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Annual Report Radioactivity Results 1963

ERRATA SHEET

1. Pages 11, 12, 13 and 14.

   Albany - Milk - Under sampling frequency for I-131, Cs-137, Ba-La-140 and Zr-Nb-95, only D (daily grab sample) should appear.

2. Pages 11, 12, 13, 14, 15 and 16.

   New York City - Milk - Under sampling frequency, the designation A (weekly composite of daily grab samples) must be clarified at this station. The procedure is to collect one daily milk sample representing the total milk supply for that day and analyze it once a week.

3. Page 13.

   Clarkstown - Milk - Under sampling frequency, the blank space should replaced with M (monthly grab sample).

4. Page 13.

   Massena - Milk - Under sampling frequency, the A should be replace with B (bi-monthly composite of daily grab sample - a two week composite.

5. Page 14.

   Middleburg - Milk - Under sampling frequency, the M should be replace with A (weekly composite of daily grab samples).

6. Pages 15 and 16.

   Albany - Milk - Under sampling frequency, for Strontium 90, Strontium 89 only A (weekly composite of daily grab samples) should appear.

7. Page 17.

   Ossining - Water - Under sampling frequency, the designation A needs clarification at this station. The procedure is to collect hourly grab samples for one week and the analysis of this weekly composite is then mad at the Division of Laboratories and Research.

8. Page 27.

   Key - The designation for B is given as "bi-weekly composite of daily grab samples." This should read "bi-monthly composite of daily grab samples. A two week composite of daily grab samples is th schedule intended.

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R PDR

12/15/64

State of New York
Department of Health
Albany, New York

October 6, 1964

TO : THE COMMISSIONER
DEPUTY ASSOCIATE ASSISTANT, COUNTY AND CITY HEALTH COMMISSIONERS
REGIONAL HEALTH DIRECTORS AND DISTRICT HEALTH OFFICERS
DIRECTORS OF BUREAUS, STAFF OFFICES, HOSPITALS AND APPROVED LABORATORIES

FROM : DR. THOMPSON

SUBJECT: ANNUAL REPORT RADIOACTIVITY RESULTS - 1963

SUMMARY OF ENVIRONMENTAL RADIOACTIVITY IN NEW YORK STATE 1963

Introduction

The Health Department of the State of New York has done extensive sampling and analysis of environmental vectors for the measurement of radioactivity since 1955 and the present report gives the data collected from this program for the year 1963.

The location of sampling stations, and the subsequent sampling and analyses, are for two purposes; namely, general surveillance and specific monitoring of nuclear facilities. The general surveillance stations are located to give a picture of the state-wide fallout from such sources as bomb testing, while the monitoring stations are located to indicate possible changes due to specific nuclear installations, such as reactors and fuel reprocessing plants. Although a majority of our stations have been located for the specific monitoring concept, when there are no releases at specific installations the interchange of results is easily possible.

The Test Ban Treaty, involving the United States, Great Britain and Russia, which was initialed July 25, 1963, signed August 5, 1963, and ratified by the United States Senate, September 24, 1963, brought to an end the atmospheric testing programs of the signatories. A review of the atmospheric test shot schedules shows that the actual cessation was some months earlier. For practical purposes, the year 1963 was essentially one of no additions of radionuclides from nuclear weapons testing in the atmosphere.

In 1963, the maximum results occurred in the general period of May-August, with certain exceptions as indicated in the tabular results. The monthly averages in this report, as well as the yearly averages for individual stations, were obtained from an arithmetic addition and division of the analytical results by the number of samples obtained for all the stations involved in a particular environmental vector for the month as shown. A similar procedure was followed for the yearly average at individual stations.

The increase in radionuclide content of practically all vectors analyzed during the spring-summer period shows a greater transfer from stratosphere to troposphere in the temperature zone during this season of the year. The theory of Stewart (1957) based on the studies of Brewer (1949) and Dobsen (1956), explains the spring increase (probably extended into summer) on the basis of air entering the stratosphere in the tropical regions. There it has been heated and, therefore, rises to great heights; moves toward the poles, and then sinks into the troposphere at the polar regions. From the troposphere it is dispersed in the lower atmosphere and is washed out in rain or settles through the atmosphere. A second theory, based on the work of Shelton (1959), explains the late winter-early spring increase in fallout on the basis of a known discontinuity in the tropopause at the temperate regions. The increased turbulence in the vicinity of this "break" in the tropopause is thought to cause an increased transport from stratosphere to troposphere in these regions. Thus, there is an increase in radionuclides in our environmental vectors from previously injected contaminants residing in the stratosphere.

The collection of the samples is handled by the various local offices of the state, county and city health departments and, in many instances, by private industry which has been very active and cooperative in our surveillance programs.

Air

For determination of the total radionuclide content of the air vector, as expressed by pc/M^3 of gross beta activity, there were five sampling stations operating in 1963 on a weekly collection schedule. Approximately 1 cfm of air was drawn continuously through a filter paper of 2" diameter for a weekly period and the filter was then sent to the laboratory for analysis. The air results (tabulations on page 9) increased in April and June, reflecting the stratospheric-tropospheric interchange, and then show a gradual decrease to the end of the year. The suspended radioactive material in the air is becoming less active with time and there is a decrease from the maximum values in April and June.

Fallout

There were four fallout stations operating in 1963. Collections were made on a weekly exposure basis using a polyethylene container with an exposure area of 0.101 ft^2 and a depth of approximately 9" from the rim. Exposure was accomplished by removing the screw-type top, exposing the container for 7 days, replacing the top and sending the entire unit to the Division of Laboratories and Research for analysis. The results of these analyses are given on page 10.

The spring-summer increase in fallout results for both Sr-89 and Sr-90 during 1963, is indicative of the increased stratospheric-tropospheric transport of radionuclides injected into the upper air during previous test series. The Sr-90 ($T_{\frac{1}{2}}$ = 27.7y) would still be detectable. Although Sr-89 ($T_{\frac{1}{2}}$ = 50.5 days) is classed as a short-lived radionuclide, Sr-89 could be detected nearly one year after release on the basis of half-life.

Milk

Twelve milk sampling stations were operated in the State for the milk vector analyses. Sampling schedules varied from daily collection of grab samples (and daily analysis) through daily collection of a grab sample and compositing on a weekly basis (with weekly analysis). The least frequent collection was a monthly grab sample (with monthly analysis). Samples are 2 liters in size for analysis in the Marinelli-type configuration used in the gamma spectrometer at the Division of Laboratories and Research. Sr-89 and Sr-90 are analyzed by separation of the radionuclide and beta counting.

The cessation of testing in 1963, is directly reflected in the <20 pc/l value for the average results of I-131 in milk during the entire period. This short-lived radionuclide ($T_{\frac{1}{2}}$ = 8.08 days) is a direct indicator of fresh fission products. It was not present in average amounts above the limit of sensitivity of our present analytical procedure (20 pc/l). Also, there were no indications of any local contamination of milk with I-131 from sources such as reactors or laboratories.

The analyses of milk show that amounts of both Cs-137 ($T_{\frac{1}{2}}$ = 26.6y) and Sr-90 ($T_{\frac{1}{2}}$ = 27.7y) have increased during 1963, as would be expected in view of the longer half-lives and the increased probability of accumulation of both of these radionuclides in soil and vegetation for eventual distribution to the cow and transfer to the milk. In general, the increase in radionuclides in milk in the spring, with exception of I-131 which has decayed out, can be attributed to the placing of cows in pasture, the increase in the stratospheric-tropospheric interchange and the increased amounts of the long-lived radionuclides in the cows' environment due to accumulation with little decrease due to decay.

