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Research and Development Report

SURVEY OF ENVIRONMENTAL
RADIOACTIVITY FOR PERIOD

1-1-68 to 6-30-68

by

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Ames Laboratory

at

Iowa State University of Science and Technology

F. H. Spedding, Director

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SURVEY OF ENVIRONMENTAL RADIOACTIVITY

FOR PERIOD 1-1-68 to 6-30-68

Milo Voss

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, 1968 to June 30, 1968. 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 12/31/67 the ALRR had generated 43,836 megawatts of heat. A total of 58,877 megawatts of heat has been generated as of 6/30/68.

The data indicates 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	132	0.27	0.007
River Water	137	13.09	0.95
ALRR Outfall	124	10.09	0.68
Bottom Sediment	26	9.81	0.52
Precipitation	31	130.56	6.72
Well Water	17	7.26	0.94
Pond Water	18	14.01	0.82

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 Wattman 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 0.06 to 0.91 pCi/M³ with an average of 0.27 pCi/M³. The alpha activity range was 0.001 to 0.042 pCi/M³ with an average of 0.007 pCi/M³. Average levels reported for 1967 were 0.12 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 filtered and the soluble and insoluble fractions are counted for gross alpha and beta content.

The beta activity range was 3.90 to 63.2 pCi/l with an average of 13.09 pCi/l. The alpha range was 0.18 to 5.10 pCi/l with an average of 0.95 pCi/l.

Average levels reported for 1967 were 11.46 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 filtered and counted as soluble and insoluble fractions.

The beta range was 3.30 pCi/l to 30.0 pCi/l with an average of 10.09 pCi/l. The alpha activity range was 0.18 pCi/l to 7.00 pCi/l with an average level of 0.68 pCi/l.

Average levels reported for 1967 were 11.20 pCi/l beta and 0.48 pCi/l alpha.

D. Bottom Sediment Samples

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

The beta activity range was 4.10 pCi/g to 18.00 pCi/g

with an average of 9.81 pCi/g. The alpha activity range was 0.04 pCi/g to 1.30 pCi/g with an average of 0.52 pCi/g.

The average levels reported for 1967 were 11.70 pCi/g beta and 0.76 pCi/g alpha.

E. Precipitation Samples

Precipitation samples are collected on an "as it happens" basis from a site near ALRR. The samples are filtered and counted as soluble and insoluble fractions for gross beta and alpha.

The beta activity range was 24.00 pCi/l to 293.00 pCi/l with an average of 130.56 pCi/l. The alpha activity range was 0.18 pCi/l to 34.00 pCi/l with an average of 6.72 pCi/l.

The average levels reported for 1967 were 75.49 pCi/l beta and 3.54 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 filtered and counted as soluble and insoluble fractions.

The beta activity range was 2.17 pCi/l to 15.10 pCi/l with an average of 7.26 pCi/l. The alpha activity range was 0.18 pCi/l to 1.84 pCi/l with an average of 1.18 pCi/l.

The average levels reported for 1967 were 7.20 pCi/l beta and 1.07 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. A one liter sample is filtered and counted as soluble and insoluble fractions for gross alpha and beta.

The beta activity range was 5.30 pCi/l to 20.84 pCi/l with an average of 14.01 pCi/l. The alpha activity range was 0.18 pCi/l to 2.70 pCi/l with an average of 0.82 pCi/l.

The average level reported for 1967 was 15.24 pCi/l beta and 1.07 pCi/l alpha.

H. Detection Limits

Detection limits are by definition only.

I. Abbreviations Used

ND means not detectable.

