

IS-2541



SURVEY OF ENVIRONMENTAL RADIOACTIVITY

January 1, 1970 - December 31, 1970

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SURVEY OF ENVIRONMENTAL RADIOACTIVITY

Milo D. Voss

I. SUMMARY

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 gross alpha and beta determinations of air, soil, vegetation, river water, ALRR outfall, bottom sediment, precipitation, well water, and pond samples.

The ALRR reached full power as of 7/12/65. The ALRR had generated 105409 megawatt hours as of 12/31/69. A total of 34051 megawatt hours was generated in 1970.

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 average levels of radioactivity were recorded for 1970:

<u>Sample Media</u>	<u>Individual Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
Air	180	0.27 pCi/M ³	0.004 pCi/M ³
Soil	25	12.71 pCi/g	0.69 pCi/g
Vegetation	13	32.18 pCi/g	0.10 pCi/g
River Water	429	8.02 pCi/l	0.74 pCi/l
ALRR Outfall	416	10.64 pCi/l	0.30 pCi/l
Bottom Sediment	51	8.06 pCi/g	0.39 pCi/g
Precipitation	53	76.70 pCi/l	1.77 pCi/l
Well Water	35	7.19 pCi/l	0.81 pCi/l
Pond Water	36	15.19 pCi/l	0.58 pCi/l

II. SAMPLE INFORMATION

A. Air Samples

Daily air samples are taken at a location on top of the Ames Laboratory Research Building. Samples are collected on Whatman #41 filter paper with a Gast pump at the flow rate of 3.75 cfm. The filter samples are held for seven days to allow short-lived activities to decay. The samples are then placed directly in a Sharp Low Beta-Matic three-inch system and counted for gross alpha and beta activity. In September there were no samples taken due to pump failure.

Beta Activity Range (pCi/M³)

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	3.40	3.86	1.26	0.30	0.15	0.12	0.20	0.24	0.27
High	22.40	13.50	5.95	1.50	2.34	0.92	0.91	1.55	1.47
Low	0.50	0.21	0.05	0.01	0.01	0.005	0.02	0.03	0.04

Alpha Activity Range (pCi/M³)

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	0.05	0.11	0.0139	0.0068	0.0025	0.004	0.005	0.004	0.004
High	0.40	0.73	0.1135	0.0760	0.030	0.050	0.050	0.034	0.026
Low	0.01	0.10	0.0004	0.00012	0.001	0.001	0.001	0.001	0.001

B. Soil Samples

Soil samples are collected once each year. Circles surrounding the ALRR site were divided into quadrants on the basis of wind frequencies. The annuli were chosen on the basis of simplicity for defining sampling area. One sample was taken in each sector of each annulus (see maps #1 and #2). Reference samples were collected at Fort Dodge, Iowa. The number-letter designations on the data sheets are our codes for sample locations. One-quart samples are collected from the 0-2 inches of top soil. The samples are dried thoroughly in a 100°C drying oven, mixed thoroughly, with large stones and roots being removed. A 3-4 gram counting sample is made from the dried soil, placed in a 3-inch aluminum planchet, and counted directly in the Sharp System for gross alpha and beta activity.

Beta Activity Range (pCi/g)

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	7.57	9.45	19.97	14.45	15.01	13.83	13.37	14.05	12.71
High	9.40	14.00	32.00	20.50	35.30	16.30	16.60	17.00	16.50
Low	5.20	7.80	13.00	3.26	11.00	11.00	10.30	10.70	9.70

Alpha Activity Range (pCi/g)

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	0.26	0.56	0.94	0.86	0.68	0.99	0.81	0.98	0.69
High	0.60	1.08	1.31	1.20	1.20	1.81	1.63	1.61	1.00
Low	0.11	0.19	0.53	0.56	0.22	0.38	0.06	0.56	0.38

C. Vegetation

Vegetation samples are collected once each year. Samples are obtained from the same location as soil samples. Date of collection is correlated to maximum growth period which is July to August for this area. Samples are not collected directly after precipitation of any kind to minimize surface contamination. The

type of vegetation is confined to grasses and none of the root systems is included in the sample.

Samples are dried, ground to a fine powder, and made into 3-4 gram counting samples on 3-inch aluminum planchets. Samples are counted for gross alpha and beta activity in the Sharp System.

Beta Activity Range (pCi/g)

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	117.30	87.50	73.26	32.49	34.00	20.61	24.88	30.47	32.10
High	181.00	186.00	125.00	43.00	90.00	26.20	35.80	46.20	38.80
Low	10.80	10.50	51.00	26.00	20.00	17.70	9.90	16.30	24.30

Alpha Activity Range (pCi/g)

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	1.62	0.96	1.27	0.38	0.13	0.21	0.13	0.91	0.10
High	4.00	4.10	3.24	1.06	0.77	0.71	0.86	1.68	0.44
Low	0.11	0.15	0.35	0.07	0.27	0.21	0.22	0.45	0.06

D. River Water Samples

River water samples are collected weekly and analyzed for gross alpha and beta activity. Samples are obtained from each river or creek in the flow route of the ALRR drainage system. In addition, two samples are obtained from streams outside the ALRR flow route. These constitute control samples and are numbers nine and ten in the data. Samples are obtained at each site until the creeks go dry in late summer and until the rivers are frozen solid in winter. If water is flowing under ice, a sample is obtained by chopping through the ice. If there is an unusually large amount of suspended material in the sample, the sample is filtered and the soluble and insoluble portions are counted separately; otherwise, the sample is evaporated to near dryness and transferred to a planchet. The planchets are placed directly in the Sharp System for counting.

