State of New York
Department of Health
Albany, New York

July 6, 1965

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: DOCTOR THOMPSON

SUBJECT: ANNUAL REPORT RADIOACTIVITY RESULTS - 1964

SUMMARY OF ENVIRONMENTAL RADIOACTIVITY IN NEW YORK STATE 1964

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 1964.

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 other monitoring stations are located to indicate possible changes due to specific nuclear installations, such as reactors and fuel reprocessing plants. Although a majority of the stations have been located for the specific monitoring concept, when there are no significant releases from specific installations the results obtained are indicative of natural background and fallout from bomb testing.

The Test Ban Treaty, involving the United States, Great Britain and Russia, which was initiated 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. The Chinese test at Sinkiang on October 16, 1964, was the only known addition to the atmosphere by above ground testing during the period covered by this report.

In 1964, 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 Dobson (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 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 perviously 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 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 1964 on a weekly collection schedule and one on a daily 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 daily station uses a high volume air sampler (approximately 50 cfm) for the sampling period of 24 hours. The air results (tabulations on page 5) increased in the spring months, 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 five 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 6 for Sr-89 and Sr-90 in

terms of pc/ft^2/day.

The spring-summer increase in fallout results for Sr-90 during 1964, is indicative of the increased stratospheric-tropospheric transport of radionuclides injected into the upper air during previous test series. The increase in Sr-89 in April is a reflection of the same process with the Sinkiang explosion as the source. The Sr-90 ($T_{\frac{1}{2}}$ = 27.7y) would still be detectable from the early testing previous to the treaty. 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

Seventeen 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 chemical separation 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 of 1964. 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). There were no indications of any local contamination of milk with I-131 from sources such as reactors or laboratories. The Sinkiang test caused slight peaks on individual samples for I-131 but did not cause averages to exceed the limit of sensitivity.

The Cs-137 in milk decreased from a spring maximum in April to a value of approximately one half of the maximum at the end of the year. This reduction can be explained on the basis of over-all decreases of Cs-137 in the environment of the cow by dilution, washing out from the soil, chemical binding in the soil and possibly the selective exclusion by the plants because of a more easily available chemical.

The Sr-90 exhibits the spring interchange increase but remains fairly constant during the entire year. Sr-89 decreased to less than detectable values (<3 pc/l) after starting the year at less than significant values (3.0 to 6.5 pc/l).

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; therefore, the following intakes over the period of a 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

There were twenty-six water sampling stations. The frequency of collection varied from continuous sampling with a weekly analysis of the composite to a monthly grab sample with individual analyses. The analyses at these stations included gross beta, I-131, Cs-137, and Ba-La-140. The results did not show a distinct seasonal trend, as did some other vectors. This can be explained by environmental factors such as increased stream flows causing scouring of bottom deposits, possible reconcentration of radionuclides in living organisms and then a "sloughing off" of the organisms and possible change in settling rates due to variations in temperature. There was, however, a slight peak in February, March, and April which could have been caused by the spring interchange at the tropospheric-stratospheric interface.

Individual gross beta analysis were evaluated and when exceeding 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 only indicative of the fact that both radionuclides were present, on the average, in less than detectable amounts for the sensitivity of the analytical procedure used.

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) seem to be decreasing in concentration in the general environment, so that a decrease is noted in milk. The stratospheric-tropospheric interchange with seasons is clearly indicated in fallout. The levels of Radioactivity in 1964 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 peacetime operations.

Air

Gross Beta - pc/M^3

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Samp. Freq.
Albany	Avg	<1	<1	1.2	1.4	2.4	1.9	1.2	1.2	1.1	1.5	<1	<1	D
	Max	1	1	2	3	5	4	3	2	2	2	2	1	
	Min	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Ithaca	Avg	1	<1	1.5	2	2.3	1.5#	<1	<1	<1	<1	<1	<1#	W
	Max	1	1	2	2	3	2	1	1	1	1	1	<1	
	Min	1	<1	1	2	1	1	<1	<1	<1	<1	<1	<1	
Pawling	Avg	1	1.5	1.5	1.7	3.0#	2.7	2#	*	*	<1#	<1	<1	W
	Max	1	2	2	2	3.0	3	2	*	*	<1	<1	<1	
	Min	1	1	1	1	3.0	2	2	*	*	<1	<1	<1	
Peekskill	Avg	1	1.3	1.6	1.8	2.5	1.5#	1.5	1.0	<1	<1	1	<1	W
	Max	1	2	2	2	3	2	3	1	1	2	2	<1	
	Min	1	1	1	1	2	1	1	1	<1	<1	<1	<1	
Tuxedo	Avg	1	2	1.5	1.6	3	2#	1.5	1.3	<1#	<1	<1	<1	W
	Max	1	3	2	2	4	2	2	2	<1	1	<1	<1	
	Min	1	1	1	1	2	2	1	1	<1	<1	<1	<1	
Yorkshire	Avg	*	*	*	*	*	*	*	*	*	*	<1#	<1	W
	Max	*	*	*	*	*	*	*	*	*	*	<1	<1	
	Min	*	*	*	*	*	*	*	*	*	*	<1	<1	

