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# RADIOACTIVITY SURVEY DATA in Japan

Part 1
= Environmental Materials =

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National Institute of Radiological Sciences
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Contents




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## 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 5000cm$^2$ in area, which was filled with water to a depth of 1 cm at the beginning of every month.

Strontium and cesium carrier solutions were added after the sample was filtered. 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 (500mℓ of Dowex 50W X8, 50~100 mesh, Na form) at a rate flow of 80mℓ/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 3000m$^3$ 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 the intake of the water-treatment plant and at the tap after water was left running for five minutes. Strontium and cesium carriers were added to the filtered water sample. 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 surface disturbance caused by dust storms, inflow and out flow due to precipitation, etc.. 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, 0-5cm and 5-20cm. The soil lumps were crushed by hands and dried in a drying oven regulated 105℃. The soil was then passed through a 2mm sieve to remove plant roots and pebbles.

(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 1mℓ to 1ℓ of sea water, and then stored in 20ℓ 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 1m 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 4kg of the sample in wet weight was spread on a stainless steel dish after removed of the pebbles, shells and other foreign materials, and dried in a drying oven regulated at 105℃.

(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 450℃ 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 46 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 left vegetables and for nonstarch 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 4kg 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 details 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 (source water) | semiyearly | 100 ℓ |
| 2. Service water (tap water) | semiyearly | 100 ℓ |
| 3. Freshwater | yearly (fishing season) | 100 ℓ |
| (4) Soil | | |
| 1. 0～ 5 cm | yearly | 4 kg |
| 2. 5～ 20cm | yearly | 4 kg |
| (5) Sea water | yearly | 40 ℓ |
| (6) Sea sediments | yearly | 4 kg |
| =Dietary materials= | | |
| (7) Total diet | semiyearly | daily amount for 5 persons |
| (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) | 500g (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 and Sea sediment

Dried soil was crushed to smaller ones than 0.25mm in size by a crusher. The sieved sample was ashed in an electric muffle furnace regulated at 450 ℃. The sample was then heated with hydrochloric acid, strontium and cesium carrier solutions and the mixture was heated. The insoluble constituent was filtered off and washed with water.

The dried sample was crushed to smaller ones than 0.25mm by a crushing machine. The further preparation of the sample was the same as that described in the section 2-(2).

(3) Rice

The ashed sample was pulverized with a porcelain mortar and passed through a 0.35mm sieve. The sieved sample to which both strontium and cesium carriers were added, was digested with nitric 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 constituent was filtered and washed. The filtrate and washings were combined for subsequent radiochemical analysis.

(4) Airborne dust, diet, milk, vegetables, 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-(4), 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 strontium and calcium were precipitated as oxalates. The precipitate was dissolved in nitric acid and strontium was separated from calcium by successive fuming nitric acid separation. 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 iron carrier was added. The solution was allowed to stand for two weeks for strontium-90 and yttrium-90 to attain equilibrium. 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 was acidified with hydrochloric acid. While stirring, cesium was adsorbed on the ammonium molybdophosphate added.

After filtered off and washed with hydrochloric acid the precipitate was dissolved in 2.5N sodium hydroxide solution. The solution was adjusted to pH 8.2 with hydrochloric acid and allowed to cool.

Resultant molybdenum hydroxide which separated

out in the solution, was filtered off and washed with water. EDTA was added to the filtrate and washings. Cesium and rubidium were adsorbed on a cation exchange column and cesium was separated from rubidium by eluting with hydrochloric acid.

The eluate was evaporated to dryness and was dissolved. The solution was filtered.
Chloroplatinic acid was added to precipitate cesium. The precipitate was filtered onto a tared paper using a demountable filter and washed with water and then ethanol. After drying, the chemical yield of cesium was determined by weighing the precipitate. Cesium-137 radioactivity was measured for this precipitate.

4. Determination of stable strontium, calcium and potassium

A weighed amount of soil or sea sediment was heated in a electric muffle furnace at 450℃ and then treated with hydrochloric acid for extraction.
A weighed aliquot of ashed samples of total diet, vegetables, milk, fish, shellfish or seaweeds was digested with hydrofluoric acid and nitric acid.
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 to 90min. Net sample counting rates were corrected for counter efficiency, recovery, self-absorption and decay to obtain the content of strontium-90 and cesium-137per sample aliquot. From the results, concentrations of these nuclides in the original samples were calculated.

