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SURVEY OF ENVIRONMENTAL RADIOACTIVITY

January 1, 1971 - June 30, 1971

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SURVEY OF ENVIRONMENTAL RADIOACTIVITY

FOR PERIOD 1/1/71 - 6/30/71

Milo D. Voss

I. 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, 1971 to June 30, 1971. 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 12/31/70 the ALRR had generated 139460 megawatt hours of heat. A total of 156241 megawatt hours of heat has been generated as of 6/30/71.

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:

Sample Media	Individual Samples	Beta Activity	Alpha Activity
Air	95	0.44	0.0045
River Water	237	6.51	0.77
ALRR Outfall	234	8.36	0.26
Bottom Sediment	25	8.18	0.42
Precipitation	22	198.60	3.00
Well Water	18	4.15	0.74
Pond Water	18	11.62	0.74

The units are pCi/M^3 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 0.07 to 1.22 pCi/M^3 with an average of 0.44 pCi/M^3. The alpha activity range was 0.0007 to 0.015 pCi/M^3 with an average of 0.0045 pCi/M^3. Average levels reported for 1970 were 0.27 pCi/M^3 beta and 0.004 pCi/M^3 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 0.68 to 55.70 pCi/l with an average of 6.51 pCi/l. The alpha range was 0.07 to 2.90 pCi/l with an average of 0.77 pCi/l.

Average levels reported for 1970 were 8.02 pCi/l beta and 0.74 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 0.81 pCi/l to 54.70 pCi/l with an average of 8.36 pCi/l. The alpha activity range was 0.07 pCi/l to 1.60 pCi/l with an average level of 0.26 pCi/l.

Average levels reported for 1970 were 10.64 pCi/l beta and 0.30 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 4.59 pCi/g to 15.20 pCi/g with an average of 8.18 pCi/g. The alpha activity range was 0.05 pCi/g to 0.90 pCi/g with an average of 0.42 pCi/g.

The average levels reported for 1970 were 8.06 pCi/g beta and 0.39 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 12.30 pCi/l to 1230.00 pCi/l with an average of 198.60 pCi/l. The alpha activity range was 0.32 pCi/l to 11.60 pCi/l with an average of 3.00 pCi/l.

The average levels reported for 1970 were 72.95 pCi/l beta and 1.77 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 1.90 pCi/l to 6.40 pCi/l with an average of 4.15 pCi/l. The alpha activity range was 0.36 pCi/l to 1.50 pCi/l with an average of 0.74 pCi/l.

The average levels reported for 1970 were 7.19 pCi/l beta and 0.81 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 2.20 pCi/l to 27.70 pCi/l with an average of 11.62 pCi/l. The alpha activity range was 0.07 pCi/l to 1.50 pCi/l with an average of 0.74 pCi/l.

The average level reported for 1970 was 15.19 pCi/l beta and 0.58 pCi/l alpha.

H. Detection Limits

Detection limits are by definition only.

I. Abbreviations Used

ND means not detectable.

Air Samples (pCi/M^3)
1970

Date	Beta Conc.	Alpha Conc.
Jan. (12)	0.09	0.004
Feb. (10)	0.22	0.003
Mar. (20)	0.22	0.002
Apr. (16)	0.63	0.006
May (15)	0.82	0.008
June (22)	0.68	0.004
Average	0.44	0.0045
High	1.22	0.015
Low	0.07	0.0007

Detection Limits 0.0066 pCi/M^3 β

0.0026 pCi/M^3 α

River Water Sample (pCi/l)

January 1971

Unfiltered Samples

Location	No. of Samples	Beta Activity	Alpha Activity
1-DD-U	0	----	----
3-On-U	4	2.85	0.95
4-On-D	1	2.80	0.31
5-Sq-U	4	2.88	0.91
6-Sq-D	4	3.73	0.81
7-Sk-U	4	5.48	0.52
8-Sk-D	1	3.50	0.67
9-CC	3	1.43	0.64
10-DM	4	5.33	0.67
11-Sk-S	4	7.78	0.82
Average		4.23	0.75
High		7.78	0.95
Low		1.43	0.31

Filtered Samples

Location	No. of Samples	Beta Activity		Alpha Activity	
		Soluble	Insoluble	Soluble	Insoluble
1-DD-U	0	----		----	
3-On-U	0	----		----	
4-On-D	0	----		----	
5-Sq-U	0	----		----	
6-Sq-D	0	----		----	
7-Sk-U	0	----		----	
8-Sk-D	0	----		----	
9-CC	0	----		----	
10-DM	0	----		----	
11-Sk-S	0	----		----	
Average					
High					
Low					