\# Partial Schedule of Samples
* No Samples Collected

Fallout

pc/ft²/day

tation		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Samp. Freq.
Strontium-89														
bany	Avg	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	W
	Max	<3	<3	4	<3	3	<3	5	<3	<3	4	<3	<3	
	Min	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
thaca	Avg	<3	3.4	<3	4	<3	4	<3	<3	<3	<3	<3	<3	W
	Max	<3	4	4	4	<3	9	<3	<3	<3	<3	<3	<3	
	Min	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
eekskill	Avg	<3	<3	<3	4.5	<3	<3	<3	<3	<3	<3	<3	<3	W
	Max	3	4	<3	10	<3	4	<3	4	<3	<3	3	4	
	Min	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
yracuse	Avg	<3	3.1	<3	5.3	<3	<3	4.2	3.5	<3	<3	<3	<3	W
	Max	7	8	<3	9	3	<3	7	7	5	<3	<3	<3	
	Min	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
enter	Avg	*	*	*	*	*	*	*	<3	3#	*	<3	<3#	B
oriches	Max	*	*	*	*	*	*	*	<3	3	*	<3	<3	
	Min	*	*	*	*	*	*	*	<3	3	*	<3	<3	
Strontium-90														
Albany	Avg	<3	<3	6.6	7.1	<3	3.8	6.2	5.4	<3	<3	<3	<3	W
	Max	<3	4	13	11	4	5	11	17	4	<3	3	<3	
	Min	<3	<3	<3	5	<3	<3	<	<3	<3	<3	<3	<3	
Ithaca	Avg	<3	<3	4.8	4	5.5	5.3	6.5	<3	<3	<3	4.8	<3	W
	Max	5	5	5	4	6	8	9	<3	3	<3	8	<3	
	Min	<3	<3	4	5	5	4	4	<3	<3	<3	<3	<3	
Peekskill	Avg	3.2	3.0	4.3	6.5	8.4	<3	<3	<3	3.4	<3	<3	<3	W
	Max	5	5	12	15	28	<3	5	4	9	<3	<3	<3	
	Min	<3	<3	<3	3	<3	<3	<3	<3	<3	<3	<3	<3	
yracuse	Avg	<3	<3	5.6	8.5	<3	3.2	<3	3.1	3.0	<3	<3	<3	W
	Max	5	3	13	9	4	7	4	8	6	<3	5	4	
	Min	<3	<3	<3	8	<3	<3	<3	<3	<3	<3	<3	<3	
nter	Avg	*	*	*	*	*		*	<3	<3	*	<3	<3#	B
oriches	Max	*	*	*	*	*	*	*	<3	<3	*	<3	5	
	Min	*	*	*	*	*	*	*	<3	<3	*	<3	<3	

Milk

Concentration - pc/l

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Samp Freq.
Iodine-131														
Albany	Avg	All	are	less	than	20								A
	Max	<20	<20	<20	<20	<20	<20	<20	<20	<20	40	<20	<20	&
	Min	All	are	less	than	20								D
Bedford		All	are	less	than	20								M
Buffalo	Avg	All	are	less	than	20								A
	Max	All	are	less	than	20								
	Min	All	are	less	than	20								
Clarkstown		All	are	less	than	20								M
Newburgh	Avg	All	are	less	than	20								A
	Max	All	are	less	than	20								
	Min	All	are	less	than	20								
NY City	Avg	All	are	less	than	20								A
	Max	All	are	less	than	20								
	Min	All	are	less	than	20								
Massena	Avg	All	are	less	than	20								A
	Max	All	are	less	than	20								
	Min	All	are	less	than	20								
Mt. Pleasant		All	are	less	than	20								M
Middleburg	Avg	All	are	less	than	20								A
	Max	All	are	less	than	20								
	Min	All	are	less	than	20								
Oyster Bay		All	are	less	than	20								M
Syracuse	Avg	All	are	less	than	20								A
	Max	All	are	less	than	20								
	Min	All	are	less	than	20								
Yorktown		All	are	less	than	20								M

Milk

Concentration - pc/l

Cont'd.

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Sample From
							Cs-137							
Albany	Avg	125	125	126	125	116	86	78	68	53	62	61	62	A
	Max	155	149	171	151	182	103	100	92	72	94	77	67	&
	Min	100	106	99	69	67	68	55	44	41	38	50	55	D
Bedford		180	110	126	172	110	144	115	50	53	63	61	43	M
Buffalo	Avg	103	92	105	112	112	105	84	61	54	56	58	91	A
	Max	125	95	114	133	118	124	95	66	62	65	65	126	
	Min	82	88	94	94	105	96	80	56	47	49	49	71	
Clarkstown		*	*	92	*	77	119	62	43	*	33	36	37	M
Newburgh	Avg	129	135	135	134	123	111	98	79	65	65	70	63	A
	Max	141	149	130	17	136	124	110	95	71	72	90	74	
	Min	117	106	117	117	103	100	86	71	57	60	54	47	
NY City	Avg	133	131	134	125	117	132	111	91	62	61	70	78	A
	Max	142	135	142	142	139	136	112	98	75	65	73	82	
	Min	122	124	134	103	82	127	107	87	52	57	67	73	
Massena	Avg	204	208	226	184	208	193	165	120	89	88	109	100	B
	Max	211	211	228	194	221	207	209	140	104	91	110	110	
	Min	197	204	223	178	195	179	121	100	73	85	108	90	
Mt. Pleasant		143	122	108	102	75	106	83	*	59	66	45	47	M
Middleburg	Avg	122	126	114	133	118	78	86	69	55	55	56	63	A
	Max	146	130	122	133	125	84	98	74	69	71	60	64	
	Min	94	119	105	132	109	71	75	57	43	46	48	61	
Oyster Bay		148	125	161	160	139	143	142	110	106	108	106	112	M
Syracuse	Avg	123	121	122	111	105	94	71#	60	58	67	54	66	A
	Max	135	132	131	133	121	104	71	70	70	77	56	63	
	Min	103	102	111	102	89	80	71	51	44	57	53	56	
Yorktown		121	125	159	127	107	153	89	65	50	73	51	52	M
Alfred		*	*	*	140	*	*	125	*	*	*	*	*	M
West Otto		*	*	*	116	*	*	109	*	*	*	*	*	M
West Henrietta		187	*	*	248	*	*	*	*	*	107	*	*	M
Mt. Sinai		118	*	*	118	*	*	102	*	*	93	*	*	M
Fairbank		106	*	*	84	*	*	89	*	*	80	*	*	M

Milk

Concentration - pc/l

Cont'd.