6. Results

(1)-1 Strontuim-90 and Cesium-137 in Rain and Dry Fallout (for domestic program) (from Oct. 1996 to Mar. 1997 )

-continued from No. 118 of this publication-

Table (1)-1 : Strontium-90 and Cesium-137 in Rain and Dry Fallout

| Location | Duration (days) | Precipitation (mm) | $^{90}Sr$ (MBq/km²) | $^{137}Cs$ (MBq/km²) |
|---|---|---|---|---|
| October, 1996 | | | | |
| Sapporo, HOKKAIDOU | 32 | 139.5 | 0.0000 ± 0.0059 | 0.0000 ± 0.0098 |
| Aomori, AOMORI | 32 | 54.8 | 0.011 ± 0.012 | 0.030 ± 0.017 |
| Morioka, IWATE | 32 | 3.4 | 0.0041 ± 0.0068 | 0.0000 ± 0.0094 |
| Onagawa-machi, MIYAGI | 31 | 36.0 | 0.001 ± 0.011 | 0.031 ± 0.019 |
| Yamagata, YAMAGATA | 32 | 21.2 | 0.0000 ± 0.0089 | 0.0000 ± 0.0091 |
| Ookuma-machi, FUKUSHIMA | 32 | 21.7 | 0.039 ± 0.014 | 0.000 ± 0.012 |
| Mito, IBARAKI | 32 | 84.5 | 0.0053 ± 0.0074 | 0.007 ± 0.011 |
| Kawachi-machi, TOCHIGI | 32 | 61.6 | 0.0005 ± 0.0058 | 0.002 ± 0.012 |
| Maebashi, GUNMA | 32 | 64.5 | 0.000 ± 0.011 | 0.000 ± 0.011 |
| Urawa, SAITAMA | 32 | 63.0 | 0.008 ± 0.011 | 0.019 ± 0.012 |
| Ichihara, CHIBA | 32 | 106.7 | 0.000 ± 0.010 | 0.006 ± 0.011 |
| Shinjuku, TOKYO | 32 | 77.3 | 0.013 ± 0.0082 | 0.000 ± 0.014 |
| Yokohama, KANAGAWA | 32 | 117.5 | 0.0092 ± 0.0083 | 0.024 ± 0.012 |
| Kosugi-machi, TOYAMA | 32 | 94.8 | 0.025 ± 0.010 | 0.022 ± 0.012 |
| Fukui, FUKUI | 29 | 137.2 | 0.000 ± 0.054 | 0.000 ± 0.059 |
| Koufu, YAMANASHI | 32 | 77.0 | 0.013 ± 0.011 | 0.002 ± 0.011 |
| Gifu, GIFU | 32 | 128.0 | 0.000 ± 0.013 | 0.000 ± 0.013 |
| Shizuoka, SHIZUOKA | 32 | 125.5 | 0.015 ± 0.0068 | 0.007 ± 0.016 |
| Nagoya, AICHI | 32 | 105.9 | 0.018 ± 0.013 | 0.028 ± 0.013 |
| Tsu, MIE | 22 | 139.5 | 0.006 ± 0.012 | 0.0000 ± 0.0099 |
| Ootsu, SHIGA | 32 | 156.8 | 0.002 ± 0.016 | 0.014 ± 0.016 |
| Kyoto, KYOTO | 31 | 117.0 | 0.000 ± 0.013 | 0.000 ± 0.012 |
| Kobe, HYOUGO | 32 | 105.8 | 0.0029 ± 0.0064 | 0.006 ± 0.012 |
| Nara, NARA | 32 | 140.0 | 0.034 ± 0.010 | 0.17 ± 0.023 |
| Wakayama, WAKAYAMA | 32 | 69.0 | 0.013 ± 0.011 | 0.000 ± 0.011 |
| Tottori, TOTTORI | 32 | 170.6 | 0.069 ± 0.017 | 0.000 ± 0.018 |

