6 pgs

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JUN 17 1963
S-8
70-36

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UNITED NUCLEAR CORPORATION, HEMATITE-LICENSE AMENDMENT-
DOCKET 70-36, DATED JUNE 7, 1963

SYMBOL: DLR:REO

The applicant requests a license amendment to manufacture 20 weight percent enriched $UO_2 SO_4 \cdot D_2O$. The $UO_2 SO_4$ has been produced in the high enrichment area (Red Room) of the applicant's plant.

The 23.1 kg Anhydrous $UO_2 SO_4$ will be handled in safe mass batches of 3.7 kg $UO_2 SO_4$ (480 g U-235) in accordance with the procedures given in the subject application. We have confirmed that the substitution of a heavy water moderator for that of a light water moderator will not result in a more reactive system than an optimumly moderated and reflected light water system upon which the safe batch limit was established.

The subject application states that the 6 liters of heavy water to be used in this operation will be stored in the Degassing and Loading Station dry box. The mass limits previously approved for this dry box had assumed moderation control. Therefore, we suggest the applicant confirms that no other special nuclear material will be in the dry box while the D_2O is present.

We have confirmed the nuclear safety of the applicant's storage array as shown in Figure 1. The applicant has proposed to store in safe mass, quantities, and, therefore, assumed a multiplication factor of 0.65 for each unit. The solid angle subtended in the central storage bottle is much less than the permissible 2.5 steradians for this value of the multiplication factor.

The applicant should confirm that this storage array will be isolated from all other special nuclear material (licensed and contract) as given in Part 70.57 or submit a nuclear safety analysis to demonstrate the array is safe even though it is not isolated.

Work

B-121

JUN 17 1963

The material will be shipped in the container and by the procedures which we approved earlier this year.

When the applicant resolves satisfactorily the two questions we raised above, we will recommend approval of the license amendment request from the standpoint of nuclear safety.

Attachment:
United Nuclear ltr dtd 6/7/63

DLR:CEB DLR:CEB

RHOdegaarden:bar CDLuke
6/17/63 6/ /63

June 14, 1963
~~RHO~~

I

United Nuclear - Hematite

License amendment to use D_2O for the manufacture of 20 w/o enriched $UO_2SO_4 \cdot 3D_2O$

Uranium;

3 Kg U-235
15 Kg U
23,1 Kg UO_2SO_4 anhydrous

D_2O;
~ 6 Kg

UO_2SO_4, O = 16, S = 32, U = 0.2 × 235 + 0.8 × 238 = 237

$1 \times 237 = 237$
$1 \times 32 = 32$
$6 \times 16 = 96$
365

$\frac{237}{365} = \underline{0,65}$

$\frac{15\,Kg}{23,1\,Kg} = \underline{0,65}$

consistent

applicant states a safe batch of UO_2SO_4 is 3,7 Kg.

3,7 Kg × 0,65 (% U) × 0,20 (% U-235) = 481 g U-235

"safe" mass for 20 w/o U

480 g U-235 (from Karlsruhe Symposium, 1961 p. 349 or table II, TID-7019)

∴ safe batch O.K. with light water

II

$$\frac{D}{X} = \frac{\frac{606 \times N_0 \times 2}{20}}{\frac{480 \times N_0}{237}} = \underline{\underline{30}}$$

See introduction to Part II, p. 13, TID-7016, Rev-1

$$\frac{\frac{480}{17.5}}{\frac{606}{1.11}} = 0.05$$ vol. fraction U-235 @ 17.5 g/cc

See fig 8, p. 183, Karlsruhe Symposium, 1961

Both of these show that heavy water substituted for light water is not a more reactive situation at least for this D/X atom ratio.

∴ Therefore it is concluded the batch is truly a "safe" batch even though heavy water is used as a moderator.

Storage:

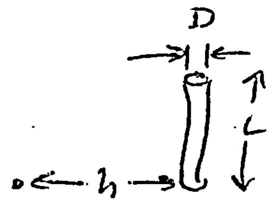
total $\Omega = 0.62$, $k = 0.65$

$\Omega_{safe} = 9 - 10k = 9 - 6.5 = 2.5$

∴ storage is safe

United Nuclear
June 19, 1963
RHO

$$\Omega = \frac{DL}{h\sqrt{h^2 + L^2}}$$



containers 6" dia. by 10" height

2 A containers:

$$\Omega = \frac{6 \times 5 \times 2 \times 2}{15\sqrt{225 + 25}} = \frac{8}{15.8} = 0.507$$

