FROM: Northern States Power Company
Minneapolis, Minnesota 55401
L. O. Mayer

DATE OF DOCUMENT: 2-29-72

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LTR. x MEMO: REPORT: OTHER:

TO: Dr. Morris

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ACTION NECESSARY ☐ NO ACTION NECESSARY ☐

CONCURRENCE ☐ COMMENT ☐

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Ltr re their 2-3-72 ltr regarding variation in the core reactivity calculation...furnishing addl info to the initial report.....

ENCLOSURES:

REFERRED TO	DATE	RECEIVED BY	DATE
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REMARKS:

U.S. ATOMIC ENERGY COMMISSION

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NSP

NORTHERN STATES POWER COMPANY

MINNEAPOLIS, MINNESOTA 55401

February 29, 1972

Dr. Peter A Morris, Director
Division of Reactor Licensing
United States Atomic Energy Commission
Washington, D C 20545

Dear Dr. Morris:

MONTICELLO NUCLEAR GENERATING PLANT

Regulatory File Cy.

Docket No. 50-263 License No. DPR-22
Supplemental Information on the
Variation in Core Reactivity Calculation

A letter reporting a variation in the core reactivity calculation was transmitted on February 3, 1972, in compliance with the 10-day reporting requirement of Section 6.6.B.1 of Appendix A, Technical Specifications. The following information is to supplement that provided in the initial report.

The attached figure shows the current sequence of withdrawal of the first three rod groups, each group consisting of 15 rods. It can be seen that groups #1 and #2 each require fully withdrawing rods starting near the core center and spiraling out to the periphery. Utilizing this sequence for initial criticality, the cold, clean core became critical with 29 rods fully withdrawn and the 30th rod partially withdrawn. This rod pattern, as shown by the shading in the figure, creates a uniform 1-rod-in-4 pattern throughout the core. Qualitatively, one can see that the 25th through the 30th rods merely add to the size of the core without adding significantly to the k-effective. In addition, because of the loose coupling of large cores, the 22nd through the 24th rods add very little to the k-effective of the 20 rod lattice.

On January 24, 1972, the core was made critical with 23 rods fully withdrawn and the 24th rod partially withdrawn. Although this is a difference of six complete rods, it must be understood that all but one of the six rods lie on the core periphery. Therefore the reactivity difference between the cold, clean critical core and the January 24, 1972, critical core is very small.

The rod withdrawal sequence suggested for the startup test program started group #3 withdrawal in the core center and spiraled out, just as for groups #1 and #2. As can be seen in the figure, the first group #3 rods in such a scheme (numbered 45 and 44) have a large effect on the core k-effective. Early in the startup test program it was recognized that criticality would occur on these high worth

rods during hot startups. For this reason group #3 was redefined to start on the core periphery and spiral in. Similar reactors having slight differences in core design did not experience initial criticality until the first or second group #3 centrally located rods were withdrawn. Therefore the difference of six peripherally located rods at Monticello, as discussed above, may be equivalent to a few notches on a centrally located group #3 rod at a similar facility.

Utilizing NSP's recently completed core analysis program to perform 3-dimensional core calculations, we have calculated the core reactivity at 1760 MWD/T for 23 rods withdrawn, 24 rods withdrawn, and 30 rods withdrawn. The calculated worth of the 24th rod is 0.13% Δ k; the total calculated worth of the 25th through 30th rods is also 0.13% Δ k. Therefore, the net difference in the calculated core k-effective from a cold, clean critical core to a critical core at 1760 MWD/T is 0.26% Δ k.

A revised FSAR figure 3-2-2 for the "Stuck Rod Margin As a Function of Exposure" was transmitted with our February 3, 1972, letter. The revised curve shows a net increase in reactivity from a cold, clean core to the point of peak reactivity to be 1.2% Δ k with one rod out. Our core analysis program predicts a 1.1% Δ k increase, thereby establishing confidence in understanding the present core performance.

On the basis of revised FSAR figure 3-2-2 which shows that the exposed core is more reactive than the clean core and that it will become slightly more reactive later in life, a shutdown margin test was performed. Technical Specification 4.3.A.1 requires that the core can be made subcritical by a margin of (0.25 + R)% Δ k with one rod fully withdrawn. At the time of the demonstration, the composite value of R was 0.65% Δ k which included effects of the existing moderator temperature, further curtain depletion and non-peak samarium conditions. The required margin was therefore 0.90% Δ k. The test on January 27, 1972, demonstrated that the shutdown margin with the strongest rod withdrawn exceeded 1.48% Δ k.

