July 11, 2001
NG-01-0852

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:
1. NG-00-1900, "Technical Specification Change Request (TSCR-042): 'Extended Power Uprate'," dated November 16, 2000.
2. NG-01-0637, "Response to Request for Additional Information (RAI) to Technical Specification Change Request TSCR-042 – Extended Power Uprate. (TAC # MB0543)," dated May 10, 2001.

File: A-117, SPF-189

Dear Sir(s):

On June 26 and June 29, 2001, conference calls were 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 details to our previous Response to Request for Additional Information (Reference 2). The Attachment to this letter contains those additional details.

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 [signature]
Gary Van Middlesworth
DAEC Site Vice-President

State of Iowa
(County) of Linn

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

by Gary Van Middlesworth.

[signature]
Notary Public in and for the State of Iowa

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

Commission Expires

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

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

a) In your May 10, 2001 Response to Request for Additional Information (i.e., NG-01-0637), you described the change in Human Error Probability for Operator actions associated with Standby Liquid Control System (SLCS) injection during an Anticipated Transient Without Scram (ATWS) event, as modeled in your Probabilistic Risk Assessment (PRA) for Extended Power Uprate (EPU). Of particular concern is the reduction in available Operator time for "early" SLCS injection from 6 minutes presently to 4 minutes under EPU. With respect to that decreased Operator response time, please provide further justification that this assumption is consistent with actual Operator response time. Specifically, please provide the following additional details:

(i) Provide additional detail regarding the actual Operator performance steps to diagnose the need for SLCS injection and the execution of that action, including a discussion of the controls on the use of the mode switch key used to initiate SLCS.

(ii) Describe any changes due to EPU in the required Operator actions for this task, such as changes in applicable procedures (equipment-specific or Emergency Operating Procedures (EOPs)), equipment modifications, etc.

(iii) Provide any available information regarding Operator performance on the plant simulator for the task of SLCS injection during an ATWS event.

DAEC Response:

Background Information

This particular event state (operator action) was labeled as "significant" in our original submittal merely because it met an arbitrary threshold (Risk Achievement Worth (RAW) of 1.06) for reporting. It should be noted that the PRA event of "early SLCS injection" is not a direct path to a core damage state; other subsequent events must occur to reach core damage. This event is merely used in the model to select the success criteria in the containment analysis. Specifically, failure to inject SLCS "early" (currently 6 minutes and 4 minutes at EPU) merely drives the number of trains of suppression pool cooling required (one vs. two) later in the event analysis to be successful in avoiding containment failure due to overheating. Thus, by itself, this event/action is not considered to be "significant."

(i) Attached is the relevant portion of the ATWS Emergency Operating Procedure (EOP) dealing with SLCS injection, i.e., Power Control (/Q). After entering this EOP, the Operator takes several immediate actions, such as placing the Mode Switch in "Shutdown," ensuring the reactor recirculation pumps are at minimum pump speed, and initiating the Alternate Rod Insertion (ARI) and ATWS-Recirculation Pump Trip (ATWS-RPT) system, prior to reaching the steps dealing with SLCS injection. At this point in the scenario, after determining that a thermal-hydraulic instability does not exist, there is only one key parameter of interest, suppression pool (torus) temperature (See the BEFORE step (/Q-6) in the attached EOP.) Consequently, a Reactor Operator at the control panels, the Shift Supervisor and the Shift Manager are all monitoring the suppression pool temperature on the control room instrumentation. In addition, the suppression pool temperature is monitored on the Safety Parameter Display System (SPDS); in particular, the SPDS is automatically trending the temperature directly on the Boron Injection Initiation Temperature (BIIT) curve, the EOP criteria for SLCS injection. This display is monitored by both the Shift Technical Advisor (STA) and the Shift Manager, in addition to being plotted manually on the BIIT curve on the EOP chart. Therefore, it is highly unlikely for the suppression pool temperature to increase beyond the BIIT curve limit undetected by the Operators.

Given this recognition that SLCS injection is required, per the ATWS-EOP step (/Q-7) to "Inject boron into the RPV using SLCS," execution of this task is very simple – only 3 steps. Using three-part communication between the Reactor Operator and the Shift Supervisor which reduces the potential for miscommunication, upon direction from the Shift Supervisor to initiate SLCS, the Reactor Operator 1) removes the key from the Reactor Mode Switch; 2) places it in the handle of the SLCS pump control switch and unlocks it; and then, 3) turns the SLCS pump control switch (a simple, two-position switch) from "Off" to the "PUMPS A and B Run" position. The two switches are located on the same control room panel and are within a couple of feet of each other. Hence, the Operator does not have to change physical location to perform this action.