The Federal Radiation Council radiation protection guides for I-131, Sr-89 and Sr-90 are given as follows:

Nuclide	Critical Organ	Intake Levels, pc/day		
		Range I	Range II	Range III
I-131	Thyroid	0-10	10-100	100-1000
Sr-90	Bone and bone marrow	0-20	20-200	200-2000
Sr-89	Bone and bone marrow	0-200	200-2000	2000-20,000

The upper limits of Range II are considered an acceptable health risk for large general population groups for a lifetime and, therefore, the following intakes over the period of year are given:

I-131 --- 100 pc/day or 36,500 pc for 12 month period
Sr-90 --- 200 pc/day or 73,000 pc for 12 month period
Sr-89 --- 2,000 pc/day or 730,000 pc for 12 month period

The reported results are well within these recommended limits.

Water

Twenty-six water sampling stations were operated from which samples were collected and analyzed. The frequency of collection varied from continuous sampling with a weekly analysis of the composite to a monthly grab sample with individual analysis. The analysis at these stations included gross beta, I-131, Cs-137, Ba-La-140 and Zr-Nb-95. The results did not show a distinct seasonal trend, as did some other vectors. This can be explained by increased stream flows causing scouring of bottom deposits, possible reconcentration of radionuclides in living organisms and then a "sluffing off" of the organisms and possible change in settling rates due to variations in temperature.

Individual gross beta analysis were evaluated and when compared to the 100 pc/l value for Sr-90, further analysis was indicated. In every case, a half-life determination or Sr-90 analysis confirmed that Sr-90 was not present, and that the analytical value was well within acceptable limits.

The Sr-89 and Sr-90 results in water were indicative of the spring stratospheric-tropospheric transfer with Sr-90 increase a little later than that of the Sr-89. The results were, however, much below the acceptable limits of intake for both the radionuclides.

Gamma Background

In 1960 and 1961, measurements of the penetrating external background radiation were made at multiple sites in New York State by scientists from the Health and Safety Laboratory of the Atomic Energy Commission. The measurements were made with 20 liter air ionization chambers. In 1963, another series of measurements was made at the same locations with a pressurized ionization chamber and a 256 channel gamma ray spectrometer utilizing a 5" by 3" NaI(Tl) crystal for separating the natural and fallout gamma components. The cosmic ray component was determined from the pressure-altitude and a previous calibration of the pressurized ionization chamber to this component at several altitudes. These data are shown on pages 25 - 27. The difference between the total dose and the natural gamma and cosmic dose for the 1963 measurements is due to gamma emitting fallout. We wish to express our appreciation to the AEC and particularly to Messrs. W. Lowder and W. Condon for the valuable data they collected and for their assistance during and after the survey.

Conclusion

With the moratorium on testing in force, fresh fission products (as indicated by I-131) are no longer a component in general fallout. The long-lived components of fission products (as indicated by Cs-137 and Sr-90) are accumulating in soil, vegetation and, to a lesser extent, in water so that an increase is noted in milk. The stratospheric-tropospheric interchange with seasons is clearly indicated in fallout. The levels of radioactivity in 1963 in New York State as a result of weapons testing or industrial sources are well within the guides established by the Federal Radiation Council for normal peace-time operations.

Average precipitation data for Albany, New York City and Syracuse show that there does not seem to be a direct correlation between periods of highest precipitation and highest radionuclide values in 1963, even in the fallout component.

1963 Average Results
(All Stations)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air-(pc/M^3)	7.3	7.9	6.5	9.3	7.3	9.0	6.3	5.1	2.7	2.5	1.2	1.1
Milk-(pc/l)												
I-131	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cs-137	64	73	50	39	39	112	138	126	106	102	126	135
Ba-La-140	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Zr-Nb-95	---	<20	<20	<20	<20	<20	<20	<20	---	---	---	---
Sr-90	8	7	7	8	14	28	31	25	21	21	23	20
Sr-89	6	5	4	8	46	86	80	47	28	18	12	8
Fallout-(pc/ft^2/day)												
Sr-90	<3	<3	<3	8	8	7	8	8	<3	<3	<3	<3
Sr-89	<3	<3	23	62	63	35	29	19	5	<3	<3	<3
Water-(pc/l)												
Gross Beta	23	21	37	27	22	18	30	26	17	16	15	15
I-131	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cs-137	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Ba-La-140	<20	<20	21	<20	20	<20	20	<20	<20	<20	<20	<20
Zr-Nb-95	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Sr-89	3	4	6	12	7	6	3	6	6	8	3	<3
Sr-90	<3	<3	<3	<3	<3	3	4	3	3	4	4	3

Rainfall in Inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Albany (Albany County Airport)	2.38	1.84	3.45	1.14	1.90	2.94	1.20	2.49	2.69	0.20	4.15	1.86
		Total = 26.24						(Normal Total = 35.08)				
New York City (Central Park)	1.93	2.55	3.61	1.27	2.16	2.72	2.19	3.21	3.95	0.14	8.34	2.31
		Total = 34.38						(Normal Total = 42.37)				
Syracuse (Hancock Field)	1.85	2.05	2.79	2.22	2.84	2.49	1.21	3.59	0.85	0.21	5.65	2.06
		Total = 27.81						(Normal Total = 37.60)				

Averages at Sampling Points
1963

Air Samples - pc/M^3

Albany	5.0
Ithaca	5.6
Pawling	4.3
Peekskill	5.7
Tuxedo	5.8

Milk Samples - pc/l

	I-131	Cs-137	Ba-La-140	Zr-Nb-95	Sr-90	Sr-89
Albany	<20	85	<20	<20	17	26
Bedford	<20	125	<20	<20	23	47
Buffalo	<20	83	<20	<20	14	26
Clarkstown	<20	52	<20	<20	11	15
Newburgh	<20	88	<20	<20	20	31
New York City	<20	97	<20	<20	21	39
Massena	<20	154	<20	<20	21	32
Mt. Pleasant	<20	80	<20	<20	12	20
Middleburg	<20	96	<20	<20	23	35
Oyster Bay	<20	100	<20	<20	18	26
Syracuse	<20	75	<20	<20	16	31
Yorktown	<20	94	<20	<20	18	27

Fallout Samples - pc/ft^2/day

	Sr-89	Sr-90
Albany	19	5.5
Ithaca	25	5.1
Peekskill	13	3.4
Syracuse	25	4.3

Averages at Sampling Points
1963

(con't)

Water - pc/l

	Gross Beta
Akron	16
Rome	15
Watertown	21
Glenmont	33
Ossining	48
Peekskill	40
Waterford	21
Cohoes	20
Schenectady	27
Niagara Falls - East Branch	17
Niagara Falls - West Branch	8
Geneva	5*
Watervliet	17
Bedford	17
Peekskill	22
Yorktown	9
Ossining - Indian Brook	33
Clarkstown - Congers Lake	35
Clarkstown - Lake De Forest	24
Hillburn	30**
Haverstraw	10
Ramapo	19
Stony Point	5
Highland Falls	15

	Sr-89	Sr-90
Albany (finished)	5	<3
Cohoes (finished)	10	5
Geneva	<3	<3
New York City	6	<3

