RADIOACTIVITY SURVEY DATA in Japan

NUMBER 6

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National Institute of Radiological Sciences

Chiba, Japan

In April 1963, in compliance with directives set forth by the Japan Atomic Energy Commisson, the Division of Radioactivity Survey, National Institute of Radiological Sciences was directed to:

1. Collect, record and maintain information on radiation from National and International sources.
2. Analyze the information collected.
3. Establish a radiation survey information exchange center.

As a part of the assignment, data from the Nationwide Radioactivity Survey Network were assembled and compiled in this publication. Present plans are to issue this type of publication on a quarterly basis.

For further information on any subject reported in this issue, readers are referred to the contributors indicated in the table headings.

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National Institute of Radiological Sciences

Meteorological Data

Monthly and Cumulative Deposition of Strontium-90 and Cesium-137

Part I *(Meteorological Research Institute, Tokyo)*

Since 1954, rain water and fallout dust have been collected monthly in a receiver (collection area, 1 m²) at the Meteorological Research Institute, Tokyo, and the content of strontium-90 and cesium-137 have been determined. The samples, collected monthly (receiver collection area, 0.5 m²) at six stations in Japan, have also been analyzed.

The results of observation during the period from August 1963 to December 1964 are shown in Table 1. Table 2 shows the annual deposition during the period from January 1954 to December 1964. The total cumulative deposition of strontium-90 and cesium-137 reached the levels of 62.6 and 167.9 mCi/km² respectively at the end of December 1964 at the Meteorological Research Institute in Tokyo. Figure 1 shows the monthly deposition of strontium-90.

Table 1. Monthly Deposition of ^{90}Sr and ^{137}Cs —Aug. 1963 to Dec. 1964—

By Y. Miyake, K. Saruhashi, Y. Katsuragi and T. Kanazawa
(Meteorological Research Institute, Tokyo)

Sapporo (Sapporo District Central Meteorological Observatory)
Location: 43°03' E, 141°20' E (16.9 m)
Receiver Collection Area: 0.5 m²

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
^{90}Sr (mCi/km²)	1964	2.24	1.03	0.94	1.47	5.24	2.65	1.13	0.58	0.49	0.79	0.33	0.52
Precipitation (mm)	1964	98.1	119.2	38.0	112.5	69.1	158.5	109.7	152.1	84.4	95.9	93.0	143.5

Akita (Akita District Meteorological Observatory)
Location: 39°43' N, 140°06' E (9.1 m)
Receiver Collection Area: 0.5 m²

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
^{90}Sr (mCi/km²)	1964	2.54	1.59	3.32	2.24	2.60	2.21	2.66	0.43	0.31	1.24	1.29	0.95
Precipitation (mm)	1964	160.0	80.8	118.3	399.4	85.9	70.4	235.2	276.3	196.8	149.6	263.6	125.2

Sendai (Sendai District Central Meteorological Observtory)
Location: 38°16' N, 140°54' E (38.4 m)
Receiver Collection Area: 0.5 m²

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
^{90}Sr (mCi/km²)	1964	0.85	0.51	1.12	1.04	4.50	2.37	1.39	1.05	0.73	1.02	0.28	0.26
Precipitation (mm)	1964	99.5	55.3	53.4	51.2	120.8	148.1	187.3	342.1	324.9	65.4	62.3	37.0

Table 1. Monthly Deposition of ^{90}Sr and ^{137}Cs —Aug. 1963 to Dec. 1964— *(continued)*

Mito (Mito District Meteorological Observatory)
Location : 36°23' N, 140°28' E (29.2 m)
Receiver Collection Area : 0.5 m²

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
^{90}Sr (mCi/km²)	1964									0.34	0.67	0.23	0.16
Precipitation (mm)	1964									113.5	139.5	51.3	49.6

Tokyo (Meteorological Research Institute)
Location : 35°42' N, 139°39' E
Receiver Collection Area : 1 m²

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
^{90}Sr (mCi/km²)	1963								1.89	1.66	1.47	0.23	0.16
	1964	0.80	0.50	0.76	1.58	1.50	1.24	0.53	0.28	0.45	0.63	0.20	0.13
^{137}Cs (mCi/km²)	1963								7.09	5.33	4.28	0.53	0.42
	1964	1.24	1.06	1.50	3.87	2.69	2.58	0.81	0.53	0.57	0.63	0.36	0.29
$^{137}Cs/Sr^{90}$	1963								3.8	3.2	2.9	2.3	2.6
	1964	1.6	2.1	2.0	2.5	1.8	2.1	1.5	1.9	1.3	1.0	1.8	2.2
Precipitation (mm)	1963								416.9	156.5	315.4	79.1	19.7
	1964	130.0	43.5	107.0	95.6	75.7	120.6	46.0	115.3	159.7	131.7	56.3	54.4

Tokyo (Tokyo District Central Meteorological Observatory)
Location : 35°41' N, 139°46' E (4.1 m)
Receiver Collection Area : 0.5 m²

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
^{90}Sr (mCi/m²)	1964	0.82	0.66	1.37	0.94	2.08	1.35	0.34	0.52	0.33	0.64	0.22	0.13
Precipitation (mm)	1964	144.6	64.0	99.7	94.2	80.4	139.9	45.9	110.8	132.4	125.0	49.0	47.5

Osaka (Osaka District Central Meteorological Obseravtory)
Location : 34°39' N, 135°32' E (6.7 m)
Receiver Collection Area : 0.5 m²

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
^{90}Sr (mCi/km²)	1964	0.68	0.56	0.91	2.31	1.06	0.56	0.58	0.11	0.16	0.41	0.18	0.10
Precipitation (mm)	1964	87.2	88.7	79.8	137.4	63.6	134.1	120.7	42.4	104.5	93.5	67.8	15.3

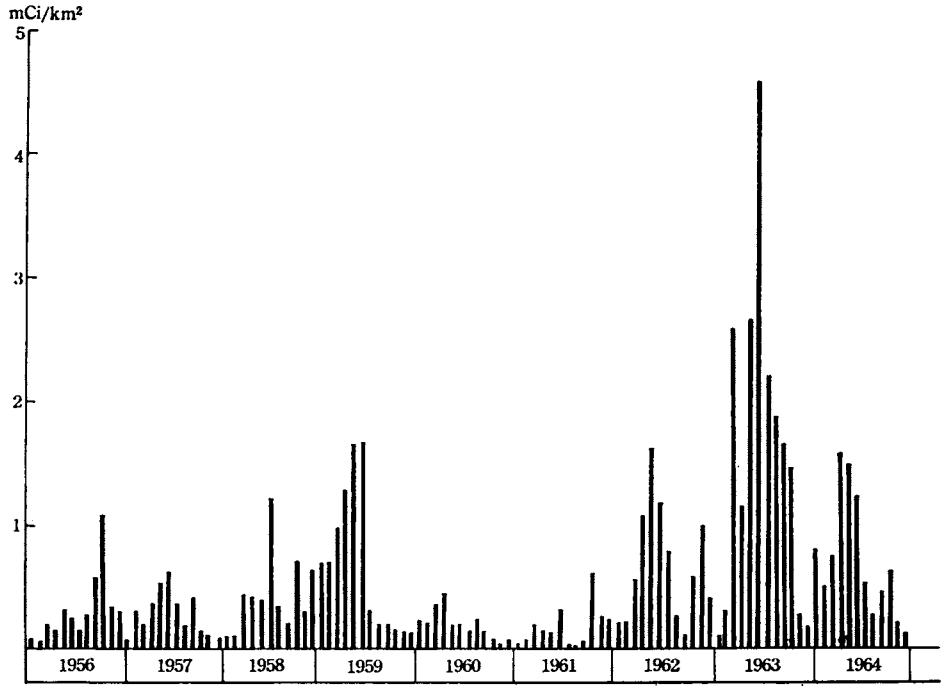
Fukuoka (Fukuoka District Central Meteorological Observatory)
Location : 33°35' N, 130°23' E (2.1 m)
Receiver Collection Area : 0.5 m²

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
^{90}Sr (mCi/km²)	1964	1.07	0.71	1.52	1.17	2.02	0.58	0.24	0.21	0.23	0.36	0.32	0.30
Precipitation (mm)	1964	144.5	62.1	58.4	183.8	138.6	184.4	91.7	131.5	143.4	101.4	106.2	42.9

Table 2. Annual deposition of ^{90}Sr at 6 stations —1954 to 1964—
*Caluculated values with β-artivity
(Unit : mCi/km²)

	Tokyo (Met. Res. Inst.) ^{90}Sr	Tokyo (Met. Res. Inst.) ^{137}Cs	Sapporo ^{90}Sr	Sendai ^{90}Sr	Akita ^{90}Sr	Osaka ^{90}Sr	Fukuoka ^{90}Sr
1954	1.0						
1955	0.7	29.0*					
1956	3.8		23.0*	22.8*	39.7*	15.6*	27.3*
1957	3.4						
1958	5.3	11.4					
1959	8.1	23.6					
1960	2.4	6.2	2.0	2.5	3.1	2.1	2.6
1961	2.1	7.3	2.2	1.9	3.8	1.1	2.8
1962	8.1	21.9	10.6	10.1	14.6	4.4	13.4
1963	19.1	52.3	21.3	17.0	40.3	13.8	20.0
1964	8.6	16.1	17.4	15.1	21.3	7.6	8.7
Total	62.6	167.9	76.5	69.5	122.9	44.5	73.7

Figure 1. Monthly Deposition of ^{90}Sr —Since 1956—
—Meteorological Research Institute in Tokyo—



Part II *(Japan Analytical Chemistry Research Institute)*

Since May 1963, the Japan Analytical Chemistry Research Institute, on commission by the Sciences and Technology Agency, has measured strontium-90 and cesium-137 content monthly, of samples taken from various locations throughout Japan. Sampling and pretreatment for concentration have been carried out by 24 prefectural public health laboratories.

