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SURVEY OF ENVIRONMENTAL  
RADIOACTIVITY

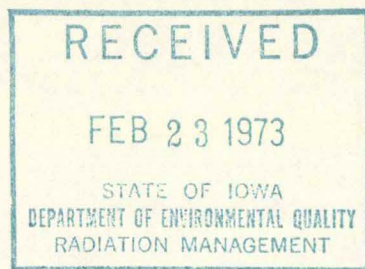
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Date of Transmittal: February 1973

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



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January 1, 1972 - December 31, 1972

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Iowa State University  
Ames, Iowa  
50010

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## INTRODUCTION

This is the environmental monitoring program for the Ames Laboratory Research Reactor.

The Ames Laboratory Research Reactor is located on a 37-acre site 1,000 feet above sea level on the northwest side of Ames, Iowa.

Ames is a town of 40,000 located in central Iowa between the Skunk River and the Squaw Creek. The median population age is 24. The population includes 19,000 students. The three largest employers are Iowa State University, the headquarters of the Iowa State Highway Commission, and the National Animal Disease Laboratory. The average annual rainfall is 31.42 inches and the average temperature is 49°F. The city covers 16.4 square miles.

The major facilities on the site are a five megawatt heavy water research reactor, a warehouse, and a radioactive waste disposal facility. The reactor is housed in a building containing 20,000 square feet of area. The other buildings are separate.

The reactor is used for the production of radioactive materials, for studies of neutron scattering, and for studies of the effects of neutron irradiation on materials.

The land near the site is used for farming and pasture. The use of surface water in the area is minimal. The city and University are supplied from wells.

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## SURVEY OF ENVIRONMENTAL RADIOACTIVITY

### I. SUMMARY

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

The environmental program consists of determinations of gross alpha and beta radioactivity in air, soil, vegetation, river water, ALRR outfall, bottom sediment, precipitation, well water, and pond water samples.

The ALRR reached full power as of 7/12/65 and had generated 170,110 megawatt hours as of 12/31/71. A total of 28,461 megawatt hours was generated in 1972.

Off-site environmental air is routinely monitored at a station atop the Research Building, Iowa State University campus, Ames, Iowa. The average radioactivity concentration in air for 1972 was  $3.0 \times 10^{-15}$   $\mu\text{Ci/ml}$   $\alpha$  and  $1.2 \times 10^{-13}$   $\mu\text{Ci/ml}$   $\beta$ . This is the normal background at the sampling location. There was no measurable increase in airborne radioactivity attributable to Ames Laboratory operations.

The alpha and beta radioactivity in stream water was determined upstream and downstream from the confluence point of streams forming the drainage pattern from the ALRR.

The average concentration during 1972 for all samples not in the direct flow (upstream) was  $7.2 \times 10^{-10}$   $\mu\text{Ci/ml}$   $\alpha$  and  $6.5 \times 10^{-9}$   $\mu\text{Ci/ml}$   $\beta$ .

In the direct flow pattern (downstream) the average concentration was  $6.3 \times 10^{-10}$   $\mu\text{Ci/ml}$   $\alpha$  and  $5.7 \times 10^{-9}$   $\mu\text{Ci/ml}$   $\beta$ .

There is no measurable radioactivity in the stream water samples attributable to Ames Laboratory operations.





## 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 ( $10^{-6}$ $\mu\text{c/g}$ )

	<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>	<u>1971</u>	<u>1972</u>
Average	7.57	9.45	19.97	14.45	15.01	13.83	13.37	14.05	12.71	9.51	11.03
High	9.40	14.00	32.00	20.50	35.30	16.30	16.60	17.00	16.50	11.60	13.10
Low	5.20	7.80	13.00	3.26	11.00	11.00	10.30	10.70	9.70	7.80	7.70

### Alpha Activity Range ( $10^{-6}$ $\mu\text{c/g}$ )

	<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>	<u>1971</u>	<u>1972</u>
Average	0.26	0.56	0.94	0.86	0.68	0.99	0.81	0.98	0.69	0.55	0.65
High	0.60	1.08	1.31	1.20	1.20	1.81	1.63	1.61	1.00	0.96	0.90
Low	0.11	0.19	0.53	0.56	0.22	0.38	0.06	0.56	0.38	0.35	0.35

## 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 ( $10^{-6}$   $\mu\text{c/g}$ )

	<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>	<u>1971</u>	<u>1972</u>
Average	117.30	87.50	73.26	32.49	34.00	20.61	24.88	30.47	32.10	26.89	23.94
High	181.00	186.00	125.00	43.00	90.00	26.20	35.80	46.20	38.80	35.80	36.60
Low	10.80	10.50	51.00	26.00	20.00	17.70	9.90	16.30	24.30	15.80	15.50

Alpha Activity Range ( $10^{-6}$   $\mu\text{c/g}$ )

	<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>	<u>1971</u>	<u>1972</u>
Average	1.62	0.96	1.27	0.38	0.13	0.21	0.13	0.91	0.10	0.22	0.35
High	4.00	4.10	3.24	1.06	0.77	0.71	0.86	1.68	0.44	0.83	0.67
Low	0.11	0.15	0.35	0.07	0.27	0.21	0.22	0.45	0.06	0.07	0.07

#### 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 ( $10^{-9}$   $\mu\text{c/ml}$ )

	<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>	<u>1971</u>	<u>1972</u>
Average	18.09	55.94	18.26	18.12	16.03	11.46	11.00	9.09	8.02	6.73	6.69
High	118.00	2270.00	273.00	51.97	76.58	17.10	18.85	14.66	43.20*	55.70*	62.10*
Low	4.50	0.80	0.39	4.68	7.07	7.75	6.65	5.47	0.54*	0.27*	0.41*

Alpha Activity Range ( $10^{-9}$   $\mu\text{c/ml}$ )

	<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>	<u>1971</u>	<u>1972</u>
Average	1.01	2.09	0.893	0.83	1.02	0.74	0.97	1.15	0.74	0.60	0.68
High	9.60	108.00	3.80	1.93	2.06	1.22	1.67	1.83	5.40*	2.90*	4.10*
Low	0.25	0.06	0.046	0.33	0.57	0.39	0.53	0.44	0.02*	0.07*	0.06*

\*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 ( $10^{-9}$   $\mu\text{c/ml}$ )

