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Mr. Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials Branch
Division of Materials Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Nussbaumer:

Transmitted herewith is proposed Amendment 5 to SNM-777, for the Fuels Recovery Plant, Wood River Junction, Rhode Island.

As you will note the attached pages are designed to replace existing section 302.2.9 in our General Information and Procedures Manual. These pages may, therefore, be inserted directly as revision and/or addition to our present manual.

The solid angle calculations are also included for insertion in Appendix 1 of our license.

Very truly yours,

D. F. Cronin

D. F. Cronin
Director of Licensing

DFC:tc

RECEIVED 1964 DEC 18 PM 4 42 U.S. ATOMIC ENERGY COMM.

attachments

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Luke

C-78

ACKNOWLEDGED
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302.2.9 All Purpose Hood (Equipment Number 1-L-18, Sheet Number A-602)

General - This all purpose hood is designed for, but not limited to, the reworking of residues generated in other parts of the plant. The equipment may be utilized for small scale pilot operations prior to full scale processing. The glass columns and associated piping and equipment will be used to handle the various solutions that are generated and are designed to permit such operations as two or three stage extractions, acidity adjustments, air sparging, precipitation, leaching of solids and filtering of solutions. The size, spacing and fixed position of the equipment in the hood will permit nuclearly safe utilization of all equipment at one time.

Equipment - This hood is equipped with three 4-inch diameter pyrex glass columns, mixers for each column, a centrifugal pump with associated piping to transfer or circulate solution to or from any or all of the columns, restricted slots under each column for Buchener filter assemblies, a solution charge funnel to the suction side of the pump, air and ammonia lines to permit the addition of either or both of these gasses to the columns, and three additional restricted slots for safe volume equipment such as 4 liter beakers or filter assemblies.

Solutions will enter the system through the funnel in the suction side of the pump. They may be recycled by way of the pump through the columns and at the same time be agitated by means of the air driven mixer in each column. By means of valving the solutions may be recycled to the same column or transferred to another.

A filter will be installed in the system. Since it is unlikely that both filters 1F-24A and B units of the dissolver system will be in use at the same time, for the present one of these filters will be used in 1-L-18. The center line of the equipment in the hood has been set back 15 1/2" to minimize interaction with portable storage carts containing filled 11-liter bottles should they be inadvertently placed against the face of the hood. Diagrammatic sketches showing the layout of the hood, both plan view and elevation are attached. A typical utilization of this hood is as follows: For solution rework, wash solutions such as sodium carbonate which contain recoverable quantities of uranium will be generated in the extraction system. This solution will be stored temporarily in safe geometry 11-liter bottles. The sodium carbonate solution will be transferred to the solumns in the 1-L-18 hood by means of the solution charge funnel to the pump suction. Acid will be added to the system via this same column. The acidified sodium carbonate solution will be air-sparged to remove the CO_2 and then ammonia added to the solution, precipitating the uranium as an impure ammonium diuranate (ADU). After

302.2.9 (continued)

precipitation, the ADU slurry will be drained from the column into the Buchener filter assembly located below the column. As required, the ADU will be transferred from the Buchener funnel to a one-gallon storage jar for future processing and the filtrate will be transferred to the safe geometry 11-liter bottle and analyzed to determine its disposition.

Safety and Criticality Control Considerations

1. This hood has a stainless steel bottom and top. The depth of the bottom is 2 inches. The 3/8" diameter holes have been drilled one inch from the bottom to overflow at one-inch solution depth.

2. Physical barriers between Buchener funnels under the columns have been installed to prevent loading at side, front, or back of each.

3. Shelf for hot plate and filter is to be 12-inches wide. Barrier installed between hot plate and filter on shelf.

4. Buchener under hot plate and beside pump to be physically isolated by barriers the same as the Bucheners under columns.

5. Position of Buchener and hot plate with 4-liter beaker are to be inter-changeable.

6. There is to be a "quick connect" line from pump discharge to fill 11-liter bottles in the portable storage cart. Since the line is near funnel which is outside the hood, an adapter will be made to cover the funnel while filling the bottle thus preventing funnel and bottle interaction.

7. Funnel has a volume of less than 4 liters of solution.

8. Air and ammonia lines pass through a check valve to prevent back-flow.

9. Buchener funnels standard 8 inches across the base, the funnel is stainless steel or porcelain, 9 inches or 10 1/2" respectively.

