Memo to J

From CKB

Project SNM

Docket 70-36

Subject: Mallinckrodt Chemical Works

We have reviewed the October 31, 1958 and the additional information submitted on November 14, request of Mallinckrodt Chemical Works, for AEC approval of two shipping containers.

Mallinckrodt proposes to use a 5 gallon drum supported inside a 55 gallon "shortec" drum with 1" x 1" x 3/16" steel tee members fashioned into tripods at top and bottom to brace the 5 gallon drum in the larger drum. (Limited Safe) Batches to be shipped in each container will vary from 88 lb of 3% enrichment (1.2 kg U-235) to 13 lb of 10% enrichment (0.6 kg U-235). The maximum quantity to be shipped in any one load will be full truck or freight car with the containers placed side by side and stacked three high.

88x.88x.03

No

B-15

12-16-58

2882

Mallinckrodt
SNM-8
Docket 70-36

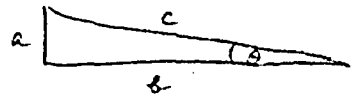
General: $\frac{\text{Cross sect area}}{\text{Sep. Dist}^2} = \frac{11.25 \times 13.50}{18.37^2} = 0.45$ for one drum

for 6 drums, $\Omega = 6 \times 0.45 = 2.70$

vs. 2.45

End to End $\frac{.785(11.25)^2}{18.5^2} = .29$

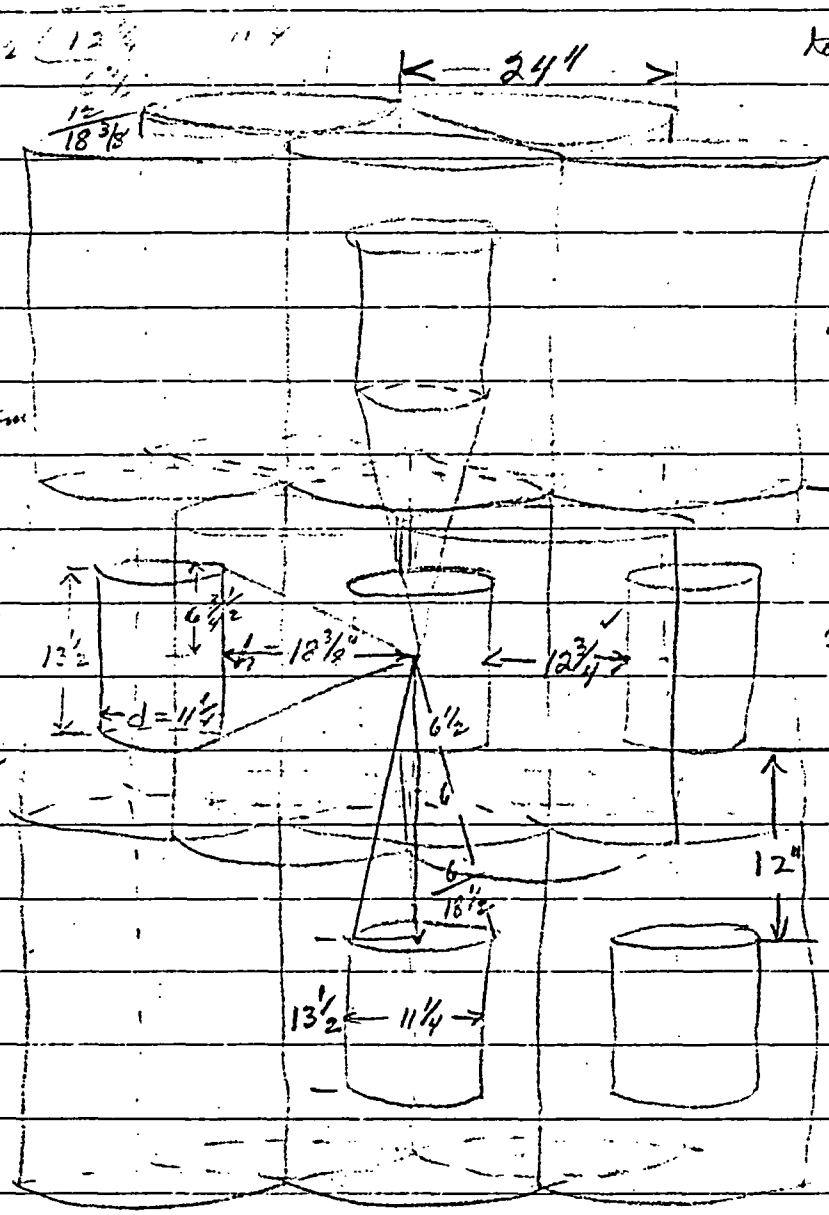
2 drums $\Omega = 2 \times .29 = 0.58$ vs 0.55



$\sin\theta = \frac{a}{c}$

$\cos\theta = \frac{b}{c}$

$\tan\theta = \frac{a}{b} = \frac{\sin\theta}{\cos\theta}$



$25\frac{1}{2}$
$13\frac{1}{2}$
$2 \left(\frac{12}{6}\right)$ top + bottom

$\sin\theta$
$\frac{13.5}{2} = 6.75$
$\frac{.50}{.75} = 42.2$
45.6
$18.38^2 = 338$
383.6
380.2
$= 19.6$
19.5

$\sin\theta \frac{6.75}{19.6} = .345$

$\frac{6.50}{19.5} = .333$

$\frac{11.25}{2} = 5.63^2$ 18.5^2 342 32 $374 = 19.35$

$\cos\theta = \frac{18.5}{19.35} = .956$

$1 - \cos\theta = \frac{.85}{19.35} = (.044)$

For 6 optimum drums $\Omega = 6\left[2\,\frac{d''}{12}\,\frac{1}{h'}\,\sin\theta\right] = 12\,\frac{11.25}{18.38}\,\frac{1}{1}\,(.333)$

Using relation $\frac{\text{Cross Sect. Area}}{(\text{Sep. Dist})^2} = \frac{13.5 \times 11.25}{(18.38)^2} = 0.45$ $6 \times 0.45 = 2.70$ $\longrightarrow$ $= 2.45 \div 6 = .41$

For drums above and below $\Omega = 2\left[2\pi(1 - \cos\theta)\right] = 2(6.29)(1 - .956)$ $.044$

$\frac{.785(11.25)^2}{(18.5)^2} = .29$, $.29 \times 2 = .58$ $\longrightarrow$ $.553$

Total angle $= 2.45 + 0.55 = 3.00$

$\frac{3}{4\pi} = 23.9\%$ OK if $k = 0.58$ Single layer $\rightarrow 2.45/4\pi = 19.5\%$; $k = 0.65$

Use 8% for $k = 0.8$