	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Average	12.25	11.22	11.18	12.15	10.64	8.15	5.63
High	22.44	14.02	15.22	14.48	32.00*	54.70*	18.00*
Low	5.88	8.89	9.01	9.29	1.40*	0.41*	0.41*

Alpha Activity Range ( $10^{-9}$   $\mu\text{c/ml}$ )

	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Average	0.61	0.48	0.70	1.00	0.30	0.28	0.29
High	1.63	0.84	1.10	1.45	4.00*	13.30*	2.00*
Low	0.20	0.23	0.44	0.54	0.02*	0.07*	0.41*

\*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 ( $10^{-6}$ $\mu\text{c/g}$ )											
	<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>	<u>1971</u>	<u>1972</u>
Average	9.88	10.65	11.13	14.64	13.75	11.70	9.84	9.28	8.06	8.93	7.71
High	22.70	51.00	54.00	34.00	31.70	21.00	18.40	16.67	22.60	54.90	13.40
Low	0.60	3.90	4.50	7.00	5.50	4.90	4.10	4.96	4.58	4.59	4.83

Alpha Activity Range ( $10^{-6}$ $\mu\text{c/g}$ )											
	<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>	<u>1971</u>	<u>1972</u>
Average	0.25	0.61	0.47	0.89	0.85	0.76	0.46	0.49	0.39	0.39	0.41
High	0.94	8.00	3.10	6.70	2.74	2.71	1.30	1.50	1.07	0.91	0.85
Low	0.09	0.01	0.096	0.08	0.06	0.09	0.04	0.05	0.05	0.05	0.08

#### 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 ( $10^{-9}$ $\mu\text{c/ml}$ )											
	<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>	<u>1971</u>	<u>1972</u>
Avg.	2018	1360	366	715	217	75	81.72	138.03	72.95	113.27	51.91
High	4288	7000	2520	19500	3240	670	293.00	926.00	811.00	1230.00	343.00
Low	922	20	20	9	4	4	3.95	11.50	5.50	2.70	1.30

Alpha Activity Range ( $10^{-9}$ $\mu\text{c/ml}$ )											
	<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>	<u>1971</u>	<u>1972</u>
Average	65.90	39.20	12.67	3.95	9.21	3.54	4.14	9.15	1.77	2.26	2.35
High	97.00	234.00	53.00	32.80	55.00	26.00	34.00	93.70	11.90	11.60	14.70
Low	13.50	00.28	3.50	0.17	0.15	0.18	0.14	0.18	0.10	0.11	0.07

#### 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 ( $10^{-9}$   $\mu\text{C}/\text{ml}$ )

	<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>	<u>1971</u>	<u>1972</u>
Average	4.01	4.78	6.83	6.80	6.93	7.20	7.35	5.81	7.19	4.61	4.39
High	6.78	16.40	12.90	22.80	13.00	15.10	16.20	13.10	16.00	9.40	9.00
Low	2.75	1.18	2.60	2.04	2.30	2.70	2.17	2.20	3.70	1.60	2.20

Alpha Activity Range ( $10^{-9}$   $\mu\text{C}/\text{ml}$ )

	<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>	<u>1971</u>	<u>1972</u>
Average	0.31	1.04	1.42	1.08	1.14	1.07	0.98	1.09	0.81	0.63	0.63
High	0.90	5.69	20.90	5.20	4.00	4.10	1.84	3.46	1.60	1.50	2.50
Low	0.17	0.10	0.046	0.12	0.18	0.18	0.18	0.18	0.23	0.18	0.18

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 ( $10^{-9}$   $\mu\text{C}/\text{ml}$ )

	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Average	16.30	15.24	14.90	13.73	15.19	11.04	8.24
High	30.40	30.70	27.00	29.00	38.10	28.00	19.50
Low	5.10	5.40	5.10	2.44	2.40	2.00	1.20

Alpha Activity Range ( $10^{-9}$   $\mu\text{C}/\text{ml}$ )

	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Average	0.86	1.07	0.83	0.84	0.58	0.56	0.42
High	2.50	3.80	2.70	2.00	3.10	1.50	1.10
Low	0.09	0.36	0.18	0.18	0.13	0.07	0.13

J. Detection Limits

Detection limits are by definition only.

III

ENVIRONMENTAL  
RADIOACTIVITY  
DATA

Air Samples ( $10^{-12}$   $\mu\text{C}/\text{ml}$ )

1972

<u>Date</u>	<u>Beta Conc.</u>	<u>Alpha Conc.</u>
January 12	0.19	0.001
February 21	0.11	0.001
March 22	0.08	0.001
April 20	0.14	0.007
May 20	0.30	0.008
June 19	0.25	0.007
July 19	0.10	0.004
August 16	0.08	0.003
September 10	0.06	0.003
October 6	0.04	0.001
November 10	0.04	0.003
December 13	0.07	0.002
Average	0.12	0.003
High	1.22	0.035
Low	0.01	0.001

Detection Limits -  $0.0048 (10^{-12} \mu\text{C}/\text{ml})$   
 $0.0032 (10^{-12} \mu\text{C}/\text{ml})$

Soil Samples  
( $10^{-6}$   $\mu\text{c/g}$ )

	<u>Date</u>	<u>Beta Conc.</u>	<u>Alpha Conc.</u>
1S-SE1	8-24-72	10.70	0.79
2S-SW1	"	10.70	0.74
3S-NW1	"	11.30	0.50
4S-NE1	"	11.40	0.68
5S-SE2	"	10.40	0.52
6S-SW2	"	11.20	0.74
7S-NW2	"	10.40	0.55
8S-NE2	"	12.90	0.80
9SV-SE3	"	11.20	0.78
10SV-SW3	"	8.66	0.54
11SV-NW3	"	12.10	0.61
12SV-NE3	"	9.10	0.69
13SV-SE4	"	11.70	0.88
14S-SW4	"	7.70	0.35
15SV-NW4	"	10.70	0.63
16S-NE4	"	8.80	0.44
17SV-NE5	"	11.20	0.54
18S-SW5	"	12.80	0.68
19SV-NW5	"	11.30	0.88
20S-NE5	"	11.90	0.57
21SV-SE6	"	11.10	0.49
22SV-SW6	"	12.20	0.75
23S-NW6	"	13.10	0.53
24SV-NE6	"	10.70	0.65
Ft. Dodge	"	12.40	0.90
Average		11.03	0.65
High		13.10	0.90
Low		7.70	0.35

Detection Limits -  $0.25 \times 10^{-6}$   $\mu\text{c/g}$   
 $0.10 \times 10^{-6}$   $\mu\text{c/g}$

At sites #3, 9, 10, 11, 12, 13, 15, 17, 19, 21, 22, 24, and Fort Dodge, a core sample is taken from 0 to 8 inches. At all of the other sites, the sample is taken from the top two inches of soil.



