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RADIOACTIVITY SURVEY DATA in Japan

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National Institute of Radiological Sciences
Chiba, Japan

Radioactivity Survey Data in Japan

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Contents

Environmental and Dietary Materials*

(Japan Chemical Analysis Center)

1. Collection and pretreatment of samples

(1) Rain and dry fallout

Rain and dry fallout was collected monthly on a sampling tray, approximately 5000 cm^2 in area, which was filled with water to a depth of 1 cm at the beginning of every month.

The sample was filtered after strontium and cesium carriers were added. The tray was washed with 5 ℓ of distilled water and the washing was combined to the filtrate.

The sample was passed through a cation exchange column (500 mℓ of Dowex 50W X8, 50~100 mesh, Na form) at a rate of 80 mℓ/min.

(2) Airborne dust

Airborne dust was collected by an electrostatic precipitator or a filter air sampler for every three months at a rate of more than 3000 m^3 per month. The sampling was done 1 to 1.5 meters above the ground.

(3) Service water and freshwater

Service water, 100 ℓ each, was collected at an intake of the water-treatment plant and at the tap after water was left running for five minutes. Water, to which added carriers of strontium and cesium immediately after sampllng, was vigorously stirred and filtered. The subsequent process was the same as that described in the section (1). Freshwater was treated in the same way as the service water.

(4) Soil

Soil was collected from the location in the spacious and flat area without past disturbance on the surface caused by duststorms, inflow and outflow due to precipitation, and so on. Any places located under trees in a forest, in a stony area or inside of river banks were avoided. Soil was taken from two layers of different depths, 0~5 cm and 5~20 cm. In the course of air-drying, lumps were crushed by hand, and roots of plants and pebbles were removed. The soil was then passed through a 2 mm sieve to remove small gravels.

(5) Sea water

Sea water was collected at the fixed stations where the effect of terrestrial fresh water from rivers was expected to be negligibly small. A special consideration was also given to weather conditions. The sampling was carried out when there was no rainfall for the last few davs. To prevent contamination, water samples were collected at the bow of a sampling boat just before she stood still by scooping surface water using a polyethylene bucket. Immediately after the collection, the samples were acidified to a pH lower than 3 by adding concentrated hydrochloric acid in a ratio of 1 mℓ to 1 ℓ of sea water, and then stored in 20-ℓ polyethylene containers. The sampling equipments as well as containers were thoroughly rinsed with dilute hydrochloric acid and then with distilled water before use. Two hundred milliliters of sea water was also collected at the same stations for the determination of chlorinity.

(6) Sea sediments

Sediment was collected in the same area as that for the sea water sample, taking the following criteria into account:

a. The depth of water exceeds 1 m at low tide.
b. No significant sedimental movement is observed in the vicinity of concern.
c. Mud, silt and fine sand are preferable.

A conventional sediment sampling device was used for collecting the top few centimeters of surface sediment. Approximately 4 kg of the sample in wet weight was spread on a large porcelain dish and dried in an electric oven at 105 to 110°C to a costant weight.

(7) Total diet

A full one day ordinary diet including three meals, water, tea and other in-between snacks for five persons was collected as a sample of "total diet". The sample in a large stainless steel pan was carbonized carefully by direct application of gas flame, and was transfered to a porcelain dish and then ashed at 500 °C in an electric muffle furnace.

(8) Rice

Polished rice was collected in producing districts at the harvest and in consuming areas when new crops were first put on sale. The sample was carbonized and ashed in a porcelain dish.

* Samples were sent to the Center from 32 contracted prefectures.

(9) Milk

Raw milk was collected in producing districts and commercial milk was purchased in consuming districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing.

(10) Vegetables

Spinach and Japanese radish were selected as the representatives for leaf vegetables and for non-starch roots, respectively. After removing soil, the edible part of vegetable sample was dried and carbonized in a stainless ateel pan or a porcelain dish.

(11) Tea

Five hundred grams of manufactured green tea was collected, carbonized and ashed in a stainless steel pan or a porcelain dish.

(12) Fish, shellfish and seaweeds

a. Sea fish and freshwater fish

Fish was rinsed with water and blotted with a filter paper. Only the edible part was used in case of larger sized fish, and the whole part was used in case of smaller ones. Each sample was weighed and placed in a stainless steel pan or a porcelain dish. After carbonized, the sample was ashed in an electric muffle furnace.

b. Shellfish

Approximately 4 kg of shellfish including the shells was collected or purchased. After removing the shells, it was treated in the same way as that for the sea fish.

c. Seaweeds

Edible seaweeds were collected and rinsed with water to remove sand and other adhering matters on the surface. These were removed of excess water, weighed dried and ashed.

Table 1 shows detailes of sample collection.

Table 1 Details of sample collection

Sample	Frequency of sampling	Quantity of sample
=Environmental materials=		
(1) Rain and dry fallout		
1 for domestic program	monthly	
2 for WHO program	monthly	
(2) Airborne dust	quarterly	>3000 m^3/month
(3) Service water and freshwater		
1 Service water (sourse water)	semiyearly (June and December)	100 ℓ
2 Service water (tap water)	semiyearly (June and December)	100 ℓ
3 Freshwater	yearly (fishing season)	100 ℓ
(4) Soil		
1 0~5 cm	yearly (June or July)	4 kg
2 5~20 cm	yearly (June or July)	4 kg
(5) Sea water	yearly (July or August)	40 ℓ
(6) Sea sediments	yearly (July or August)	4 kg
=Dietary materials=		
(7) Total diet	semiyearly (June, November or December)	daily amount for 5 person
(8) Rice		
1 Producing districts	Yearly (harvesting season)	5 kg (polished rice)
2 consuming districts	yearly (harvesting season)	5 kg (polished rice)
(9) Milk		
1 producing districts for WHO program	quarterly (February, May, August and November)	3 ℓ
2 producing districts for domestic program	semiyearly (February and August)	3 ℓ

Sample	Frequency of sampling	Quantity of sample
3 consuming districts	semiyearly (February and August)	3 ℓ
4 powdered milk	semiyearly (April and October)	2~3 kg
(10) Vegetables		
1 producing districts	yearly (hervesting season)	4 kg
2 consuming districts	yearly (harvesting season)	4 kg
(11) Tea	yearly (the first harvesting season)	500 g (manufactured tea)
(12) Fish, shellfish, and seaweeds		
1 Sea fish	yearly (fishing season)	4 kg
2 Freshwater fish	yearly (fishing season)	4 kg
3 Shellfish	yearly (fishing season)	4 kg
4 Seaweeds	yearly (fishing season)	2~3 kg

2. Preparation of samples for analysis

(1) Rain, service water and freshwater

Strontium and cesium were eluted with hydrochloric acid from the cation exchange column. The residue of rain sample on the filter paper was ashed in an electric muffle furnace and the ash was dissolved in hydrochlbric acid. The insoluble part was filtered and washed. The filtrate and the washings were combined to the previous eluate and used for radiochemical analysis.

(2) Soil

Air-dried soil was passed through a 20 mesh sieve. The sieved sample was heated, in the presence of strontium and cesium carriers, together with sodium hydroxide. The sample was then heated with hydrochloric acid and the insoluble part was filtered and washed. The combined solution of the filtrate and washings was used for radiochemical analysis.

(3) Sea sedments

After removal of pebbles, shells and other foreign matters, the sediment sample was dried in a hot-air oven and ground finely with a mortar. The sample was passed through a 20 mesh sieve. The further preparation of the sample was the same as that described in the section 2-(2).

(4) Rice

The ashed sample was pulverlized with a porcelain mortar and passed through a 42 mesh sieve. The sieved sample to which both strontium and cesium carriers were added, was digested with hydrochloric acid by heating. After the sample was heated again with nitric acid to dryness, strontium and cesium were extracted with hydrochloric acid and water. The insoluble part was filtered and washed. The filtrate and washings were combined for subsequent radiochemical analysis.

