May 11, 2001
NG-01-0660

Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station 0-P1-17
Washington, DC 20555-0001

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License No: DPR-49
Response to Request for Additional Information (RAI) to Technical Specification Change Request TSCR-042 – Extended Power Uprate. (TAC # MB0543)

Reference: NG-00-1900, "Technical Specification Change Request (TSCR-042): 'Extended Power Uprate'," dated November 16, 2000.

File: A-117, SPF-189

Dear Sir(s):

On May 3, 2001, a conference call was held with the NRC Staff regarding the referenced amendment request to increase the authorized license power level of the Duane Arnold Energy Center. In order to complete their review, the Staff has requested additional information to our application. The proposed Request for Additional Information (RAI) had been provided to us electronically on April 27, 2001 to facilitate discussions. As a result of this conference call, we agreed to provide this information in multiple submittals to allow the Staff and their contractor to begin their audit calculations as soon as possible. Consequently, Attachment 1 to this letter contains the complete RAI and our first set of Responses. Please note that we have reformatted the original data request into a tabular format more conducive to the segmented manner in which it is being prepared. The remaining items have been annotated as "LATER." We anticipate providing the remaining Responses within the next two weeks.

Please note that the response in Attachment 1 contains information that the General Electric Company (GE) considers to be proprietary in nature and subsequently, pursuant to 10 CFR 9.17(a)(4), 2.790(a)(4) and 2.790(d)(1), requests that such information be withheld from public disclosure. The portion of the text containing the proprietary information is identified with vertical sidebars in the right margin. An affidavit supporting this request is provided as Attachment 2 to this letter. Attachment 3 is the redacted version of Attachment 1, with the GE proprietary material removed, suitable for public disclosure.

No new commitments are being made in this letter.

Please contact this office should you require additional information regarding this matter.



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This letter is true and accurate to the best of my knowledge and belief.

NUCLEAR MANAGEMENT COMPANY, LLC

By _____
Gary Van Middlesworth
DAEC Site Vice-President

State of Iowa
(County) of Linn

Signed and sworn to before me on this 11th day of May, 2001,
by Gary Van Middlesworth.

_____
Notary Public in and for the State of Iowa

Nov. 3, 2001
Commission Expires

Attachments:
1) DAEC Responses to NRC Containment Systems Branch Request for Additional Information Regarding Proposed Amendment for Power Uprate
2) General Electric Affidavit of Proprietary Information
3) Redacted Version of DAEC Response to NRC Containment Systems Branch Request for Additional Information Regarding Proposed Amendment for Power Uprate

cc: T. Browning
R. Anderson (NMC) (w/o Attachments 1 & 2)
B. Mozafari/Darl Hood (NRC-NRR)
J. Dyer (Region III)
D. McGhee (State of Iowa) (w/o Attachments 1 & 2)
NRC Resident Office
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**Attachment 2 to**

**NG-01-0660**

**General Electric Affidavit of Proprietary Information**

# General Electric Company

# AFFIDAVIT

**I, George B. Stramback,** being duly sworn, depose and state as follows:

(1) I am Project 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 to letter GEDA –AEP-552, *Response to NRC RAI Regarding the Containment Analysis*, (GE Company Proprietary), dated May 9, 2001. The proprietary information is delineated by bars marked in the margin adjacent to the specific material in the *Enclosure 1 to Letter GEDA-AEP-552 Response to NRC RAI Regarding the Containment Analyses.*

(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), 2.790(a)(4), and 2.790(d)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions 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 cost or price information, production capacities, budget levels, or commercial strategies of General Electric, its customers, or its suppliers;

d. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, of potential commercial value to General Electric;

e. 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 both paragraphs (4)a. and (4)b., above.

(5) 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 contains further details regarding the GE proprietary report NEDC-32980P, *Safety Analysis Report for Duane Arnold Energy Center Extended Power Uprate,* Class III (GE Proprietary Information), dated November 2000, which contains detailed results of analytical models, methods and processes, including

computer codes, which GE has developed, obtained NRC approval of, and applied to perform evaluations of transient and accident events in the GE Boiling Water Reactor ("BWR").

