



GE Nuclear Energy

Sandra A. Delvin
Manager, ESBWR
Engineering & Technology

General Electric Company
175 Curtner Avenue, M/C 307 San Jose, CA 95125-1014
408 925-3900 (phone) 408 925-5490 (facsimile)

Project 717

MFN 03-141
November 7, 2003

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20852-2738

Attention: Chief, Information Management Branch
Program Management
Policy Development and Analysis Staff

Subject: **Response to Request for Additional Information (RAI) on Model LTR
NEDE-32176 (Rev 1 and 2) and RAI number (330.4) for ESBWR Pre-
application Review – Additional Supplementary Information.**

In response to requests from the NRC (References 1 and 2), GE Nuclear Energy is submitting, in enclosures 1 and 2, supplementary information in support of GE's previously submitted documents (MFN 96-008 and MFN 99-040), and additional information in support of our response (MFN 03-081) to Requests for Additional Information (RAI) number 330.4, which are included in the referenced letters.

Enclosure 1 contains the supplementary information with GE proprietary information as defined by 10CFR2.790. GE customarily maintains this information in confidence and withholds it from public disclosure. A non-proprietary version of the information 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 GE. GE hereby requests that the information of Enclosure 1 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.790 and 9.17.

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

Sincerely,

for Sandra A. Delvin
Manager, ESBWR
Engineering & Technology

References:

1. Email from Amy Cabbage to Bharat Shiralkar (GE), October 30, 2003, SUBJECT: Followup on NEDE-32176P, rev 1
2. Email from Amy Cabbage to Atambir Rao (GE), November 5, 2003, SUBJECT: Atam, [Request for Test Data related to RAI 330.4]
3. MFN 03-081, Letter From Atambir Rao (GE) to NRC, September 3, 2003, SUBJECT: RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION (RAI) 330 INCLUDING ESBWR INPUT DECKS FOR ESBWR PRE-APPLICATION REVIEW
4. MFN 99-040, Letter From James F. Klapproth (GE) to NRC, December 3, 1999, SUBJECT: TRANSMITTAL OF GE PROPRIETARY LICENSING TOPICAL REPORT NEDE-32176P, "TRACG MODEL DESCRIPTION", REVISION 2, DECEMBER 1999
5. MFN 96-008, Letter From J.E. Quinn (GE) to NRC, January 31, 1996, SUBJECT: SBWR -TRANSMITTAL OF GE LICENSING TOPICAL REPORT NEDE-32176P, TRACG MODEL DESCRIPTION, REV. 1, DATED JAN. 1996

Enclosures:

1. MFN 03-141 Response to NRC RAI Regarding NEDE-32176P (Rev. 1 and 2) and RAI number (330.4) – Additional Supplementary Information - Proprietary Information (on CD)
2. MFN 03-141 Response to NRC RAI Regarding NEDE-32176P (Rev. 1 and 2) and RAI number (330.4) – Additional Supplementary Information – Non-proprietary Information
3. Affidavit, George B. Stramback, dated November 7, 2003

cc: A. Cabbage USNRC (with enclosure)
J. Lyons USNRC (w/o enclosure)
G.B. Stramback GE (with enclosure)

MFN 03-141
Enclosure 2

ENCLOSURE 2

MFN 03-141

Response to NRC RAI Regarding NEDE-32176P (Rev. 1 and 2) and
RAI number (330.4) – Additional Supplementary Information

Non-proprietary

MFN 03-141
Enclosure 2

**Response to NRC Question on Model LTR NEDE-32176 (Rev 1 and 2)
Equation 6.6-61**

Question:

On page 6.6-38 for NEDE-32176P, rev 1, third equation, it appears that there is an extra term that should not have been included in the equation. This is the hfg term. Please take a look at this equation, and let us know whether the equation is correct.

Response:

There are typographical errors in Equations 6.6-61 (indicated above) and in Equation 6.6-62. These are corrected in the attached corrected Page 6.6-38 for NEDE-32176 Rev. 1. These equations are intermediate steps in the derivation of Equation 6.6-67 for the Nusselt condensation heat transfer coefficient. Equation 6.6-67 is correct in the report. The implementation of the equation for the condensation heat transfer coefficient in TRACG has been checked and is also correct.

