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**Proprietary Notice**
This letter forwards proprietary information in accordance with 10CFR2.390. Upon the removal of Enclosure 2, the balance of this letter may be considered non-proprietary.

MFN 09-567

Docket No. 52-010

September 4, 2009

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

Subject: **Transmittal of ESBWR Responses to CRHA Open Topic Items #2 and #4 Arising from Meeting on June 23, 2009**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) responses to ESBWR Control Room Habitability Area (CRHA) open topic items #2 and #4. This letter is a follow-up to close GEH open items arising from an NRC review of the ESBWR CRHA systems conducted on June 23, 2009 (Reference 1).

Enclosures 1 and 2 contain the GEH responses to open topic items #2 and #4, respectively. The response to open topic item #5 was previously submitted to the NRC via Reference 2. The responses to open topic items #3 and #6 were previously submitted to the NRC via Reference 3. The response to open topic item #1 was previously submitted to the NRC via Reference 4.

Enclosure 2 contains GEH proprietary information as defined by 10 CFR 2.390. GEH customarily maintains this information in confidence and withholds it from public disclosure. Enclosure 3 is a non-proprietary version, suitable for public disclosure, of Enclosure 2.

The affidavit contained in Enclosure 4 identifies that information contained in Enclosure 1 has been handled and classified as proprietary to GEH. GEH hereby requests that the information in Enclosure 1 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17.

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

Sincerely,

Timothy L. Enfinger for Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

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NRO

Reference:

1. MFN 09-473, Summary of the June 23, 2009, Partially Closed Meeting with GEH regarding Control Room Habitability Area, July 1, 2009
2. MFN 09-525, Transmittal of ESBWR CRHA Heatup Calculation, including Applicable Input and Output Data Files, August 4, 2009
3. MFN 09-551, Transmittal of ESBWR Responses to CRHA Open Topic Items #3 and #6 Arising from Meeting on June 23, 2009, August 17, 2009
4. MFN 09-553, Transmittal of ESBWR Response to CRHA Open Topic Item #1 Arising from Meeting on June 23, 2009, August 18, 2009

Enclosures:

1. Transmittal of ESBWR Responses to CRHA Open Topic Items #2 and #4 Arising from Meeting on June 23, 2009 - Response to Open Topic Item #2
2. Transmittal of ESBWR Responses to CRHA Open Topic Items #2 and #4 Arising from Meeting on June 23, 2009 - Response to Open Topic Item #4 – GEH Proprietary Information
3. Transmittal of ESBWR Responses to CRHA Open Topic Items #2 and #4 Arising from Meeting on June 23, 2009 - Response to Open Topic Item #4 – Public Version
4. Transmittal of ESBWR Responses to CRHA Open Topic Items #2 and #4 Arising from Meeting on June 23, 2009 - Response to Open Topic Item #4 – Affidavit

cc: AE Cubbage USNRC (with enclosures)
JG Head GEH/Wilmington (with enclosures)
DH Hinds GEH/Wilmington (with enclosures)
eDRF Section 0000-0106-2091

# Enclosure 1

# MFN 09-567

# Transmittal of ESBWR Responses to CRHA Open Topic Items #2 and #4 Arising from Meeting on June 23, 2009

## Response to Open Topic Item #2

NRC Telepresence Meeting Control Room Habitability Heatup
Analysis & Emergency Filter Unit (EFU) Operations – 23 June 09 OPEN ITEM #2

***Response to Open Topic Item #2***

## TOPIC ITEM

*Explain the reason that using engineering vent flows based on constant volume is acceptable with the drop in CRHA pressure as much as -6 inches w.g. in the first two hours. The staff is concerned that using a constant volume flow rate and allowing the pressure to change results in additional heat being removed than if the flows were based on a mass flow rate, which would essentially keep the CRHA pressure constant. The staff estimated the unaccounted for heat loss could be between 500 and 1500 watts depending on temperature differences.*

## RESPONSE / RESOLUTION

Using engineering vent flows based on constant volumetric flow rates is acceptable with the drop in CRHA pressure as much as -6 inches w.g (0.217 psi) in the first 2 hours because the negative pressure caused by a constant volumetric flow rate out has a negligible impact on the temperature results.