The tray has a collection area of 5,000 cm², and is exposed to rain and dust throughout the month. The depth of water in the tray is kept at 10 mm to prevent dust from being blown away. At the end of each month, water in the tray and water used to wash the tray are combined with

with strontium and cesium carriers, and pass through a column filled with sodium type cation exchange resin (Dowex 50 W-X 8, 50~100 mesh), then the column is sent to the Japan Analytical Chemistry Research Institute. The column used was illustrated in Figure 4, Issue No. 2 of this publication.

After a fraction containing both strontium-90 and cesium-137 is eluted from the resin, radiochemical analysis is carried out using the method recommended by the Science and Technology Agency.

Results obtained during the period April to September 1964 are shown in Table 3.

Table 3. ^{90}Sr and ^{137}Cs in Rain and Dry Fallout —Apr. 1964 to Sept. 1964—

By T. Asari, M. Chiba and M. Kuroda
(Japan Analytical Chemistry Research Institute)

Station	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Apr 1964				
Sapporo, HOKKAIDO	29	115.9	1.78	2.29
Aomori, AOMORI	30	222.6	1.65	0.79
Sendai, MIYAGI	〃	51.2	1.36	2.84
Akita, AKITA	22	393.2	1.81	2.87
Mito, IBARAGI	30	80.5	1.51	1.70
Konan, SAITAMA	〃	69.8	0.96	1.42
Tokyo	〃	94.2	1.52	2.40
Yokohama, KANAGAWA	〃		1.20	1.51
Niigata, NIIGATA	〃	132.2	1.53	2.23
Kanazawa, ISHIKAWA	〃	245.6	1.81	2.12
Fukui, FUKUI	〃	218.2	1.71	3.28
Shizuoka, SHIZUOKA	〃	179.0	1.16	2.12
Nagoya, AICHI	〃	178.6	1.45	2.12
Kyoto, KYOTO	〃	175.3	1.17	2.24
Osaka, OSAKA	29	137.0	1.53	1.27
Kobe, HYOGO	30	155.4	1.47	2.27
Wakayama, WAKAYAMA	〃	112.0	1.17	2.03
Tottori, TOTTORI	〃	100.3	1.31	2.07
Okayama, OKAYAMA	〃	143.8	1.62	1.60
Hiroshima, HIROSHIMA	〃	183.6	0.71	2.26
Kochi, KOCHI	〃	467.0	5.31	8.25
Fukuoka, FUKUOKA	〃		1.50	2.38
Nagasaki, NAGASAKI	〃	271.0	3.16	5.21
Kagoshima, KAGOSHIMA	〃	227.0	2.42	3.57
May 1964				
Sapporo, HOKKAIDO	32	69.1	1.16	1.57
Aomori, AOMORI	31	75.0	1.20	0.23
Sendai, MIYAGI	〃	118.3	4.45	7.69
Akita, AKITA	29	85.5	2.26	3.23
Mito, IBARAGI	31	101.3	3.46	1.27
Konan, SAITAMA	〃	51.1	1.19	1.85
Tokyo	〃	80.4	0.74	1.04
Yokohama KANAGAWA	〃		0.89	1.16
Niigata, NIIGATA	〃	62.3	1.61	2.71
Kanazawa, ISHIKAWA	〃	116.4	1.30	2.47
Fukui, FUKUI	〃	75.8	1.24	2.28
Shizuoka, SHIZUOKA	〃	96.2	0.39	0.56
Nagoya, AICHI	〃	68.4	1.28	1.94
Kyoto, KYOTO	〃	94.8	1.42	2.82
Osaka, OSAKA	〃	53.6	0.63	0.96
Kobe, HYOGO	〃	73.0	1.24	1.73
Wakayama, WAKAYAMA	〃	83.5	1.43	2.23
Tottori, TOTOTRI	〃	76.2	0.89	1.27
Okayama, OKAYAMA	〃	45.1	0.58	0.99
Hiroshima, HIROSHIMA	32	50.6	0.72	1.04
Kochi, KOCHI	31	134.1	1.37	1.15
Fukuoka, FUKUOKA	〃	138.6	1.18	1.80
Nagasaki, NAGASAKI	〃	115.0	1.17	1.00
Kagoshima, KAGOSHIMA	〃	153.6	1.49	2.32

Table 3. ^{90}Sr and ^{137}Cs in Rain and Dry Fallout —Apr. 1964 to Sept. 1964— *(continued)*

Station	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Jun 1964				
Sapporo, HOKKAIDO	30	149.3	1.84	2.54
Aomori AOMORI	〃	92.0	1.13	0.13
Sendai, MIYAGI	〃	148.0	2.23	3.39
Akita, AKITA	〃	70.4	2.47	3.54
Mito, IBARAGI	〃	108.6	1.97	2.56
Konan, SAITAMA	〃	104.1	1.17	3.51
Tokyo	〃	139.9	1.19	1.54
Yokohama, KANAGAWA	〃	156.0	0.73	1.74
Niigata NIIGATA	〃	98.5	1.90	2.30
Kanazawa, ISHIKAWA	〃	238.0	2.55	3.04
Fukui, FUKUI	〃	205.6	2.17	4.20
Shizuoka, SHIZUOKA	〃	509.9	1.91	1.91
Nagoya AICHI	〃	179.4	1.43	1.90
Kyoto, KYOTO	〃	227.8	1.91	2.66
Osaka, OSAKA	〃	86.5	0.75	0.93
Kobe, HYOGO	〃	150.0	0.88	1.57
Wakayama, WAKAYAMA	〃	127.6	1.57	0.89
Tottori, TOTTORI	32	166.2	1.17	1.73
Okayama, OKAYAMA	30	208.2	1.10	1.22
Hiroshima, HIROSHIMA	29	346.8	1.71	2.27
Kochi, KOCHI	30	349.1	2.91	4.35
Fukuoka, FUKUOKA	〃	188.2	1.11	1.60
Nagasaki, NAGASAKI	〃	336.3	1.27	1.96
Kagoshima, KAGOSHIMA	〃	565.5	1.46	1.96
Jul 1964				
Sapporo, SAPPORO	31	80.7	1.09	1.51
Aomori, AOMORI	〃	178.0	1.15	0.37
Sendai, MIYAGI	〃	187.3	1.43	2.10
Akita, AKITA	〃	235.2	2.90	3.53
Mito, IBARAGI	〃	119.5	0.86	0.76
Konan, SAITAMA	33	93.5	0.86	1.00
Tokyo	31	45.9	0.40	0.60
Yokohama, KANAGAWA	〃	77.9	0.18	0.26
Niigata, NIIGATA	〃	351.7	1.45	2.48
Kanazawa, ISHIKAWA	〃	680.5	1.33	0.98
Fukui FUKUI	〃	464.4	1.45	2.64
Shizuoka SHIZUOKA	〃	49.3	0.26	0.37
Nagoya, AICHI	〃	95.2	0.59	0.78
Kyoto, KYOTO	〃	153.5	0.91	1.43
Osaka, OSAKA	〃	120.7	0.44	0.55
Kobe, HYOGO	〃	104.2	0.40	0.62
Wakayama, WAKAYAMA	〃	74.2	0.36	0.51
Tottori, TOTTORI	33	262.8	1.23	1.85
Okayama, OKAYAMA	31	117.1	0.14	0.29
Hiroshima, HIROSHIMA	〃	73.1	0.39	0.52
Kochi, KOCHI	〃	80.5	0.31	0.44
Fukuoka, FUKUOKA	〃	85.0	0.29	0.35
Nagasaki, NAGASAKI	〃	63.0	0.08	0.20
Kagoshima, KAGOSHIMA	〃	150.2	0.26	0.42
Aug 1964				
Sapporo, HOKKAIDO	〃	164.1	0.45	0.66
Aomori, AOMORI	〃	200.9	0.83	0.52
Sendai, MIYAGI	27	272.2	0.42	0.99
Akita, AKITA	31	326.4	0.38	0.42
Mito, IBARAGI	〃	268.1	0.30	0.38
Kumagaya, SAITAMA	28	136.1	0.40	0.44
Tokyo	31	110.8	0.15	0.23
Yokohama, KANAGAWA	〃	103.1	0.24	0.30
Niigata, NIIGATA	〃	142.5	0.41	0.53
Kanazawa, ISHIKAWA	〃	144.0	0.25	0.51
Fukui, FUKUI	33	269.2	0.47	0.87
Shizuoka, SHIZUOKA	31	101.5	0.24	0.29
Nagoya, AICHI	〃	170.2	0.20	0.27
Kyoto, KYOTO	〃	108.7	0.14	0.13
Osaka, OSAKA	〃	42.4	0.13	0.22

Table 3. ^{90}Sr and ^{137}Cs in Rain and Dry Fallout —Apr. 1964 to Sept. 1964— *(continued)*

Station	Duration (days)	Precipitation (mm)	^{90}Sr (mc/km^2)	^{137}Cs (mc/km^2)
Aug 1964				
Kobe, HYOGO	31	15.3	0.12	0.10
Wakayama, WAKAYAMA	〃	37.1	0.13	0.39
Tattori, TOTTORI	28	162.4	0.26	0.31
Okayama, OKAYAMA	31	85.7	0.13	0.19
Hiroshima, HIROSHIMA	〃	96.6	0.14	0.15
Kochi KOCHI	〃	191.3	0.33	0.39
Fukuoka, FUKUOKA	〃	107.8	0.24	0.31
Nagasaki, NAGASAKI	〃	146.0	0.17	0.36
Kagoshima, KAGOSHIMA	〃	298.2	0.29	0.31
September 1964				
Sapporo, HOKKAIDO	30	96.9	0.64	0.75
Aomori, AOMORI	〃	92.0	0.27	0.23
Sendai, MIYAGI	〃	304.2	0.84	1.04
Akita, AKITA	〃	166.8	0.51	0.61
Mito, IBARAGI	〃	162.1	0.50	0.60
Kumagaya, SAITAMA	31	117.8	0.80	0.61
Tokyo	30	132.4	0.34	0.44
Yokohama, KANAGAWA	〃	205.9	0.39	0.65
Niigata, NIIGATA	〃	294.5	0.75	0.99
Kanazawa, ISHIKAWA	〃	375.5	0.41	0.69
Fukui, FUKUI	28	170.6	0.42	0.58
Shizuoka, SHIZUOKA	30	319.7	0.35	0.45
Nagoya, AICHI	〃	185.9	0.28	0.31
Kyoto, KYOTO	〃	144.4	0.21	0.23
Osaka OSAKA	〃	104.5	0.21	0.28
Kobe, HYOGO	〃	145.9	0.22	0.25
Wakayama, WAKAYAMA	〃	92.5	0.62	0.38
Tottori, TOTTORI	31	229.9	0.66	0.87
Okayama OKAYAMA	30	80.6	0.25	0.24
Hiroshima, HIROSHIMA	〃	109.5	0.19	0.29
Kochi, KOCHI	〃	208.3	0.31	0.42
Fukuoka FUKUOKA	〃	119.0	0.16	0.41
Nagasaki, NAGASAKI	〃	107.0	0.13	0.21
Kogoshima, KAGOSHIMA	〃	184.1	0.19	0.32