## Vegetation Samples

 $(10^{-6} \mu\text{c/g})$ 

	<u>Date</u>	<u>Beta Conc.</u>	<u>Alpha Conc.</u>
3SV-NW1	8-24-72	21.70	0.29
9SV-SE3	"	23.80	N.D.
10SV-SW3	"	21.00	0.61
11SV-NW3	"	31.80	0.67
12SV-NE3	"	27.90	0.16
13SV-SE4	"	24.40	0.23
15SV-NW4	"	15.50	0.15
17SV-NE5	"	23.90	0.61
19SV-NW5	"	20.80	0.45
21SV-SE6	"	36.60	0.65
22SV-SW6	"	17.20	0.41
24SV-NE6	"	19.30	0.07
Ft. Dodge	"	27.30	0.22
Average		23.94	0.35
High		36.60	0.67
Low		15.50	0.07

Detection Limits -  $2.07 \times 10^{-6} \mu\text{c/g}$   
 $0.78 \times 10^{-6} \mu\text{c/g}$

River Water Samples ( $10^{-9}$   $\mu\text{c}/\text{ml}$ )  
1972 Yearly Averages of Months

Filtered

	Beta Activity		Alpha Activity	
	<u>Filtrate</u>	<u>Residue</u>	<u>Filtrate</u>	<u>Residue</u>
Average	7.64	10.86	0.75	1.12
High	13.05	35.42	0.83	2.37
Low	4.60	1.93	0.55	0.47

Unfiltered

	<u>Beta Activity</u>	<u>Alpha Activity</u>
Average	5.66	0.54
High	10.04	0.73
Low	2.92	0.28

Detection Limits -  $1.00 \times 10^{-9}$   $\mu\text{c}/\text{ml}$   
 $0.39 \times 10^{-9}$   $\mu\text{c}/\text{ml}$

River Water Sample ( $10^{-9}$   $\mu\text{c/ml}$ )

January 1972

## Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
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

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
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 ( $10^{-9}$   $\mu\text{C}/\text{ml}$ )

February 1972

## Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
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

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
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  $1.2 \times 10^{-7}$   $\mu\text{C}/\text{ml}$ . The sample was counted by gamma spectrometry and determined to be  $\text{Ir}^{192}$ . 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 ( $10^{-9}$   $\mu\text{C}/\text{ml}$ )

March 1972

## Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
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

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
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 ( $10^{-9}$   $\mu\text{c/ml}$ )

April 1972

## Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
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

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
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 ( $10^{-9}$   $\mu\text{c}/\text{ml}$ )

May 1972

## Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
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

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
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 ( $10^{-9}$   $\mu\text{c/ml}$ )

June 1972

## Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
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

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
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



River Water Sample ( $10^{-9}$   $\mu\text{c/ml}$ )

July 1972

## Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-U	2	2.75	0.12
3-On-U	2	2.40	N.D
4-On-D	2	2.70	0.43
5-Sq-U	2	1.91	0.51
6-Sq-D	2	7.55	0.79
7-Sk-U	2	4.20	0.55
8-Sk-D	2	3.30	0.43
9-CC	2	2.75	0.54
10-DM	2	5.85	0.76
11-Sk-S	3	9.13	0.35
Average		4.49	0.44
High		9.13	0.79
Low		1.91	0.12

## Filtered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-U	2	7.10	13.40	0.60	1.05
3-On-U	2	13.20	5.95	0.84	0.63
4-On-D	2	11.75	3.70	0.50	0.52
5-Sq-U	2	5.20	1.37	1.10	0.43
6-Sq-D	2	8.10	9.35	1.00	0.54
7-Sk-U	2	6.00	7.30	0.73	0.96
8-Sk-D	2	4.65	3.65	0.30	0.49
9-CC	2	9.60	12.85	1.01	0.94
10-DM	2	5.45	9.05	0.94	0.77
11-Sk-S	1	10.90	N.D.	0.06	0.13
Average		8.05	7.01	0.75	0.68
High		13.20	13.40	1.10	1.05
Low		4.65	1.37	0.06	0.13

River Water Samples ( $10^{-9}$   $\mu\text{c/ml}$ )  
 August 1972  
 Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-U	3	3.30	0.34
3-On-U	4	2.08	0.59
4-On-D	4	2.65	0.20
5-Sq-U	3	8.27	0.50
6-Sq-D	3	3.93	0.72
7-Sk-U	3	4.57	0.48
8-Sk-D	3	4.03	0.40
9-CC	3	3.47	0.58
10-DM	3	4.70	0.45
11-Sk-S	4	8.55	0.17
Average		4.54	0.43
High		8.55	0.72
Low		2.08	0.17

Filtered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-U	2	1.80	4.41	0.09	0.83
3-On-U	1	5.70	6.40	0.60	1.30
4-On-D	1	4.20	5.70	0.67	1.20
5-Sq-U	2	6.40	2.44	1.15	0.95
6-Sq-D	2	6.00	8.35	0.57	1.38
7-Sk-U	2	11.35	3.47	0.79	0.72
8-Sk-D	1	3.40	15.40	0.24	1.30
9-CC	2	4.00	5.75	0.30	1.15
10-DM	2	5.75	10.55	0.70	0.92
11-Sk-S	1	8.30	0.54	0.13	0.06
Average		5.76	6.12	0.55	0.99
High		11.35	15.40	1.15	1.38
Low		1.80	0.54	0.09	0.06

River Water Samples ( $10^{-9}$   $\mu\text{c/ml}$ )

September 1972

## Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-U	4	3.10	0.26
3-On-U	3	4.17	0.51
4-On-D	4	3.18	0.53
5-Sq-U	3	4.17	0.71
6-Sq-D	3	3.27	0.86
7-Sk-U	3	5.43	0.65
8-Sk-D	4	3.35	0.50
9-CC	3	4.10	0.66
10-DM	3	4.00	0.87
11-Sk-S	4	10.05	0.38
Average		4.53	0.57
High		10.05	0.87
Low		3.10	0.26