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Sam Fre
						Ba-La-140								
Albany	Avg	All	are	less	than	20								A
	Max	<20	<20	<20	<20	<20	<20	<20	<20	<20	72	37	28	&
	Min	All	are	less	than	20								D
Bedford		All	are	less	than	20								M
Buffalo	Avg	All	are	less	than	20								A
	Max	All	are	less	than	20								
	Min	All	are	less	than	20								
Clarkstown		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	23	<20	M
Newburgh	Avg	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	20	<20	A
	Max	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	53	<20	
	Min	All	are	less	than	20								
NY City	Avg	All	are	less	than	20								A
	Max	All	are	less	than	20								
	Min	All	are	less	than	20								
Massena	Avg	All	are	less	than	20								A
	Max	All	are	less	than	20								
	Min	All	are	less	than	20								
Mt. Pleasant		All	are	less	than	20								M
Middleburg	Avg	All	are	less	than	20								A
	Max	All	are	less	than	20								
	Min	All	are	less	than	20								
Oyster Bay		All	are	less	than	20								M
Syracuse	Avg	All	are	less	than	20								A
	Max	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	22	
	Min	All	are	less	than	20								
Yorktown		All	are	less	than	20								M

Milk

Concentration - pc/l

Cont'd.

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Samp. Freq.
Strontium-89														
Albany	Avg	4.9	4.3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	A
	Max	9	5	4	<3	5	<3	3	4	<3	5	5	<3	&
	Min	<3	3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	D
Bedford		8	4	<3	<3	13	<3	<3	<3	<3	<3	<3	<3	M
Buffalo	Avg	5.9	3.1	<3	3	<3	3.6	<3	<3	<3	<3	<3	3	A
	Max	9	5	3	6	<3	6	<3	<3	<3	3	<3	6	
	Min	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
Clarkstown		*	<3	*	*	<3	3	<3	<3	*	<3	<3	<3	M
Newburgh	Avg	6.6	5.3	6	3.5	4.6	4.1	<3	<3	6	<3	<3	3.1	A
	Max	11	9	13	7	8	12	<3	7	15	<3	3	8	
	Min	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
NY City	Avg	6	3.6	3.1	3.8	<3	<3	<3	<3	5.6	<3	<3	<3	A
	Max	8	10	7	6	<3	<3	<3	3	9	4	3	4	
	Min	4	<3	<3	<3	4	4	<3	<3	<3	<3	<3	<3	
Massena	Avg	4	5.2	9.7	7.8	3.8	<3	<3	<3	<3	5	5	<3	B
	Max	5	9	18	13	6	<3	5	4	<3	5	5	<3	
	Min	3	<3	<3	<3	<3	<3	<3	<3	<3	4	5	<3	
Mt. Pleasant		5	<3	<3	<3	3	6	<3	*	<3	<3	<3	<3	M
Middleburg	Avg	6.2	<3	5.2	6.3	3.3	<3	<3	<3	<3	<3	<3	<3	A
	Max	7	3	12	7	10	3	6	4	<3	3	4	<3	
	Min	5	<3	<3	5	<3	<3	<3	<3	<3	<3	<3	<3	
Oyster Bay		4	<3	<3	<3	<3	6	<3	<3	<3	19	<3	<3	M
Syracuse	Avg	5.7	<3	3.8	<3	3.2	<3	5.1	<3	<3	<3	<3	<3	A
	Max	15	3	6	8	6	5	8	<3	<3	3	<3	<3	
	Min	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
Yorktown		5	3	4	3	<3	*	<3	<3	3	<3	<3	<3	M
Ashford		*	*	*	4.7	*	*	<3	*	*	*	*	*	M
East Otto		*	*	*	5.5	*	*	3.3	*	*	*	*	*	M
Jenter Moriches		19	*	*	*	*	*	*	*	*	<3	*	*	M
Mt. Sinai		4	*	*	*	*	*	*	*	*	*	*	*	M
Raphank		7	*	4	<3	*	*	<3	*	*	*	*	*	M

Milk

Concentration - pc/l

Cont'd.

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Samp Freq
Strontium-90														
Albany	Avg	19	17	20	19	21	20	20	14	14	10	14	14	A
	Max	25	19	22	22	22	23	28	15	15	10	17	15	&
	Min	16	13	17	15	19	18	17	13	12	10	11	12	D
Bedford		25	17	24	31	28	41	26	10	18	20	18	16	M
Buffalo	Avg	13.6	10.3	16.2	14	23	20	17	13	12	11	12	14	A
	Max	17	16	19	19	26	22	19	15	13	13	14	15	
	Min	10	4	14	10	20	19	13	11	11	9	10	11	
Clarkstown		*	11	*	*	12	13	21	10	*	10	8	9	M
Newburgh	Avg	23	16	19	20	23	26	23	18	13	13	17	14	A
	Max	37	21	22	22	27	38	26	22	17	17	22	17	
	Min	17	12	16	15	17	21	20	17	8	8	11	8	
NY City	Avg	25	21	25	23	25	34	28	19	16	18	21	20	A
	Max	28	26	29	27	35	37	30	24	19	21	23	22	
	Min	22	17	21	19	1[illegible]	26	25	14	14	17	19	18	
Massena	Avg	28	32	27	31	26	40	21	17	15	16	16	18	B
	Max	32	34	29	36	31	45	21	20	16	17	17	23	
	Min	24	30	25	27	20	34	21	16	14	16	16	12	
Mt. Pleasant		10	15	14	11	11	14	15	*	13	10	11	28	M
Middleburg	Avg	17	19	18	17	27	35	21	18	16	15	20	16	A
	Max	21	24	23	20	36	42	26	22	18	17	26	20	
	Min	8	10	13	15	15	28	17	15	14	14	15	15	
Oyster Bay		22	21	20	25	14	18	32	23	16	19	18	17	M
Syracuse	Avg	19	21	18	15	22	21	14	13	13	16	13	16	A
	Max	23	27	22	19	37	23	15	14	13	16	13	17	
	Min	13	16	11	9	14	18	13	12	13	16	13	15	
Yorktown		22	16	10	18	26	34	16	19	13	16	18	26	M
Ashford		*	*	*	23	*	*	25	*	*	*	*	*	M
East Otto		*	*	*	17	*	*	29	*	*	*	*	*	M
Center Moriches		38	*	*	*	*	*	*	*	*	38	*	*	M
Mt. Sinai		16	*	*	*	*	*	*	*	*	*	*	*	M
Yaphank		12	*	10	17	*	*	20	*	*	*	*	*	M