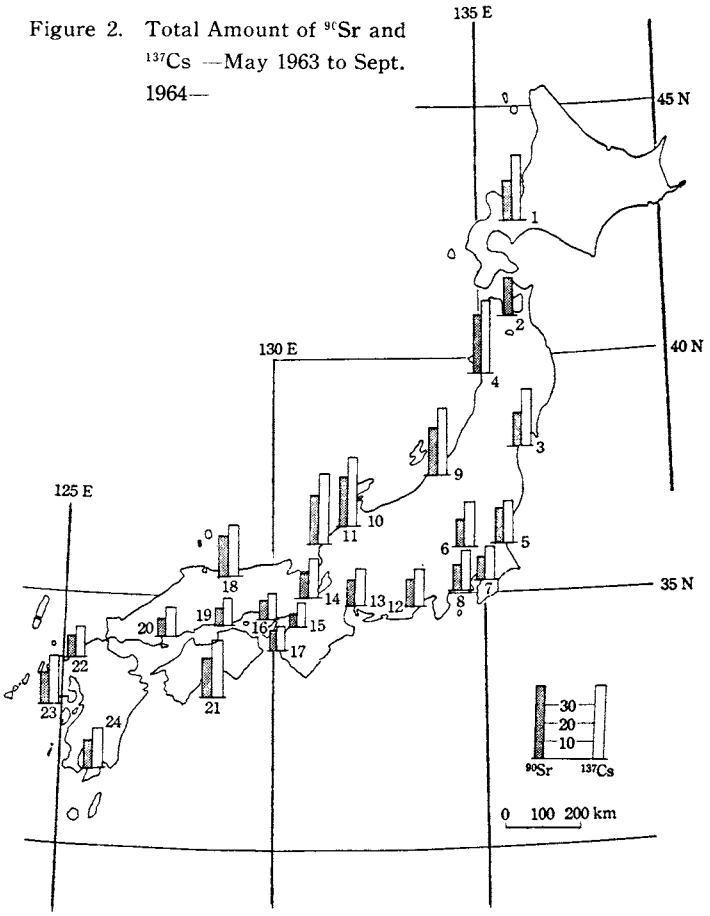
Table 4 shows the monthly mean values of strontium-90 and cesium-137 averaged over the 24 stations during the period April 1964 to September 1964. Figure 2 shows the total amount of strontium-90 and cesium-137 deposits during the period May1963 to September 1964.

Table 4 Monthly Mean Values of 24 Stations —Apr. 1963 to Sept. 1964—

Month	Precipitation (mm)	^{90}Sr (pCi/km^2)	^{137}Cs (pCi/km^2)	$^{137}Cs/^{90}Sr$
Apr 64	179.7	1.70	2.53	1.49
May 64	87.9	1.37	1.87	1.36
Jun 64	206.3	1.59	2.21	1.39
Jul 64	164.3	0.77	1.00	1.30
Aug 64	154.2	0.28	0.39	1.39
Sept 64	172.9	0.40	0.49	1.22

	Station	Sr-90 (pCi/km²)	Cs-137 (pCi/km²)
1	Sapporo	22.3	36.9
2	Aomori	19.5	
3	Sendai	18.1	32.8
4	Akita	30.2	38.1
5	Mito	18.0	21.4
6	Kumagaya	14.7	25.0
7	Tokyo	12.3	18.9
8	Yokohama	15.1	21.4
9	Niigata	25.7	35.5
10	Kanazawa	26.6	36.1
11	Fukui	24.9	38.7
12	Shizuoka	13.8	19.1
13	Nagoya	13.0	20.7
14	Kyoto	14.4	23.0
15	Osaka	8.1	13.8
16	Kobe	10.0	14.4
17	Wakayama	9.7	13.0
18	Tottori	23.1	27.0
19	Okayama	9.2	12.9
20	Hiroshima	10.5	16.6
21	Kochi	22.3	30.7
22	Fukuoka	12.4	17.1
23	Nagasaki	15.5	23.8
24	Kagoshima	14.0	18.9

Figure 2. Total Amount of ^{90}Sr and ^{137}Cs —May 1963 to Sept. 1964—



Strontium-90, Cesium-137 and Cerim-144 in Air

(Japan Analytical Chemistry Research Institute)

The Japan Analytical Chemistry Research Institute has started to analyses of strontium-90, cesium-137 and cerium-144 content in air, on commssion by the Science and Technology Agency, in April 1964.

Samples are collected by the prefectural public health laboratories of Hokkaido, Fukui and Aichi, using a cottrel type dust collector (1,200 liters per hour).

Results obtained during the period April to June. 1964 are shown in Table 5.

Table 5. ^{90}Sr, ^{137}Cs and ^{144}Ce in Air

By T. Asari, M. Chiba and M. Kuroda

(Japan Analytical Chemistry Research Institute)

Location	Duration (days)	Air inhaled (m^3)	Efficiency of cottrel (%)	^{90}Sr (pCi/m^3)	^{137}Cs (pCi/m^3)	^{144}Ce (pCi/m^3)
April 1964						
Sapporo, HOKKAIDO	12	7,800	93	0.058	0.085	0.48
Fukui, FUKUI	12	8,664	96	0.058	0.036	0.24
Nagoya, AICHI	6	2,340	95	0.017	0.026	0.14
May 1964						
Sapporo, HOKKAIDO	13	8,400	93	0.029	0.098	0.50
Fukui, FUKUI	12	8,664	96	0.057	0.080	0.41
Nagoya, AICHI	7	2,430	95	0.023	0.036	0.19
June 1964						
Sapporo, HOKKAIDO	14	7,800	93	0.032	0.046	0.30
Fukui, FUKUI	9	6,498	96	0.038	0.054	0.29
Nagoya, AICHI	7	2,880	95	0.015	0.027	0.14

^{144}Ce : Converted Values as of 15th of each Month

Note:

Analytical Method of Ce-144 in Air

Preparation of Samples for Analyses

Dry the sample at 110°C, then subject it to dry ashing at each prefectural public health laboratories.

Analytical Procedure

1) Dissolve the ash in HCl. Fuse the insoluble material with Na_2CO_3 and dissolve in HNO_3 and H_2O_2.
2) Adjust the pH of the solution to 4.0-4.2 and precipitate the rare earths and the alkaline earth metals as oxalate.
3) Convert the oxalate to ash at 600-700°C and dissolve in HNO_4 and H_2O_2.
4) In order to remove alkaline earth metals add ammonia to the solution. (in the case of analysing Sr-90 use the filtrate obtained here.)
5) Dissolve the hydroxide of rare earths in HNO_3. Oxidize cerium to quadrivalent state with sodium bromate and extract it by methyl isobuthyl ketone.
6) Back-extract cerium into the aqueous layer containing H_2O_2 (cerium being reduced to trivalent state) and pricipitate it as oxalate.
7) Ignite the oxalate to CeO_2 and weigh. Calculate the recovery of cerium.
8) Mount the oxide on a counting tray and measure the β-activity of Ce-144 and Pr-144 with a low back-ground gas flow counter.
9) Correct the observed activity for the recovery and thickness of the sample and for the counting efficiency. Calculate the activity of Ce-144 of the original sample.

Ref. L. F. Glendenin et al., Anal. Chem., 37 59 (1955).

Water Data

Strontium-90 and Cesium-137 in City Water

Since December 1961, the National Institute of Radiological Sciences (Part 1) has analyzed the strontium-90 and cesium-137 content in city water. However, in April 1963, a major portion of this work was transferred to the Japan Analytical Chemistry Research Institute (Part II). Sampling and pretreatment for concentration have been carried out by 24 prefectural public health laboratories.

Part I *(National Institute of Radiological Sciences)*

At present, the National Institute of Radiological Sciences is in charge of the analysis of strontium-90 and cesium-137 in city water samples from Tokyo, Niigata and Osaka prefectures, to compare the amount of radionuclides in "source water" and "treated water" collected from the same water supply system.

To accomplish this, two type of city water samples were collected every other month in a city in each prefecture. One is the "source water" collected before the treatment, the other, "treated water" collected from a tap.

To concentrate strontium-90 and cesium-137, the ion exchange method has been used. An "A" type column, filled with sodium cation exchange resin (Dowex 50 W-X 8, 50-80 mesh), and 100 ml of carrier solution, containing both 100 mg of strontium and cesium, were sent in advance from the National Institute of Radiologicrl Sciences to each prefectural public health laboratory. The column used was illustrated in Figure 2, Issue No. 2 of this publication. At each prefectural public health laboratory, a 100 liter water sample is passed through the column at the rate of 12 liters per hour, then the column "A" is sent back to the National Institute of Radiological Sciences.

At the National Institute of Radiological Sciences, after 2 liter of 5%-oxalic acid is passed through the column, strontium and cesium adsorbed by the resin are eluted by 3 liters of 3 N-hydrochloric acid. The hydrochloric acid fraction is analyzed using the method recommended by the Science and Technology Agency.

Results obtained during the period April to August 1964 are shown in Table 6.