The development and approval of these system, component, and thermal hydraulic models and computer codes was achieved at a significant cost to GE, on the order of several million dollars.

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.

STATE OF CALIFORNIA )
) ss:
COUNTY OF SANTA CLARA )

George B. Stramback, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at San Jose, California, this 9th day of May 2001.

George B. Stramback
General Electric Company

Subscribed and sworn before me this 9th day of May 2001.

VICKY D. SCHROER
Commission # 1224251
Notary Public - California
Santa Clara County
My Comm. Expires Jun 12, 2003

Notary Public, State of California

**Redacted Version of**
**DAEC Responses to NRC**
**Containment Systems Branch**
**Request for Additional Information**
**Regarding Proposed Amendment for Power Uprate**

1. Provide input to the computer calculation of short-term containment pressure and temperature. Details of the input and method of transmittal to the NRC will be decided mutually in a conference call with the licensee, NRC staff and NRC contractor[2]. Preliminary list is given in Attachment 1 below.

DAEC Response: LATER

2. Provide input to computer calculation of long-term containment pressure and temperature calculations. Details of the input, method of transmittal to the NRC will be decided mutually in a conference call with the licensee, NRC staff and the NRC contractor. Preliminary list is given in Attachment 1below.

DAEC Response:

See Attached Tables – 1 and 2 for the initial set of inputs for the long-term DBA-LOCA. The inputs for the other events will be supplied in a subsequent submittal.

3. Provide short term and long term results (curves or tables of calculated values as a function of time) of Duane Arnold calculations for:

(A)drywell short term pressure and temperature,
(B)suppression pool short term temperature
(C)wetwell atmosphere short term pressure and temperature
(D)suppression pool long term temperature
(E)wetwell atmosphere long term pressure and temperature

If the long term calculation results are different from those used for calculating NPSH, provide the suppression pool long term temperature and wetwell atmosphere long term pressure and temperature used for the NPSH calculation.

DAEC Response: LATER

4. Explain why the 31.7 GWD/Short ton is conservative for Duane Arnold decay heat calculations.

DAEC Response:

The exposure used in the decay heat calculations was taken from the power uprate equilibrium fuel cycle, as outlined in PUSAR Section 2.1, and then adjusted to provide

[2] Information Systems Laboratories, Inc., Rockville, Maryland

extra conservatism to account for any future cycle-to-cycle differences. The core average exposure for the DAEC power uprate equilibrium fuel cycle was 34 GWd/Metric Ton. This value was rounded upward to 35 GWd/Metric Ton, which is equivalent to 31.7 GWd/Short Ton. This value was used to evaluate various decay heat parameters and to estimate the average in-core irradiation time. A direct calculation of the irradiation time using this exposure resulted in a value of 3.31 years. This was rounded upward to 3.5 years for an extra degree of conservatism. Finally, an allowance of two-sigma uncertainty was applied to the decay heat table. All of these individual conservatisms ensure that the overall calculation for the decay heat curve (Table 2, attached) is bounding for the DAEC power uprate conditions.

5. Explain why a higher power level increases subcooling in the vessel downcomer region.

DAEC Response:

This is a characteristic of a constant pressure power uprate with no increase in core flow. The following values were taken from results of the reactor heat balance summarized in PUSAR Section 1.3.1, Table 1-2 and Figure 1-1. Core flow remains at 49 Mlb/hr. Reactor pressure remains at 1040 psia, so the reactor coolant saturation temperature remains at 540 °F. The increase in vessel steam flow from 7.172 Mlb/hr to 8.352 Mlb/hr reduces the return flow to the downcomer (i.e., core flow minus vessel steam flow) from 41.83 Mlb/hr to 40.65 Mlb/hr at 540 °F. There is a corresponding increase in Feedwater flow from 7.221 Mlb/hr at 424 °F to 8.414 Mlb/hr at 431.4 °F. Despite the increase in Feedwater temperature, the bulk average downcomer temperature decreases from 531 °F to 529 °F. Therefore, the downcomer subcooling increases from about 9 °F to 11 °F, at the saturation pressure of 1040 psia in the reactor steam dome. A similar decrease in core inlet enthalpy can be seen in Table 1-2.

