Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

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Director, Nuclear Reactor Regulation
Att Mr Dennis L Ziemann, Chief
Operating Reactors Branch No 2
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 -
PALISADES PLANT - WATER HOLE PEAKING

Reference (1) Letter from D L Ziemann to D A Bixel dated July 11, 1979.

Reference (1) requested information which would provide assurance that water hole peaking is appropriately considered in the calculation of flux distributions. Consumers Power Company's response is provided below:

Water hole peaking is accounted for in the evaluation of Palisades power distributions by including a computed factor for local peaking within assemblies. The local peaking factors are derived from two-dimensional quarter-core pin-by-pin PDQ analyses of the core power distribution. Changes in local peaking with both assembly burnup and the position of the control rod banks are accounted for in the power distribution synthesis procedure.

The calculational procedures for the PDQ analyses are described in the ENC Topical Report XN-75-27 with supplements. In the pin-by-pin PDQ model the various composition regions of the core are specifically described including fuel pins, burnable poisons, instrument tubes, guide bars and water holes or slots. Cross sections appropriate to each of these regions are put into the program and their effect on the local power distribution is inherent in the flux solution.

There is some information on local power distribution verification in Section 4.2 of XN-75-27. In addition, a comparison between ENC's calculational models and a Monte Carlo calculation (XMC) for a Combustion Engineering assembly containing water holes was presented to the NRC on April 25, 1979 in conjunction with a review of the ENC PWR neutronics methods. This comparison performed on a 14 x 14 CE assembly with an average enrichment of 3.03 w/o is shown in Figure 1. The comparison indicates good agreement between XMC and the two-group XPOSE/PDQ7 design model with the largest deviation adjacent to the water holes being about 1.5 percent.

A comparison for Palisades assemblies has been made between the ENC PDQ model and the CASMO program run at Consumers Power Company. CASMO is a single assembly lattice physics program using a version of transport theory called transmission-probabilities and several energy groups. Figure 2 shows the maximum local pin peaking factor as a function of exposure in a Palisades Reload H unshimmed assembly calculated by the two-group MND XPOSE/PDQ7 model and by CP Co's CASMO model. The two curves are similar in shape with the maximum difference being about 2.2%. Up to a burnup of about 20 Gwd/mt the peak power in the assembly is located in the corner adjacent to the intersection of the wide water gaps, thus the matter of "water hole peaking" is addressed in the comparison.

It should be noted that in the model no credit is taken for the effect of gamma smearing on the local energy deposition rate distributions. It is estimated that the "real" peaking factors are one to two percent below those based on fission rate distributions alone.

We conclude that the differences between the peaking factors calculated by the ENC model and more sophisticated techniques are small and that the conservative assumption that the energy deposition distribution is proportional to the energy production distribution tends to offset errors in calculated peaking factors.

In summary, we submit that:

1. Water hole peaking is considered in the evaluation of Palisades power distributions through the application of assembly local peaking factors.

2. Through information provided by the fuel vendor and through independent verification, we conclude that the effects of water holes are adequately considered in the calculation of the local peaking factors.

George S. Cashell for
David P Hoffman
Assistant Nuclear Licensing Administrator

CC JGKeppler, USNRD

Figure 1

CE Assembly Normalized Power
14x14 Pin by Pin
3.03 w/o Enriched

0.0 0.0	1.079 ± .019 1.063	.977 ± .014 .971	.949 ± .013 .943	.933 ± .011 .934	.913 ± .008 .933	.929 ± .015 .949
	1.029 ± .017 1.006	.962 ± .011 .972	.974 ± .011 .970	.967 ± .010 .966	.942 ± .009 .954	.969 ± .010 .962
		1.002 ± .015 1.007	1.077 ± .009 1.064	1.061 ± .011 1.065	1.010 ± .011 1.010	1.000 ± .019 .988
			0.0 0.0	0.0 0.0	1.098 ± .013 1.081	1.022 ± .011 1.017
				0.0	1.095 ± .014 1.088	1.020 ± .014 1.023
					1.000 ± .023 1.034	.999 ± .017 1.012
						1.017 ± .024 1.018

X.XXX Monte Carlo (XMC)