## Filtered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-U	0	----	----	----	----
3-On-U	1	11.50	0.95	0.60	0.41
4-On-D	0	----	----	----	----
5-Sq-U	1	6.70	0.41	0.54	N.D.
6-Sq-D	1	5.90	7.20	1.00	0.72
7-Sk-U	1	5.10	0.68	1.10	0.60
8-Sk-D	0	----	----	----	----
9-CC	1	6.20	6.40	1.10	0.90
10-DM	1	5.00	2.40	0.49	0.18
11-Sk-S	0	----	----	----	----
Average		6.73	1.93	0.81	0.47
High		11.50	7.20	1.10	0.90
Low		5.00	0.41	0.49	0.18

River Water Samples ( $10^{-9}$   $\mu\text{c}/\text{ml}$ )

October 1971

## Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-U	5	2.00	0.27
3-0n-U	4	3.63	0.44
4-0n-D	5	2.98	0.54
5-Sq-U	4	3.98	0.55
6-Sq-D	4	3.08	0.62
7-Sk-U	4	4.08	0.64
8-Sk-D	4	2.38	0.28
9-CC	4	3.38	0.38
10-DM	4	3.92	0.80
11-Sk-S	4	6.75	0.38
Average		3.56	0.49
High		6.75	0.80
Low		2.00	0.27

## Filtered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
1-DD-U	0	----	----	----	----
3-0n-U	1	6.90	2.00	0.90	0.49
4-0n-D	0	----	----	----	----
5-Sq-U	1	4.20	4.10	0.96	1.80
6-Sq-D	1	N.D.	2.30	0.96	1.10
7-Sk-U	1	6.10	2.70	0.85	0.85
8-Sk-D	0	----	----	----	----
9-CC	1	8.80	6.50	0.85	1.10
10-DM	1	1.60	5.40	0.31	1.90
11-Sk-S	0	----	----	----	----
Average		4.60	3.83	0.81	1.12
High		8.80	6.50	0.96	1.90
Low		1.60	2.00	0.31	0.49

River Water Samples ( $10^{-9}$   $\mu\text{c/ml}$ )

November 1972

## Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-U	4	3.23	0.36
3-On-U	4	2.75	0.65
4-On-D	4	2.45	0.38
5-Sq-U	4	2.65	0.85
6-Sq-D	4	2.78	0.90
7-Sk-U	4	3.80	0.82
8-Sk-D	3	3.97	0.63
9-CC	4	1.92	0.71
10-DM	4	4.40	0.72
11-Sk-S	4	9.45	0.35
Average		3.73	0.64
High		9.45	0.90
Low		1.92	0.35

## Filtered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
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 ( $10^{-9}$   $\mu\text{c/ml}$ )  
December 1972  
Unfiltered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
1-DD-U	4	1.69	0.41
3-On-U	4	2.23	0.63
4-On-D	4	2.11	0.84
5-Sq-U	4	2.00	0.77
6-Sq-D	4	1.57	0.92
7-Sk-U	4	2.08	0.91
8-Sk-D	2	2.95	1.13
9-CC	4	2.23	0.38
10-DM	4	3.33	0.90
11-Sk-S	4	9.00	0.62
Average		2.92	0.73
High		9.00	1.13
Low		1.57	0.38

Filtered Samples

<u>Location</u>	<u>No. of Samples</u>	<u>Beta Activity</u>		<u>Alpha Activity</u>	
		<u>Soluble</u>	<u>Insoluble</u>	<u>Soluble</u>	<u>Insoluble</u>
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					

## ALRR Outfall Samples

1972

 $(10^{-9} \mu\text{c/ml})$ 

<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
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
July	5.81	0.35
August	4.45	0.28
September	4.04	0.34
October	4.99	0.34
November	4.60	0.31
December	4.55	0.44
Average	5.63	0.29
High	7.37	0.44
Low	4.04	0.19

Detection Limits -  $1.00 \times 10^{-9} \mu\text{c/ml}$   
 $0.39 \times 10^{-9} \mu\text{c/ml}$

Bottom Sediment Samples ( $10^{-6}$   $\mu\text{c/g}$ )

<u>Location</u>	<u>Date</u>	<u>Beta Concentration</u>	<u>Alpha Concentration</u>
1-DD-U	3-28-72	5.68	0.21
	6-30-72	4.83	0.14
	9-22-72	5.74	0.36
	12-21-72	6.46	0.32
	Average	5.68	0.26
ALRR Outfall	3-28-72	7.27	0.42
	6-30-72	7.77	0.36
	9-22-72	8.85	0.59
	12-21-72	7.50	0.55
	Average	7.85	0.48
3-0n-U	3-28-72	6.90	0.14
	6-30-72	8.65	0.37
	9-22-72	5.77	0.19
	12-21-72	6.72	0.32
	Average	7.01	0.26
4-0n-D	3-28-72	5.67	0.30
	6-30-72	8.35	0.56
	9-22-72	6.02	0.18
	12-21-72	7.30	0.24
	Average	6.84	0.32
5-Sq-U	3-28-72	9.12	0.57
	6-30-72	8.79	0.46
	9-22-72	9.90	0.57
	12-21-72	5.67	0.27
	Average	8.37	0.47
6-Sq-D	3-28-72	10.40	0.65
	6-30-72	7.70	0.37
	9-22-72	5.98	0.10
	12-21-72	7.05	0.42
	Average	7.78	0.39



Bottom Sediment Samples ( $10^{-6}$   $\mu\text{c/g}$ )

<u>Location</u>	<u>Date</u>	<u>Beta Concentration</u>	<u>Alpha Concentration</u>
7-Sk-U	3-28-72	11.10	0.85
	6-30-72	6.01	0.36
	9-22-72	5.47	0.08
	12-21-72	5.87	0.22
	Average	7.11	0.38
9-CC	3-28-72	5.85	0.33
	6-30-72	6.28	0.17
	9-22-72	5.37	0.15
	12-21-72	6.97	0.25
	Average	6.12	0.25
10-DM	3-28-72	11.50	0.55
	6-30-72	8.38	0.73
	9-22-72	9.62	0.48
	12-21-72	9.45	0.55
	Average	9.74	0.58
11-Sk-S	3-28-72	9.25	0.66
	6-30-72	8.96	0.71
	9-22-72	5.23	0.17
	12-21-72	7.77	0.38
	Average	7.80	0.48
Todd Pond	3-28-72	7.68	0.50
	6-20-72	8.55	0.53
	9-22-72	7.63	0.48
	12-21-72	9.63	0.50
	Average	8.37	0.50
Izaak Walton League Pond	3-28-72	8.17	0.28
	6-30-72	6.55	0.24
	9-22-72	5.10	0.23
	12-21-72	7.20	0.24
	Average	6.76	0.25