(5) Airborne dust, diet, milk, vegetable, fish and shellfish, seaweeds, tea, and others.

These ashed samples were treated with the same procedure as that described in the section 2-(4).

3. Separation of strontiunm-90 and cesium-137

(1) Strontium-90

Sample solutions, prepared as in the foregoing sections 2-(1) through 2-(5), were neutralized with sodium hydroxide. After sodium carbonate was added, the precipitate of strontium and calcium carbonates was separated. The supernatant solution was retained for cesium-137 determination. The carbonates were dissolved in hydrochloric acid and calcium and strontium were precipitated as oxalates. The precipitate was dissolved in nitric acid and strontium was separated from calcium by successive fuming nitric acid separations. Iron scavenge was made after addition of ferric iron carrier followed by barium chromate separation after addition of barium carrier to remove radium, its daughters and lead. Strontium was recovered as carbonate, and the precipitate was dried and weighed to determine strontium recovery. The strontium carbonate was dissolved in hydrochloric acid and the iron carrier was added. The solution was allowed to stand for two weeks for strontium-90 and yttrium-90 to attain equilibrium. The yttrium-90 was coprecipitated with ferric hydroxide and the precipitate was filtered off, washed and counted.

(2) Cesium-137

The supernatant separated from the strontium fraction in the solution was acidified with hydrochloric acid.

While stirring the solution, cesium was adsorbed on ammonium molybdophosphate.

After filtered off and washed with dilute nitric acid, the precipitate was dissolved in 2.5N sodium hydroxide solution. Ammonia was removed completely from the solution by boiling. The solution was adjusted to pH 8.2 with hydrochloric acid and allowed to cool. Molybdenum hydroxide which came out in the solution, was filtered off and washed with water. In such circumstance that contamination by rubidium-87 was not negligible for the measurement of cesium-137, the follwing ion-exchange procedure was applied. A fixed amount of ferric chloride solution was added to the solution dissolved with 2.5N sodium hydroxide. Ammonia and molybdenum hydroxide were removed as described above. Ethylenediaminetetraaceticacid tetrasodium salt was added to the filtrate and washings. Cesium and rubidium were adsorbed on a cation exchange resin. Cesium was separated from rubidium by eluting with hydrochloric acid.

To this eluate or the filtrate and washings after removing molybdenum hydroxide, chloroplatinic acid solution was added to precipitate cesium. The precipitate was filtered onto a tared paper in a demountable filter and washed with water and then ethanol.
After fixing the filter paper on a tared planchette and drying it, the chemical yield of cesium was determined by weighing the precipitate with the planchette. Radioactivity from cesium-137 was measured for this precipitate.

4. Determination of stable strontium, calcium and potassium

A weighed amount of soil or sea sediment was treated under heating with sodium hydroxide and then with hydrochloric acid for extraction. A weighed aliquot of ashed samples of total diet, vegetables, milk, fish, shellfish or seeweeds was digested using hydrochloric acid or nitric acid, hydrofluoric acid being used when necessary. The extract was made up to an appropriate volume with dilute hydrochloric acid. The sample solution was analyzed for calcium by titration with standard potassium permanganate solution after separating calcium as oxalate. Atomic absorption spectroscopy was applied when appropriate. Stable strontium and potassium were determined by atomic absorption and flame emission spectrometry, respectively.

5. Counting

After the radiochemical separation, the mounted precipitates were counted for activity using low background beta counters normally for 60 min. Net sample counting rates were corrected for counter efficeiency, recovery, self-absorption and decay to obtain the content of strontium-90 and cesium-137 radioactivity per sample aliquot. From the results, concentrations of these nuclides in the original samples were calculated.

(1)-1 Strontium-90 and Cesium-137 in Rain and dry fallout(for domestic program) (from Nov. 1983 to Jal. 1984)

—continued from NO. 66 of this publication—

Table(1)-1: Strontium-90 and Cesium-137 Rain and dry fallout

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
November, 1983				
Matsue, SHIMANE	30	130.6	0.008±0.0009	0.006±0.0008
December, 1983				
Matsue, SHIMANE	31	234.5	0.006±0.0008	0.006±0.0008
January, 1984				
Sapporo, HOKKAIDO	37	70.5	0.002±0.0006	0.002±0.0007
Aomori, AOMORI	29	43.5	0.005±0.0008	0.002±0.0007
Ojika-gun, MIYAGI	36	65.7	0.005±0.0008	0.002±0.0007
Yamagata, YAMAGATA	29	69.7	0.001±0.0006	0.002±0.0007
Futaba-gun, FUKUSHIMA	36	39.9	0.002±0.0006	0.001±0.0006
Mito, IBARAGI	28	40.0	0.001±0.0006	0.003±0.0007
Shinjuku, TOKYO	29	71.0	0.000±0.0005	0.002±0.0007
Yokohama, KANAGAWA	29	31.3	0.001±0.0008	0.005±0.0008
Fukui, FUKUI	25	289.8	0.007±0.0009	0.007±0.0009
Shizuoka, SHIZUOKA	29	38.5	0.002±0.0006	0.000±0.0006
Nagoya, AICHI	28	32.6	0.002±0.0006	0.001±0.0006
Kyoto, KYOTO	28	46.2	0.002±0.0006	0.001±0.0006
Kobe, HYOGO	36	20.7	0.002±0.0006	0.001±0.0007
Wakayama, WAKAYAMA	27	28.9	0.001±0.0005	0.001±0.0006
Tottori, TOTTORI	28	177.6	0.006±0.0008	0.007±0.0009
Matsue, SHIMANE	32	149.2	0.005±0.0007	0.007±0.0008
Hiroshima, HIROSHIMA	28	22.0	0.004±0.0007	0.006±0.0008
Matsuyama, EHIME	37	66.5	0.002±0.0006	0.002±0.0007
Dazaifu, HUKUOKA	29	85.1	0.002±0.0006	0.001±0.0007
Saga, SAGA	35	52.3	0.002±0.0007	0.000±0.0006
Nagasaki, NAGASAKI	29	79.0	0.001±0.0007	0.003±0.0007
Nakagami-gun, OKINAWA	37	132.0	0.003±0.0007	0.002±0.0007
February, 1984				
Sapporo, HOKKAIDO	30	148.5	0.001±0.0006	0.003±0.0007
Aomori, AOMORI	30	50.1	0.006±0.0008	0.003±0.0007
Ojika-gun, MIYAGI	30	104.9	0.003±0.0006	0.002±0.0006
Yamagata, YAMAGATA	30	65.8	0.000±0.0006	0.001±0.0006
Futaba-gun, FUKUSHIMA	30	105.1	0.002±0.0007	0.003±0.0007
Mito, IBARAGI	30	73.0	0.001±0.0006	0.003±0.0007
Shinjuku, TOKYO	30	74.0	0.001±0.0006	0.003±0.0007
Yokohama, KANAGAWA	29	90.8	0.002±0.0006	0.004±0.0007
Fukui, FUKUI	32	356.5	0.004±0.0007	0.007±0.0008
Shizuoka, SHIZUOKA	30	96.0	0.002±0.0006	0.001±0.0006

