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DAEC Plant Support Center
Operated by Nuclear Management Company, LLC

May 8, 2001
NG-01-0614

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)

References:
1. NG-00-1900, "Technical Specification Change Request (TSCR-042): 'Extended Power Uprate'," dated November 16, 2000.
2. NG-01-0463, "Response to Request for Additional Information (RAI) to Technical Specification Change Request TSCR-042 – Extended Power Uprate. (TAC # MB0543)," dated April 16, 2001.

File: A-117, SPF-189

Dear Sir(s):

On May 2, 2001, a conference call was held with the NRC Staff regarding the Reference 1 amendment request to increase the authorized license power level of the Duane Arnold Energy Center. In order to complete their review, the Staff requested additional information to that previously supplied by Reference 2. Attachment 1 to this letter contains that additional information, as requested in that conference call.

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.

A001

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

NUCLEAR MANAGEMENT COMPANY, LLC

By Gary Van Middlesworth
Gary Van Middlesworth
DAEC Site Vice-President

State of Iowa
(County) of Linn

Signed and sworn to before me on this 8th day of May, 2001,

by Gary VanMiddlesworth.

Nancy S. Franck
Notary Public in and for the State of Iowa

NANCY S. FRANCK
MY COMMISSION EXPIRES
9-28-01

Commission Expires

Attachments: 1) DAEC Response to NRC Mechanical and Civil Engineering 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 Mechanical and Civil Engineering Branch Request for Additional Information Regarding Proposed Amendment for Power Uprate
4) Excerpted Pages from Section F6 of the DAEC Certified Stress Report for the Reactor Pressure Vessel

cc: T. Browning
R. Anderson (NMC) (w/o Attachments 1&2)
B. Mozafari (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-01-0614

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-550, *Response to NRC Regarding the CRD-HRS*, (GE Proprietary Information), dated may 7, 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-550 Response to NRC RAI Regarding the CRD-HRS Nozzles.*

(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 7th day of May 2001.

George B. Stramback
General Electric Company

Subscribed and sworn before me this 7th day of MAY 2001.

Notary Public, State of California

ANNA HANLIN
Commission # 1184507
Notary Public - California
Santa Clara County
My Comm. Expires Jun 19, 2002

Redacted Version of
DAEC Response to NRC
Mechanical and Civil Engineering Branch
Request for Additional Information
Regarding Proposed Amendment for Power Uprate

In its Response to RAI#1A, you indicated that the original skin stress was replaced with the alternate value of skin stress for the power uprate, thus reducing the calculated fatigue usage from 0.825 to 0.572 for the CRD-Hydraulic System Return (HRS) Nozzle. Please also describe the method of calculating the original and the alternate values of the skin stress for the power uprate and provide the calculation for the fatigue usage factor of the CRD-HSR nozzle.

DAEC Response: See DAEC UFSAR, Appendix 5A, Section 5A.5.7 for a discussion of the original evaluation.

As discussed in UFSAR Section 5A.5.7, our original "certified stress report" on the reactor vessel was docketed pursuant to Paragraph N142 of Section III to the ASME code. Sheets 18 through 21 of Section F6 in that stress report discuss the alternate skin stress calculation method used in the power uprate calculation. For the Staff's convenience, these pages are included as Attachment 4, herein.

The following is a summary description of the calculation performed for the power uprate:

Examination of the original stress report revealed that the original fatigue calculation incorporated an additional plastic fatigue method used to supplement the Code analysis for the calculation of the alternating stress intensity. This supplemental method is described in "Tagart, Jr., S. W., "Plastic Fatigue Analysis of Pressure Components", Joint Conference with the Pressure Vessels and Piping Division in Dallas, TX, September 22-25, 1968, ASME Paper 68-PVP-3, May 1968". Hereafter referred to as Tagart. To be consistent with the original analysis, the methods described in Tagart are used here.

Procedure for EPU Fatigue Evaluation:
The following general procedure describes the standard method used to perform the Code fatigue evaluation for EPU conditions.

[[General Electric Proprietary Information Redacted]]

The stainless steel portion of the CRD-HSR nozzle would not satisfy the code fatigue usage requirements using the normal stress intensity scaling method. Sht. 19 of F6 (Attachment 4) describes an alternate method of calculating the skin stresses in the CRD-HSR for **[[General Electric Proprietary Information Redacted]]** conditions. The original skin stress was replaced with the alternate value of skin stress calculated as shown on Sht. 19a of F6 (Attachment 4). A new S_{alt} was calculated using the alternate thermal skin stress as follows:

The thermal skin stresses for the **[[General Electric Proprietary Information Redacted]]** transients in the original stress analysis will be replaced with the alternate skin stress (Sheet 19a of F6 in Attachment 4) of 14,900 psi.

	C	D	E	F	G	H
Pt. 5	K(A+B)	$\frac{E\alpha\Delta T}{1-\gamma}$	C+D σ_ϕ (input)	$\sigma\theta$ (KAL.)	F+D σ_θ (input)	σr (input)
[[General Electric Proprietary Information Redacted]]						

[[General Electric Proprietary Information Redacted]]

Maximum stress intensity from original report was from **[[General Electric Proprietary Information Redacted]]**:

[[General Electric Proprietary Information Redacted]]

From Sht. 20 of F6 (Attachment 4), Max. range of peak stress intensities is 160,300 psi at Pt. 5.