Beta Activity Range

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	18.09	55.94	18.26	18.12	16.03	11.46	11.00	9.09	8.02
High	118.00	2270.00	273.00	51.97	76.58	17.10	18.85	14.66	*43.20
Low	4.50	0.80	0.39	4.68	7.07	7.75	6.65	5.47	* 0.54

Alpha Activity Range

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	1.01	2.09	0.893	0.83	1.02	0.74	0.97	1.15	0.74
High	9.60	108.00	3.80	1.93	2.06	1.22	1.67	1.83	*5.40
Low	0.25	0.06	0.046	0.33	0.57	0.39	0.53	0.44	*0.02

* Individual Highs and Lows

E. ALRR Outfall

One liter samples are collected daily from this site and analyzed for gross beta and alpha content. The samples are handled in the same manner as the river water samples.

Beta Activity Range (pCi/l)

	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	12.25	11.22	11.18	12.15	10.64
High	22.44	14.02	15.22	14.48	*32.00
Low	5.88	8.89	9.01	9.29	* 1.40

Alpha Activity Range (pCi/l)

	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	0.61	0.48	0.70	1.00	0.30
High	1.63	0.84	1.10	1.45	*4.00
Low	0.20	0.23	0.44	0.54	*0.02

* Individual Highs and Lows

F. Bottom Sediment

Bottom sediment samples are obtained at or near the river water and pond water sites on a quarterly basis. Samples are analyzed for gross alpha and beta activity. A one-quart sample is obtained from the top 2-3 inches of bottom sediment in a semi-quiet area. The sample is mixed thoroughly and a 3-4 gram counting sample is

prepared. The counting samples are dried thoroughly in an oven and then counted directly in the Sharp System.

Beta Activity Range (pCi/g)

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	9.88	10.65	11.13	14.64	13.75	11.70	9.84	9.28	8.06
High	22.70	51.00	54.00	34.00	31.70	21.00	18.40	16.67	22.60
Low	0.60	3.90	4.50	7.00	5.50	4.90	4.10	4.96	4.58

Alpha Activity Range (pCi/g)

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	0.25	0.61	0.47	0.89	0.85	0.76	0.46	0.49	0.39
High	0.94	8.00	3.10	6.70	2.74	2.71	1.30	1.50	1.07
Low	0.09	0.01	0.096	0.08	0.06	0.09	0.04	0.05	0.05

G. Precipitation Samples

Precipitation samples are collected on an "as it happens basis" and analyzed for gross alpha and beta activity. The sampling site is the weather observation tower near the ALRR. The samples are handled in the same manner as the river water samples.

Beta Activity Range (pCi/l)

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	2018.17	1360.00	366.23	714.94	217.15	75.49	81.72	138.03	72.95
High	4288.00	7000.00	2520.00	19500.00	3240.00	670.00	293.00	926.00	811.00
Low	922.00	20.00	20.00	8.70	4.30	4.20	3.95	11.50	5.50

Alpha Activity Range (pCi/l)

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	65.90	39.20	12.67	3.95	9.21	3.54	4.14	9.15	1.77
High	97.00	234.00	53.00	32.80	55.00	26.00	34.00	93.70	11.90
Low	13.50	0.28	3.50	0.17	0.15	0.18	0.14	0.18	0.10

H. Well Water Samples

Well water samples are obtained monthly from City of Ames wells, Iowa State University (ISU) campus wells, and from a personal farm well at a location two miles

north of the ALRR. The sample size is one liter and is handled in the same manner as the river water samples.

Beta Activity Range (pCi/l)

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	4.01	4.78	6.83	6.80	6.93	7.20	7.35	5.81	7.19
High	6.78	16.40	12.90	22.80	13.00	15.10	16.20	13.10	16.00
Low	2.75	1.18	2.60	2.04	2.30	2.70	2.17	2.20	3.70

Alpha Activity Range (pCi/l)

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	0.31	1.04	1.42	1.08	1.14	1.07	0.98	1.09	0.81
High	0.90	5.69	20.90	5.20	4.00	4.10	1.84	3.46	1.60
Low	0.17	0.10	0.046	0.12	0.18	0.18	0.18	0.18	0.23

I. Pond Water

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. The sample size is one liter and is handled in the same manner as the river water samples.