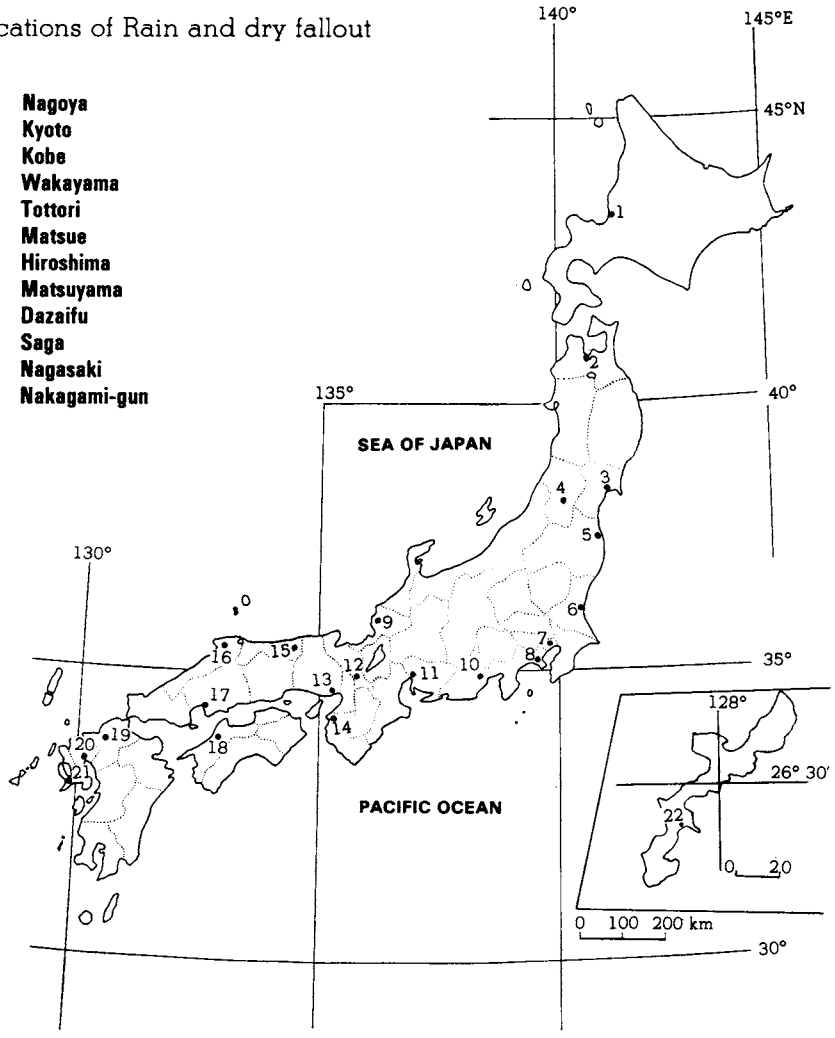
Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Nagoya, AICHI	30	96.6	0.001±0.0006	0.003±0.0007
Kyoto, KYOTO	30	70.0	0.003±0.0007	0.001±0.0006
Wakayama, WAKAYAMA	30	40.0	0.001±0.0005	0.001±0.0006
Tottori, TOTTORI	30	144.4	0.006±0.0008	0.008±0.0009
Matsue, SHIMANE	31	54.8	0.005±0.0007	0.007±0.0007
Hiroshima, HIROSHIMA	30	47.1	0.004±0.0007	0.005±0.0007
Matsuyama, EHIME	30	60.5	0.002±0.0006	0.003±0.0007
Dazaifu, FUKUOKA	30	54.1	0.001±0.0006	0.002±0.0007
Saga, SAGA	24	42.4	0.002±0.0006	0.003±0.0007
Nagasaki, NAGASAKI	30	26.5	0.003±0.0007	0.002±0.0007
Nakagami-gun, OKINAWA	30	42.5	0.004±0.0011	0.002±0.0011
March, 1984				
Sapporo, HOKKAIDO	31	81.0	0.001±0.0006	0.002±0.0007
Aomori, AOMORI	33	32.8	0.012±0.0010	0.006±0.0008
Ojika-gun, MIYAGI	31	42.6	0.004±0.0007	0.003±0.0007
Yamagata, YAMAGATA	33	61.8	0.002±0.0006	0.004±0.0007
Futaba-gun, FUKUSHIMA	31	30.9	0.002±0.0006	0.008±0.0009
Mito, IBARAGI	33	48.5	0.003±0.0007	0.007±0.0008
Shinjuku, TOKYO	33	86.0	0.004±0.0007	0.012±0.0010
Yokohama, KANAGAWA	32	98.3	0.002±0.0007	0.006±0.0008
Fukui, FUKUI	30	121.2	0.004±0.0007	0.040±0.0015
Shizuoka, SHIZUOKA	33	104.5	0.002±0.0006	0.002±0.0005
Nagoya, AICHI	33	82.5	0.001±0.0006	0.004±0.0006
Kyoto, KYOTO	33	44.9	0.004±0.0008	0.004±0.0006
Kobe, HYOGO	32	42.5	0.003±0.0007	0.004±0.0006
Wakayama, WAKAYAMA	31	48.8	0.002±0.0006	0.003±0.0006
Tottori, TOTTORI	33	84.8	0.005±0.0008	0.009±0.0009
Matsue, SHIMANE	32	51.1	0.005±0.0007	0.008±0.0008
Hiroshima, HIROSHIMA	33	63.0	0.004±0.0008	0.006±0.0007
Matsuyama, EHIME	30	56.0	0.002±0.0006	0.003±0.0006
Dazaifu, FUKUOKA	33	80.3	0.003±0.0007	0.004±0.0006
Saga, SAGA	27	68.0	0.001±0.0006	0.002±0.0005
Nagasaki, NAGASAKI	32	74.5	0.002±0.0006	0.003±0.0006
Nakagami-gun, OKINAWA	28	175.0	0.003±0.0007	0.004±0.0006
April, 1984				
Sapporo, HOKKAIDO	32	32.5	0.002±0.0007	0.003±0.0006
Aomori, AOMORI	30	56.6	0.023±0.0012	0.005±0.0007
Ojika-gun, MIYAGI	30	211.2	0.008±0.0009	0.005±0.0008
Yamagata, YAMAGATA	30	80.3	0.002±0.0006	0.004±0.0006
Futaba-gun, FUKUSHIMA	30	89.2	0.003±0.0006	0.007±0.0007
Mito, IBARAGI	30	38.0	0.002±0.0006	0.002±0.0005
Shinjuku, TOKYO	30	62.0	0.001±0.0006	0.003±0.0007
Yokohama, KANAGAWA	32	37.5	0.003±0.0007	0.004±0.0006
Fukui, FUKUI	32	89.7	0.002±0.0006	0.005±0.0007
Shizuoka, SHIZUOKA	30	121.5	0.004±0.0007	0.001±0.0005

