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RADIOACTIVITY SURVEY DATA in Japan

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National Institute of Radiological Sciences
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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 5ℓ 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, 100ℓ 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 sampling, 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 days. 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 constant 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 transferred 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.

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* 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 steel 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 (harvesting 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 hydrochloric 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 sediments

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 strontium-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 ontamination by rubidium-87 was not negligible for the measurement of cesium-137, the following 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 efficiency, recovery, self-absorption and decay to obtain the content of strontium-90 and cesium-137 radio activity per sample aliquot. From the results, concentrations of these nuclides in the original samples were calculated.

6. Results

(1)-1 Strontium-90 and Cesium-137 in Rain and dry fallout (for domestic program) (from Jan. 1985 to Jul. 1985)

– continued from No. 70 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)
January, 1985				
Sapporo, HOKKAIDO	37	157.0	0.001 ± 0.0005	0.004 ± 0.0006
Aomori, AOMORI	26	36.6	0.004 ± 0.0007	0.002 ± 0.0006
Onagawa-machi, MIYAGI	37	6.6	0.007 ± 0.0008	0.001 ± 0.0005
Yamagata, YAMAGATA	29	35.4	0.002 ± 0.0006	0.002 ± 0.0005
Ookuma-machi, FUKUSHIMA	36	9.4	0.001 ± 0.0006	0.002 ± 0.0006
Mito, IBARAGI	28	4.5	0.001 ± 0.0006	0.002 ± 0.0006
Shinjuku, TOKYO	29	4.0	0.001 ± 0.0006	0.001 ± 0.0005
Yokohama, KANAGAWA	28	13.2	0.001 ± 0.0005	0.001 ± 0.0005
Fukui, FUKUI	31	147.6	0.005 ± 0.0007	0.004 ± 0.0006
Shizuoka, SHIZUOKA	29	21.0	0.002 ± 0.0006	0.000 ± 0.0005
Nagoya, AICHI	26	18.0	0.001 ± 0.0006	0.001 ± 0.0005
Kyoto, KYOTO	29	9.0	0.002 ± 0.0005	0.001 ± 0.0004
Kobe, HYOGO	36	8.7	0.002 ± 0.0006	0.002 ± 0.0005
Wakayama, WAKAYAMA	26	14.8	0.000 ± 0.0005	0.000 ± 0.0004
Tottori, TOTTORI	28	190.6	0.005 ± 0.0007	0.004 ± 0.0006
Matsue, SHIMANE	32	116.0	0.003 ± 0.0006	0.003 ± 0.0006
Hiroshima, HIROSHIMA	26	1.2	0.005 ± 0.0007	0.002 ± 0.0006
Matsuyama, EHIME	36	16.5	0.002 ± 0.0005	0.000 ± 0.0005
Dazaifu, FUKUOKA	29	43.2	0.001 ± 0.0005	0.002 ± 0.0005
Saga, SAGA	33	13.4	0.001 ± 0.0005	0.000 ± 0.0004
Nagasaki, NAGASAKI	29	21.0	0.002 ± 0.0006	0.000 ± 0.0004
Yonagusuku-mura, OKINAWA	26	49.0	0.001 ± 0.0007	0.000 ± 0.0005
February, 1985				
Sapporo, HOKKAIDO	29	99.0	0.001 ± 0.0006	0.002 ± 0.0006
Aomori, AOMORI	29	54.7	0.007 ± 0.0008	0.003 ± 0.0006
Onagawa-machi, MIYAGI	28	104.8	0.007 ± 0.0008	0.002 ± 0.0006
Yamagata, YAMAGATA	29	66.7	0.002 ± 0.0006	0.001 ± 0.0005
Ookuma-machi, FUKUSHIMA	29	151.7	0.005 ± 0.0007	0.015 ± 0.0011