At this point the Reactor Operator has completed the task of SLCS injection. The Operator then verifies that SLCS has successfully actuated by observing the indication lights (pump running indication lights and the squib injection valve indication lights) and pump flow and discharge pressure indications, which are on the same panel. In addition, there is an Annunciator alarm associated with the firing of the squib valves. The Operator then reports back to the Shift Supervisor, again using three-part communication, that SLCS injection has been sucessfully initiated. The Shift Supervisor then records the action as completed on the EOP flowchart (step /Q-8).

It should be noted that the key for the Reactor Mode Switch must be in the switch to unlock it in order to place the Mode Switch in the RUN position (power operation), i.e., at the beginning of this event. This key cannot physically be removed from the switch until it is placed in either the SHUTDOWN or REFUEL position. Because the Mode Switch has already been placed in the SHUTDOWN position, per the EOP actions discussed above, it can readily be removed when needed to execute the SLCS injection step. In the very unlikely event that the key in the Mode Switch is not available, identical keys are kept in the "EOP key box" in the desk directly behind the Reactor Operator. Thus, a "backup" key is readily available and would not introduce an appreciable time delay in the execution of this EOP action.

(ii) There have been no changes in the above Operator actions due to EPU. As stated in our previous RAI response (NG-01-0637), there was a slight change to the BIIT curve due to EPU, but this adjustment did not change the Operator responses in the actual EOP steps.

(iii) The graded evaluation of operating crew performance on the DAEC plant-specific simulator under ATWS scenarios is a routine training exercise. The execution of the EOP step to "Inject boron into the RPV with SLCS" before reaching the BIIT curve limit is a "critical task" in the training program. Failure to properly perform a critical task results in a "crew failure" on the graded simulator scenario. We have reviewed the training records from 1997-to-present for the evaluated scenarios. Of the 58 evaluated scenarios involving ATWS events conducted during this period, every crew successfully executed this critical task, i.e., a 100% pass rate.

It should be noted that the operating crews were not timed during these evaluated scenarios as the Pass/Fail criterion. The execution of this critical task (SLCS injection) does not have a specific time limit associated with it to be considered successful. The time available to the Operator is dependent upon how fast the suppression pool temperature is increasing toward the BIIT curve limit and varies with the individual event scenarios, i.e., initiating event, equipment failures, etc. Again, while not specifically timed, some ATWS evaluated scenarios can reach the BIIT criterion quite rapidly, within a few minutes of the event initiation, consistent with the timeline from the PRA. Based upon observation of the crews during these evaluated scenarios, we know that the execution of this task (inject SLCS) occurs very quickly once the decision is made to perform it and is not dependent upon the pace of the scenario. We estimate it to be on the order of 10-15 seconds.

While the operating crews have not yet been formally evaluated under EPU-based conditions, they have practiced on the plant-specific simulator, including ATWS scenarios, with all the EPU changes installed. We have not observed a decrease in current Operator performance in these practice sessions.

