

CENTRAL FILES NUMBER

48-9-306

1600

U. S. ATOMIC ENERGY COMMISSION
COVER SHEET AND ROUTE SLIP FOR CLASSIFIED MATERIAL

AEC FORM 94 (MAR. 19, 1947)

Particle file

	TO	INITIALS	
1	<i>Mr. Weston</i>	ORNL	DISPATCHED SEP 30 1948 CLASSIFIED FILE United States Atomic Energy Comm.
2	<i>U-10 area</i>	MASTER COPY	61473
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Technical Information Officer Date
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Estimation of Number of Particles carried by the Wind from X-10 Stack to Scarboro and Western East Fork Valley

J. Z. Holland

I. Fall of particles through the air from 200 ft. to ground.

For UO₂, density 10.9 grams per cc., the time of fall is as follows (Dallavalle, "Micromeritics"):

Diameter of particle, microns	0.1	1	10	100	500
Time of fall, min., for sphere	15.2	4.8	1.5	0.5	0.2
Time of fall, min., irregular shape	7.7	2.4	0.8	0.2	0.1

Then the distance travelled is as follows; for spheres, (which are carried farthest):

Velocity, mph	Hours		Distances, feet				
	WSW	SE	2700	850	250	90	40
1-3	185	29	7000	2000	700	200	100
4-7	492	10	13,500	4000	1300	450	200
8-12	155	0	20,000	6500	2000	650	300
13-17	6	0	27,000	8500	2700	900	400

Hours WSW are total for April, May and June 1948 of all West and Southwest winds reported by X-10 or by the Knoxville pilot balloon observation for 1000 m. MSL.

Hours SE are total for April, May and June 1948 of all cases when a South, Southeast, or East wind coincided with a S, SSE, SE or ESE wind at 500m. MSL (1000 m MSL Knoxville observation was used as representative), the necessary condition for particles to be transported across the ridges toward W. East Fork Valley.

Scarboro is approximately 37000 ft. ENE.

W. East Fork is approximately 18000 ft. NW. Thus all particles would have fallen out before reaching either Scarboro or W. East Fork Valley.

II. Distribution of small particles (1μ) by atmospheric diffusion (Sutton, Quart. Jour. Roy. Met. Soc., 1947)

Assumptions:

a. Stack height 75 m.

b. Rolling terrain

c. 1000 particles per second emitted in size range where atmospheric diffusion predominates over free fall.

d. All particles brought within 1 m of the surface fall to the ground within 1 second. This is a maximum deposition, corresponding roughly to $1/\mu$ particle diameter. Attenuation of the cloud due to deposition has been neglected.

e. Average meteorological conditions.

Number of particles of Diameter Less than 1 Micron, per Thousand Emitted, Deposited per Square Meter, April - June, 1948.

Distance in Meters	Meters		6500	1000	2000	2350*	5000	10,000
	Hrs. WSW	Hrs. SE	Particles per Square Meter per hour					
1-3 mph	185	29	0	16	72	78	36	13
4-7	381	46	0	7	31	34	16	6
8-12	492	10	0	4	16	17	8	3
13-17	155	0	0	2	10	11	5	2
18 and over	6	0	0	2	8	9	4	1
Total particles / m^2 , towards ENE:			0	7800	34500	37500	17500	6500
Total particles / m^2 , towards NW:			0	800	3700	4000	1900	700

*Distance of maximum deposition.

The Scarborough area at approximately 10 km. ENE from the stack, would have had deposited in the three months April, May and June, 1948, 6500 particles per m^2 .

The Western portion of East Fork Valley, approximately 5 km. N, NW, and W from the stack, would have had deposited during these three months 700 particles per m^2 .