10. Pump volume less than 4.8 liters (see Section 301.5 of The General Information and Procedures Manual).

11. All piping inside the hood is 1/2" diameter stainless steel.

12. In the adjacent room behind the hood, there is no process piping or equipment against the column wall which is laid of 12" solid concrete blocks.

302.2.9 (continued)

13. This hood has 1/4" thick plexiglass front panel with openings adjacent to the filters and the hot plate.

14. All exhaust air from the hood is filtered.

15. Solutions are fed to the columns through the funnel.

16. The recycle line has been connected to Tank 1-D-43. 1-D-43 connects to Assay Tanks.

17. Pan under filter and/or pump to be 1/2" in depth.

18. Agitators have steady rests at the bottom to prevent whipping action of the shaft.

19. All operations in this hood will be performed according to standard operating procedures which have had prior internal review and approval.

Item	Max k eff	Ref.	Allowable Solid Angle
4" Columns	.425	Fig 4 K-1317	4.75
Funnel 10.5" diam X 4"high*	.623	Fig 4 K-1317 ($\lambda = \frac{4}{10.5} = 0.381$)	2.77
9" diam X 4" high	.572		3.28
4-liter flask	.63	Assume equivalent to 7" IC cyl 6.34" high ($\lambda = 0.906$) conservative since 8" ID cyl or 6" ID cyl of same volume have k eff .605 and .59 respectively	2.7
Filter Press*	.670	Equiv. to 8.18" diam cyl 6" high	2.3
5" diam 11 liter bottle in cart	.58		3.2
1 Gal bottle	.596		3.04

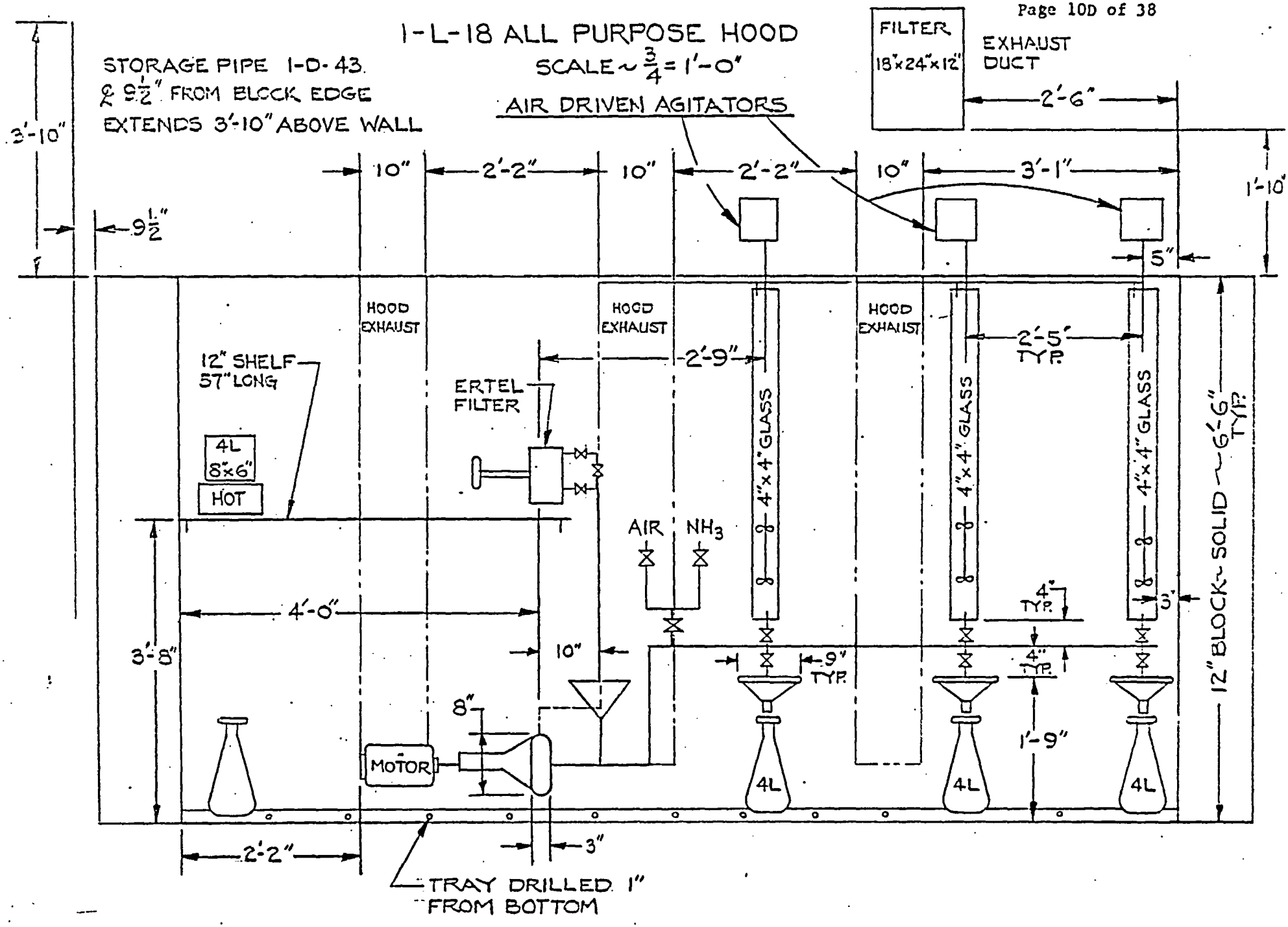
Ω to central column represented as a 9" diameter cylinder with filter flask and funnels included the total solid angle is 1.24 steradians. The contribution from surrounding assay tanks is $\approx$ 0.198 steradians, from 2-11 liter bottles in two adjacent carts is 0.44 steradians. Total is 1.88 steradians max.

