June 11, 2001
NG-01-0764

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 1, 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 30, 2001 to facilitate discussions. As a result of this conference call, modifications were made to this draft RAI and it was retransmitted to us electronically on May 9, 2001. The Attachment to this letter contains the modified RAI and our Responses.

The following new commitment is being made in this letter:

The NMC will either: 1) perform the generator load reject and full main steamline isolation valve closure transients tests required by the Extended Power Uprate (EPU) topical report ELTR-1, at their respective required power levels; or, 2) NMC will submit a request to deviate from ELTR-1, with supporting additional justification for not performing these large transient tests at uprated power conditions, and we will not operate the DAEC at power levels above that at which the individual tests are required by ELTR-1 prior to NRC approval of that deviation request.

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
Gary Van Middlesworth
DAEC Site Vice-President

State of Iowa
(County) of Linn

Signed and sworn to before me on this 11th day of June, 2001,

by John Bjorseth.

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

NANCY S. FRANCK
Commission Number 011041
MY COMMISSION EXPIRES
9-28-01

Commission Expires

Attachment: 1) DAEC Responses to NRC Reactor Systems Branch Request for Additional Information Regarding Proposed Amendment for Power Uprate

cc: T. Browning
R. Anderson (NMC)
B. Mozafari (NRC-NRR)
J. Dyer (Region III)
D. McGhee (State of Iowa)
NRC Resident Office
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DAEC Responses to NRC
Reactor Systems Branch
Request for Additional Information
Regarding Proposed Amendment for Power Uprate

1. Section 10.4, of your submittal, "NEDC-32980P," stated that DAEC does not intend to perform tests involving automatic scram from high power, because Duane Arnold's operating history, the transient analyses performed at the uprated condition and comparable uprate tests performed at other stations such as Hatch, all demonstrate that the unit can withstand these tests. You pointed out that high power tests will subject the unit to unnecessary plant transients. You added that if Duane Arnold experiences Main Steam Isolation Valves Closure (MSIVC) or Generator Load Reject at the uprated RTP, you will analyze the data available and confirm that the unit responded as expected. You concluded that you have verified that the data acquisition system will provide the necessary data to assess the plant's response to the transient.

   The NRC-approved ELTR-1 requires the MSIVC test to be performed if the power uprate is more than 10% above the previously recorded MSIV closure transient data. The topical report also requires the GLR test to be performed if the power uprate is more than 15% of the previously recorded transient data.

   Please, provide further clarifications, information and answers to the following questions.

   (1) You proposed to implement the power uprate in phases. Specify the % power uprate to be implemented in each phase.

   DAEC Response:

   Original Rated Thermal Power (ORTP) = 1593 MWth
   Current Rated Thermal Power (CRTP) = 1658 MWth
   EPU Phase I = 1790 MWth (112.4% ORTP/107.9% CRTP)*
   EPU Phase II = 1912 MWth (120% ORTP/115.3% CRTP)

   * Approximate value. The final value will be determined during system performance testing during Cycle 18.

(2) **Describe the type of high power startup tests you performed in the initial startup and the basis of the requirements.**

DAEC Response:

The power ascention testing performed as part of original plant startup is described in DAEC UFSAR Table 14.2-3. The basis for the testing is described in DAEC UFSAR Section 14.2.1.3. In addition, the supporting basis for the individual test performance criteria is General Electric specification 22A2569 "General Electric Startup Test Specification," described more fully in our Response to Question #4 below.

(3) **Demonstrate that you will comply with the ELTR-1 requirement for each phase of the power uprate. Identify which MSIVC and GLR events would represent your transient event of record and indicate the % of power increases from the 100% RTP at the time of the event.**

DAEC Response:

Section L.2.4 (2) of ELTR-1 (NEDC-32424-P-A) specifies, "When the power uprate is within 10% and 15% power of previously recorded data, for MSIV closure and Generator Load Reject events, respectively, no uprate specific tests are necessary. Previously recorded data may include unplanned as well as planned transients." Additionally, the response to an RAI[1] included in the NRC approved copy of ELTR-1, also indicates the acceptability of data available as a result of inadvertent events in lieu of data obtained from a special test in fulfilling the large transient testing requirements.

The DAEC experienced unplanned events at approximately 1658 MWth (as detailed in our Response to Question 4 below) which provides the data necessary to fulfill the requirements of Section L.2.4 of ELTR-1 up to and including power levels of 1823.8 MWth for the MSIVC test and 1906.7 MWth for the GLR test. As noted in our Response to Question 1 above, we do not intend to operate above these power levels during EPU Phase I, and as such, the large transient tests would not be required at this time. As EPU Phase II is implemented, either the large transient test(s) will be scheduled and conducted in accordance with ELTR-1 at the appropriate power levels; or, NMC will seek NRC relief from performing the high power test(s), prior to exceeding the thermal power level required for that specific test.

