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DAEC Plant Support Center
Operated by Nuclear Management Company, LLC

May 10, 2001
NG-01-0637

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 requested additional information to our application. The proposed Request for Additional Information (RAI) had been provided to us as a faximile earlier to facilitate discussions. As a result of this conference call, one clarification was made in Question 6.2(b) of the draft RAI. The Attachment to this letter contains that RAI, including the clarification, and our Responses.

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
Gary Van Middlesworth
DAEC Site Vice-President

State of Iowa
(County) of Linn

Signed and sworn to before me on this 10th day of May, 2001,

by Gary Van Middlesworth.

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

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

Commission Expires

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

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

DAEC Responses to NRC
Human Factors Branch
Request for Additional Information
Regarding Proposed Amendment for Power Uprate

6.1 Changes in Emergency and Abnormal Operating Procedures

Describe how the proposed power uprate will change the plant emergency and abnormal procedures.

DAEC Response:

As described in Section 11.1.2.4 of NEDC-32980 (PUSAR), the Emergency Operating Procedures (EOPs) have been revised to reflect the uprated conditions, as well as the introduction of the GE14 fuel design. Minor changes to various EOP curves and limits resulted. For example, Boron Initiation Injection Temperature (BIIT), Pressure Suppression Pressure, and Heat Capacity Temperature Limit (HCTL). The most noteworthy change is in the Minimum Number of SRVs Required For Emergency Depressurization going from 3 to 4 (out of 6 available). However, none of these changes has any impact on the existing accident response strategies or require new operator actions.

The impact on Abnormal Operating Procedures (AOPs) is also not significant. Most of the changes are directly tied to the change in definition of Rated Thermal Power from 1658 MWt to 1912 MWt (or some percentage thereof). Others are tied to a specific parameter that is changed, such as rated steamflow. No significant changes in actual operator actions have been identified as a result of these parameter/definition changes in the AOPs. For the Station Blackout (SBO) AOP, the operators will need to lower reactor pressure late in the 4 hour coping period in order to stay within the EOP HCTL curve. This action is currently part of the operator strategy for coping with an SBO event. Consequently, the uprate does not have a significant impact on this AOP.

6.2 Changes to Risk-important Operator Actions Sensitive to Power Uprate

a) Describe any new risk important operator actions required as a result of the proposed power uprate.

DAEC Response:

As stated in Sections 10.5.3.4 and 11.1.2.4 of the PUSAR, no new risk important operator actions have been identified.

b) Describe changes to any current risk-important operator actions that will occur as a result of the power uprate.

Per the conference call of May 3, 2001, an additional clarification was made to this question to also include a short discussion of these operator actions, in particular, the indictation that directs the operator to perform the actions, the number of manipulations involved, and direct feedback mechanisms on successful execution.

DAEC Response:

The risk-important actions are listed in Section 10.5.3.4 of the PUSAR. Attached Table-1 is a more-detailed discussion of those operator actions, as requested.

c) Explain any changes in plant risk that result from changes in risk-important operator actions.

(e,g., Identify operator actions that will require additional response time or will have reduced time available. Identify any operator actions that are being automated as a result of the power uprate. Provide justification for the acceptability of these changes).

DAEC Response:

As discussed in Section 10.5 of the PUSAR, virtually all of the change in plant risk (Core Damage Frequency (CDF) and Large Early Release Frequency (LERF)) is due to the increases in Human Error Probability (HEP). However, as shown in Table 10-3 of the PUSAR and discussed in Sections 10.5.4 and 10.5.5, these increases in CDF and LERF are judged to be not significant. Thus, no operator actions are being automated as a result of the power uprate.

6.3 Changes to Control Room Controls, Displays and Alarms

a) Describe any changes the proposed power uprate will have on the operator interfaces for control room controls, displays and alarms. For example, what zone markings (e.g., normal, marginal and out-of-tolerance ranges) on meters will change?

DAEC Response:

See attached Table-2. As stated in our original application, this list of modifications constitute "planned actions" which do not represent formal commitments on NMC's part to implement them exactly as described or on this proposed schedule.

b) What set points will change?

DAEC Response:

Section 5.3 of the PUSAR discusses Instrument Setpoints. The major change is the incorporation of new Average Power Range Monitor (APRM) flow-biased setpoints as part of the implementation of Maximum Extended Load Line Limit Analysis (MELLLA), which is in parallel with the power uprate. Other NSSS setpoint changes are the Main Steamline High Flow and High Radiation isolations and Turbine First-stage Pressure trip bypass (bypasses the turbine/generator trip scram and recirculation pump trip signals at low power).

c) How will the operators know of the change?