302.2.9 (continued)

Similarly the filter press as the most reactive component could be represented as a squat cylinder between a 6" cylinder on the left and a 9" cylinder on the right each 78" tall. The total solid angle is then 1.102 steradians including 2-11 liter bottles in carts adjacent to hood.

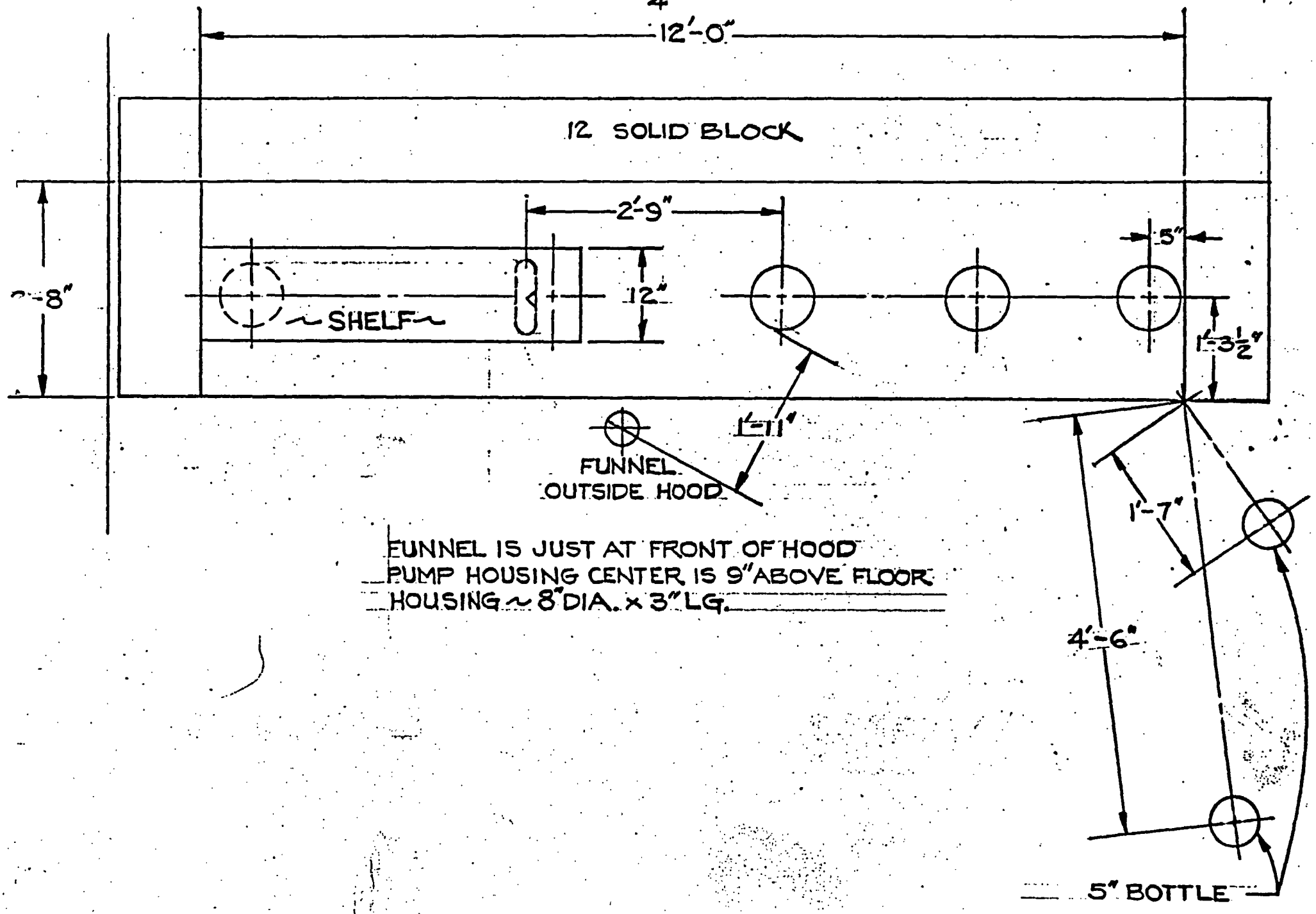
1-L-18 ALL PURPOSE HOOD

SCALE ~ $\frac{3}{4}$ = 1'-0"



1-L-18 ALL PURPOSE HOOD

SCALE ~ $\frac{3}{4}$" = 1'-0"



FUNNEL IS JUST AT FRONT OF HOOD
PUMP HOUSING CENTER IS 9" ABOVE FLOOR
HOUSING ~ 8" DIA. x 3" LG.

Interaction calculations for I-L-18 Hood

I Ω at central glass column

$\Omega = \frac{2d}{h} \sin\theta$ $\quad d = 4''$

$h = 29 - 2 = 27''$

$\tan\theta = .8889$ $\quad L = 48$; $L/2 = 24''$

$\sin\theta = .6644$

$\Omega = \frac{2(4)}{27}(.6644) =$ 0.197 steradians/column

2 columns, $\Omega = 0.394$ steradians

However, representing each 4" column with associated filter flasks and funnels as 9" diam cylinders with a height equal to that of the hood = 77"

then $d = 9''$

$h = 29 - 4.5 = 24.5''$

$L/2 = 38.5$ in.

$\tan\theta = \frac{38.5}{24.5} = 1.571$ $\quad \sin\theta = 0.8436$

