IS-2926

SURVEY OF ENVIRONMENTAL RADIOACTIVITY

January 1, 1972 - June 30, 1972

Milo D. Voss

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IOWA STATE UNIVERSITY
AMES, IOWA

Date Transmitted: August 1972

PREPARED FOR THE U. S. ATOMIC ENERGY COMMISSION DIVISION OF RESEARCH
UNDER CONTRACT W-7405-eng-82

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TABLE OF CONTENTS

Previous research reports in this series are:

TID-20369
IS-1098
IS-1320
IS-1523
IS-1647
IS-1776
IS-1924
IS-2025
IS-2154
IS-2260
IS-2393
IS-2541
IS-2658
IS-2791

SURVEY OF ENVIRONMENTAL RADIOACTIVITY

FOR PERIOD 1/1/72 - 6/30/72

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, 1972 to June 30, 1972. 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 12/31/71 the ALRR had generated 170110 megawatt hours of heat. A total of 187146 megawatt hours of heat has been generated as of 6/30/72.

The data indicated 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	115	0.18	0.0042
River Water	205	8.22	0.62
ALRR Outfall	256	6.49	0.24
Bottom Sediment	26	8.13	0.46
Precipitation	20	84.36	3.50
Well Water	18	5.23	0.83
Pond Water	18	10.10	0.45

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 0.01 to 0.88 pCi/M^3 with an average of 0.18 pCi/M^3. The alpha activity range was 0.001 to 0.026 pCi/M^3 with an average of 0.0042 pCi/M^3. Average levels reported for 1971 were 0.34 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 0.81 to 62.10 pCi/l with an average of 8.22 pCi/l. The alpha range was 0.06 to 4.10 pCi/l with an average of 0.62 pCi/l.

Average levels reported for 1971 were 6.73 pCi/l beta and 0.60 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 0.54 pCi/l to 18.00 pCi/l with an average of 6.49 pCi/l. The alpha activity range was 0.06 pCi/l to 1.10 pCi/l with an average level of 0.24 pCi/l.

Average levels reported for 1971 were 8.15 pCi/l beta and 0.28 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 4.83 pCi/g to 13.40 pCi/g with an average of 8.13 pCi/g. The alpha activity range was 0.14 pCi/g to 0.85 pCi/g with an average of 0.46 pCi/g.

The average levels reported for 1971 were 8.93 pCi/g beta and 0.31 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 14.00 pCi/l to 343.00 pCi/l with an average of 84.36 pCi/l. The alpha activity range was 0.34 pCi/l to 14.70 pCi/l with an average of 3.50 pCi/l.

The average levels reported for 1971 were 113.27 pCi/l beta and 2.26 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 2.20 pCi/l to 9.00 pCi/l with an average of 5.23 pCi/l. The alpha activity range was 0.23 pCi/l to 2.50 pCi/l with an average of 0.83 pCi/l.

The average levels reported for 1971 were 4.61 pCi/l beta and 0.63 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 4.50 pCi/l to 19.50 pCi/l with an average of 10.10 pCi/l. The alpha activity range was 0.18 pCi/l to 1.10 pCi/l with an average of 0.45 pCi/l.

The average level reported for 1971 was 11.04 pCi/l beta and 0.56 pCi/l alpha.

H. Detection Limits

Detection limits are by definition only.

I. Abbreviations Used

ND means not detectable.

Air Samples (pCi/M^3)

Date	Beta Conc.	Alpha Conc.
Jan. (12)	0.19	0.001
Feb. (21)	0.11	0.001
Mar. (22)	0.08	0.001
Apr. (20)	0.14	0.007
May (20)	0.30	0.008
June (19)	0.25	0.007
Average	0.18	0.0042
High	0.88	0.026
Low	0.01	0.001

Detection Limits 0.0066 pCi/M^3 β

0.0026 pCi/M^3 α

River Water Sample (pCi/l)

January 1972

Unfiltered Samples

Location	No. of Samples	Beta Activity	Alpha Activity
1-DD-U	0	----	----
3-On-U	2	7.60	0.36
4-On-D	0	----	----
5-Sq-U	4	5.03	0.70
6-Sq-D	3	4.03	0.40
7-Sk-U	5	5.94	0.42
8-Sk-D	5	7.42	0.34
9-CC	2	6.30	0.34
10-DM	4	5.50	0.48
11-Sk-S	5	14.54	0.60
Average		7.38	0.47
High		14.54	0.70
Low		4.03	0.34

Filtered Samples

Location	No. of Samples	Beta Activity Soluble	Beta Activity Insoluble	Alpha Activity Soluble	Alpha Activity 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 1972

