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Proj. 5-8
Docket 70-36

4 pages
PH: 7/25/60

Mallinckrodt's 7/8/60 proposed bridge
for 8" U₂ 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 5, p. 75 →
safe interaction $\Omega = 2.5$ steradians.

Mallinckrodt uses the cylindrical shape
in determining Ω , and comes out with
values of 1.39 and 2.37 steradians. How-
ever, 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-66

(2)

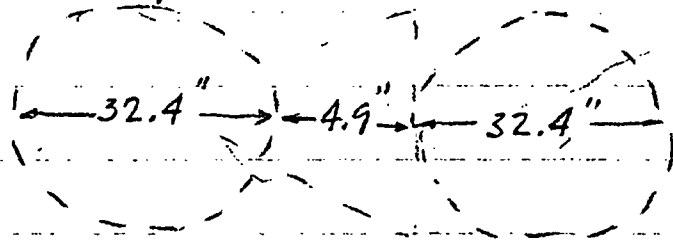
For 12.5% enrichment, assume that most of volume of sphere is taken up by water at an $H/U = 800$

$$\therefore \text{In a cylinder, grams H}_2\text{O} = \frac{800(9,600)(18)}{(2)(235)} = 294,000$$

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

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

Adjacent ~~cylinders~~ spheres!



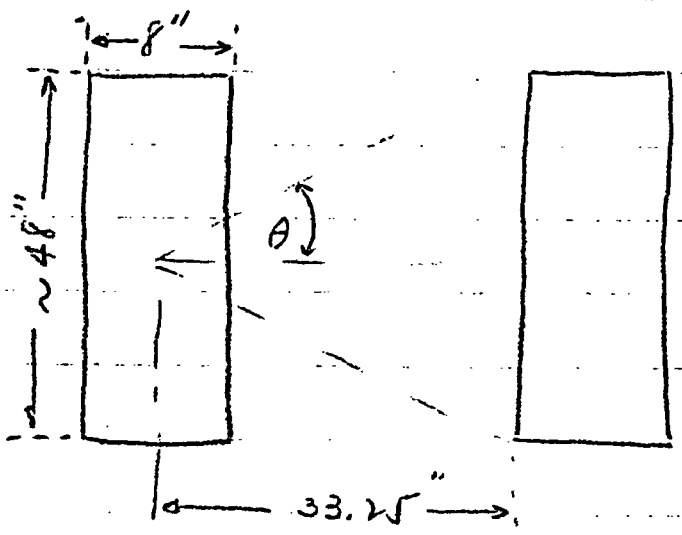
$$\Omega = 2\pi(1 - \cos\theta); \quad \tan\theta = \frac{16.2}{16.2 + 4.9} = 0.767$$

$$\therefore \cos\theta = 0.793$$

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

(for adjacent ~~cylinders~~ spheres)

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



$\rho_c = 37 \frac{1}{4}$ " approx $\sim 55^\circ$

$\frac{281}{516} = 0.544$
 $0.675 \times 0.9 = 0.6075$
 $10303 \times 8 = 82424$
 $0.225 \times 8 = 1.8$
 1.124
 580
 1.704
 1.485
 2.242
 1.83
 2.610

$$\Omega = \frac{2d}{h} \sin \theta$$

$$\tan \theta = \frac{24}{33.25}$$

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

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

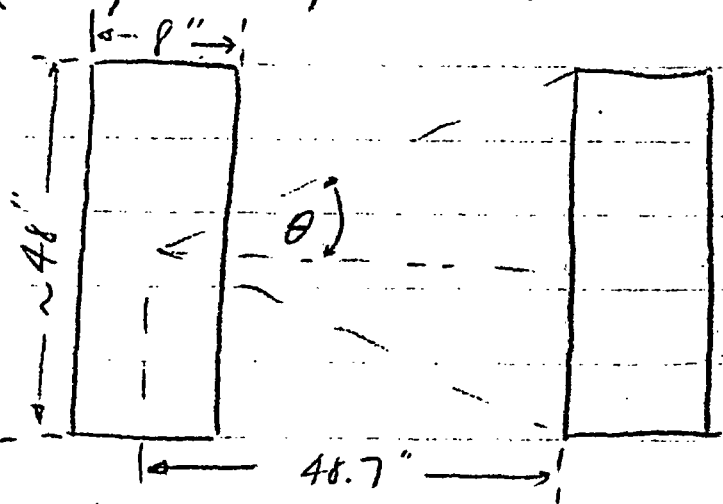
(Diagonal cylinders):

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

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

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

$$\Omega = 0.145$$



(4)

$$\begin{aligned}\therefore \Omega &= 3(\text{adjacent cyles.}) + 2(\text{diagonal}) \\ &= 3(0.281) + 2(0.145) = 0.844 + 0.290 = 1.13\end{aligned}$$

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

Two trucks side-by-side:

$$\begin{aligned}\Omega &= 4(\text{adj cyles}) + 4(\text{diagonal}) \\ &= 4(0.281) + 4(0.145) = 1.13 + 0.58 = 1.71\end{aligned}$$

(Again, MCW is conservative).

Total height of 8" cylinder $\approx 56\frac{1}{2}$ "

Height of birdcage = 52"

Height of cylinder stand = 6"

\therefore Cylinder will protrude above top of birdcage by $56\frac{1}{2} - 52 = 4\frac{1}{2}$ "

diameter of protrusion = 5.7"

clearance into birdcage above = 4.0";

\therefore cylinders cannot be conveniently stacked.