

NRC PDR



BROOKHAVEN NATIONAL LABORATORY  
ASSOCIATED UNIVERSITIES, INC.

Upton, New York 11973

Department of Nuclear Energy

(516) 345- 2146

September 10, 1979

Dr. P. S. Kapo  
Reactor Safety Branch  
Division of Operating Reactors  
Nuclear Regulatory Commission  
Washington, D. C. 20555

Dear Dr. Kapo:

In response to your request for a criticality study related to the drop of a heavy load in a spent fuel storage facility, we have performed a series of calculations using the conditions you had specified.

The HAMMER multigroup, transport theory code has been used to obtain the multiplication factors for an infinite array of PWR fuel pins. The calculations were carried out at three different enrichments (0.9, 2.0, and 3.5 w/o  $^{235}\text{U}$ ) over a range of water-to-uranium volume ratios from 0.5 to 4.0 and at four boron concentrations: 0, 1000, 2000, and 3000 ppm.

Table 1 lists the  $k_{\infty}$ 's for each of the conditions investigated. Figures 1, 2, and 3 show the criticality curves for the 0.9, 2.0, and 3.5 w/o  $^{235}\text{U}$  enrichments, respectively.

We shall be glad to discuss this work with you should you have any questions.

Sincerely yours,

Dimitrios Cokinos  
Reactor Core Safety Analysis Group

DC/as  
CC: J. Carew  
P. Check  
D. Diamond  
M. Dunenfeld  
W. Y. Kato  
M. M. Levine  
Attachments (5)