Table 6. ^{90}Sr and ^{137}Cs in Source water and Treated Water —Apr. to Aug. 1964—

By M. Saiki, H. Kamada and E. Shimizu
(National Institute of Radiogical Sciences)

City	Source	Type	Date	^{90}Sr(pCi/l)	^{137}Cs(pCi/l)	pH*
April, May 1964						
Tokyo	Edo River sf.	SW	30 Apr 64	0.70	0.29	6.8
〃	〃	TW	〃	0.55	0.14	6.9
Niigata, NIIGATA	Agano River sf.	SW	24 Apr 64	1.36	0.50	6.7
〃	〃	TW	〃	0.71	0.16	6.6
Osaka, OSAKA	Yodo River sf.	SW	23 Apr 64	1.06	0.24	7.0
〃	〃	TW	11 May 64	1.01	0.18	6.4
June, July 1964						
Tokyo	Edo River sf.	SW	16 Jun 64	1.14	0.17	
〃	〃	TW	〃	1.05	0.15	
Niigata, NIIGATA	Agano River sf.	SW	7 Jul 64	1.06	0.39	7.1
〃	〃	TW	〃	1.05	0.21	6.6
Osaka, OSAKA	Yodo River sf.	SW	8 Jun 64	1.19	0.35	7.0
〃	〃	TW	11 Jun 64	1.18	0.22	6.6
August 1964						
Tokyo	Edo River sf.	SW	28 Aug 64	0.69	0.12	7.4
〃	〃	TW	〃	0.52	0.11	7.2
Niigata, NIIGATA	Agano River sf.	SW	28 Aug 64	0.78	0.30	7.2
〃	〃	TW	〃	0.74	0.20	7.1
Osaka, OSAKA	Yodo River sf.	SW	18 Aug 64	0.92	0.22	7.0
〃	〃	TW	24 Aug 64	0.79	0.21	6.4

Note: * By notice from each prefectural public health laboratory
SW and TW indicates Source and Treated Water respectively.
sf indicates surface water.

Part II *(Japan Analytical Chemistry Research Institute)*

Since May 1963, the Japan Analytical Chemistry Research Institute, on commission by the Science and Technology Agency, has analyzed the strontium-90 and cesium-137 content in city water from 21 prefectures twice a month, to continue the work carried out by the National Institute of Radiological Sciences up to March 1963.

"Source water" is the only type of city water sample being collected.

The analytical procedure applied is the same as that used in Part I (National Institute of Radiological Sciences).

Results obtained during the period April to October 1964 are shown in Table 7.

Table 7. ^{90}Sr and ^{137}Cs in Source Water —Apr. to Jun. 1964—

By T. Asari and M. Chiba and M. Kuroda
(Japan Analytical Chemistry Research Institute)

City	Source	Date	^{90}Sr (pCi/l)	^{137}Cs (pCi/l)	Nature of Water pH	Appearance
April 1964						
Sapporo, HOKKAIDO	Toyohira River sf.	21 Apr	0.42	0.11	7.0	slight muddy
Aomori, AOMORI	Yokouchi River sf.	28 Apr	0.48	0.33	6.8	clear
Sendai, MIYAGI	Okura and Aoshita Rivers sf.	30 Apr	0.62	0.15	7.0	clear
Akita, AKITA	Asahi River sf.	27 Apr	0.28	0.34	6.4	slight muddy
Mito, IBARAGI	Naka River sf. and rb.	28 Apr	0.22	0.21	7.2	
Urawa, SAITAMA	Well	20 Apr	0.01	0.09	7.4	
Tokyo	Tama River sf.	25 Apr	0.28	0.37	7.3	
Odawara, KANAGAWA	Sakawa River rb.	Apr	0.04	0.02		
Niigata, NIIGATA	Shinano River sf.	23 Apr	0.98	0.25	6.9	slight muddy (yellow)
Kanazawa, ISHIKAWA	Sai River sf. and rb.	22 Apr	1.00	0.11	7.2	slight muddy
Shimizu, SHIZUOKA	Okitsu River rb.	27 Apr	0.06	0.05	7.4	clear
Nagoya, AICHI	Kiso River sf.	24 Apr	0.36	0.11	6.7	clear
Kyoto, KYOTO	Biwa Lake sf.	21 Apr	1.31	0.28	7.6	clear
Osaka, OSAKA	Yodo River sf.	23 Apr	1.21	0.73	6.8	
Kobe, HYOGO	Chikari River sf.	27 Apr	0.10	0.17	6.9	slight muddy (yellow)
Wakayama, WAKAYAMA	Kino River sf. and rb.	30 Apr	0.23	0.28	7.2	slight muddy
Tottori, TOTTORI	Bitani Storing Reservoir sf.	23 Apr	0.49	0.27	6.8	slight muddy (white)
Okayama, OKAYAMA	Asahi River rb.	24 Apr	0.43	0.12	7.1	clear
Hiroshima, HIROSHIMA	Ota River sf. and rb.	20 Apr	0.44	0.12	7.0	slight muddy
Kochi, KOCHI	Kagami River rb.	22 Apr	0.18	0.26	7.2	clear
Fukuoka, FUKUOKA	Muromi River rb.	30 Apr	0.48	0.28	6.8	clear
Nagasaki, NAGASAKI	Storing Reservoir sf.	24 Apr	0.62	0.57	8.2	slight muddy (white)
Kagoshima, KAGOSHIMA	Nanakubo Spring	30 Apr	0.04	0.07	6.8	
* * *						
Yoshida-mura, FUKUI	Stream sf.	30 Apr	0.15	0.07	7.6	clear
June 1964						
Sapporo, HOKKAIDO	Toyohira River sf.	18 Jun	0.39	0.12	7.1	clear
Aomori, AOMORI	Yokouchi River sf.	11 Jun	0.20	0.21	7.0	clear
Sendai, MIYAGI	Okura and Aoshita Rivers sf.	30 Jun	0.69	0.42	7.0	slight muddy
Akita, AKITA	Asahi River sf.	29 Jun	0.51	0.41	6.8	clear
Mito, IBARAGI	Naka River sf. and rb.	11 Jun	0.43	0.14	7.1	slight muddy
Urawa, SAITAMA	Well	8 Jun	0.03	0.17	7.5	clear
Tokyo	Tama River sf.	19 Jun	0.29	0.06	7.0	muddy (white)
Odawara, KANAGAWA	Sakawa River rb.	Jun	0.07	0.04		
Niigata, NIIGATA	Shinano River sf.	12 Jun	0.11	0.08	7.0	slight muddy
Kanazawa, ISHIKAWA	Sai River sf. and rb.	11 Jun	0.77	0.08	7.2	slight muddy
Shimizu, SHIZUOKA	Okitsu River rb.	8 Jun	1.02	0.15	7.4	clear
Nagoya, AICHI	Kiso River sf.	5 Jun	0.36	0.17	6.9	clear
Kyoto, KYOTO	Biwa Lake sf.	3 Jun	1.15	1.38	6.5	slight muddy
Osaka, OSAKA	Yodo River sf.	8 Jun	1.17	0.31	6.8	muddy (yellow)
Kobe, HYOGO	Chikari River sf.	15 Jun	0.37	0.11	6.9	clear
Wakayama, WAKAYAMA	Kino River sf. and rb.	29 Jun	0.21	0.15	6.8	slight muddy
Tottori, TOTTORI	Bitani Storing Reservoir sf.	8 Jun	0.49	0.22	6.7	muddy (brawn)
Okayama, OKAYAMA	Asahi River rb.	26 Jun	0.36	0.15	7.2	slight muddy (white)
Hiroshima, HIROSHIMA	Ota River sf. and rb.	15 Jun	0.61	0.26	7.1	clear
Kochi, KOCHI	Kagami River rb.	2 Jun	0.25	0.10	7.2	clear
Fukuoka, FUKUOKA	Muromi River rb.	26 Jun	0.56	0.19	6.8	clear
Nagasaki, NAGASAKI	Storing Reservoir sf.	24 Jun	0.35	0.26	6.8	slight muddy
Kagoshima, KAGOSHIMA	Nanakubo Spring	8 Jun	0.04	0.04	6.7	clear
* * *						
Yoshida-mura, FUKUI	Stream sf.	24 Jun	0.23	0.06	7.6	

