Problem
Enrichment -3

Calculate the natural U feed and SWU factors 1 billion y into the future. Assume tails of 0.15% and 3% enriched product;

$t_{\frac{1}{2}}\left(^{35}U\right)$ **= 7.1 x 10^8 y,**

$t_{\frac{1}{2}}\left(^{38}U\right)$ **= 4.51 x 10^9 y.**

x_p **= 3%**
x_w **= 0.15%**
x_f **= ?**

assume 1 g, today-0.00711 g ^{35}U, 0.99289 g ^{38}U

after 1x10^9 y,

$$[^{35}U]=0.00711 * [\exp(\frac{-0.693 \bullet 1}{0.71})]=0.002679 \text{ g } ^{35}\text{U}$$

$$[^{38}U]=0.99289 * [\exp(\frac{-0.693 \bullet 1}{4.51})]=0.851467 \text{ g}$$

total U= 0.854147 grams

frac ^{35}U = 0.003136
^{38}U = 0.996864
x_f **= 0.003136**

$$V(x_w) = (2x_w - 1)\ln[\frac{x_w}{(1 - x_w)}] = (0.997)(6.5008) = 6.48129$$

$$V(x_p) = (2x_p - 1)\ln\left[\frac{x_p}{(1 - xp)}\right] = (.94)(3.476)$$
$$= 3.2675$$

$$V(x_f) = (2x_f - 1)\ln\left[\frac{x_f}{(1 - x_f)}\right] = (.99373)(5.7618)$$
$$= 5.7257$$

$$S = V(x_p) + \frac{W}{P} V(x_w) - \frac{F}{P} V(x_f)$$

$$S = 3.2675 + \left(\frac{F}{P} - 1\right) 6.48129 - \frac{F}{P}\{5.7257\}$$

$$= -3.21379 + \frac{F}{P}(0.75559)$$

$$\frac{F}{P} = \frac{(x_p - x_w)}{(x_f - x_w)} = \frac{(0.03 - 0.0015)}{(0.003136 - 0.0015)}$$

$$= \frac{(0.0285)}{(0.001636)} = 17.421$$

$$S = 17.421 \bullet 0.75559 - 3.21379$$

$$S = 9.95 \text{ SWU/kg}$$

Today, S= 5-6 SWU/kg