7910090368

1114 058

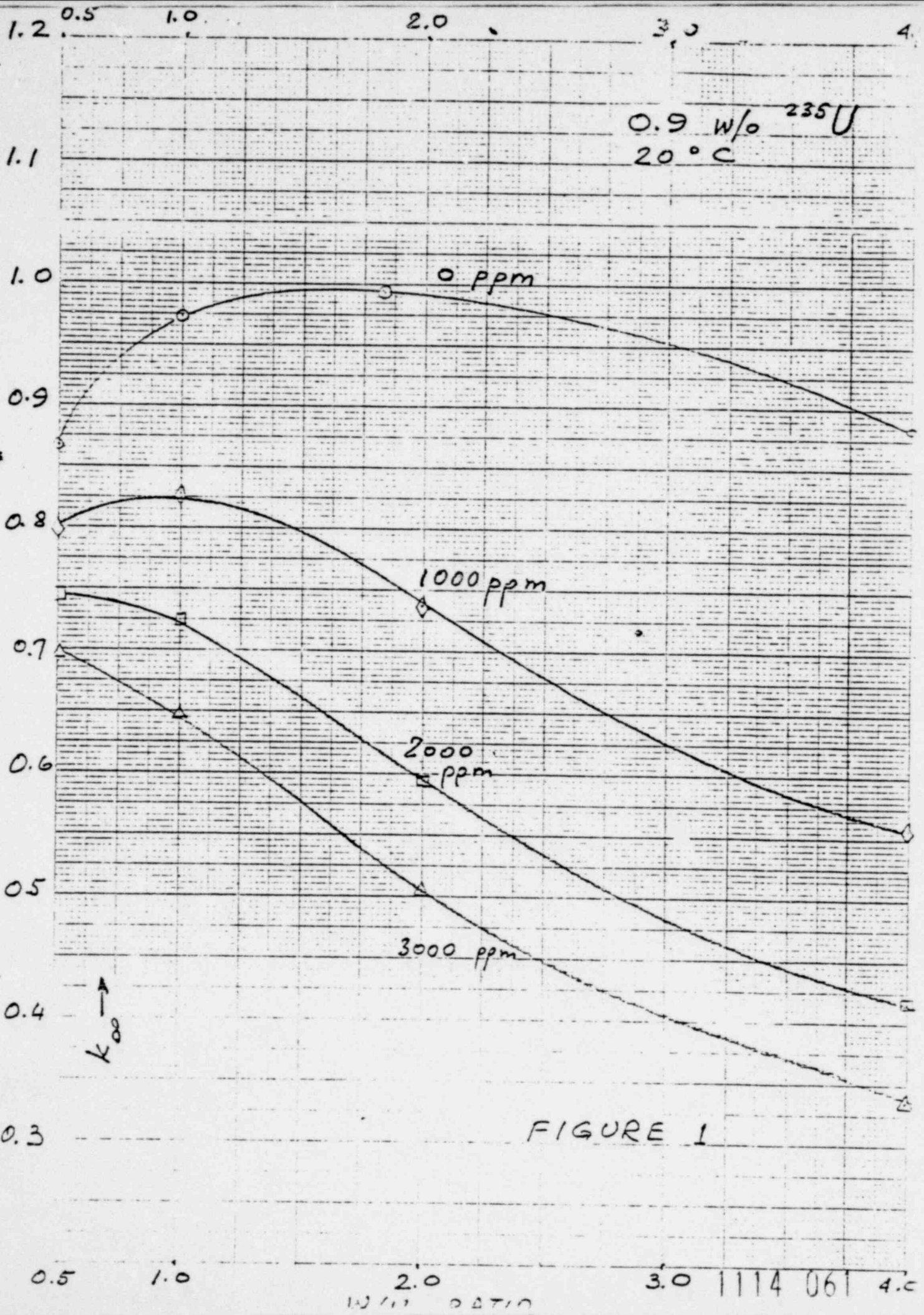
TABLE I

ENRICHMENT w/o	BORON CONCENTRATION ppm	W/U RATIO	$k_{\infty}$
0.9	0	0.5	0.86694
0.9	0	1.0	0.97398
0.9	0	1.7	0.99437
0.9	0	4.0	0.88216
0.9	1000	0.5	0.79986
0.9	1000	1.0	0.82726
0.9	1000	2.0	0.73696
0.9	1000	4.0	0.55640
0.9	2000	0.5	0.74541
0.9	2000	1.0	0.72484
0.9	2000	2.0	0.59640
0.9	2000	4.0	0.41519
0.9	3000	0.5	0.69958
0.9	3000	1.0	0.64812
0.9	3000	2.0	0.50498
0.9	3000	4.0	0.33523
2.0	0	0.5	1.04818
2.0	0	0.67	1.12029
2.0	0	1.0	1.20508
2.0	0	2.0	1.27528
2.0	0	4.0	1.21536
2.0	1000	0.5	0.99938
2.0	1000	0.67	1.04771
2.0	1000	1.0	1.08670
2.0	1000	2.0	1.04481
2.0	1000	4.0	0.86081
2.0	2000	0.5	0.95670
2.0	2000	1.0	0.99345
2.0	2000	2.0	0.93168
2.0	2000	4.0	0.67498
2.0	3000	0.5	0.91833
2.0	3000	0.67	0.93333
2.0	3000	1.0	0.91684
2.0	3000	1.67	0.82768
2.0	3000	2.0	0.78056
2.0	3000	4.0	0.55884

TABLE I (continued)

ENRICHMENT w/o	BORON CONCENTRATION ppm	W/U RATIO	$k_{\infty}$
3.5	0	0.5	1.14502
3.5	0	0.67	1.22127
3.5	0	1.0	1.31842
3.5	0	2.0	1.42324
3.5	0	4.0	1.40510
3.5	1000	0.5	1.11129
3.5	1000	0.67	1.16948
3.5	1000	1.0	1.22990
3.5	1000	2.0	1.23402
3.5	1000	4.0	1.07821
3.5	2000	0.5	1.08061
3.5	2000	0.67	1.12361
3.5	2000	1.0	1.15537
3.5	2000	1.67	1.12624
3.5	2000	2.0	1.09494
3.5	2000	4.0	0.88348
3.5	3000	0.5	1.05207
3.5	3000	0.67	1.08200
3.5	3000	1.0	1.09071
3.5	3000	2.0	0.98661
3.5	3000	4.0	0.75212

