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RESULTS OF PRELIMINARY NUCLEAR CALCULATIONS
FOR A HOMOGENEOUS RESEARCH REACTOR

Critical mass, fuel concentration, power, maximum power density, and wall power density have been obtained for bare spherical reactors having diameters of 8, 10, 11, and 12 feet, operating at 20°C, 100°C, 200°C, and 300°C and having poison levels of 0, 10% and 30%.* Maximum flux in all reactors was taken as 1×10^{16} neutrons/cm² sec.; since the power and all power densities are directly proportional to this figure, power and power densities corresponding to other fluxes may be easily computed.

The values for power density at the wall are rough estimates only, since the flux at the wall is a sensitive function of the assumed extrapolation distance.

Results for all reactors described above are shown in the graphs, results for 20°C and 300°C, 0 and 10% poison levels are tabulated. Pertinent nuclear data and methods of calculation are on file.

* Based on macroscopic fission cross section.

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20°C, clean

Reactor diameter, ft	M _c , kg	gms 25/kg D ₂ O	Power, Mw	Max.Power Dens., kw/L	Wall Power Dens., kw/L
8	3.6	0.43	400	170	2.5
9	4.0	0.34	450	140	1.8
10	4.5	0.28	500	110	1.3
11	5.1	0.23	560	94	0.98
12	5.7	0.20	630	81	0.79

20°C, 10% poison

Diameter, ft	M _c , kg	gms 25/kg D ₂ O	Power, Mw	Max.Power Dens., kw/L	Wall Power Dens., kw/L
8	4.0	0.47	440	190	2.8
9	4.4	0.37	490	150	2.0
10	5.0	0.30	550	120	1.5
11	5.5	0.25	610	100	1.1
12	6.2	0.22	680	88	0.86

300°C, Clean

Diameter, ft	M _c , kg	gms 25/kg D ₂ O	Power, Mw	Max.Power Dens., kw/L	Wall Power Dens., kw/L
8	8.7	1.4	670	290	6.6
9	9.2	1.1	710	215	4.4
10	10	0.84	760	170	3.1
11	11	0.69	820	140	2.2
12	12	0.57	890	110	1.7

300°C, 10% Poison

Diameter, ft	M _c , kg	gms 25/kg D ₂ O	Power, Mw	Max.Power Dens., kw/L	Wall Power Dens., kw/L
8	9.6	1.6	740	320	9.7
9	10	1.2	780	240	6.2
10	11	0.93	840	190	4.3
11	12	0.75	910	150	3.1
12	13	0.63	970	130	2.3

CRITICAL MASS, KG.

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Power, M W., FOR $\phi_{max} = 1 \times 10^{16} \text{ n/cm}^2 \text{ sec}$

Reactor Diam., ft.

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MAX. POWER DENSITY, KW/L, FOR $\phi_{max} = 1 \times 10^{16}$ N/cm² sec

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Power Density at Wall, kw/in^2 , for $\phi_{\text{max}} = 1 \times 10^{16} \text{ N/cm}^2\text{sec}$

DIAMETER, FT.

12

11

10

9

8

7

6

5

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007