Water

Concentration - pc/l

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Samp. Freq.
Gross Beta														
Akron (Murder Ck.)	Avg	16	12.5	14.5	10	12	13	12	12	10	8	10	16	B
	Max	20	13	16	11	13	14	13	15	11	9	10	12	
	Min	12	12	13	10	11	12	12	10	10	7	9	8	
Bedford (Byram L.)		9	3	23	15	15	10	4	10	9	10	13	8	M
Clarkstown (Congers L.)		22	15	25	56	26	28	22	15	15	*	*	*	M
Clarkstown (Lake DeForest)		18	20	13	21	12	10	12	8	*	*	8	6	M
Cohoes (Mohawk R.- Raw)	Avg	9.1	9	11.3	*	*	8	6	8	8	8	7	6	C
	Max	14	10	15	*	*	11	9	8	8	9	9	8	
	Min	<3	7	8	*	*	5	2	8	8	7	5	5	
Glenmont (Hudson R.)	Avg	9	8.5	11	12	7	8	8	9	8	6	8	6	A
	Max	12	12	18	16	11	9	11	10	9	9	10	7	
	Min	6	6	6	5	4	5	6	8	6	1	6	6	
Haverstraw (Letchworth V. Res.)		8	5	7	7	5	5	6	6	5	*	2	6	M
Highland Falls (Bog Meadow Brook)		6	<3	11	5	12	<20	5	*	4	*	5	6	M
Niagara Falls (East Branch)		6	*	11	16	*	9	*	7	9	*	4	*	M
Niagara Falls (West Branch)		8	*	8	11	*	7	*	8	7	*	3	*	M
Ossining (Hudson R.)	Avg	58	55	20	15	28	36	52	57	63	68	60	60	A
	Max	105	109	26	23	68	47	57	64	69	86	83	55	
	Min	31	33	10	2	6	29	48	51	54	52	50	74	
Ossining (Indian Br. Res.)		13	16	15	20	13	7	17	4	12	7	6	7	M
Oswego (Lake Ontario)	Avg	6.2	10	6.7	7	6	6	*	4	7	7	5	5	W
	Max	14	14	9	8	6	7	*	5	7	7	5	7	
	Min	3	6	5	6	5	5	*	4	7	7	5	4	

Water

Concentration - pc/l

Cont'd.

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Samp. Freq.
						Gross Beta							
Pawling (Pond at United Nuclear)	7	16	20	6	12	8	4	8	8	3	5	*	M
Peekskill (Camp Field Res.)	9	13	16	19	8	10	10	12	6	5	4	7	M
Peekskill Avg	24	11	12	18	8	20	33	32	42	39	57	45	C
(Hudson R.) Max	31	32	20	45	12	29	40	41	52	48	88	58	
Min	15	<6	7	7	5	15	22	23	36	32	24	30	
Ramapo (Hillburn Water)	9	5	3	12	6	3	7	4	5	4	5	5	M
Rome Avg	10	7.5	13	15	14	6	8	8	8	5	6	7	B
(Fish Ck.) Max	11	8	15	17	16	7	9	10	9	5	6	8	
Min	9	7	11	12	12	6	8	6	6	5	5	6	
Schenectady Avg	6.8	5	10.6	12	8	7	8.8	8	7.8	7.2	6.2	5.8	C
(Mohawk R.- Max	11	7	14	14	10	10	10	9	9	8	7	7	
G.E.) Min	<3	3	7	10	7	3	6	7	7	6	4	5	
Tuxedo (Indian Kill)	7	<3	7	13	7	9	*	11	10	11	10	11	M
Waterford Avg	13.3	13	23	6	7	4.8	9.6	8	7	5.5	5.4	4.6	A
(Hudson R.) Max	22	16	55	9	10	9	11	9	8	6	6	6	
Min	7	10	16	1	3	1	8	6	6	5	3	3	
Watertown Avg	27	12	14	14	9	10	6	10	8	6	8	8	B
(Black R.) Max	36	12	15	16	10	11	8	10	9	7	8	8	
Min	18	12	13	12	8	10	3	8	7	6	7	7	
Watervliet Avg	18	11	12	5	6	6	9	5	5	7	4	6	A
(French Max	35	13	15	9	7	7	9	6	5	9	5	6	
Mills Res.) Min	9	10	8	<3	5	4	9	4	5	5	4	5	
Yorktown (Croton Res.)	<3	3	14	21	19	10	13	9	9	9	8	6	M

WATER

Concentrations in pc/l

Location		Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Samp. Freq.
Strontium-90														
Albany	Avg	<3	<3	4.1	<3	<3	<3	<3	4	<3	<3	4	<3	W
	Max	5	4	8	4	4	<3	4	4	<3	<3	4	<3	
	Min	<3	<3	<3	<3	<3	<3	<3	3	<3	<3	3	<3	
Cohoes	Avg	5.6	<3	<3	<3	4.7	<3	*	<3	<3	<3	<3	3.7	C
	Max	7	3	3	3	9	4	*	<3	<3	<3	3	6	
	Min	<3	<3	<3	<3	3	<3	*	<3	<3	<3	<3	<3	
Geneva	Avg	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	B
	Max	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
	Min	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
NY City	Avg	<3	<3	4.5	<3	<3	<3	3.2	<3	<3	<3	<3	<3	W
	Max	5	4	4	4	3	3	5	<3	<3	<3	3	<3	
	Min	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
Ashford (Buttermilk Ck.)		*	*	*	*	*	*	*	*	*	<3	<3	6	M
Ashford (Buttermilk & Frank's Creeks)		*	*	*	*	*	*	<3	*	*	<3	<3	<3	M
Ashford (Cattaraugus Ck)		*	*	*	*	*	*	*	*	*	<3	<3	<3	M
Ashford (West Valley Res.)		*	*	*	*	<3	*	*	*	*	*	<3	<3	M
East Otto (Cattaraugus Ck)		*	*	*	*	*	*	*	*	*	<3	<3	*	M
East Otto (Connoisarauley Creek)		*	*	*	*	*	*	*	*	<3	6	<3	<3	M
East Otto (East Otto Ck.)		*	*	*	*	*	*	*	*	*	6	<3	*	M
Ellicottville		*	*	*	*	*	*	*	*	<3	<3	<3	<3	M
Franklinville		*	*	*	*	<3	*	*	*	<3	6	<3	<3	M