Unfiltered Samples

Location	No. of Samples	Beta Activity	Alpha Activity
1-DD-U	0	----	----
3-On-U	1	17.20	0.67
4-On-D	0	----	----
5-Sq-U	3	15.67	0.62
6-Sq-D	1	13.60	0.54
7-Sk-U	3	6.47	0.41
*8-Sk-D	4	7.47	0.21
9-CC	0	----	----
10-DM	4	7.70	0.48
11-Sk-S	4	10.73	0.47
Average		10.04	0.45
High		17.20	0.67
Low		6.47	0.21

Filtered Samples

Location	No. of Samples	Beta Activity Soluble	Beta Activity Insoluble	Alpha Activity Soluble	Alpha Activity 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					

*The sample taken from site #8 on 2/14/72 was 1.2×10^{-7} μc/ml. The sample was counted by gamma spectrometery and determined to be Ir^{192}. The sample was also placed on a piece of x-ray film and the geometry of the Ir was determined to be a small speck. This sample is not included in the data, as the isotope was determined, and the other data are not otherwise specified.

River Water Samples (pCi/l)

March 1972

Unfiltered Samples

Location	No. of Samples	Beta Activity	Alpha Activity
1-DD-U	0	----	----
3-On-U	4	6.30	0.78
4-On-D	0	----	----
5-Sq-U	4	11.78	1.03
6-Sq-D	4	13.35	1.00
7-Sk-U	4	9.70	0.77
8-Sk-D	3	7.93	0.56
9-CC	4	7.28	0.61
10-DM	4	10.18	0.50
11-Sk-S	4	10.40	0.30
Average		9.67	0.70
High		13.35	1.03
Low		6.30	0.30

Filtered Samples

Location	No. of Samples	Beta Activity Soluble	Beta Activity Insoluble	Alpha Activity Soluble	Alpha Activity 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)

April 1972

Unfiltered Samples

Location	No. of Samples	Beta Activity	Alpha Activity
1-DD-U	2	9.15	0.22
3-On-U	4	5.70	0.53
4-On-D	4	5.35	0.43
5-Sq-U	4	6.65	0.87
6-Sq-D	4	6.33	0.60
7-Sk-U	4	6.60	0.93
8-Sk-D	3	5.77	1.02
9-CC	4	6.88	0.65
10-DM	4	7.15	0.64
11-Sk-S	4	11.53	0.55
Average		7.04	0.66
High		11.53	1.02
Low		5.35	0.22

Filtered Samples

Location	No. of Samples	Beta Activity Soluble	Beta Activity Insoluble	Alpha Activity Soluble	Alpha Activity 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 1972

Unfiltered Samples

Location	No. of Samples	Beta Activity	Alpha Activity
1-DD-U	5	5.40	0.26
3-On-U	5	3.78	0.60
4-On-D	5	3.12	0.34
5-Sq-U	5	5.66	0.63
6-Sq-D	5	6.18	0.68
7-Sk-U	5	4.70	0.80
8-Sk-D	4	3.08	0.62
9-CC	5	3.84	0.72
10-DM	5	8.10	1.00
11-Sk-S	5	8.58	0.30
Average		5.29	0.59
High		8.58	1.00
Low		3.08	0.26

Filtered Samples

Location	No. of Samples	Beta Activity Soluble	Beta Activity Insoluble	Alpha Activity Soluble	Alpha Activity 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)

June 1972

Unfiltered Samples

Location	No. of Samples	Beta Activity	Alpha Activity
1-DD-U	3	3.50	0.12
3-On-U	4	4.43	0.33
4-On-D	4	4.33	0.23
5-Sq-U	3	4.60	0.40
6-Sq-D	3	3.77	0.40
7-Sk-U	3	3.87	0.45
8-Sk-D	2	4.35	0.07
9-CC	3	3.90	0.33
10-DM	3	5.27	0.16
11-Sk-S	4	8.43	0.29
Average		4.76	0.28
High		8.43	0.45
Low		3.50	0.07

Filtered Samples

Location	No. of Samples	Beta Activity		Alpha Activity	
		Soluble	Insoluble	Soluble	Insoluble
1-DD-U	1	26.50	31.50	1.00	2.90
3-On-U	0	------		-------	
4-On-D	0	------		-------	
5-Sq-U	1	9.20	48.90	1.80	2.30
6-Sq-D	1	11.60	42.60	0.67	2.50
7-Sk-U	1	9.10	53.00	0.49	3.50
8-Sk-D	0	------		-------	
9-CC	1	14.10	22.40	0.72	1.70
10-DM	1	7.80	14.10	0.31	1.30
11-Sk-S	0	------		-------	
Average		13.05	35.42	0.83	2.37
High		26.50	53.00	1.80	3.50
Low		7.80	14.10	0.31	1.30

ALRR Outfall Samples (pCi/l)

