health and safety laboratory

PRELIMINARY DATA ON FALLOUT FROM THE
FALL 1961 USSR TEST SERIES

STAFF REPORT

HEALTH AND SAFETY LABORATORY
FEBRUARY 27, 1962

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE

ADDENDUM TO REPORT No. HASL-121, UC-41 (Health & Safety)

LEGAL NOTICE

Printed in USA. Price $.50. Available from the Office of Technical Service, Department of Commerce, Washington 25, D.C.

HASL-121

PRELIMINARY DATA ON FALLOUT FROM THE FALL 1961 USSR TEST SERIES

STAFF REPORT

HEALTH AND SAFETY LABORATORY

FEBRUARY 27, 1962

The Soviet Union conducted a series of atmospheric tests in the fall of 1961. The AEC has announced[1] preliminary data on a number of these tests, classifying them as to yield. Those announced as about 1 megaton were detonated on September 16, 18, 20 and 22; October 2, 25 and 31. Those announced as several megatons were detonated on September 10, 12 and 14; October 4, 6, 20 and 31; and November 4.

The test on October 23 was described as 25 MT and the one on October 30 as 55-60. The total fission yield was estimated as 25 MT, about twice that of the fall 1958 USSR series.

Following the USSR announcement of its intention to resume testing, arrangements were made for the three stations collecting individual rainfall samples to begin analyses for short-lived nuclides. Some of the data are now available and are reported here.

Additional information is available on I-131 levels in milk in the Radiological Health Data reports of the U. S. Public Health Service for November 1961 and later.

It is expected that a considerable mass of information will be published in the next few months from numerous investigators here and abroad.

(1) Press Releases of the AEC

DATA

Stations at Pittsburgh, Pennsylvania, Westwood, New Jersey and Richmond, California have large area collectors for sampling individual rainfalls. Weekly collections are also made during dry periods. Samples from October on have been analyzed for Sr-89, Zr-95, Ba-140, Ce-141 and Ce-144 as well as Sr-90. Data for Pittsburgh and Westwood are available and are shown in the tables at the end of this report.

These stations also maintain pot and ion-exchange collectors for monthly samples. The pot samples are analyzed for the above nuclides plus Rh-102, Ru-106 and Cs-137. The ion-exchange collector samples are analyzed for Sr-89 and Sr-90 only. The available data, including samples for Houston, Texas and Louisville, Kentucky are given in the tables at the end of this report.

Comparative graphs of isotopic ratios were plotted and comparative tables of deposition were drawn up. A typical table is shown below.

COMPARISON OF OCTOBER DEPOSITION FOR 1958 AND 1961
(mc/mi/inch of rainfall)

		Sr-90	Sr-89	Ba-140	Zr-95
Pittsburgh	1958	.57	18	45*	-
	1961	.13	9	20*	17
New York	1958	.19	10	-	21
	1961	.14	11	-	-
Westwood	1958	.35	17	-	-
	1961	.46	-	-	-
Louisville	1958	.28	7	-	-
	1961	.13	9	-	-

*Sum of rainfall data, others from monthly pots

PRELIMINARY CONCLUSIONS

1. The specific activity of deposition from the two series was not markedly different in 1958 and 1961. Although the yield of the 1961 USSR series was twice that of the 1958 fall series, contributions from earlier 1958 tests obscured this difference. This may not be true when data summaries covering October, November, and December are available.

2. The Sr-90 activity per inch of rainfall in 1961 may be lower than it was in 1958. This is to be expected since the long-lived nuclide contribution from previous test series should be smaller in 1961. This is based on comparison of September and October monthly depositions for the two years.

3. Study of the isotopic ratios indicates that the 1961 fallout resulted from a number of individual tests and no clear picture can be presented. For example, the Pittsburgh Ba-140/Sr-89 ratios date individual rain activities to September 6 (2 rains), 15th (3 rains), 27th (5 rains) and October 3rd (2 rains). Expected uncertainties in analysis and mixing of debris cast doubt on the exactness of this dating process.

DISCUSSION

It is to be expected that only debris from the troposphere would appear in fallout collections to the end of 1961. Important quantities of the long-lived nuclides should not appear until the spring of 1962. The test suspension since 1958 has been sufficiently long so that only Sr-90, Cs-137, and smaller quantities of Ru-106, Ce-144 and Pm-147 remain as fission products from earlier tests. Thus, the spring of 1962 should be a particularly valuable period for study of the medium-lived nuclides such as Sr-89 and Zr-95.