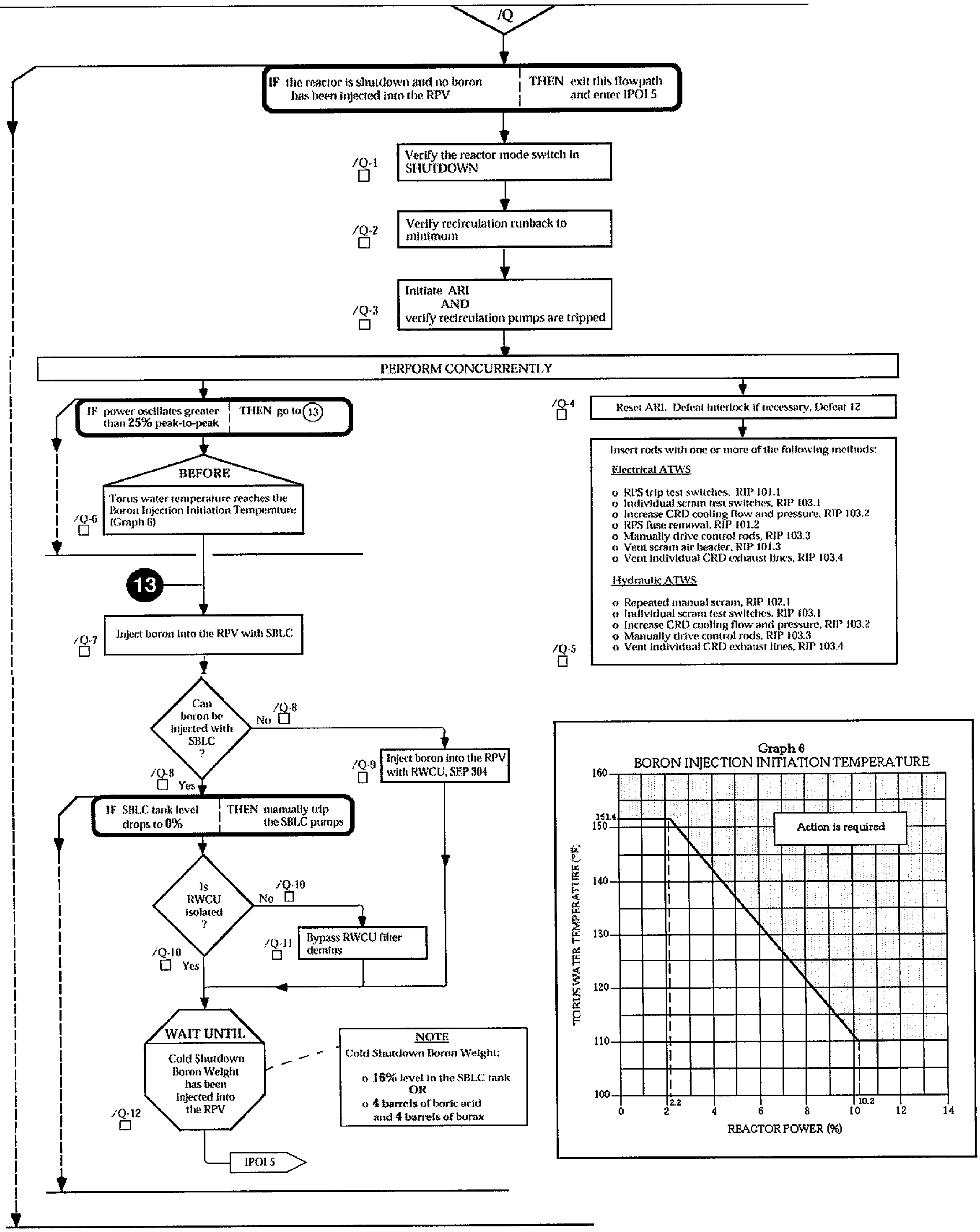
Therefore, based upon all these factors:

- the simplicity of the task;
- the focus of the operating crew to diagnose the action when required; and,

- the lack of a change in the direct Operator actions due to EPU;

we fully believe that the DAEC Operators will continue to successfully perform this task after implementation of EPU.

Because of the above high rate of actual success in performing this task, we believe the assumed failure rate used in the PRA evaluation (~ 18%) is a very conservative prediction of the actual impact of EPU. Therefore, the PRA should be viewed very cautiously when making decisions relative to the need for automatic (vs. manual) response for SLCS injection.


/Q
IF the reactor is shutdown and no boron has been injected into the RPV
THEN exit this flowpath and enter IPOI 5
/Q-1
Verify the reactor mode switch in SHUTDOWN
/Q-2
Verify recirculation runback to minimum
/Q-3
Initiate ARI AND verify recirculation pumps are tripped
PERFORM CONCURRENTLY
IF power oscillates greater than 25% peak-to-peak
THEN go to 13
BEFORE
/Q-6
Torus water temperature reaches the Boron Injection Initiation Temperature (Graph 6)
13
/Q-7
Inject boron into the RPV with SBLC
Can boron be injected with SBLC ?
No
/Q-8
Yes
/Q-9
Inject boron into the RPV with RWCU, SEP 304
IF SBLC tank level drops to 0%
THEN manually trip the SBLC pumps
Is RWCU isolated ?
No
/Q-10
Yes
/Q-11
Bypass RWCU filter demins
WAIT UNTIL
Cold Shutdown Boron Weight has been injected into the RPV
/Q-12
IPOI 5
NOTE
Cold Shutdown Boron Weight:
o 16% level in the SBLC tank
OR
o 4 barrels of boric acid and 4 barrels of borax
/Q-4
Reset ARI. Defeat interlock if necessary, Defeat 12
Insert rods with one or more of the following methods:
Electrical ATWS
o RPS trip test switches, RIP 101.1
o Individual scram test switches, RIP 103.1
o Increase CRD cooling flow and pressure, RIP 103.2
o RPS fuse removal, RIP 101.2
o Manually drive control rods, RIP 103.3
o Vent scram air header, RIP 101.3
o Vent individual CRD exhaust lines, RIP 103.4
Hydraulic ATWS
o Repeated manual scram, RIP 102.1
o Individual scram test switches, RIP 103.1
o Increase CRD cooling flow and pressure, RIP 103.2
o Manually drive control rods, RIP 103.3
o Vent individual CRD exhaust lines, RIP 103.4
/Q-5
Graph 6
BORON INJECTION INITIATION TEMPERATURE
Action is required
TORUS WATER TEMPERATURE (°F)
160
151.4
150
140
130
120
110
100
REACTOR POWER (%)
0
2
2.2
4
6
8
10
10.2
12
14