Note sf. and rb. indicates surface and river bed water respectively

Table 7. ^{90}Sr and ^{137}Cs in Source Water —Apr. to Jun. 1964— *(continued)*

City	Source	Date	^{90}Sr (pCi/l)	^{137}Cs (pCi/l)	Nature of Water* pH	Appearance
August 1964						
Sapporo, HOKKAIDO	Toyohira River sf.	7 Aug	0.39	0.15	7.2	slight muddy
Aomori AOMORI	Yokouchi River sf.	21 Aug	0.22	0.14	7.0	clear
Sendai, MIYAGI	Okura and Aoshita Rivers sf.	28 Aug	0.46	0.27	6.7	muddy (yellow)
Akita, AKITA	Asahi River sf.	21 Aug	0.61	0.20	7.0	clear
Mito, IBARAGI	Naka River sf. and rb.	10 Aug	0.24	0.14	7.0	
Urawa, SAITAMA	Well	5 Aug	0.03	0.03	7.4	clear
Tokyo	Tama River sf.	28 Aug	0.34	0.35	7.2	
Odawara, KANAGAWA	Sakawa River rb.	7 Aug	0.31	0.22	6.8	
Niigata, NIIGATA	Shinano River sf.	18 Aug	1.12	0.02	7.3	
Kanazawa, ISHIKAWA	Sai River sf. and rb.	12 Aug	0.75	0.41	7.2	slight muddy
Shimizu, SHIZUOKA	Okitsu River	4 Aug	0.37	0.05	7.4	clear
Nagoya, AICHI	Kiso River sf.	6 Aug	0.62	0.09	6.9	clear
Kyoto, KYOTO	Biwa Lake sf.	3 Aug	1.51	0.18	7.5	clear
Osaka, OSAKA	Yodo River sf.	18 Aug	1.16	0.11	6.8	
Kobe, HYOGO	Chikari River sf.	17 Aug	0.01	0.07	7.0	slight muddy
Wakayama, WAKAYAMA	Kino River sf. and rb.	31 Aug	0.19	0.07	7.2	
Tottori, TOTTORI	Bitani Storing Reservoir sf.	8 Aug	0.68	0.10	6.7	
Okayama, OKAYAMA	Asahi River rb.	8 Aug	0.76	0.11	7.1	slight muddy (white)
Hiroshima, HIROSHIMA	Ota River sf. and rb.	5 Aug	0.76	0.12	7.1	slight muddy
Kochi, KOCHI	Kagami River rb.	4 Aug	0.57	0.03	7.2	clear
Fukuoka, FUKUOKA	Muromi River rb.	28 Aug	0.56	0.12	6.8	clear
Nagasaki, NAGASAKI	Storing Reservior sf.	11 Aug	0.55	0.16	9.0	slight muddy
Kagoshima, KAGOSHIMA	Nanakubo Spring	3 Aug	0.04	0.03	6.7	clear
* * *						
Yoshida-mura, FUKUI	Stream sf.	17 Aug	0.29	0.03	7.5	
October 1964						
Sapporo, HOKKAIDO	Toyohira River sf.	5 Oct	0.42	0.08	7.2	clear
Aomori, AOMORI	Yokouchi River sf.					
Sendai, MIYAGI	Okura and Aoshita Rivers sf.					
Akita, AKITA	Asahi River sf.	7 Oct	0.48	0.12	6.9	
Mito, IBARAGI	Naka River sf. and rb.	6 Oct	0.24	0.04	7.2	
Urawa, SAITAMA	Well	7 Oct	0.11	0.01	7.5	clear
Tokyo	Tama River sf.					
Odawara, KANAGAWA	Sakawa River rb.		0.16	0.02		
Niigata, NIIGATA	Shinano River sf.					
Kanazawa, ISHIKAWA	Sai River sf. and rb.					
Shimizu, SHIZUOKA	Okitsu River rb.					
Nagoya, AICHI	Kiso River sf.		0.26	0.05	6.8	
Kyoto, KYOTO	Biwa Lake sf.	2 Oct		0.13	7.3	slight muddy
Osaka, OSAKA	Yodo River sf.					
Kobe, HYOGO	Chikari River sf.					
Wakayama, WAKAYAMA	Kino River sf. and rb.	16 Oct	0.10	0.05	6.8	
Tottori, TOTTORI	Bitani storing Reservoir sf.	14 Oct	0.47	0.12	6.8	
Okayama, OKAYAMA	Asahi River rb.	10 Oct	0.46	0.06	7.1	
Hiroshima, HIROSHIMA	Ota River sf. and rb.					
Kochi, KOCHI	Kagami River rb.	6 Oct	0.30	0.04	7.2	
Fukuoka, FUKUOKA	Muromi River rb.					
Nagasaki, NAGASAKI	Storing Reservoir sf.	6~10 Oct	0.25	0.21	8.6	
Kagoshima, KAGOSHIMA	Nanakubo Spring	5 Oct	0.04	0.02	6.9	clear
* * *						
Yoshida-mura, FUKUI	Stream sf.					

Note sf. and rb. indicates surface and river bed water respectively

* By notice from each prefectural public health laboratory

Strontium-90 and Cesium-137 in Potable Rain Water

(Japan Analytical Chemistry Research Institute)

Since December 1961, potable rain water used by residents of lighthouses has been analyzed for strontium-90 and cesium-137 content at the Hydrographic Division, the Maritime Safety Agency. In April 1962, this work has been transferred to the National Institute of Hygienic Sciences, and again, in April 1964 to the Japan Analytical Chemistry Research Institute.

Samples were collected in polyethylene bottles at 7 lighthouses once every other month. Ten liter samples each of potable rain water, with and without filtration through sand and charcoal, were sent from each lighthouse.

The analytical method applied was the method recommmended by the Science and Technology Agency.

Results obtained during the period May to September 1964 are shown in Table 8

Table 8. ^{90}Sr and ^{137}Cs in Potable Rain Water for Lighthouse —May to Sept. 1964—

By T. Asari, M. Chiba and M. Kuroda

(Japan Analytical Chemistry Research Institute)

Lighthouse	Date	Original ^{90}Sr (pCi/*l*)	Original ^{137}Cs (pCi/*l*)	Filtrate ^{90}Sr (pCi/*l*)	Filtrate ^{137}Cs (pCi/*l*)
(May, Jun 64)					
Shakotan	5 Jun	0.18	0.29	0.07	0.24
Miyakejima	25 May	5.91	8.60	6.63	5.09
Ryotsu	24 May	12.67	0.17	3.90	0.05
Nagaohana	25 Jun	11.82	37.83	1.21	4.40
Murotomisaki	22 May	22.85	131.5	7.15	0.03
Makurazaki	25 Jun	4.74	3.24	4.32	1.88
(Jul, Aug 64)					
Soyamisaki	30 Jul	2.98	0.15	1.00	0.14
Shakotan	27 Aug			0.19	3.49
//	29 Aug	30.62	20.77		
Miyakejima	19 Jul	2.86	6.84	3.86	3.44
Ryotsu	30 Jul	5.09	1.42	9.33	0.12
Nagaohana	28 Jul	12.00	351.6	8.08	27.30
Murotomisaki	25 Jul	34.29	0.94	6.66	0.27
Makurazaki	20 Jul	2.97	1.82	0.48	0.42
(Sep 64)					
Soyamisaki	6 Sep	12.23	1.45	0.11	0.01
Shakotan	26 Sep	59.61	162.7	0.24	0.49
Miyakejima	20 Sep	7.23	8.21	3.63	3.11
Nagaohana	9 Sep	0.30	2.79	0.98	1.04
Murotomisaki	18 Sep	4.77	0.19	18.94	28.96
Makurazaki	25 Sep	13.86	10.96	23.55	0.31

In 1962, the prefectural governments arranged to provide the rain water filter tubes for regular rain water. The Japan Analytical Chemistry Research Institute analyzed the strontium-90 and cesium-137 content in potable rain water, on commission by the Science and Technology Agency, for the purpose of studying the efficacy of filter and radioactivity intake in regular users of rain water.

The specifications of the tube are shown in Figure 3. The tube holds ten liters of vermiculite and three liters of charcoal. The calcinated vermiculite is 0.38 to 0.65 cm in diameter.

Samples of rain water with and without filtration through the filter were collected by the prefectural public health laboratories. The analytical method recommended by the Science and Technology Agency was used.

Results obtained are shown in Table 9. Figure 4 shows the efficacy of decontamination.

Figure 3. The Specification of the Rain Water Filter Tube

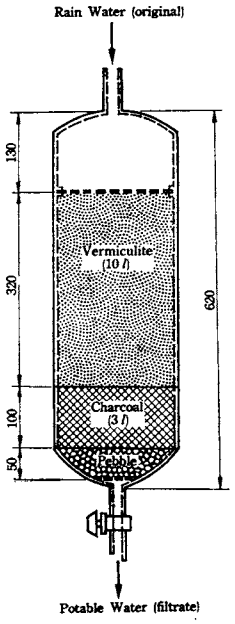
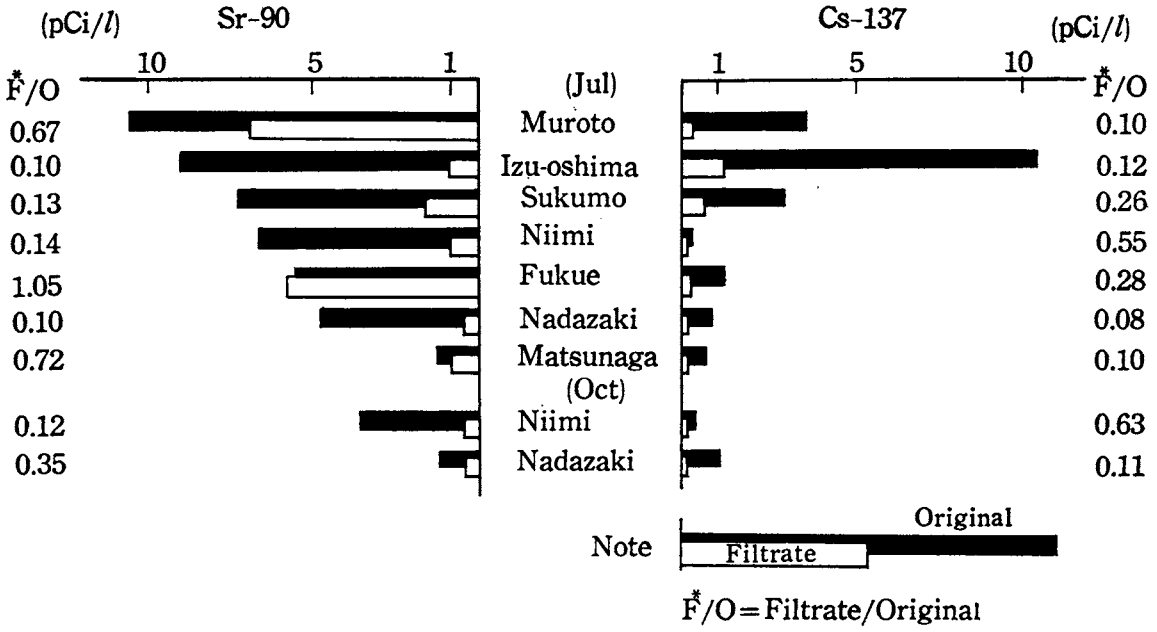


Table 9. ^{90}Sr and ^{137}Cs in Potable Rain Water

By T. Asari, M. Chiba and M. Kuroda
(Japan Analytical Chemistry Research Institute)

Location	Date	Original		Filtrate		Filtrate/Original	
		^{90}Sr (pCi/l)	^{137}Cs (pCi/l)	^{90}Sr (pCi/l)	^{137}Cs (pCi/l)	^{90}Sr	^{137}Cs
Izuoshima, TOKYO	29 Jul	8.79	10.52	0.86	1.27	0.10	0.12
Niimi, OKAYAMA	13 Jul	6.60	0.33	0.88	0.18	0.14	0.55
Nadazaki, OKAYAMA	20 Jul	4.76	0.90	0.47	0.07	0.10	0.08
Matsunaga, HIROSHIMA	8 Jul	1.26	0.75	0.90	0.08	0.72	0.11
Muroto, KOCHI	10 Jul	10.35	3.84	6.85	0.38	0.67	0.10
Sukumo, KOCHI	13 Jul	7.08	3.00	1.59	0.77	0.23	0.26
Fukue, NAGASAKI	14 Jul	5.45	1.27	5.70	0.35	1.05	0.28
Niimi, OKAYAMA	5 Oct	3.64	0.17	0.43	0.11	0.12	0.65
Nadazaki, OKAYAMA	7 Oct	1.32	1.10	0.46	0.12	0.35	0.11

Figure 4. ^{90}Sr and ^{137}Cs in Potable Rain Water



Dietary Data

Strontium-90 in Wheat

(National Institute of Agricultural Sciences)

Strontium-90 contents in farm soil, rice and wheat have been determined at the National Institute of Agricultural Sciences since 1957.