Bottom Sediment Samples ( $10^{-6}$   $\mu\text{c/g}$ )

<u>Location</u>	<u>Date</u>	<u>Beta Concentration</u>	<u>Alpha Concentration</u>
Kelley Pond	3-28-72	13.40	0.80
	6-30-72	8.65	0.59
	9-22-72	9.39	0.69
	12-21-72	12.03	0.75
	Average	10.87	0.71
Average for 52 Samples		7.71	0.41
High		13.40	0.85
Low		4.83	0.08

Detection Limits - 0.25 pCi/g  $\beta$   
0.10 pCi/g  $\alpha$

Precipitation Samples ( $10^{-9}$   $\mu\text{c/ml}$ )

<u>Date</u>	<u>No. of Samples</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
January	3	52.10	4.16
February	4	73.70	2.85
March	2	236.50	13.85
April	6	101.96	1.89
May	4	31.95	1.46
June	1	23.60	1.30
July	3	12.43	0.22
August	2	25.45	0.99
September	8	5.98	0.97
October	3	15.20	1.70
November	0		
December	0		
Average		51.91	2.35
Individual High		343.00	14.70
Individual Low		1.30	0.07

Detection Limits -  $1.00 \times 10^{-9}$   $\mu\text{c/ml}$   
 $0.39 \times 10^{-9}$   $\mu\text{c/ml}$

Well Water Samples ( $10^{-9}$   $\mu\text{c/ml}$ )

1972

<u>Location</u>	<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
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
	7-03-72	2.40	N.D.
	8-07-72	N.D.	N.D.
	9-05-72	3.50	0.36
	10-02-72	3.80	0.60
	11-06-72	3.00	0.72
	12-04-82	4.60	1.30
	Average		4.38
High		9.00	2.50
Low		2.40	0.31
City of Ames	1-05-72	3.90	0.78
	2-04-72	3.90	0.36
	3-04-72	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
	7-03-72	3.00	0.18
	8-07-72	5.00	0.60
	9-05-72	3.90	0.31
	10-02-72	3.20	0.18
	11-06-72	4.50	0.31
	12-04-72	3.60	0.36
	Average		3.71
High		5.00	1.30
Low		2.20	0.18

Well Water Samples ( $10^{-9}$   $\mu\text{C}/\text{ml}$ )

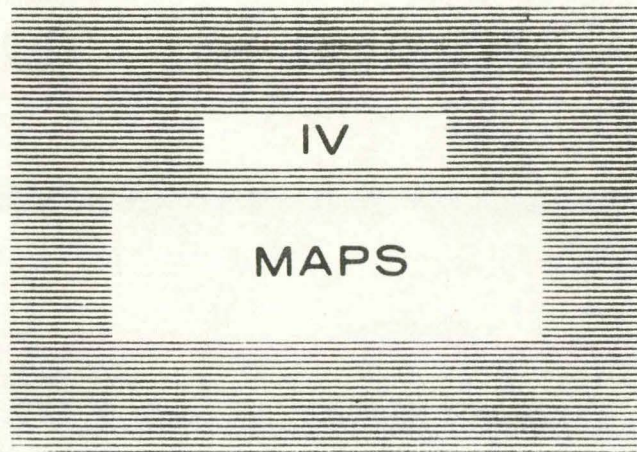
<u>Location</u>	<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
Arland	1-03-72	4.90	1.10
Martin	1-31-72	6.40	0.36
Acreage	3-06-72	6.80	0.36
	4-03-72	6.60	0.54
	5-01-72	8.50	0.67
	6-05-72	4.50	0.60
	7-03-72	N.D.	N.D.
	8-07-72	4.80	0.67
	9-05-72	5.30	0.60
	10-02-72	2.30	0.36
	11-06-72	5.50	0.31
	12-04-72	5.50	0.78
	Average		5.09
High		8.50	1.10
Low		2.30	0.31
Average for 36 Samples		4.39	0.63
High for 36 Samples		9.00	2.50
Low for 36 Samples		2.20	0.18

Pond Water Samples ( $10^{-9}$   $\mu\text{c/ml}$ )

<u>Location</u>	<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
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
	7-03-72	2.70	N.D.
	8-07-72	4.00	0.24
	9-05-72	4.40	0.42
	10-02-72	3.60	0.54
	11-06-72	3.40	0.36
	12-04-72	1.40	0.42
	Average		6.01
High		18.40	0.72
Low		1.40	0.24
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
	7-03-72	3.00	0.24
	8-07-72	15.50	0.36
	9-05-72	13.40	0.31
	10-02-72	3.30	0.60
	11-06-72	15.70	0.72
	12-04-72	17.20	0.54
	Average		12.73
High		19.50	1.10
Low		3.00	0.18

Pond Water Samples ( $10^{-9}$   $\mu\text{C}/\text{ml}$ )

