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DAEC Plant Support Center
Operated by Nuclear Management Company, LLC

June 21, 2001
NG-01-0789

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 June 8, 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 as a facsimile on June 7, 2001 to facilitate discussions. Consequently, the Attachment to this letter contains that RAI and our Responses.

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 ______ for 6/21/01
Gary Van Middlesworth
DAEC Site Vice-President

State of Iowa
(County) of Linn

Signed and sworn to before me on this 21 day of June, 2001,
by John Bjorseth.

Lila Hancock
Notary Public in and for the State of Iowa

LILA HANCOCK
Commission Number
MY COMMISSION EXPIRES

5-14-2002
Commission Expires

Attachment: DAEC Responses to NRC Plant Systems Branch Request for Additional Information Regarding Proposed Amendment for Power Uprate

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

DAEC Responses to NRC
Plant Systems Branch
Request for Additional Information
Regarding Proposed Amendment for Power Uprate

With regard to the following RAI, refer to General Electric's Safety Analysis Report for the DAEC EPU (NEDC-32980P, DRF A22-00100-73, Class III), dated November 2000:

I. Report Section 4.4, "Control Room and Technical Support Center Habitability"

1. The third paragraph reads as follows:

"The charcoal filter bed removal efficiency for radioiodine is unaffected by EPU. As a result of application of alternative source terms (AST) derived from NUREG-1465 (See Section 9.2), the calculated post-DBA-LOCA total iodine loading on the Control Building SFUs decreases to 8.25E-06 mg/gm of charcoal at the EPU conditions. In addition, the calculated post-DBA-LOCA total iodine loading on the TSC SFUs decreases to 7.54E-06 mg/gm of charcoal at the EPU conditions. Both of these results are well below the Regulatory Guide 1.52 value of 2.5 mg/gm of charcoal. Therefore, the systems contain sufficient charcoal to ensure iodine removal efficiencies greater than 90%".

Explain how the application of ASTs were used to determine the results of calculated post-DBA-LOCA total iodine loadings on the Control Building and Technical Support Center (TSC) Standby Filter Units (SFUs) at EPU conditions, which are " well below" the RG 1.52 value.

DAEC Response:

Filter loading calculations were performed for the Standby Gas Treatment System (SGTS), and Control Room (CR) and Technical Support System (TSC) Standby Filter Units (SFUs), assuming Extended Power Uprate (EPU) conditions. The filter loading calculations used the source term inventory, release timing, isotopic release fraction assumptions, and iodine chemical form assumptions used to perform radiological consequences dose analyses in support of the DAEC's conversion to the Alternate Source Term (AST) of 10 CFR 50.67. The limiting event for filter loading was determined to be the Design Basis Accident-Loss-of-Coolant Accident (DBA-LOCA).

A new DAEC-specific source term inventory was developed for the AST, reflecting the change to GE14 fuel design and operation at EPU conditions with two year operating cycles. 100% of the CR and TSC intake flows were assumed to be processed by the CR and TSC SFUs, respectively (excluding Noble Gases and including the stable isotopes of Iodine).

In each case, the large decrease in charcoal filter loading was related to the change in chemical form of Iodine associated with the AST. In accordance with the AST (Ref. Reg. Guide 1.183), 95% of the DBA-LOCA Iodine source term is in the particulate form. The previous NRC guidance (Ref. Reg. Guide 1.3) assumed only 5% of the Iodine was particulate and the remaining 95% was in organic and elemental forms, which would pass through the mechanical filters onto the charcoal filter beds. To maximize the charcoal filter loading in the current evaluations, we assumed nominal efficiencies on the mechanical filtration (99%). Consequently, only about 6% of the total Iodine source term using the AST, reaches the charcoal filter beds, compared to 95% using the Reg. Guide 1.3 assumptions.

Therefore, the change in assumed chemical forms of the Iodine, associated with the AST, leads to the charcoal filter loading at EPU conditions being well below the Reg. Guide 1.52 limit, as shown in our Response to Question 2 below.