Beta Activity Range (pCi/l)

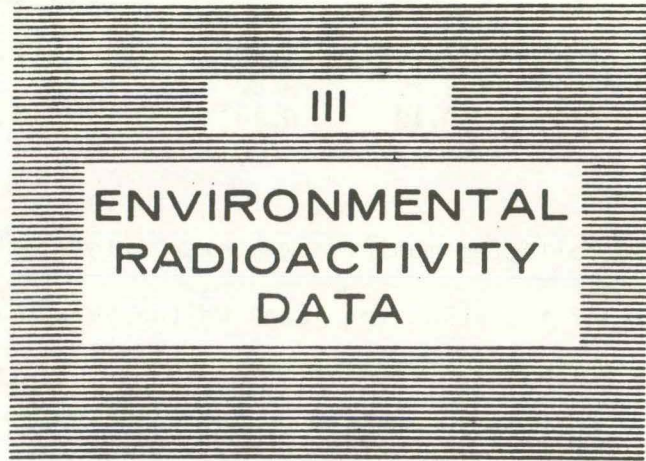
	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	16.30	15.24	14.90	13.73	15.19
High	30.40	30.70	27.00	29.00	38.10
Low	5.10	5.40	5.10	2.44	2.40

Alpha Activity Range (pCi/l)

	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Average	0.86	1.07	0.83	0.84	0.58
High	2.50	3.80	2.70	2.00	3.10
Low	0.09	0.36	0.18	0.18	0.13

J. Detection Limits

Detection limits are by definition only.



III

ENVIRONMENTAL
RADIOACTIVITY
DATA

Air Samples (pCi/M³)

1970

<u>Date</u>	<u>Beta Conc.</u>	<u>Alpha Conc.</u>
January 15	0.15	0.002
February 15	0.13	0.002
March 19	0.29	0.002
April 21	0.30	0.003
May 19	0.55	0.005
June 20	0.64	0.009
July 15	0.50	0.011
August 10	0.39	0.008
September	Pump Failure	
October 14	0.11	0.002
November 17	0.11	0.002
December 15	0.09	0.003
Average	0.27	0.004
High	1.47	0.026
Low	0.04	0.001

Detection Limits - 0.0048 pCi/M³ β
0.0032 pCi/M³ α

Soil Samples

pCi/g

	<u>Date</u>	<u>Beta Conc.</u>	<u>Alpha Conc.</u>
1S-SE1	8-24-70	14.30	0.81
2S-SW1	"	12.80	0.69
3S-NW1	"	13.10	0.88
4S-NE1	"	10.90	0.53
5S-SE2	"	13.90	0.67
6S-SW2	"	14.50	0.54
7S-NW2	"	11.60	0.80
8S-NE2	"	16.50	0.80
9SV-SE3	"	11.50	0.56
10SV-SW3	"	11.10	0.92
11SV-NW3	"	11.40	0.55
12SV-NE3	"	11.70	0.52
13SV-SE4	"	12.70	0.92
14S-SW4	"	10.40	0.48
15SV-NW4	"	14.00	0.53
16S-NE4	"	15.90	0.84
17SV-NE5	"	12.90	1.00
18S-SW5	"	11.70	0.66
19SV-NW5	"	13.50	0.98
20S-NE5	"	13.90	0.95
21SV-SE6	"	12.20	0.38
22SV-SW6	"	13.40	0.50
23S-NW6	"	9.70	0.59
24SV-NE6	"	11.10	0.52
Ft. Dodge	"	13.00	0.74
Average		12.71	0.69
High		16.50	1.00
Low		9.70	0.38

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

Vegetation Samples

pCi/g

	<u>Date</u>	<u>Beta Conc.</u>	<u>Alpha Conc.</u>
3SV-NW1	8-24-70	35.30	N.D.
9SV-SE3	"	38.80	0.29
10SV-SW3	"	38.10	0.22
11SV-NW3	"	34.50	0.07
12SV-NE3	"	35.10	N.D.
13SV-SE4	"	29.90	0.44
15SV-NW4	"	25.50	0.07
17SV-NE5	"	30.20	N.D.
19SV-NW5	"	24.30	0.07
21SV-SE6	"	33.30	N.D.
22SV-SW6	"	31.90	N.D.
24SV-NE6	"	24.80	0.06
Ft. Dodge	"	36.60	0.14
Average		32.18	0.10
High		38.80	0.44
Low		24.30	0.06

Detection Limits - 2.07 pCi/g β
0.78 pCi/g 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>Filtrate</u>	<u>Residue</u>	<u>Filtrate</u>	<u>Residue</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>Filtrate</u>	<u>Residue</u>	<u>Filtrate</u>	<u>Residue</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>
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>
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>Filtrate</u>	<u>Residue</u>	<u>Filtrate</u>	<u>Residue</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>Filtrate</u>	<u>Residue</u>	<u>Filtrate</u>	<u>Residue</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

River Water Samples (pCi/l)

July 1970

Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-u	0	No Samples - - - - -	- - - - -
3-On-u	3	7.13	0.59
4-On-D	3	6.30	0.40
5-Sq-u	3	6.67	0.76
6-Sq-D	3	6.33	0.74
7-Sk-u	3	7.33	0.47
9-c.c.	3	6.27	0.58
10-DM	3	10.03	0.72
11-Sk-S	4	15.93	0.11
Average		8.25	0.55
High		15.93	0.76
Low		6.27	0.11