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Nagoya, AICHI	30	143.0	0.002±0.0006	0.003±0.0006
Kyoto, KYOTO	30	69.2	0.002±0.0006	0.001±0.0005
Kobe, HYOGO	28	69.3	0.002±0.0006	0.001±0.0005
Wakayama, WAKAYAMA	32	113.7	0.003±0.0007	0.002±0.0006
Tottori, TOTTORI	30	144.7	0.003±0.0007	0.004±0.0007
Matsue, SHIMANE	32	120.4	0.004±0.0007	0.005±0.0007
Hiroshima, HIROSHIMA	30	180.8	0.004±0.0007	0.002±0.0006
Matsuyama, EHIME	33	162.5	0.001±0.0006	0.003±0.0006
Dazaifu, FUKUOKA	30	71.0	0.001±0.0006	0.001±0.0005
Saga, SAGA	36	171.8	0.000±0.0006	0.002±0.0006
Nagasaki, NAGASAKI	30	156.5	0.003±0.0007	0.002±0.0006
Nakagami-gun, OKINAWA	30	162.5	0.001±0.0006	0.002±0.0005
May, 1984				
Sapporo, HOKKAIDO	32	34.0	0.003±0.0006	0.003±0.0006
Aomori, AOMORI	32	37.2	0.021±0.0012	0.006±0.0007
Ojika-gun, MIYAGI	34	88.4	0.005±0.0008	0.005±0.0008
Yamagata, YAMAGATA	32	54.4	0.003±0.0007	0.004±0.0006
Futaba-gun, FUKUSHIMA	34	75.3	0.004±0.0007	0.004±0.0007
Mito, IBARAGI	32	51.5	0.003±0.0006	0.003±0.0006
Shinjuku, TOKYO	32	74.0	0.001±0.0006	0.005±0.0007
Yokohama, KANAGAWA	31	75.6	0.003±0.0007	0.004±0.0006
Fukui, FUKUI	32	94.3	0.002±0.0007	0.004±0.0006
Shizuoka, SHIZUOKA	32	105.5	0.003±0.0007	0.004±0.0006
Nagoya, AICHI	32	110.0	0.001±0.0006	0.002±0.0005
Kyoto, KYOTO	32	99.1	0.002±0.0007	0.002±0.0005
Kobe, HYOGO	35	133.9	0.002±0.0006	0.004±0.0006
Wakayama, WAKAYAMA	32	70.2	0.001±0.0006	0.002±0.0005
Tottori, TOTTORI	32	62.9	0.005±0.0008	0.003±0.0006
Matsue, SHIMANE	31	45.8	0.001±0.0006	0.002±0.0005
Hiroshima, HIROSHIMA	32	88.0	0.004±0.0007	0.002±0.0006
Matsuyama, EHIME	32	121.0	0.002±0.0006	0.002±0.0006
Dazaifu, FUKUOKA	32	125.0	0.002±0.0006	0.002±0.0006
Saga, SAGA	34	77.2	0.001±0.0006	0.001±0.0005
Nagasaki, NAGASAKI	33	91.5	0.002±0.0006	0.003±0.0006
Nakagami-gun, OKINAWA	35	147.0	0.001±0.0006	0.001±0.0005
June, 1984				
Sapporo, HOKKAIDO	32	38.0	0.002±0.0007	0.003±0.0007
Aomori, AOMORI	32	52.8	0.013±0.0010	0.003±0.0006
Yamagata, YAMAGATA	32	52.4	0.000±0.0006	0.003±0.0007
Futaba-gun, FUKUSHIMA	31	127.6	0.004±0.0007	0.003±0.0007
Mito, IBARAGI	32	177.0	0.001±0.0006	0.001±0.0004
Shinjuku, TOKYO	32	201.8	0.001±0.0006	0.003±0.0007
Yokohama, KANAGAWA	31	272.3	0.005±0.0008	0.003±0.0007
Fukui, FUKUI	32	205.8	0.001±0.0007	0.002±0.0007
Nagoya, AICHI	32	272.0	0.001±0.0006	0.003±0.0005
Kyoto, KYOTO	30	229.2	0.002±0.0007	0.002±0.0005

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Kobe, HYOGO	29	290.7	0.005±0.0007	0.002±0.0006
Wakayama, WAKAYAMA	32	313.1	0.004±0.0008	0.003±0.0006
Tottori, TOTTORI	33	182.8	0.007±0.0009	0.003±0.0006
Hiroshima, HIROSHIMA	32	295.7	0.005±0.0008	0.002±0.0006
Matsuyama, EHIME	32	384.0	0.002±0.0007	0.001±0.0005
Dazaifu, FUKUOKA	32	324.7	0.000±0.0006	0.001±0.0005
Saga, SAGA	30	381.5	0.002±0.0006	0.002±0.0005
Nagasaki, NAGASAKI	32	405.0	0.003±0.0007	0.003±0.0005
Nakagami-gun, OKINAWA	35	188.5	0.004±0.0008	0.001±0.0004
July, 1984				
Yamagata, YAMAGATA	31	72.8	0.001±0.0006	0.002±0.0005
Futaba-gun, FUKUSHIMA	32	88.4	0.001±0.0006	0.001±0.0004
Nagoya, AICHI	31	193.0	0.003±0.0007	0.001±0.0005
Kobe, HYOGO	33	132.8	0.001±0.0006	0.001±0.0005

Figure (1)-1 Sampling Locations of Rain and dry fallout

1. **Sapporo**
2. **Aomori**
3. **Ojika-gun**
4. **Yamagata**
5. **Futaba-gun**
6. **Mito**
7. **Shinjuku**
8. **Yokohama**
9. **Fukui**
10. **Shizuoka**
11. **Nagoya**
12. **Kyoto**
13. **Kobe**
14. **Wakayama**
15. **Tottori**
16. **Matsue**
17. **Hiroshima**
18. **Matsuyama**
19. **Dazaifu**
20. **Saga**
21. **Nagasaki**
22. **Nakagami-gun**



(1)-2 Strontium-90 and Cesium-137 in Rain and dry fallout(for WHO program) (from Jan. 1984 to Jul. 1984)

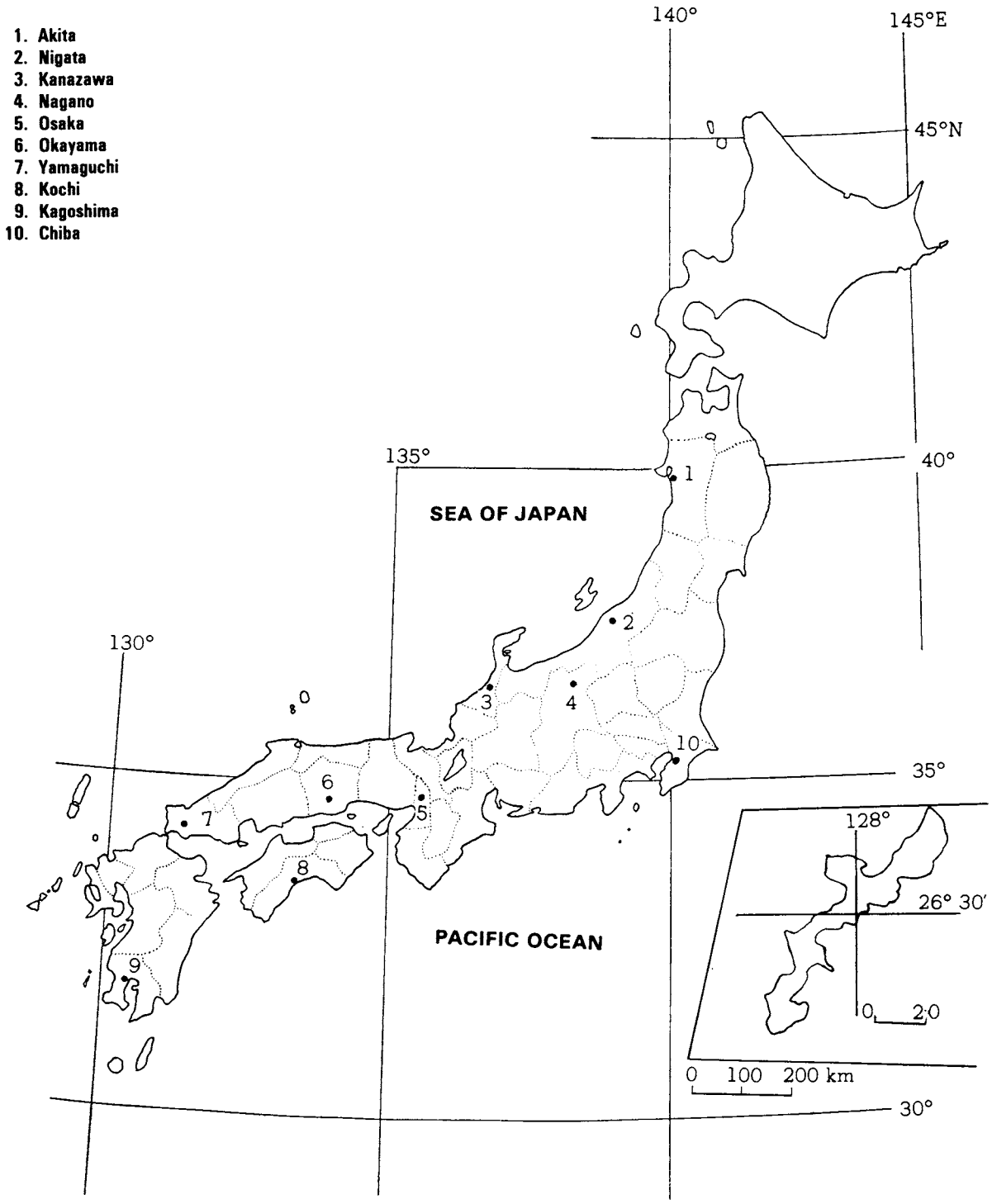
—continued from NO. 66 of this publication—

