In the water the diffusion of thermal neutrons is governed by the simple diffusion equation,

$$(n\nu)_3'' - (n\nu)_3/L^2 + Q_3/L^2\,\sigma_a^{(H)} = 0 \tag{17}$$

Here $\sigma_a^{(H)}$ is the hydrogen thermal absorption cross section per cm^3 in water and L is the thermal diffusion length in water; $\sigma_a^{(H)} = 0.0208\ cm^{-1}$ and $L = 2.88$ cm.

In the active material the thermal neutron mean free path and diffusion length are designated as Λ_3 and L_3, respectively. Thermal neutrons which enter the active layer obey the diffusion equation,

$$(N\nu)_3'' - (N\nu)_3/L_3^2 = 0 \tag{18}$$

The boundary conditions at $x = 0$ that the solutions of Eqs. 17 and 18 satisfy are:

$$L^2\,\sigma_a^{(H)}(n\nu_3)' = (\Lambda_3/3)(N\nu)_3', \text{ and } (n\nu)_3 = (N\nu)_3 \tag{19}$$

Multiplying the thermal-neutron flux in the active material $(N\nu)_3$ by the thermal-neutron fission cross section per cm^3, $\sigma_f^{(3)}$, one obtains the third-group fission distribution,

$$I\,f_s^{(3)}(x)\,dx = I\,F_3\exp(x/L_3)\,d(x/L_3), \quad x \le 0 \tag{20}$$

where F_3 is the long expression,

$$\begin{aligned}
F_3 = {} & (L_3/l)(\sigma_f^{(3)}/\sigma_a^{(H)})(1 - \tau_1'/l^2)^{-1}\,(1 + S_3/3\,\sigma_a^{(H)}\,L)^{-1} \\
& \times \{(1 - \tau_2''/l^2)(1 + L/l)^{-1} - (\sqrt{\tau_1'}/l)(1 + S_1 l/\lambda)(1 + L/\sqrt{\tau_1'})^{-1} \\
& \times (1 - \tau_2''/\tau_1')^{-1}\,B(\tau_1') \\
& + (\sqrt{\tau_1'}/l)(1 + S_1 l/\lambda)(1 - \sqrt{\tau_2''/\tau_1'} + B'^{-1}(\tau_2''))(1 - \tau_2''/\tau_1')^{-1} \\
& + (1 + L/\sqrt{\tau_2''})^{-1}\,B(\tau) \\
& - (\sqrt{\tau_2''}/l)(1 + S_2 l/\lambda)(1 + L/\sqrt{\tau_2''})^{-1}(1 - \tau_2''/l)^{-1}\,B'(\tau_2'')\}
\end{aligned} \tag{21}$$

In the next section we will consider the fast neutron multiplication that proceeds from the fission neutron source, $\phi(x)$, given by ν times the sum of the three fission rate distributions, Eqs. 8, 13, and 20.