Yours very truly,

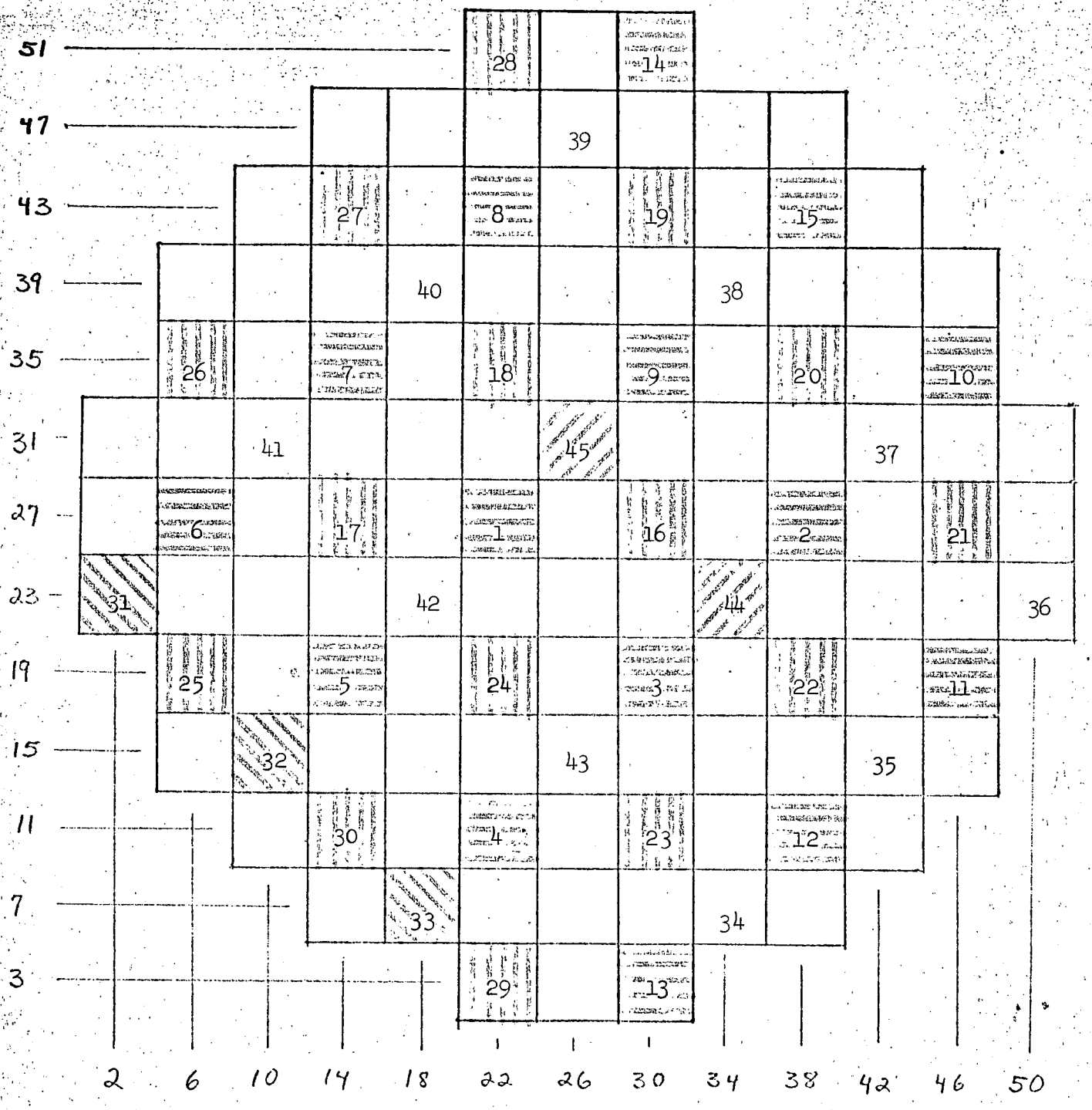
L. O. Mayer

L O Mayer, P.E.
Director-Nuclear Support Services

LOM/MHV/br

cc: B H Grier

Attachment



Group 1 rods

Group 2 rods

1st Group 3 rods (current sequence)

1st Group 3 rods (initially proposed sequence)