DAEC Response:

All setpoint changes are done under the DAEC design control process, which requires that all design changes (modifications) be evaluated by the Training Department for impact on both operator and craft (i.e., technician) training.

d) Describe any controls, displays, alarms that will be upgraded from analog to digital instruments as a result of the proposed power uprate.

DAEC Response:

Power Uprate does not require any instruments to be upgraded from analog to digital systems. One instrument (condensor backpressure alarm) is being replaced with a digital device, as a system enhancement. The replacement instrument has the capability for a variable setpoint to avoid nuisance alarms, as condensor vacuum is directly dependent upon ambient conditions. Operator actions in response to this alarm are unaffected.

e) How operators were tested to determine they could use the instruments reliably.

DAEC Response:

It is not necessary to "test" the operators on this replacement, as they do not physically operate this instrument and, as stated in d) above, their actions in response to this control room alarm are not changed by this modification. However, the modification overview will be discussed in training.

6.4 Changes on the Safety Parameter Display System

a) Describe any changes the proposed power uprate will have on the Safety Parameter Display System.

DAEC Response:

As noted in our response to 6.1 above, various EOP curves and limits have been revised. These, in turn, require that the SPDS be updated as well.

b) How will the operators know of the changes?

DAEC Response:

As discussed in Sections 10.6 and 11.1.2.4 of the PUSAR, these changes will be incorporated into the formal operator training program.

6.5 Changes to the Operator Training Program and the Control Room Simulator

a) Describe any changes the proposed power uprate will have on the operator training program.

DAEC Response:

As discussed in Section 10.6 of the PUSAR, the impact of the uprate, itself, on operator training is not expected to be significant. As noted in the PUSAR as part of the power uprate "overview," there will be demonstration of expected plant response to key transient/accident events on the plant reference simulator. As noted in PUSAR sections 5.3.8 and 9.1, the loss-of-feedwater event, in particular, will be reviewed due to the increased likelihood of reaching the low-low-low reactor level trip setpoint.

As part of our normal design change process, plant modifications are reviewed for impact on training, both to the operators and other plant personnel. DAEC uses the INPO-accredited process of the Systematic Approach to Training, where the individual Task Analyses are evaluated based upon the specific hardware modification and impacts on Critical Tasks are identified. The impact on training is directly a function of the impact on Critical Tasks, as to whether classroom training, On-the-job training/experience (OJT/E) or simulator training needs to be revised as a result of the modification.

b) Describe any changes the proposed power uprate will have on the plant reference control room simulator.

DAEC Response:

As discussed in Section 10.6 of the PUSAR, changes to the plant reference simulator are controlled by the modification process in order to maintain fidelity, per ANSI/ANS-3.5-1985. In addition, the new accident analyses performed at the uprated condition will be used to simulate the plant's response to those scenarios at the uprated conditions.

c) Provide the implementation schedule for making the changes.

DAEC Response:

The implementation schedule is integrated with the implementation of the modifications. Thus, those modifications being installed in the upcoming refuel outage (Spring 2001), will be incorporated into the training and simulator as part of the normal training cycle for startup from the refuel outage and will be factored into the permanent training information. Those modifications scheduled for implementation in the 2003 refuel outage will be trained on as part of that outage's training package. Also, the "overview" of the power uprate will be part of the startup training for this upcoming outage, with feedback from the startup testing experiences to be included in the continuing training process.

Table 1: Risk - Significant Operator Actions

Description	1658 MWt Probability of Failure to Diagnose & Perform	1912 MWt Probability of Failure to Diagnose & Perform	Required Operator Actions	Comments
1) A decrease in the time available for the operator to initiate Standby Liquid Control (SLC) in turbine trip and MSIV closure ATWS events.				
a) Operator fails to inject SLC early (within 6 minutes)	1.1E-01	1.8E-01	Recognition: Based on Suppression Pool water temperature exceeding the "Boron Injection Initiation Temperature" as defined in the ATWS Emergency Operating Procedure (EOP), the operators are directed to initiate SLC. Manipulations: To initiate SLC, 1) the operator removes the key from the Reactor Mode Switch and 2) uses it to unlock the Standby Liquid Control Switch, 3) then turns that switch to the "Pumps A and B Run" position. The Mode switch and the Standby Liquid Controls switch are located on the main control console, 1C05. Confirmation: Immediate task success feedback is available to the operator through pump running indicator lights, injection valve position lights, annunciator alarm activation, and pump discharge pressure and flow indication, all located on 1C05. After verifying proper SLC injection is occurring, the operator walks to the adjacent control panel (1C04) and verifies the Reactor Water Cleanup System has isolated, which is an automatic function initiated by the SLC control switch.	This scenario pertains to ATWS events with the main condenser not available as a heat sink. If injection by both SLC pumps is successful within 6 minutes from the beginning of the event (4 minutes after power uprate), then reactor vessel Emergency Depressurization will be avoided, as the Suppression Pool's Heat Capacity Temperature Limit will be met. These operator actions are frequently practiced in the simulator and are routinely successfully completed in a timely manner.