The constant volumetric flow rate out of the CRHA in the CONTAIN heat up analysis causes a negative pressure due to the loss of a small amount of mass of air (nitrogen + oxygen + water vapor). A sensitivity calculation was executed in which the CRHA pressure was maintained at a constant positive pressure above the specification value. The results show that the constant positive pressure has a negligibly small conservative impact on the final temperature.

A first principles hand calculation has been performed using a constant mass of air in the CRHA. The calculation is discussed in detail in the Resolution/Response to Issue #4. The results show that the potentially unaccounted for mass of air has a negligible impact on the final temperature.

# Enclosure 3

# MFN 09-567

# Transmittal of ESBWR Responses to CRHA Open Topic Items #2 and #4 Arising from Meeting on June 23, 2009

## Response to Open Topic Item #4

## Public Version

***Response to Open Topic Item #4***

## TOPIC ITEM

*Evaluate the temperature differences required to transfer heat into the thermal mass during the 0-72 hour period and relate to the amount of heat that is required to be removed.*

## RESPONSE / RESOLUTION

A first principles hand calculation has been performed to evaluate the temperature differences required to transfer heat into the thermal mass of concrete, which maintains the temperature of the CRHA below 93°F (33.9°C) for 72 hours. The calculation is an alternate method to the CONTAIN heat up analysis submitted to the NRC staff.

The inputs/assumptions in the calculation are similar to the inputs/assumptions in the CONTAIN heat up analysis. The following is a summary of the inputs/assumptions used in the analysis.

**Input:**

Material properties used in this heat transfer analysis are presented in Tables 1 and 2. Table 1 shows concrete properties. Table 2 shows CRHA air (oxygen + nitrogen + water vapor) properties.

**Table 1: Inputs – Concrete**

| Concrete Type | Conductivity (W/m-K) | Specific Heat (J/kgK) | Mass (kg) | Surface Area ($m^2$) | Thickness (m) | Initial Temp °F (K) |
|---|---|---|---|---|---|---|
| Internal Solid Concrete | [[ | | | | | |
| Concrete Ceiling | | | | | | |
| Concrete Floor | | | | | | |
| Concrete Walls | | | | | | ]] |

**Table 2: Inputs - CRHA Air (O2 + N2 + Water Vapor)**

| | Specific Heat (J/kgK) | Mass (kg) | Initial Temp °F (K) |
|---|---|---|---|
| CRHA Air | [[ | | ]] |

A heat load of 9630 W is an input to the calculation to account for the internal heat load from equipment. The energy from a fan with a volumetric flow rate of 0.24 $m^3/s$ of outside air with a maximum temperature of 117°F (320.35 K), specific heat of [[ ]] J/kgK and a 27°F (15 K) temperature profile are inputs into the calculation.

**Major Assumptions that differ from the CONTAIN analysis:**

- The calculation only considers the Control Room Habitability Area (CRHA) for the evaluation.
- Table 1 considers that half the mass and thickness of the concrete that surrounds the CRHA is available for heat transfer. The other half is considered to be affected by conditions outside the CRHA and is not credited. The entire mass and thickness of concrete inside the CRHA is considered.
- The CRHA concrete walls, ceiling, and floor, which have different thicknesses, are combined in lumped heat slabs with different temperatures.
- The mass of air in the CRHA is assumed to be constant by considering the mass flow rate introduced into the CRHA, by the volumetric fan, is the same as the mass flow rate leaving the CRHA.
- The initial temperature of the concrete is assumed to be [[ ]], which is the maximum initial concrete temperature from the CONTAIN analysis.

**Analysis:**

A first principles transient heat transfer analysis has been performed for the CRHA that is consistent with the nodalization found in the CONTAIN heat up analysis report, in Appendix E, that has been transmitted to the NRC staff. The CRHA is passively cooled by the thermal mass of concrete. The CRHA heats up due to the energy added by the outside air and internal heat load from equipment. The thermal mass of concrete in the CRHA slows the temperature rise.