The situation described above did not hold in 1958 and 1959 when the U. S. Hardtack Series and even the early 1958 Soviet tests contributed to the Sr-89 and Zr-95 deposition. Thus it was necessary to use the W-185 produced in the Hardtack Series to separate the various contributions. The specific sources of stratospheric fallout in the spring of 1962 should be classifiable directly from fission product ratios.

Monthly Fallout Collections - Fall of 1961

Radionuclide: mc/mi^2 at midpoint of collection period

Month	Precip. Inches	Location	Sr^{90} P	Sr^{90} F	Cs^{137}	Ce^{144}	Puα	Rh^{102}	Ru^{106}	Sr^{89} P	Sr^{89} F	Zr^{95}	Ba^{140}	Ce^{141}
Sept.	1.68	Pittsburgh	0.07	0.02	0.17	0.4	<0.006	<0.03	0.5	1.3	0.4	1.1	6.4	2.9
			0.07	0.02	0.13	0.6	0.010	<0.02	0.4	1.4	0.7	1.6	6.8	2.1
	1.48	Louisville	0.13							2.7				
			0.08							3.3				
	3.68	Westwood		0.14										
				0.19										
	7.89	Houston	0.09			1.50	0.013			0.99		lost	21.6	4.7
			0.06			1.34	0.005			0.26		3.76	27.0	5.6
	1.70	New York	0.05											
			0.06											
Oct.	3.09	Pittsburgh	0.44	0.19	0.69	7.9	<0.008	0.08	5.8	27	9.4	37	57	44
			0.37	0.13	0.69	8.8	0.014	0.06	5.4	28	6.7	68	64	42
	2.00	Louisville	0.24							18				
			0.28							19				
	2.06	Westwood		0.92										
				1.12										
	2.21	New York	0.32											
			0.28							24				
Nov.	4.23	Louisville	0.73							64				
			0.79							61				
Dec.	3.76	Louisville	0.86							53				
			0.91							58				

Note: P - pot.
F - funnel and ion-exchange column.

Radionuclides in Individual Precipitation Collections: New Jersey, Westwood

Sampling Period From	To	Precip. (inches)	Sr-90	Sr-89	Ce-144	Zr-95	Ba-140	Ce-141
			millicuries per square mile at midpoint of sampling period					
8/27, 1400	9/5, 1600	1.65	0.057 ± 0.001	<0.00027	0.130 ± 0.005	lost	lost	<0.0762
9/5, 1600	9/12, 1430	dry	0.003 ± 0.000	0.003 ± 0.000	0.026 ± 0.001		lost	<0.0374
9/12, 1430	9/15, 1430	0.54	0.006 ± 0.000	0.060 ± 0.001	0.057 ± 0.002	lost	0.232 ± 0.009	<0.0178
9/15, 1430	9/19, 2200	0.15	0.028 ± 0.001	2.08 ± 0.03	0.755 ± 0.006	2.51 ± 0.04	6.87 ± 0.08	3.19 ± 0.34
9/19, 2200	9/22, 1430	1.34	0.021 ± 0.000	0.706 ± 0.016	0.298 ± 0.002	lost	2.64 ± 0.04	1.30 ± 0.10
9/22, 1430	10/4, 1100	0.84			0.565 ± 0.015	4.44 ± 0.03		2.36 ± 0.03
10/4, 1100	10/12, 1500	dry						
10/12, 1500	10/15, 1600	0.84						
10/15, 1600	10/23, 1400	0.13			2.58 ± 0.05	7.39 ± 0.09		8.75 ± 0.47
10/23, 1400	10/26, 1400	0.03			0.626 ± 0.016	2.99 ± 0.04		2.03 ± 0.16
10/26, 1400	10/31, 1400	0.22			1.05 ± 0.03	1.75 ± 0.02		4.15 ± 0.29

