Consumers Power Company

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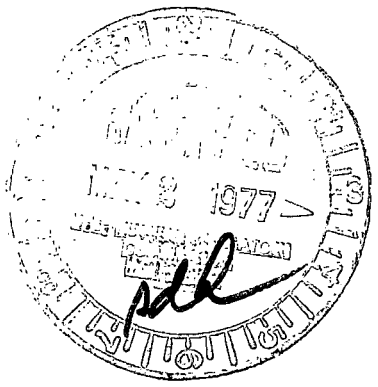
April 29, 1977

REGULATORY DOCKET FILE COPY



Director of Nuclear Reactor Regulation
Att: Mr Albert Schwencer, Chief
Operating Reactor Branch No 1
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 -
PALISADES PLANT - ADDENDUM TO
CYCLE II START-UP REPORT

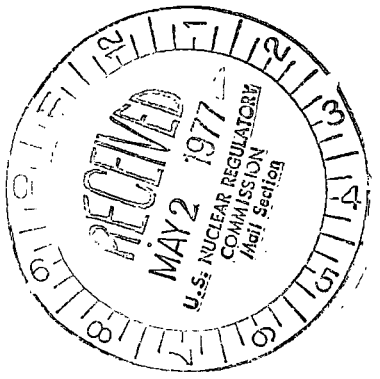
On August 30, 1976 we transmitted "Palisades Plant Special Report No 9, Cycle II Start-Up Report" which was amended by our November 11, 1976 letter.

The attached report is an addendum to the Cycle II Start-Up Report.

David P. Hoffman

David P Hoffman
Assistant Nuclear Licensing Administrator

CC: JGKeppler, USNRC



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ADDENDUM

TO

CYCLE II START-UP REPORT

Palisades Plant

February 25, 1977

ADDENDUM TO PALISADES CYCLE II START-UP REPORT

The measured reactivity worths reported in the Palisades Cycle II start-up report were significantly smaller than the calculations predicted. It has been found that much of the error can be attributed to an underestimate of the effective delayed neutron fraction, $\beta_{effective}$, which has a direct bearing on measured reactivity worths.

β_{eff} was originally computed using delayed neutron data from Reference 1 which was published in 1965 and used in the industry for many years. However, more recent evaluations based on measurements performed over the last ten years, such as the one in Reference 2, show a significant increase in the values of delayed neutrons per fission for all the important isotopes of uranium and plutonium. β_{eff} was recalculated using the data from Reference 2 yielding a value of .00727 versus the old value of .00690, representing an increase of 5.4%. Since β_{eff} is used to convert reactivity in cents from the reactivity computer to % $\Delta\rho$, this change represents a 5.4% increase in the measured reactivity worths.

It was found that, upon applying this correction, the measured values of dropped rod worth, ejected rod worth, moderator temperature coefficients and soluble boron worth are all still within the predetermined acceptance criteria. However, the differences between the measured and predicted control rod bank worths, which previously had exceeded the acceptance criteria, are significantly reduced. Table 1 showing the corrected rod bank worths compared to calculated values is similar to Table 5 from the start-up report.

As can be seen from the table, the differences between the revised measurements and calculations for the individual rod bank worths (4 through B) are within the acceptance criteria of either 0.2% $\Delta\rho$ or 15% difference and the total rod worth is within the acceptance criterion of 10%.

The revised measured total rod worth when factored into the shutdown margin table results in a 0.43% $\Delta\rho$ increase in net shutdown rod worth at end of cycle. The attached Table 2 is similar to Table 6 contained in the start-up report.

This increase results in 36 inches more allowable control rod insertion at zero power. Unfortunately, the allowable insertion is still not within the envelope outlined by the Technical Specifications PDIL curve because of the 10% uncertainty penalty on the measurement. The new PDIL curve is shown as Figure 1.

The sharp drop at about 75% of Group 3 is where the shutdown margin curve intersects the existing Technical Specifications curve. Because the power defect assumed in this analysis conforms to our submittal regarding operation at increased pressure, the curve is applicable to 2100 psi operation as well as 1800.