The heat added, in Joules, to the CRHA air as a result of the outside air mass replacing the air mass exiting is governed by the following equation:

$$Q_{Outside\_air}(t) = m_{Outside\_air} * C_{Outside\_air} * \left(T_{Outside}(t) - T_{CRHA}(t)\right)$$

Where:

$m_{Outside\_air}$ = Mass of outside air per time step
$C_{Outside\_air}$ = Specific heat of outside air
$T_{Outside}(t)$ = Temperature of outside air as a function of time
$T_{CRHA}(t)$ = CRHA air temperature as a function of time

The heat transfer, in Joules, from the internal equipment heat loads is 9630 W (9630 J/s):

$$Q_{Equipment} = 9630(\Delta t)$$

Where:

$\Delta t$ = Time interval in seconds

The heat removed, in Joules, by the concrete is governed by the following equation:

$$Q_{Concrete}(t) = \frac{[T_{Concrete}(t) - T_{CRHA}(t)] * \Delta t * A_{Concrete}}{\frac{L_{Concrete}}{k_{Concrete}}}$$

Where:

$A_{Concrete}$ = Surface area of the concrete
$T_{Concrete}(t)$ = Temperature of the concrete as a function of time
$T_{CRHA}(t)$ = Temperature of the CRHA as a function of time
$\Delta t$ = Time interval between current and previous data point
$L_{Concrete}$ = Thickness of concrete
$k_{Concrete}$ = Conductivity of concrete

The temperature of the concrete, in Kelvin, is governed by the following equation:

$$T_{Concrete}(t) = \frac{-[Q_{concrete}(t)]}{m_{Concrete} * C_{Concrete}} + T_{n(Concrete)}$$

Where:

$T_{Concrete}(t)$ = Temperature of the concrete as a function of time
$m_{Concrete}$ = Mass of concrete
$C_{Concrete}$ = Specific heat of concrete
$T_{n(Concrete)}$ = Temperature of concrete from previous time step

The temperature of the CRHA is calculated from the following equation:

$$T_{CRHA}(t) = \frac{[Q_{Concrete}(t) + Q_{Equipment}(t) + Q_{Outside\_Air}(t)]}{m_{CRHA} * C_{CRHA}} + T_{n(CRHA)}$$

Where:

$Q_{Concrete}$ = Heat load removed by the concrete
$Q_{Equipment}$ = Heat load from equipment
$Q_{Outside\_Air}$ = Heat load from outside air
$m_{CRHA}$ = Mass of CRHA air
$C_{CRHA}$ = Specific heat of CRHA air
$T_{n(CRHA)}$ = Temperature of CRHA air from previous time step

**Results:**

The maximum temperature reached in the first principles calculation is [[
]]. This temperature is reasonably close to the CONTAIN analysis result of 92.0°F (306.5 K). The temperature profiles of the first principles calculation and the CONTAIN analysis are shown in Figure 1. It is shown that the first principles calculation and the CONTAIN results are similar. Additionally, maintaining the CRHA air mass constant had a negligible effect on the final temperature.

[[ ]]

Figure 1: CRHA Heat Up Profile

# Enclosure 4

# MFN 09-567

# Transmittal of ESBWR Responses to CRHA Open Topic Items #2 and #4 Arising from Meeting on June 23, 2009

# Response to Open Topic Item #4

# Affidavit

**GE-Hitachi Nuclear Energy Americas LLC**

# AFFIDAVIT

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

(1) I am 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 2 of GEH's letter, MFN 09-567, Mr. Richard E. Kingston to U.S. Nuclear Energy Commission, entitled "Transmittal of ESBWR Responses to CRHA Open Topic Items #2 and #4 Arising from Meeting on June 23, 2009" dated September 4 2009. The proprietary information in enclosure 2, entitled "Transmittal of ESBWR Responses to CRHA Open Topic Items #2 and #4 Arising from Meeting on June 23, 2009 - Response to Open Topic Item #4 – GEH Proprietary Information," is delineated by a [[dotted underline inside double square brackets$^{(3)}$]]. 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 for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, 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 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) is classified as proprietary because it contains details of GEH's design and licensing methodology. The development of the methods used in these analyses, along with the testing, development and approval of the supporting methodology was achieved at a significant cost to GEH.

(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 and obtaining 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 4th day of September 2009.

David H. Hinds
GE-Hitachi Nuclear Energy Americas LLC