Air Samples (pCi/M³)

1968

<u>Date</u>	<u>Beta Conc.</u>	<u>Alpha Conc.</u>
January (24)	0.22	0.011
February (24)	0.25	0.014
March (19)	0.27	0.005
April (19)	0.32	0.004
May (23)	0.28	0.002
June (23)	0.31	0.005
Average	0.27	0.007
High	0.91	0.042
Low	0.06	0.001

Detection Limit 0.0066 pCi/M³ β 0.0026 pCi/M³ α

River Water Samples (pCi/l)

January 1968

<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 Sample	-----	-----	-----
4-On-D	No Sample	-----	-----	-----
5-Sq-U	No Sample	-----	-----	-----
6-Sq-D	No Sample	-----	-----	-----
7-Sk-U	No Sample	-----	-----	-----
9-CC	No Sample	-----	-----	-----
10-DM	8.62	0.66	0.54	0.11
11-Sk-S	17.22	1.08	0.11	0.29
Average	12.92	0.87	0.33	0.20
High	17.22	1.08	0.54	0.29
Low	8.62	0.66	0.11	0.11
Detection Limit	1.00 pCi/l β	0.39 pCi/l α		

River Water Samples (pCi/l)

February 1968

Beta Activity

<u>Location</u>	<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-U	No Sample	-----	-----	-----
3-On-U	No Sample	-----	-----	-----
4-On-D	No Sample	-----	-----	-----
5-Sq-U	11.60	0.68	0.90	ND
6-Sq-D	11.10	0.27	0.54	ND
7-Sk-U	19.60	ND	0.90	0.18
9-CC	14.90	0.95	ND	0.18
10-DM	7.35	0.82	0.32	0.32
11-Sk-S	14.08	1.09	0.45	0.27
Average	13.11	0.64	0.52	0.16
High	19.60	1.09	0.90	0.32
Low	7.35	0.27	0.32	0.18
Detection Limit	1.00 pCi/l β	0.39 pCi/l α		

River Water Samples (pCi/l)

March 1968

Beta Activity

Alpha Activity

<u>Location</u>	<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-U	No Sample	-----	-----	-----
3-On-U	10.43	0.45	0.48	0.43
4-On-D	No Sample	-----	-----	-----
5-Sq-U	7.90	0.57	0.41	0.09
6-Sq-D	8.73	1.70	0.78	0.36
7-Sq-U	6.63	2.02	0.66	0.67
9-CC	14.68	3.33	1.00	0.60
10-DM	5.98	1.70	0.58	0.27
11-Sk-S	14.13	0.73	0.62	0.87
Average	9.78	1.50	0.65	0.47
High	14.68	3.33	1.00	0.87
Low	5.98	0.45	0.41	0.09
Detection Limit	1.00 pCi/l β	0.39 pCi/l α		

River Water Samples (pCi/l)

April 1968

Beta Activity

Alpha Activity

<u>Location</u>	<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-U	No Sample	-----	-----	-----
3-On-U	9.44	3.66	0.69	0.25
4-On-D	No Sample	-----	-----	-----
5-Sq-U	8.84	0.79	0.69	0.36
6-Sq-D	9.96	1.34	0.54	0.25
7-Sk-U	10.50	1.10	0.79	0.04
9-CC	8.86	1.32	1.08	0.14
10-DM	8.80	3.46	0.43	0.44
11-Sk-S	17.58	1.05	0.54	0.32
Average	10.57	1.82	0.68	0.26
High	17.58	3.66	1.08	0.44
Low	8.80	0.79	0.43	0.04
Detection Limit	1.00 pCi/l β	0.39 pCi/l α		

River Water Samples (pCi/l)

May 1968

Beta Activity

Alpha Activity

<u>Location</u>	<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-U	No Sample	-----	-----	-----
3-On-U	5.78	1.13	0.45	0.18
4-On-D	No Sample	-----	-----	-----
5-Sq-U	6.05	0.84	0.32	0.32
6-Sq-D	5.43	1.09	0.81	0.11
7-Sk-U	6.05	1.05	0.45	0.50
9-CC	6.33	1.70	0.36	0.09
10-DM	7.55	1.63	0.78	0.18
11-Sk-S	14.73	1.47	0.58	0.18
Average	7.42	1.28	0.54	0.22
High	14.73	1.70	0.81	0.50
Low	5.43	0.84	0.32	0.09
Detection Limit	1.00 pCi/l β	0.39 pCi/l α		

River Water Samples (pCi/l)