* Only 2 monthly samples
** Only 1 monthly sample

Air

Gross Beta - pc/M^3

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Samp. Freq.
Albany	Ave	5.1	6.2	5.8	7.6	7.8	7.8	6.5	4.8	3.0	3.0	1.1	1.0	D
	Max	22	9	11	15	18	15	10	9	6	8	2	1	
	Min	1	3	1	1	2	1	2	1	1	1	<1	<1	
Ithaca	Ave	9.0	9.2	6.7	7.3	7.6	8.8	5.7	5.3	3.2	2.5#	1.0#	1.0#	W
	Max	10	13	11	12	11	12	7	8	4	3	1	1	
	Min	7	7	4	1.4	2	6	4	3	3	2	1	<1	
Pawling	Ave	*	*	*	*	6.5#	11#	5.8	4.8	2.0	2.0	1.3	1#	W
	Max	*	*	*	*	7	11	9	8	2	2	2	1	
	Min	*	*	*	*	6	11	4	3	2	2	<1	1	
Peekskill	Ave	8.0	8.0	6.8	10.8	6.2	9.0	6.8	5.5	3.2	2.5#	1.2	1.0	W
	Max	10	10	9	13	8	13	9	8	4	3	2	1	
	Min	6	5	5	8	5	6	7	3	2	2	<1	1	
Tuxedo	Ave	7.2	8.2	6.8	11.3	8.5	8.5	6.5	5.3	2.0#	2.5#	1.2	1.3	W
	Max	10	10	11	15	10	10	9	9	2	3	2	2	
	Min	5	6	4	9	6	6	5	3	2	2	<1	1	

Partial Schedule of Samples

Fallout

pc/ft^2/day

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Samp. Freq.
Strontium-89														
Albany	Ave	<3	<3	<3	89	68	20	17	20	6	<3	<3	<3	W
	Max	<3	<3	<3	126	120	44	28	39	18	<3	<3	<3	
	Min	<3	<3	<3	12	46	6	<3	<3	<3	<3	<3	<3	
Ithaca	Ave	<3	<3	71	41	72	32	45	20	5	<3	<3	<3	W
	Max	<3	<3	140	80	97	64	74	29	15	<3	<3	<3	
	Min	<3	<3	<3	12	40	11	17	10	<3	<3	<3	<3	
Peekskill	Ave	<3	<3	17	12	40	38	17	13	7	3	<3	<3	W
	Max	<3	<3	35	34	94	94	40	46	26	7	<3	<3	
	Min	<3	<3	<3	<3	11	20	<3	<3	<3	<3	<3	<3	
Syracuse	Ave	<3	<3	<3	105	70	50	37	24	<3	<3	<3	<3	W
	Max	<3	<3	<3	155	193	82	61	64	<3	<3	<3	<3	
	Min	<3	<3	<3	30	11	16	13	<3	<3	<3	<3	<3	
Strontium-90														
Albany	Ave	<3	<3	<3	20	9	7	8	8	<3	<3	<3	<3	W
	Max	<3	<3	<3	33	18	11	10	11	<3	<3	<3	<3	
	Min	<3	<3	<3	6	<3	<3	4	<3	<3	<3	<3	<3	
Ithaca	Ave	<3	<3	4	6	12	6	10	9	4	<3	<3	<3	W
	Max	<3	<3	7	14	15	7	19	13	8	<3	<3	<3	
	Min	<3	<3	<3	<3	5	4	<3	6	<3	<3	<3	<3	
Peekskill	Ave	<3	4	3	<3	6	4	4	8	<3	<3	<3	<3	W
	Max	<3	10	7	5	7	6	11	14	<3	<3	<3	<3	
	Min	<3	<3	<3	<3	3	<3	<3	<3	<3	<3	<3	<3	
Syracuse	Ave	<3	<3	<3	5	6	9	9	8	<3	<3	4	<3	W
	Max	<3	<3	<3	8	10	15	14	31	<3	<3	9	<3	
	Min	<3	<3	<3	<3	<3	<3	5	<3	<3	<3	<3	<3	

Milk

Concentration - pc/l

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Samp. Freq.
							Iodine-131							
Albany	Ave	All	less	than	20									A
	Max	28	<20	<20	<20	<20	28	25	43	42	<20	<20	<20	&
	Min	All	less	than	20									D
Bedford		<20	*	<20	<20	<20	<20	<20	*	<20	<20	<20	<20	M
Buffalo	Ave	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	A
	Max	28	<20	<20	<20	<20	<20	21	<20	<20	<20	<20	<20	
	Min	All	less	than	20									
Clarkstown			<20	<20	22	<20	<20	*	25	<20	<20	<20	*	M
Newburgh	Ave	All	less	than	20									A
	Max	All	less	than	20									
	Min	All	less	than	20									
NY City	Ave	<20	<20	21	<20	<20	<20	<20	<20	<20	<20	<20	<20	A
	Max	<20	<20	38	31	32	<20	<20	<20	<20	<20	<20	<20	
	Min	All	less	than	20									
Massena	Ave	All	less	than	20									
	Max	21	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	B
	Min	All	less	than	20									
Mt. Pleasant		<20	<20	<20	31	<20	<20	<20	<20	<20	<20	<20	<20	M
Middleburg	Ave	*	*	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	A
	Max	*	*	<20	<20	47	<20	<20	<20	<20	<20	<20	<20	
	Min	*	*	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Oyster Bay		All	less	than	20									M
Syracuse	Ave	<20	<20	<20	<20	22	<20	<20	<20	<20	<20	<20	<20	A
	Max	24	<20	<20	22	43	<20	<20	<20	<20	<20	<20	<20	
	Min	All	less	than	20									
Yorktown		All	less	than	20									M

Milk

Concentration - pc/l

con't

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Samp. Freq.
							Cs-137							
Albany	Ave	58	63	41	48	51	92	101	133	103	99	112	120	A
	Max	83	77	71	71	75	122	177	156	164	148	144	151	&
	Min	34	56	<20	<20	<20	60	54	85	28	26	62	84	D
Bedford		69	*	44	58	91	169	209	*	123	150	164	172	M
Buffalo	Ave	69	91	67	35	76	86	105	89	93	79	102	106	A
	Max	101	137	74	54	98	90	187	112	112	89	140	126	
	Min	39	64	54	<20	57	75	57	65	84	67	81	92	
Clarkstown		*	36	37	<20	30	26	*	68	72	67	120	*	M
Newburgh	Ave	55	66	58	29	79	107	125	137	84	91	98	122	A
	Max	64	78	84	51	91	131	160	149	92	123	130	131	
	Min	39	54	33	<20	61	92	94	105	72	64	64	115	
NY City	Ave	67	63	61	<20	65	135	119	126	126	117	122	153	A
	Max	80	73	94	<20	91	180	149	167	134	138	168	175	
	Min	56	56	25	<20	33	104	68	58	110	104	67	135	
Massena	Ave	114	137	97	73	79	160	224	226	193	150	205	187	B
	Max	127	150	129	77	83	190	229	266	212	158	231	212	
	Min	105	125	53	69	75	130	118	185	174	142	180	163	
Mt. Pleasant		<20	78	20	26	54	129	114	117	94	94	103	121	M
Middleburg	Ave	*	*	58	52	65	94	133	139	85	83	119	127	A
	Max	*	*	64	83	95	125	153	149	104	93	133	142	
	Min	*	*	52	<20	31	71	109	129	79	77	92	116	
Oyster Bay		75	82	<20	45	64	100	132	124	130	123	155	157	M
Syracuse	Ave	55	50	36	<20	51	95	88	110	85	80	111	123	A
	Max	64	86	73	40	99	115	110	145	90	87	136	141	
	Min	50	21	<20	<20	<20	73	62	90	78	73	90	104	
Yorktown		59	66	62	46	90	154	172	113	83	87	99	95	M

