

3898

Project: S-8
Docket: 70-36

Donald A. Nussebaum, Chief
Source & Special Nuclear Materials Br.

MAR 7 1962

Charles D. Luke, Chief
Criticality Evaluation Br.

UNITED NUCLEAR-WALLINGKRODT -- DOCKET 70-36

REF: DLR:CDL

We have reviewed the United Nuclear applications dated December 28, 1961, and January 5, 1962, requesting approval of shipping procedures for UO₂ pellets with enrichments up to 5% U-235.

We do not recommend approval of the proposed procedures for two reasons. First, for mass controlled units in containers of sheet metal as described by the applicant, it is not proper to multiply the safe mass at optimum moderation by a factor of 1.8, because the full safety factor of 2.3 is necessary to protect against criticality in the event of accident, moderation and the combining of the contents of two containers.

Second, we recommend against the proposed notation on the bill of lading to prevent commingling. Please refer to the fourth paragraph of our January 4 memo for a possible alternative.

We suggest Mr. Christian Beck give you his thoughts on the structural integrity of the shipping container.

Attachments:

1. Ltr dtd 12/28/61
2. Ltr dtd 1/5/62

DLR:FL:CEB

CDLuke/vj

3/7/62

B-90

File with General ...
Unit. Num (Mallinckr.)

70-36

5-

Dec 28, 1961 UO_2 fuel Rod Ship Cont.

$\leq 5\%$ enr UO_2 ^{3/4" dia} pellets ($\rho = 10.5$) in metal or paper (plastic) tubes
length 18" to 60"

wt 200 - 2000g UO_2

Tie seven rods together and put in paper tube

Put nine or more in container (7501)

Container filled for 2.5% enr and lower

Above 2.5% use shim and restriction plate

Wt. leads to 1.8 x M_2 ... Fig 13 (for ...)

Example Enr. 2.4%

$$M_2 (\text{Fig. 13}) = 1.2 \text{ kg}$$

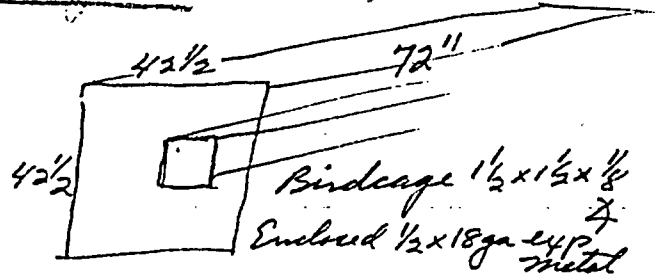
$$M = 1.2 \text{ kg} = 2.16 \text{ kg} \times = 2.16 \times \frac{1}{0.024} \times \frac{1}{0.02} = 102.5 \text{ kg } UO_2$$

However, only 134 sticks or 96 kg UO_2 can be placed

therein

Truck 7'11" high 7'8" wide

RR Car 8'6" high 8'6" wide
or 10'6" " 9'2" "



\therefore most compact array is single row, double layer array (at 1)

Ship LTr, LCh or ry express. Max 22 containers

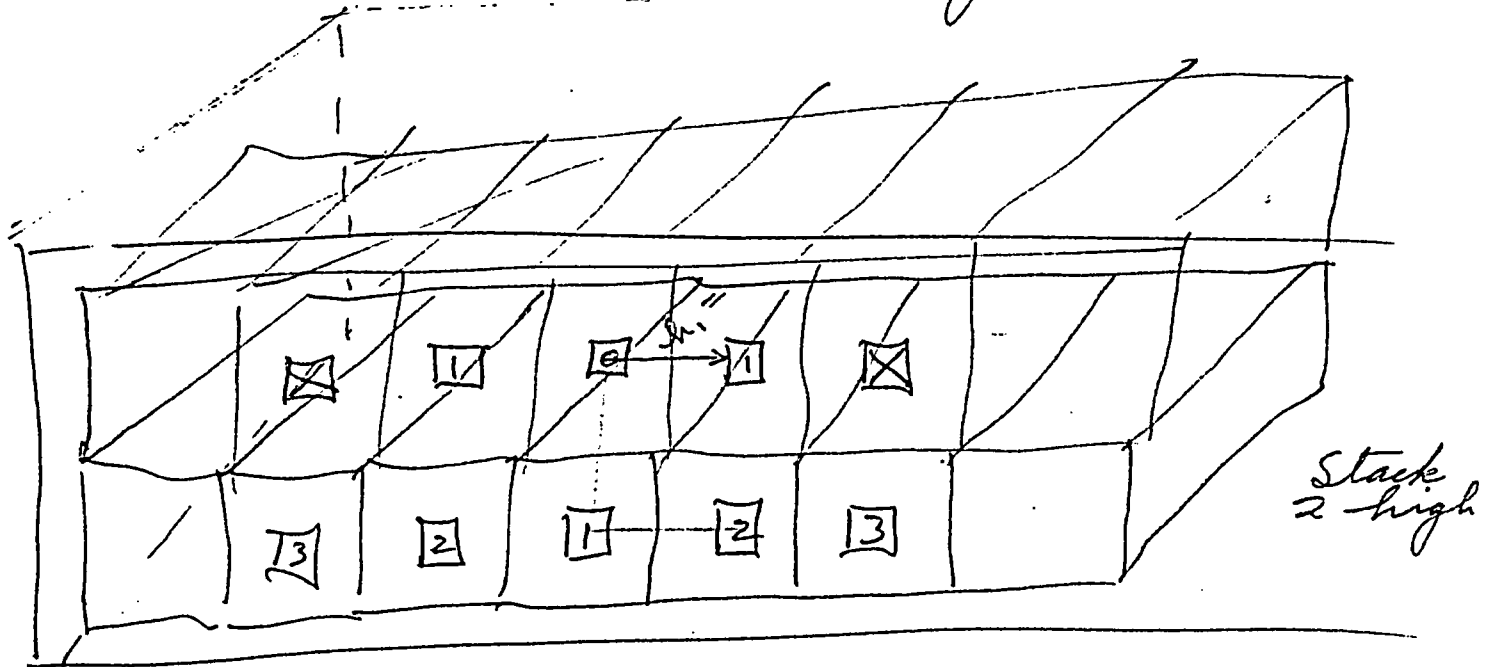
20 max can in truck will hold?

$\bar{v}_f = .093$ (1.17 ster); With twin $v_f = 0.135$ (1.7 ster)

Since $h_{eff} = 0.65$, max $v_f = 0.20$, so spacing is OK.

Avoid commingling by instructions on B/p.

Check on Solid Angle



Stack
2 high

From 0 to three #1 $h_1 = 42.5 - \frac{6.5}{2} = 42.5 - 3.3 = 39.2''$

K-1309 $\left\{ \begin{aligned} \sigma &= \frac{e \times e}{dia} = \frac{42.5 - 6.5}{6.5} = \frac{36}{6.5} = 5.53 \\ \lambda &= \frac{l}{d} = \frac{60}{6.5} = 9.2 \end{aligned} \right.$

$\bar{n} = .0155$ (see jetric graph. Van Wall 0.016)

$C_0 \times C_2 = \sqrt{42.5^2 + 42.5^2} = \sqrt{1805 + 1805} = \sqrt{3610} = 60$

$\sigma = \frac{e \times e}{dia} = \frac{60 - 6.5}{6.5} = \frac{53.5}{6.5} = \frac{53.5}{9.2} = \underline{\underline{5.8}}$

$\lambda = \frac{l}{d} = \frac{60}{9.2} = \underline{\underline{6.5}}$

$\bar{n} = \underline{\underline{.011}}$ Van Wall .0126