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MASTER

SURVEY OF ENVIRONMENTAL RADIOACTIVITY FOR PERIOD

1-1-70 to 6-30-70

MILO D. VOSS

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SURVEY OF ENVIRONMENTAL RADIOACTIVITY

FOR PERIOD 1/1/70 - 6/30/70

Milo D. Voss

1. ABSTRACT

This is the environmental monitoring program of the Ames Laboratory of the USAEC for the Ames Laboratory Research Reactor (ALRR).

The environmental program consists of air samples, soil, vegetation, river water, bottom sediment, precipitation, pond water, ALRR outfall, and well water samples. This report will cover the period from January 1, 1970 to June 30, 1970. As soil and vegetation samples are collected later in the year (usually August) that data will be reported in the annual report.

The ALRR reached full power as of 7/12/65. As of 12/31/69 the ALRR had generated 105,409 megawatt hours of heat. A total of 122,258 megawatt hours of heat has been generated as of 6/30/70.

The data indicate that the ALRR has not contributed a significant amount of radioactivity to the environment in the Ames area. The conclusion is reached that radioactivity levels recorded for environmental samples represent background conditions from atmospheric fallout and naturally occurring radioactivity.

The following levels of radioactivity were recorded for the period:

<u>Sample Media</u>	<u>Individual Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
Air	109	0.36	0.004
River Water	206	9.27	0.72
ALRR Outfall	174	12.45	0.29
Bottom Sediment	25	8.04	0.35
Precipitation	26	73.93	1.65
Well Water	18	7.70	0.84
Pond Water	18	18.41	0.59

The units are pCi/M³ for air, pCi/l for river water, precipitation, well water, pond water, and ALRR outfall, and pCi/g for bottom sediment.

II. SAMPLE INFORMATION

A. Air Samples

Daily air samples are taken on top of the Ames Laboratory Research Building. Samples are collected on Whatman No. 41 filters with a Gast sampler which has a flow rate of 3.75 cfm. The air samples are counted on a Sharp Low Beta Matic System for gross alpha and beta activity seven days after collection.

The beta activity range was 0.04 to 1.47 pCi/M³ with an average of 0.36 pCi/M³. The alpha activity range was 0.001 to 0.026 pCi/M³ with an average of 0.004 pCi/M³. Average levels reported for 1969 were 0.24 pCi/M³ beta and 0.004 pCi/M³ alpha.

B. River Water Samples

One liter samples are collected weekly from each of the sample sites unless the site is dry or frozen solid. These samples are evaporated to near dryness and transferred to a three inch Al planchette, dried, and counted for gross alpha and beta content. If the samples contain a large amount of insoluble material, they are filtered and counted as soluble and insoluble portions.

The beta activity range was 1.40 to 36.30 pCi/l with an average of 9.27 pCi/l. The alpha range was 0.11 to 5.40 pCi/l with an average of 0.72 pCi/l.

Average levels reported for 1969 were 9.09 pCi/l beta and 1.15 pCi/l alpha.

C. ALRR Outfall Samples

One liter samples are collected daily from this site and analyzed for gross beta and alpha content. The samples are analyzed by the same method as the River water samples.

The beta range was 2.80 pCi/l to 27.50 pCi/l with an average of 12.45 pCi/l. The alpha activity range was 0.05 pCi/l to 3.40 pCi/l with an average level of 0.29 pCi/l.

Average levels reported for 1969 were 12.15 pCi/l beta and 1.00 pCi/l alpha.

D. Bottom Sediment Samples

One quart bottom sediment samples are obtained at or near the river and pond water sites on a quarterly basis. Samples are analyzed for gross alpha and beta activity.

The beta activity range was 4.58 pCi/g to 12.20 pCi/g with an average of 8.04 pCi/g. The alpha activity range was 0.05 pCi/g to 1.07 pCi/g with an average of 0.35 pCi/g.

The average levels reported for 1969 were 9.28 pCi/g beta and 0.49 pCi/g alpha.

E. Precipitation Samples

Precipitation samples are collected on an "as it happens" basis from a site near ALRR. The samples are analyzed by the same method as the river water samples.

The beta activity range was 18.60 pCi/l to 240.00 pCi/l with an average of 73.93 pCi/l. The alpha activity range was 0.18 pCi/l to 7.10 pCi/l with an average of 1.65 pCi/l.

The average levels reported for 1969 were 138.03 pCi/l beta and 9.15 pCi/l alpha.

F. Well Water Samples

Well water samples are obtained from three sites on a monthly basis and analyzed for gross alpha and beta content. Samples are analyzed by the same method as the river water samples.