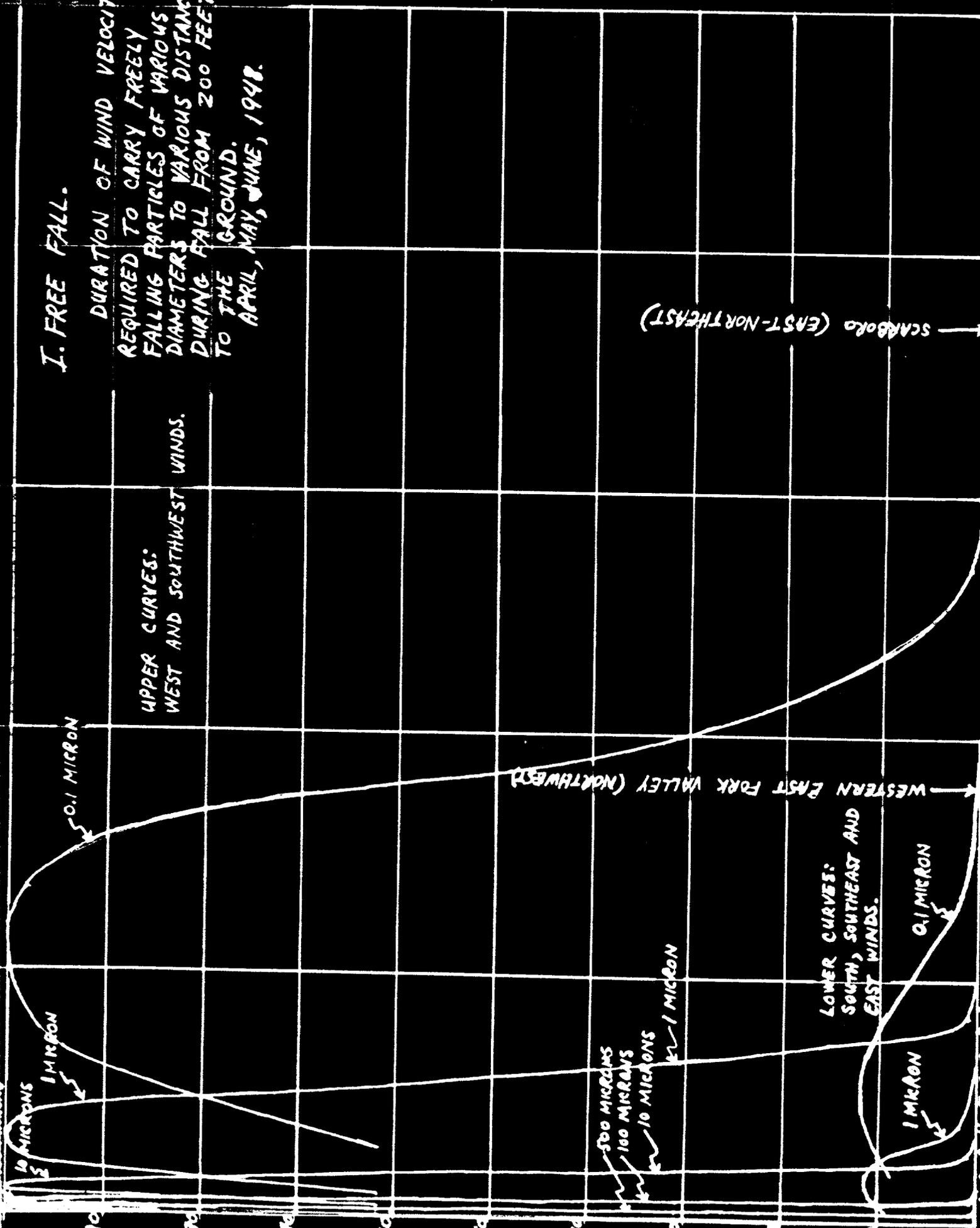
I. FREE FALL.

DURATION OF WIND VELOCITY
REQUIRED TO CARRY FREELY
FALLING PARTICLES OF VARIOUS
DIAMETERS TO VARIOUS DISTANCES
DURING FALL FROM 200 FEET
TO THE GROUND.
APRIL, MAY, JUNE, 1948.

UPPER CURVES:
WEST AND SOUTHWEST
WINDS.

10 MICRONS
5 MICRONS
1 MICRON
0.1 MICRON

DURATION OF WIND VELOCITY ± 12 MPH, HOURS



WESTERN EAST FORK VALLEY (NORTHWEST)

SCARBORO (EAST-NORTHEAST)

LOWER CURVES:
SOUTH, SOUTHEAST AND
EAST WINDS.

500 MICRONS
100 MICRONS
10 MICRONS
1 MICRON

1 MICRON
0.1 MICRON

ATMOSPHERIC DIFFUSION.

NUMBER OF PARTICLES OF DIAMETER LESS THAN 1 MICRON, PER THOUSAND PER SECOND EMITTED, DEPOSITED ON A SQUARE METER OF SURFACE AT VARIOUS DISTANCES FROM X-10 STACK, APRIL, MAY, AND JUNE, 1948.