Table 1

Measured Group Rod Worths

Control Rod Group	Measured Worth	Calculated Worth	Difference	Difference/ Calculated, %
4	.66	.70	-.04	-5.7
3	.91	.95	-.04	-4.2
2	.84	.72	+.12	+16.6
1	1.92	2.20	-.28	-12.7
Total Regs	4.33			
Regs (Overlap)	4.20			
Regs (Average)	4.26	4.57	-.31	-6.8
B	1.54	1.55	-.01	-0.6
Regs + B	5.80	6.12	-.32	-5.2
A	3.19*	3.37	-.18	-5.3
All Rods	8.99	9.49	-.50	-5.3

*The Group A worth was estimated from the calculation and the total observed calculation/measurement difference for Groups 1, 2, 3, 4 and B.

$$3.37 \times (1 - .052) = 3.19$$

Table 2

Palisades Cycle II Shutdown Margin

	BOC		EOC	
	HZP	HFP	HZP	HFP
Total Measured Full Length Rod Worth	8.99	8.99	9.15*	9.15*
Stuck Rod Worth	3.22	3.22	3.52	3.52
Total Minus Stuck Rod	5.77	5.77	5.63	5.63
Uncertainty	.58	.58	.56	.56
Net Shutdown Rod Worth	5.19	5.19	5.07	5.07
Doppler Defect	0	1.00	0	1.00
Moderator Temperature	0	.20	0	.80
Moderator Void Defect	0	0	0	.10
Axial Flux Redistribution	0	0	0	.50
Required Shutdown Margin	3.40	2.00	3.40	2.00
Total Reactivity Allowances	3.40	3.20	3.40	4.40
Available For Maneuvering	1.79	1.99	1.67	0.67
PDIL Rod Insertion	1.43	0.07	1.67	0.15
Excess Margin	0.36	1.92	0.00	0.52

*EOC Rod Worth = EOC (Calculated) x $\frac{\text{BOC Measured}}{\text{BOC Calculated}}$

Table 3

Palisades PDIL Calculation for End of Cycle II

Power %	Net Shutdown Rod Worth % Δρ	Required Margin % Δρ	Sum of Power Defects* % Δρ	Allowable Insertion % Δρ	Rod Position in.	Rod Insertion %
0	5.07	3.40	0	1.67	3 @ 24	3 @ 81.8
10	5.07	3.26	0.24	1.57	3 @ 31	3 @ 76.5
20	5.07	3.12	0.48	1.47	3 @ 39	3 @ 70.5
30	5.07	2.98	0.72	1.37	3 @ 48	3 @ 63.6
40	5.07	2.84	0.96	1.27	3 @ 57	3 @ 56.8
50	5.07	2.70	1.20	1.17	3 @ 68	3 @ 48.5
60	5.07	2.56	1.44	1.07	3 @ 76	3 @ 42.4
70	5.07	2.42	1.68	0.97	4 @ 05	4 @ 96.2
80	5.07	2.28	1.92	0.87	4 @ 13	4 @ 90.2
90	5.07	2.14	2.16	0.77	4 @ 21	4 @ 84.1
100	5.07	2.00	2.40	0.67	4 @ 30	4 @ 77.3

