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DENTON, H.R. Office of Nuclear Reactor Regulation

SUBJECT: Responds to NRC 781220 ltr requesting info on axial power distribution monitoring sys & potential emergency core cooling sys reliability improvements after 1 year of operation.

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February 8, 1979  
AEP:NRC:00126

Donald C. Cook Nuclear Plant Unit No. 2  
Docket No. 50-316  
License No. DPR-74

Mr. Harold R. Denton, Director  
Office of Nuclear Reactor Regulation  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Mr. Denton:

Attached please find our responses to the requests for information contained in the attachment to Mr. A. Schwencer's letter dated December 20, 1978 which we received on December 26, 1978. Mr. Schwencer's letter requested information on the Axial Power Distribution Monitoring System (APDMS) and on potential Emergency Core Cooling System (ECCS) reliability improvements for Donald C. Cook Nuclear Plant Unit No. 2 after one year of operation. The requested information is contained in Attachments 'A' and 'B' to this letter.


The attached information is being submitted at the request of the NRC staff and provides additional information regarding operational experiences with previously reviewed and approved systems. In light of the above, AEPSC interprets 10 CFR 170.22 as requiring that no fee accompany this submittal. (Reference: 10 CFR Part 170.22, Footnote (2).)

Very truly yours,



F. N. Bien  
Vice President

Sworn and subscribed to before me  
this 8th day of February, 1979 in  
New York County, New York

  
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Mr. Harold R. Denton, Director      -2-      AEP:NRC:00126

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ATTACHMENT 'A' TO AEP:NRC:00126

A. Axial Power Distribution Monitoring System (APDMS)

Request No. 1

(Provide) a discussion and evaluation of any operational difficulties experienced, especially instances of restricted reactor power due to down time or unavailability of the APDMS.

Response

The APDMS has functioned well during the first year of operation of the Donald C. Cook Nuclear Plant Unit No. 2. There were however, several minor problems with the APDMS during this time. These problems are described below.

- (a) On one occasion, the full length step counter did not change indication, nor did it actuate a sequence when control bank D was withdrawn. The cause of this event was found to be the "hanging up" of relay K 8 which feeds the signal, indicating Bank D withdrawal, to the APDMS. The relay was repaired and the APDMS returned to service. This event did not result in a power reduction.
- (b) On one occasion one of the APDMS detectors withdrew from its park position near the bottom of the core to its fully withdrawn position. This detector's signal was switched out and a redundant detector was used to allow continued APDMS operation. Investigation revealed that the "problem" was a dirty relay in the detector control panel. This and the other system relays have been cleaned and inspected. No similar events have been encountered to date.
- (c) The most serious problem associated with the APDMS involved a faulty CPU input card, on loan from the vendor, which resulted in the dedicated computer's failure to output Fz and its limit comparison. The input card was replaced and the APDMS was returned to service. Since then, no similar events have occurred.

## Request No. 2

(Provide) A report of any situation in which power was limited by the Technical Specifications to less than 100% of design power level as a consequence of the APDMS indication (e.g., such as at beginning of cycle).

## RESPONSE

At beginning of life the unit was restricted to 95% power to preserve margin to  $F_L^Z$ . Had AEPCS/I&M not had this internal requirement to maintain margin to  $F_L^Z$  the unit could have operated at a higher power level. Table No. 1 (attached) summarizes the dates and approximate burnups at which the APDMS setpoints were changed.

We do not possess a reliable estimate of the lost generation due to the APDMS imposed power limit. This is due to the fact that coincident with the presence of such limits, other equipment problems prevented the Unit from achieving 100% thermal power.

## Requests No. 3 and 4

(Provide) Comparison tables of power peaking factors as measured by the incore flux maps and by the APDMS including data taken under different conditions of axial offset and burnup.

(Provide) A brief discussion of the highlights of the comparison.

## RESPONSE

Table No. 2 (attached) shows a comparison between the  $F_q^N$  values calculated by the APDMS and from full core flux maps, respectively.

It is not possible to obtain APDMS data during the flux map data acquisition periods. The data shown in Table 2 are APDMS data taken immediately prior and/or after the flux map data acquisition period. As can be seen, the APDMS yields, with a few exceptions, a larger or more conservative  $F_q^N$ . Out of 73 comparisons, only 12 displayed a non-conservative APDMS  $F_q^N$ . The maximum amount that the APDMS was non-conservative to the flux maps was only 1.10%, well within the uncertainties associated with that system. That is, the APDMS  $F_q^N$  is penalized by 12.52%, whereas the flux map  $F_q^N$  is penalized by only 8.15%. The average  $F_q^N$  deviation is -1.29% with a standard deviation of 1.24%.