The beta activity range was 4.60 pCi/l to 13.60 pCi/l with an average of 7.70 pCi/l. The alpha activity range was 0.36 pCi/l to 1.60 pCi/l with an average of 0.84 pCi/l.

The average levels reported for 1969 were 5.81 pCi/l beta and 1.09 pCi/l alpha.

G. Pond Water Samples

Pond water samples are collected monthly from three sites: the George Todd site three miles northeast of the ALRR; the Izaak Walton League site three miles east of the ALRR; and the Kelley site five miles south of the ALRR. Samples are analyzed by the same method as the river water samples.

The beta activity range was 5.67 pCi/l to 38.10 pCi/l with an average of 19.16 pCi/l. The alpha activity range was 0.18 pCi/l to 3.10 pCi/l with an average of 0.59 pCi/l.

The average level reported for 1969 was 13.73 pCi/l beta and 0.84 pCi/l alpha.

H. Detection Limits

Detection limits are by definition only.

I. Abbreviations Used

ND means not detectable.

Air Samples (pCi/M³)
1970

<u>Date</u>	<u>Beta Conc.</u>	<u>Alpha Conc.</u>
Jan. (15)	0.15	0.002
Feb. (15)	0.13	0.002
Mar. (19)	0.29	0.002
Apr. (21)	0.30	0.003
May (19)	0.55	0.005
June (20)	0.64	0.009
Average	0.36	0.004
High	1.47	0.026
Low	0.04	0.001
Detection Limits	0.0066 pCi/M ³ β	
	0.0026 pCi/M ³ α	

River Water Samples (pCi/l)
January 1970
Unfiltered Samples

<u>Location</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-u	No sample	
3-On-u	5.05	0.41
4-On-D	No sample	
5-Sq-u	14.57	1.14
6-Sq-D	5.25	0.43
7-Sk-u	5.40	0.63
9-c.c.	2.53	0.30
10-DM	7.60	0.54
11-Sk-S	20.15	0.73
Average	8.65	0.60
High	20.15	1.14
Low	2.53	0.30

Filtered Samples

<u>Location</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
	<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-u	No sample			
3-On-u	No filtered sample			
4-On-D	No sample			
5-Sq-u	No filtered sample			
6-Sq-D	No sample			
7-Sk-u	No filtered sample			
9-c.c.	No filtered sample			
10-DM	No filtered sample			
11-Sk-S	No filtered sample			
Average				
High				
Low				

River Water Samples (pCi/l)
February 1970
Unfiltered Samples

<u>Location</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-u	4.90	0.18
3-On-u	7.67	0.42
4-On-D	No samples	
5-Sq-u	8.93	0.54
6-Sq-D	8.05	1.08
7-Sk-u	7.18	0.45
9-c.c.	4.30	0.49
10-DM	8.63	0.45
11-Sk-S	16.68	0.27
Average	8.29	0.49
High	16.68	1.08
Low	4.30	0.18

Filtered Samples

<u>Location</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
	<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-u	No filtered samples			
3-On-u	No filtered samples			
4-On-D	No samples			
5-Sq-u	No filtered samples			
6-Sq-D	No filtered samples			
7-SK-u	No filtered samples			
9-c.c.	No filtered samples			
10-DM	No filtered samples			
11-Sk-S	No filtered samples			
Average				
High				
Low				

River Water Samples (pCi/l)
March 1970
Unfiltered Samples

<u>Location</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-u	4.13	0.27
3-On-u	9.16	0.86
4-On-D	No samples	
5-Sq-u	9.88	0.97
6-Sq-D	9.90	0.61
7-SK-u	10.50	0.96
9-c.c.	7.16	0.61
10-DM	8.76	0.73
11-Sk-S	16.48	0.50
Average	9.50	0.69
High	16.48	0.97
Low	4.13	0.27

Filtered Samples

<u>Location</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
	<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-u	No filtered samples			
3-On-u	No filtered samples			
4-On-D	No samples			
5-Sq-u	No filtered samples			
6-Sq-D	No filtered samples			
7-SK-u	No filtered samples			
9-c.c.	No filtered samples			
10-DM	No filtered samples			
11-Sk-S	No filtered samples			
Average				
High				
Low				

River Water Samples (pCi/l)
April 1970
Unfiltered Samples

<u>Location</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-u	6.53	0.05
3-On-u	4.80	0.59
4-On-D	4.20	0.54
5-Sq-u	5.40	0.54
6-Sq-D	6.30	0.77
7-SK-u	6.75	0.81
9-c.c.	5.33	0.54
10-DM	6.38	0.54
11-Sk-S	12.18	0.36
Average	6.43	0.53
High	12.18	0.81
Low	4.20	0.05

