August 4, 1951

N. E. Bradbury, Director, IASL

Gaelen Pelt. Group J-15

SMAIL-PARTICIE CONCENTRATIONS

SD- 4461



The concentration near the ground of radioactivity carried by particles in the range from 0 to 5 microns has been estimated, following your request, on the basis of the fall-out model described in my memorandum to Graves (LAB-J-2362). Since a calculation of the general expression for the distribution of activity with cloud height as a function of time is more complax than warranted by the regults, the approximation has been made that all of the small-particle activity has fallen from the same height. The simplified expression for the total small-particle activity from an interval of height A h at h is therefore:

$$\Delta A = \frac{1.2 \times 10^3}{\sqrt{9/7}} \left( \frac{\text{V}^{1.2}}{\text{B}} \right) \cdot \left\{ \int_0^{x_5} x^2 e^{-x^2} dx \right\} \cdot \left\{ \int_0^{y} \frac{x^{7/2}}{h_0^{9/2}} \Delta \right\} \text{ as gacuries}$$

Apere

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V = wind velocity in mph

D = distance the cloud has traveled in miles

T a particle diameter "d" in microns mean particle diameter "a"

ha= cloud height in miles

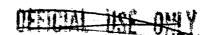
$$h = \frac{x_5^2 a^2 b}{7.26 \text{ y}} \times 10^{-3}$$

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The general assumptions leading to the above expression for  $\Delta$  A are discussed in the memorandum to Graves. The specific values of the parameters for the present estimate are:

> V = 10 mph D = 50 miles h = 1 mile a = 75 microns

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The choice of h, the height from which the 5-micron particles must fall by Stoke's law in order to be near the ground at D, leads to a conservatively high value for the concentration. The activity carried by particles smaller than 5 microns and contained in the same volume at D should properly be weighted by a factor  $h^{7/2}/h^{9/2}$  where  $h \leq h_0$ 

The volume occupied by the small-particle activity at D is assumed to be

$$\Omega = \sqrt[4]{\frac{D}{12}} \Delta h$$

Substitution of numbers into the various expressions leads to an average concentration

A change of the parameter "a" from 75 microns to 5 microns will increase this estimate approximately by a factor 2 X 103. One should note in addition that at 50 miles the concentration varies as  $V^{-2} \cdot 3$  for V = 1/6 mph.

CARLEN PELT Group J-15

OLF:1h

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