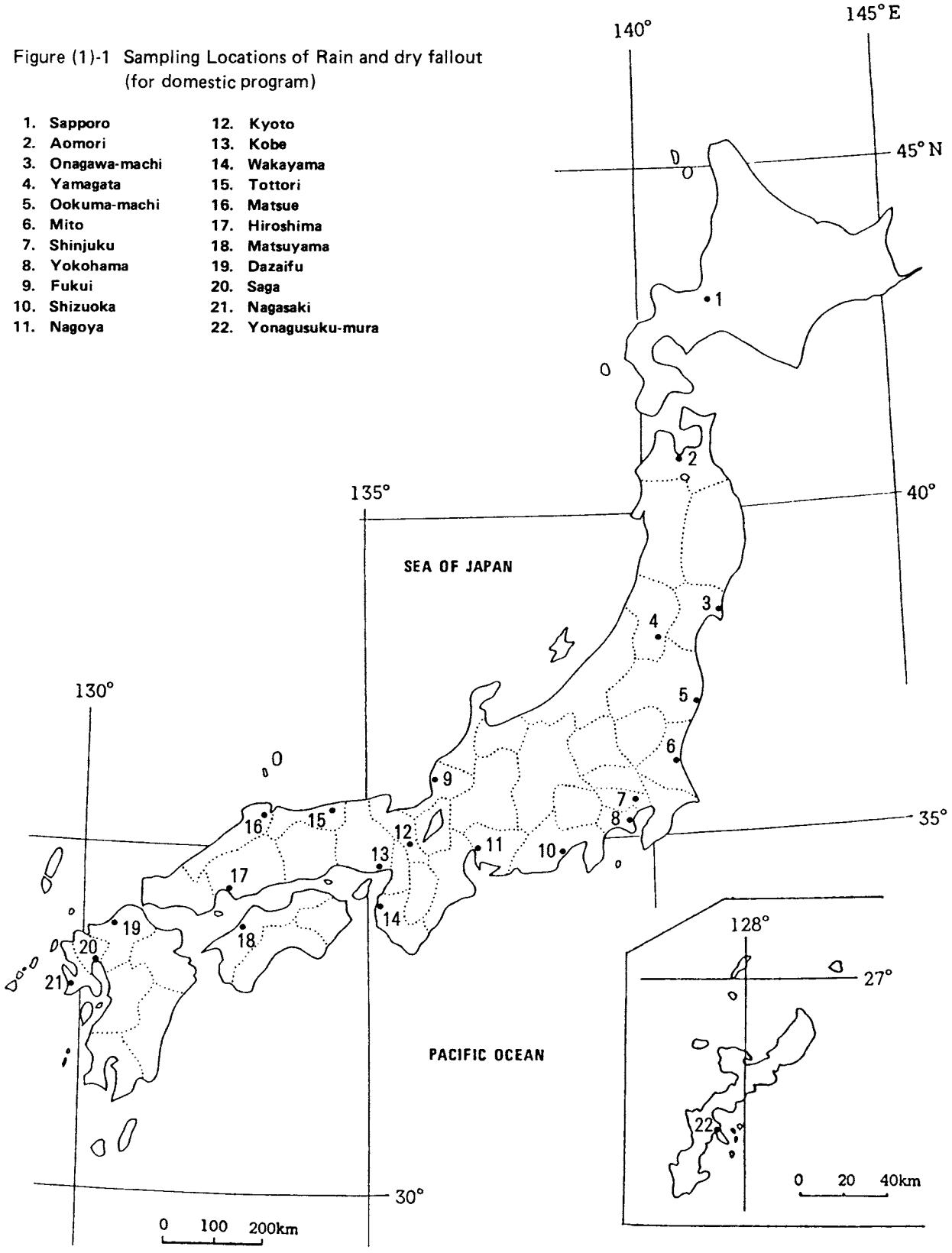
Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/Km^2)
Mito, IBARAGI	29	185.0	0.002 ± 0.0006	0.003 ± 0.0006
Shinjuku, TOKYO	29	185.2	0.005 ± 0.0007	0.003 ± 0.0006
Yokohama, KANAGAWA	30	178.3	0.002 ± 0.0006	0.001 ± 0.0006
Fukui, FUKUI	26	214.2	0.004 ± 0.0006	0.002 ± 0.0005
Shizuoka, SHIZUOKA	29	152.5	0.001 ± 0.0005	0.001 ± 0.0006
Nagoya, AICHI	29	132.0	0.002 ± 0.0006	0.002 ± 0.0005
Kyoto, KYOTO	29	92.0	0.002 ± 0.0005	0.001 ± 0.0004
Kobe, HYOGO	29	98.7	0.002 ± 0.0006	0.002 ± 0.0006
Wakayama, WAKAYAMA	33	44.2	0.002 ± 0.0006	0.002 ± 0.0005
Tottori, TOTTORI	29	172.2	0.004 ± 0.0007	0.004 ± 0.0008
Matsue, SHIMANE	31	117.6	0.003 ± 0.0007	0.003 ± 0.0006
Hiroshima, HIROSHIMA	29	112.8	0.006 ± 0.0007	0.001 ± 0.0005
Matsuyama, EHIME	29	80.5	0.002 ± 0.0005	0.001 ± 0.0005
Dazaifu, FUKUOKA	29	139.0	0.002 ± 0.0006	0.001 ± 0.0005
Saga, SAGA	30	132.9	0.002 ± 0.0006	0.002 ± 0.0005
Nagasaki, NAGASAKI	29	114.0	0.002 ± 0.0005	0.001 ± 0.0005
Yonagusuku-mura, OKINAWA	29	177.0	0.001 ± 0.0005	0.001 ± 0.0005
March, 1985				
Sapporo, HOKKAIDO	37	157.0	0.001 ± 0.0005	0.004 ± 0.0006
Aomori, AOMORI	32	15.5	0.013 ± 0.0010	0.004 ± 0.0007
Onagawa-machi, MIYAGI	30	127.7	0.006 ± 0.0007	0.002 ± 0.0006
Yamagata, YAMAGATA	32	65.6	0.003 ± 0.0006	0.003 ± 0.0007
Ookuma-machi, FUKUSHIMA	30	149.2	0.006 ± 0.0007	0.003 ± 0.0007
Mito, IBARAGI	32	126.0	0.003 ± 0.0006	0.001 ± 0.0006
Shinjuku, TOKYO	32	145.7	0.002 ± 0.0006	0.003 ± 0.0007
Yokohama, KANAGAWA	30	188.5	0.005 ± 0.0007	0.003 ± 0.0006
Fukui, FUKUI	32	161.4	0.004 ± 0.0007	0.006 ± 0.0008
Shizuoka, SHIZUOKA	32	319.0	0.001 ± 0.0005	0.002 ± 0.0006
Nagoya, AICHI	32	165.0	0.003 ± 0.0006	0.003 ± 0.0006
Kyoto, KYOTO	29	127.1	0.003 ± 0.0006	0.001 ± 0.0005
Kobe, HYOGO	31	117.0	0.002 ± 0.0006	0.002 ± 0.0006
Wakayama, WAKAYAMA	25	148.3	0.003 ± 0.0007	0.001 ± 0.0005
Tottori, TOTTORI	32	177.6	0.006 ± 0.0007	0.006 ± 0.0008
Matsue, SHIMANE	32	125.9	0.003 ± 0.0007	0.006 ± 0.0008
Hiroshima, HIROSHIMA	32	190.0	0.004 ± 0.0007	0.004 ± 0.0006
Matsuyama, EHIME	32	155.0	0.002 ± 0.0006	0.002 ± 0.0006
Dazaifu, FUKUOKA	32	181.4	0.002 ± 0.0006	0.003 ± 0.0006
Saga, SAGA	26	121.6	0.002 ± 0.0006	0.001 ± 0.0005

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/Km^2)
Nagasaki, NAGASAKI	32	186.0	0.002 ± 0.0005	0.003 ± 0.0006
Yonagusuku-mura, OKINAWA	34	108.5	0.001 ± 0.0005	0.000 ± 0.0004
April, 1985				
Sapporo, HOKKAIDO	31	51.5	0.002 ± 0.0006	0.004 ± 0.0006
Aomori, AOMORI	31	33.0	0.021 ± 0.0011	0.002 ± 0.0006
Onagawa-machi, MIYAGI	33	138.8	0.006 ± 0.0007	0.004 ± 0.0007
Yamagata, YAMAGATA	31	54.4	0.001 ± 0.0006	0.004 ± 0.0007
Ookuma-machi, FUKUSHIMA	33	225.1	0.002 ± 0.0006	0.005 ± 0.0006
Mito, IBARAGI	31	176.5	0.001 ± 0.0006	0.003 ± 0.0006
Shinjuku, TOKYO	31	213.2	0.001 ± 0.0006	0.004 ± 0.0006
Yokohama, KANAGAWA	32	253.8	0.002 ± 0.0007	0.004 ± 0.0006
Fukui, FUKUI	31	174.7	0.001 ± 0.0006	0.003 ± 0.0006
Shizuoka, SHIZUOKA	31	241.5	0.002 ± 0.0007	0.002 ± 0.0006
Nagoya, AICHI	31	210.0	0.002 ± 0.0006	0.003 ± 0.0006
Kyoto, KYOTO	30	133.9	0.003 ± 0.0006	0.001 ± 0.0005
Kobe, HYOGO	32	171.2	0.001 ± 0.0005	0.002 ± 0.0005
Wakayama, WAKAYAMA	40	88.3	0.002 ± 0.0006	0.003 ± 0.0006
Tottori, TOTTORI	31	191.8	0.005 ± 0.0007	0.004 ± 0.0007
Matsue, SHIMANE	31	117.6	0.002 ± 0.0006	0.004 ± 0.0006
Hiroshima, HIROSHIMA	31	160.2	0.003 ± 0.0007	0.003 ± 0.0006
Matsuyama, EHIME	31	131.5	0.002 ± 0.0006	0.003 ± 0.0006
Dazaifu, FUKUOKA	31	140.3	0.001 ± 0.0005	0.002 ± 0.0006
Saga, SAGA	37	140.5	0.003 ± 0.0006	0.002 ± 0.0006
Nagasaki, NAGASAKI	31	129.5	0.002 ± 0.0006	0.002 ± 0.0005
Yonagusuku-mura, OKINAWA	28	142.5	0.002 ± 0.0006	0.001 ± 0.0005
May, 1985				
Sapporo, HOKKAIDO	31	16.0	0.003 ± 0.0006	0.002 ± 0.0006
Aomori, AOMORI	32	77.5	0.020 ± 0.0011	0.002 ± 0.0006
Onagawa-machi, MIYAGI	32	110.5	0.004 ± 0.0007	0.002 ± 0.0006
Yamagata, YAMAGATA	32	79.2	0.002 ± 0.0008	0.002 ± 0.0007
Ookuma-machi, FUKUSHIMA	32	69.3	0.002 ± 0.0006	0.002 ± 0.0005
Mito IBARAGI	32	67.0	0.001 ± 0.0005	0.002 ± 0.0006
Shinjuku, TOKYO	32	89.6	0.001 ± 0.0005	0.001 ± 0.0005
Yokohama, KANAGAWA	32	117.9	0.003 ± 0.0006	0.002 ± 0.0006
Fukui, FUKUI	31	189.3	0.000 ± 0.0005	0.001 ± 0.0006
Shizuoka, SHIZUOKA	32	185.5	0.002 ± 0.0007	0.001 ± 0.0006