January - June 1972

Date	Beta Activity	Alpha Activity
January	6.47	0.19
February	6.54	0.26
March	7.23	0.25
April	7.37	0.31
May	5.93	0.22
June	5.43	0.20
Average	6.50	0.24
High	7.37	0.31
Low	5.43	0.19

Detection Limits - 1.00 pCi/l β

0.39 pCi/l α

Bottom Sediment Samples (pCi/g)

Location	Date	Beta Concentration	Alpha Concentration
1-DD-u	3-28-72	5.68	0.21
	6-30-72	4.83	0.14
	Average	5.26	0.18
2-DD-D	3-28-72	7.27	0.42
ALRR	6-30-72	7.77	0.36
Outfall	Average	7.52	0.39
3-On-u	3-28-72	6.90	0.14
	6-30-72	8.65	0.37
	Average	7.78	0.26
4-On-D	3-28-72	5.67	0.30
	6-30-72	8.35	0.56
	Average	7.01	0.43
5-Sq-u	3-28-72	9.12	0.57
	6-30-72	8.79	0.46
	Average	8.96	0.52
6-Sq-D	3-28-72	10.40	0.65
	6-30-72	7.70	0.37
	Average	9.05	0.51
7-SK-u	3-28-72	11.10	0.85
	6-30-72	6.01	0.36
	Average	8.56	0.61
9-cc.	3-28-72	5.85	0.33
	6-30-72	6.28	0.17
	Average	6.07	0.25
10-DM	3-28-72	11.50	0.55
	6-30-72	8.38	0.73
	Average	9.94	0.64
11-Sk-S	3-28-72	9.25	0.66
	6-30-72	8.96	0.71
	Average	9.11	0.69
Todd Pond	3-28-72	7.68	0.50
	6-30-72	8.55	0.53
	Average	8.12	0.52

Bottom Sediment Samples (pCi/g) (Continued)

Location	Date	Beta Concentration	Alpha Concentration
Izaak Walton League Pond	3-28-72	8.17	0.28
	6-30-72	6.55	0.24
	Average	7.36	0.26
Kelley Pond	3-28-72	13.40	0.80
	6-30-72	8.65	0.59
	Average	11.03	0.70
Average for 26 samples		8.13	0.46
High		13.40	0.85
Low		4.83	0.14

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

Well Water Samples (pCi/l)

Location	Date	Beta Activity	Alpha Activity
City of Ames	1-05-72	3.90	0.78
	2-04-72	3.90	0.36
	3-06-72	2.20	1.30
	4-03-72	4.20	0.23
	5-01-72	3.80	1.00
	6-05-72	3.30	0.42
Average		3.55	0.68
High		4.20	1.30
Low		2.20	0.23
Iowa State University	1-03-72	5.90	2.50
	1-31-72	6.00	2.20
	3-06-72	4.20	0.83
	4-03-72	9.00	0.31
	5-01-72	5.80	0.31
	6-05-72	4.30	1.10
Average		5.87	1.21
High		9.00	2.50
Low		4.20	0.31

Well Water Samples (pCi/l)

Location	Date	Beta Activity	Alpha Activity
Arland Martin Acreage	1-03-72	4.90	1.10
	1-31-72	6.40	0.36
	3-06-72	6.80	0.36
	4-03-72	6.60	0.54
	5-01-72	8.50	0.67
	6-05-72	4.50	0.60
Average		6.28	0.61
High		8.50	1.10
Low		4.50	0.36
Average for 18 Samples		5.23	0.83
High for 18 Samples		9.00	2.50
Low for 18 Samples		2.20	0.23

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	1-03-72	6.30	0.42
	1-31-72	7.70	0.72
	3-06-72	18.40	0.29
	4-03-72	6.40	0.72
	5-01-72	6.60	0.72
	6-05-72	7.20	0.72
Average		8.77	0.60
High		18.40	0.72
Low		6.30	0.29
Izaak Walton League Pond	1-03-72	14.10	0.24
	1-31-72	13.10	0.54
	3-06-72	19.50	0.18
	4-03-72	16.10	0.54
	5-01-72	4.50	0.31
	6-05-72	17.30	1.10
Average		14.10	0.49
High		19.50	1.10
Low		4.50	0.18

Pond Water Samples (pCi/l)

Location	Date	Beta Activity	Alpha Activity
Kelley Pond	1-03-72	5.30	0.36
	1-31-72	5.90	0.36
	3-06-72	8.80	0.36
	4-03-72	6.80	0.42
	5-01-72	6.10	0.18
	6-05-72	11.70	N.D.
Average		7.43	0.28
High		11.70	0.42
Low		5.30	0.18
Average for 18 Samples		10.10	0.45
High for 18 Samples		19.50	1.10
Low for 18 Samples		4.50	0.18

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