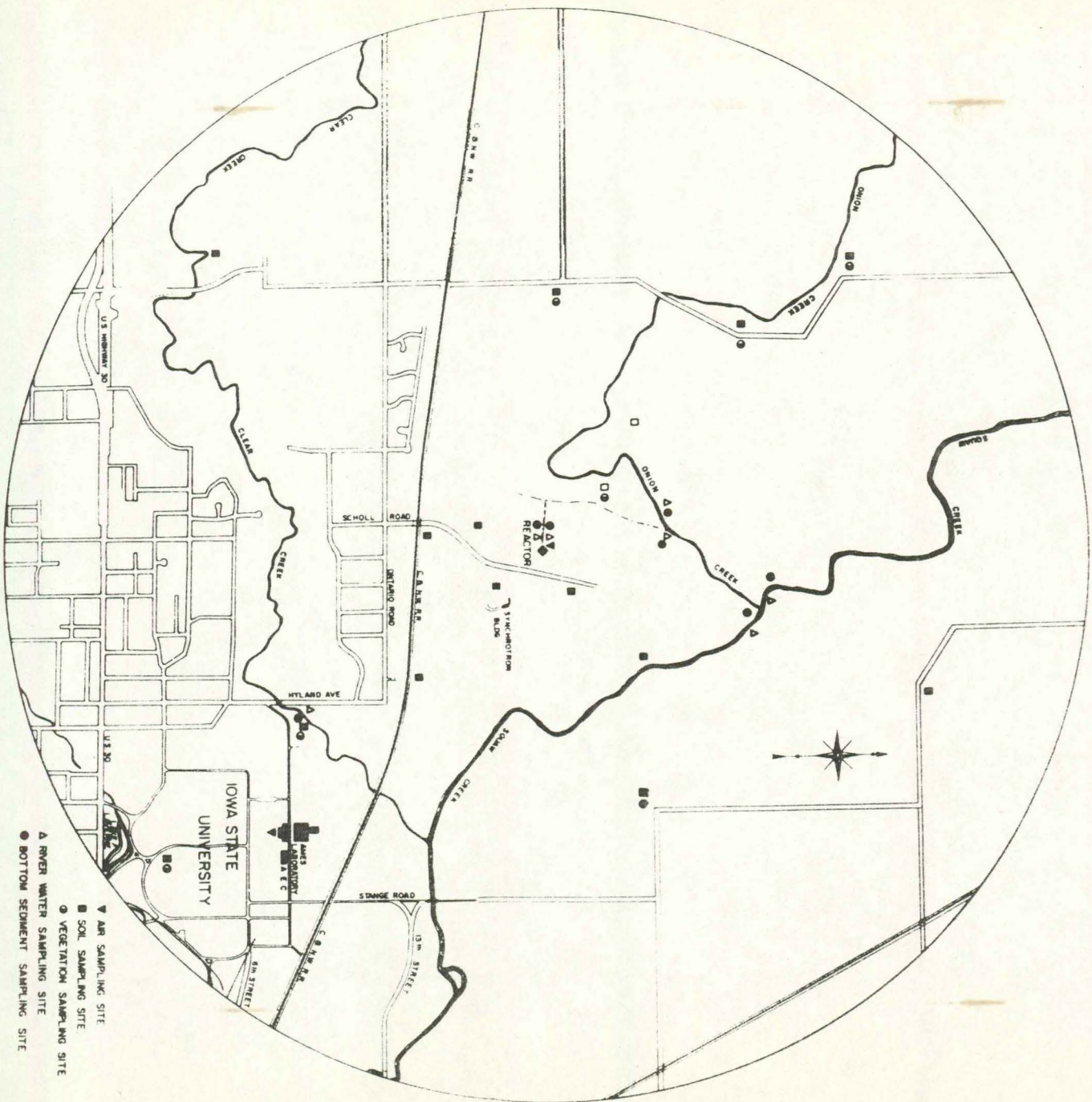
<u>Location</u>	<u>Date</u>	<u>Beta Activity</u>	<u>Alpha Activity</u>
Kelley Pond	1-03-72	5.30	0.36
	1-31-72	5.90	0.36
	3-06-72	8.80	0.36
	4-03-72	6.80	0.42
	5-01-72	6.10	0.18
	6-05-72	11.70	N.D.
	7-03-72	2.30	0.60
	8-07-72	3.10	0.31
	9-05-72	11.10	0.13
	10-02-72	1.20	0.31
	11-06-72	4.50	0.67
	12-04-72	5.20	0.31
	Average		6.00
High		11.70	0.67
Low		1.20	0.13
Average for 36 samples		8.24	0.42
High for 36 samples		19.50	1.10
Low for 36 samples		1.20	0.13