Milk

Concentration - pc/l

con't

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Samp. Freq.
						Ba-La-140								
Albany	Ave	All	are	less	than	20								A
	Max	<20	<20	78	69	49	38	<20	<20	<20	<20	<20	<20	&
	Min	All	are	less	than	20								D
Bedford		<20	20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	M
Buffalo	Ave	All	are	less	than	20								
	Max	<20	<20	24	<20	<20	<20	<20	<20	<20	<20	<20	<20	A
	Min	All	are	less	than	20								
Clarkstown		All	are	less	than	20								
Newburgh	Ave	<20	<20	<20	<20	24	<20	20	<20	<20	<20	<20	<20	A
	Max	<20	<20	<20	<20	65	<20	50	<20	<20	<20	<20	<20	
	Min	All	are	less	than	20								
NY City	Ave	All	are	less	than	20								
	Max	<20	<20	<20	<20	20	<20	<20	<20	<20	<20	<20	<20	A
	Min	All	are	less	than	20								
Massena	Ave	All	are	less	than	20								A
	Max	<20	<20	31	<20	33	<20	<20	<20	<20	<20	<20	<20	
	Min	All	are	less	than	20								
Mt. Pleasant		All	are	less	than	20								M
Middleburg	Ave	*	*	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	A
	Max	*	*	29	<20	<20	27	<20	<20	<20	<20	<20	<20	
	Min	*	*	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Oyster Bay		<20	<20	<20	34	<20	<20	<20	<20	<20	<20	<20	<20	M
Syracuse	Ave	All	are	less	than	20								
	Max	20	<20	<20	<20	64	<20	<20	<20	<20	<20	<20	<20	A
	Min	All	are	less	than	20								
Yorktown		All	are	less	than	20								M

Milk

Concentration - pc/l

con't.

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Samp. Freq.
							Zr-Nb-95							
Albany	Ave	*	*	21	<20	<20	<20	<20	<20	*	*	*	*	A
	Max	*	*	87	41	44	67	54	<20	*	*	*	*	&
	Min	*	*	<20	<20	<20	<20	<20	<20	*	*	*	*	D
Bedford		*	<20	*	<20	<20	*	*	*	*	*	*	*	M
Buffalo	Ave	*	*	<20	<20	<20	<20	<20	*	*	*	*	*	A
	Max	*	*	39	36	<20	<20	<20	*	*	*	*	*	
	Min	*	*	<20	<20	<20	<20	<20	*	*	*	*	*	
Clarkstown		*	*	<20	<20	<20	<20	*	*	*	*	*	*	M
Newburgh	Ave	*	*	<20	<20	<20	<20	<20	*	*	*	*	*	A
	Max	*	*	22	<20	<20	<20	<20	*	*	*	*	*	
	Min	*	*	<20	<20	<20	<20	<20	*	*	*	*	*	
NY City	Ave	*	*	*	<20	22	22	<20	*	*	*	*	*	A
	Max	*	*	*	<20	36	46	<20	*	*	*	*	*	
	Min	*	*	*	<20	<20	<20	<20	*	*	*	*	*	
Massena	Ave	*	*	<20	<20	<20	<20	*	*	*	*	*	*	B
	Max	*	*	21	<20	<20	<20	*	*	*	*	*	*	
	Min	*	*	<20	<20	<20	<20	*	*	*	*	*	*	
Mt. Pleasant		*	*	26	<20	*	*	<20	*	*	*	*	*	M
Middleburgh	Ave	*	*	<20	<20	<20	<20	<20	*	*	*	*	*	M
	Max	*	*	<20	<20	<20	<20	<20	*	*	*	*	*	
	Min	*	*	<20	<20	<20	<20	<20	*	*	*	*	*	
Oyster Bay		*	*	*	<20	<20	<20	<20	*	*	*	*	*	M
Syracuse	Ave	*	*	<20	<20	<20	<20	<20	*	*	*	*	*	A
	Max	*	*	<20	<20	53	<20	<20	*	*	*	*	*	
	Min	*	*	<20	<20	<20	<20	<20	*	*	*	*	*	
Yorktown		*	*	<20	<20	*	<20	*	*	*	*	*	*	M

Milk

Concentration - pc/l

con't.

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Samp. Freq.
							Strontium-90							
Albany	Ave	5	6	7	8	12	21	26	30	26	21	21	18	A
	Max	8	9	9	11	20	32	29	34	35	23	25	22	&
	Min	3	3	6	4	<3	9	24	24	19	19	17	14	D
Bedford		9	*	<3	6	18	42	54	*	20	35	28	19	M
Buffalo	Ave	8	8	8	9	13	24	14	20	18	13	15	12	A
	Max	11	11	11	11	15	31	19	24	25	15	16	15	
	Min	3	6	7	6	12	14	7	17	10	10	13	9	
Clarkstown		*	3	<3	4	4	34	*	13	12	13	15	*	M
Newburgh	Ave	8	6	6	8	20	30	34	38	27	20	22	22	A
	Max	10	9	9	9	25	37	46	49	33	22	27	26	
	Min	7	3	4	6	14	22	21	26	18	17	17	18	
NY City	Ave	9	9	9	9	20	34	27	32	31	25	24	25	A
	Max	12	13	10	9	35	59	38	39	42	30	26	30	
	Min	3	7	4	7	11	17	18	25	20	21	21	21	
Massena	Ave	12	13	9	12	12	15	40	30	22	29	34	29	B
	Max	14	16	11	19	13	29	49	36	32	32	38	30	
	Min	11	11	7	8	12	<3	31	25	12	27	29	28	
Mt. Pleasant		5	6	5	6	7	16	20	21	7	18	16	13	M
Middleburg	Ave	*	*	8	6	15	34	41	29	29	25	25	21	A
	Max	*	*	9	7	24	61	55	38	40	32	29	26	
	Min	*	*	7	6	8	17	32	16	13	16	21	17	
Oyster Bay		12	13	7	8	16	24	27	5	32	8	33	27	M
Syracuse	Ave	6	5	6	7	14	26	26	20	21	20	23	18	A
	Max	8	7	7	9	26	32	42	33	30	23	42	20	
	Min	4	3	4	5	4	22	18	14	14	17	13	17	
Yorktown		10	3	10	10	22	32	27	32	11	22	17	19	M

Milk

Concentration - pc/l

con't.