River Water Samples (pCi/l)

February 1971

Unfiltered Samples

Location	No. of Samples	Beta Activity	Alpha Activity
1-DD-U	0	----	----
3-On-U	4	4.05	0.99
4-On-D	3	3.13	0.67
5-Sq-U	4	5.28	0.95
6-Sq-D	4	4.70	0.99
7-Sk-U	4	4.80	1.09
8-Sk-D	3	8.67	0.99
9-CC	4	5.53	0.64
10-DM	3	4.67	0.91
11-Sk-S	4	12.78	0.41
Average		6.00	0.85
High		12.78	1.09
Low		3.13	0.41

Filtered Samples

Location	No. of Samples	Beta Activity		Alpha Activity	
		Soluble	Insoluble	Soluble	Insoluble
1-DD-U	0	----		----	
3-On-U	0	----		----	
4-On-D	0	----		----	
5-Sq-U	0	----		----	
6-Sq-D	0	----		----	
7-Sk-U	0	----		----	
8-Sk-D	0	----		----	
9-CC	0	----		----	
10-DM	0	----		----	
11-Sk-S	0	----		----	
Average					
High					
Low					

River Water Samples (pCi/l)

March 1971

Unfiltered Samples

Location	No. of Samples	Beta Activity	Alpha Activity
1-DD-U	1	3.10	0.18
3-On-U	4	5.75	0.64
4-On-D	3	6.07	0.82
5-Sq-U	4	9.85	1.00
6-Sq-D	4	8.03	0.97
7-Sk-U	5	7.96	1.13
8-Sk-D	4	6.83	0.86
9-CC	5	5.34	0.79
10-DM	4	8.13	0.79
11-Sk-S	4	8.75	0.28
Average		7.29	0.80
High		9.85	1.13
Low		3.10	0.18

Filtered Samples

Location	No. of Samples	Beta Activity		Alpha Activity	
		Soluble	Insoluble	Soluble	Insoluble
1-DD-U	0	----		----	
3-On-U	1	8.20	4.60	0.61	1.40
4-On-D	1	3.90	4.20	0.67	0.72
5-Sq-U	1	5.10	4.30	0.54	1.10
6-Sq-D	1	10.70	5.40	0.97	1.40
7-Sk-U	0	----	----	----	----
8-Sk-D	1	5.40	3.10	0.25	1.20
9-CC	0	----	----	----	----
10-DM	1	12.30	14.20	0.97	1.70
11-Sk-S	1	7.40	0.27	0.43	0.61
Average		7.57	5.15	0.63	1.16
High		12.30	14.20	0.97	1.70
Low		3.90	0.27	0.25	0.61

River Water Samples (pCi/l)

April 1971

Unfiltered Samples

Location	No. of Samples	Beta Activity	Alpha Activity
1-DD-U	4	2.68	0.20
3-On-U	4	2.75	0.73
4-On-D	4	2.48	0.39
5-Sq-U	4	3.10	0.77
6-Sq-D	4	2.80	0.79
7-Sk-U	4	4.15	1.06
8-Sk-D	4	6.08	0.98
9-CC	4	1.80	0.39
10-DM	4	6.75	0.93
11-Sk-S	4	10.60	0.59
Average		4.32	0.68
High		10.60	1.06
Low		1.80	0.20

Filtered Samples

Location	No. of Samples	Beta Activity		Alpha Activity	
		Soluble	Insoluble	Soluble	Insoluble
1-DD-U	0	----		----	
3-On-U	0	----		----	
4-On-D	0	----		----	
5-Sq-U	0	----		----	
6-Sq-D	0	----		----	
7-Sk-U	0	----		----	
8-Sk-D	0	----		----	
9-CC	0	----		----	
10-DM	0	----		----	
11-Sk-S	0	----		----	
Average					
High					
Low					

River Water Samples (pCi/l)

May 1971

Unfiltered Samples

Location	No. of Samples	Beta Activity	Alpha Activity
1-DD-U	3	2.60	0.31
3-On-U	3	3.43	0.67
4-On-D	4	4.30	0.71
5-Sq-U	3	4.97	0.65
6-Sq-D	3	3.27	0.35
7-Sk-U	3	3.77	0.74
8-Sk-D	4	4.83	0.50
9-CC	3	2.23	0.65
10-DM	3	6.57	1.04
11-Sk-S	4	10.68	0.33
Average		4.84	0.59
High		10.68	1.04
Low		2.23	0.31

