Relate Burn -up and Integral Flux

Let N = atoms of fissile isotopes

σ_c, σ_f = capture and fission xsections, respectively

$$\frac{dN}{dt} = -Nnv\sigma_a$$

where $\sigma_a = \sigma_c + \sigma_f$

Integrating and finding the % of fissile atoms lost, one finds;

$$100\left\{\frac{(N_o - N)}{N_o}\right\} = 100\left\{1 - e^{-nvt\sigma_a}\right\}$$

The % of atoms fissioned is then;

$$100\left[\frac{\sigma_f}{\sigma_a}\right]\left\{1 - e^{-nvt\sigma_a}\right\}$$

when $nvt\sigma_a$ << 1, exp (-x) ≈ 1-x,

% atoms fissioned = 100 nvtσ_f

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since σ_f ≈ 550 barns for ^{35}U in thermal flux;

% B.U. of ^{35}U atoms = 55000 b • (nvt)

If only a fraction of U atoms are fissionable;

$$\frac{N_f}{N_U}\left[100 \bullet nvt\sigma_f\right]$$