*Doppler + Moderator Temperature + Void + Axial Flux Redistribution

PALISADES PLANT

CONTROL ROD INSERTION LIMITS

ALLOWABLE POWER LEVEL (% OF 2200 MW)
VS
CONTROL ROD INSERTION (%) BY ROD GROUP

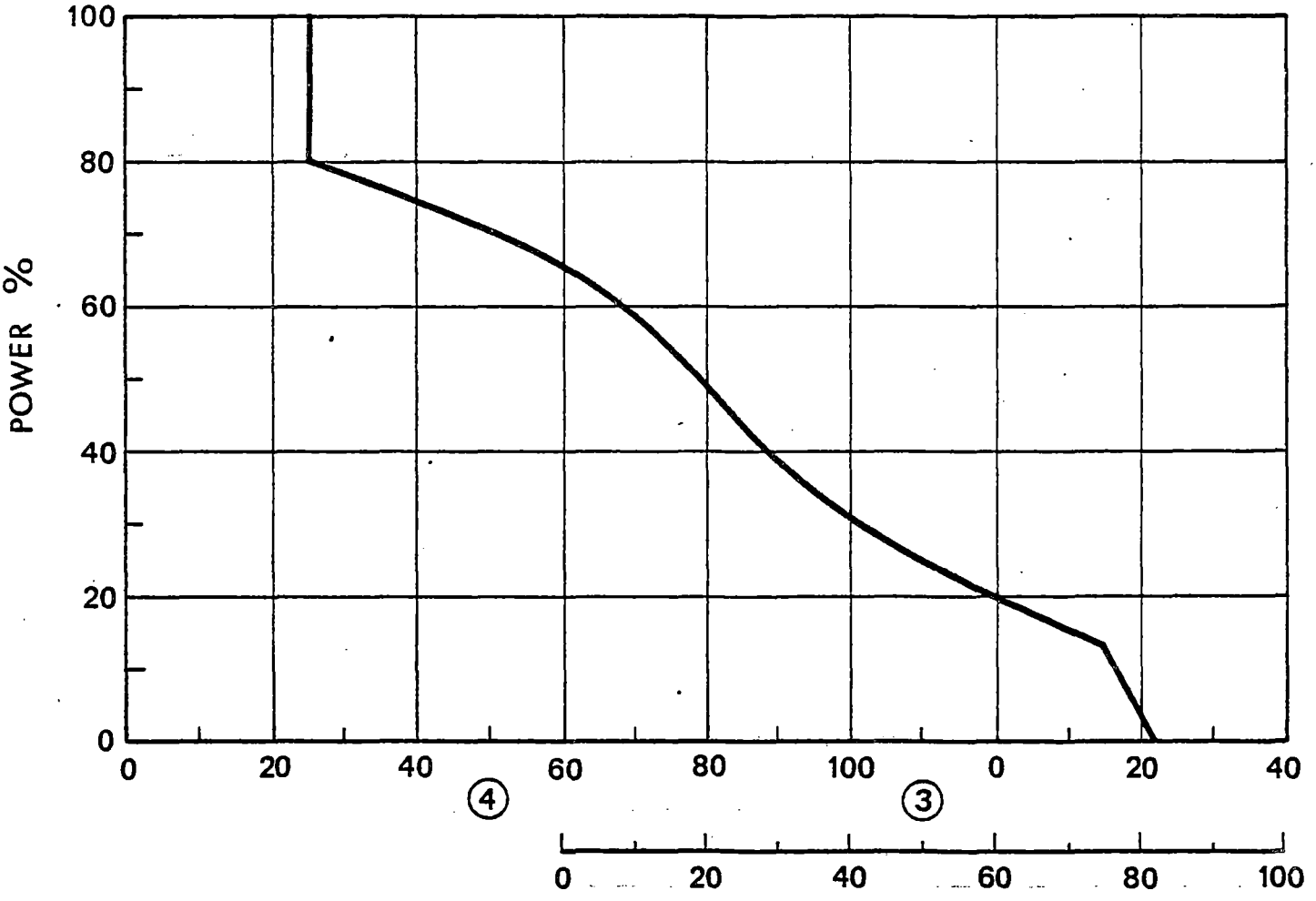

Figure 1

References

1. G R Keepin, Physics of Nuclear Kinetics, Addison-Wesley, MA (1965)

2. R J Tuttle, "Delayed-Neutron Data for Reactor Physics Analysis", Nucl. Sci. and Eng., 56, p 37, (1975).

3. D A Bixel to J G Keppler, "Palisades Plant Special Report No. 9, Cycle II Startup Report, August 30, 1976.

4. D A Bixel to A Schwencer, "Palisades Plant - Special Report No. 9, Revision of Table 6, November 9, 1976.