Filtered Samples

Location	No. of Samples	Beta Activity		Alpha Activity	
		Soluble	Insoluble	Soluble	Insoluble
1-DD-U	1	4.10	N.D.	N.D.	0.07
3-On-U	1	9.90	1.20	0.67	0.13
4-On-D	0	----	----	----	----
5-Sq-U	1	7.30	6.20	0.74	0.18
6-Sq-D	1	19.60	36.10	0.72	0.61
7-Sk-U	1	11.60	40.80	0.79	0.84
8-Sk-D	0	----	----	----	----
9-CC	1	13.60	8.20	0.72	0.25
10-DM	1	6.60	4.20	0.72	0.67
11-Sk-S	0	----	----	----	----
Average		10.39	13.81	0.62	0.39
High		19.60	40.80	0.79	0.84
Low		4.10	1.20	0.67	0.07

River Water Samples (pCi/l)

June 1971

Unfiltered Samples

Location	No. of Samples	Beta Activity	Alpha Activity
1-DD-U	3	4.73	0.45
3-On-U	3	2.70	0.51
4-On-D	3	3.17	0.38
5-Sq-U	3	4.17	0.55
6-Sq-D	3	3.73	0.39
7-Sk-U	3	5.03	0.55
8-Sk-D	3	4.00	0.51
9-CC	3	2.63	0.56
10-DM	3	8.90	0.80
11-Sk-S	5	8.06	0.19
Average		4.92	0.47
High		8.90	0.80
Low		2.70	0.19

Filtered Samples

Location	No. of Samples	Beta Activity		Alpha Activity	
		Soluble	Insoluble	Soluble	Insoluble
1-DD-U	2	3.75	3.50	0.43	0.37
3-On-U	2	7.65	4.15	0.85	0.70
4-On-D	2	8.85	1.29	0.76	0.27
5-Sq-U	2	5.30	5.48	0.16	1.21
6-Sq-D	2	4.90	5.00	0.28	0.70
7-Sk-U	2	5.80	4.45	0.55	0.49
8-Sk-D	2	3.65	4.85	0.64	0.90
9-CC	2	8.05	1.58	0.28	0.25
10-DM	2	9.75	10.50	1.44	0.84
11-Sk-S	0	----	----	----	----
Average		6.41	4.53	0.60	0.64
High		9.75	10.50	1.44	1.21
Low		3.65	1.29	0.16	0.25

ALRR Outfall Samples (pCi/l)

January - June 1970

Date	Beta Activity	Alpha Activity
January	6.38	0.48
February	6.74	0.41
March	7.15	0.15
April	9.29	0.20
May[a]	10.76	0.13
June[b,a]	9.84	0.21
Average	8.36	0.26
High	10.76	0.48
Low	6.38	0.13

Detection Limits - 1.00 pCi/l β

0.39 pCi/l α

[a]On the following dates in May, higher than normal levels of radioactivity were determined. A gamma ray spectrum showed the activity to be Cs^{137}.

1630	5-26-71	2.43×10^{-8} µC/ml
0830	5-27-71	6.23×10^{-8} µC/ml
1400	5-27-71	4.96×10^{-8} µC/ml
0830	5-28-71	1.14×10^{-7} µC/ml
1630	5-28-71	1.91×10^{-8} µC/ml
0830	6-1-71	8.47×10^{-8} µC/ml

As the specific isotope was identified, and the rest of the data was not otherwise specified, these samples were not included in the averages.

[b]Samples taken on 6-16-71 were determined to be higher than normal with respect to gross β activity, 1.43×10^{-7} µc/ml and 9.27×10^{-8} µc/ml. The isotope was identified by gamma ray spectrum as Co^{60}. As the isotope was identified and the rest of the data was not otherwise specified, these samples were not included in the averages.

The Cs^{137} and Co^{60} levels determined are < 1% of the values for Cs^{137} and Co^{60} in 10CFR-20 Table 2, Column 2.