Filtered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Filtrate</u>	<u>Residue</u>	<u>Filtrate</u>	<u>Residue</u>
1-DD-u	0	No samples - - - - -			
3-On-u	1	15.40	10.40	0.36	0.41
4-On-D	0	No filtered samples - - - - -			
5-Sq-u	1	13.70	7.80	0.13	0.54
6-Sq-D	1	16.50	18.30	0.05	1.20
7-Sk-u	1	14.40	12.10	0.36	0.72
9-c.c.	1	22.90	9.70	0.85	0.96
10-DM	1	10.60	7.80	0.49	0.85
11-Sk-S	0	No Filtered Samples - - - - -			
Average		15.58	11.02	0.37	0.78
High		22.90	18.30	0.85	1.20
Low		10.60	7.80	0.05	0.41

River Water Samples (pCi/l)

August 1970

Unfiltered Samples

<u>Location</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-u	5.07	0.23
3-On-u	5.70	0.54
4-On-D	5.08	0.55
5-Sq-u	5.86	0.40
6-Sq-D	6.68	0.72
7-Sk-u	7.90	0.60
9-c.c.	5.54	0.50
10-DM	9.24	0.53
11-Sk-S	9.96	0.26
Average	6.78	0.48
High	9.96	0.72
Low	5.07	0.23

Filtered Samples

<u>Location</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
	<u>Filtrate</u>	<u>Residue</u>	<u>Filtrate</u>	<u>Residue</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)
September 1970
Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-u	4	2.67	0.09
3-On-u	3	3.47	0.64
4-On-D	3	3.77	0.61
5-Sq-u	3	4.63	0.47
6-Sq-D	3	4.03	0.32
7-Sk-u	3	7.13	0.62
9-c.c.	3	3.60	0.38
10-DM	3	8.43	0.59
11-Sk-S	4	10.98	0.25
Average		5.41	0.44
High		10.98	0.64
Low		2.67	0.09

Filtered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Filtrate</u>	<u>Residue</u>	<u>Filtrate</u>	<u>Residue</u>
1-DD-u	0	No Filtered Samples - - - - -			
3-On-U	1	11.90	12.30	0.95	1.30
4-On-D	1	9.30	2.80	0.54	1.20
5-Sq-u	1	7.30	5.80	0.54	0.41
6-Sq-D	1	7.00	14.90	0.54	1.44
7-Sk-u	1	8.40	8.50	0.23	0.23
9-c.c.	1	14.70	28.50	1.40	2.20
10-DM	1	6.80	3.00	0.29	0.65
11-Sk-S	0	No Filtered Samples - - - - -			
Average		9.34	10.83	0.65	1.06
High		14.70	28.50	1.40	2.20
Low		6.80	2.80	0.23	0.23

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

<u>Location</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-u	2.61	0.17
3-On-u	5.43	0.65
4-On-D	6.00	0.55
5-Sq-u	7.43	0.73
6-Sq-D	6.73	0.55
7-Sk-u	9.08	0.73
9-c.c.	5.43	0.50
10-DM	10.03	0.57
11-Sk-S	7.87	0.07
Average	6.73	0.50
High	10.03	0.73
Low	2.61	0.07

Filtered Samples

<u>Location</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
	<u>Filtrate</u>	<u>Residue</u>	<u>Filtrate</u>	<u>Residue</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)

November 1970

Unfiltered Samples

<u>Location</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-u	1.96	0.59
3-On-u	2.76	1.05
4-On-D	2.98	0.83
5-Sq-u	2.94	1.11
6-Sq-D	2.86	1.22
7-Sk-u	3.66	1.39
9-c.c.	3.18	0.96
10-DM	6.76	1.13
11-Sk-S	7.78	0.72
Average	3.88	1.00
High	7.78	1.39
Low	1.96	0.59

Filtered Samples

<u>Location</u>	<u>Beta Activity</u>	<u>Alpha Activity</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)

December 1970

Unfiltered Samples

<u>Location</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-u	1.96	0.73
3-On-u	2.65	0.72
4-On-D	2.70	1.25
5-Sq-u	1.75	0.73
6-Sq-D	1.75	0.72
7-Sk-u	5.28	1.26
9-c.c.	5.10	0.75
10-DM	5.43	0.97
11-Sk-S	8.60	0.68
Average	3.91	0.88
High	8.60	1.26
Low	1.75	0.68

Filtered Samples

<u>Location</u>	<u>Beta Activity</u>	<u>Alpha Activity</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)
 1970 Yearly Averages of Months
 Filtered

	Beta Activity		Alpha Activity	
	<u>Filtrate</u>	<u>Residue</u>	<u>Filtrate</u>	<u>Residue</u>
Average	9.31	9.86	0.52	0.83
High	15.58	11.25	0.65	1.06
Low	5.58	6.34	0.37	0.69

Unfiltered

	Beta Activity	Alpha Activity
Average	6.60	0.59
High	9.50	1.00
Low	3.88	0.28

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

ALRR Outfall Samples

1970

(pCi/l)

