A STUDY OF AIRBORNE RADIOACTIVITY AT VERMILLION, SOUTH DAKOTA FROM OCTOBER 28, 1958 TO APRIL 1, 1959

James D. Jensen and Gottfried I. Moller
State University of South Dakota, Vermillion

Daily samples of airborne particulate matter were collected on the dust filter of an air sampler (Staplex) operating on a 24-hour intermittent schedule at a location above the roof of the Armory-Gymnasium at the State University of South Dakota from October 28, 1958 to April 1, 1959. Beta-gamma activity was determined by end-window geiger counting and some analysis was performed on alpha activity by a zinc sulfide scintillation detector. All samples showed relatively high initial beta activity due to the presence of naturally occurring thoron and radon daughter products which are solids and adhere to atmospheric dust particles.

The decay of beta activity was followed for all samples over an extended period of time and the uranium fission product activity at collection time was determined by extrapolation from the activity of the third and tenth day following collection. Thus, time was allowed for the natural thoron and radon products to decay to negligible values. In this extrapolation the fission product activity was assumed to follow the $t^{-1.2}$ law for decay of fission products formulated by Way and Wigner (1). An unusually high level of long-lived beta activity was found in air samples collected November 3 and 4, 1958 and from the decay characteristics appeared to be due to newly formed fallout from uranium bomb explosions. The beta decay of these samples was found to be in especially good agreement with the $t^{-1.2}$ law. A trace of long-lived alpha activity was detected in these samples as late as March 1959. These were the only samples showing such marked alpha activity, although not all samples were examined for long-lived alpha activity.

The daily variation in fission product beta activity observed at Vermillion followed a pattern similar to that observed in Washington, D. C. during 1953 and 1954 as reported by Blifford and Rosenstock (2) and in Tokyo in 1955 as reported by Tajima and Doke (3). Fission product activity varied appreciably from day to day but exceptionally high activity was infrequent. Tables I and II summarize the findings for beta-gamma fission product activity.

The pattern is one of daily variation with least variation occurring in the mid-winter months. Some correlation with meteorological conditions is indicated but was not established. The absolute

TABLE I
DAILY BETA-GAMMA ACTIVITY*

Day	Activity	Day	Activity
Oct. 28, 1958	1.6	13	1.64
29	4.88	14	2.20
30	3.56	15	4.80
31	4.38	16	5.36
Nov. 3	127.4	17	2.78
4	105.6	18	4.66
6	1.88	19	1.90
7	11.36	20	2.40
8	1.60	22	4.28
9	5.48	23	6.20
10	6.08	24	4.62
11	5.46	25	4.52
12	7.04	26	4.28
13	5.88	27	3.56
14	5.70	28	3.22
15	6.18	29	3.36
16	15.94	30	4.10
18	4.56	31	3.34
19	5.84	Jan. 2, 1959	3.54
20	3.86	3	3.56
21	2.26	4	3.48
22	5.74	5	3.38
23	2.62	6	3.64
24	2.20	7	4.64
25	1.60	8	4.72
26	0.94	9	3.48
27	5.14	10	3.22
28	4.60	11	2.66
29	3.62	12	3.62
30	4.22	13	7.12
Dec. 1	4.46	14	3.68
2	2.44	15	3.98
3	3.38	16	4.12
4	6.44	17	4.50
5	2.22	18	3.84
6	3.76	19	4.44
7	3.44	20	4.20
8	0.88	21	4.68
9	1.16	22	2.82
10	1.66	23	4.70
11	2.30	24	3.84
12	2.18	25	4.72

*Micro-micro curies per cubic meter of air.

TABLE I (Continued)

Day	Activity	Day	Activity
26	3.82	13	2.40
27	1.94	15	1.60
28	3.14	16	1.92
29	3.84	17	2.36
30	3.90	18	2.14
31	4.42	19	2.60
Feb. 1	4.00	20	2.04
2	2.90	21	4.60
3	1.86	23	4.10
4	5.24	24	2.82
5	7.14	28	4.60
6	3.48	30	3.48
7	4.90		
8	4.80		
9	4.36		
10	4.36		
11	3.46		
12	2.98		
13	3.22		
14	6.24		
15	5.68		
16	3.74		
17	2.86		
18	2.22		
19	2.44		
20	1.68		
21	2.68		
22	3.72		
23	2.74		
24	2.74		
25	3.74		
26	3.78		
27	1.84		
28	2.32		
Mar. 1	2.40		
2	1.50		

TABLE I (Continued)

Day	Activity	Day	Activity
3	2.42		
4	3.48		
5	2.80		
6	2.08		
7	3.10		
10	1.68		
11	1.58		
12	1.22		

TABLE II

FISSION PRODUCT BETA-GAMMA ACTIVITY IN AIR*

Month	High	Low	Mean
November, 1958	127.4	0.94	5.82
December, 1958	11.4	0.88	3.66
January, 1959	7.2	1.94	3.92
February, 1959	7.14	1.68	3.62
March, 1959	4.60	1.22	2.60

*Micro-micro curies per cubic meter of air.

values of the activity reported here are dependent on the accuracy of air flow measurement, particle collection efficiency, and counting efficiency. The sampling equipment was stationed above a large roof and local surface dust from the earth is not thought to have contributed significantly to the captured activity. The air filter pads remained relatively clean in appearance throughout a sampling period.

BIBLIOGRAPHY

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