$\Omega = \frac{2}{24.5}(9)(0.8436) = 0.620$ steradians/column

Ω due to adjacent column = 1.24 steradians max

Contribution from assay tanks

assume ∞ long $\quad d = 5''$

$h = 15.5(9) + 15.5 - 2.5 = 152.5$ in

$\Omega = \frac{2d}{h}(1) =$ .066 steradians/tank

Ω due to 3 tanks $\simeq$ 0.198 steradians

Contribution from an 11 liter bottle in a cart placed directly in front of hood. Cart frame assumes 13.5" from edge of frame to surface of bottle.

$d = 5''$ $\quad h = 15.5 + 13.5 = 29''$

$L = 48''$ $\quad L/2 = 24''$

$\tan\theta = \frac{24}{29} = 0.8276$ $\quad \sin\theta = 0.6376$

$\Omega = \frac{2(5)}{29}(0.6376) =$ 0.220; 2 bottles in 2 carts = 0.44 steradians

Entel Filter

Assume filter is a squat cylinder for solid angle

calculations $d = 7.25\sqrt{2} = 10.25"$ $L = 6"$ $d/2 = 3"$

36" distance (h) to left hand column (representing 4 liter beaker and flask 6" diam x 78" tall.

33" distance (h) to right hand column representing 4" column and associated funnel + flask (9" diam x 78" tall)

Ω from LH $= \frac{2(6)}{36} .735 = 0.245$

Ω from RH $= \frac{2(9)}{33} .761 = 0.417$

~~total~~ ~~0.662~~

Ω from possible 2-11 liter bottles in carto $\frac{.44}{1.102}$ steradians