2. The fourth paragraph reads as follows:

"An evaluation of the fission product accumulation on both the Control Building and TSC SFU prefilters and High Efficiency Particulate Air (HEPA) filters was made performing a comparison to the Standby Gas Treatment System (SGTS), which is a much larger capacity system and exposed to a higher loading of post-DBA-LOCA. This evaluation concluded that the Control Building Ventilation System and the TSC Air Cleanup System retain the capability of meeting the design basis function of limiting control room operator and emergency response personnel dose to within the guidelines of 10 CFR 50, Appendix A, General Design Criteria and 10 CFR 50.67 following a DBA-LOCA".

Clarify how an evaluation of the fission product accumulation on both the Control Building and TSC SFU prefilters and HEPA filters was made by performing a comparison to the SGTS. Explain how this type of comparison is sufficient to determine that the Control Building Ventilation System and TSC Air Cleanup System retain the capability of limiting control room and emergency response personnel dose to within regulatory guidelines at EPU conditions.

DAEC Response:

While the stated results were based upon a conservative evaluation, which compared relative filter sizes and system flow capacities between the CR and TSC SFUs with those of the SGTS to arrive at the stated filter loadings, actual filter loading calculations were performed as part of the AST analyses. In the AST evaluation, to maximize the loading on the mechanical filters, we assumed a 100% efficiency for particulate filtration. The results of those calculations are as follows:

	Mechanical Filters		Charcoal Filter	
Filter	Particulate Loading	Design Limit	Iodine Loading*	RG 1.52 Limit
CR SFU	1.92E-6 kg	0.9 kg	6.42E-6 mg/gm	2.5 mg/gm
TSC SFU	8.59E-7 kg	0.9 kg	5.86E-6 mg/gm	2.5 mg/gm

* It should be noted that the values stated in the PUSAR, derived from the simplified SGTS comparison evaluation, are conservative relative to the calculated values in the AST analyses provided here.

Based upon the above results, we can continue to conclude that the SFUs are capable of maintaining the dose to the CR and TSC personnel to well within the regulatory limits.

II. Report Section 4.5, "Standby Gas Treatment System"

1. The second paragraph reads as follows:

"The charcoal filter bed removal efficiency for radioiodine is unaffected by the EPU. As a result of application of AST derived from NUREG-1465 (see Section 9.2), the post-DBA-LOCA (the limiting event) total iodine loading is 0.003 mg/gm of charcoal at the EPU conditions, which is well below the Regulatory Guide 1.52 value of 2.5 mg/gm. The system therefore contains sufficient charcoal to ensure iodine removal efficiencies greater than the current design requirement of 99%".

Explain how the application of ASTs were used to determine the result of calculated post-DBA-LOCA total iodine loading on SGTS charcoal filters at EPU conditions, which is "well below" the RG 1.52 value.

DAEC Response:

As noted in our Response to Question I.1 above, the application of the AST changes the assumed chemical forms of the Iodine in the source term, i.e., the ratio of particulate to non-particulate species. The large increase in particulate species, which is filtered by the upstream mechanical filters, results in the significantly decreased loading on the charcoal filters to values "well below" the Reg. Guide 1.52 value.

2. The third paragraph reads as follows:

"In addition, evaluation of fission product accumulation within the SGTS filter trains, consistent with AST assumptions, shows that both the increase in component operating temperature due to decay heating, and the increase in solids loading on the prefilters and HEPA filters are well within system's design limits. Therefore, it is concluded that the SGTS retains its capability of meeting its design basis function of limiting offsite dose within the guidelines of 10 CFR 50.67 following a design basis accident".

Explain how the application of AST assumptions used in evaluation of fission product accumulation within the SGTS filter trains shows that the increase in solid loading on the prefilters and HEPA filters are within system design limits and thus allows the determination that the SGTS retains its capability to limit offsite dose within regulatory guidelines at EPU conditions.

