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HRT CRITICAL CONCENTRATION AS A FUNCTION OF TEMPERATURE

The data presented in this report are the results of two-group, two-region calculations using the most recent nuclear data available. Results are given in Fig. I; pertinent nuclear data, reactor dimensions and the sources of this information are given in Table I; and symbols are defined in Table II. Blanket and non-fuel core composition was taken as 99.75% D₂O (by weight).

Table I

Temp., °C.	τ , cm ⁽¹⁾	D ₁ , cm ⁽²⁾	D ₂ , cm ⁽³⁾	Σ_a^m ⁽⁴⁾ cm ⁻¹	$\rho(T, P)$ ⁽⁵⁾ gm/cm ³
20	118.4	1.292	0.8338	8.803×10^{-5}	1.1106
50	120.6	1.292	0.8583	8.302×10^{-5}	1.100
100	128.5	1.346	0.9017	7.740×10^{-5}	1.066
150	141.5	1.412	0.9673	6.705×10^{-5}	1.016
250	182.9	1.606	1.146	5.301×10^{-5}	0.8935
280	207.2	1.709	1.233	4.844×10^{-5}	0.8395

Core radius 40.64 cm = 16 inches

Core tank thickness 0.635 cm = 1/4 inch

Blanket thickness 34.93 cm = 13.75 inches (Pressure vessel ID = 60 inches)

CF 54-8-53, HRT Design Data, R. E. Aven and F. C. Zapp

(1) Based on $\tau[20^\circ\text{C}, 1 \text{ atm}] = 120 \text{ cm}^2$ and $\tau(T, P) = \left[\frac{\rho(20^\circ\text{C}, 1 \text{ atm})}{\rho(T, P)} \right] \tau(20^\circ\text{C}, 1 \text{ atm})$
where $P = 2000 \text{ psia}$

(2) Calculated from various multigroup cross sections

(3) Calculated from values given in CF 54-4-142, "Temperature Dependence of the Neutron Diffusion Coefficient in Heavy Water" by L. C. Noderer

(4) Calculated from BNL 325 values: $\left\{ \begin{array}{l} \sigma_a^D (2200 \text{ m/sec}) = 0.49 \text{ mb, both assumed } \frac{1}{v} \\ \sigma_a^H (2200 \text{ m/sec}) = 330 \text{ mb} \end{array} \right.$

(5) Data from R. E. Aven, CF 54-1-161

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Table II

τ	Fermi Age
D_1	Fast group neutron diffusion coefficient
D_2	Thermal group neutron diffusion coefficient
Σ_a^M	Moderator macroscopic absorption cross section
ρ	Moderator density
σ_a^D	Microscopic absorption cross section of deuterium
σ_a^H	Microscopic absorption cross section of hydrogen

1 mb = 10^{-3} barns

CRITICAL CONCENTRATION, GMS. D_2O

Fig. 1

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