Filtered Samples

<u>Location</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
	<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-u	No filtered samples			
3-On-u	No filtered samples			
4-On-D	No filtered samples			
5-Sq-u	No filtered samples			
6-Sq-D	No filtered samples			
7-SK-u	No filtered samples			
9-c.c.	No filtered samples			
10-DM	No filtered samples			
11-Sk-S	No filtered samples			
Average				
High				
Low				

River Water Samples (pCi/l)
May 1970
Unfiltered Samples

<u>Location</u>	<u>No. of samples</u>	<u>Average Beta Activity</u>	<u>Average Alpha Activity</u>
1-DD-u	3	4.93	0.22
3-On-u	1	3.24	N.D.
4-On-D	1	3.20	N.D.
5-Sq-u	1	3.40	0.36
6-Sq-D	1	2.97	0.36
7-SK-u	1	4.60	0.54
9-c.c.	1	3.00	0.36
10-DM	1	7.60	0.54
11-SK-S	4	10.50	0.14
Average		4.83	0.28
High		10.50	0.54
Low		2.97	0.14

Filtered Samples

<u>Location</u>	<u>No. of samples</u>	<u>Average Beta Activity</u>		<u>Average Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-u	1	4.60	5.50	N.D.	0.36
3-On-u	3	7.10	10.13	0.91	0.60
4-On-D	3	6.47	9.53	0.41	0.75
5-Sq-u	3	6.47	12.47	0.25	0.87
6-Sq-D	3	7.17	16.07	0.43	0.92
7-SK-u	3	6.57	11.43	1.69	0.65
9-c.c.	3	7.30	12.23	0.43	0.93
10-DM	3	8.27	12.67	0.60	1.20
11-Sk-S		No filtered samples			
Average		6.74	11.25	0.59	0.79
High		8.27	16.07	1.69	1.20
Low		4.60	5.50	0.25	0.36

River Water Samples (pCi/l)
June 1970
Unfiltered Samples

<u>Location</u>	<u>No. of samples</u>	<u>Average Beta Activity</u>	<u>Average Alpha Activity</u>
1-DD-u		No unfiltered samples	
3-On-u	1	5.00	0.67
4-On-D	1	5.00	0.61
5-Sq-u	1	6.20	0.79
6-Sq-D	1	6.10	0.72
7-SK-u	1	6.50	0.54
9-c.c.	1	4.20	0.72
10-DM	1	7.40	0.54
11-Sk-S	5	12.24	0.18
Average		6.58	0.60
High		12.24	0.79
Low		4.20	0.18

Filtered Samples

<u>Location</u>	<u>No. of samples</u>	<u>Average Beta Activity</u>		<u>Average Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-u	4	4.78	7.13	0.20	0.42
3-On-u	4	4.80	3.65	0.44	0.53
4-On-D	4	5.63	3.25	0.50	0.50
5-Sq-u	4	5.38	7.28	0.61	0.98
6-Sq-D	4	5.48	7.85	0.47	0.82
7-SK-u	4	5.55	7.68	0.50	0.91
9-c.c.	4	5.30	3.75	0.41	0.57
10-DM	4	7.73	10.10	0.66	0.81
11-Sk-S		No filtered samples			
Average		5.58	6.34	0.47	0.69
High		7.73	10.10	0.66	0.98
Low		4.78	3.25	0.20	0.42

ALRR Outfall Samples (pCi/l)
January - June 1970

<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
January	14.83	0.36
February	13.61	0.19
March	14.08	0.24
April	12.40	0.24
May	10.91	0.23
June	8.88	0.48
Average	12.45	0.29
High	14.83	0.48
Low	8.88	0.19

Detection Limits - 1.00 pCi/l β

0.39 pCi/l α

Bottom Sediment Samples (pCi/g)

<u>Location</u>	<u>Date</u>	<u>Beta Concentration</u>	<u>Alpha Concentration</u>
1-DD-u	3/30/70	8.18	0.36
	6/01/70	6.42	0.18
	Average	7.30	0.27
2-DD-D ALRR Outfall	3/30/70	7.13	0.05
	6/01/70	7.08	0.35
	Average	7.11	0.20
3-On-u	3/30/70	5.95	0.05
	6/01/70	7.44	0.16
	Average	6.70	0.11
4-On-D	3/30/70	No sample	
	6/01/70	6.32	0.12
	Average	6.32	0.12
5-Sq-u	3/30/70	11.80	0.54
	6/01/70	10.30	0.17
	Average	11.05	0.36
6-Sq-D	3/30/70	4.58	0.18
	6/01/70	6.31	0.12
	Average	5.45	0.15
7-SK-u	3/30/70	8.49	0.28
	6/01/70	7.23	0.29
	Average	7.86	0.29
9-c.c.	3/30-70	6.14	0.09
	6/01/70	5.85	0.75
	Average	6.00	0.42
10-DM	3/30/70	10.20	0.76
	6/01/70	10.10	0.28
	Average	10.15	0.53
11-Sk-S	3/30/70	6.39	0.14
	6/01/70	6.76	0.62
	Average	6.58	0.38
Todd Pond	3/30/70	9.56	0.41
	6/01/70	12.20	0.26
	Average	10.88	0.34