[1] NRC Request for Additional Information (RAIs) on GE Licensing Topical Report NEDC-32424P, "Generic Guidelines for GE Boiling Water Reactor Extended Power Uprate", (TAC No. M91680).

(4) **For each high power event of reference, provide your post-scram event evaluation and the applicable transient analysis that would indicate how the actual plant response parallels the analytical results.**

DAEC Response:

The ability to compare the actual plant events in any significant detail to the analytical predictions of the computer codes is limited. The codes can perform their calculations with much more precision and at much faster time steps than actual in-plant recording capability. This point can best be made by the fact that we must use a setpoint methodology that "corrects" the actual in-plant settings of these instruments to compensate for these shortcomings, such as response time, accuracy (both instrument and process measurement), and repeatability, to be able to correlate back to the analytical results. In addition, the code calculation rarely matches the actual plant response, due to such factors as "simplifications" and other correlations for complex physical phenomena, bounding assumptions in the analysis and other "approximations" in plant equipment performance characteristics, which allow the code to be run in a reasonable time within the processing capability of the computer system used. What we can reasonably do is compare the basic trends in the key parameters and look for "go/no-go" type comparisions (e.g., did the Safety/Relief Valves (SRVs) open when pressure approached their setpoint?; not, did the SRVs open at 3.512 seconds into the event as predicted by the code?). Consistent with our response to Generic Letter 83-28 "Required Actions Based on Generic Implications of Salem ATWS Events", the DAEC conducts a post-scram review of each event to evaluate any anomalies observed in the plant response. This review compares the specific event response to any previous or similar events at DAEC, as well as to compare the basic parameter trends and sequence of events to the analysis. This is how the post scram reviews are conducted to arrive at the conclusion that the plant behaviour seen was "as expected."

Startup testing requirements for the original DAEC test program were listed in Specification 22A2569 "General Electric Startup Test Specification". Included in this specification were Level 1 and Level 2 acceptance criteria. Level 1 criteria established a minimum performance where a hold should be placed on operation at a higher power level until the unacceptable performance could be corrected. Level 2 criteria listed performance criteria for desired system performance. Consequently, if we are going to treat these actual plant events as satisfying the ELTR testing requirements, then we must apply these same acceptance criteria, not whether the plant event matches the computer code predictions. It should be noted that a number of the original startup test acceptance criteria have become Technical Specification Surveillance Requirements (SR) and would no longer be specifically part of the testing at uprated conditions. For example, SR 3.6.1.3.5 confirms that the MSIV stroke time is between 3 and 5 seconds and SR 3.3.1.1.19

confirms the Response Time of Reactor Protection System (RPS) signals. Thus, acceptance criteria of this nature have been removed in the following discussion, as their compliance is assured by SR 3.0.1.

For the Main Steam Isolation Valve Closure event the criteria are:

Level 1:

a) Reactor pressure shall be maintained below 1240 psig, the setpoint of the first safety valve, during the transient following closure of all valves.

Level 2:

a) The maximum reactor pressure should be less than 1200 psig, 40 psi below the first safety valve setpoint, during the transient following closure of all valves. This pressure margin should prevent safety valve weeping.

For the Generator Load Reject event the criteria are:

Level 1:

a) Reactor pressure shall be maintained below 1240 psig, the setpoint of the first safety valve, during the transient following the fast closure of the control valves.

b) Reactor thermal power, as indicated by the simulated heat flux, must not significantly exceed that analyzed by the Transient Analyses (non-LOCA) for the Generator Load Rejection event.

c) The Turbine Control Valves must begin to close before the Turbine Stop Valves during the control valve trip.

d) Feedwater settings must prevent flooding of the main steam lines following this transient (reactor level < 266" TAF).

Level 2:

a) The maximum reactor pressure should be less than 1200 psig, 40 psi below the first safety valve setting, during the transient following fast closure of the turbine stop and control valves. This pressure margin should prevent safety valve weeping.

b) The measurement of simulated heat flux must not be greater than that analyzed by the Transient Analyses (non-LOCA) for the Generator Load Rejection event.

c) The pressure regulator and feedwater controls must regain control before a low pressure reactor isolation (850 psig) or high level trip of feedwater pumps (211" TAF) occurs.

d) Feedwater control adjustments shall prevent low level initiation of the HPCI system (116.7" TAF) and main steam isolation (46.6" TAF) as long as feedwater flow remains available.

Since the licensed thermal power rating for the DAEC was increased to 1658 MWth in 1985 the DAEC has experienced 23 reactor scrams. Two events are of particular merit with respect to large transient testing recommended by ELTR-1. First, on March 5, 1989, the DAEC experienced a full isolation of the main steamlines. Second, on June 23, 2000, a main generator backup lockout differential current trip resulted in a control valve fast closure event. Below is a summary of key parameter values and acceptance criteria of maximum parameters for these events at CRTP.