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/Km^2)
Nagoya, AICHI	31	211.5	0.002 ± 0.0005	0.001 ± 0.0005
Kyoto, KYOTO	32	60.7	0.002 ± 0.0006	0.001 ± 0.0005
Kobe, HYOGO	32	167.9	0.002 ± 0.0005	0.001 ± 0.0006
Wakayama, WAKAYAMA	28	131.5	0.002 ± 0.0006	0.002 ± 0.0005
Tottori, TOTTORI	32	134.8	0.004 ± 0.0007	0.001 ± 0.0005
Hiroshima, HIROSHIMA	34	155.8	0.005 ± 0.0007	0.001 ± 0.0005
Matsuyama, EHIME	32	186.5	0.003 ± 0.0006	0.002 ± 0.0005
Dazaifu, FUKUOKA	32	193.5	0.002 ± 0.0006	0.000 ± 0.0005
Saga, SAGA	31	225.7	0.003 ± 0.0006	0.001 ± 0.0006
Nagasaki, NAGASAKI	32	229.5	0.002 ± 0.0006	0.001 ± 0.0005
Yonagusuku-mura, OKINAWA	32	167.5	0.000 ± 0.0005	0.001 ± 0.0005
June, 1985				
Sapporo, HOKKAIDO	32	16.0	0.001 ± 0.0006	0.004 ± 0.0006
Onagawa-machi, MIYAGI	30	93.9	0.004 ± 0.0006	0.002 ± 0.0005
Yamagata, YAMAGATA	31	57.9	0.002 ± 0.0006	0.002 ± 0.0005
Ookuma-machi, FUKUSHIMA	31	217.6	0.003 ± 0.0006	0.002 ± 0.0005
Mito, IBARAGI	31	332.5	0.002 ± 0.0006	0.001 ± 0.0004
Shinjuku, TOKYO	31	439.5	0.001 ± 0.0006	0.002 ± 0.0005
Yokohama, KANAGAWA	32	535.3	0.003 ± 0.0006	0.002 ± 0.0005
Fukui, FUKUI	37	290.4	0.001 ± 0.0006	0.002 ± 0.0005
Shizuoka, SHIZUOKA	31	520.5	0.000 ± 0.0006	0.001 ± 0.0004
Nagoya, AICHI	32	374.4	0.002 ± 0.0006	0.002 ± 0.0005
Kyoto, KYOTO	32	344.9	0.003 ± 0.0007	0.002 ± 0.0005
Kobe, HYOGO	32	197.3	0.001 ± 0.0006	0.002 ± 0.0005
Wakayama, WAKAYAMA	30	282.0	0.001 ± 0.0006	0.001 ± 0.0005
Tottori, TOTTORI	31	262.5	0.007 ± 0.0008	0.001 ± 0.0005
Hiroshima, HIROSHIMA	29	420.9	0.004 ± 0.0006	0.001 ± 0.0004
Matsuyama, EHIME	31	236.5	0.002 ± 0.0005	0.001 ± 0.0005
Dazaifu FUKUOKA	31	633.2	0.001 ± 0.0006	0.001 ± 0.0005
Saga, SAGA	24	553.4	0.002 ± 0.0006	0.001 ± 0.0005
Nagasaki, NAGASAKI	31	456.5	0.002 ± 0.0006	0.001 ± 0.0005
Yonagusuku-mura, OKINAWA	33	279.0	0.001 ± 0.0005	0.000 ± 0.0004
July, 1985				
Yamagata, YAMAGATA	32	168.1	0.001 ± 0.0005	0.000 ± 0.0005
Nagoya, AICHI	32	230.3	0.001 ± 0.0006	0.000 ± 0.0004
Kobe, HYOGO	31	92.6	0.001 ± 0.0006	0.000 ± 0.0004
Hiroshima, HIROSHIMA	32	216.6	0.002 ± 0.0006	0.001 ± 0.0004

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

1. Sapporo
2. Aomori
3. Onagawa-machi
4. Yamagata
5. Ookuma-machi
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. Yonagusuku-mura



(1)-2 Strontium-90 and Cesium-137 in Rain and dry fallout (for WHO program) (from Jan. 1985 to Jul. 1985)