± XXX

Y.YYY XPOSE/PDQ

2 Group MND 1.855 EV Cutoff

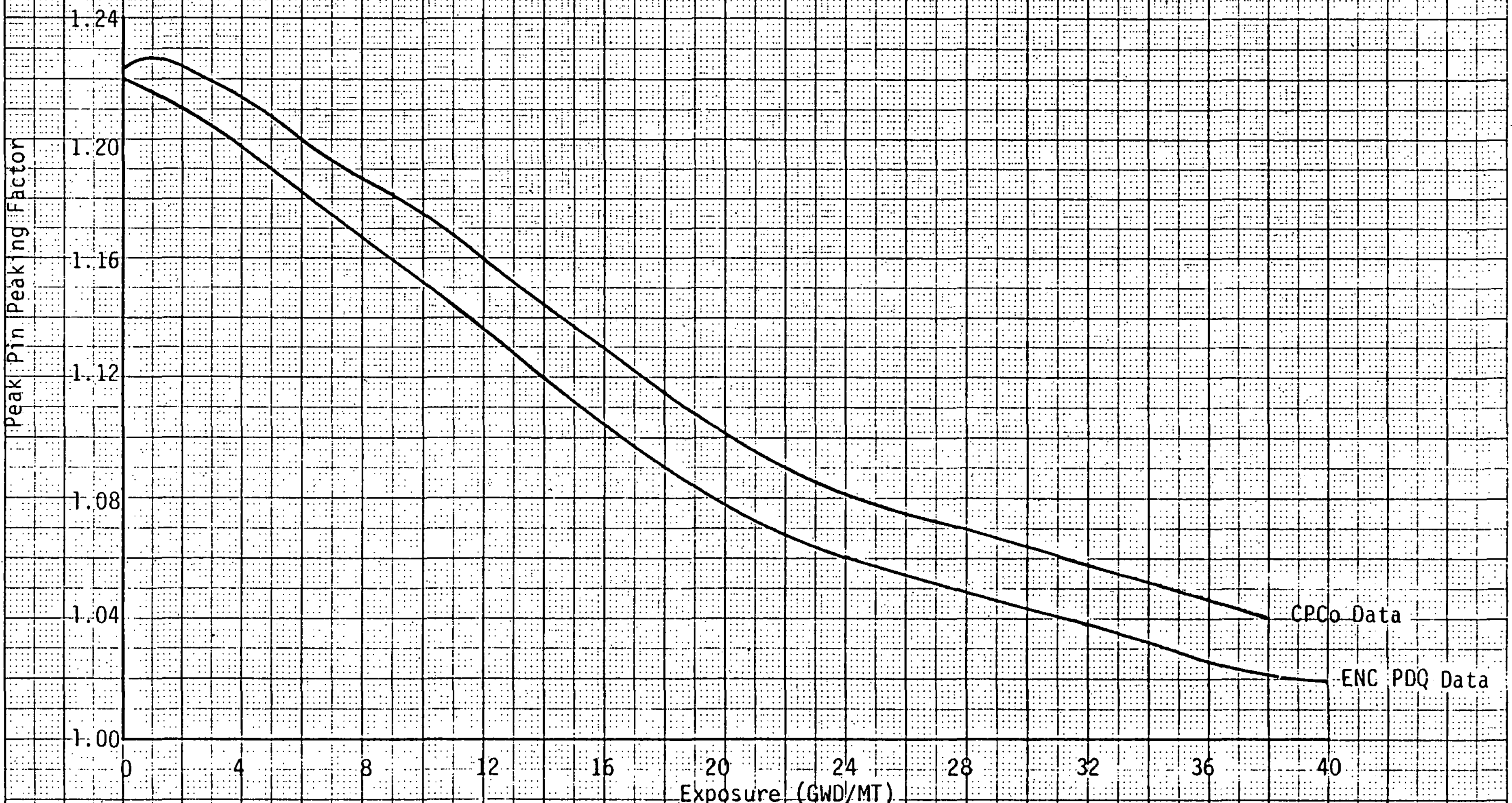

Figure 2 Palisades Peaking Factor vs. Exposure "H" Fuel Unshimmed

Figure 2