Therefore, with new thermal stress, max. range of peak stress intensities is:

[[General Electric Proprietary Information Redacted]]

Now from Sht. 20 of F6 **[[General Electric Proprietary Information Redacted]]**.

	A	B	C	D#	E
Pt.	Max Range Peak Stress Intensities	Max Pipe Reaction Stress Intensities	A+B S_{rij} (P)	S_{rij}(n)	C/D K_t >K
5	**[[General Electric Proprietary Information Redacted]]**				

[[General Electric Proprietary Information Redacted]]

And, from Sht 21 of F6 (Attachment 4)

$$K_F = K_t + A (K_t - 1)$$

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

and

$S_{alt} = \frac{1}{2} K_F K_\varepsilon S_{rij}(n)$

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

Now apply SCF to **[[General Electric Proprietary Information Redacted]]**.

$S_{alt-new}$ = **[[General Electric Proprietary Information Redacted]]**

The new S_{alt} is only applied for the **[[General Electric Proprietary Information Redacted]]** cycles investigated in the fatigue usage calculation. These cycles are:

[[General Electric Proprietary Information Redacted]]

The original limiting primary plus secondary stress intensity and cumulative usage factor are:

$$P + Q = 32{,}257 \text{ psi.}$$
$$U = 0.825$$

[[General Electric Proprietary Information Redacted]]

The original stress report calculated the fatigue usage factor using two groups of cycles: SCRAMs and "All other cycles." Using the standard scaling methodology:

$S_{alt,new} = S_{alt,old} * SCF$

[[General Electric Proprietary Information Redacted]]

All stress intensities used in this analysis are listed in Section 6 of the Stress Report. The fatigue curve corresponding to Stainless Steel (Ref. ASME B&PV Code-1965, Section III, Fig. N-415(B)), is used for the fatigue evaluation. By entering the applicable alternating stress intensities into the Stainless Steel fatigue curve the following cumulative usage factor is determined:

[[General Electric Proprietary Information Redacted]]

Cumulative Usage Factor: $U = u_1 + u_2 = \mathbf{0.572}$

The EPU cumulative fatigue usage factor is shown above to be within the Code allowable limit of 1.0.

Attachment 4 to

NG-01-0614

Excerpted Pages from Section F6 of the DAEC Certified Stress Report for the Reactor Pressure Vessel

SECTION F6

183" BWR VESSEL

CRD-HSR NOZZLE

FATIGUE ANALYSIS

D. SIMPLIFIED ELASTIC-PLASTIC ANALYSIS

Reference 22 has been used for calculating the equivalent strain amplitude to be compared with the fatigue curves of Section III. The table on page F6-20 shows the calculation of the overall effective stress concentration factors, K_t. The maximum range of peak stress intensities obtained from PRINCESS, as previously mentioned, have been listed in Column A. Column B lists the maximum pipe reacton stress intensity obtained from NAPALM runs. The sum of the values of Columns A and B is the maximum range of peak stress intensities, listed in Column C. Previously calculated nominal effective stress ranges are tabulated in Column D. The desired overall effective concentration factor is obtained by dividing the value of Column C by that of Column D for each point.

The table on page F6-21 shows the calculation of S_{alt} at each point. Column A of the table lists previously calculated values of the nominal elastic calculated effective stress range. In Column B parameters necessary for use with graphs of the reference paper have been calculated. The values of the discontinuity strain concentration factor, K_ε, have been obtained from Fig. 20 of the reference paper and are listed in Column C. Factors A for calculating the overall fatigue reduction factor, $K_f = K_t + A(K_t - 1)$, have been listed in Column D. These values have been obtained from Figure 13 of the reference paper for carbon steel and the solid line of Figure 15 for stainless steel materials. In Column E of the table the values of K_f have been calculated. Finally the values of $S_{alt} = \frac{1}{2} K_f K_\varepsilon S_{rij}(n)$ have been calculated and listed in Colunm F. The highest value of 145,100 psi occurs at Point 5 of the model. This point being located on the stainless steel safe end, Figure N-415(B) of Section III is used. The corresponding number of allowable cycles is 400.

The cycles contributing to fatigue of this nozzle are:

Startup-shutdown	120	
Loss of feedwater pumps	10	
Turbine generator trip	40	
Reactor overpressure with delayed scram	1	
Relief valve blowdown	2	
All other scrams	147	
Normal operation (see 35B9990, Sht. 6)	10	
Total	330	cycles

Conservatively assuming that each of the above cycles will result in the maximum calculated stress range, the usage factor will be $\frac{330}{400} = .825$.

However, because of many simplifying conservative assumptions throughout the analysis, the actual margin against fatigue failure will be considerably greater than indicated by this.