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Samp. Freq.
Strontium-89														
Albany	Ave	5	4	<3	3	40	74	69	49	30	18	13	9	D
	Max	9	5	<3	5	87	91	75	61	40	22	15	14	&
	Min	3	<3	<3	<3	4	51	62	33	24	16	12	5	A
Bedford		9	*	5	8	58	158	139	*	26	42	20	9	M
Buffalo	Ave	5	6	4	5	30	56	45	33	27	27	11	12	A
	Max	6	6	5	11	47	71	54	44	55	35	15	24	
	Min	5	4	3	<3	6	49	37	27	12	19	8	7	
Clarkstown		*	<3	4	7	4	79	*	16	13	8	4	*	M
Newburgh	Ave	5	7	4	14	72	81	76	58	27	18	6	11	A
	Max	6	17	5	32	90	109	92	90	31	30	17	33	
	Min	5	3	3	5	38	60	72	45	22	11	<3	<3	
NY City	Ave	6	4	3	6	87	113	90	80	30	20	18	8	A
	Max	11	5	6	15	141	145	108	89	45	27	21	14	
	Min	7	<3	<3	4	20	36	46	72	21	5	16	<3	
Massena	Ave	7	7	7	4	36	76	106	49	44	16	19	7	B
	Max	10	8	8	6	64	117	122	53	64	22	32	10	
	Min	5	5	5	<3	8	35	91	46	23	10	6	3	
Mt. Pleasant		5	<3	<3	9	22	52	88	40	15	<3	<3	<3	M
Middleburg	Ave	*	*	<3	6	44	89	67	63	32	25	14	9	A
	Max	*	*	3	10	91	109	86	70	47	32	20	13	
	Min	*	*	<3	<3	10	69	50	51	25	17	18	<3	
Oyster Bay		14	4	6	7	26	76	57	61	32	17	<3	7	M
Syracuse	Ave	6	5	3	5	66	91	84	41	30	19	17	8	A
	Max	7	6	5	6	132	108	72	49	43	20	29	12	
	Min	5	5	<3	3	6	74	46	32	18	18	5	<3	
Yorktown		<3	9	8	22	73	84	57	28	24	<3	14	<3	M

Water

Concentration - pc/l

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Samp. Freq.
Gross Beta														
Akron (Murder Ck.)	Ave	*	*	*	18	19	13	18	14	*	14	13	21	B
	Max	*	*	*	20	22	18	19	15	*	14	14	26	
	Min	*	*	*	15	16	<6	17	12	*	13	12	16	
Bedford (Byram L.)		6	9	12	34	6	6	30	23	15	31	18	8	M
Clarkstown (Congers L.)		16	65	42	23	62	27	42	35	27	15	33	*	M
Clarkstown (Lake DeForest)		19	20	90	16	41	9	24	19	15	13	<3	*	M
Cohoes (Mohawk R.)	Ave	27	7	47	23	20	18	72	38	15	33	13	26	C
	Max	37	14	130	34	28	24	167	81	23	39	17	40	
	Min	7	<3	6	11	<6	12	6	17	12	27	10	12	
Geneva (Seneca L.)	Ave	*	*	3	*	*	*	*	8	*	*	*	*	B
	Max	*	*	3	*	*	*	*	8	*	*	*	*	
	Min	*	*	3	*	*	*	*	8	*	*	*	*	
Glenmont (Hudson R.)	Ave	20	29	112	62	12	58	21	22	14	16	13	17	A
	Max	24	60	210	120	18	160	25	26	18	19	15	26	
	Min	11	<6	<60	15	6	22	14	17	10	14	11	12	
Haverstraw (Letchworth V. Res.)		6	3	9	6	14	14	17	10	6	*	10	*	M
Highland Falls (Meadow Brook)		*	9	8	16	10	26	49	28	4	6	4	5	M
Hillburn		*	*	*	30	*	*	*	*	*	*	*	*	M
Niagara Falls (East Branch)		*	3	70	11	16	16	*	*	6	9	7	*	M
Niagara Falls (West Branch)		*	3	17	<6	8	11	*	*	5	9	5	*	M
Ossining (Hudson R.)	Ave	<60	<6	<60	44	22	25	43	91	68	69	53	30	A
	Max	<60	<6	<60	<60	30	38	72	98	72	121	95	44	
	Min	<60	<6	<60	28	6	<6	20	83	62	12	<6	16	
Ossining (Indian Bk.Res.)		42	29	28	12	<60	36	79	26	13	12	28	*	M

Water

Concentration - pc/l

con't.

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Samp. Freq.
							Gross Beta							
Oswego (Lake Ontario)	Ave	6	7	14	8	8	7	9	13	4	6	7	6	W
	Max	*	10	31	14	13	10	16	17	5	9	7	7	
	Min	*	4	4	3	<3	<6	4	8	<3	3	6	3	
Pawling (Pond at United Nuclear				23	32	19	9	54	49	14	22	25	18	M
Peekskill (Camp Field Res.)		29	51	53	8	10	15	20	20	12	12	21	11	M
Peekskill (Hudson R.)	Ave	47	<60	60	40	11	20	49	60	75	14	21	23	C
	Max	65	<60	60	60	15	40	62	95	77	31	40	48	
	Min	<30	<60	<60	21	8	6	23	<3	72	6	3	6	
Ramapo (Spring Valley)		*	<3	14	*	52	25	<6	34	8	12	17	*	M
Rome (Fish Ck.)	Ave	12	6	11	18	30	15	18	15	12	8	15	16	B
	Max	12	6	11	21	34	21	18	15	13	10	17	22	
	Min	12	6	11	13	25	11	18	14	10	5	10	11	
Schenectady (G.E. Plant)	Ave	16	85	67	47	19	9	14	16	13	12	10	13	C
	Max	42	170	90	60	27	12	18	18	15	13	12	15	
	Min	6	11	<60	21	10	<6	10	17	12	10	7	9	
Stony Point (Iona Island)		<3	4	3	*	<6	11	11	4	<3	3	<3	*	M
Tuxedo (Indian Kill)				24	8			36	25		15	18	15	M
Waterford (Hudson R.)	Ave	22	21	60	52	10	13	20	20	12	12	9	10	A
	Max	33	<60	90	90	13	24	24	30	15	13	10	12	
	Min	15	<6	30	14	6	<6	17	10	10	11	8	9	
Watertown (Black R.)	Ave	31	10	24	31	32	13	15	28	15	17	15	17	B
	Max	38	10	37	36	41	14	16	34	17	17	15	17	
	Min	23	9	10	26	22	11	14	21	13	17	15	16	
Watervliet (French Mills Res.)	Ave	26	7	15	71	11	14	14	16	9	9	8	9	A
	Max	53	14	23	210	14	17	15	16	10	10	12	10	
	Min	9	4	4	13	10	11	12	15	8	8	6	7	
Yorktown (Croton Res.)		9	5	3	8	8	6	36	21	9	16	14	9	M

All samples for which results are given for Gross Beta were also analyzed for I-131, Cs-137, Ba-La-140, and Zr-Nb-95. All were found to be less than 20 pc/l unless listed below.

Station	Month	Isotope	Ave	Max	Min
Rome (Fish Creek)	March	(Ba-La-140)	30	30	30
Glenmont (Hudson River)	April	(Ba-La-140)	21	22	<20
Ossining (Hudson River)	April	(Cs-137)	24	28	<20
	February	(Ba-La-140)	20	21	<20
	November	(I-131)	33	41	<20
Peekskill (Hudson River)	April	(Cs-137)	27	35	<20
	March	(Ba-La-140)	23	27	<20
	July	(Ba-La-140)	25	41	<20
Waterford (Hudson River	May	(I-131)	23	27	<20
	May	(Ba-La-140)	23	25	<20
Schoes (Mohawk River)	March	(Ba-La-140)	30	53	<20
	July	(Ba-La-140)	20	25	<20
Schenectady (G.E. Plant)	July	(Cs-137)	20	25	<20
	May	(Ba-La-140)	41	63	<20
	June	(Ba-La-140)	23	33	<20
Geneva (Seneca Lake)	May	(I-131	20	23	<20
Watervliet (French Mills Res.)	May	(I-131)	24	34	<20
	March	(Ba-La-140)	20	22	<20
	May	(Ba-La-140)	23	37	<20
	June	(Ba-La-140)	20	25	<20
	July	(Ba-La-140)	37	55	<20
	November	(Cs-137)	29	38	<20

WATER

con't.