6. Describe any changes made in assumptions or physically to the ultimate heat sink and the residual heat removal heat exchanger which affect the long term containment analysis.

DAEC Response:

No changes in the current analysis assumptions for either the Ultimate Heat Sink (PUSAR 6.4.5) or the Residual Heat Removal heat exchanger (PUSAR 3.9.2 and 6.4.1.1.2) were made.

7. Describe the steam line break scenario which requires calculating a 120 day containment response. Describe in more detail the calculation which is done for this scenario or provide the calculation.

DAEC Response: LATER

8. Explain why the EPU peak drywell gas pressure is less than for the current licensing basis (Table 4-1 of NEDC-32980P).

DAEC Response: LATER

9. Explain the reason for redoing the subcompartment analyses assuming the break flow is subcooled liquid (Section 4.1.2.3 of NEDC-32980P).

DAEC Response: LATER

10. Describe or reference the methods and assumptions used to calculate mass and energy release for the short term and long-term pressure and temperature calculations. Verify that the HEM model is being used in a manner consistent with the staff SER on NEDO-21052, September 1975.

DAEC Response: LATER

11. Other than the effects due to the increase in power, verify that no other changes in assumptions in the NPSH calculation have been made in the assumptions or input since the Duane Arnold responses to GL 97-04.

DAEC Response:

As stated in PUSAR Section 4.1.1.1(b), the only assumption that was changed from the NPSH analysis for GL 97-04 was in the decay heat curve, which assumed a finite versus infinite fuel exposure.

TABLE – 1
Input Parameter to Containment Analysis for
DAEC Extended Power Uprate

| Parameter \ Case | Unit | Short-Term DBA-LOCA | Long-Term DBA-LOCA | Long-Term DBA-LOCA for NPSH | Long-Term 0.01 $ft^2$ Steam Line Break |
|---|---|---|---|---|---|
| **GE Computer Code used** | | | SHEX | | |
| **Break Critical Flow Model** | | | HEM | | |
| **Containment Volumes** | | | | | |
| Drywell (including free volume of vents) | $ft^3$ | | 130,000 | | |
| Wetwell Atmosphere | $ft^3$ | | 96,670 | | |
| Wetwell Liquid | $ft^3$ | | 58,900 | | |
| **Initial RPV Water Volume (include liquid in recirc, LPCI, CS, HPCI, RCIC and RHR shutdown piping)** | $ft^3$ | | 7,431 | | |
| **Recirc Suction Nozzle Inside Diameter** | in | | 19.75 | | |
| **DBA-LOCA Break Area** | | | | | |
| Recirc Suction Nozzle | $ft^2$ | | 2.127 | | |
| Jet Pump Nozzles | $ft^2$ | | 0.380 | | |
| Bottom Head Drain Nozzle | $ft^2$ | | 0.016 | | |
| Total | $ft^2$ | | 2.523 | | |

TABLE – 1
Input Parameter to Containment Analysis for
DAEC Extended Power Uprate

| Parameter \ Case | Unit | Short-Term DBA-LOCA | Long-Term DBA-LOCA | Long-Term DBA-LOCA for NPSH | Long-Term 0.01 $ft^2$ Steam Line Break |
|---|---|---|---|---|---|
| **Torus Geometry Description** | | | | | |
| Inside Diameter | ft | | 25.667 | | |
| Upper Torus Thickness | ft | | 0.042 | | |
| Lower Torus Thickness (not modeled) | ft | | 0.045 | | |
| Baffles Dimensions, Mass and Location | | | Not Modeled | | |
| Initial Suppression Pool Depth | ft | | 7.449* | | |
| * The torus-shaped suppression pool is converted into a rectangle in the SHEX code by retaining the same pool surface area, same vent and SRV quencher submergences and preserving the total pool volume. | | | | | |
| Suppression Pool Surface Area (assumed constant) | $ft^2$ | | 7,763 | | |
| Pump Suction Location | | | Not Modeled | | |
| **Initial Drywell Air and Vapor Masses are based on the following Conditions** | | | | | |
| Pressure | psig | | 2.3 | | |
| Temperature | °F | | 135 | | |
| Relative Humidity | % | | 20 | | |
| **Initial Wetwell Air and Vapor Masses are based on the following Conditions** | | | | | |
| Pressure | psig | | 2.3 | | |