June 1968

<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	10.75	7.08	0.76	1.14
4-On-D	No Sample	-----	-----	-----
5-Sq-U	10.18	10.95	0.72	0.86
6-Sq-D	12.60	9.96	0.86	1.19
7-Sk-U	11.43	11.83	1.05	1.01
9-CC	9.93	7.09	0.85	0.63
10-DM	8.68	8.50	0.87	1.05
11-Sk-S	12.48	0.52	0.27	0.41
Average	10.86	7.99	0.77	0.90
High	12.60	11.83	1.05	1.19
Low	8.68	0.52	0.27	0.41
Detection Limit	1.00 pCi/l β	0.39 pCi/l α		

ALRR Outfall Samples (pCi/l)

January - June 1968

<u>Date</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
	<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
January	9.50	0.85	0.45	0.20
February	9.18	1.29	0.38	0.28
March	10.52	0.46	0.23	0.42
*April	8.01	1.39	0.48	0.62
May	7.62	1.39	0.17	0.29
June	8.90	1.37	0.23	0.32
Average	8.96	1.13	0.32	0.36
High	10.52	1.39	0.48	0.59
Low	7.62	0.46	0.17	0.20
Detection Limit	1.00 pCi/l β		0.39 pCi/l α	

* On April 11 and April 12 Na^{24} used for tracer work in the secondary cooling system was detected in the outfall water. The levels were $4.5 \times 10^{-7} \mu\text{c/ml}$ and $2.3 \times 10^{-6} \mu\text{c/ml}$. The MPC for Na^{24} is $2 \times 10^{-4} \mu\text{c/ml}$. As the specific isotope in the two cases was identified and the rest of the data is not otherwise specified, these two dates were not included in the averages.

Bottom Sediment Samples (pCi/g)

<u>Location</u>	<u>Date</u>	<u>Beta Concentration</u>	<u>Alpha Concentration</u>
1-DD-U	3-27-68	7.50	0.69
	*7-29-68	7.60	0.26
	Average	7.55	0.48
2-DD-D ALRR Outfall	3-27-68	9.00	0.42
	*7-29-68	7.20	0.50
	Average	8.10	0.46
3-On-U	3-27-68	7.10	0.13
	*7-29-68	8.60	0.08
	Average	7.85	0.11
4-On-D	3-27-68	7.10	0.27
	*7-29-68	8.20	0.17
	Average	7.65	0.23
5-Sq-U	3-27-68	6.60	0.34
	*7-29-68	8.30	0.48
	Average	7.45	0.41
6-Sq-D	3-27-68	12.00	0.97
	*7-29-68	11.30	0.47
	Average	11.65	0.72
7-Sk-U	3-27-68	7.00	1.20
	*7-29-68	9.20	0.22
	Average	8.10	0.72
9-CC	3-27-68	10.00	0.47
	*7-29-68	7.10	0.08
	Average	8.55	0.28
10-DM	3-27-68	11.00	0.95
	*7-29-68	8.40	0.29
	Average	9.70	0.62
11-Sk-S	3-27-68	14.00	1.20
	*7-29-68	4.10	0.04
	Average	9.05	0.62

Continued

<u>Location</u>	<u>Date</u>	<u>Beta Concentration</u>	<u>Alpha Concentration</u>
Todd Pond	3-27-68	13.00	0.71
	*7-29-68	17.90	0.84
	Average	15.45	0.78
Izaak Walton League Pond	3-27-68	18.00	1.30
	*7-29-68	7.00	0.30
	Average	12.50	0.80
Kelley Pond	3-27-68	17.00	0.75
	*7-29-68	10.80	0.42
	Average	13.90	0.59
Average for 26 Samples (1st half of 1968)		9.81	0.52
High		18.00	1.30
Low		4.10	0.04
Detection Limit	0.25 pCi/g β	0.10 pCi/g α	

* Due to a change in personnel the bottom sediment samples were not picked up for the second quarter until July 29, 1968.

