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Proj. 5-8
Docket 70-36
PH: 7/25/60

Mallinckrodt's 7/8/60 proposed bandage for 8" UF_6 cylinders.

Range of values:

Enrichment, % U-235	12.5 %	3.75 %
Kg U-235 / cylinder	9.6 Kg	2.88 Kg

Spacing of Table X, TID-7019 not used; instead, mass control chosen, and a k of 0.65 assumed (¶ 3.3, item 3C(2), p. 22, TID-7019); from Appendix V, p. 75 → Safe interaction Ω = 2.5 steradians.

Mallinckrodt uses the cylindrical shape in determining Ω, and comes out with values of 1.39 and 2.37 steradians. However, item 3C(2) specifically says that interaction in this case is to be computed on the basis of the mass being contained in a spherical volume of H/U = 800.

B-ble

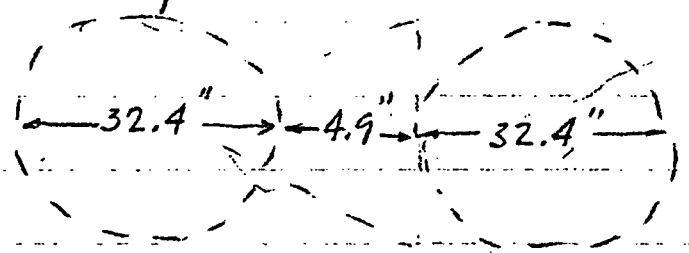
For 12.5% enrichment, assume that most of volume of sphere is taken up by water at an $H/U = 800$

$\therefore$ In a cylinder, grams $H_2O = \frac{800(9,600)(18)}{(2)(235)} = 294,000$

$294 \text{ liters} \times \frac{61 \text{ in}^3}{\text{liter}} = 18,000 \text{ in}^3$

$\therefore r^3 = \frac{18,000}{\frac{4}{3}\pi} = 4,280 \rightarrow r = 16.2 \text{ inches}$

Adjacent ~~cylinders~~ spheres:



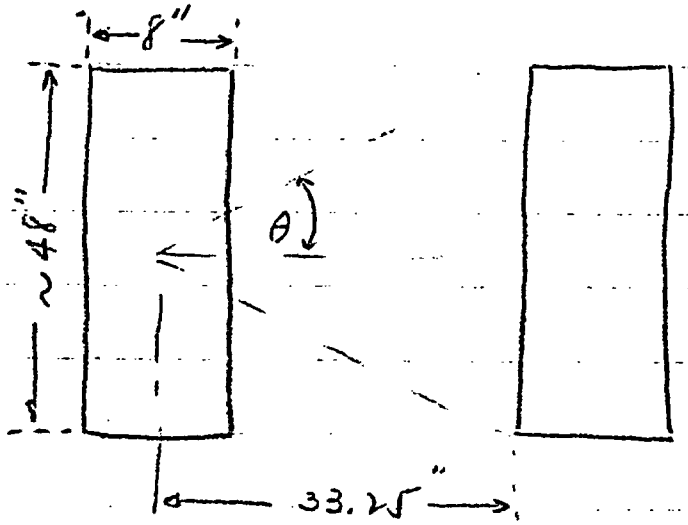
$\Omega = 2\pi(1 - \cos\theta)$; $\tan\theta = \frac{16.2}{16.2+4.9} = 0.767$

$\therefore \cos\theta = 0.793$

$\Omega = 2\pi(1-0.793) = 2\pi(0.207) = 1.3$

(for adjacent ~~cylinders~~ spheres)

Recalc. of Ω using cylindrical geometry (Adjacent cylinders):



$$\Omega = \frac{2d}{h}\sin\theta \quad ; \quad \tan\theta = \frac{24}{33.25}$$

$$\therefore \sin\theta = 0.585$$

$$\therefore \Omega = \frac{16}{33.25}(0.585) = 0.281$$

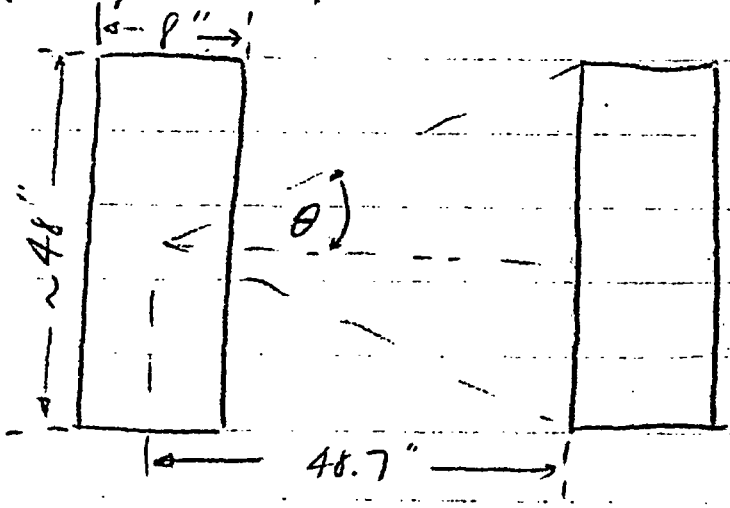
(Diagonal cylinders):

$$\tan\theta = \frac{24}{48.7} = 0.493$$

$$\therefore \sin\theta = 0.442$$

$$\therefore \Omega = \frac{16}{48.7}(0.442)$$

$$\Omega = 0.145$$



$\therefore \Omega = 3(\text{adjacent cyls.}) + 2(\text{diagonal})$
$= 3(0.281) + 2(0.145) = 0.844 + 0.290 = 1.13$

(checks 1.39 steradians calc. by MCW fairly well, as they have also included very remote containers).

Two trucks side-by-side:

$\Omega = 4(\text{adj cyls}) + 4(\text{diagonal})$
$= 4(0.281) + 4(0.145) = 1.13 + 0.58 = 1.71$

(Again, MCW is conservative).

Total height of 8" cylinder $\approx$ 16½"
Height of "birdcage" = 8"
Height of cylinder stand = 6"
$\therefore$ cylinder will protrude above top of birdcage by 16½" − 12" = 4½"

diameter of protrusion = 7"
clearance into birdcage above = 4.0";
$\therefore$ cylinders cannot be conveniently stacked.