WATER

Concentrations in pc/l

Location		Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Sample Freq
Strontium-89														
Albany	Avg	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	W
	Max	<3	3	3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
	Min	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
Albion	Avg	<3	<3	<3	<3	<3	<3	*	<3	<3	3.8	<3	<3	C
	Max	5	5	<3	4	<3	4	*	<3	<3	5	3	<3	
	Min	<3	<3	<3	<3	<3	<3	*	<3	<3	<3	<3	<3	
Geneva	Avg	<3	<3	<3	<3	<3	<3	<3	<3	<3	3.7	<3	<3	B
	Max	<3	<3	<3	<3	<3	<3	<3	<3	<3	6	<3	<3	
	Min	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
NY City	Avg	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	W
	Max	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
	Min	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
Ashford (Buttermilk Ck.)		*	*	*	*	*	*	*	*	*	<3	<3	<3	M
Ashford (Buttermilk & Frank's Creeks)		*	*	*	*	*	*	<3	*	*	<3	<3	<3	M
Ashford (Cattaraugus Ck.)		*	*	*	*	*	*	*	*	*	<3	<3	<3	M
Ashford (West Valley Res.)		*	*	*	*	<3	*	*	*	*	*	<3	<3	M
East Otto (Cattaraugus Ck.)		*	*	*	*	*	*	*	*	*	<3	<3	*	M
East Otto (Connoisarauley Creek)		*	*	*	*	*	*	*	*	<3	<3	<3	<3	M
East Otto (East Otto Ck.)		*	*	*	*	*	*	*	*	*	<3	<3	*	M
Ellicottville		*	*	*	*	*	*	*	*	<3	<3	<3	<3	M
Franklinville		*	*	*	*	3	*	*	*	<3	<3	<3	<3	M

Water

Concentration - pc/l

Location	Month	Isotope	Avg	Max	Min
Clermont (Hudson River)	December	(I-131)	<20	23	<20
Geneva (Seneca Lake)	November	(Ba-La-140)	34	58	<20
Tuxedo (Indian Kill)	November	(Ba-La-140)	<20	24	<20
Stony Point (Iona Island)	July	(Cs-137)	30	30	30
Stony Point (Iona Island)	October	(Cs-137)	66	66	66
		(Ba-La-140)	73	73	73
Peekskill (Hudson River)	October	(I-131)	<20	25	<20
Ashford (Buttermilk & Frank's Creeks)	November	(I-131)	27	27	27
East Otto (Connoisarauley Creek)	December	(Ba-La-140)	28	28	28

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 except those listed above.

KEY

pc = picocurie = one millionth of a millionth of a curie.
M³ = 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.

Averages at Sampling Points
1964

Air Samples - pc/M^3 - Gross Beta

Albany	1.3
Ithaca	<1.0
Pebling	1.6
Peekskill	1.3
Tuxedo	1.3
Yorkshire	<1.0

Milk Samples - pc/l

	I-131	Cs-137	Ba-La-140	Sr-90	Sr-89
Albany	<20	91	<20	16.8	<3
Bedford	<20	102	<20	22.8	3.2
Buffalo	<20	80	<20	14.6	<3
Clarkstown	<20	62	<20	11.7	<3
Newburgh	<20	100	<20	18.7	3.8
New York City	<20	104	<20	22.9	<3
Massena	<20	158	<20	23.9	4.0
Mt. Pleasant	<20	87	<20	13.8	<3
Middleburg	<20	90	<20	19.9	<3
Oyster Bay	<20	130	<20	20.4	3.4
Syracuse	<20	88	<20	16.8	<3
Yorktown	<20	98	<20	20	<3
Ashford	<20	132	<20	24#	3.1#
East Otto	<20	112	<20	23	4.4
Center Moriches	<20	180	<20	38#	10#
Mt. Sinai	<20	108	<20	16#	4#
Yaphank	<20	90	<20	15	3.6

Fallout Samples - pc/ft^2/day

	Sr-89	Sr-90
Albany	1.6	3.5
Ithaca	2.4	3.1
Peekskill	2.1	3.3
Syracuse	2.6	3.2
Center Moriches	4.1	2.0#

Averages at Sampling Points
1964

Cont'd.