Table(1)-2 Strontium-90 and Cesium-137 Rain and dry fallout

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
January, 1984				
Akita, AKITA	29	85.1	0.003±0.0007	0.004±0.0008
Niigata, NIIGATA	28	110.1	0.005±0.0007	0.003±0.0007
Kanazawa, ISHIKAWA	35	342.0	0.004±0.0008	0.007±0.0009
Nagano, NAGANO	29	30.9	0.001±0.0006	0.000±0.0006
Osaka, OSAKA	28	56.9	0.004±0.0007	0.002±0.0007
Okayama, OKAYAMA	28	42.1	0.001±0.0006	0.001±0.0006
Yamaguchi, YAMAGUCHI	29	41.5	0.003±0.0007	0.003±0.0007
Kochi, KOCHI	28	67.7	0.004±0.0007	0.001±0.0006
Kagoshima, KAGOSHIMA	28	53.6	0.007±0.0013	0.002±0.0006
February, 1984				
Akita, AKITA	32	77.1	0.001±0.0006	0.002±0.0006
Niigata, NIIGATA	30	52.4	0.001±0.0006	0.003±0.0007
Kanazawa, ISHIKAWA	31	217.0	0.004±0.0007	0.006±0.0008
Nagano, NAGANO	30	40.0	0.001±0.0006	0.001±0.0006
Osaka, OSAKA	30	79.7	0.002±0.0006	0.003±0.0007
Okayama, OKAYAMA	30	45.5	0.001±0.0005	0.005±0.0007
Yamaguchi, YAMAGUCHI	30	61.0	0.008±0.0008	0.009±0.0008
Kochi, KOCHI	30	86.0	0.004±0.0007	0.002±0.0007
Kagoshima, KAGOSHIMA	30	71.6	0.008±0.0010	0.003±0.0007
Chiba, CHIBA	30	51.6	0.001±0.0006	0.002±0.0005
March, 1984				
Akita, AKITA	31	70.5	0.002±0.0007	0.007±0.0008
Niigata, NIIGATA	33	55.0	0.005±0.0007	0.009±0.0009
Kanazawa, ISHIKAWA	33	132.5	0.006±0.0008	0.012±0.0010
Nagano, NAGANO	33	32.9	0.002±0.0006	0.002±0.0006
Osaka, OSAKA	31	56.8	0.003±0.0007	0.004±0.0006
Okayama, OKAYAMA	33	57.2	0.002±0.0007	0.004±0.0006
Yamaguchi, YAMAGUCHI	33	77.0	0.008±0.0009	0.006±0.0007
Kochi, KOCHI	30	69.4	0.004±0.0008	0.002±0.0005
Kagoshima, KAGOSHIMA	31	159.5	0.007±0.0009	0.004±0.0006
Chiba, CHIBA	33	87.2	0.002±0.0006	0.004±0.0006
April, 1984				
Akita, AKITA	29	82.9	0.003±0.0007	0.003±0.0006
Niigata, NIIGATA	30	24.2	0.003±0.0007	0.004±0.0006
Kanazawa, ISHIKAWA	30	110.5	0.002±0.0006	0.003±0.0006
Nagano, NAGANO	30	25.4	0.001±0.0005	0.000±0.0005
Osaka, OSAKA	32	78.1	0.002±0.0006	0.003±0.0006

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Okayama, OKAYAMA	30	101.3	0.002±0.0006	0.003±0.0006
Yamaguchi, YAMAGUCHI	30	105.0	0.004±0.0007	0.002±0.0006
Kochi, KOCHI	33	369.4	0.008±0.0008	0.006±0.0007
Kagoshima, KAGOSHIMA	32	265.0	0.004±0.0008	0.002±0.0006
Chiba, CHIBA	31	80.9	0.002±0.0007	0.003±0.0005
May, 1984				
Akita, AKITA	33	93.5	0.003±0.0007	0.007±0.0008
Niigata, NIIGATA	32	59.3	0.002±0.0006	0.005±0.0006
Kanazawa, ISHIKAWA	32	104.5	0.002±0.0007	0.004±0.0006
Nagano, NAGANO	32	67.9	0.002±0.0007	0.003±0.0006
Osaka, OSAKA	32	162.7	0.001±0.0006	0.003±0.0006
Okayama, OKAYAMA	32	76.4	0.001±0.0005	0.001±0.0005
Yamaguchi, YAMAGUCHI	32	70.0	0.006±0.0007	0.002±0.0006
Kochi, KOCHI	33	100.6	0.005±0.0007	0.001±0.0005
Kagoshima, KAGOSHIMA	32	145.5	0.002±0.0006	0.000±0.0005
Chiba, CHIBA	31	50.8	0.001±0.0005	0.002±0.0005
June, 1984				
Akita, AKITA	31	123.6	0.002±0.0006	0.001±0.0005
Niigata, NIIGATA	32	67.6	0.005±0.0008	0.001±0.0005
Kanazawa, ISHIKAWA	32	249.0	0.001±0.0007	0.001±0.0007
Nagano, NAGANO	32	154.4	0.003±0.0007	0.002±0.0007
Osaka, OSAKA	32	332.8	0.001±0.0005	0.002±0.0005
Okayama, OKAYAMA	32	202.6	0.002±0.0006	0.001±0.0005
Yamaguchi, YAMAGUCHI	32	323.5	0.002±0.0006	0.002±0.0005
Kochi, KOCHI	31	601.1	0.009±0.0009	0.005±0.0007
Kagoshima, KAGOSHIMA	32	250.0	0.002±0.0009	0.002±0.0005
Chiba, CHIBA	32	250.4	0.003±0.0008	0.001±0.0005
July, 1984				
Akita, AKITA	32	214.4	0.002±0.0006	0.002±0.0005
Chiba, CHIBA	31	91.9	0.002±0.0007	0.001±0.0006

Figure (1)-2 Sampling Locations of Rain and dry fallout



(2) Strontium-90 and Cesium-137 in Airborne dust (from Oct. 1983 to Jun. 1984)