Table 1: Risk - Significant Operator Actions

Description	1658 MWt Probability of Failure to Diagnose & Perform	1912 MWt Probability of Failure to Diagnose & Perform	Required Operator Actions	Comments
b) Operator fails to inject SLC late (within 20 minutes)	7.5E-02	9.5E-02	Same actions as above.	This is a continuation of the above scenario, assuming that the operator fails to initiate SLC within 6 minutes from the beginning of the event (4 minutes for power uprate). Because of this operator failure, the Suppression Pool's Heat Capacity Temperature Limit is reached, and Emergency Depressurization is required. Successful injection by one SLC pump, within 20 minutes (14 minutes for power uprate), in conjunction with initiating suppression pool cooling (two RHR pumps and two RHRSW pumps), will prevent containment failure from high Suppression Pool temperature.
2) A decrease in time available to inhibit the Automatic Depressurization System (ADS) in MSIV closure ATWS scenarios with high pressure injection initially available.	1.4E-02	3.4E-02	Recognition: Upon entry into the ATWS EOP, the procedure's first direction is to inhibit ADS. Manipulations: To inhibit ADS, 1) the operator depresses and turns 2 pushbuttons, one for the "A" and one for the "B" ADS initiation logic timers located side-by-side on control console 1C03. Confirmantion: Immediate feedback is available on 1C03 by verifying the amber ADS Timer indicating lights turn off; and, by an annunciator alarm for "ADS Both Timers Locked Out."	This scenario pertains to ATWS events for which the main condenser is not available as a heat sink and the feedwater and condensate systems are not available for reactor inventory makeup. The failure to inhibit ADS results in the automatic injection of a large quantity of water by the low pressure Emergency Core Cooling Systems. This dilutes the boron in the core and causes re-criticality. Successfully inhibiting ADS within 16 minutes from the beginning of the event (10 minutes for power uprate) will preclude the low pressure ECCS from injecting. These operator actions are frequently practiced in the simulator and are routinely successfully completed in a timely manner.

Table 1: Risk - Significant Operator Actions

Description	1658 MWt Probability of Failure to Diagnose & Perform	1912 MWt Probability of Failure to Diagnose & Perform	Required Operator Actions	Comments
3) A decrease in the time available to initiate reactor water level control in order to reduce power for MSIV closure ATWS events.	1.5E-02	3.4E-02	Recognition: During an ATWS condition and based on the inability of other strategies to completely shutdown the reactor, the ATWS EOP directs the operators to intentionally lower reactor water level to a band between +87 inches TAF and +15 inches TAF by terminating and/or preventing injection from reactor makeup water sources. The major makeup sources of concern are Condensate/Feedwater, HPCI, RHR, and Core Spray. Manipulations: Securing each particular makeup water source is accomplished by either: turning the individual pump handswitches to "Off"; or, by closing the system's inject valve (single switch per valve). All of these operator actions are accomplished at main control room consoles. In the case of HPCI, the operator trips its turbine (one pushbutton) and prevents re-start by securing the turbine lube oil pump (one handswitch), both located on main control console 1C03. Confirmation: Immediate task success feedback is available to the operator through pump running indicator lights or injection valve position lights, annunciator alarm activation (HPCI turbine trip), or pump discharge pressure and flow indication, as applicable to each makeup source. Additionally, cumulative feedback is available through indication of a lowering reactor water level, which is the desired effect.	This scenario pertains to ATWS events for which early (6 minutes (4 minutes for power uprate)) SLC injection is successful. Successfully lowering of vessel water level to lower reactor power within 15 minutes from the beginning of the event (12 minutes for power uprate) will avoid the need for Emergency Depressurization due to the Suppression Pool temperature reaching the Heat Capacity Temperature Limit. The actions required for "EOP Power/Level Control" are routinely practiced in the simulator. Usually, actions required to accomplish this task are performed simultaneously by more than one member of the operating crew.