Radionuclides in Individual Precipitation Collections: Pennsylvania, Pittsburgh

Sampling Period		Precip.	millicuries per square mile at midpoint of sampling period					
From	To	(inches)	Sr-90	Sr-89	Ba-140	Ce-144	Ce-141	Zr-95
1961								
8/29, 1630	9/7, 1345	0.04	0.028 ± 0.004	---	0 ± 0.020	0.20 ± 0.10	0 ± 0.20	0.05 ± 0.03
9/7, 1345	9/11, 1500	dry	0.011 ± 0.003	0 ± 0.007	0 ± 0.017	0.15 ± 0.02	0 ± 0.05	0.03 ± 0.02
9/11, 1500	9/14, 1615	dry	0 ± 0.002	0.002 ± 0.004	0 ± 0.009	0.06 ± 0.01	0 ± 0.01	0.05 ± 0.03
9/14, 1615	9/15, 0925	0.18	0.012 ± 0.002	0.068 ± 0.010	0.222 ± 0.019	0.03 ± 0.01	0 ± 0.02	0.04 ± 0.02
9/15, 0925	9/19, 1530	0.05	0.010 ± 0.002	0.121 ± 0.012	0.803 ± 0.030	0.06 ± 0.01	0.19 ± 0.04	0.28 ± 0.03
9/19, 1530	9/21, 1045	1.26	0.026 ± 0.003	0.535 ± 0.027	1.42 ± 0.05	0.10 ± 0.01	0.41 ± 0.05	0.22 ± 0.03
9/21, 1045	9/26, 0945	0.15	0.005 ± 0.002	0.259 ± 0.016	0.833 ± 0.051	0.07 ± 0.02	0.35 ± 0.07	0.22 ± 0.02
9/26, 0945	10/2, 1125	0.55	0.045 ± 0.004	3.94 ± 0.12	12.9 ± 0.3	1.54 ± 0.04	6.19 ± 0.25	15.4 ± 0.3
10/2, 1125	10/4, 1010	0.75	0.046 ± 0.005	4.85 ± 0.10	12.4 ± 0.3	0.37 ± 0.02	2.34 ± 0.08	1.79 ± 0.05
10/4, 1010	10/11, 0940	dry	0 ± 0.003	0.22 ± 0.02	0.74 ± 0.07	0.26 ± 0.02	1.17 ± 0.04	0.65 ± 0.04
10/11, 0940	10/16, 1000	0.94	0.097 ± 0.007	8.64 ± 0.17	19.8 ± 0.4	1.17 ± 0.04	5.90 ± 0.14	7.07 ± 0.14
10/16, 1000	10/20, 1520	trace	0.010 ± 0.003	0.76 ± 0.03	1.60 ± 0.09	1.15 ± 0.04	2.72 ± 0.08	6.14 ± 0.12
10/20, 1520	10/27, 1340	0.65	0.064 ± 0.006	4.40 ± 0.09	4.84 ± 0.23	2.20 ± 0.04	7.38 ± 0.15	10.7 ± 0.2
10/27, 1340	10/31, 0930	0.20	0.042 ± 0.004	2.33 ± 0.05	4.76 ± 0.10	0.79 ± 0.02	2.64 ± 0.06	2.83 ± 0.06
10/31, 0930	11/6, 1400	0.36	0.096 ± 0.005	7.88 ± 0.16	8.27 ± 0.27	1.61 ± 0.04	4.83 ± 0.11	7.65 ± 0.15
11/6, 1400	11/13, 1130	0.08	0.063 ± 0.005	5.15 ± 0.10	8.66 ± 0.17	2.04 ± 0.04	6.17 ± 0.12	6.33 ± 0.13
11/13, 1130	11/15, 1130	0.55	0.091 ± 0.005	7.26 ± 0.15	9.80 ± 0.20	1.12 ± 0.03	3.03 ± 0.09	5.32 ± 0.13
11/15, 1130	11/16, 1600	0.60	0.034 ± 0.003	3.00 ± 0.06	3.35 ± 0.07	0.63 ± 0.02	2.22 ± 0.07	1.68 ± 0.15
11/16, 1600	11/17, 1530	0.015	0.007 ± 0.003	0.20 ± 0.02	0.37 ± 0.02	0.19 ± 0.02	0.60 ± 0.04	0.57 ± 0.03
11/17, 1530	11/21, 1515	0.14	0.053 ± 0.005	3.66 ± 0.07	3.14 ± 0.07	0.94 ± 0.03	2.31 ± 0.07	3.23 ± 0.06
11/21, 1515	11/24, 1400	1.43	0.206 ± 0.008	15.0 ± 0.3	12.1 ± 0.2	4.0 ± 0.08	12.2 ± 0.2	12.2 ± 0.2
11/24, 1400	11/28, 1445	0.05	0.058 ± 0.005	3.72 ± 0.11	2.70 ± 0.05	1.13 ± 0.03	2.96 ± 0.07	2.97 ± 0.06
11/28, 1445	11/30, 1420	dry	0.017 ± 0.002	0.46 ± 0.02	2.72 ± 0.05	1.65 ± 0.04	3.77 ± 0.09	4.80 ± 0.10