– continued from No. 70 of this publication –

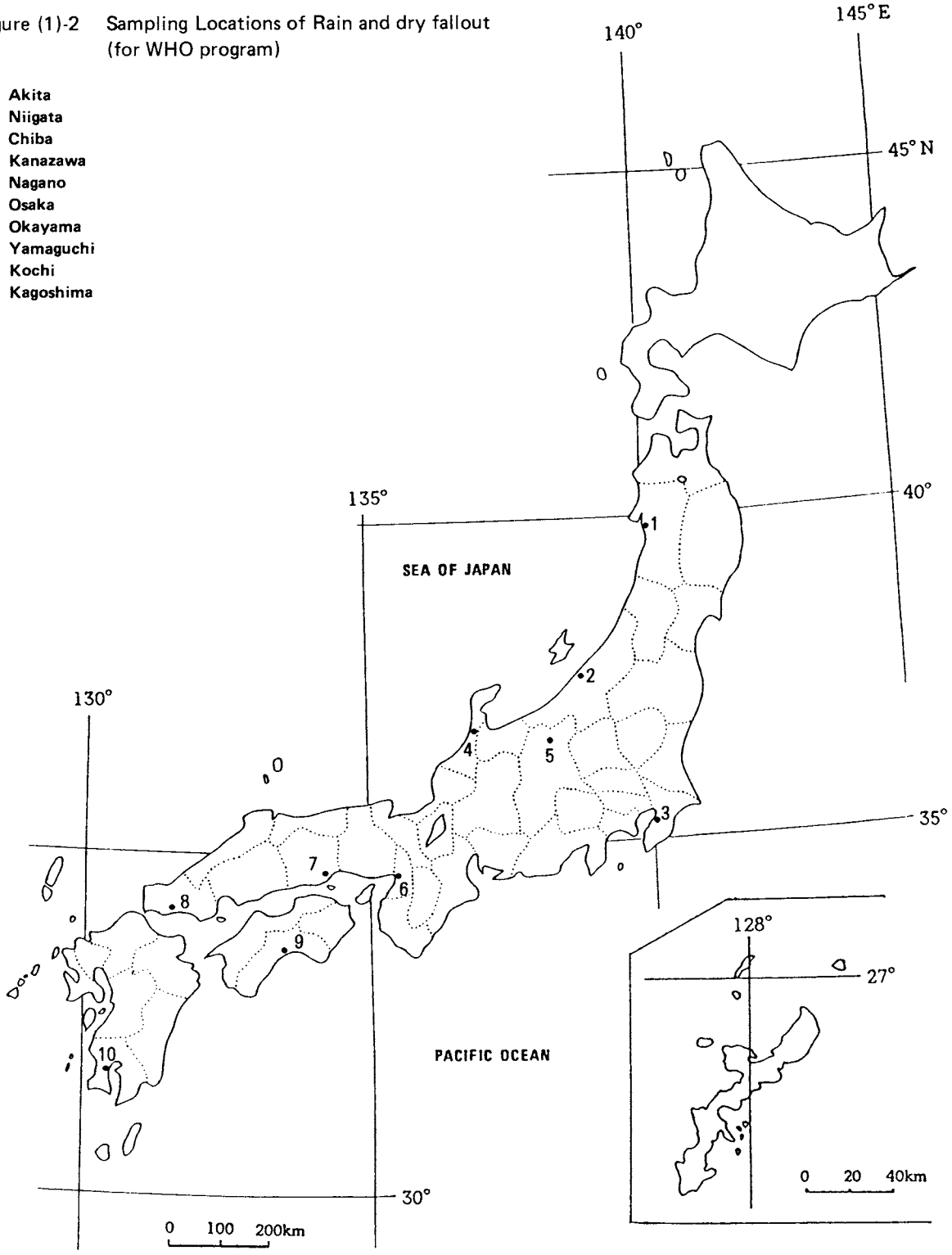
Table (1)-2: Strontium-90 and Cesium-137 Rain and dry fallout

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/Km^2)
January, 1985				
Akita, AKITA	29	81.9	0.004 ± 0.0007	0.002 ± 0.0006
Niigata, NIIGATA	29	73.9	0.002 ± 0.0006	0.006 ± 0.0006
Kanazawa, ISHIKAWA	35	275.0	0.004 ± 0.0006	0.004 ± 0.0007
Nagano, NAGANO	29	13.4	0.002 ± 0.0006	0.001 ± 0.0005
Osaka, OSAKA	29	20.7	0.001 ± 0.0005	0.000 ± 0.0005
Okayama, OKAYAMA	28	11.2	0.000 ± 0.0005	0.000 ± 0.0004
Yamaguchi, YAMAGUCHI	33	49.5	0.004 ± 0.0006	0.001 ± 0.0005
Kochi, KOCHI	28	7.7	0.004 ± 0.0006	0.002 ± 0.0004
Kagoshima, KAGOSHIMA	26	12.0	0.003 ± 0.0007	0.002 ± 0.0005
February, 1985				
Akita, AKITA	29	119.1	0.004 ± 0.0007	0.004 ± 0.0006
Chiba, CHIBA	29	206.3	0.000 ± 0.0005	0.002 ± 0.0004
Niigata, NIIGATA	29	64.5	0.004 ± 0.0007	0.004 ± 0.0007
Kanazawa, ISHIKAWA	29	161.5	0.004 ± 0.0006	0.003 ± 0.0006
Nagano, NAGANO	29	64.6	0.001 ± 0.0005	0.001 ± 0.0005
Osaka, OSAKA	29	95.3	0.003 ± 0.0006	0.002 ± 0.0006
Okayama, OKAYAMA	29	95.5	0.001 ± 0.0005	0.001 ± 0.0005
Yamaguchi, YAMAGUCHI	29	164.5	0.004 ± 0.0006	0.001 ± 0.0005
Kochi, KOCHI	29	178.5	0.004 ± 0.0006	0.002 ± 0.0004
Kagoshima, KAGOSHIMA	29	189.0	0.008 ± 0.0008	0.003 ± 0.0006
March, 1985				
Akita, AKITA	32	109.5	0.002 ± 0.0006	0.004 ± 0.0007
Chiba, CHIBA	32	158.2	0.001 ± 0.0006	0.002 ± 0.0005
Niigata, NIIGATA	32	113.7	0.003 ± 0.0006	0.004 ± 0.0007
Kanazawa, ISHIKAWA	33	208.5	0.003 ± 0.0006	0.005 ± 0.0007
Nagano, NAGANO	32	88.6	0.001 ± 0.0005	0.001 ± 0.0006
Osaka, OSAKA	30	179.8	0.003 ± 0.0007	0.003 ± 0.0007
Okayama, OKAYAMA	32	117.5	0.002 ± 0.0006	0.001 ± 0.0005
Yamaguchi, YAMAGUCHI	33	177.5	0.003 ± 0.0006	0.002 ± 0.0006
Kochi, KOCHI	28	245.7	0.005 ± 0.0007	0.002 ± 0.0005
Kagoshima, KAGOSHIMA	32	125.0	0.003 ± 0.0006	0.002 ± 0.0006