Precipitation Samples (pCi/l)

<u>Date</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
	<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
January	143.00	75.50	7.30	4.60
February	56.75	95.00	ND	3.00
March	97.95	96.68	6.43	5.10
April	61.11	49.11	3.39	5.56
May	45.14	21.50	2.36	1.38
June	30.91	10.68	0.94	0.45
Average	72.48	58.08	3.40	3.35
Individual High	181.00	171.00	11.00	24.00
Individual Low	16.70	3.40	0.45	0.19
Detection Limit	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>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
City of Ames	1-02-68	5.30	1.90	0.18	0.18
	2-05-68	1.90	0.27	1.10	0.36
	3-06-68	4.30	1.80	ND	0.18
	4-01-68	4.10	0.41	1.10	0.54
	6-11-68	5.90	0.54	1.10	ND
Average		4.30	0.98	0.70	0.25
High		5.90	1.90	1.10	0.54
Low		1.90	0.27	0.18	0.18
Iowa State University	1-02-68	6.50	2.20	ND	ND
	2-05-68	5.40	ND	1.40	0.36
	3-04-68	13.60	1.50	0.36	1.08
	4-01-68	5.30	0.68	0.18	ND
	4-29-68	6.10	1.10	1.80	ND
6-03-68	3.90	1.20	ND	ND	
Average		6.80	1.11	0.62	0.24
High		13.60	2.20	1.80	1.08
Low		3.90	0.68	0.18	0.36
Arland Martin Acreage	1-02-68	5.90	ND	1.40	0.18
	2-05-68	7.00	0.54	0.36	0.18
	3-04-68	7.30	0.81	0.54	1.30
	4-01-68	8.80	1.40	ND	0.18
	4-29-68	7.20	1.10	1.10	0.18
6-03-68	8.20	1.10	0.18	0.36	
Average		7.40	0.83	0.60	0.40
High		8.80	1.40	1.40	1.30
Low		5.90	0.54	0.18	0.18
Average for 17 Samples		6.29	0.97	0.64	0.30
High for 17 Samples		13.60	2.20	1.80	1.30
Low for 17 Samples		1.90	0.27	0.18	0.18
Detection Limit	1.00 pCi/l β		0.39 pCi/l α		

Pond Water Samples (pCi/l)

<u>Location</u>	<u>Date</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
George Todd Pond	1-22-68	12.20	ND	ND	ND
	2-19-68	5.50	ND	0.36	ND
	3-11-68	5.30	ND	0.72	0.36
	4-01-68	12.40	ND	0.18	0.54
	5-29-68	15.40	2.60	0.54	0.36
	6-11-68	18.10	0.68	0.18	0.54
Average		11.48	0.54	0.33	0.30
High		18.10	2.60	0.72	0.54
Low		5.30	0.68	0.18	0.36
Isaac Walton League Pond	1-22-68	9.20	ND	1.10	ND
	2-19-68	16.60	ND	0.54	0.36
	3-11-68	12.00	ND	0.36	0.90
	4-01-68	18.50	1.60	0.18	ND
	5-29-68	20.30	0.54	0.54	0.18
	6-11-68	17.80	0.95	0.54	0.36
Average		15.73	0.52	0.54	0.30
High		20.30	1.60	1.10	0.90
Low		9.20	0.54	0.18	0.18
Kelley Pond	1-22-68	19.70	ND	ND	0.36
	2-19-68	6.80	ND	0.90	0.36
	3-11-68	6.90	ND	0.54	0.18
	4-01-68	13.50	0.95	0.72	ND
	5-29-68	11.50	7.40	1.30	1.40
	6-11-68	12.50	3.20	0.18	ND
Average		11.82	1.93	0.61	0.38
High		19.70	7.40	1.30	1.40
Low		6.80	0.95	0.18	0.18
Average for 18 Samples		13.01	1.00	0.49	0.33
High for 18 Samples		20.30	7.40	1.30	1.40
Low for 18 Samples		5.30	0.54	0.18	0.18
Detection Limit	1.00 pCi/l β		0.39 pCi/l α		

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