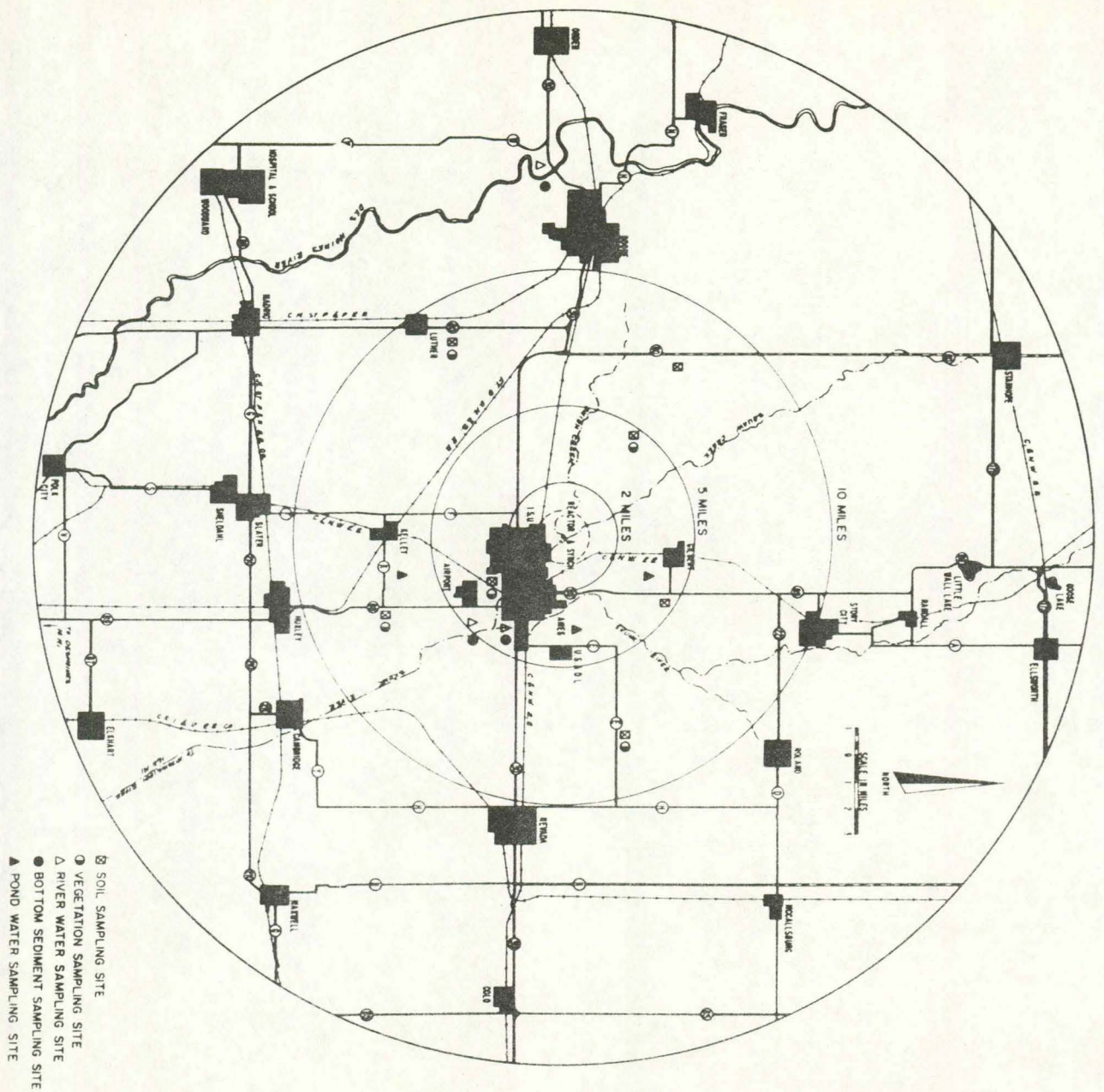
IV

MAPS

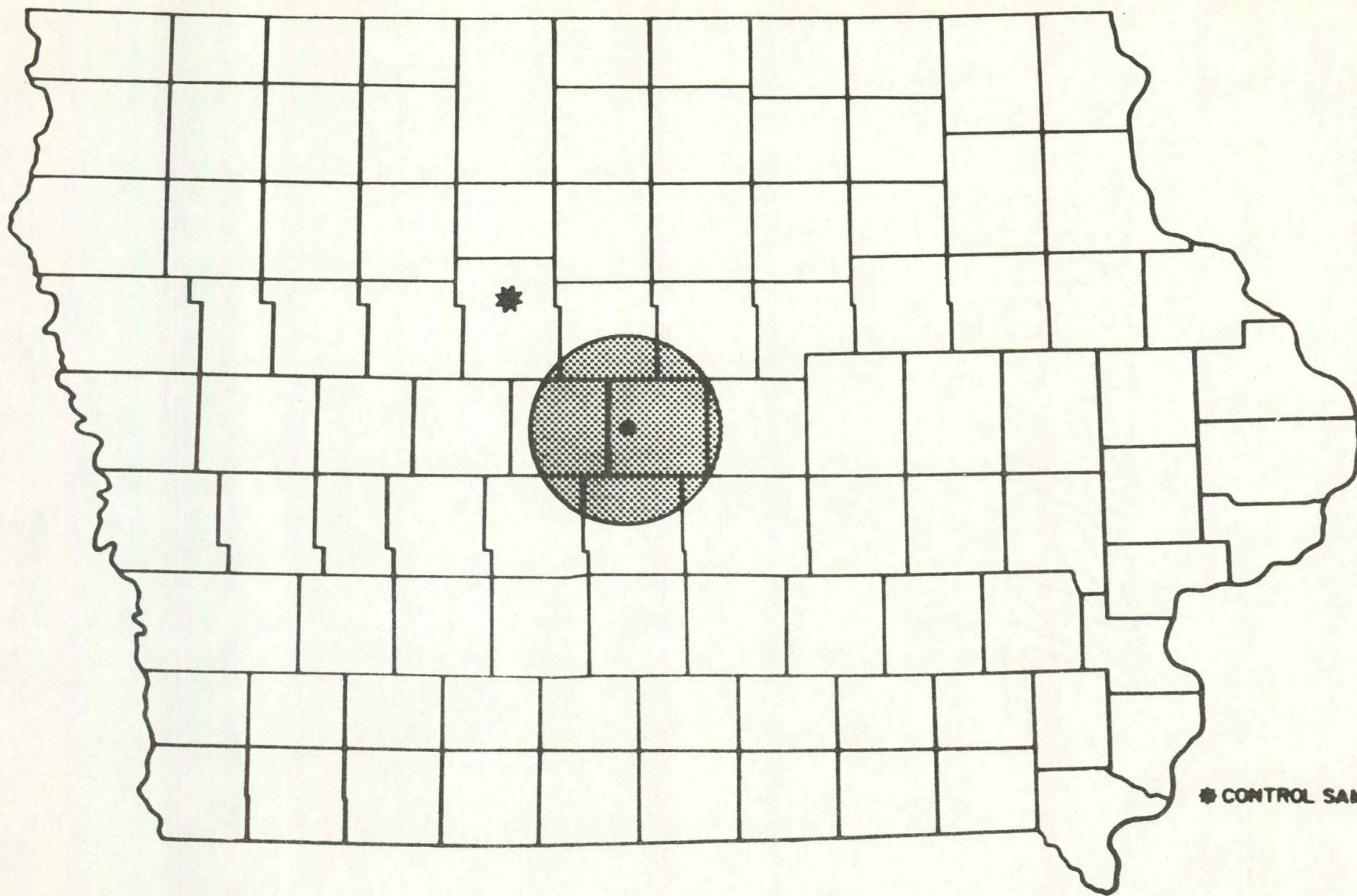




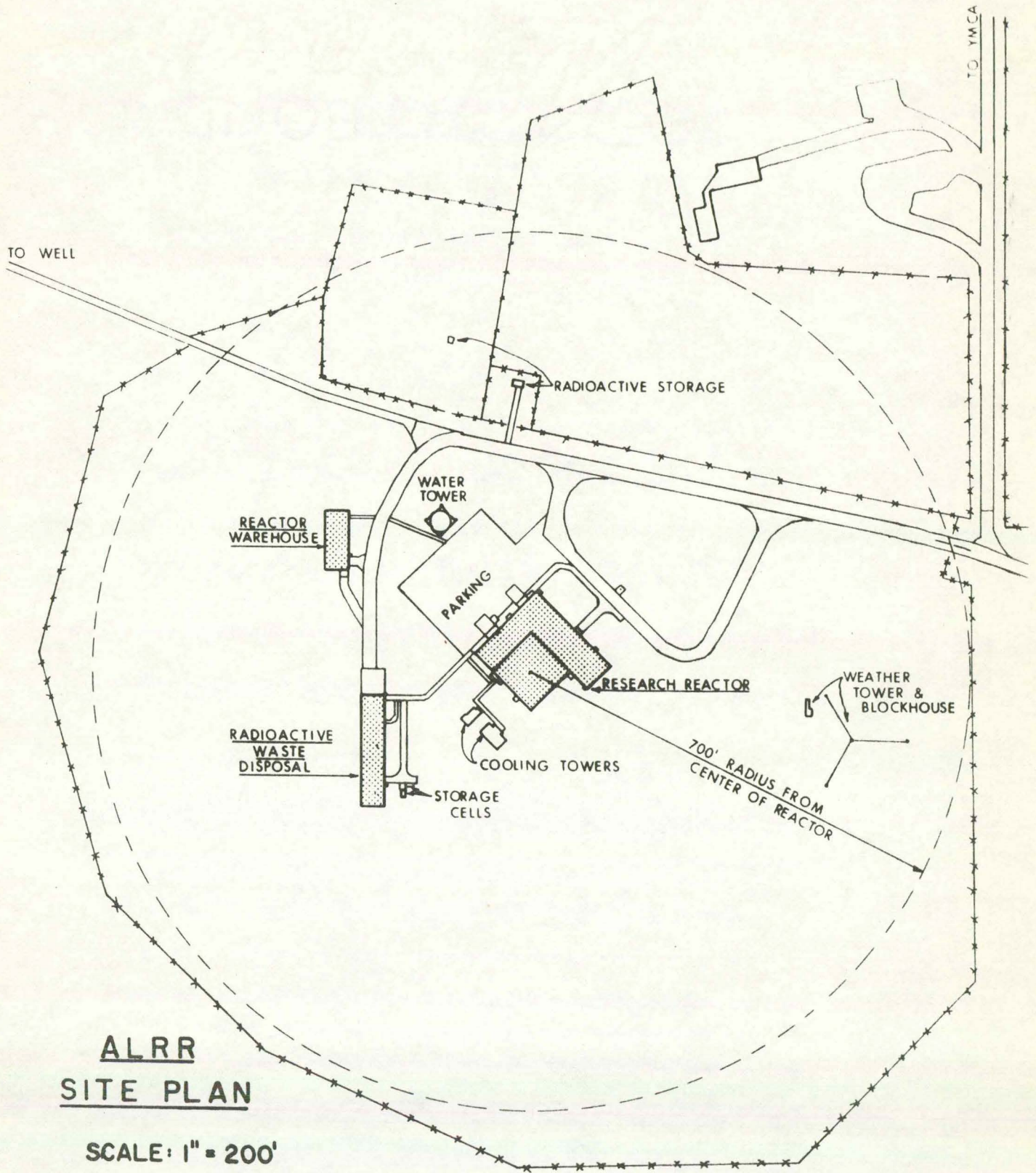
MAP 1



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



MAP 3



Confidence Limits - 95%

Sample Media		$\beta$	$\alpha$
air	(152 m <sup>3</sup> 50 min)	0.12 X 10 <sup>-12</sup> $\mu$ Ci/ml $\pm$ 0.009 X 10 <sup>-12</sup> $\mu$ Ci/ml	0.003 X 10 <sup>-12</sup> $\mu$ Ci/ml $\pm$ 0.0016 X 10 <sup>-12</sup> $\mu$ Ci/ml
soil	(4 gm 30 min)	11.03 X 10 <sup>-6</sup> $\mu$ Ci/gm $\pm$ 0.69 X 10 <sup>-6</sup> $\mu$ Ci/gm	0.65 X 10 <sup>-6</sup> $\mu$ Ci/gm $\pm$ 0.19 X 10 <sup>-6</sup> $\mu$ Ci/gm
vegetation	(.8 gm 30 min)	23.94 X 10 <sup>-6</sup> $\mu$ Ci/gm $\pm$ 2.29 X 10 <sup>-6</sup> $\mu$ Ci/gm	0.35 X 10 <sup>-6</sup> $\mu$ Ci/gm $\pm$ 0.32 X 10 <sup>-6</sup> $\mu$ Ci/gm
river water	(1 l 30 min)	6.69 X 10 <sup>-9</sup> $\mu$ Ci/ml $\pm$ 1.08 X 10 <sup>-9</sup> $\mu$ Ci/ml	0.68 X 10 <sup>-9</sup> $\mu$ Ci/ml $\pm$ 0.20 X 10 <sup>-9</sup> $\mu$ Ci/ml
