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80937
HW-80937

FISSION PRODUCT FORMATION
IN FUEL ELEMENTS

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REACTOR PHYSICS OPERATION
RESEARCH AND ENGINEERING
N-REACTOR DEPARTMENT

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MASTER

GROUP 1

FISSION PRODUCT FORMATION
IN FUEL ELEMENTS

REQUEST TO DETERMINE Kr-85 BUILDUP FOR N-REACTOR FUELS

The appropriate constants for equations similar to those in HW-58959 that should be representative for N-Reactor fuels are given below.

The yields used are:

$$\frac{Y_{2r}}{T_{1/2}} = .02691 \text{ percent X yr}^{-1}$$

$$\frac{Y_{28}}{T_{1/2}} = .0143 \text{ percent X yr}^{-1}$$

$$\frac{Y_{49}}{T_{1/2}} = .01196 \text{ percent X yr}^{-1}$$

(a) For Natural Uranium

$$\frac{\text{Curies of Kr-85}}{\text{Ton Uranium}} = \left[(.430 - .201 \frac{\delta}{1+\delta}) M - .374 \times 10^{-4} M^2 \right] \\ (1-.000088T) (1-.0001778t)$$

(b) For .94% Uranium

$$\frac{\text{Curies of Kr-85}}{\text{Ton Uranium}} = \left[(.430 - .201 \frac{\delta}{1+\delta}) M - .296 \times 10^{-4} M^2 \right] \\ (1-.0000888T) (1-.0001775t)$$

where M = MWD/T

T = reactor residence time (days)

t = out of reactor time (days)

$\delta = .069$

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(c) For Natural Uranium

$$\frac{\text{Curies Kr-85}}{\text{gm Pu}} = \frac{1}{1.13} \left[(.430 - .201 \frac{\delta}{1+\delta}) - .374 \times 10^{-4} M \right]$$

$$\left[1 - .0000888T \right] \left[1 - .0001775t \right]$$

$$\exp (.75 \times 10^{-4} M)$$

(d) For .94% Uranium

$$\frac{\text{Curies Kr-85}}{\text{gm Pu}} = \frac{1}{.95} \left[(.430 - .201 \frac{\delta}{1+\delta}) - .296 \times 10^{-4} M \right]$$

$$\left[1 - .0000888T \right] \left[1 - .0001775t \right]$$

$$\exp (1.59 \times 10^{-4} M)$$

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