All wheat samples were collected at, and sent from national and prefectural agricultural experimental stations, covering all important agricultural areas throughout Japan. The samples were chosen as representative of agricultural conditions, including soil type, crop variety, fertilizer application and harvest time. Sampling station are shown in Figure 5.

One Kg of wheat grain was burned in an electric muffle furnace. Hydrochloric acid solutions of the finely ground ash were measured using the method recommended by the Science and Technology agency for radiochemical analysis of strontium-90. Beta-radioactivity of strontium-90 was measured by a low background counter.

Results of analyses are shown in Table 10, and Figure 6 shows the yearly average of strontium-90 content during the period 1957 to 1964. The tendency is rather close to that of fallout rate. The contamination was the highest in 1963, and decreased in 1964.

Figure 5. Sampling Location of Wheat

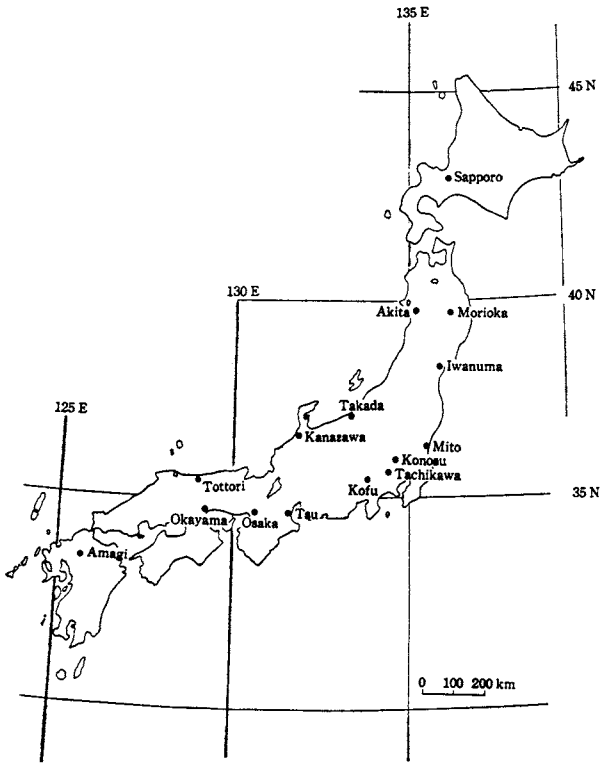


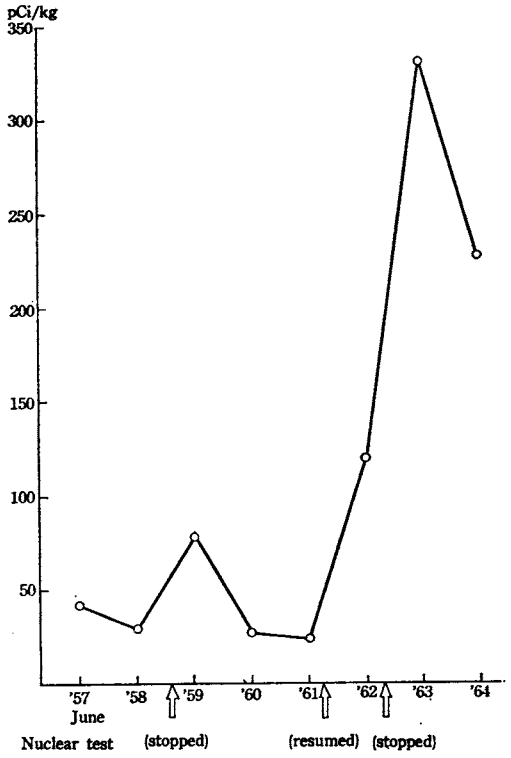
Table 10. ^{90}Sr in Wheat

By K. Kodaira and M. Ishikawa

(National Institute of Agricultural Sciences)

location	Month harvested	Whole Grain ^{90}Sr (pCi/kg) 1962	1963	1964
Sapporo, HOKKAIDO	Aug	106	—	224
Akita, AKITA	July	69	585	725
Takada, NIIGATA	June	72	153	149
Kanazawa, ISHIKAWA	June	106	—	—
Tottori, TOTTORI	June	139	472	—
Morioka, IWATE	July	243	188	172
Iwanuma, MIYAGI	June	271	217	201
Mito, IBARAGI	June	112	222	280
Konosu, SAITAMA	June	133	223	213
Tachikawa, TOKYO	June	106	269	155
Kofu, YAMANASHI	June	146	141	—
Tsu, MIE	June	101	743	—
Osaka, OSAKA	June	49	274	79
Okayama, OKAYAMA	June	47	457	70
Amagi, FUKUOKA	June	98	357	229
Mean Values		120	331	227

Figure 6. ^{90}Sr in Wheat —1957 to 1964—
(National Institute of Agricultural Sciences)



Strontium-90 and Cesium-137 in Milk

Part I *(National Institute of Animal Industry)*

The observation of the monthly variation of strontium-90 and cesium-137 content in milk was made at the National Institute of Animal Industry.

Samples were collected from a cow at the farm of this institute and from three other national agricultural experimental stations once a month and analyzed by the method recommended by the Science and Technology Agency.

Results obtained during the period February 1964 to December 1964 are shown in Table 11.

Table 11. ^{90}Sr and ^{137}Cs in Milk —Feb. 1964 to Dec. 1964—
By H. Danbara and T. Mitsuhashi
(National Institute of Animal Industry)

Location	Date	Component Ca (g/l)	Component K (g/l)	Strontium-90 (pCi/l)	Strontium-90 (pCi/gCa)	Cesium-137 (pCi/l)	Cesium-137 (pCi/gK)
(Feb 64)							
Sapporo, HOKKAIDO	13 Feb	0.9	1.3	38.1	42.3	121	93
//	//	1.2	1.4	47.7	39.8	123	88
Morioka, IWATE	20 Feb	1.1	1.4	24.1	21.9	76	54
Chiba, CHIBA	15 Feb	0.9	1.5	21.8	24.2	62	41
//	//	0.9	1.4	20.4	22.7	49	35
Nishigoshi, KUMAMOTO	15 Feb	0.9	1.5	21.8	24.2	62	41
//	//	0.9	1.4	20.4	22.7	49	35

Table 11. ^{90}Sr and ^{137}Cs in Milk —Feb. 1964 to Dec. 1964— *(continued)*

Location	Date	Component Ca (g/*l*)	Component K (g/*l*)	Strontium-90 (pCi/*l*)	Strontium-90 (pCi/gCa)	Cesium-137 (pCi/*l*)	Cesium-137 (pCi/gK)
(Mar 64)							
Sapporo, HOKKAIDO	13 Mar	1.0	1.5	40.2	40.2	96	64
〃	〃	1.1	1.4	42.3	38.5	76	54
Chiba, CHIBA	15 〃	0.9	1.4	20.1	22.3	70	50
〃	〃	1.0	1.4	21.2	21.2	50	36
Nishigoshi, KUMAMOTO	15 〃	0.9	1.4	20.1	22.3	70	50
〃	〃	1.0	1.4	21.2	21.2	50	36
(Apr 64)							
Sapporo, HOKKAIDO	15 Apr	1.1	1.3	43.6	39.6	156	120
〃	〃	1.2	1.3	42.8	35.6	153	118
Morioka, IWATE	15 〃	0.9	1.5	22.0	22.4	88	63
Chiba, CHIBA	15 〃	1.0	1.3	11.4	11.4	67	48
〃	〃	1.1	1.4	10.1	10.1	67	48
Nishigoshi, KUMAMOTO	5 〃	1.0	1.5	17.0	17.0	103	69
〃	〃	0.9	1.4	20.1	22.4	57	38
〃	25 〃	1.0	1.4	21.8	21.8	76	55
〃	〃	1.0	1.5	22.5	22.5	59	42
(May 64)							
Chiba, CAIBA	16 May	1.1	1.3	12.0	11.0	109	84
Nishigoshi, KUMAMOTO	20 〃	1.0	1.4	10.4	10.4	96	69
〃	〃	1.1	1.4	14.1	12.8	84	60
(Jun 64)							
Chiba, CHIBA	17 Jun	1.0	1.5	14.0	14.0	123	82
〃	〃	1.0	1.5	16.9	16.9	156	104
Nishigoshi, KUMAMOTO	20 〃	1.0	1.4	15.1	15.1	85	61
〃	〃	1.1	1.5	15.8	14.4	84	56
(Jul 64)							
Nishigoshi, KUMAMOTO	15 Jul	1.1	1.5	6.2	5.6	82	55
〃	〃	1.1	1.4	4.1	3.7	60	43
(Aug 64)							
Sapporo, HOKKAIDO	16 Aug	1.3	1.6	19.4	14.9	231	144
〃	〃	1.3	1.6	14.3	11.0	176	110
Nishigoshi, KUMAMOTO	17 〃	1.0	1.4	4.8	4.8	65	46
〃	〃	1.0	1.5	7.7	7.7	47	31
(Sept 64)							
Sapporo, HOKKAIDO	15 Sept	1.2	1.5	11.0	9.2	148	98
〃	〃	1.2	1.6	6.7	5.6	145	90
Chiba, CHIBA	20 〃	1.1	1.4	3.7	3.4	41	29
Nishigoshi, KUMAMOTO	20 〃	1.0	1.5	5.7	5.7	32	21
〃	〃	1.1	1.5	7.2	6.5	64	43
(Oct 64)							
Sapporo, HOKKAIDO	1 Oct	1.0	1.7	10.2	10.2	230	130
〃	〃	1.0	1.5	12.5	12.5	253	168
〃	15 〃	0.9	1.3	20.3	22.6	212	163
〃	〃	1.0	1.6	17.5	17.5	245	153
Nishigoshi, KUMAMOTO	20 〃	1.0	1.4	5.6	5.6	114	81
〃	〃	0.9	1.4	9.9	11.0	104	75
(Nov 64)							
Sapporo, HOKKAIDO	8 Nov	1.0	1.5	21.5	21.5	208	139
〃	〃	1.0	1.5	18.2	18.2	245	163
Chiba, CHIBA	15 〃	1.0	1.5	3.1	3.1	65	43
(Dec 64)							
Chiba, CHIBA	15 Dec	1.0	1.5	3.8	3.8	51	34
〃	〃	1.0	1.4	10.1	10.1	71	51
Nishigoshi, KUMAMOTO	20 〃	1.1	1.4	11.3	10.3	107	76
〃	〃	1.1	1.7	12.0	10.9	48	28