TABLE 1

SUMMARY OF POWER LIMITATIONS DUE TO  
APDMS LIMITS IN CYCLE 1 OF UNIT 2

<u>SETPOINT CHANGE DATA</u>	<u>P<sub>L</sub>(*)</u>	<u>APPROXIMATE BURNUP (MWD/MTU)</u>
6/8/78	95	454
6/9/78	97	472
7/12/78	98	989
7/20/78	99	1107
8/21/78	100	1477

(\*) LIMITING POWER IN PERCENT



TABLE 2  
COOK UNIT 2

COMPARISON TABLE - APDMS PERFORMANCE

Date	Flux Map Number	Burnup MW/MTU	Axial Offset %	APDMS Detector Location	Flux Map Fz (Peak)	APDMS Fz (Peak)	R at Time of Flux Map	APDMS Fq	Flux Map Fq <sup>N</sup> / Location	Fq Deviation % Flux Map Fq <sup>N</sup> - % 100 x Flux Map Fq <sup>N</sup>
5/19/78	201-18	567.8	-9.936	P4 H2 B13 L13	1.411 1.414 1.414 1.408	1.405 1.41 1.3568 1.40	1.3659 1.3636 1.3568 1.3717	1.9191 1.9227 1.9131 1.9203	1.9112 H4	-0.41 -0.60 -0.10 -0.48
6/6/78	201-19	685.9	-9.446	P4 H2 B13 L13	1.398 1.401 1.391 1.394	1.39 1.38 1.395 1.40	1.3636 1.3608 1.3553 1.3700	1.8954 1.8779 1.8906 1.9180	1.8989 H4	+0.18 +1.10 +0.44 -1.01
7/10/78	201-21	1518.6	-7.724	P4 H2 B13 L13	1.365 1.369 1.361 1.354	1.365 1.37 ----- 1.35	1.3607 1.3589 1.3558 1.3665	1.8573 1.8616 ----- 1.8448	1.8342 H5	-1.26 -1.50 ----- -0.58
7/13/78	201-22	1625.9	-7.879	P4 H2 B13 L13	1.359 1.369 1.362 1.347	1.361 1.36 ----- 1.343	1.3576 1.3563 1.3536 1.3646	1.8482 1.8445 1.8325 -----	1.8272 H4	-1.15 -0.95 ----- -0.29
7/14/78	201-23	1669.0	-6.732	P4 H2 B13 L13	1.348 1.347 1.347 1.332	1.35 1.35 ----- 1.33	1.3565 1.3526 1.3517 1.3622	1.8313 1.8260 ----- 1.8117	1.7927 E8	-2.15 -1.86 ----- -1.06
8/7/78	201-24	1851.8	-7.033	P4 H2 B13 L13	1.350 1.353 1.351 1.339	1.35 1.36 1.37 1.35	1.3508 1.3469 1.3483 1.3582	1.8236 1.8318 1.8471 1.8336	1.8170 E8	-0.35 -0.31 -1.66 -0.91
8/17/78	201-25	2217.3	-6.568	P4 H2 B13 L13	1.327 1.337 1.327 1.314	1.33 1.33 1.32 1.31	1.3461 1.3424 1.3470 1.3557	1.7903 1.7855 1.7781 1.7760	1.7958 L8	+0.31 +0.58 +0.99 +1.10
9/13/78	201-26	2906.3	-5.341	P4 H2 B13 L13	1.301 1.310 1.303 1.284	1.29 1.315 1.30 1.28	1.3459 1.3410 1.3473 1.3573	1.7362 1.7635 1.7514 1.7373	1.7128 H5	-1.35 -2.05 -2.96 -1.43
9/13/78	201-27	2914.7	-13.462	P4 H2 B13 L13	1.385 1.396 1.399 1.367	1.385 1.40 1.40 1.37	1.3459 1.3410 1.3473 1.3573	1.8640 1.8774 1.8862 1.8595	1.8222 D12	-2.30 -3.03 -3.51 -2.05
9/14/78	201-28	2918.2	-20.246	P4 H2 B13 L13	1.429 1.451 1.442 1.425	1.44 1.455 1.445 1.415	1.3459 1.3410 1.3473 1.3573	1.9380 1.9512 1.9468 1.9206	1.8925 D12	-2.41 -3.10 -2.87 -1.48
9/14/78	201-29	2924.8	+6.302	P4 H2 B13 L13	1.362 1.367 1.371 1.345	1.35 1.355 1.35 1.32	1.3459 1.3410 1.3473 1.3573	1.8169 1.8171 1.8188 1.7916	1.7943 H5	-1.26 -1.27 -1.37 +0.15

ATTACHMENT 'B' TO AEP:NRC:00126

B. ECCS and Shutdown Heat Removal Systems Reliability

Request No. 1

Identify those systems or components that have encountered problems in operational reliability.