Corrected Page

A simple energy balance yields:

$$\Gamma(z) = \frac{\bar{h}(z)}{h_{fg}} (T_s - T_w) z \quad (6.6-59)$$

where $\bar{h}(z)$ is the average value of the film heat transfer coefficient h_{ref} from the start of condensation to z .

Combining Equations 6.6-56 and 6.6-59 and differentiating

$$d(Re_\ell) = \frac{4h_{ref}}{\mu_\ell h_{fg}} (T_s - T_w) dz \quad (6.6-60)$$

Now, combining Equations 6.6-58 and 6.6-60

$$\frac{2}{3} Re_\ell^{-1/3} = 0.052 \frac{g^{1/3} \rho_\ell^{2/3} k_\ell}{\mu_\ell^{2/3}} \cdot \frac{1}{4h_{ref}} \quad (6.6-61)$$

Using Equations 6.6-54 and 6.6-61 and solving for δ gives the turbulent film thickness

$$\delta = 51.3 \left(\frac{\mu_\ell^2}{\rho_\ell^2 g Re_\ell} \right)^{1/3} \quad \text{or} \quad \delta = 32.3 \left(\frac{\mu_\ell^3}{\rho_\ell^2 g \Gamma} \right)^{1/3} \quad (6.6-62)$$

for $Re_\ell > 2000$.

As stated above, the two-part correction takes the form:

$$h_{condensation} = f_1 f_2 h_{ref} \quad (6.6-63)$$

where f_1 is a factor greater than unity, which accounts for increased heat transfer due to shearing (thinning) of the condensate film layer. The factor, f_2 , is less than unity and accounts for the decrease in heat transfer resulting from the presence of noncondensibles.

The factor f_1 is given by:

$$f_1 = 1 + 2.88 \times 10^{-5} Re_m^{1.18} \quad \text{for } Re_\ell \leq 1000 \quad (6.6-64)$$

with the limit of $f_1 \leq 3$ and

$$f_1 = 1 \quad \text{for } Re_\ell > 2000$$

MFN 03-141
Enclosure 2

Supplemental Information for RAI 330.4

The experimental data for the PSTF 5803_1 and 5803_2 tests are summarized in the following tables. These tables present Level (“_L”), Pressure (“_P”), and Break flow (“_W”) versus time. For 5803_1 test, SI units (second, m, MPa, kg/s) are used. For 5803_2 test, British units (second, ft, psia, lb/s) are used.

[[

[[]]

]]

MFN 03-141
Enclosure 2

[[

]]

MFN 03-141
Enclosure 2

[[

[[]]

]]

MFN 03-141
Enclosure 2

[[

]]

General Electric Company

AFFIDAVIT

I, **George B. Stramback**, state as follows:

- (1) I am Manager, Regulatory Services, General Electric Company ("GE") 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 the Enclosure 1 of GE letter MFN 03-141, Sandra Delvin to NRC, *Response to Request for Additional Information (RAI) on Model LTR NEDE-32176 (Rev 1 and 2) and RAI number (330.4) for ESBWR Pre-application Review – Additional Supplementary Information.*, dated November 7, 2003. The proprietary information is in Enclosure 1, *Response to Request for Additional Information (RAI) on Model LTR NEDE-32176 (Rev 1 and 2) and RAI number (330.4) for ESBWR Pre-application Review – Additional Supplementary Information.* For text and text contained in tables, GE proprietary information is identified by a double underline inside double square brackets. 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, GE 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 2.790(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 General Electric's competitors without license from General Electric 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 General Electric customer-funded development plans and programs, resulting in potential products to General Electric;
- 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 2.790 (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 GE, 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 GE, 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. Access to such documents within GE 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 GE 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 details for licensing application of TRACG to the ESBWR passive safety system design of the BWR. This TRACG code has been developed by GE for over fifteen years, at a total cost in excess of three million dollars. The reporting, evaluation and interpretations of the results, as they relate to the ESBWR, was achieved at a significant cost, to GE.

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 GE asset.

- (9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GE'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 GE.

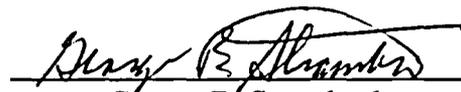
The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE 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 GE 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 GE 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 27th day of November 2003


George B. Stramback
General Electric Company