POOR ORIGINAL

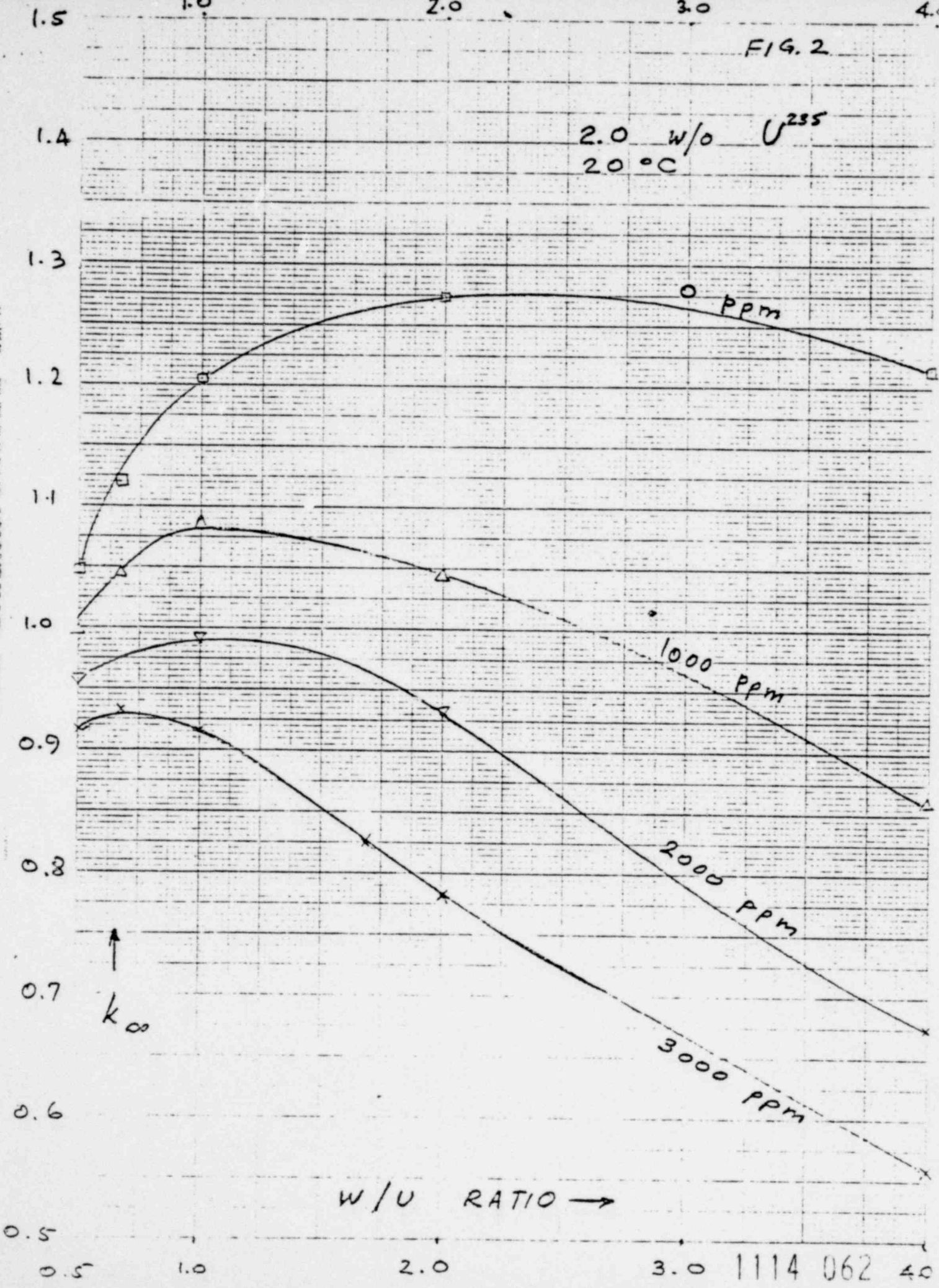


POOR ORIGINAL

ASSEMBLY PA

FIG. 2

2.0 w/o  $U^{235}$   