Station	Month	Isotope	Only one sample per month collected
Peekskill (Camp Field Res)	February	(Ba-La-140)	34
Clarkstown (Congers Lake)	March	(I-131)	21
	March	(Ba-La-140)	32
Clarkstown (Lake DeForest)	January	(Cs-137)	28
Haverstraw (Letchworth V. Res)	January	(Cs-137)	21

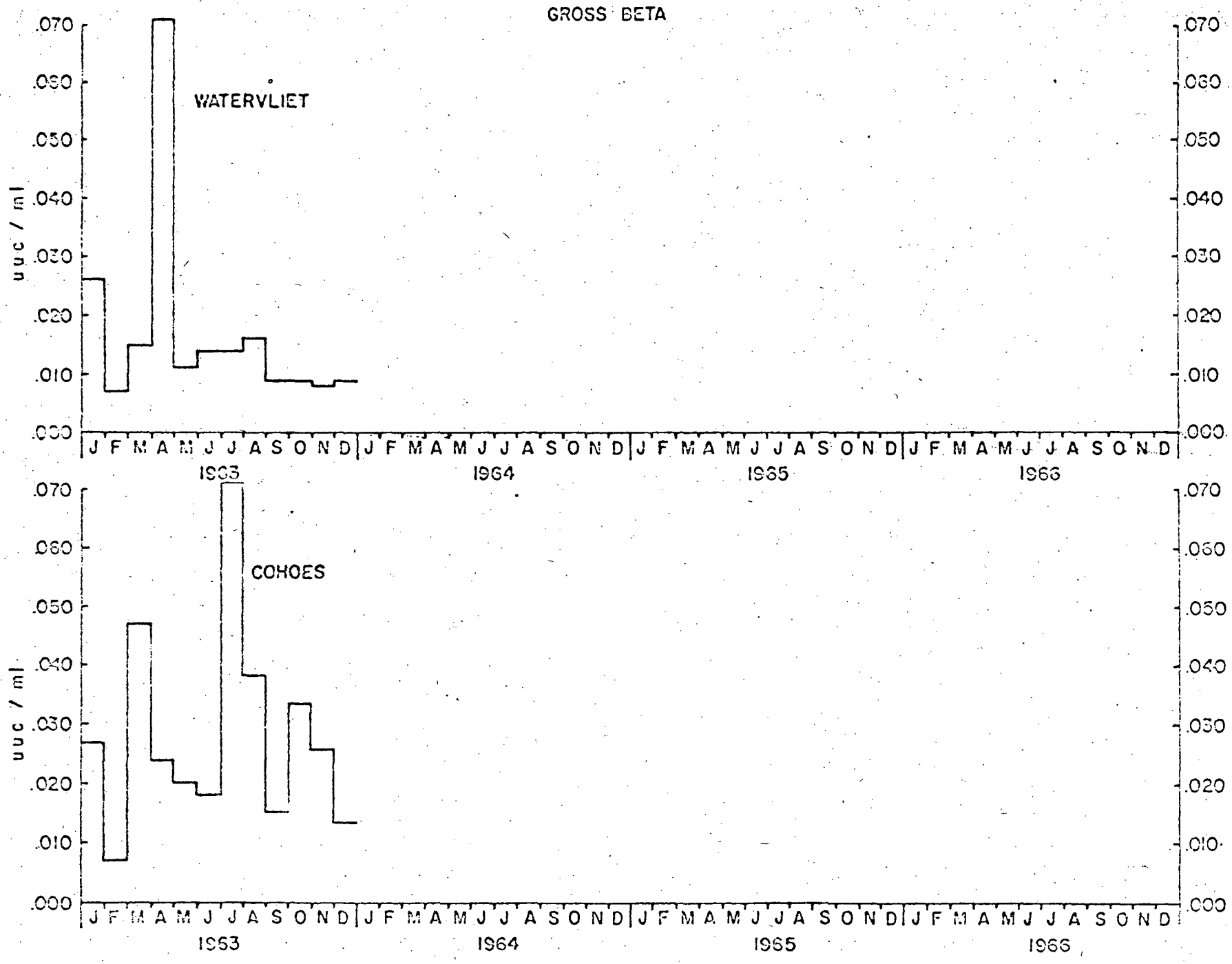
*Not Sampled.