Response

No systems or components in the ECCS or RHR system encountered problems in operational reliability during Unit No. 2 operation.

Request No. 2 .

Discussion of any design, procedural, or equipment modifications implemented or considered as a result of this operating experience.

Response

No modifications have been implemented or considered as a result of Unit No. 2 operating experience. The RHR pump seal sleeves have been modified to reduce the possibility of leakage as a result of Unit No. 1 operating experience.

Request No. 3

Provide an evaluation of any other potential improvements of the ECCS and shutdown heat removal systems that you have considered, emphasizing reliability aspects.

Response

No modifications are planned for the ECCS and RHR systems.

TABLE 2 - Cont'd.

## COOK UNIT 2

## COMPARISON TABLE - APDMS PERFORMANCE

Date	Flux Map Number	Burnup MWD/MTU	Axial Offset %	APDMS Detector Location	Flux Map Fz(Peak)	APDMS Fz (Peak)	R at Time of Flux Map	APDMS F <sub>q</sub> <sup>N</sup>	Flux Map F <sub>q</sub> <sup>N</sup>	F <sub>q</sub> Deviation %	
										100 x	Flux Map F <sub>q</sub> <sup>N</sup> - APDMS Flux Map F <sub>q</sub> <sup>N</sup>
10/10/78	201-30	3876.9	-5.132	P4	1.273	1.27	1.3390	1.7006	D4		-1.73
				N2	1.285	1.285	1.3330	1.7130			-2.48
				B13	1.287	1.285	1.3388	1.7204			-2.92
				L13	1.260	1.255	1.3526	1.6975			-1.55
11/6/78	201-31	4743.8	-2.782	P4	1.260	1.26	1.3339	1.6807	D12		+0.11
				N2	1.295	1.28	1.3255	1.6980			-0.92
				B13	1.295	1.32	1.3308	1.7567			-4.41
				L13	1.249	1.25	1.3480	1.6850			-0.15
11/30/78	201-32	4979.3	-3.964	P4	1.232	1.23	1.3323	1.6388	H11		+0.15
				N2	1.246	1.25	1.3207	1.6502			-0.59
				B13	1.244	1.24	1.3237	1.6415			-0.02
				L13	1.215	1.215	1.3454	1.6359			+0.33
12/18/78	201-33	5645.7	-2.991	P4	1.203	1.20	1.3327	1.5992	M4		-0.50
				N2	1.226	1.23	1.3184	1.6216			-1.90
				B13	1.223	1.22	1.3219	1.6127			-1.34
				L13	1.188	1.18	1.3472	1.5897			+0.10
12/28/78	201-34	6032.6	-4.534	P4	1.215	1.22	1.3288	1.6212	H5		-3.64
				N2	1.218	1.23	1.3110	1.6125			-3.08
				B13	1.214	1.21	1.3146	1.5907			-1.69
				L13	1.194	1.205	1.3442	1.6198			-3.55
12/28/78	201-35	6038.2	-9.827	P4	1.273	1.25	1.3288	1.6610	M12		-2.05
				N2	1.290	1.275	1.3110	1.6715			-2.70
				B13	1.284	1.265	1.3146	1.6630			-2.18
				L13	1.258	1.225	1.3442	1.6467			-1.17
12/28/78	201-36	6040.9	-18.095	P4	1.372	1.37	1.3288	1.8205	L8		-3.38
				N2	1.371	1.365	1.3110	1.7895			-1.62
				B13	1.361	1.35	1.3146	1.7748			-0.79
				L13	1.353	1.345	1.3442	1.8080			-2.67
12/29/78	201-37	6048.1	+14.415	P4	1.398	1.375	1.3288	1.8271	H5		-0.94
				N2	1.372	1.39	1.3110	1.8223			-0.67
				B13	1.384	1.39	1.3146	1.8273			-0.95
				L13	1.376	1.355	1.3442	1.8214			-0.63