Lothar W. Nordheim

1594

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Subject (STACK ACTIVITIES)

Those Eligible To Read The Attached

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By Nordheim MUC No.

To Newson

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ChemRisk Document No. 1594

Dr. L. W. Nordheim
The University of Chicago
Metallurgical Laboratory

[redacted]

BUTTERFIELD 4300

January 14 , 1944

CLASSIFICATION CANCELLED
DATE SEP 20 1963
For The Atomic Energy Commission
H. R. Carnell
Chief, Declassification Branch

Dr.H.W.Newsome
c/o Dr.M.D.Whittaker
Clinton Laboratories
P.O.Box 1991
Knoxville, Tenn.

Dear Newsome.

I am sorry that I was unable to give you the complete answer to the question of the stack activities on Wednesday evening, but I was very tired and rushed. Here is my very simple analysis of the problem which, I feel sure, is the same as your own.

The following notation is used :

P = activity produced in ~~pile~~ air per (sec cm^3) in pile

$a_{1,2}$ = specific activities in duct air and pile air

$A_{1,2}$ = total activities produced by duct air and trapped air

$V_{1,2}$ = volumes of ducts and of air pockets respectively

K_0 = argon period =(1/110 min)

K_2 = relaxation period of trapped air = (1/73 min)

($K_0 + K_2$ = (1/44 min) observed)

The contribution of the duct air to stack activity is then simply

$$I \quad A_1 = V_1 P$$

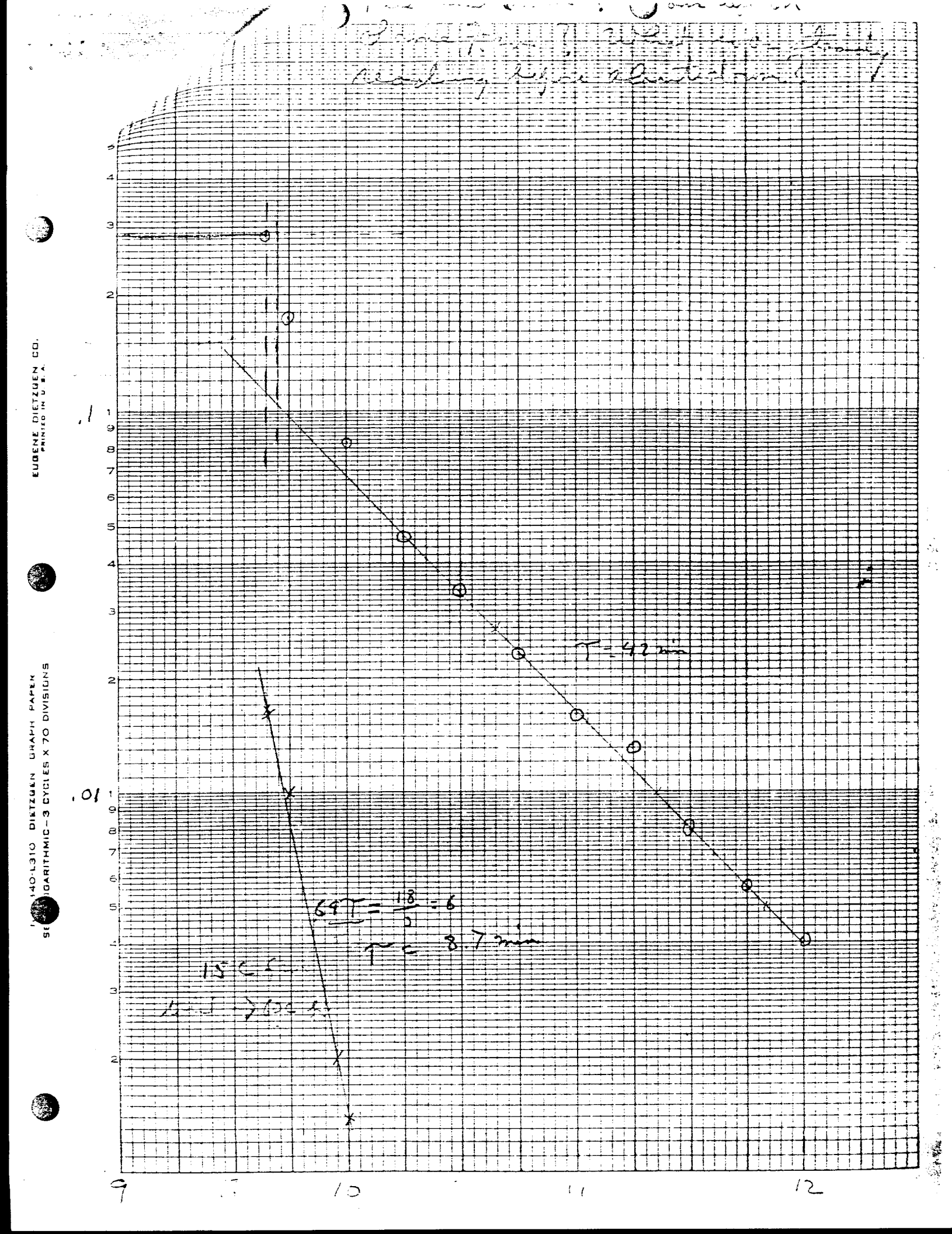
(the transit time in the pile is so short that decay during transit is negligible)

The specific activity of the trapped air is determined by

$$\frac{da_2}{dt} = -K_2 a_2 - K_0 a_2 + P$$

or in the steady state

[redacted]



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$$a_2 = \frac{P}{K_0 + K_2}$$

To obtain the contribution to the stack activity, multiply by rate of escape

$$\frac{dV_2}{dt} = - K_2 V_2$$

that is

II $$A_2 = K_2 V_2 \frac{P}{K_2 + K_0}$$

Let the ratio of activities after and before shut down be

$$r = \frac{A_2}{A_1 + A_2} \; ; \quad A_2 = A_1 \frac{r}{1-r}$$

then from I and II

III $$V_2 = V_1 \frac{r}{1-r} \frac{K_0 + K_2}{K_2}$$

With $r = 1/2$ and the observed values for K_0, K_2

$$V_2 = 1.66 \; V_1$$

This means that ~ 1/12 of the graphite volume is filled by air which can escape readily. This seems to be quite reasonable.

I suppose, we will arrive in Oak Ridge on January 24 or 25. Looking forward to seeing you then

Yours very sincerely

L. W. Nordheim

L.W.Nordheim

[redacted]

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