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/Km^2)	^{137}Cs (mCi/Km^2)
April, 1985				
Akita, AKITA	31	115.5	0.002 ± 0.0006	0.004 ± 0.0006
Chiba, CHIBA	32	180.3	0.001 ± 0.0007	0.003 ± 0.0005
Niigata, NIIGATA	31	58.3	0.002 ± 0.0006	0.003 ± 0.0006
Kanazawa, ISHIKAWA	30	124.0	0.001 ± 0.0006	0.002 ± 0.0006
Nagano, NAGANO	31	66.1	0.002 ± 0.0007	0.000 ± 0.0005
Osaka, OSAKA	32	200.7	0.002 ± 0.0006	0.002 ± 0.0006
Okayama, OKAYAMA	31	136.0	0.003 ± 0.0006	0.002 ± 0.0005
Yamaguchi, YAMAGUCHI	30	215.5	0.003 ± 0.0006	0.003 ± 0.0006
Kochi, KOCHI	35	419.7	0.006 ± 0.0007	0.003 ± 0.0006
Kagoshima, KAGOSHIMA	31	63.0	0.004 ± 0.0006	0.001 ± 0.0005
May, 1985				
Akita, AKITA	32	130.0	0.001 ± 0.0005	0.002 ± 0.0006
Chiba, CHIBA	33	120.1	0.001 ± 0.0006	0.001 ± 0.0005
Niigata, NIIGATA	32	165.3	0.003 ± 0.0007	0.001 ± 0.0005
Kanazawa, ISHIKAWA	35	238.5	0.001 ± 0.0006	0.001 ± 0.0005
Nagano, NAGANO	32	64.9	0.002 ± 0.0006	0.001 ± 0.0005
Osaka, OSAKA	32	125.8	0.002 ± 0.0005	0.001 ± 0.0006
Okayama, OKAYAMA	32	94.7	0.002 ± 0.0006	0.001 ± 0.0006
Yamaguchi, YAMAGUCHI	34	219.0	0.002 ± 0.0006	0.001 ± 0.0005
Kochi, KOCHI	32	290.1	0.004 ± 0.0007	0.002 ± 0.0006
Kagoshima, KAGOSHIMA	32	159.0	0.003 ± 0.0006	0.002 ± 0.0005
June, 1985				
Akita, AKITA	31	34.4	0.003 ± 0.0009	0.002 ± 0.0007
Chiba, CHIBA	29	349.1	0.001 ± 0.0007	0.002 ± 0.0006
Niigata, NIIGATA	31	97.5	0.002 ± 0.0007	0.001 ± 0.0004
Kanazawa, ISHIKAWA	27	217.0	0.002 ± 0.0006	0.000 ± 0.0004
Nagano, NAGANO	31	282.4	0.001 ± 0.0006	0.001 ± 0.0005
Osaka, OSAKA	32	327.6	0.001 ± 0.0006	0.001 ± 0.0005
Okayama, OKAYAMA	31	489.5	0.002 ± 0.0005	0.002 ± 0.0005
Yamaguchi, YAMAGUCHI	29	675.0	0.001 ± 0.0006	0.001 ± 0.0004
Kochi, KOCHI	31	303.2	0.004 ± 0.0007	0.000 ± 0.0004
Kagoshima, KAGOSHIMA	31	180.5	0.001 ± 0.0005	0.001 ± 0.0005
July, 1985				
Chiba, CHIBA	32	58.8	0.003 ± 0.0022	0.000 ± 0.0004
Osaka, OSAKA	32	85.5	0.001 ± 0.0007	0.001 ± 0.0004
Kagoshima, KAGOSHIMA	32	260.0	0.001 ± 0.0005	0.000 ± 0.0005

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

1. Akita
2. Niigata
3. Chiba
4. Kanazawa
5. Nagano
6. Osaka
7. Okayama
8. Yamaguchi
9. Kochi
10. Kagoshima



(2) Strontium-90 and Cesium-137 in Airborne dust (from Oct. 1984 to Jun. 1985)

– continued from No. 70 of this publication –

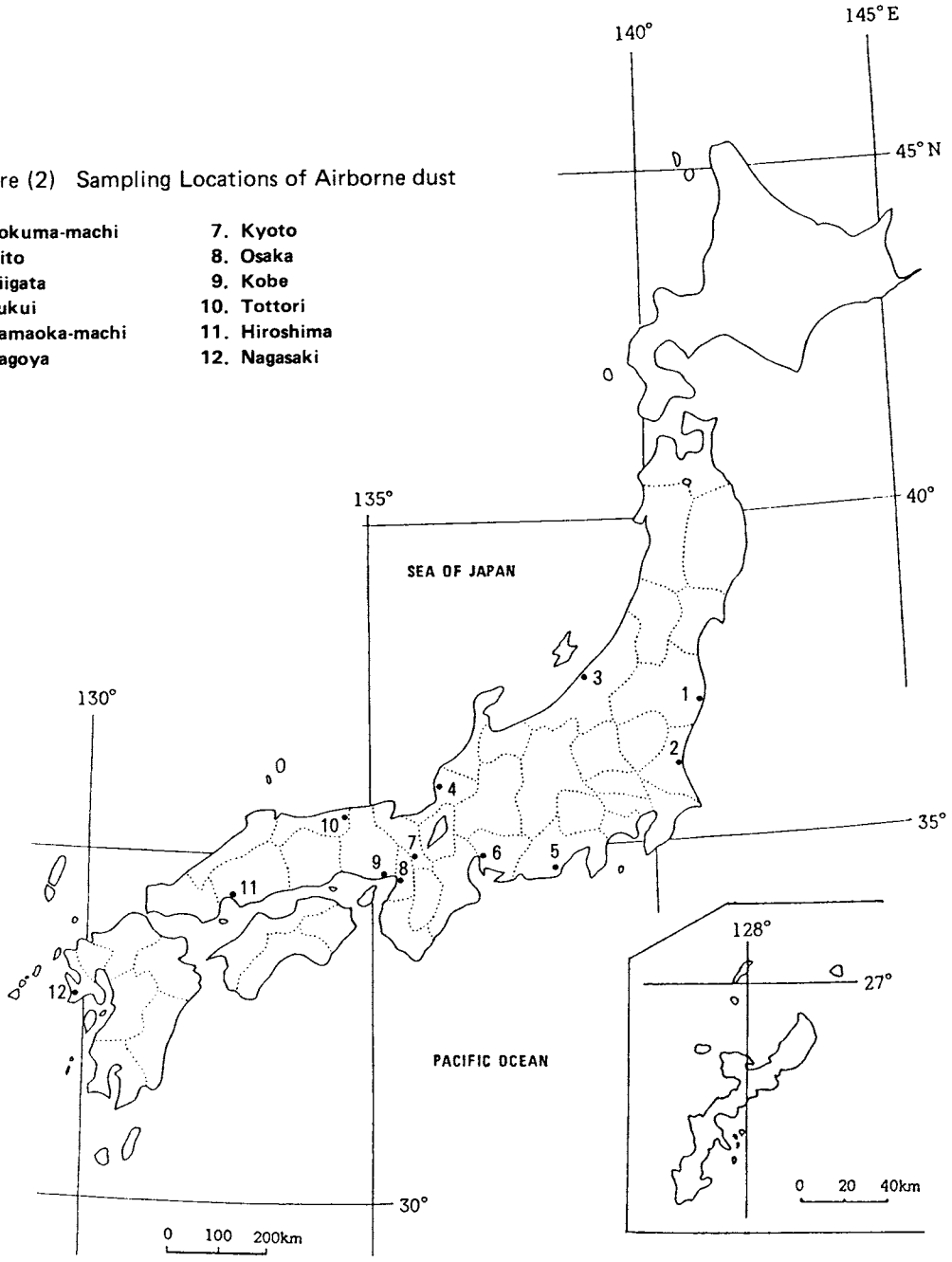
Table (2): Strontium-90 and Cesium-137 in Airborne dust

