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EXTRA

MALLINCKRODT NUCLEAR CORPORATION

SAINT LOUIS 7, MISSOURI · U.S.A. · CENTRAL 1-8980

Plant
Hematite, Missouri

April 14, 1960

Mr. J. C. Delaney
Licensing Branch
Division of Licensing and Regulation
U. S. Atomic Energy Commission
Washington 25, D. C.

SUBJECT: Special Nuclear Material License No. 33

Dear Mr. Delaney:

This letter is a request for an extension of our special nuclear material license No. 33 to include the uranium recovery process discussed herein. We desire to use this process for recovering the uranium content from scrap material of any U^{235} enrichment.

In essence, the recovery process involves:

1. Dissolving the scrap material in nitric acid.

2. Extracting the uranium content from this acid solution.

3. Precipitating the extracted uranium.

4. Filtering the precipitate.

Figure I at the end of this letter shows a plane view of the vessels to be used in the extraction and precipitation operations. Vessel dimensions and vessel separation distances are given on this figure.

Initial dissolving of the scrap material will be done in tanks having safe volumes--conforming to data in Table XIII, p. 21, K 1019, Fifth Revision. Each batch of scrap that is dissolved will be limited to a safe mass of U^{235} as listed in Table XIV, p. 22, K 1019, Fifth Revision. The "scrap" solution that is formed will be poured into the tank system shown in Figure I. Here the uranium content will be extracted, precipitated,

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and filtered. It is to be noted that several batches of solution will be poured into the system before an extraction-filtration run is made. The total uranium content of one of these extraction-filtration runs will be less than 3.0 kg. of uranium.

The precipitate that is formed will be deposited in tank 9 in Figure I. This tank has an always safe void volume of 293 cubic inches in which precipitate may be deposited (Table XIII, p. 21, K 1019, Fifth Revision). When the filter is full and the precipitate has been blown with nitrogen, the cake will be knocked from this tank into geometrically safe vessels, and removed from the system.

Except for two 5-1/4" diameter tanks (tanks 7 and 9), all tanks in the extraction system are 5" or less in diameter. The two 5-1/4" diameter tanks are limited safe by the data in Table XV, p. 23, K 1019, Fifth Revision. All interconnecting piping between the tanks is 1" or less.

Except for tanks 7 and 8, all tanks are at least 12" apart. This spacing meets the requirement of paragraph "e", p. 26, K 1019, Fifth Revision. A 12" interval was not deemed necessary between tanks 7 and 8 since the bottom of tank 7 is approximately 1" above the top of tank 8.

Since each vessel in the extraction-filtration system has a diameter of approximately 5", a k value of near .58 is allowed for each vessel. A k value of .58 permits a maximum solid angle of 3.2 steradians to be subtended at any one tank (Table XVII, p. 29, K 1019, Fifth Revision). For our system, as shown in Figure I, a maximum solid angle of 1.75 steradians is subtended at tank 6 (see sample calculations at the end of this letter). In view of the fact that 1.75 steradians is considerably less than 3.2 steradians, it can be concluded that our system is safe from an interaction standpoint.

Sincerely,

MALLINCKRODT NUCLEAR CORPORATION

E. H. Dencker

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EHD/jrt

SAMPLE CALCULATIONS

I. Solid Angle Calculations.

1. Solid angle subtended at tank 6 (see Fig. I).

$$\Omega_x = \frac{2d_x}{h_x} \sin \theta_x$$

Method B. 1, Appendix 3, K 1019, Fifth Revision

x indicates vessel 1, 2, 3, etc.

(a) By vessel 1:

$$\Omega_1 = \frac{2\ (5)}{(30.5)} \quad \frac{(38)}{\sqrt{(30.5)^2 + (38)^2}} =$$

$$\frac{380}{(30.5)\ (48.74)} = .256 \text{ steradians}$$

(b) By vessel 2:

Ω_2 = .118 steradians

(c) By vessel 3:

Ω_3 = .176 steradians

(d) By vessel 4:

Ω_4 = .062 steradians

(e) By vessel 5:

Ω_5 = .321 steradians

(f) By vessel 7:

Ω_7 = .358 steradians

(g) By vessel 8:

Ω_8 = .458 steradians

(h) By vessel 9:

$$\Omega_9 = 0 \quad \text{(vessel 7 hides 9)}$$

(i) Total solid angle subtended at tank 6:

$$\Omega_{total} = 1.749 \text{ steradians}$$

2. Solid angle subtended at tank 2:

$$\Omega_{total} = 1.443 \text{ steradians}$$

(NOTE: Method of calculation is the same as in I. 1)

3. Solid angle subtended at tank 7:

$$\Omega_{total} = 1.007 \text{ steradians}$$

NOTE: Method of calculation is the same as in I. 1 and I. 2 except for drum 8. For drum 8, method A. 4 a, Appendix 3, K 1019, Fifth Revision, is used:

$$\Omega_{8\ top} = \frac{a\ b\ \cos\ \theta}{q^2}$$

where a = b = diameter of tank 8

and

$$\Omega_{8\ side} = \frac{a\ b\ \cos\ \theta}{q^2}$$

where a = diameter of tank 8.

b = height of tank 8.