ALRR outfall	(1 l 30 min)	5.63 X 10 <sup>-9</sup> $\mu$ Ci/ml $\pm$ 1.00 X 10 <sup>-9</sup> $\mu$ Ci/ml	0.29 X 10 <sup>-9</sup> $\mu$ Ci/ml $\pm$ 0.26 X 10 <sup>-9</sup> $\mu$ Ci/ml
bottom sediment	(4 gm 30 min)	7.71 X 10 <sup>-6</sup> $\mu$ Ci/gm $\pm$ 0.58 X 10 <sup>-6</sup> $\mu$ Ci/gm	0.41 X 10 <sup>-6</sup> $\mu$ Ci/gm $\pm$ 0.15 X 10 <sup>-6</sup> $\mu$ Ci/gm
precipitation	(0.750 l 30 min)	51.91 X 10 <sup>-9</sup> $\mu$ Ci/ml $\pm$ 3.49 X 10 <sup>-9</sup> $\mu$ Ci/ml	2.35 X 10 <sup>-9</sup> $\mu$ Ci/ml $\pm$ 0.85 X 10 <sup>-9</sup> $\mu$ Ci/ml
well water		4.39 X 10 <sup>-9</sup> $\mu$ Ci/ml $\pm$ 0.88 X 10 <sup>-9</sup> $\mu$ Ci/ml	0.63 X 10 <sup>-9</sup> $\mu$ Ci/ml $\pm$ 0.38 X 10 <sup>-9</sup> $\mu$ Ci/ml
pond water		8.24 X 10 <sup>-9</sup> $\mu$ Ci/ml $\pm$ 1.21 X 10 <sup>-9</sup> $\mu$ Ci/ml	0.42 X 10 <sup>-9</sup> $\mu$ Ci/ml $\pm$ 0.31 X 10 <sup>-9</sup> $\mu$ Ci/ml

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