Location	Sampling Period	Absorption volume (m^3)	^{90}Sr (10^{-3} pCi/m^3)	^{137}Cs (10^{-3} pCi/m^3)
October ~ December, 1984				
Ookuma-machi, FUKUSHIMA	10 ~ 12	13,736	0.0 ± 0.02	0.04 ± 0.01
Mito, IBARAGI	10 ~ 12	11,488	0.01 ± 0.02	0.01 ± 0.02
Niigata, NIIGATA	10 ~ 12	13,971	0.0 ± 0.02	0.01 ± 0.01
Fukui, FUKUI	10 ~ 12	19,830	0.0 ± 0.01	0.01 ± 0.01
Hamaoka-machi, SHIZUOKA	10 ~ 12	11,526	0.03 ± 0.02	0.01 ± 0.01
Nagoya, AICHI	10 ~ 12	9,576	0.0 ± 0.03	0.03 ± 0.02
Kyoto, KYOTO	10 ~ 12	9,980	0.02 ± 0.03	0.0 ± 0.02
Osaka, OSAKA	10 ~ 12	8,424	0.02 ± 0.03	0.0 ± 0.02
Kobe, HYOGO	10 ~ 12	10,299	0.01 ± 0.03	0.01 ± 0.02
Tottori, TOTTORI	10 ~ 12	9,216	0.0 ± 0.03	0.03 ± 0.02
Hiroshima, HIROSHIMA	10 ~ 12	10,710	0.0 ± 0.02	0.0 ± 0.02
Nagasaki, NAGASAKI	10 ~ 12	12,052	0.01 ± 0.02	0.02 ± 0.01
January ~ February, 1985				
Kobe, HYOGO	1 ~ 2	9,923	0.0 ± 0.02	0.0 ± 0.01
January ~ March, 1985				
Ookuma-machi, FUKUSHIMA	1 ~ 3	10,870	0.01 ± 0.02	0.0 ± 0.01
Mito, IBARAGI	1 ~ 3	10,890	0.01 ± 0.02	0.02 ± 0.01
Niigata, NIIGATA	1 ~ 3	15,454	0.0 ± 0.02	0.01 ± 0.01
Fukui, FUKUI	1 ~ 3	19,477	0.03 ± 0.02	0.01 ± 0.01
Hamaoka-machi, SHIZUOKA	1 ~ 3	11,654	0.0 ± 0.02	0.0 ± 0.01
Nagoya, AICHI	1 ~ 3	9,643	0.0 ± 0.02	0.01 ± 0.02
Kyoto, KYOTO	1 ~ 3	8,601	0.02 ± 0.03	0.0 ± 0.02
Osaka, OSAKA	1 ~ 3	7,776	0.04 ± 0.04	0.03 ± 0.02
Tottori, TOTTORI	1 ~ 3	9,407	0.04 ± 0.03	0.0 ± 0.02
Hiroshima, HIROSHIMA	1 ~ 3	10,397	0.0 ± 0.02	0.1 ± 0.02
Nagasaki NAGASAKI	1 ~ 3	11,837	0.0 ± 0.02	0.01 ± 0.01
April ~ June, 1985				
Ookuma-machi, FUKUSHIMA	4 ~ 6	10,111	0.04 ± 0.02	0.03 ± 0.02
Niigata, NIIGATA	4 ~ 6	15,911	0.01 ± 0.02	0.01 ± 0.01
Fukui, FUKUI	4 ~ 6	19,961	0.0 ± 0.01	0.0 ± 0.01
Hamaoka-machi, SHIZUOKA	4 ~ 6	11,312	0.02 ± 0.02	0.03 ± 0.01
Nagoya, AICHI	4 ~ 6	10,259	0.02 ± 0.02	0.1 ± 0.02

Location	Sampling Period	Absorption volume (m^3)	^{90}Sr (10^{-3} pCi/m^3)	^{137}Cs (10^{-3} pCi/m^3)
Osaka, OSAKA	4～6	14,008	0.03 ± 0.02	0.1 ± 0.01
Kobe, HYOGO	4～6	9,825	0.03 ± 0.02	0.1 ± 0.02
Tottori, TOTTORI	4～6	10,003	0.02 ± 0.03	0.0 ± 0.01
Hiroshima, HIROSHIMA	4～6	10,097	0.04 ± 0.02	0.1 ± 0.02

Figure (2) Sampling Locations of Airborne dust

1. Ookuma-machi
2. Mito
3. Niigata
4. Fukui
5. Hamaoka-machi
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. 1984 to Jul. 1985)

– continued from No. 70 of this publication –

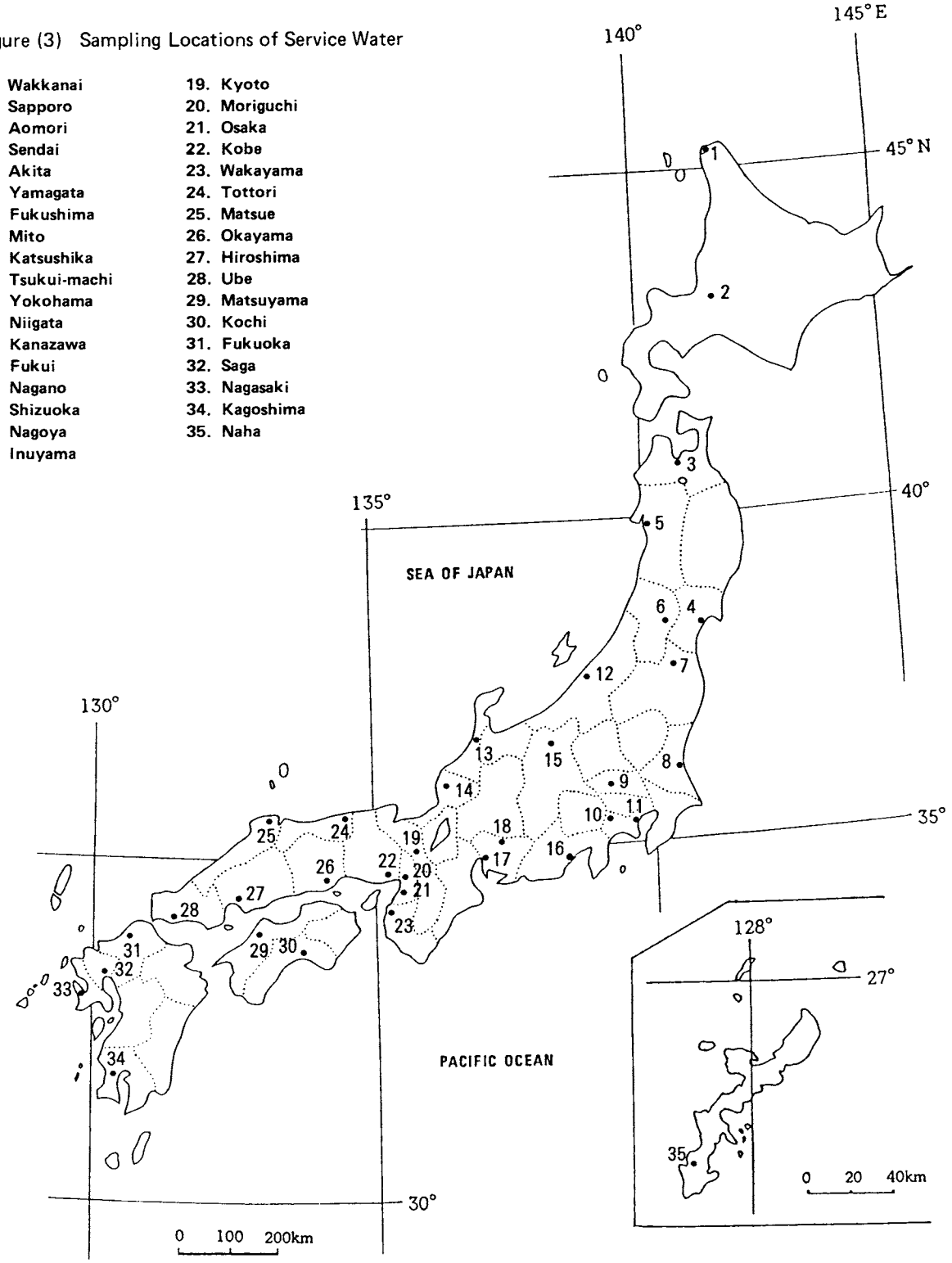
Table (3): Strontium-90 and Cesium-137 in Service water