4. Solid angles subtended at the other tanks would be less than those subtended at tanks 2, 6, and 7 because of obvious dimensional and geometric considerations.

FIGURE 1

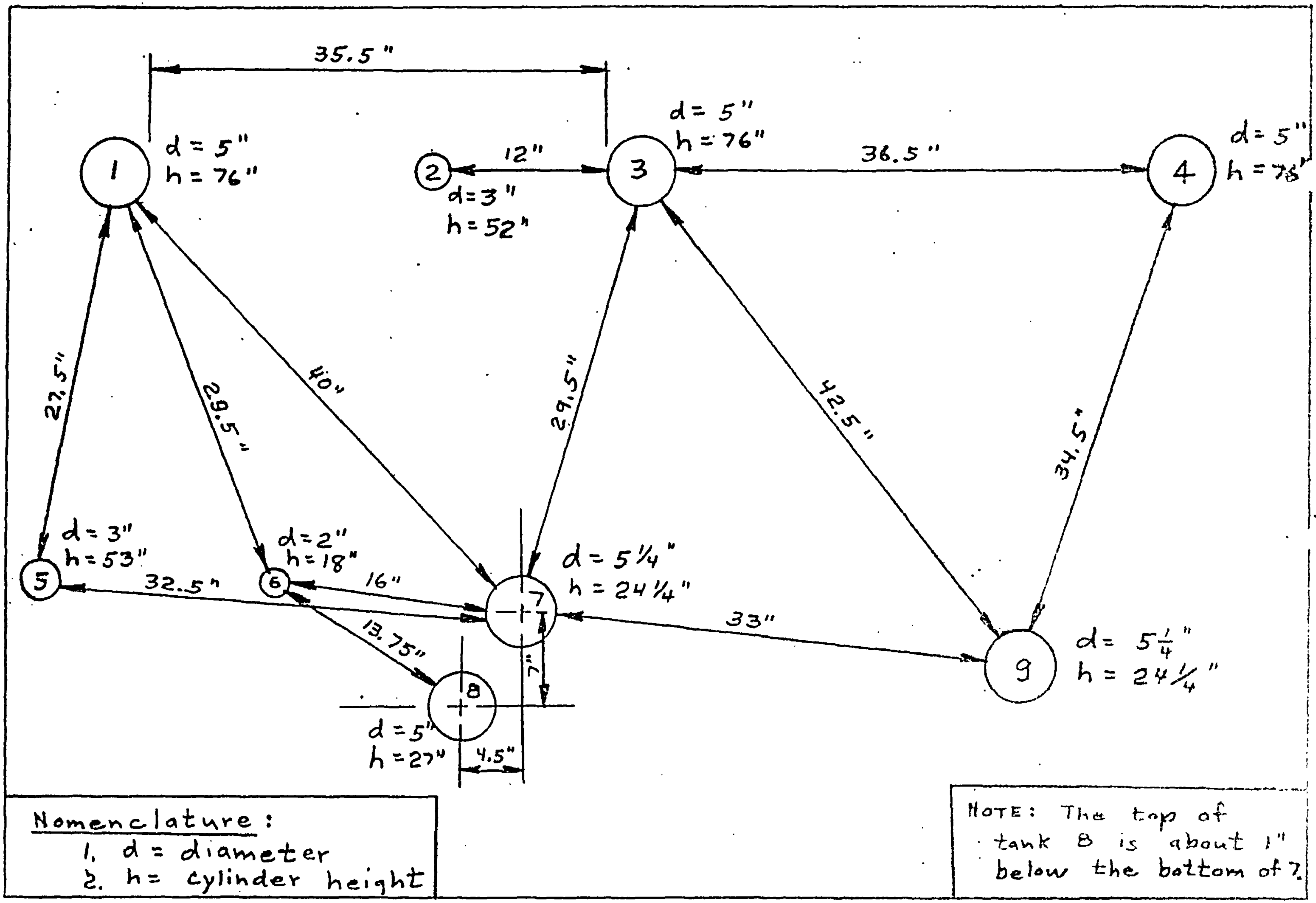

FIGURE 1 - System Layout