that GEH had provided to the staff in response to RAI 12.2-19 had been superseded based on a sensitivity study performed by GEH. The staff is concerned about what effects this sensitivity study may have on the shielding calculations performed for other parts of the plant.

3) Describe what effects the results of this sensitivity study may have on the calculated dose rates and radiation zone designations for other parts of the plant.

GEH Response

Part 1 of NRC request:

Using the revised fuel element source term calculated in GEH's response to supplement 2 of staff RAI 12.2-19, describe what effect this increase in the fuel assembly source term will have on the dose rates and radiation zoning designations in the each of the areas surrounding the IFTT listed in Table 2 (of GEH's response to RAI12.4-19 S01 and S02). Note that this analysis should assume that the resulting dose rates are from the simultaneous transfer in the IFTT of two fuel elements with the revised source term.

GEH Response to Part 1:

The effect of the fuel assembly source term on dose rates and radiation zone designations evaluated in this response is based on the change in doses in MFN 06-528 Supplement 3. The dose rates for a 35 GWd/MTU burnup and 58 GWd/MTU burnup fuel bundle drop are provided in response to RAI 12.2-19 S02, MFN 06-528 Supplement 3. They are 7.06 Sv/hr (706 rem/hr) and 8.25 Sv/hr (825 rem/hr), respectively. The dose rate is 17% higher for the higher burnup bundle. These dose rates are determined for the worst location. This corresponds to a 1.17 or +17% increase scale factor. To account for shielding and geometry differences, between the IFTT areas and the upper drywell, a higher scale factor, +50% increase is assumed to apply to the dose rates of rooms adjacent to, or through which the IFTT transits. This factor has been applied to dose rates which already account for simultaneous transfer of two fuel elements. The table below shows the dose rates of Table 2 (of GEH's response to RAI12.4-19 S01 and S02) increased by 50%, and compares the dose rate to the upper zone limit. This scaling results in no changes to the radiation zoning of each of the areas surrounding the IFTT listed in Table 2 (of GEH's response to RAI12.4-19 S01 and S02).

Table 2

Dose rate and radiation zoning designations during IFTT operation

Room		Concrete shielding cm.	RAI 12.4-19 S01 & S02 Dose (mSv/h)	Scaled Dose rate (mSv/h)	Max. Dose for Zone (mSv/h)	Rad. Zone
1401	RB CRD B Panel Room.	200 (1)	9.52E-04	1.43E-03	6.00E-03	A
1501	Reactor Building. Electrical Equipment Room B	200	6.84E-04	1.03E-03	6.00E-03	A
1600	Wetwell access / Fan room. Hallway between quadrants.	200	6.84E-04	1.03E-03	6.00E-03	A (2)
1703	Standby Liquid control Pump room.	200	9.52E-04	1.43E-03	6.00E-03	A (2)
1702	Incline fuel transfer tube room.	N/A: Inside	8.16E+06	1.22E+07	Unlimited	J
-	Trapezoidal room.	N/A: Inside	8.16E+06	1.22E+07	Unlimited	J
2IP1	Incline fuel transfer pit.	N/A: Inside	8.16E+06	1.22E+07	Unlimited	J
2190	FB Commodity chase.	200	9.52E-04	1.43E-03	6.00E-03	A (3)
2400	FB Rail car bay (at Elevations 4650, and 13570)	125 (4)	1.86E+00	2.79E+00	1.0E+01	F

Note 1. The wall of the Trapezoidal Room to room 1401 is designed up to a minimum 200 cm concrete shielding equivalent, keeping the room 1401 as a radiation zone "A" during IFTT operation.

Note 2. The normal Operation Radiation Zone Classification is "B".

Note 3. The normal Operation Radiation Zone Classification is "D".

Note 4. The wall of the trapezoidal room to room 2400, at Elevation 4650, is designed up to a minimum 125 cm concrete shielding equivalent, keeping the room 2400 at this area as a radiation zone "F" or lower during IFTT operation.

Access to any area adjacent to the transfer tube, with high radiation zone classification is controlled, in accordance with 10 CFR 20.1601 and 10 CFR 20.1902, through a system of physical controls, interlocks and annunciators (see response to Supplement 2 part (c)).

Part 2 of NRC request:

In the response to staff RAI 9.1-50 S03 (MFN 09-427), GEH provided information on the expected dose rates above the spent fuel pool from the movement of a spent fuel assembly in the spent fuel pool.

2) Using the revised fuel element source term calculated in GEH's response to supplement 2 of staff RAI12.2-19, describe what effect this increase in the fuel assembly source term will have on the dose rates and radiation zoning designations above the spent fuel pool during fuel movement.

GEH Response to Part 2:

To account for water vs. metal shielding and geometry differences between the IFTT areas and spent fuel pool, a higher scale factor, +80% increase is assumed to apply to derive a dose rate above the pool surface, during high exposure bundle transfers. The resulting radiation level on the fuel transfer machine increases from [[
]] (RAI 9.1-50 S03 (MFN 09-427 value) to [[
]]. A note will be added on Figures 12.3-9 & 10. "Zoning increases to Zone D above 18P1, 18P2 and 17P3 during high radiation fuel movements". A note will be added on Figure 12.3-11. "Zoning increases to Zone D above 18P1 during high radiation fuel movements".

Part 3 of NRC request:

In GEH's response to staff supplement 2 of RAI 12.2-19 (MFN 06-528 supplement 3), GEH stated that the dose rate values that GEH had provided to the staff in response to RAI 12.2-19 had been superseded based on a sensitivity study performed by GEH. The staff is concerned about what effects this sensitivity study may have on the shielding calculations performed for other parts of the plant.

3) Describe what effects the results of this sensitivity study may have on the calculated dose rates and radiation zone designations for other parts of the plant.

GEH Response to Part 3:

The sensitivity studies for activities based on individual bundle exposure provide the dose effects for the transfer or positioning of individual fuel bundles for evaluation of zone designations. These evaluations are applicable for activities performed in a short interval after shutdown, where the high exposure and short time after shutdown apply. Activities expected to occur shortly after shutdown with high exposure fuel are removal from the reactor, dechanneling, transfer to the spent fuel pool and storage in the spent fuel pool. Removal and dechanneling involve greater water depth than spent fuel pool transfer, such that the spent fuel pool dose rate represents the limiting case. The dose rates and radiation zone designations for the areas of the plant that are affected are addressed in items 1 and 2 above. Other areas of the plant (not discussed in items 1 or 2) are not affected by higher bundle exposures.

DCD Impact

DCD Tier # 2 Figures 12.3-9,10 & 11 will be revised as noted in the attached markup.