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HANFORD ATOMIC PRODUCTS OPERATION -- RICHLAND, WASHINGTON

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TITLE
A CRITICAL MASS STUDY OF HOOD NO. 5 AND THE FILTER BOAT CLEANING AND TESTING HOOD IN 234-5 BUILDING

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O. T. Hill ~104-3J	12297	2704-Z	OTH	7/21/55
C. L. Brown	525	NOV 18 1957 234-5	CLB	11/20/57
E. J. Bricker	[illegible]	234-5 JUN 24 1959		

C-1616-DS (11-54) AEC-GE RICHLAND WASH

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C: 1. GW Anthony
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A CRITICAL MASS STUDY OF HOOD NO. 5 AND THE FILTER BOAT CLEANING AND TESTING HOOD IN 234-5 BUILDING

Hood No. 5 Study

The following estimates were made for plutonium solutions in vessels listed:

TABLE I

Estimated Minimum Critical Mass (grams)

Process Vessel	0 MWD/T	200 MWD/T	400 MWD/T	600 MWD/T
SW Hold Tank (1)*	630	680	735	800
Vac. Trap No. 1 (2)	3000	3000	3000	3000
Vac. Trap No. 2 (2)	3000	3000	3000	3000
Overflow Tank (2)				
(a) Condition 1	1600	2500	3500	3500
(b) Condition 2	3500	3500	3500	3500

* See References at end of report.

[redacted]

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It is assumed that the Overflow Tank (for which no print appears to be available) has the dimensions of the vacuum trap.** The Overflow Tank is located in Hood No. 5 on the same level with two in-line filters. It was also observed that this Overflow Tank is presently not anchored to any base, making it possible for this vessel to slide against an in-line filter[4,5,6,7,8,9] so that their respective bottom flanges are touching (Condition 1 above). If there is a center-to-center separation between the in-line filter and the overflow tank of 12 inches or more, the estimated critical masses for Condition 2 above prevail. The in-line filter itself is critically safe.

All the above critical masses do not allow the approach of personnel into Hood No. 5 when these vessels are full. For contact maintenance these vessels should be empty or lower critical mass limits should be established.

It is our understanding that solutions may be transferred in and out of the PR cans and RC cans outside the hood. Since these vessels are removed from their jackets before weighing, it is conceivable that a PR can may come in contact with an RC can. Under these conditions the following critical masses for the RC cans haveheen calculated as a function of plutonium mass in the PR cans as well as a function of pile exposure:

TABLE II

Grams Pu in PR Can	5000	3000	1500	5000 in Solution**
MWD/T	Grams Pu in RC Can			
0	470	630	720	750
200	490	660	760	790
400	510	700	800	840
600	530	730	850	880

These estimates do not allow for the presence of personnel in contact with the RC can.

It was decided *** that the closest approach of a PR can to an RC can would occur with the PR can in its jacket and the RC can outside its jacket. However, in the weighing of these cans, two people may be in contact with the vessel. Moreover, these vessels are weighed just outside Hood No. 5. Under these conditions Table III shows the estimated critical masses for these vessels.

* Ray Isaacson, verbal communication

** Does not allow for precipitate formation in the PR can. All plutonium must be in solution.

*** Oral discussion with Ray Isaacson and Ralph Pugh

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TABLE III

Grams Pu in PR Can	3000	1500
MWD/T	Grams Pu in RC Can	
0	680	715
200	715	750
400	755	795
600	795	835

If there were a minimum center-to-center separation of PR can and RC can of 36 inches, Table IV shows the critical masses of these vessels.

TABLE IV

Grams Pu in PR Can	3000
MWD/T	Grams Pu in RC Can
0	715
200	750
400	800
600	845

Had there been no interaction between an RC can outside its jacket and another plutonium bearing vessel, a completely tamped RC can would have the critical masses given in Table V.

TABLE V

MWD/T	Estimated Minimum Critical Mass in RC Can (Grams)
0	735
200	775
400	825
600	865

During the weighing of an RC can it is conceivable that the vessel will be completely tamped (surrounded by a wall on one side and personnel around the remaining portion of the vessel).

Filter Boat Cleaning and Testing Hood (10)

The following estimates have been made of critical mass as a function of pile exposure for the washing pan assembly and the rinsing pan assembly in this hood.

[redacted]

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[redacted]

TABLE VI

MWD/T	Critical Mass/2 Sinks (gms)
0	750
200	790
400	840
600	890

The above table gives the critical mass for the two sinks taken as a unit. If a separate critical mass was established for each sink assembly, it would be one-half the above values.

REFERENCES:

(1) H-2-16757 - Hood No. 5 SW Hold Tank
(2) H-2-16756 - Hood No. 5 Vacuum Trap
(3) H-2-16758 - Hood No. 5 Arrangement and Piping
(4) H-2-18307 - In Line Filter Type I
(5) H-2-18308 - In Line Filter Type II
(6) H-2-18309 - In Line Filter Type III
(7) H-2-18310 - Filter Boat Lid Filter
(8) H-2-18311 - Filter Details
(9) H-2-18312 - Filter Details
(10) H-2-16778 - (Sheets 1, 2, and 3) - Filter Boat Cleaning and Testing Hood

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