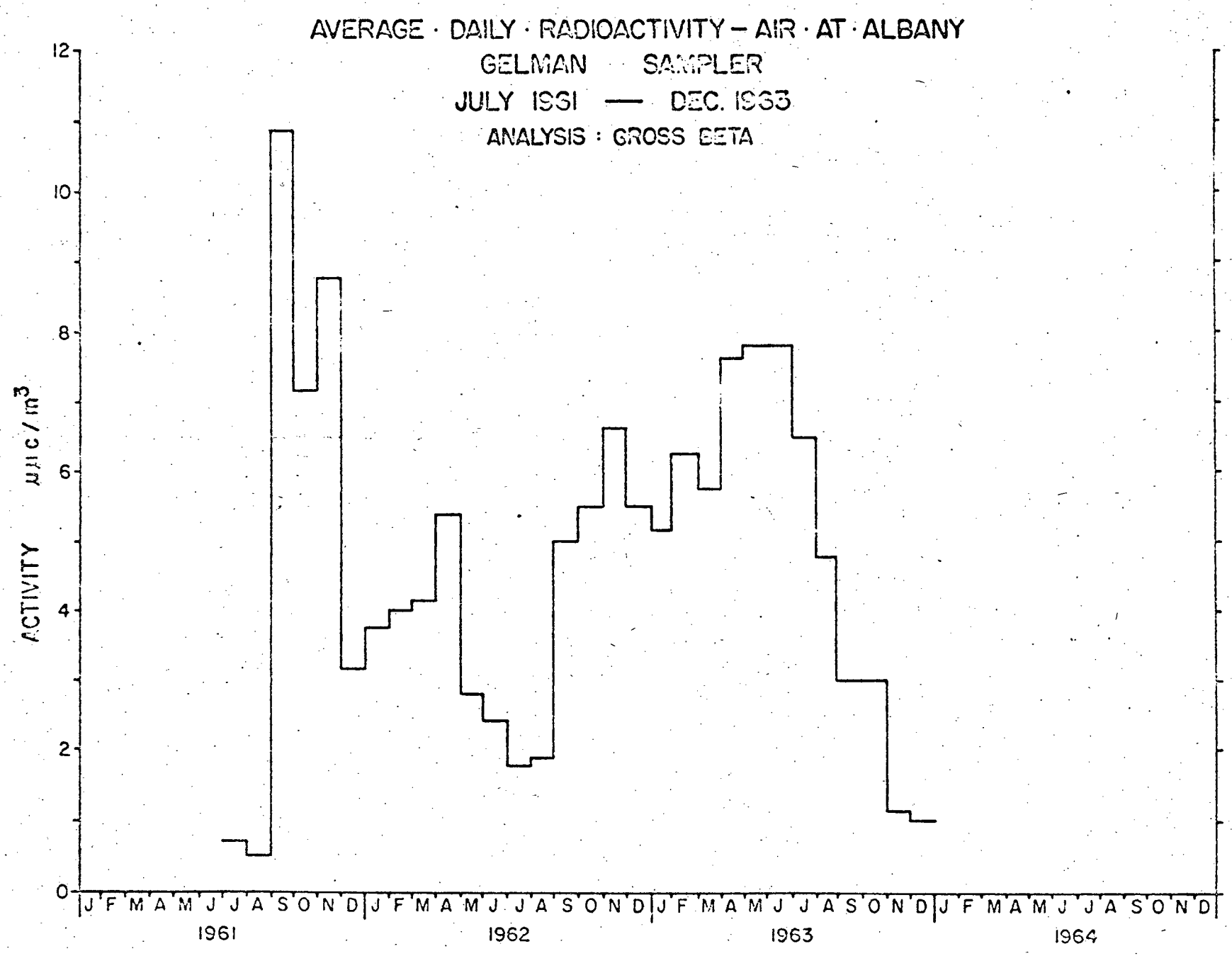
WATER

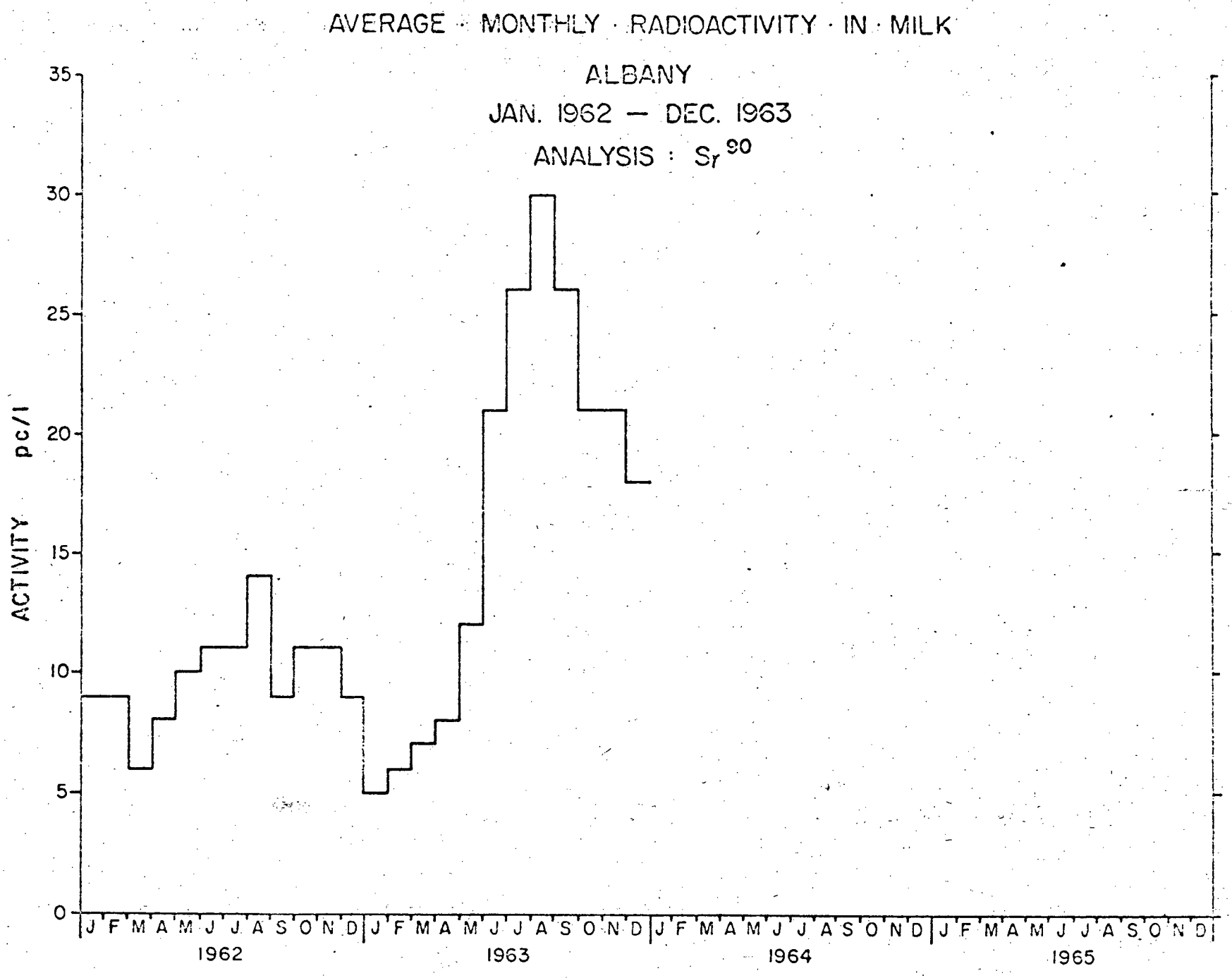
Concentrations in pc/l

Station	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Strontium-89												
Albany	4	<3	4	10	6	4	<3	5	5	7	5	<3
Cohoes	5	7	11	25	10	13	6	10	12	15	4	<3
Geneva	3	4	3	5	<3	<3	<3	<3	<3	3	<3	<3
New York City	<3	4	8	7	10	6	4	8	7	9	<3	<3
Average	3	4	6	12	7	6	3	6	6	8	3	<3
Strontium-90												
Albany	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	3
Cohoes	<3	<3	3	<3	4	5	7	7	6	9	9	6
Geneva	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
New York City	<3	<3	<3	<3	<3	3	4	<3	<3	<3	<3	<3
Average	<3	<3	<3	<3	<3	3	4	3	3	4	4	3

RAW WATER SUPPLIES FOR COHOES AND WATERVLIET
GROSS BETA




AVERAGE · DAILY · RADIOACTIVITY – AIR · AT · ALBANY
GELMAN SAMPLER
JULY 1961 — DEC. 1963
ANALYSIS : GROSS BETA
ACTIVITY μμc/m³
0
2
4
6
8
10
12
J F M A M J J A S O N D
1961
1962
1963
1964