DAEC Response:

As noted in our Response to Question I.1 above, application of AST assumptions results in 95% of the fission products reaching the SGTS being in the particulate form and, therefore, accumulate on the prefilter or HEPA filter upstream of the charcoal filters. Using the nominal design filtration efficiency of 80% for the pre-filters, results of the evaluation show that the fission product mass loading is 306 grams, well below the 760 gram design capacity. For the HEPA filters with a nominal efficiency of 99.97%, the mass loading is 76 grams after 30 days, only 2% of the 3600 gram design capacity. Thus, there is ample margin to the design filter loading, even if we maximized the filter loadings by assuming 100% efficiency individually on each filter, instead of the nominal values above.

This, along with the significant decrease in filter loading on the charcoal beds noted in PUSAR Section 4.5, allows us to conclude that the SGTS retains its ability to limit offsite (and onsite) doses to well within regulatory guidelines, as seen in PUSAR Table 9-3 for the DBA-LOCA.

III. Report Section 6.6, "Power Dependent Heating, Ventilation, and Air Conditioning"

I. The fifth paragraph reads as follows:

"The heat loads discussed above represent an increase of approximately 2% to 5% in the drywell cooling, reactor building, and main steam tunnel and approximately 21% in the heater bay area total heat loads. Based on a review of design basis calculations and environmental qualification design temperatures, these increases are within the excess design capability available. Therefore, the design and operation of the HVAC is not adversely affected by the EPU".

Explain what constitutes the total heat load increase of 21% in the heater bay area and how this heat load increase is accommodated by HVAC systems, such that environmental operating temperatures remain within design basis limits. Clarify what is meant by "excess design capability available". Provide an example or two demonstrating how based on a review of design basis calculations and environmental qualification design temperatures, the total heat load increase is within the "excess design capability available" at EPU conditions.

DAEC Response:

For the PUSAR evaluation of the Turbine Building Heating, Ventilation and Air Conditioning (HVAC) performance, assumptions were made that maximized the duty on the cooling units. For example, the largest increase in the "sub-area" heat load (21% near the Main Condenser and Feedwater Heater #1) was conservatively assumed to apply to the entire condenser/heater bay area. Most "sub-areas" were predicted to experience an increase in heat load of only 4 – 10%. In addition, the 21% increase is referenced to the original heat balance for 1593 MWt, not the current licensed power level of 1658 MWt. The inlet air temperature used was the same as that used to originally size the cooling units, which is conservative relative to the actual inlet air temperature. The evaluation resulted in the bulk area temperature increase of 4.9 °F stated in PUSAR Section 6.6.

The Turbine Building HVAC system is sized with enough margin to accommodate the expected increase in actual heat load in the Feedwater heater bay area. This can be seen in the small increase in outlet cooling water temperature (< 3.5 °F) in the coolers for this 21% increase in heat load (Ref. PUSAR Section 6.4.4). Because of this excess cooling capacity, and the use of very conservative inputs in the analysis, we do not expect to see any noticeable increase in actual operating temperatures in this area.

For the purposes of this RAI Response, we will conservatively apply this bulk area increase (5°F) to the current environmental qualification (EQ) temperature of a component to illustrate the impact on qualification of equipment in this area. In reality, the EQ Program uses actual, monitored temperatures, as close to the component as practical, to determine component lifetimes.

As our example, the current qualification for a motor-operated valve located in the heater bay (MO 1362A-O) is based on an in-service temperature of 155.6 °F. Assuming the ambient operating temperature increases to 160.6 °F, the "new" qualified life is provided as follows:

Using the Arrhenius methodology:

$$t_1 = t_2\, e^{[(\varnothing/K)(1/T_1 - 1/T_2)]}$$

where: t_1 = qualified life duration
- t_2 = as-tested aging time = 100 hours
- T_1 = "new" service temperature = 160.6 °F (344.6 °K)
- T_2 = test temperature = 356 °F (453.16 °K)
- $\varnothing$ = 1.02 eV
- K = Boltzman's Constant = 8.617 E-5 eV/°K

Thus, the "new" qualified life (t_1) is 42.7 years. As this is beyond the licensed operating period of the plant, we can conclude that there is "excess design capability" in the equipment performance in this area, even if we assumed this worst-case increase in operating temperature, due to EPU.