NOTE: An alternate method of calculating skin stresses would have been to use the maximum temperature change of 546-50 = 496°F, and method of ASME Publication #69-GT-107. Since during the scram cycles there is no flow thru nozzle, free convection can be assumed. From Page T6-7,

$h = 93.4\ (\Delta T)^{1/3}$ and for a maximum ΔT of 12°F, $h = 214$. Value of ℓ is half the safe end thickness or $\ell = \frac{.278}{2 \times 12} = .0116$ feet, and value of K for the stainless steel safe end is 9.4. Therefore, $\frac{h\ell}{k} = \frac{214 \times .0116}{9.4} = .264$ and from the curves of referenced paper the correction factor S1 = 0.1. Therefore, the maximum value of the skin stress on the inside of the safe end would be

$$S_{1x} \frac{E\alpha\Delta T}{1-\nu} = 0.1 \times \frac{30 \times 10^6 \times 7 \times 10^6}{1 - .3} (496) = 14{,}900 \text{ psi}$$

This is less than the value previously calculated for the critical point 5. The value calculated with the previous method and used in this analysis was 56,800 psi (see column D of Page F6-17). This indicates that skin stresses have adequately been accounted for.

	A	B	C	D	E
POINT NUMBER	MAX. RANGE OF PEAK STRESS INTENSITIES	MAX. PIPE REACTION STRESS INTENSITIES	A+B $S_{rij}(p)$	$S_{rij}(n)$	C/D $K_t \geq K$
1	73,950	9931	83881	64991	1.29
2	54,530	11996	66526	66526	1.00
3	122,400	9934	132334	72094	1.84
4	101,300	11999	113299	81269	1.40
5	160,300	2060	162360	47655	3.41
6	60,545	2891	63436	50566	1.26
7	19,200	2552	21752	13999	1.55
8	21,890	3425	25315	15121	1.68
9	19,118	2597	21715	21855	1.00
10	24,795	3491	28286	28836	1.00
11	19,947	4259	24206	24206	1.00
12	27220	4259	31479	33264	1.00
13	33950	4259	38209	39994	1.00
14	27611	5059	32670	34455	1.00
15	33739	4389	38128	39913	1.00
16	34346	4389	38735	40520	1.00
17	19739	4389	24128	24504	1.00
18	17020	5219	22239	24024	1.00
19	44636	4627	49263	48808	1.01
20	38352	4627	42979	42524	1.01
21	19790	4627	24417	23102	1.06
22	32014	5509	37523	37068	1.01

CHICAGO BRIDGE & IRON COMPANY OAK BROOK ENGINEERING

	A	B	C	D	E	F
POINT NUMBER	$S_{rij}(n)$	$\frac{S_{rij}(n)}{3S_m}$	K_ϵ	FACTOR "A"	$K_f = K_t + A(K_t - 1)$	S_{ALT} $\frac{1}{2} K_f K_\epsilon S_{rij}(n)$
1	64991	$\frac{65.0}{39.9} = 1.63$	1.40	0.7	1.49	67.8
2	66526	$\frac{66.5}{39.9} = 1.67$	1.47	0.7	1.00	48.8
3	72094	$\frac{72.1}{39.9} = 1.81$	1.55	0.7	2.43	136.0
4	81269	$\frac{81.3}{39.9} = 2.04$	1.74	0.7	1.68	119.0
5	47655	$\frac{47.6}{39.9} = 1.19$	1.13	0.7	5.10	145.1
6	50566	$\frac{50.6}{39.9} = 1.27$	1.15	0.7	1.44	46.2
7	13999	$\frac{14.0}{39.9} < 1.00$	1.0	0.7	1.93	13.5
8	15121	$\frac{15.1}{39.9} < 1.00$	1.0	0.7	2.16	16.3
9	21855	$\frac{21.9}{39.9} < 1.00$	1.0	0.7	1.00	11.0
10	28836	$\frac{28.8}{39.9} < 1.00$	1.0	0.7	1.00	14.4
11	24206	$\frac{24.2}{80.0} < 1.00$	1.0	0.65	1.00	12.1
12	33264	$\frac{33.3}{80.0} < 1.00$	1.0	0.65	1.00	16.7
13	39994	$\frac{40.0}{80.0} < 1.00$	1.0	0.65	1.00	20.0
14	34455	$\frac{34.5}{80.0} < 1.00$	1.0	0.65	1.00	17.3
15	39913	$\frac{39.9}{80.0} < 1.00$	1.0	0.65	1.00	20.0
16	40520	$\frac{40.5}{80.0} < 1.00$	1.0	0.65	1.00	20.3
17	24504	$\frac{24.5}{80.0} < 1.00$	1.0	0.65	1.00	12.3
18	24024	$\frac{24.0}{80.0} < 1.00$	1.0	0.65	1.00	12.0
19	48808	$\frac{48.8}{80.0} < 1.00$	1.0	0.65	1.02	24.5
20	42524	$\frac{42.5}{80.0} < 1.00$	1.0	0.65	1.02	21.4
21	23102	$\frac{23.1}{80.0} < 1.00$	1.0	0.65	1.10	12.5
22	37068	$\frac{37.1}{80.0} < 1.00$	1.0	0.65	1.02	18.7