<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
July	10.60	0.18
August	9.94	0.13
September	7.99	0.18
October	7.65	0.10
November	6.69	0.57
December	10.05	0.75
Average	10.64	0.30
High	14.83	0.75
Low	6.69	0.10

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

* On June 30, 1970 the outfall sample was $4 \times 10^{-7} \mu\text{C/ml}$. This sample was analyzed by gamma ray spectrometry and found to contain Ag^{110} . This concentration for Ag^{110} is approximately 1% MPC. As the specific isotope was identified, and the rest of the data was not otherwise specified, this sample was 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	3-30-70	8.18	0.36
	6-01-70	6.42	0.18
	9-14-70	6.09	0.13
	11-5-70	7.31	0.55
	Average	7.00	0.31
ALRR Outfall	3-30-70	7.13	0.05
	6-01-70	7.08	0.35
	9-14-70	6.42	0.26
	11-5-70	6.97	0.32
	Average	6.90	0.25
3-On-U	3-30-70	5.95	0.05
	6-01-70	7.44	0.16
	9-14-70	5.68	0.24
	11-5-70	6.43	0.33
	Average	6.38	0.20
4-On-D	3-30-70	No Sample	---
	6-01-70	6.32	0.12
	9-14-70	6.51	0.15
	11-5-70	6.24	0.54
	Average	6.36	0.27
5-Sq-U	3-30-70	11.80	0.54
	6-01-70	10.30	0.17
	9-14-70	6.79	0.19
	11-5-70	8.80	0.81
	Average	9.42	0.43
6-Sq-D	3-30-70	4.58	0.18
	6-01-70	6.31	0.12
	9-14-70	6.60	0.16
	11-5-70	7.27	0.43
	Average	6.19	0.22

Bottom Sediment Samples (pCi/g)

<u>Location</u>	<u>Date</u>	<u>Beta Concentration</u>	<u>Alpha Concentration</u>
7-Sk-U	3-30-70	8.49	0.28
	6-01-70	7.23	0.29
	9-14-70	7.16	0.19
	11-05-70	10.10	0.89
	Average	8.25	0.41
9-CC	3-30-70	6.14	0.09
	6-01-70	5.85	0.75
	9-14-70	7.92	0.38
	11-05-70	7.63	0.51
	Average	6.89	0.43
10-DM	3-30-70	10.20	0.76
	6-01-70	10.10	0.28
	9-14-70	6.51	0.15
	11-05-70	11.60	0.71
	Average	9.60	0.48
11-Sk-S	3-30-70	6.39	0.14
	6-01-70	6.76	0.62
	9-14-70	8.74	0.24
	12-05-70	4.75	0.45
	Average	6.66	0.36
Todd Pond	3-30-70	9.56	0.41
	6-01-70	12.20	0.26
	9-14-70	8.29	0.66
	11-05-70	8.50	0.80
	Average	9.64	0.53
Izaak Walton League Pond	3-30-70	9.42	0.87
	6-01-70	8.18	0.11
	9-14-70	7.86	0.25
	11-05-70	8.04	0.36
	Average	8.38	0.40

Bottom Sediment Samples (pCi/g)

<u>Location</u>	<u>Date</u>	<u>Beta Concentration</u>	<u>Alpha Concentration</u>
Kelley Pond	3-30-70	10.90	0.50
	6-01-70	8.16	1.07
	9-14-70	9.09	0.47
	11-05-70	22.60	0.90
	Average	12.69	0.74
Average for 51 Samples		8.06	0.39
High		22.60	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
July	209.17	3.48
August	36.27	0.46
September	41.91	0.87
October	88.70	2.53
November	42.35	4.75
December	58.50	5.20
Average	76.70	2.26
Individual High	811.00	11.90
Individual Low	5.50	0.10

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

Well Water Samples (pCi/l)

1970

<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
	7-06-70	5.00	1.00
	8-03-70	6.90	1.30
	9-08-70	4.50	0.90
	10-05-70	3.70	0.25
	11-05-70	4.10	1.30
Average		5.91	1.00
High		8.10	1.60
Low		3.70	0.25
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
	7-13-70	5.60	0.29
	8-07-70	6.10	1.10
	9-08-70	7.60	N.D.
	10-07-70	16.00	1.40
	11-05-70	5.40	1.10
	12-10-70	5.40	1.40
Average		7.46	0.82
High		16.00	1.60
Low		5.40	0.29

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	2-05-70	7.70	0.36
Acreage	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
	7-06-70	8.00	0.41
	8-03-70	8.90	0.41
	9-08-70	5.10	0.47
	10-05-70	5.90	0.23
	11-05-70	8.50	1.20
	12-07-70	6.50	0.67

Average	8.11	0.63
High	13.60	1.44
Low	5.10	0.23

Average for 35 samples	7.19	0.81
High for 35 samples	16.00	1.60
Low for 35 samples	3.70	0.23

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

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

	<u>Beta Activity</u>		<u>Alpha Activity</u>	
	<u>Filtrate</u>	<u>Residue</u>	<u>Filtrate</u>	<u>Residue</u>
Arland Martin Acreage	7.20	2.80	0.72	0.60
Iowa State University	5.30	2.80	0.40	1.00