Water - pc/l

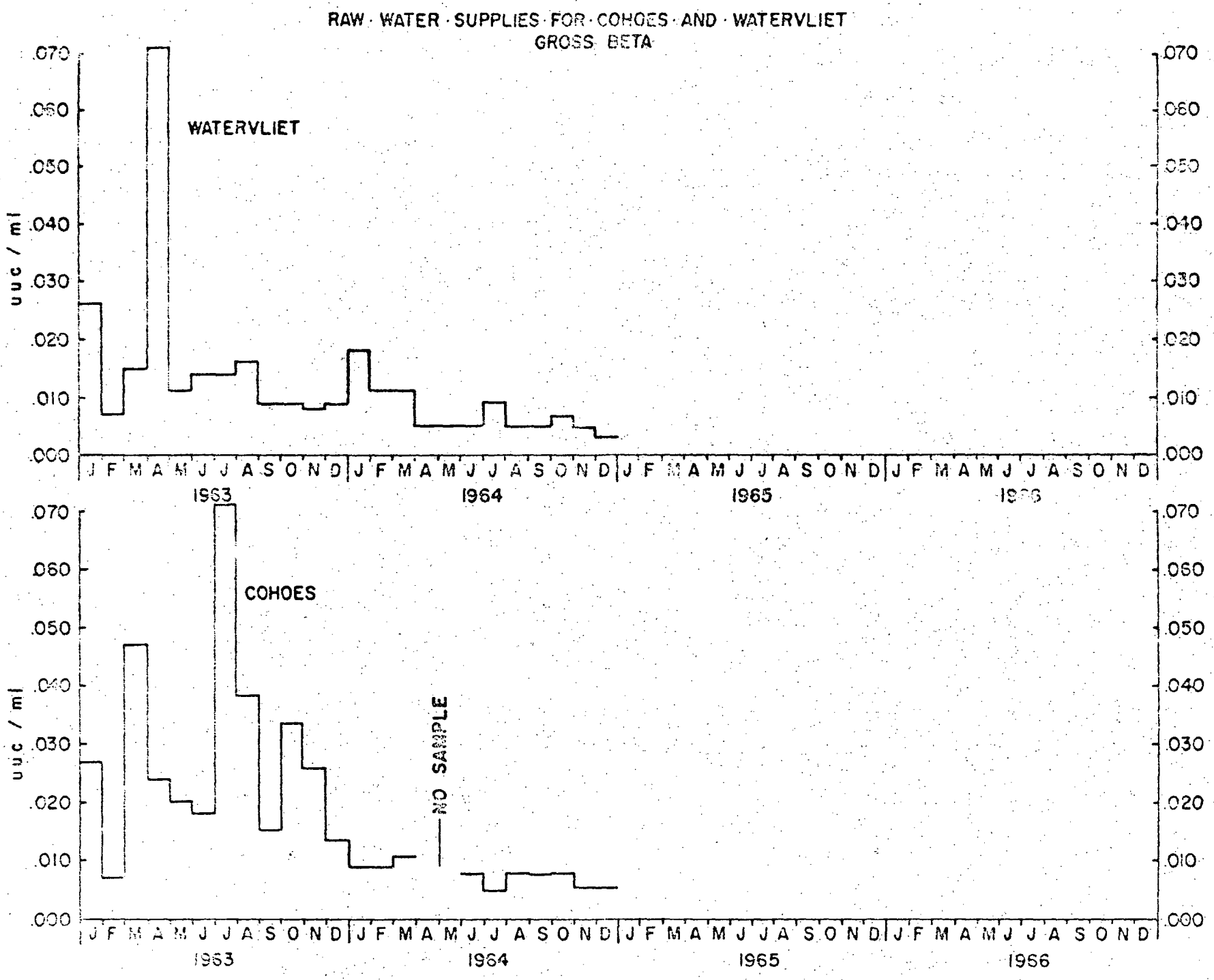
	Gross Beta
Akron	12.1
Rome	14.5
Watertown	11
Glenmont	8.4
Ossining	53.1
Peekskill	28.4
Waterford	8.9
Cohoes	8
Schenectady	7.8
Tuxedo	8.9
Niagara Falls - East Branch	8.8
Niagara Falls - West Branch	7.4
Watervliet	7.8
Bedford	10.8
Peekskill	9.4
Yorktown	10.2
Ossining - Indian Brook	11.5
Clarkstown - Congers Lake	24.9
Clarkstown - Lake De Forest	12.8
Haverstraw	5.6
Ramapo	5.7
Highland Falls	6.6
Oswego	6.4
Pawling	8.8

	Sr-89	Sr-90
Albany (finished)	<3	<3
Cohoes (finished)	<3	<3
Geneva	<3	<3
New York City	<3	<3
Ashford		
(Buttermilk Creek)	<3	3***
(Buttermilk & Frank's Creeks)	<3	<3
(Cattaraugus Creek)	<3	<3
(West Valley Reservoir)	<3	<3
East Otto		
(Cattaraugus Creek)	<3	<3
(Connoisarauley Creek)	<3	3***
(East Otto Creek)	<3	3.7**
Ellicottville	<3	<3
Franklinville	<3	3***

** Only 2 Monthly Samples
*** Only 3 Monthly Samples

1964 Average Results
(All Stations)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Air-(pc/M³)												
Gross Beta	1.0	1.3	1.5	1.7	2.6	1.9	1.3	1.0	<1.0	<1.0	<1.0	<1.0
Fallout-(pc/ft²/day)												
Sr-89	<3	<3	<3	3.8	<3	<3	<3	<3	<3	<3	<3	<3
Sr-90	<3	<3	5.5	6.5	4.2	3.4	3.9	<3	<3	<3	<3	<3
Milk-(pc/l)												
I-131	All	are	less	than	20							
Cs-137	138	129	134	137	115	122	100	74	64	72	65	68
Ba-La-140	All	are	less	than	20							
Sr-90	20.6	18	18.4	20.1	22	26.3	21.8	15.8	14.4	14.4	15.5	17.3
Sr-89	6.5	3	3.6	3.3	3.3	<3	<3	<3	<3	3.4	<3	<3
Water-(pc/l)												
Gross Beta	13.4	11.5	13.1	14.6	11.4	10.5	12.6	11	11.9	12	10.8	11.6
I-131	All	are	less	than	20							
Cs-137	All	are	less	than	20							
Ba-La-140	All	are	less	than	20							
Sr-89	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Sr-90	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3