Bottom Sediment Samples (pCi/g)

Location	Date	Beta Concentration	Alpha Concentration
1-DD-u	3-26-71	6.70	0.42
	5-13-71	8.27	0.39
	Average	7.49	0.41
2-DD-D	3-26-71	8.54	0.32
ALRR	5-13-71	15.20	0.90
Outfall	Average	11.87	0.61
3-On-u	3-26-71	6.74	0.09
	5-13-71	6.62	0.77
	Average	6.68	0.43
4-On-D	3-26-71	5.71	0.18
	5-13-71	5.67	0.45
	Average	5.69	0.32
5-Sq-u	3-26-71	9.19	0.49
	5-13-71	6.59	0.78
	Average	7.89	0.64
6-Sq-D	3-26-71	6.47	0.20
	5-13-71	7.63	0.30
	Average	7.05	0.25
7-SK-u	3-26-71	8.73	0.51
	5-13-71	4.59	0.12
	Average	6.66	0.32
9-cc.	3-26-71	6.40	0.05
	5-13-71	5.57	0.12
	Average	5.99	0.09
10-DM	No Sample - - - - - - - - - - - - - - - - -		
	5-13-71	9.73	0.41
	Average	9.73	0.41
11-Sk-S	3-26-71	8.66	0.37
	5-13-71	4.83	0.09
	Average	6.75	0.23
Todd Pond	3-26-71	14.40	0.83
	5-13-71	14.60	0.62
	Average	14.50	0.73

Bottom Sediment Samples (pCi/g) (Continued)

Location	Date	Beta Concentration	Alpha Concentration
Izaak Walton League Pond	3-26-71	9.01	0.26
	5-13-71	8.44	0.77
	Average	8.73	0.52
Kelley Pond	3-26-71	9.73	0.78
	5-13-71	6.38	0.18
	Average	8.06	0.48
Average for 25 Samples		8.18	0.42
High		15.20	0.90
Low		4.59	0.05

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

Precipitation Samples (pCi/l)

Date	# of Samples	Beta Activity	Alpha Activity
January	1	12.30	2.70
February	3	26.07	2.93
March	2	45.25	0.65
April	4	235.03	3.04
May	5	395.34	4.64
June	7	181.63	2.56
Average		198.60	3.00
Individual High		1230.00	11.60
Individual Low		12.30	0.32

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

Well Water Samples (pCi/l)

Location	Date	Beta Activity	Alpha Activity
City of Ames	1-04-71	3.50	1.20
	2-08-71	3.40	1.50
	3-04-71	3.60	0.36
	4-07-71	5.80	0.85
	5-05-71	4.30	1.20
	6-09-71	4.30	1.00
Average		4.15	1.02
High		5.80	1.50
Low		3.40	0.36
Iowa State University	1-04-71	3.60	0.85
	2-02-71	3.80	1.20
	3-01-71	3.40	0.36
	4-05-71	3.00	0.36
	5-03-71	1.90	0.79
	6-01-71	3.40	0.79
Average		3.18	0.73
High		3.80	1.20
Low		1.90	0.36

Well Water Samples (pCi/l)

Location	Date	Beta Activity	Alpha Activity
Arland Martin Acreage	1-04-71	5.90	0.49
	2-02-71	5.10	0.54
	3-01-71	3.50	0.61
	4-05-71	6.40	0.49
	5-03-71	4.30	0.36
	6-01-71	5.50	0.36
Average		5.12	0.48
High		6.40	0.61
Low		3.50	0.36
Average for 18 Samples		4.15	0.74
High for 18 Samples		6.40	1.50
Low for 18 Samples		1.90	0.36

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

Pond Water Samples (pCi/l)

Location	Date	Beta Activity	Alpha Activity
George Todd Pond	1-04-71	2.40	1.40
	2-02-71	2.20	0.85
	3-01-71	27.70	1.40
	4-05-71	3.90	0.72
	5-03-71	2.70	0.85
	6-01-71	4.90	0.49
Average		7.30	0.95
High		27.70	1.40
Low		2.20	0.49
Izaak Walton League Pond	1-04-71	17.00	0.61
	2-02-71	18.10	1.10
	3-01-71	13.00	0.43
	4-05-71	22.70	0.36
	5-03-71	20.70	0.61
	6-01-71	21.60	0.67
Average		18.85	0.63
High		22.70	1.10
Low		13.00	0.36

Pond Water Samples (pCi/l)

Location	Date	Beta Activity	Alpha Activity
Kelley Pond	1-04-71	3.40	0.07
	2-02-71	5.90	1.50
	3-01-71	15.70	0.25
	4-05-71	11.10	0.25
	5-03-71	5.50	0.97
	6-01-71	10.70	0.79
Average		8.72	0.64
High		15.70	1.50
Low		3.40	0.07
Average for 18 Samples		11.62	0.74
High for 18 Samples		27.70	1.50
Low for 18 Samples		2.20	0.07

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