Pond Water Samples (pCi/l)

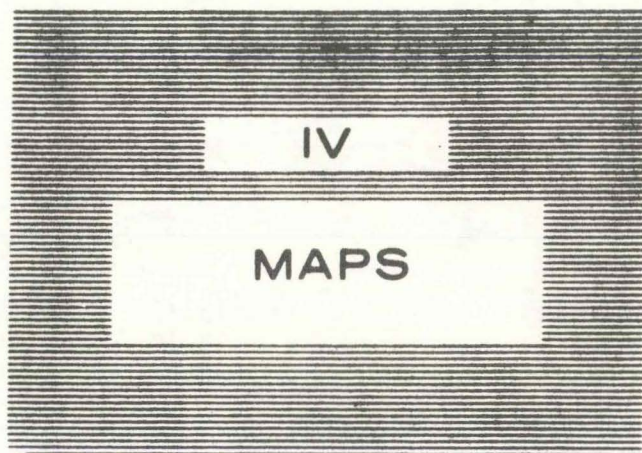
<u>Location</u>	<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
George Todd Pond	1-05-70	6.60	0.54
	2-05-70	36.10	0.36
	3-03-70	24.70	0.36
	3-30-70	17.70	0.54
	5-04-70	8.60	N.D.
	*6-01-70	13.60	1.00
	7-06-70	7.20	0.72
	8-03-70	10.00	0.31
	9-08-70	6.40	0.43
	10-05-70	3.80	0.31
	11-05-70	2.40	0.65
	12-07-70	3.40	0.54
	Average		11.71
High		36.10	1.00
Low		2.40	0.31
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
	7-06-70	25.50	0.36
	8-03-70	22.70	0.49
	9-08-70	20.10	0.36
	10-05-70	21.50	0.61
	11-05-70	21.40	0.85
	12-07-70	18.60	0.90
	Average		22.09
High		27.60	3.10
Low		15.70	0.36

Pond Water Samples (pCi/l)

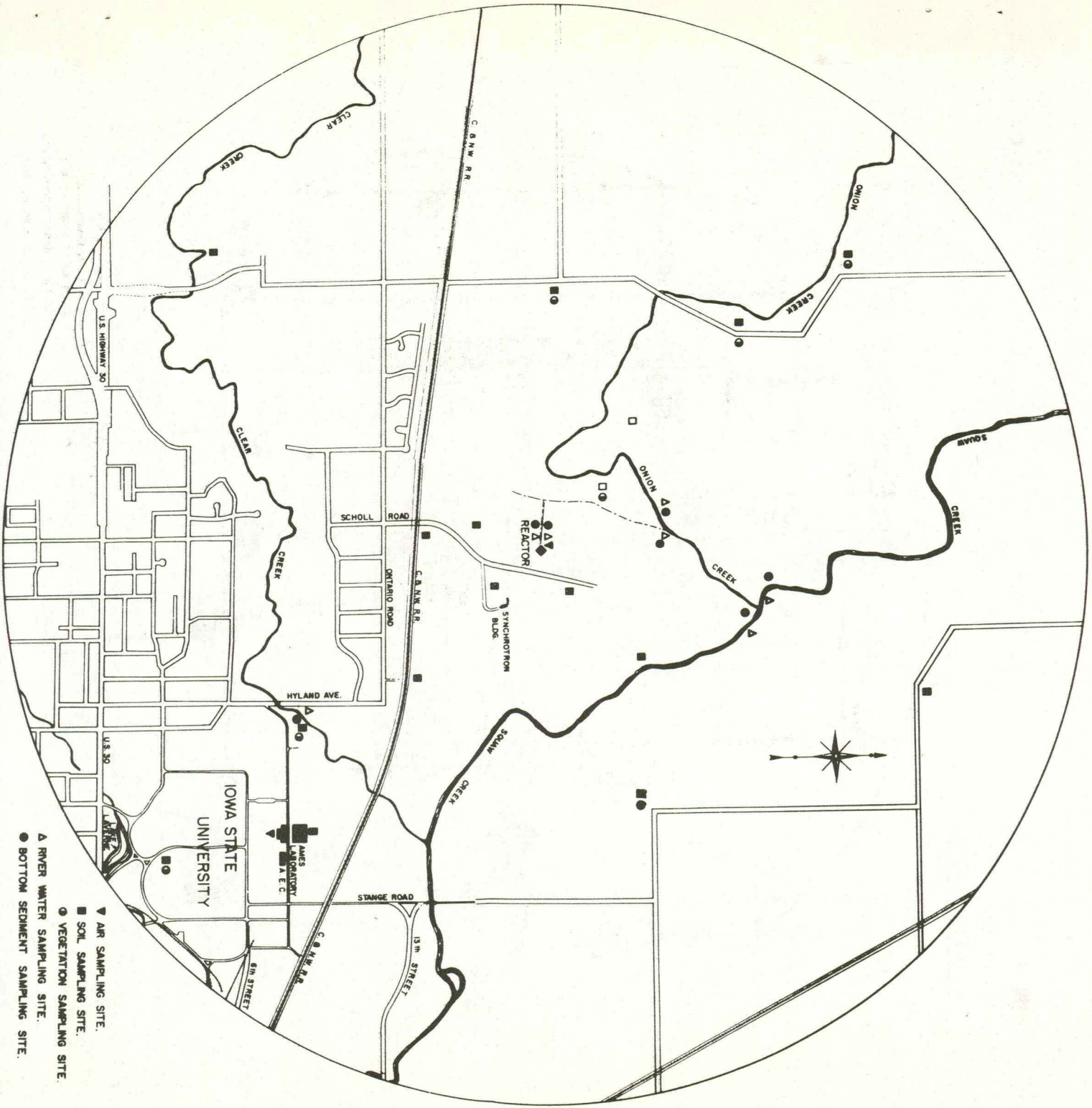
<u>Location</u>	<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
Kelly Pond	1-05-70	21.80	0.36
	2-05-70	12.30	N.D.
	3-03-70	38.10	0.90
	3-30-70	9.32	0.18
	5-04-70	5.67	0.18
	*6-01-70	15.10	0.68
	7-06-70	7.90	1.10
	8-03-70	10.40	0.13
	9-08-70	5.30	0.23
	10-05-70	5.40	0.79
	11-05-70	6.60	0.67
	12-07-70	3.40	0.90
	Average		11.77
High		38.10	1.10
Low		3.40	0.13
Average for 36 samples		15.19	0.58
High for 36 samples		38.10	3.10
Low for 36 samples		2.40	0.13