Initial Conditions Event 1: With the reactor operating at approximately 1658 MWth, one main steam isolation valve unexpectedly closed due to a failed solenoid. Reactor pressure and reactor power increased and steam flow through the remaining three steam lines increased until a full isolation of the main steam lines was initiated on high steam flow (Nominal setpoint at 140% rated steam flow).

Parameter	Event Peak Value	Level 1 Criteria	Level 2 Criteria
Reactor water level (min.)	119 inches TAF	N/A	N/A
Neutron Flux (max.)	115%	N/A	N/A
Reactor Pressure (max.)	1126 psig	<1240 psig	<1200 psig

Comments: No significant anomalies in the plant response were observed. The event of March 5, 1989 satisfies the APED 22A2569 requirements as a successful test.

Initial Conditions Event 2: The reactor was operating at approximately 1658 MWth when a main generator backup lockout differential current trip resulted in a control valve fast closure event. The primary source signal for the reactor scram was the pressure switches on the Electro-Hydraulic Control (EHC) that signal the fast closure of the turbine control valves.

Parameter	Event Peak Value	Level 1 Criteria	Level 2 Criteria
Reactor water level (max.)	>211 inches TAF	<266 inches TAF	<211 inches TAF
Reactor water level (min.)	164 inches TAF	N/A	>116.7 inches TAF
Heat Flux (max.)	100%	<115%*	<112%
Reactor Pressure (max.)	1115 psig	<1240 psig	<1200 psig
Reactor Pressure (min.)	~920 psig	N/A	>850 psig

* The criteria is "significantly exceed that analyzed" and has been interpreted as 3% greater than the analysis value.

Comments: No significant anomalies in the plant response were observed. The event of June 23, 2000 satisfied the testing and acceptance criteria of APED 22A2569 with one exception; feedwater controls allowed reactor level to increase to greater than the feedwater pump trip setpoint. While the Level 2 criterion was not met, the Level 1 criterion that the steam lines not be flooded was met. There is no safety consequences to the Level 2 criterion not being met, which occurred approximately two minutes after the initial event, as normal reactor level control was readily re-established. Therefore, the event of June 23, 2000 satisfies the APED 22A2569 requirements as a successful test.

Thus, based upon the above being acceptable tests at 1658 MWt, the ELTR-1 testing would not be required at the DAEC until a thermal power level of 1823.8 MWt for the MSIV closure test and 1906.7 MWt for the GLR test.

(5) You cited uprated tests performed at Hatch as an example of industry experience that indicate Duane Arnold could also withstand isolation transients from high power. For the Hatch Unit 1 and 2 uprate tests, compare the units actual response with the applicable transient analyses. Discuss how this industry experience demonstrates that for Duane Arnold power uprate, the cycle-specific limiting transient analyses would provide equivalent protection compared to startup tests.

DAEC Response:

First, a clarification of our position relative to Plant Hatch. Our original intent of referencing Plant Hatch was to cite precedence for not performing these high power transient tests, as Southern Nuclear Operating Company's (SNOC) application for Extended Power Uprate was granted with the exception from the ELTR-1 requirements. Plant Hatch is a BWR/4 with a Mark I containment of essentially the same design as the DAEC, including the key balance of plant area of turbine-generator control logic (i.e., electro-hydraulic control system). Consequently, our plant response to the two key transient tests would be very similar to Plant Hatch and would not require DAEC to perform the tests due to some uniqueness in design. Although Plant Hatch, Unit 2, was granted an exception to performing these tests, they subsequently had an unplanned event which resulted in a generator load reject from their full uprated power level. As noted in SNOC's report, LER #1999-005, no anomolies were seen in the plant's response to this event. In addition, Plant Hatch, Unit 1, has experienced one turbine trip and one generator load reject event subsequent to its uprate, (Ref. LERs # 2000-004 and #2001-002). Again, the behavior of the primary safety systems was as expected. And, more importantly, no new plant behaviors have been observed that would indicate that the analytical models being used are not capable of modelling plant behavior at the Extended Power Uprate conditions.

As discussed in our Response to Question 4, the DAEC has exhibited expected response to these types of events at the current power level. Individual components are tested and calibrated to ensure they operate as designed. System designs, as demonstrated by previous transients, ensure that the individual components work properly synergistically. Thus, industry (Hatch) and DAEC-specific experience demonstrate that by designing facilities to mitigate the consequences of these events, as predicted by the analytical tools, and by properly maintaining the plant equipment, the consequences (peak heat flux, vessel pressure, etc.) of operational transients are well within system capabilities, and thus, the analytical tools being used provide the "equivalent protection" of performing actual plant transient tests.

While DAEC is of the opinion that the large transient tests will yield no valuable information, unnecessarily cause large perturbations in plant operation, and cause several days of lost electrical generation, as stated in our Response to Question 3 above, DAEC will comply with the testing requirements of ELTR-1 or seek specific relief from the Staff to not perform the tests.