Table 1: Risk - Significant Operator Actions

Description	1658 MWt Probability of Failure to Diagnose & Perform	1912 MWt Probability of Failure to Diagnose & Perform	Required Operator Actions	Comments
4) A decrease in time available to initiate Standby Liquid Control combined with a reduction in the time available to initiate power/level control for turbine trip with bypass available ATWS events.	Same as 3 above	Same as 3 above	This scenario is the sequential combination of scenarios 1 & 3 above.	This basic event pertains to ATWS scenarios for which the main condenser is available, via the Main Turbine Bypass Valves. Since early injection of SLC is not successful, reactor power remains higher than the capacity of the Bypass Valves (25% power currently, and 20.6% for power uprate). The reactor power being generated in this ATWS scenario is in excess of the Bypass Valve capacity. This excess power is added to the Suppression Pool by the Safety/Relief Valves. Consequently, the EOP Power/Level Control must be implemented prior to the Suppression Pool reaching the Heat Capacity Temperature Limit. The time sequence for this scenario was not explicitly calculated, as it is bounded by scenario 3 above, where all the reactor power being generated is added to the Suppression Pool.

Table 1: Risk - Significant Operator Actions

Description	1658 MWt Probability of Failure to Diagnose & Perform	1912 MWt Probability of Failure to Diagnose & Perform	Required Operator Actions	Comments
5) A decrease in the time available for the operator to depressurize the vessel to allow low-pressure injection into the vessel following failure of the high-pressure injection systems for non-ATWS events with the reactor at high pressure. NOTE: A separate evaluation was performed for the medium break LOCA initiator due to its greater inventory loss rate. This separate case was not examined as a direct result of power uprate, but rather, as an enhancement to the current PRA methodology.)	2.1E-04	a) 2.6E-04 (transients and small break LOCAs) b) 1.2E-2 (medium break LOCAs)	Recognition: The EOPs direct that an Emergency Depressurization of the reactor vessel be performed when any one of several conditions exist and/or plant parameters exceed various limits, such as the Suppression Pool reaching the Heat Capacity Temperature Limit. Manipulations: The operator places the four individual ADS relief valve handswitches on main control console 1C03 to "Open". Confirmation: Immediate task success feedback is available at 1C03 by individual valve position indicating lights and relief valve exhaust line high pressure lights. Additionally, cumulative feedback is available through indication of a decreasing reactor pressure on meters and recorders on main control consoles 1C03 and 1C05, which is the desired effect.	This event pertains to both transients as well as small and medium break LOCAs. When high pressure injection systems are not available, vessel depressurization is required to allow injection by low pressure ECCS. The allowed time for operator action, 64 minutes from the beginning of the event (55 minutes for power uprate transients & small break LOCAs; 25 minutes for power uprate medium break LOCAs) corresponds to the time at which vessel water level drops below the 1/3 core submergence required for adequate core cooling and prevention of significant core damage. These operator actions are frequently practiced in the simulator and are routinely successfully completed in a timely manner.

Table - 2
Control Room Indications Changes for Power Uprate

Items planned for Refuel Outage 17 (Spring 2001)

Individual main steam flow transmitters will be re-scaled.

The Feedwater flow instrumentation will be re-scaled.

MSR reheat steam flow instrumentation currently read out in D/P need to be re-scaled. This instrumentation will include a square rooter to allow indication to read out in lb_m/hr.

The Condensate Pump Current needs to be rescaled.

Combined Intermediate Valve discharge pressure needs to be re-scaled.

Turbine Steam pressure needs rescaling.

Generator "LOAD SET" will need to be rescaled.

Generator Gross Megawatts/Megavars recorder needs to be re-scaled.

Feedwater Heaters 4A/B & 5A/B Extraction Steam pressures need to re-scaled.

Feedwater and Condensate Temperature Recorders need to have some channels re-scaled:
- 2A/B Feedwater Heater drain temperature
- 4A/B Feedwater Heater drain temperature
- 6A/B Feedwater Heater drain temperature
- 3A/B Feedwater Heater outlet temperature
- 6A/B Feedwater Heater outlet temperature

Condensor Vacuum pressure indication "red banding" and setpoint arrows will be changed in support of instrument upgrade to variable setpoint capability.

Standby Liquid Control System Solution Tank level "red banding" and cold shutdown boron and hot shutdown boron weight arrows will be changed to support the new Tech Limit.

Main Generator Amp Meters will be "red banded" at 18000 amps

Table – 2 (cont.)
Control Room Indications Changes for Power Uprate

Items planned for Refuel Outage 18 (Spring 2003)

Flow transmitters for Hydrogen Water Chemistry system hydrogen injection.

Feedwater pump suction indication.

The Isophase bus ammeters will need to be re-scaled and new Current Transformers installed.

Condensate Demineralizer Flow meter will require resizing the flow orifices and re-tuning the loop orifice size.

The Reactor Water Cleanup flow transmitters will have to be replaced and the instrument loop recalibrated.

Feedwater Heater 6A/B Extraction steam pressures need to be re-scaled.