Location	pH	^{90}Sr (pCi/ℓ)	^{137}Cs (pCi/ℓ)
(Source Water)			
December, 1984			
Katsusika, TOKYO	7.1	0.05 ± 0.005	0.01 ± 0.003
Fukuoka, FUKUOKA	6.8	0.08 ± 0.006	0.01 ± 0.002
January, 1985			
Sapporo, HOKKAIDO	6.9	0.08 ± 0.005	0.00 ± 0.002
Kyoto, KYOTO	7.6	0.17 ± 0.007	0.005 ± 0.002
May, 1985			
Tsukui-machi, KANAGAWA	7.8	0.01 ± 0.003	0.002 ± 0.003
June, 1985			
Katsushika, TOKYO	6.7	0.08 ± 0.005	0.01 ± 0.003
Inuyama, AICHI	7.1	0.08 ± 0.005	0.00 ± 0.003
Moriguchi, OSAKA	7.2	0.15 ± 0.007	0.01 ± 0.003
Fukuoka, FUKUOKA	6.8	0.08 ± 0.005	0.001 ± 0.003
July, 1985			
Sapporo, HOKKAIDO	6.9	0.07 ± 0.005	0.01 ± 0.003
(Tap Water)			
December, 1984			
Wakkanai, HOKKAIDO	6.6	0.09 ± 0.006	0.01 ± 0.002
Aomori, AOMORI	7.3	0.03 ± 0.004	0.01 ± 0.003
Akita, AKITA	6.7	0.12 ± 0.007	0.004 ± 0.002
Fukushima, FUKUSHIMA	6.7	0.13 ± 0.006	0.002 ± 0.002
Katsushika, TOKYO	6.9	0.06 ± 0.005	0.01 ± 0.003
Yokohama, KANAGAWA	6.6	0.03 ± 0.004	0.00 ± 0.002
Niigata, NIIGATA	7.0	0.12 ± 0.007	0.01 ± 0.002
Shizuoka, SHIZUOKA	7.6	0.05 ± 0.005	0.001 ± 0.002
Matsue, SHIMANE	7.4	0.14 ± 0.006	0.00 ± 0.002
Okayama, OKAYAMA	6.8	0.08 ± 0.005	0.00 ± 0.002
Hiroshima, HIROSHIMA	6.9	0.08 ± 0.006	0.005 ± 0.002
Ube, YAMAGUCHI	7.2	0.08 ± 0.006	0.00 ± 0.002
Matsuyama, EHIME	7.1	0.06 ± 0.005	0.00 ± 0.002
Fukuoka, FUKUOKA	6.9	0.10 ± 0.006	0.01 ± 0.003
Nagasaki, NAGASAKI	7.0	0.07 ± 0.005	0.005 ± 0.002

Location	pH	^{90}Sr (pCi/ℓ)	^{137}Cs (pCi/ℓ)
Kagoshima, KAGOSHIMA	7.1	0.02 ± 0.003	0.004 ± 0.002
Naha, OKINAWA	7.3	0.20 ± 0.008	0.00 ± 0.002
January, 1985			
Kyoto, KYOTO	7.1	0.18 ± 0.007	0.002 ± 0.002
Wakayama, WAKAYAMA	7.9	0.09 ± 0.005	0.004 ± 0.002
May, 1985			
Yokohama, KANAGAWA	7.4	0.02 ± 0.003	0.003 ± 0.003
June, 1985			
Wakkanai, HOKKAIDO	6.4	0.05 ± 0.005	0.004 ± 0.003
Aomori, AOMORI	7.6	0.05 ± 0.005	0.01 ± 0.003
Yamagata, YAMAGATA	7.0	0.08 ± 0.006	0.01 ± 0.003
Mito, IBARAGI	7.4	0.06 ± 0.005	0.005 ± 0.003
Katsushika, TOKYO	6.7	0.07 ± 0.008	0.01 ± 0.003
Niigata, NIIGATA	7.1	0.10 ± 0.006	0.01 ± 0.003
Kanazawa, ISHIKAWA	7.0	0.09 ± 0.006	0.01 ± 0.003
Fukui, FUKUI	7.2	0.01 ± 0.003	0.01 ± 0.003
Nagano, NAGANO	6.8	0.04 ± 0.004	0.004 ± 0.003
Shizuoka, SHIZUOKA	7.5	0.05 ± 0.004	0.001 ± 0.003
Nagoya, AICHI	6.7	0.09 ± 0.006	0.01 ± 0.003
Osaka, OSAKA	6.8	0.12 ± 0.006	0.003 ± 0.003
Kobe, HYOGO	7.5	0.11 ± 0.008	0.00 ± 0.003
Wakayama, WAKAYAMA	7.1	0.08 ± 0.005	0.002 ± 0.003
Tottori, TOTTORI	7.5	0.08 ± 0.006	0.003 ± 0.003
Matsue, SHIMANE	7.2	0.12 ± 0.006	0.01 ± 0.002
Okayama, OKAYAMA	6.7	0.09 ± 0.006	0.01 ± 0.003
Hiroshima, HIROSHIMA	6.6	0.08 ± 0.005	0.001 ± 0.003
Ube, YAMAGUCHI	7.1	0.07 ± 0.005	0.00 ± 0.003
Matsuyama, EHIME	7.4	0.05 ± 0.004	0.00 ± 0.003
Kochi, KOCHI	7.1	0.05 ± 0.004	0.003 ± 0.003
Fukuoka, FUKUOKA	6.9	0.08 ± 0.005	0.00 ± 0.003
Saga, SAGA	7.2	0.07 ± 0.005	0.00 ± 0.002
Kagoshima, KAGOSHIMA	6.9	0.02 ± 0.003	0.001 ± 0.003
July, 1985			
Sendai, MIYAGI	6.3	0.06 ± 0.005	0.01 ± 0.003
Naha, OKINAWA	7.7	0.17 ± 0.007	0.004 ± 0.003