Part II *(Japan Analytical Chemistry Research Institute)*

Since December 1961, milk samples from various part of Japan have been collected by 24 prefectural public health laboratories and analyzed for strontium-90 and Cesium-137 content at the Japan Analytical Chemistry Research Institute. Sampling stations are shown in Figure 7.

Three liters of fresh milk was purchased at a represental farm in each prefecture, and carbonized by the 24 public health laboratories. The carbonized samples were then sent to the Japan Analytical Chemistry Research Institute, and ashed and analyzed using the method recomended by the Science and Technology Agency.

Results obtained during the period April to September 1964 are shown in Table 12.

Figure 7. Sampling Station of Milk

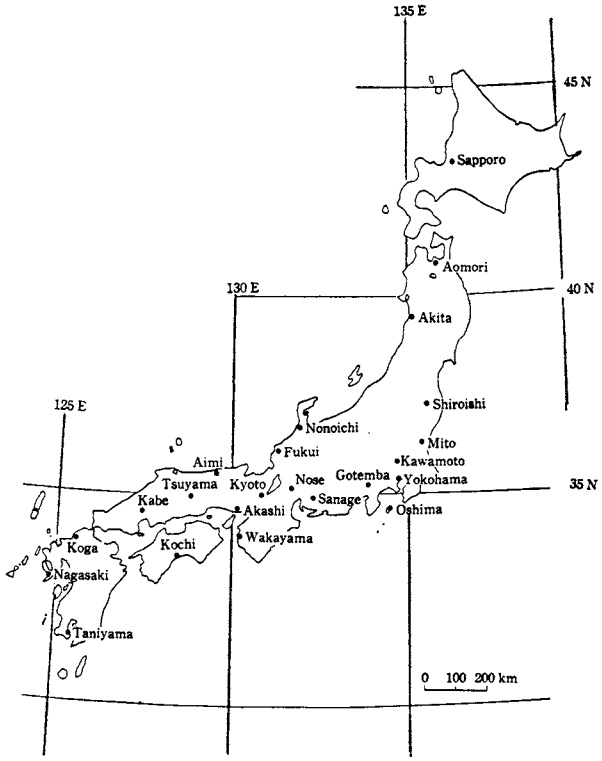


Table 12. ^{90}Sr and ^{137}Cs in Milk —Apr. 1964 to Sept. 1964—

By T. Asari, M. Chiba and M. Kuroda

(Japan Analytical Chemistry Research Institute)

(Continuation of Table 15, Issue No. 4, "Radioactivity Survey Data in Japan")

Location	Date	Component (g/*l*)			Strontium-90		Cesium-137	
		Ash	Ca	K	(pCi/*l*)	(pCi/gCa)	(pCi/*l*)	(pCi/gK)
(Apr 64)								
Sapporo, HOKKAIDO	25 Apr	7.30	1.12	1.66	15.7	14.0	99	60
Aomori, AOMORI	28 Apr	7.11	0.95	1.61	20.8	22.0	143	89
Nonoichi, ISHIKAWA	21 Apr	6.86	1.04	1.51	18.1	17.4	118	78
Fukui, FUKUI	27 Apr	6.81	0.78	1.55	12.8	16.4	75	48
Sanage, AICHI	28 Apr	6.97	1.05	1.55	10.3	9.8	56	36
Nose, OSAKA	28 Apr	7.30	1.04	1.66	14.0	13.5	83	50
Tsuyama, OKAYAMA	25 Apr	6.94	1.01	1.41	14.8	14.6	65	46
(May 64)								
Sapporo, HOKKAIDO	21 May	7.44	1.18	1.49	19.8	16.8	115	77
Shiroishi, MIYAGI	25 May	7.42	0.87	1.77	9.6	10.7	124	70
Akita, AKITA	12 May	7.44	1.00	1.94	27.7	27.7	127	65
Mito, IBARAGI	11 May	9.63	1.56	2.00	24.3	15.6	131	66
Kawamoto, SAITAMA	28 May	6.92	1.00	1.46	8.3	8.3	60	41
Izu-oshima, TOKYO	25 May	7.39	1.03	1.65	24.0	23.3	260	158
Yokohama, KANAGAWA	20 May	7.32	1.01	1.47	10.7	10.6	82	56
Gotenba, SHIZUOKA	29 May	6.11	0.97	1.41	18.2	18.8	218	155
Kyoto, KYOTO	11 May	7.13	1.03	1.29	13.4	13.0	76	59
Wakayama, WAKAYAMA	21 May	6.33	0.88	1.36	10.9	12.4	62	46

Table 12. ^{90}Sr and ^{137}Cs in Milk —Apr. 1964 to Sept. 1964— *(continued)*

Location	Date	Component (g/*l*) Ash	Ca	K	Strontium-90 (pCi/*l*)	(pCi/gCa)	Cesium-137 (pCi/*l*)	(pCi/gK)
(May 64)								
Aimi, TOTTORI	28 May	7.44	1.18	1.79	27.3	23.1	103	57
Kabe, HIROSHIMA	13 〃	7.66	0.94	1.32	9.5	10.1	193	146
Kochi, KOCHI	6 〃	7.55	0.91	1.82	17.9	19.6	152	84
Koga, FUKUOKA	28 〃	8.75	1.20	1.71	24.3	20.3	157	92
Nagasaki, NAGASAKI	11 〃	8.55	0.95	1.54	17.0	17.9	105	68
Taniyama, KAGOSHIMA	7 〃	7.38	1.13	1.68	21.0	18.6	121	72
(Jun 64)								
Aomori, AOMORI	11 Jun	7.53	1.24	1.75	18.6	15.0	87	50
Mito, IBARAGI	12 〃	11.0	1.35	2.09	23.4	17.3	91	44
Nonoichi, ISHIKAWA	11 〃	6.89	1.06	1.59	20.6	19.4	131	83
Fukui, FUKUI	13 〃	6.52	1.10	1.55	18.2	16.5	185	120
Sanage, AICHI	10 〃	7.34	1.08	1.62	11.1	10.3	70	43
Akashi, HYOGO	4 〃	7.39	1.20	1.63	13.5	11.3	119	73
Tsuyama, OKAYAMA	11 〃	7.28	0.96	1.65	11.6	12.1	60	37
(Jul 64)								
Yokohama, KANAGAWA	25 〃	6.89	0.96	1.39	13.1	13.7	77	55
Nose, OSAKA	24 〃	7.39	0.99	1.60	17.5	17.7	88	55
Aimi, TOTTORI	28 〃	6.89	1.07	1.51	18.7	17.5	65	43
(Aug 64)								
Aomori, AOMORI	21 Aug	5.94	0.82	1.07	22.6	27.5	59	55
Mito, IBARAGI	4 〃	7.20	1.01	1.40	16.8	16.6	67	48
Nonoichi, IBHIKAWA	12 〃	6.89	0.99	1.61	22.2	22.4	85	53
Fukui, FUKUI	18 〃	6.61	0.89	1.55	8.1	9.1	49	36
Akashi, HYOGO	3 〃	7.81	1.14	1.67	6.9	6.1	59	36
Tsuyama, OKAYAMA	11 〃	6.97	0.94	1.48	13.1	13.9	40	27
(Sept 64)								
Kawamoto, SAITAMA	17 Sept	7.17	1.03	1.24	7.7	7.5	124	100
Izu-oshima, TOKYO	10 〃	6.58	0.81	1.42	12.3	15.2	131	92
Kochi, KOCHI	7 〃	8.42	1.15	1.86	9.0	7.8	48	26

Human Data

Cesium-137 in Human Urine

(National Institute of Radiological Sciences)

Cesium-137 content in human urine has been analyzed at the National Institute of Radiological Sciences since 1959 to estimate the cesium-137 body burden of the population. During the period 1963 fiscal year (April 1963 to March 1964) samples were sent from Osaka, Ishikawa and Saitama Prefectures twice a year.

Urine samples were collected from approximately 1,200 middle school students in each prefecture. The urine taken from 50 students were combined to make one 10 liter sample. Urine was collected and concentrated at the prefectural public health laboratories, then sent to the National Institute of Radiological Sciences.

