

GENERAL LATTICE DESIGN GROUP

A. M. Weinberg

Lattice Calculations

The multiplication constants for various geometries using P-9 as moderator were calculated by Messrs. Williamson and Stephenson. The values quoted below are based on an oxygen cross-section of 8×10^{-27} and a D cross-section of 1.9×10^{-27} ; in view of the recent measurements at Argonne, the value for oxygen is extremely pessimistic. This is somewhat balanced by the fact that the P-9 actually available will contain some H₂O contamination.

<u>Geometry</u>	<u>Density of Metal</u>	<u>Moderator</u>	<u>Best η'/ϵ</u>	<u>Radius or Half Thickness of Metal at Optimum (in cm.)</u>	<u>$\left(\frac{\text{Vol. of Moderator}}{\text{Vol. of Metal}} \right)_{\text{optimum}}$</u>
Cylinders	18.9	P-9	~1.111	2 and over	27 at $r_0 = 2$ cm.
Cylinders	9	P-9	1.123	3 and over	
Cylinders	4	P-9	1.129	4 to 5	
Slabs	18.9	P-9	1.1415	0.6	23
Cylinders	18.9	P-9 with 2.5 mm. H ₂ O film	1.182		
Cylinders	18.9	Graphite soaked in P-9	1.182	1.25 to 1.50	43 at 1.25

The multiplication constant is $k = \eta \epsilon / \eta' \approx 1.305 \epsilon / \eta'$.

The k loss due to the 2.5 mm. water film is mostly determined by the thermal absorption of the water and much less by the blocking effect and added slowing down in the water. The overall loss for a 2.5 mm. film is about 4% for a 1 cm. rod. The blocking effect is less than in the graphite lattices partly because the diffusion coefficients in P-9 and graphite