Figure (3) Sampling Locations of Service Water

1. Wakkanai
2. Sapporo
3. Aomori
4. Sendai
5. Akita
6. Yamagata
7. Fukushima
8. Mito
9. Katsushika
10. Tsukui-machi
11. Yokohama
12. Niigata
13. Kanazawa
14. Fukui
15. Nagano
16. Shizuoka
17. Nagoya
18. Inuyama
19. Kyoto
20. Moriguchi
21. Osaka
22. Kobe
23. Wakayama
24. Tottori
25. Matsue
26. Okayama
27. Hiroshima
28. Ube
29. Matsuyama
30. Kochi
31. Fukuoka
32. Saga
33. Nagasaki
34. Kagoshima
35. Naha



(4) Strontium-90 and Cesium-137 in Freshwater (May, 1985)

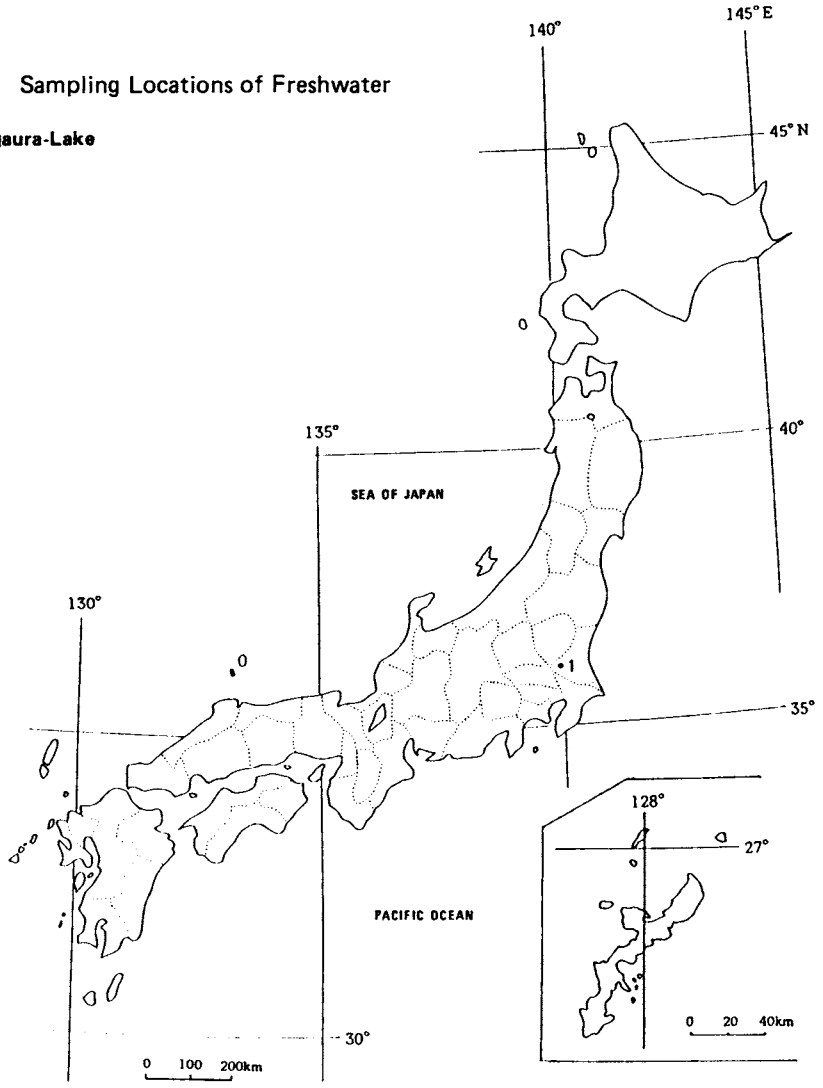
– continued from No. 70 of this publication –

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

Location	pH	^{90}Sr (pCi/ℓ)	^{137}Cs (pCi/ℓ)
(Freshwater)			
May, 1985			
Kasumigaura-Lake, IBARAGI	8.5	0.16 ± 0.007	0.03 ± 0.004

Figure (4) Sampling Locations of Freshwater

1. **Kasumigaura-Lake**



(5) Strontium-90 and Cesium-137 in Soil (from May 1985 to Jul. 1985)

– continued from No. 70 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, 1985					
Tookai-mura, IBARAGI	0 ~ 5	150 ± 7	6.0 ± 0.28	580 ± 13	23 ± 0.5
〃	5 ~ 20	88 ± 5.6	8.6 ± 0.55	200 ± 8	20 ± 0.8
Akabane-machi, AICHI	0 ~ 5	12 ± 3.0	0.7 ± 0.19	11 ± 3.2	0.7 ± 0.20
〃	5 ~ 20	15 ± 3.3	3.0 ± 0.64	2 ± 2.7	0.4 ± 0.53
June, 1985					
Fukushima, FUKUSHIMA	0 ~ 5	160 ± 7	2.7 ± 0.12	440 ± 12	7.5 ± 0.20
〃	5 ~ 20	37 ± 4.1	3.3 ± 0.36	40 ± 4.2	3.6 ± 0.37
July, 1985					
Yamagata, YAMAGATA	0 ~ 5	150 ± 7	6.6 ± 0.32	810 ± 16	37 ± 0.7
〃	5 ~ 20	29 ± 3.7	4.3 ± 0.55	47 ± 4.4	7.1 ± 0.66
Miyatsu, KYOTO	0 ~ 5	48 ± 4.2	2.2 ± 0.19	1700 ± 20	79 ± 1.0
〃	5 ~ 20	92 ± 5.4	25 ± 1.5	170 ± 7	45 ± 1.9
Kobe, HYOGO	0 ~ 5	34 ± 4.7	1.4 ± 0.19	290 ± 10	12 ± 0.4
〃	5 ~ 20	33 ± 3.8	3.6 ± 0.41	270 ± 9	30 ± 1.0
Hiroshima, HIROSHIMA	0 ~ 5	52 ± 4.6	4.6 ± 0.41	290 ± 9	26 ± 0.8
〃	5 ~ 20	54 ± 4.5	14 ± 1.2	200 ± 8	52 ± 2.2
Kaimon-machi, KAGOSHIMA	0 ~ 5	26 ± 3.6	1.0 ± 0.13	51 ± 4.6	1.9 ± 0.17
〃	5 ~ 20	13 ± 3.0	1.4 ± 0.30	42 ± 4.3	4.3 ± 0.44

Figure (5) Sampling Locations in Soil

1. Yamagata
2. Fukushima
3. Tokai-mura
4. Akabane-machi
5. Miyatsu
6. Kobe
7. Hiroshima
8. Kaimon-machi