RAW WATER SUPPLIES FOR COHOES AND WATERVLIET
GROSS BETA
WATERVLIET
COHOES
NO SAMPLE
uuc / ml
.070
.060
.050
.040
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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
1963
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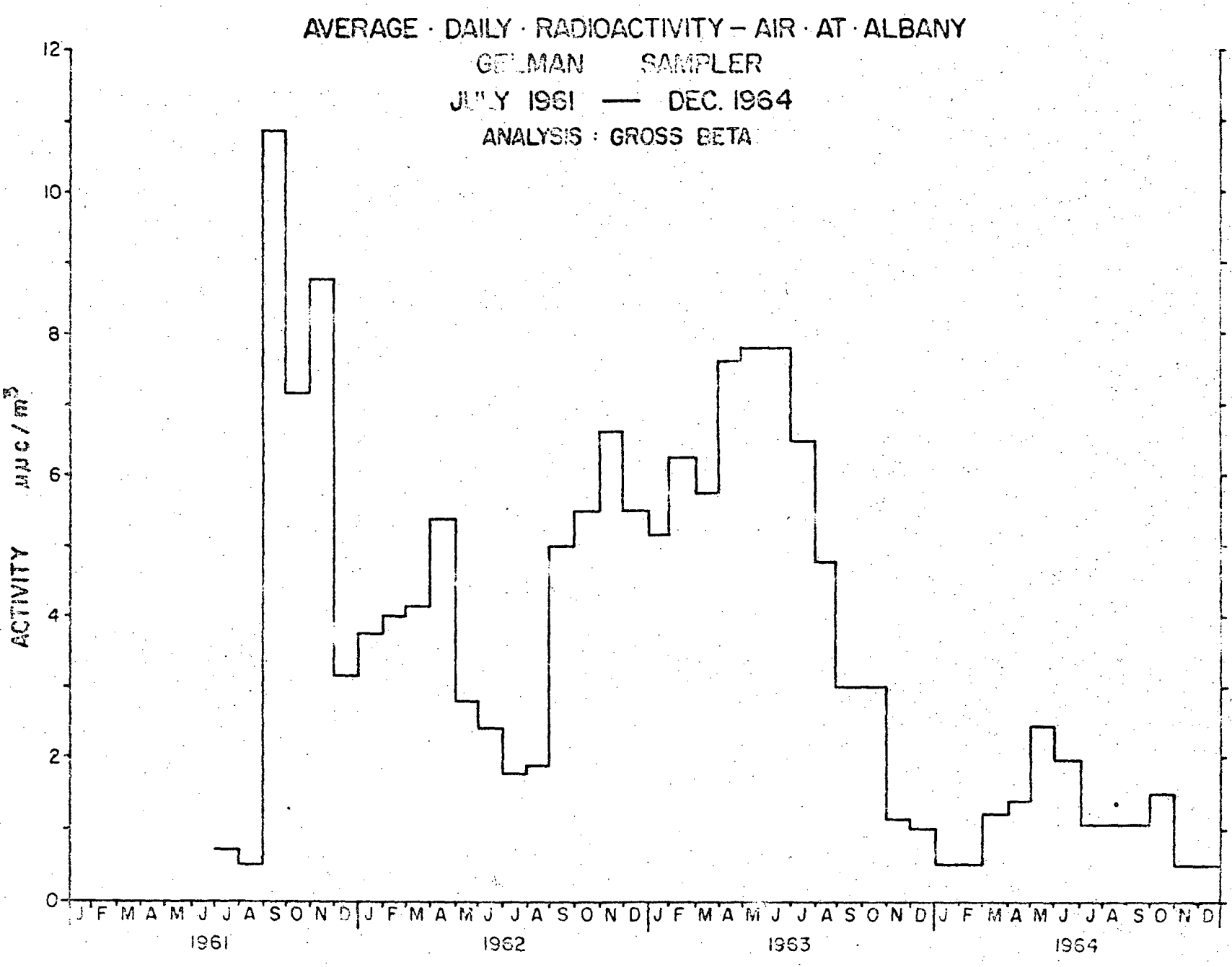
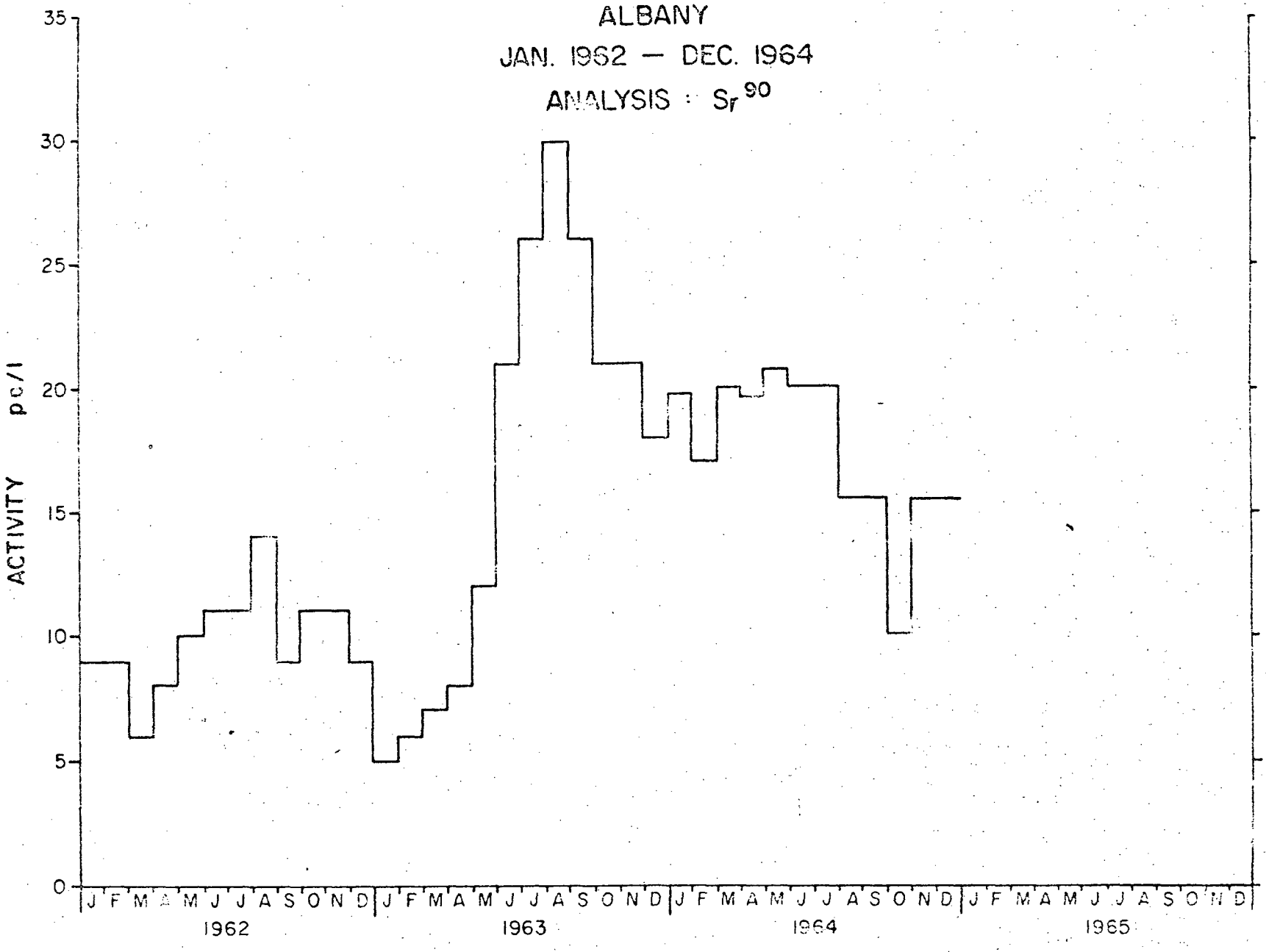