Bottom Sediment Samples (pCi/g) (Continued)

Izaak Walton	3/30/70	9.42	0.87
League Pond	6/01/70	8.18	0.11
	Average	8.80	0.49
Kelley Pond	3/30/70	10.90	0.50
	6/01/70	8.16	1.07
	Average	9.53	0.79
Average for 25 Samples		8.04	0.35
High		12.20	1.07
Low		4.58	0.05

Detection Limits - 0.25 pCi/g β
0.10 pCi/g α

Precipitation Samples (pCi/l)

<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
January	18.60	1.90
February	77.38	1.71
March	46.16	2.06
April	106.64	1.87
May	116.45	1.73
June	78.32	0.60
Average	73.93	1.65
Individual High	240.00	7.10
Individual Low	18.60	0.18

Detection Limits - 1.00 pCi/l β

0.39 pCi/l α

Well Water Samples (pCi/l)

<u>Location</u>	<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
Iowa State University	1-05-70	5.96	0.72
	2-07-70	8.00	1.60
	3-02-70	5.50	0.90
	3-30-70	7.00	1.30
	5-04-70	6.20	0.36
	*6-01-70	8.10	1.40
Average		6.79	1.05
High		8.10	1.60
Low		5.50	0.36
City of Ames	1-05-70	7.30	0.45
	2-09-70	7.40	1.60
	3-09-70	6.40	0.90
	4-02-70	11.50	N.D.
	5-04-70	4.60	0.54
	6-03-70	6.20	1.10
Average		7.23	0.77
High		11.50	1.60
Low		4.60	0.45

Well Water Samples (pCi/l)

<u>Location</u>	<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
Arland	1-05-70	13.60	1.44
Martin			
Acreage	2-05-70	7.70	0.36
	3-02-70	9.05	0.72
	3-30-70	6.90	0.36
	5-04-70	7.20	N.D.
	*6-01-70	10.00	1.30
Average		9.08	0.70
High		13.60	1.44
Low		6.90	0.36
Average for 18 Samples		7.70	0.84
High for 18 Samples		13.60	1.60
Low for 18 Samples		4.60	0.36

Detection Limits - 1.00 pCi/l β

0.39 pCi/l α

* These two samples were filtered and counted as soluble and insoluble portions. The results are as follows:

	<u>Beta</u>		<u>Alpha</u>	
	<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
Arland	7.20	2.80	0.72	0.60
Martin				
Acreage				
Iowa State University	5.30	2.80	0.40	1.00

Pond Water Samples (pCi/l)

<u>Location</u>	<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
George Todd Pond	1-05-70	6.60	0.54
	2-05-70	36.10	0.36
	3-03-70	24.70	0.36
	3-30-70	17.70	0.54
	5-04-70	8.60	N.D.
	*6-01-70	13.60	1.00
Average		17.88	0.47
High		36.10	1.00
Low		6.60	0.36
Izaak Walton League Pond	1-05-70	20.50	0.54
	2-05-70	21.60	0.36
	3-03-70	26.70	1.10
	3-30-70	23.20	3.10
	5-04-70	15.70	N.D.
	*6-01-70	27.60	0.44
Average		22.55	0.92
High		27.60	3.10
Low		15.70	0.36

Pond Water Samples (pCi/l)

<u>Location</u>	<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
Kelley Pond	1-05-70	21.80	0.36
	2-05-70	12.30	N.D.
	3-03-70	38.10	0.90
	3-30-70	9.32	0.18
	5-04-70	5.67	0.18
	*6-01-70	15.10	0.68
Average		17.05	0.38
High		38.10	0.90
Low		5.67	0.18
Average for 18 Samples		19.16	0.59
High for 18 Samples		38.10	3.10
Low for 18 Samples		5.67	0.18

Detection Limits - 1.00 pCi/l β
0.39 pCi/l α

* These three samples were filtered and counted as soluble and insoluble portions. The results are as follows:

	<u>Beta</u>		<u>Alpha</u>	
	<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
George Todd Pond	9.40	4.20	0.49	0.49
Izaak Walton League Pond	24.20	3.40	0.31	0.13
Kelley Pond	11.00	4.10	0.25	0.43