—continued from NO. 66 of this publication—

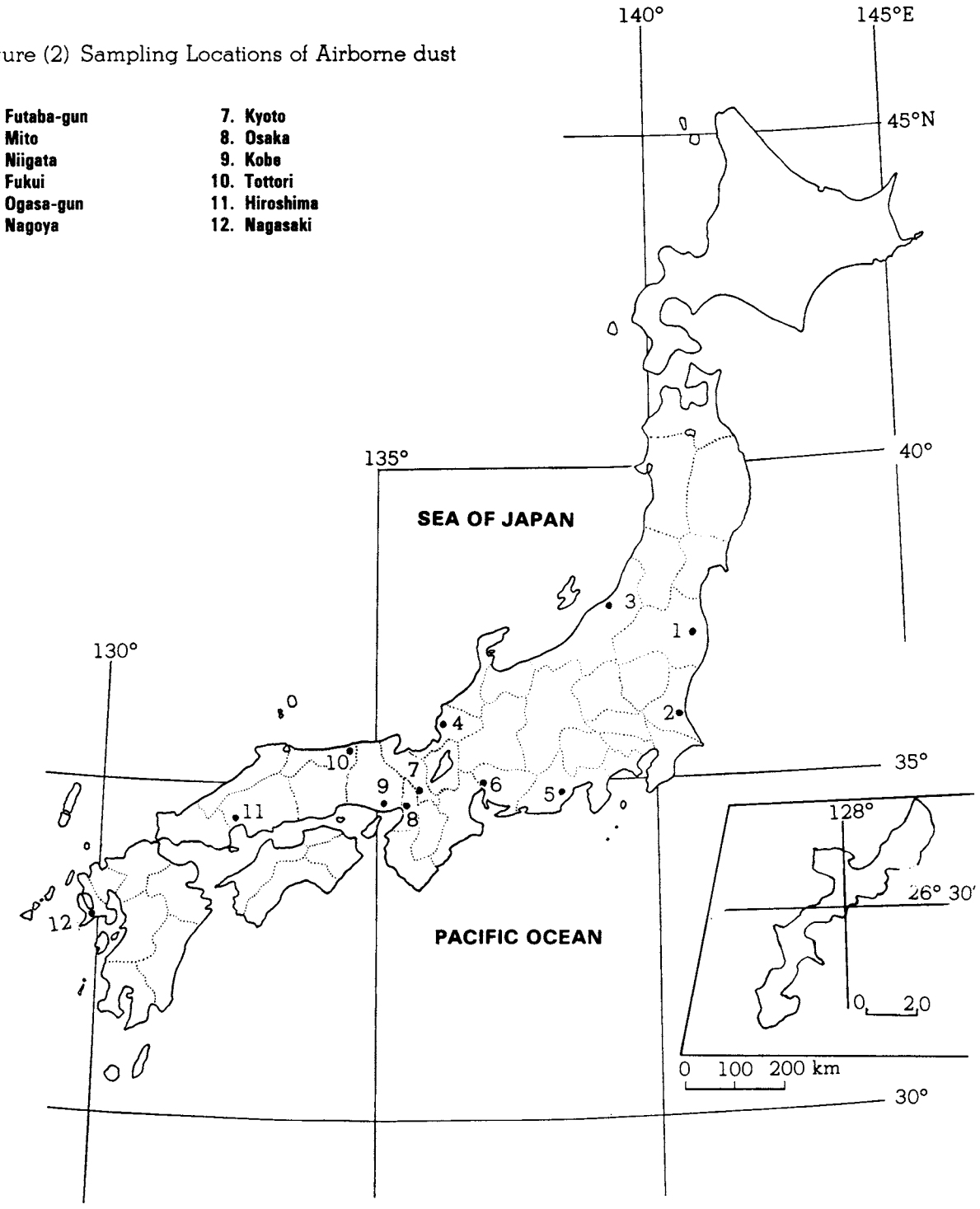
Table(2): Strontium-90 and Cesium-137 in Airborne dust

Location	Sampling Period	Absorption volume(m^3)	^{90}Sr ($10^{-3}pCi/m^3$)	^{137}Cs ($10^{-3}pCi/m^3$)
October~December, 1983				
Mito, IBARAGI	10~12	10,508	0.03±0.03	0.05±0.02
Niigata, NIIGATA	10~12	14,468	0.05±0.02	0.05±0.02
Fukui, FUKUI	10~12	20,332	0.03±0.01	0.04±0.01
Ogasa-gun, SHIZUOKA	10~12	11,660	0.04±0.02	0.03±0.02
Nagoya, AICHI	10~12	9,457	0.04±0.03	0.05±0.02
Kyoto, KYOTO	10~12	9,101	0.01±0.03	0.03±0.02
Osaka, OSAKA	10~12	7,776	0.02±0.03	0.05±0.03
Kobe, HYOGO	10~12	10,047	0.03±0.03	0.05±0.02
Tottori, TOTTORI	10~12	9,889	0.00±0.03	0.04±0.02
Nagasaki, NAGASAKI	10~12	11,958	0.00±0.02	0.02±0.01
November~December, 1983				
Futaba-gun, FUKUSHIMA	11~12	7,535	0.01±0.03	0.03±0.02
Hiroshima, HIROSHIMA	11~12	10,024	0.00±0.02	0.02±0.01
January~February, 1984				
Nagasaki, NAGASAKI	1~2	9,502	0.02±0.03	0.01±0.02
January~March, 1984				
Mito, IBARAGI	1~3	9,807	0.10±0.03	0.00±0.02
Niigata, NIIGATA	1~3	14,392	0.02±0.02	0.04±0.01
Fukui, FUKUI	1~3	20,100	0.02±0.01	0.03±0.01
Ogasa-gun, SHIZUOKA	1~3	11,445	0.10±0.03	0.03±0.02
Nagoya, AICHI	1~3	10,277	0.10±0.03	0.10±0.02
Kyoto, KYOTO	1~3	7,581	0.10±0.04	0.03±0.03
Osaka, OSAKA	1~3	7,776	0.02±0.04	0.02±0.02
Kobe, HYOGO	1~3	10,150	0.00±0.03	0.02±0.01
Tottori, TOTTORI	1~3	10,002	0.10±0.03	0.02±0.02
Hiroshima, HIROSHIMA	1~3	10,078	0.10±0.04	0.10±0.02
February~March, 1984				
Futaba-gun, FUKUSHIMA	2~3	12,546	0.04±0.02	0.00±0.01
April~June, 1984				
Futaba-gun, FUKUSHIMA	4~6	12,786	0.00±0.02	0.02±0.02
Niigata, NIIGATA	4~6	14,293	0.03±0.02	0.04±0.02
Fukui, FUKUI	4~6	17,786	0.01±0.02	0.04±0.01
Ogasa-gun, SHIZUOKA	4~6	12,007	0.02±0.03	0.04±0.02
Nagoya, AICHI	4~6	11,315	0.01±0.03	0.10±0.02
Osaka, OSAKA	4~6	7,776	0.10±0.04	0.03±0.03
Kobe, HYOGO	4~6	9,909	0.10±0.03	0.10±0.02
Tottori, TOTTORI	4~6	10,165	0.02±0.03	0.04±0.02
Hiroshima, HIROSHIMA	4~6	10,692	0.00±0.03	0.02±0.02
Nagasaki, NAGASAKI	4~6	14,021	0.00±0.02	0.04±0.02

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
May~June, 1984				
Kyoto, KYOTO	5~6	11,117	0.00±0.03	0.05±0.02

Figure (2) Sampling Locations of Airborne dust

1. **Futaba-gun**
2. **Mito**
3. **Niigata**
4. **Fukui**
5. **Ogasa-gun**
6. **Nagoya**
7. **Kyoto**
8. **Osaka**
9. **Kobe**
10. **Tottori**
11. **Hiroshima**
12. **Nagasaki**



(3) Strontium-90 and Cesium-137 in Service water (from Dec. 1983 to Jul. 1984)