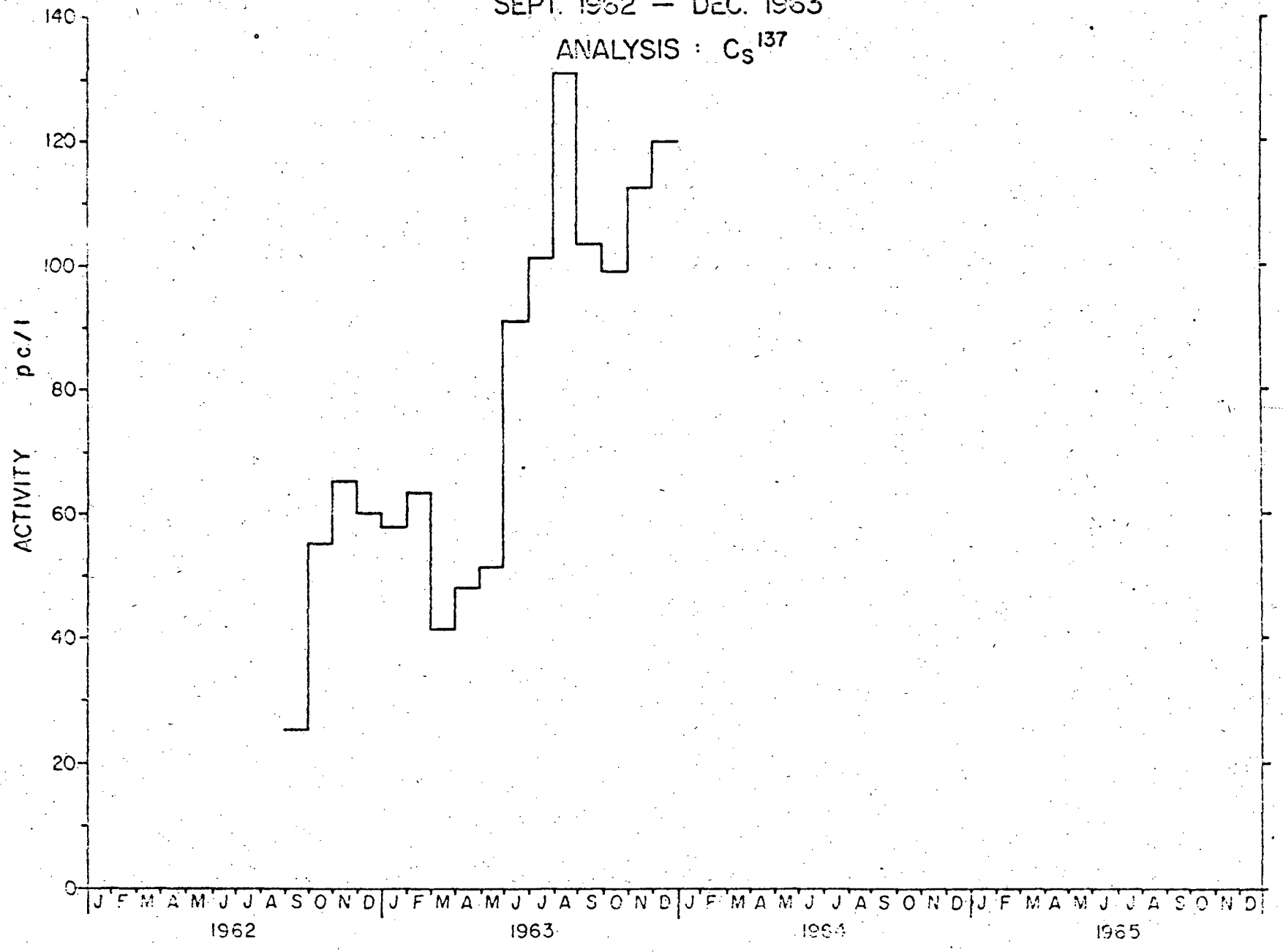

AVERAGE · MONTHLY · RADIOACTIVITY · IN · MILK
ALBANY
JAN. 1962 — DEC. 1963
ANALYSIS : Sr^{90}
ACTIVITY pc/l
35
30
25
20
15
10
5
0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1962
1963
1964
1965

AVERAGE · MONTHLY · RADIOACTIVITY · IN · MILK

ALBANY

SEPT. 1962 — DEC. 1963

ANALYSIS : Cs^{137}



Gamma Background
Total Dose Rates
(ur/hr)

Location	1963 Total	1963 Natural Gamma + Cosmic	1961 Total	1960 Total
Middletown	14.7	10.9	----	11.3
	13.6	10.1	----	10.6
Beacon	14.6	9.7	----	12.3
	14.5	10.7	----	11.5
	13.8	10.5	----	11.0
Poughkeepsie	15.1	12.0	----	11.6
	15.3	----	----	----
	13.9	10.5	----	9.6
	13.9	10.5	----	----
Hudson Falls	13.9	9.2	----	9.4
	13.4	9.2	----	----
Glens Falls	14.2	10.3	----	10.1
	13.4	9.6	----	8.8
	14.2	10.2	----	9.5
Saratoga Springs	13.6	8.0	----	8.7
	15.6	8.2	----	8.8
Amsterdam	14.1	9.5	----	10.2
	13.1	9.6	----	----
	14.2	----	----	11.7
	15.5	9.3	----	11.1
	14.0	9.4	----	----
Johnstown	14.1	9.7	----	----
	13.4	9.7	----	----
Cortland	15.7	----	----	10.5
	14.4	9.9	----	10.3
Ithaca	14.6	----	----	----
	13.6	9.8	----	----
	13.7	10.2	----	----
Elmira	14.2	10.4	8.3	----
	13.8	11.0	9.1	----
	14.1	----	----	----
Waverly	13.7	10.0	8.4	----
	14.6	----	----	----
Corning	13.3	----	----	----
	13.3	----	9.5	----
Bath	13.1	9.8	8.5	----
	13.4	----	----	----
	13.4	----	----	----
Hornell	14.1	10.5	9.9	----
	12.6	----	----	----
Wellsville	12.8	----	----	----
	12.0	----	9.0	----
	12.0	----	9.0	----
	13.0	10.1	----	----

Gamma Background
Total Dose Rates
(ur/hr)

(Cont'd)

Location	1963 Total	1963 Natural Gamma + Cosmic	1961 Total	1960 Total
Olean	13.6	----	9.0	----
	15.7	----	11.5	----
	13.3	9.9	----	----
	13.8	9.4	----	----
Salamanca	12.8	9.5	8.9	----
	13.0	----	8.8	----
Jamestown	13.6	----	9.6	----
	13.6	----	----	----
	13.6	----	----	----
	14.2	10.1	8.7	----
Fredonia	13.0	9.7	9.1	----
	13.5	----	----	----
	13.0	9.5	8.2	----
Medina	12.9	9.3	----	----
	12.8	----	----	----
	12.4	----	----	----
Dansville	12.8	----	9.2	----
	12.8	9.1	8.5	----
	12.3	8.6	7.8	----
Pen Yan	12.5	----	----	----
	14.6	11.5	----	----
Geneva	15.0	11.5	----	----
	14.2	----	----	----
	15.9	10.3	8.8	----
	13.7	10.1	9.2	----
Seneca Falls	12.9	9.5	9.0	----
	13.4	----	----	----
	14.5	11.1	9.0	----
Auburn	12.8	----	----	----
	12.8	8.8	9.0	----
	12.6	8.8	9.3	----
	12.5	8.1	8.2	----
Fulton	12.6	8.9	----	----
	12.3	8.8	----	----
	13.1	----	----	----
	12.7	----	----	----
Theresa	14.8	11.0	----	----
	15.1	11.7	----	----
Gouverneur	13.6	----	----	----
	13.4	9.4	----	----
Ogdensburg	12.8	----	----	----
	13.5	10.3	----	----
	11.8	----	----	----

Gamma Background
Total Dose Rates
(ur/hr)

(Cont'd)

Location	1963 Total	1963 Natural Gamma + Cosmic	1961 Total	1960 Total
Malone	11.8	----	----	----
	12.5	8.3	----	----
Plattsburg	13.0	----	----	----
	12.8	----	----	----
Saranac Lake	13.2	----	----	----
Typper Lake	14.3	8.8	----	----
Albany	13.4	9.8	----	----
Guilderland	15.9	----	----	----

KEY

pc = picocurie = one millionth of a millionth of a curie.
M^3 = cubic meter or approximately 35.3 cubic ft.
l = liter or approximately 1.1 quart.
Samp. Freq. = Sampling frequency.
D = daily grab sample
W = weekly grab sample
A = weekly composite of daily grab samples
B = bi-weekly composite of daily grab samples
M = monthly grab sample
C = continuous bleed-off analyzed weekly