For the analysis of cesium-137, an aliquot of the acidified urine sample was taken after adding a cesium carrier, then the cesium was adsorbed on solid ammonium phosphomolybdate. The precipitate was dissolved with a sodium hydroxide solution, and cesium was separated by using a phenol-sulfonic acid type cation exchange resin column. Cesium was finally precipitated as cesium perchlorate, and the beta-activity measured with an anticoincidence low-background counter.

Results obtained during the period 1963 fiscal year are shown in Table 13. Figure 8 shows sampling location of human urine since 1959, and Figure 9 shows graphically the time course of cesium-137 content in human urine. In 1963, cesium-137 levels of human urine were noteworthy increased. The levels of February 1964 at Saitama rose strikingly, and was twice as high as it was at half year before.

Table 13. ^{137}Cs in Human Urine —Jun. 1963 to Feb. 1964—

By M. Saiki, M. Uchiyama and C. Tsai
(National Institute of Radiological Sciences)

Kanazawa, ISHIKAWA (Jun 63)

Age	Sex	Month Sampled	^{137}Cs (pCi/l)
12	M	Jun 63	89.1
〃	M	〃	78.0
〃	M	〃	71.8
〃	M	〃	71.6
〃	F	〃	64.4
〃	F	〃	62.9
〃	M	〃	62.5
〃	F	〃	61.5
〃	F	〃	61.3
〃	F	〃	60.4
〃	M	〃	60.1
〃	M	〃	60.0
〃	F	〃	59.2
〃	F	〃	56.9
〃	F	〃	54.6
〃	F	〃	52.7
〃	F	〃	52.7
〃	M	〃	52.3
〃	F	〃	50.6
〃	M	〃	50.4
〃	M	〃	49.9
〃	M	〃	49.5
〃	F	〃	47.2
〃	M	〃	45.9
	Ave.		59.4

Osaka, OSAKA (Jun, Jul 63)

Age	Sex	Month Sampled	^{137}Cs (pCi/l)
12~14	M	Jun 63	57.2
〃	M	Jul 63	56.0
〃	F	〃	55.0
〃	M	〃	54.6
〃	F	Jun 63	54.6
〃	M	〃	53.4
〃	M	〃	53.2
〃	M	〃	51.7
〃	F	〃	51.7
〃	M	Jul 63	51.5
〃	F	Jun 63	51.0
〃	F	Jul 63	50.9
〃	M	〃	50.7
〃	M	〃	50.6
〃	F	Jun 63	49.6
〃	M	Jul 63	47.2
〃	F	Jun 63	46.2
〃	F	Jul 63	45.4
〃	F	Jun 63	44.3
〃	F	Jul 63	43.5
〃	M	Jun 63	43.4
〃	F	Jul 63	39.4
〃	F	〃	37.2
	Ave.		49.5

Table 13. ^{137}Cs in Human Urine —Jun. 1963 to Feb. 1964— *(continued)*

Omiya, SAITAMA (Jun 63)

Age	Sex	Month Sampled	^{137}Cs (pCi/*l*)
13～14	M	Jun 63	75.6
12～13	F	〃	73.0
13～14	F	〃	71.1
12～13	M	〃	67.7
13～14	M	〃	63.1
12～13	F	〃	61.9
13～14	M	〃	61.4
12～14	M	〃	59.7
13	F	〃	59.0
12～14	M	〃	58.7
〃	M	〃	58.0
〃	F	〃	55.6
13～14	F	〃	55.1
12～13	F	〃	54.6
〃	M	〃	54.0
12～14	M	〃	53.6
12～13	M	〃	53.6
〃	F	〃	52.8
〃	F	〃	51.8
12～14	F	〃	50.6
12～13	F	〃	50.2
12～14	M	〃	49.2
〃	F	〃	45.9
	Ave.		58.1

Kanazawa, ISHIKAWA (Dec 63)

Age	Sex	Month Sampled	^{137}Cs (pCi/*l*)
12～13	F	Dec 63	84.6
〃	M	〃	83.3
〃	M	〃	82.0
〃	F	〃	81.2
〃	M	〃	80.4
〃	M	〃	79.4
〃	M	〃	79.3
〃	M	〃	79.0
〃	F	〃	78.3
〃	M	〃	78.0
〃	F	〃	74.6
〃	M	〃	74.2
〃	F	〃	74.0
〃	M	〃	73.4
〃	M	〃	73.0
〃	M	〃	70.0
〃	F	〃	68.7
〃	M	〃	68.0
〃	F	〃	65.3
〃	F	〃	59.1
〃	F	〃	58.8
〃	F	〃	57.3
〃	F	〃	57.0
	Ave.		73.0

Osaka, OSAKA (Dec 63)

Age	Sex	Month Sampled	^{137}Cs (pCi/*l*)
12～14	F	Dec 64	104.6
〃	F	〃	101.6
〃	M	〃	97.8
〃	F	〃	94.9
〃	F	〃	91.0
〃	M	〃	88.9
〃	F	〃	88.7
〃	M	〃	88.0
〃	M	〃	87.5
〃	M	〃	86.4
〃	F	〃	85.7
〃	M	〃	85.5
〃	M	〃	84.9
〃	F	〃	84.6
〃	F	〃	81.6
〃	F	〃	80.9
〃	M	〃	80.7
〃	M	〃	79.6
〃	M	〃	78.7
〃	F	〃	76.7
〃	F	〃	73.6
〃	M	〃	72.5
〃	M	〃	72.0
〃	F	〃	63.5
	Ave.		84.6

Omiya, SAITAMAM (Feb 64)

Age	Sex	Month Sampled	^{137}Cs (pCi/*l*)
13～14	M	Feb 64	157.7
12～14	M	〃	149.1
13～14	M	〃	144.7
〃	M	〃	142.6
12～14	M	〃	142.0
〃	M	〃	141.1
〃	F	〃	135.8
12～13	M	〃	134.0
12～14	M	〃	131.0
〃	F	〃	128.0
〃	F	〃	127.7
13～14	F	〃	127.6
〃	F	〃	124.0
12～13	F	〃	119.2
12～14	F	〃	116.7
〃	F	〃	111.9
〃	F	〃	110.4
13～14	F	〃	107.3
12～14	M	〃	99.8
〃	M	〃	98.5
	Ave.		127.5

Figure 8. Sampling Location of Human Urine

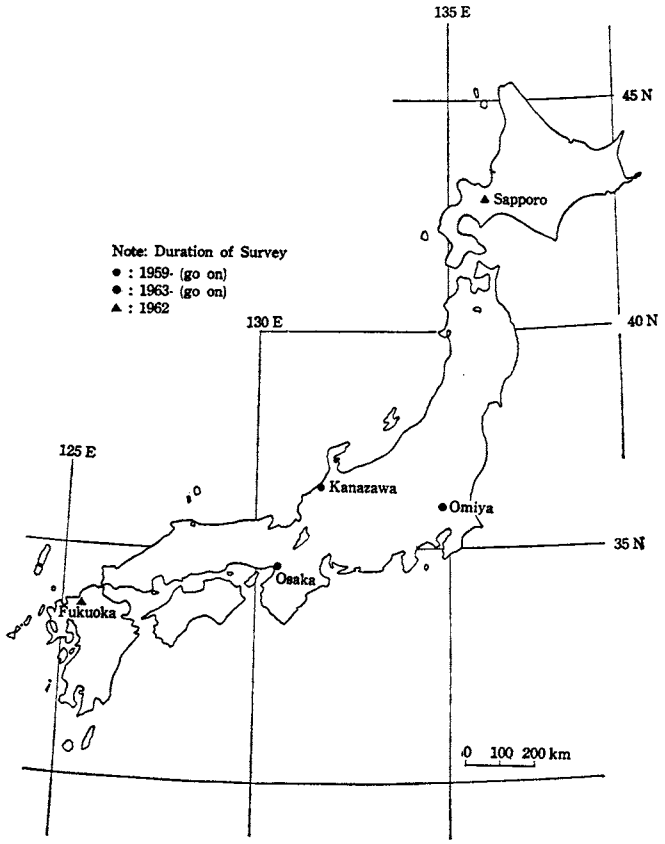
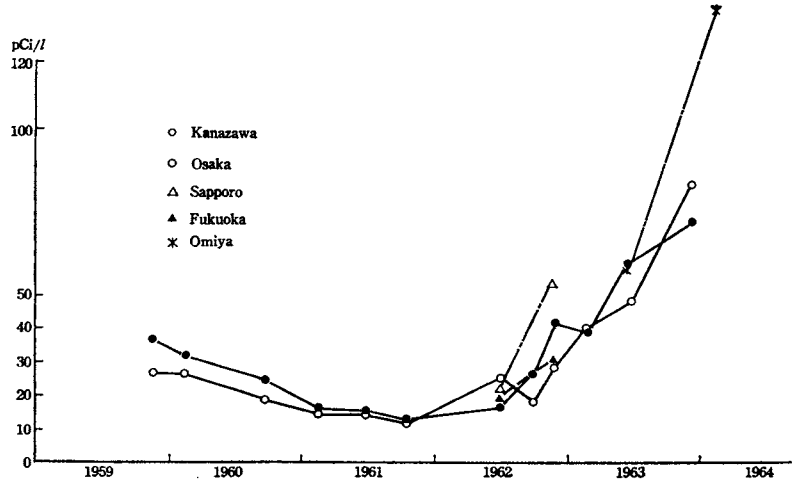


Figure 9. ^{137}Cs in Human Urine



Contributor

The results quoted in this Issue were contributed by the following Institutes.

Institute and Address	Item
Japan Analytical Chemistry Research Institute 17, Kikukawa-cho-2-chome, Sumida-ku Tokyo	Monthly Deposition Dust, City Water, Rain Water, Milk
Meteorological Research Institute Kita-4-chome, Koenji, Suginamiku, Tokyo	Monthly Deposition
National Institute of Agricultural Sciences 1, Nishigahara-2-chome, Kita-ku, Tokyo	Cereals
National Institute of Animal Industry 959, Aoba-cho, Chiba-shi	Milk
National Institute of Radiological Sciences 9-1, Anagawa-4-chome, Chiba-Shi	City Water, Human Urine