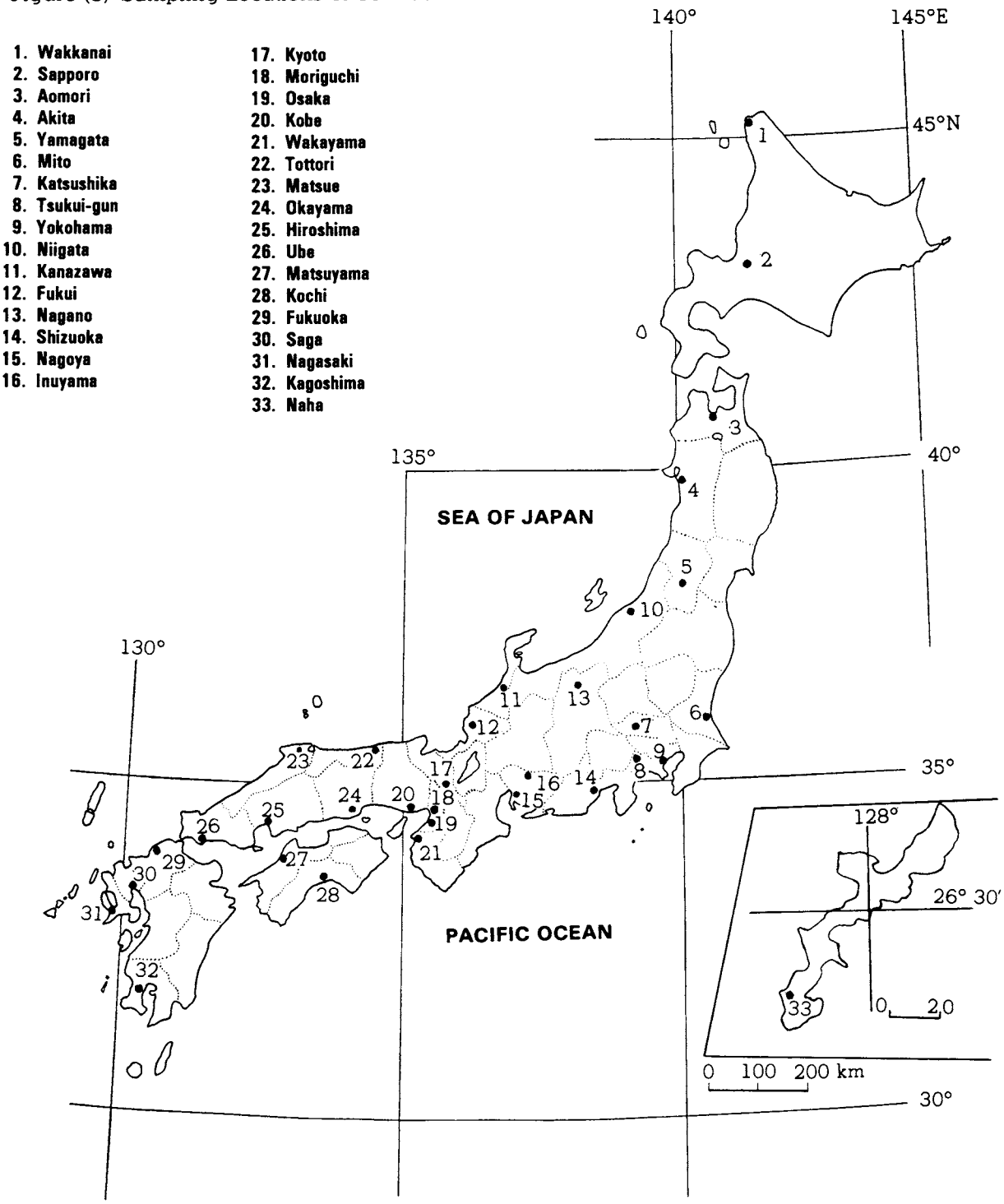
—continued from NO. 66 of this publication—

Table(3): Strontium-90 and Cesium-137 in Service water

Location	pH	^{90}Sr (pCi/ℓ)	^{137}Cs (pCi/ℓ)
(Source Water)			
December, 1983			
Katsusika, TOKYO	7.1	0.06±0.005	0.002±0.003
Tsukui-gun, KANAGAWA	7.4	0.02±0.004	0.010±0.003
Moriguchi, OSAKA	7.0	0.16±0.007	0.010±0.003
Fukuoka, FUKUOKA	6.5	0.05±0.004	0.003±0.002
January, 1984			
Sapporo, HOKKAIDO	6.8	0.07±0.005	0.004±0.003
Kyoto, KYOTO	7.3	0.18±0.007	0.003±0.002
June, 1984			
Katsushika, TOKYO	6.9	0.07±0.005	0.003±0.002
Tsukui-gun, KANAGAWA	8.2	0.02±0.004	0.001±0.002
Inuyama, AICHI	6.9	0.10±0.006	0.002±0.002
Moriguchi, OSAKA	7.0	0.19±0.008	0.010±0.002
Fukuoka, FUKUOKA	6.3	0.11±0.006	0.003±0.002
July, 1984			
Sappro, HOKKAIDO	7.1	0.09±0.006	0.010±0.002
(Tap Water)			
December, 1983			
Wakkanai, HOKKAIDO	6.7	0.07±0.005	0.004±0.003
Aomori, AOMORI	7.3	0.03±0.004	0.010±0.003
Katsushika, TOKYO	6.7	0.05±0.005	0.005±0.003
Yokohama, KANAGAWA	7.4	0.03±0.004	0.003±0.003
Fukui, FUKUI	7.2	0.01±0.004	0.003±0.003
Shizuoka, SHIZUOKA	7.3	0.04±0.004	0.010±0.003
Matse, SHIMANE	7.4	0.06±0.005	0.000±0.002
Ube, YAMAGUCHI	7.2	0.07±0.005	0.000±0.002
Kochi, KOCHI	7.2	0.07±0.005	0.002±0.003
Fukuoka, FUKUOKA	6.3	0.08±0.005	0.000±0.002
Saga, SAGA	7.2	0.06±0.005	0.000±0.003
Nagasaki, NAGASAKI	6.9	0.09±0.007	0.002±0.003
Kagoshima, KAGOSHIMA	6.7	0.02±0.003	0.010±0.003
January, 1984			
Kyoto, KYOTO	7.1	0.17±0.008	0.010±0.003
Wakayama, WAKAYAMA	7.2	0.05±0.004	0.000±0.002
Hiroshima, HIROSHIMA	6.6	0.09±0.006	0.001±0.003
Naha, OKINAWA	7.6	0.15±0.007	0.010±0.003

Location	pH	^{90}Sr (pCi/ℓ)	^{137}Cs (pCi/ℓ)
June, 1984			
Wakkanai, HOKKAIDO	6.6	0.06±0.005	0.001±0.002
Aomori, AOMORI	7.2	0.04±0.004	0.010±0.002
Yamagata, YAMAGATA	7.0	0.03±0.004	0.003±0.002
Mito, IBARAGI	7.1	0.03±0.004	0.001±0.002
Katsushika, TOKYO	6.7	0.06±0.005	0.010±0.002
Yokohama, KANAGAWA	7.0	0.04±0.004	0.003±0.002
Niigata, NIIGATA	6.8	0.11±0.007	0.010±0.002
Kanazawa, ISHIKAWA	6.6	0.04±0.004	0.005±0.002
Fukui, FUKUI	8.0	0.02±0.003	0.004±0.002
Nagano, NAGANO	6.8	0.05±0.005	0.005±0.002
Shizuoka, SHIZUOKA	7.6	0.05±0.005	0.000±0.002
Nagoya, AICHI	6.4	0.10±0.006	0.010±0.002
Osaka, OSAKA	6.8	0.12±0.006	0.001±0.002
Kobe, HYOGO	6.9	0.11±0.006	0.003±0.002
Wakayama, WAKAYAMA	7.4	0.08±0.005	0.002±0.003
Tottori, TOTTORI	7.5	0.09±0.006	0.000±0.002
Okayama, OKAYAMA	6.8	0.09±0.006	0.000±0.002
Hiroshima, HIROSHIMA	6.5	0.11±0.006	0.000±0.002
Ube. YAMAGUCHI	7.2	0.10±0.006	0.010±0.003
Matsuyama, EHIME	7.1	0.06±0.005	0.000±0.002
Kochi, KOCHI	7.2	0.05±0.005	0.000±0.002
Fukuoka, FUKUOKA	5.8	0.08±0.006	0.001±0.003
Saga, SAGA	7.2	0.06±0.005	0.000±0.002
Nagasaki, NAGASAKI	7.1	0.08±0.006	0.010±0.003
Kagoshima, KAGOSHIMA	—	0.03±0.004	0.010±0.002
Naha, OKINAWA	7.4	0.15±0.007	0.000±0.002
July, 1984			
Akita, AKITA	7.2	0.11±0.006	0.010±0.002