*These three samples were filtered and counted as filtrate and residue portions:

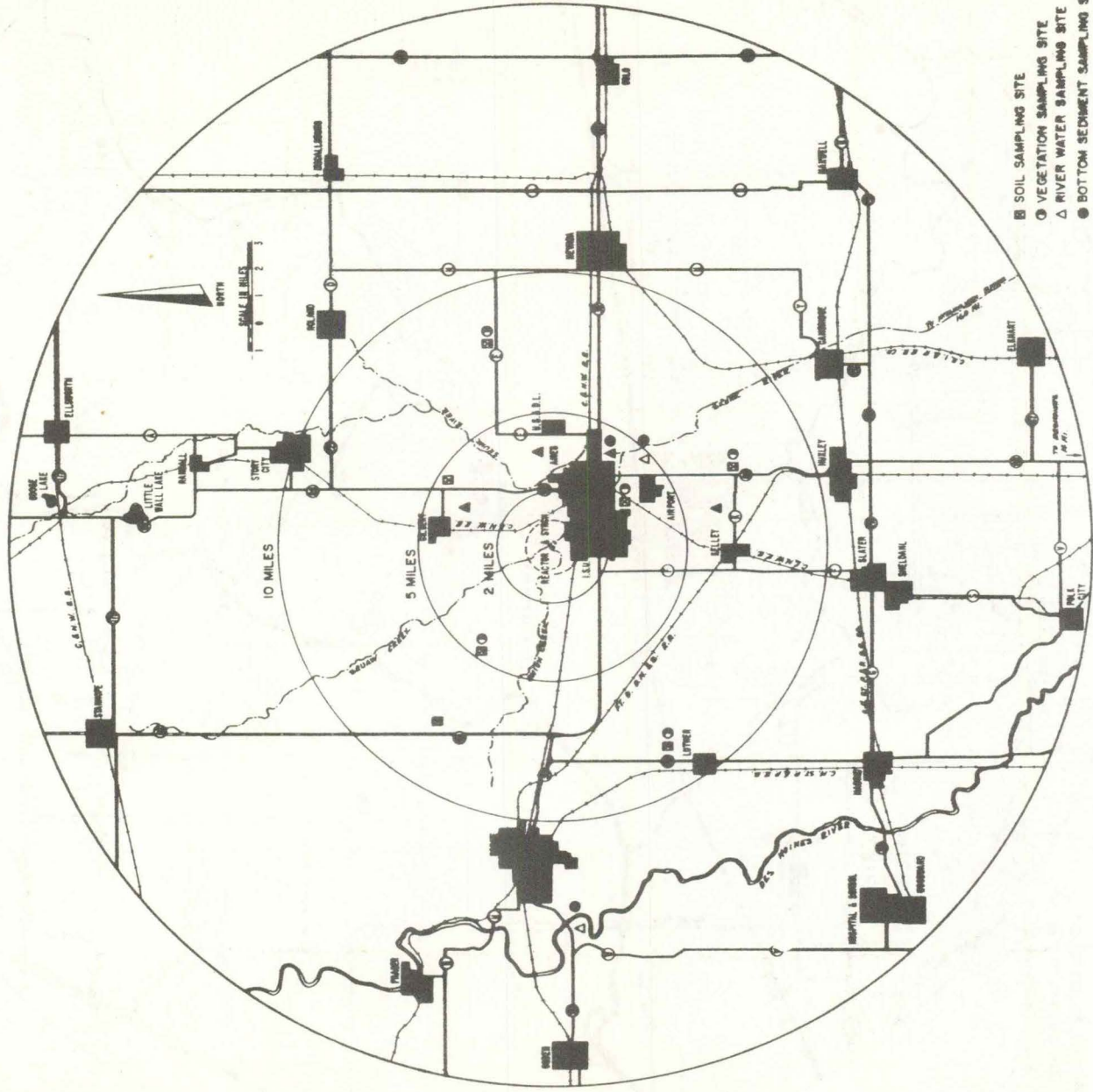
	<u>Beta Activity</u>		<u>Alpha Activity</u>	
	<u>Filtrate</u>	<u>Residue</u>	<u>Filtrate</u>	<u>Residue</u>
George Todd	9.40	4.20	0.49	0.49
Izaak Walton League	24.20	3.40	0.31	0.13
Kelly Pond	11.00	4.10	0.25	0.43