20 °C



$k_{\infty}$

W/U RATIO →

1114 062 40

POOR ORIGINAL

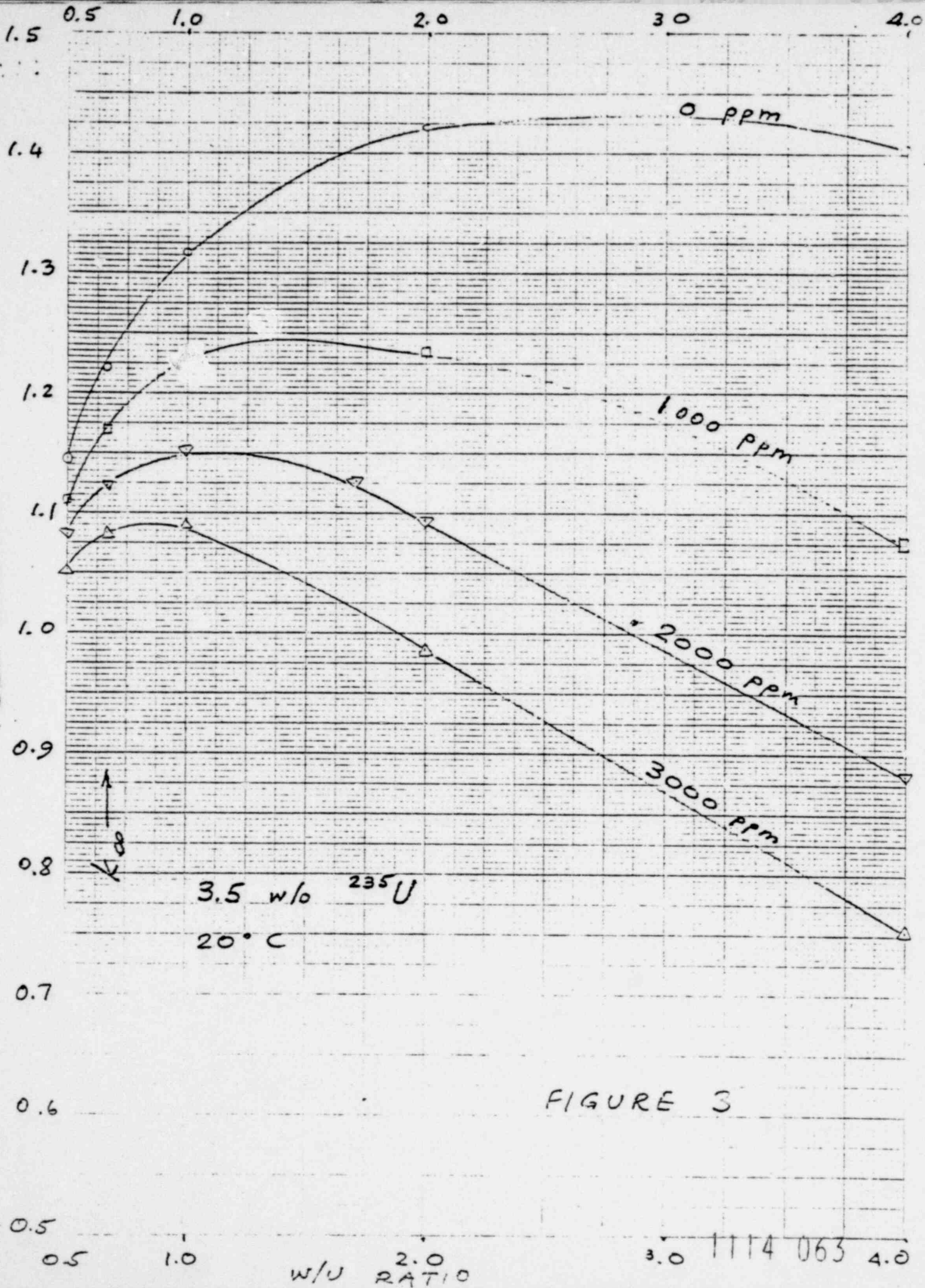


FIGURE 3