The decrease of the thermal-neutron fission rate, F_3, with increasing enrichment is produced by the increase of the penetration length. Spreading thermal neutrons further into the tamper because of their higher incident energy allows the absorption by water to compete successfully against an increasing fission cross section in the active material.

In all cases the first and second groups correspond respectively to the range of ages $\tau_1' = 2$ cm^2 and $\tau_2'' = 3.3$ cm^2. It was convenient to split the two groups in this manner because, at an energy corresponding to the age $\tau_1 = l^2 + \tau_1'$ from incidence, a sharp increase in the UF_6 absorption cross section with age set in. The correlation between neutron energy and age in water was made by referring to the report by Nordheim, Nordheim, and Soodak. (CP-1251).

The three diffusion lengths L_1, L_2, and L_3 as a function of percentage enrichment, (25)/(25 + 28), in solid UF_6 are shown in Fig. 3.

The calculations of the critical slab thickness by Eq. 50 requires knowledge of ν, σ, and f. Throughout we used $\nu = 2.47$ and σ and f are shown in Fig. 4 as functions of enrichment percentage. They depend on E_f, the average fast neutron energy in the UF_6, which is shown in the same figure.

The rapid decline of σ between 6 and 15% enrichment shows the effect of the low energy resonance in the Fluorine cross section.

In estimating E_f one must bear in mind the fact that it is certainly less than the average energy of neutrons incident on the water tamper, E_I, because a sizable fraction of the total current I going into the water consists of fission neutrons that come directly from the slow neutron fission source, $\phi(x)$, without suffering any collisions in the UF_6. This part of the current of neutrons which suffers no moderation in the UF_6 is

$$I_0 = \int_0^a dx\ \phi(x)\ E_2(x)/2 \tag{63}$$

where

$$E_2(x) = \int_1^\infty dy\ e^{-xy}/y^2$$

By extending the upper limit of integration to ∞ ($\phi(x)\ E_2(x)$ is negligible for $x > a$), one obtains, upon inserting Eq. 22 for $\phi(x)$ into Eq. 63

$$I_0 = I(\nu/2) \sum_{i=1}^{3} F_i[1 - \alpha_i^{-1}\ ln\ (1 + \alpha_i)] \tag{64}$$

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