2B:

$$\Omega = \frac{6 \times 5 \times 2 \times 2}{37\sqrt{1162 + 25}} = \frac{120}{37 \times 37.7} = 0.086$$

4C:

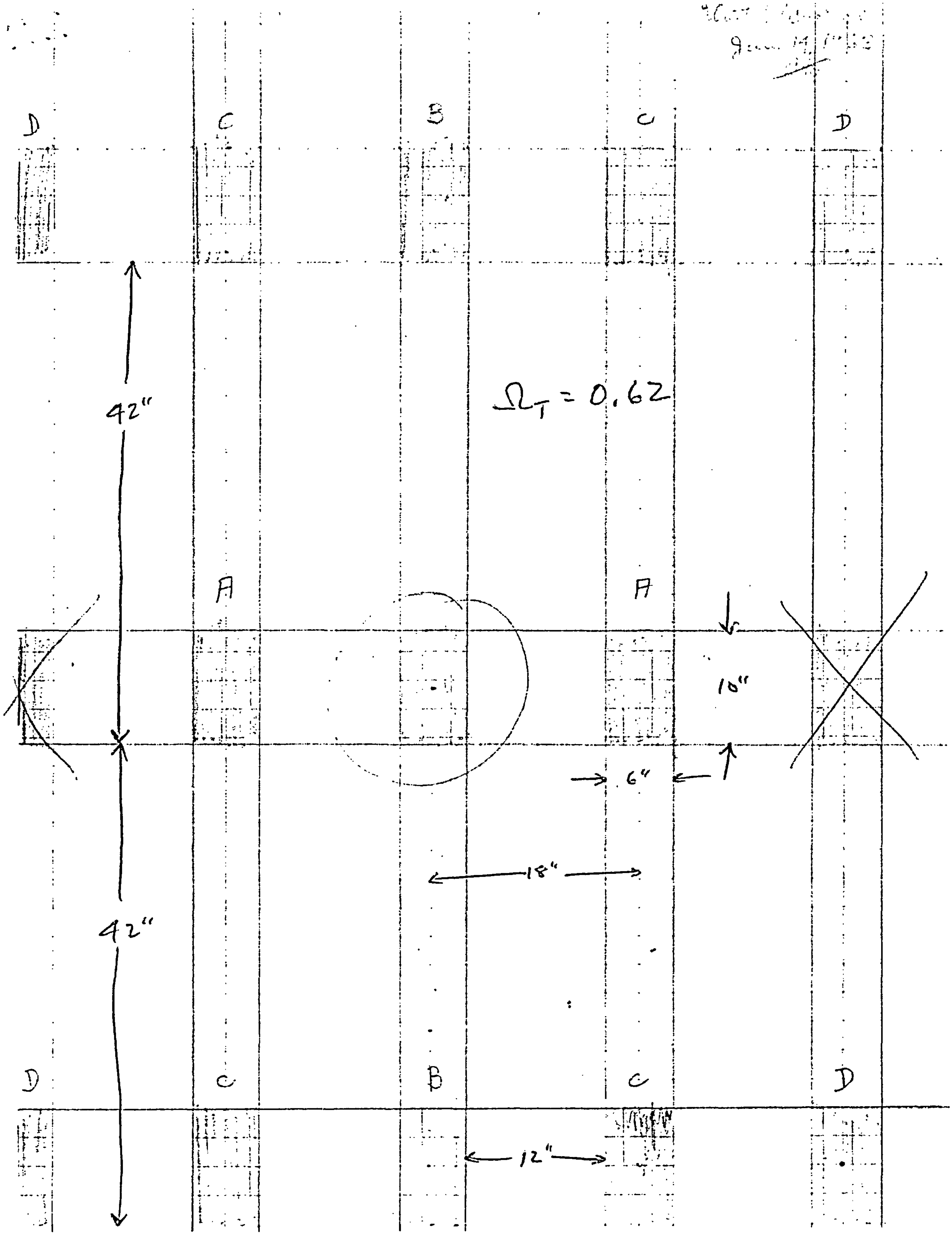
$$\Omega = \frac{6 \times 5 \times 2 \times 4}{42\sqrt{1760 + 25}} = \frac{240}{42 \times 42.2} = 0.014$$

4D:

$$\Omega = \frac{6 \times 5 \times 2 \times 4}{52\sqrt{2700 + 25}} = \frac{240}{52 \times 52.2} = 0.009$$

2A = 0.507
2B = 0.086
4C = 0.014
4D = 0.009

0.616


D
C
B
C
D
42"
$\Omega_T = 0.62$
A
A
10"
6"
18"
42"
D
C
B
C
D
12"