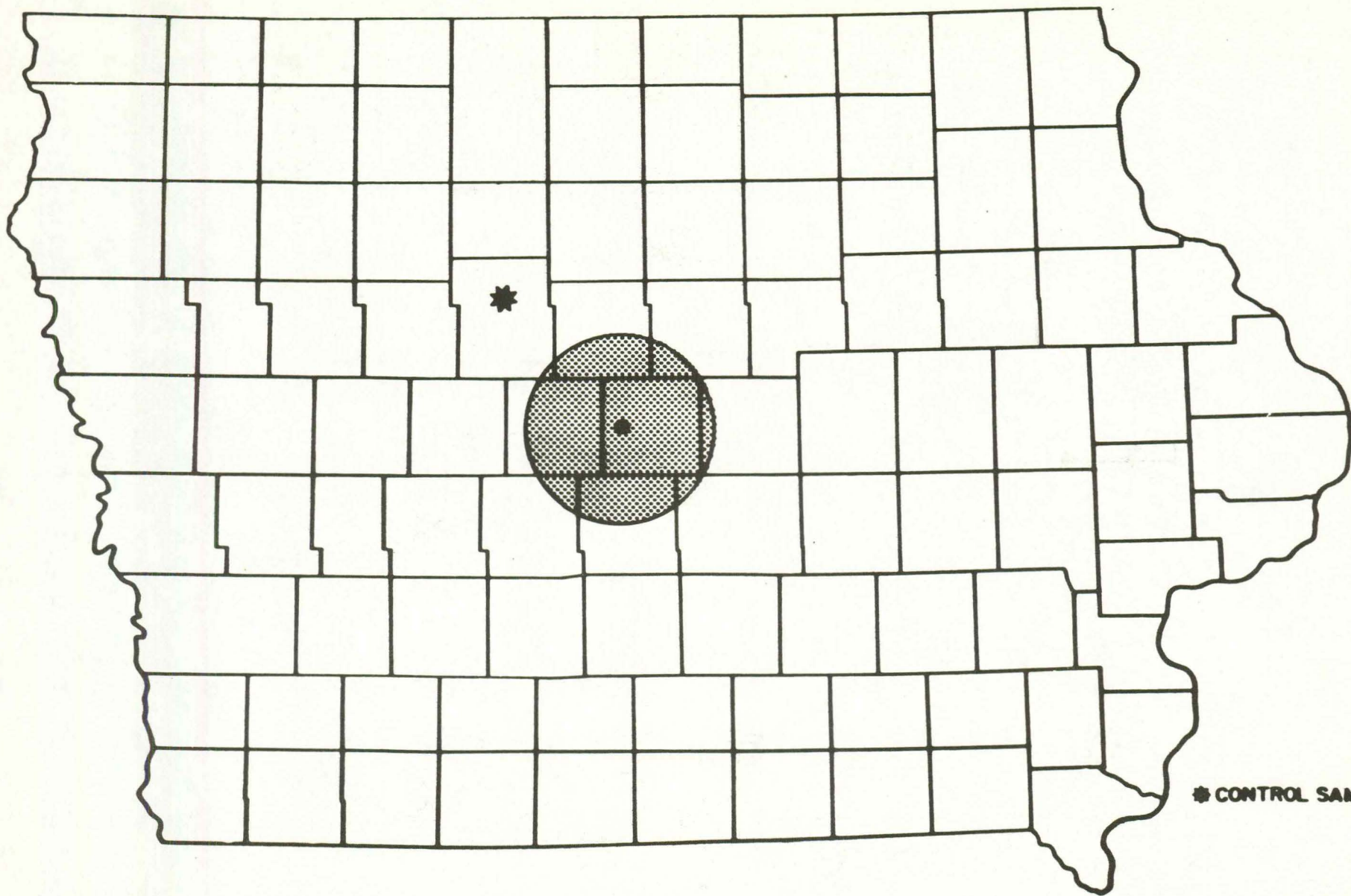
IV
MAPS



MAP 1



- SOIL SAMPLING SITE
- VEGETATION SAMPLING SITE
- △ RIVER WATER SAMPLING SITE
- BOTTOM SEDIMENT SAMPLING SITE
- ▲ POND WATER SAMPLING SITE



MAP 3

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