Figure (3) Sampling Locations of Service Water



(4) Strontium-90 and Cesium-137 in Freshwater (from May. 1984)

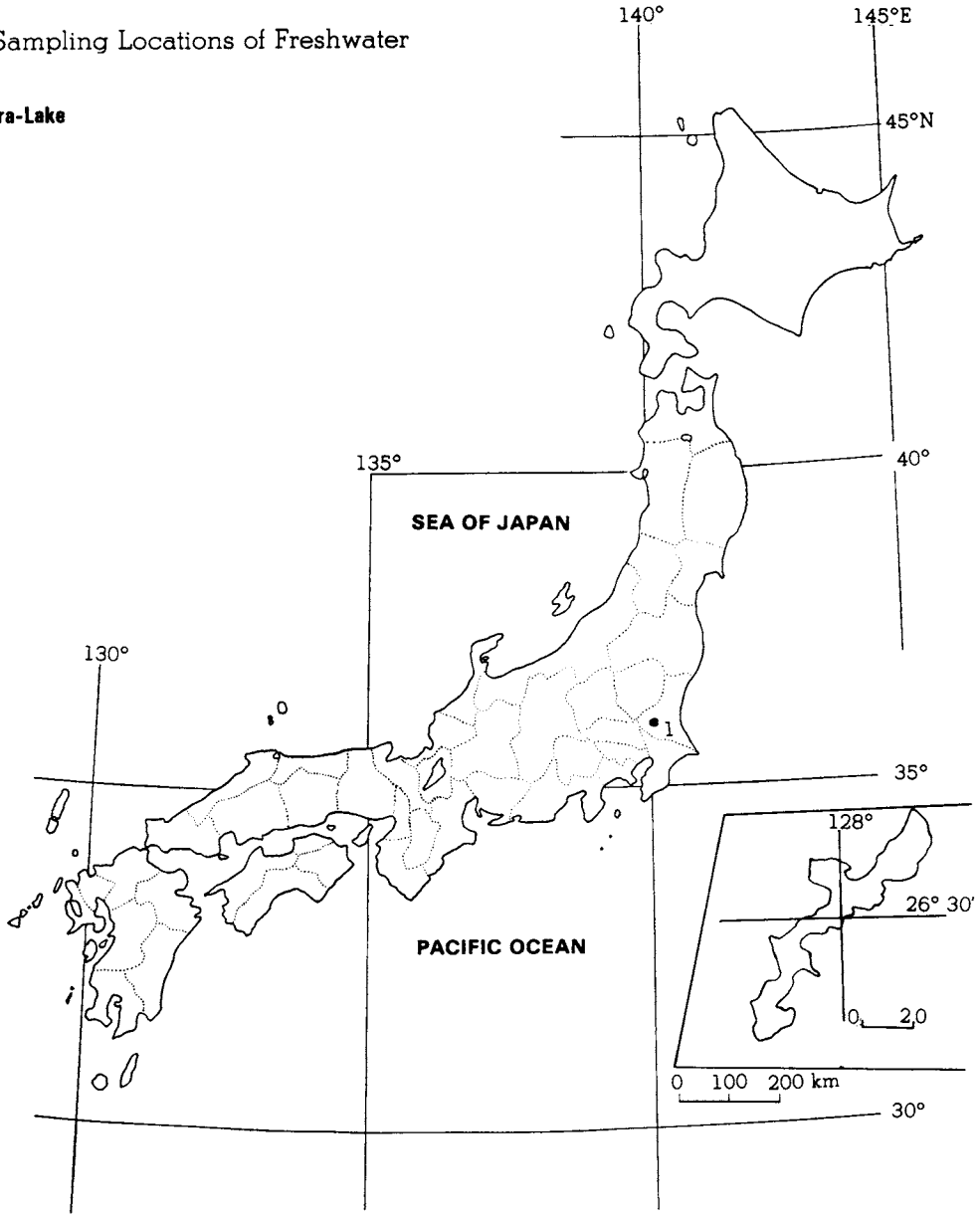
—continued from NO. 66 of this publication—

Table(4): Strontium-90 and Cesium-137 in Freshwater

Location	pH	^{90}Sr (pCi/ℓ)	^{137}Cs (pCi/ℓ)
(Freshwater)			
May, 1984			
Kasumigaura-Lake, IBARAGI	8.0	0.11±0.006	0.02±0.003

Figure (4) Sampling Locations of Freshwater

1. Kasumigaura-Lake



(5) Strontium-90 and Cesium-137 in Soil (from May. 1984 to Jul. 1984)

—continued from NO. 66 of this publication—

Table(5): Strontium-90 and Cesium-137 in Soil

Location	Sampling Depth(cm)	^{90}Sr (pCi/kg)	^{90}Sr (mCi/km^2)	^{137}Cs (pCi/kg)	^{137}Cs (mCi/km^2)
May, 1984					
Tookaimura, IBARAGI	0~5	310.0±10.0	9.5±0.29	780.0±15.0	23.0±0.50
〃	5~20	140.0± 7.0	9.7±0.48	79.0± 5.2	5.6±0.37
Atsumi-gun, AICHI	0~5	18.0± 3.6	1.1±0.22	58.0± 4.6	3.6±0.29
〃	5~20	18.0± 3.6	3.9±0.75	21.0± 3.4	4.6±0.71
June, 1984					
Gotenba, SHIZUOKA	0~5	60.0± 4.8	2.1±0.16	140.0± 7.0	4.9±0.24
〃	5~20	26.0± 3.8	4.2±0.61	54.0± 4.5	8.7±0.72
July, 1984					
Kawabe-gun, AKITA	0~5	400.0±11.0	12.0±0.30	1200.0±20.0	37.0±0.60
〃	5~20	730.0±15.0	73.0±1.50	2000.0±20.0	200.0±2.00
Yamagata, YAMAGATA	0~5	93.0± 5.6	5.7±0.34	440.0±12.0	27.0±0.70
〃	5~20	22.0± 3.4	2.3±0.35	45.0± 4.2	4.7±0.43
Nagano, NAGANO	0~5	110.0± 6.0	5.2±0.31	310.0±10.0	15.0±0.50
〃	5~20	94.0± 5.9	9.9±0.62	250.0± 9.0	27.0±0.90
Miyatsu, KYOTO	0~5	63.0± 5.2	2.3±0.19	1600.0±20.0	57.0±0.70
〃	5~20	80.0± 5.8	23.0±1.70	110.0± 6.0	30.0±1.60
Ibusuki-gun, KAGOSHIMA	0~5	38.0± 4.3	1.8±0.21	76.0± 5.2	3.8±0.25
〃	5~20	38.0± 4.3	3.5±0.41	66.0± 4.9	6.2±0.46

Figure (5) Sampling Locations in Soil

1. **Kawabe-gun**
2. **Yamagata**
3. **Tookaimura**
4. **Nagano**
5. **Gotenba**
6. **Atsumi-gun**
7. **Miyatsu**
8. **Ibasuki-gun**