AVERAGE · DAILY · RADIOACTIVITY – AIR · AT · ALBANY
GELMAN SAMPLER
JULY 1961 — DEC. 1964
ANALYSIS : GROSS BETA
ACTIVITY μμc/m³
12
10
8
6
4
2
0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1961
1962
1963
1964

AVERAGE · MONTHLY · RADIOACTIVITY · IN · MILK

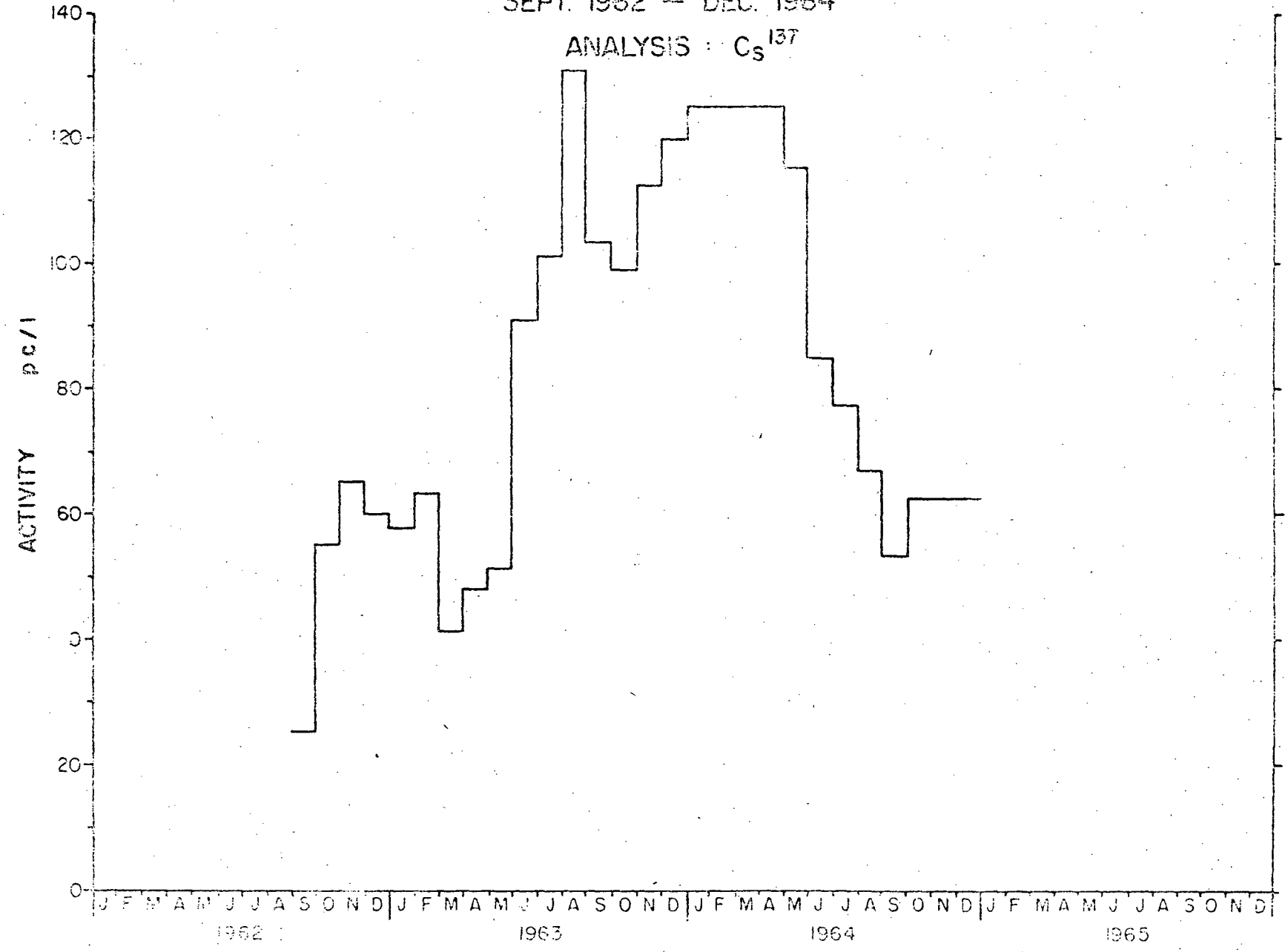


AVERAGE · MONTHLY · RADIOACTIVITY · IN · MILK

ALBANY

SEPT. 1962 — DEC. 1964

ANALYSIS : Cs^{137}



Mr. William F. Nelson
Consolidated Edison Co.
of New York
Buchanan, New York

OCT 1965