TABLE – 1
Input Parameter to Containment Analysis for
DAEC Extended Power Uprate

| Parameter \ Case | Unit | Short-Term DBA-LOCA | Long-Term DBA-LOCA | Long-Term DBA-LOCA for NPSH | Long-Term 0.01 $ft^2$ Steam Line Break |
|---|---|---|---|---|---|
| Temperature | °F | | 95 | | |
| Relative Humidity | % | | 100 | | |
| **Initial Suppression Pool Water Mass** | lbm | | 3.656E6 | | |
| **Initial Submergences** | | | | | |
| Downcomers (Vents) | ft | | 3.026 | | |
| SRV Discharge Lines / Quenchers | ft | | 6.125 | | |
| **Heat Structures Properties** | | | | | |
| Drywell and Wetwell Internal metal Structures and Vents (Steel) | | | Not Modeled | | |
| Density | $lbm/ft^3$ | | 490 | | |
| Specific Heat | Btu/lbm-°F | | 0.11 | | |
| Thermal Conductivity | Btu/hr-ft-°F | | 26 | | |
| Drywell and Wetwell Air Properties | | | | | |
| Constant Volume Specific Heat, $C_v$ | Btu/lbm-°F | | 0.171 | | |
| Ratio of Specific Heats, $\gamma$ | | | 1.4 | | |
| Ideal Gas Constant, R | $lb_f$-ft/lbm-°F | | 53.34 | | |

TABLE – 1
Input Parameter to Containment Analysis for
DAEC Extended Power Uprate

| Parameter \ Case | Unit | Short-Term DBA-LOCA | Long-Term DBA-LOCA | Long-Term DBA-LOCA for NPSH | Long-Term 0.01 $ft^2$ Steam Line Break |
|---|---|---|---|---|---|
| **Suppression to Drywell Vacuum Breakers** | | | | | |
| Number | | | 6 | | |
| Flow Area (per Vacuum Breaker) | $ft^2$ | | 1.396 | | |
| Differential Pressure Setpoint | psid | | 0.35 | | |
| Loss Coefficient (per Vacuum Breaker) | | | 2.41 | | |
| **RX Building to Suppression Vacuum Breakers** | | | Not Modeled | | |
| Number | | | NA | | |
| Flow Area (per Vacuum Breaker) | $ft^2$ | | NA | | |
| Differential Pressure Setpoint | psid | | NA | | |
| Opening Time | sec | | NA | | |
| Loss Coefficient (per Vacuum Breaker) | | | NA | | |
| Drywell Spray Flow Rate | gpm | | Not Modeled | | |
| **Wetwell Spray Flow Rate** | gpm | | Not Modeled | | |
| Normalized Decay Heat vs Time | | | Table 2 | | |
| **Operating Pumps** | | | | | |
| RHR/LPCI Pumps | | | | | |

TABLE – 1
Input Parameter to Containment Analysis for
DAEC Extended Power Uprate

| Parameter \ Case | Unit | Short-Term DBA-LOCA | Long-Term DBA-LOCA | Long-Term DBA-LOCA for NPSH | Long-Term 0.01 $ft^2$ Steam Line Break |
|---|---|---|---|---|---|
| Number of Operating Pumps | | | 2 before 600 sec<br>1 after 600 sec | | |
| Heat Exchanger K-factor (per HX) | Btu/sec-°F | | 135 | | |
| Pump Heat (per Pump) | hp | | 600 | | |
| Core Spray Pumps | | | | | |
| Number of Operating Pumps | | | 1 | | |
| Pump Heat (per Pump) | hp | | 700 | | |
| Modeling of Condensation on Containment Walls | | | Not Modeled | | |

TABLE – 2

**Normalized ANS 5.1 + 2σ Shutdown Power Values for DAEC Extended Power Uprate (Sum of Decay Heat, Fuel Relaxation and Metal-Water Reaction Energy)**

| Time (sec) | Shutdown Power |
|---|---|

**[[General Electric Proprietary Information Redacted]]**