| Location | Duration (days) | Precipitation (mm) | $^{90}Sr$ (MBq/km²) | $^{137}Cs$ (MBq/km²) |
|---|---|---|---|---|
| Matsue, SHIMANE | 32 | 77.9 | 0.0010 ± 0.0061 | 0.011 ± 0.0075 |
| Hiroshima, HIROSHIMA | 32 | 79.6 | 0.12 ± 0.038 | 0.000 ± 0.013 |
| Ishii-machi, TOKUSHIMA | 30 | 43.5 | 0.015 ± 0.014 | 0.000 ± 0.016 |
| Takamatsu, KAGAWA | 32 | 82.0 | 0.014 ± 0.0075 | 0.019 ± 0.010 |
| Matsuyama, EHIME | 32 | 70.5 | 0.003 ± 0.011 | 0.014 ± 0.017 |
| Dazaifu, FUKUOKA | 32 | 70.3 | 0.001 ± 0.011 | 0.0000 ± 0.0092 |
| Saga, SAGA | 32 | 53.6 | 0.009 ± 0.014 | 0.006 ± 0.016 |
| Nagasaki, NAGASAKI | 32 | 46.0 | 0.022 ± 0.016 | 0.000 ± 0.016 |
| Uto, KUMAMOTO | 32 | 72.2 | 0.0013 ± 0.0097 | 0.000 ± 0.010 |
| Ooita, OOITA | 32 | 83.4 | 0.0000 ± 0.0069 | 0.000 ± 0.010 |
| Miyazaki, MIYAZAKI | 32 | 152.2 | 0.0000 ± 0.0088 | 0.000 ± 0.016 |
| Yonagusuku-machi, Okinawa | 36 | 65.5 | 0.0000 ± 0.0097 | 0.000 ± 0.012 |
| November, 1996 | | | | |
| Sapporo, HOKKAIDOU | 29 | 48.0 | 0.028 ± 0.012 | 0.0046 ± 0.0091 |
| Aomori, AOMORI | 32 | 84.1 | 0.040 ± 0.015 | 0.006 ± 0.017 |
| Morioka, IWATE | 32 | 74.3 | 0.023 ± 0.012 | 0.0000 ± 0.0094 |
| Onagawa-machi, MIYAGI | 32 | 79.0 | 0.007 ± 0.011 | 0.000 ± 0.017 |
| Yamagata, YAMAGATA | 32 | 82.1 | 0.0018 ± 0.0077 | 0.015 ± 0.011 |
| Ookuma-machi, FUKUSHIMA | 32 | 94.3 | 0.015 ± 0.011 | 0.037 ± 0.013 |
| Mito, IBARAKI | 32 | 95.5 | 0.039 ± 0.017 | 0.002 ± 0.020 |
| Kawachi-machi, TOCHIGI | 32 | 91.4 | 0.0000 ± 0.0068 | 0.000 ± 0.010 |
| Maebashi, GUNMA | 32 | 52.5 | 0.000 ± 0.010 | 0.000 ± 0.011 |
| Urawa, SAITAMA | 32 | 85.6 | 0.009 ± 0.013 | 0.015 ± 0.012 |
| Ichihara, CHIBA | 32 | 131.6 | 0.033 ± 0.014 | 0.035 ± 0.013 |
| Shinjuku, TOKYO | 32 | 86.6 | 0.0000 ± 0.0064 | 0.017 ± 0.017 |
| Yokohama, KANAGAWA | 31 | 100.5 | 0.0084 ± 0.0082 | 0.0033 ± 0.0097 |
| Kosugi-machi, TOYAMA | 32 | 283.3 | 0.010 ± 0.0071 | 0.025 ± 0.011 |

| Location | Duration (days) | Precipitation (mm) | $^{90}Sr$ (MBq/km²) | $^{137}Cs$ (MBq/km²) |
|---|---|---|---|---|
| Fukui, FUKUI | 32 | 231.3 | 0.000 ± 0.051 | 0.000 ± 0.052 |
| Koufu, YAMANASHI | 32 | 58.5 | 0.032 ± 0.0095 | 0.010 ± 0.011 |
| Gifu, GIFU | 32 | 83.0 | 0.000 ± 0.018 | 0.000 ± 0.023 |
| Shizuoka, SHIZUOKA | 32 | 139.5 | 0.0086 ± 0.0065 | 0.048 ± 0.019 |
| Nagoya, AICHI | 32 | 66.4 | 0.0088 ± 0.0074 | 0.026 ± 0.013 |
| Tsu, MIE | 32 | 89.5 | 0.036 ± 0.013 | 0.0000 ± 0.0098 |
| Ootsu, SHIGA | 32 | 88.5 | 0.000 ± 0.017 | 0.14 ± 0.023 |
| Kyoto, KYOTO | 33 | 84.5 | 0.020 ± 0.015 | 0.000 ± 0.011 |
| Kobe, HYOUGO | 30 | 53.2 | 0.0030 ± 0.0061 | 0.002 ± 0.011 |
| Nara, NARA | 32 | 99.4 | 0.015 ± 0.012 | 0.000 ± 0.012 |
| Wakayama, WAKAYAMA | 32 | 72.0 | 0.014 ± 0.011 | 0.000 ± 0.017 |
| Tottori, TOTTORI | 31 | 83.0 | 0.093 ± 0.019 | 0.009 ± 0.032 |
| Hiroshima, HIROSHIMA | 32 | 43.5 | 0.19 ± 0.024 | 0.007 ± 0.014 |
| Ishii-machi, TOKUSHIMA | 33 | 49.5 | 0.014 ± 0.0079 | 0.042 ± 0.014 |
| Takamatsu, KAGAWA | 32 | 40.0 | 0.013 ± 0.014 | 0.000 ± 0.015 |
| Matsuyama, EHIME | 32 | 49.0 | 0.062 ± 0.018 | 0.004 ± 0.017 |
| Dazaifu, FUKUOKA | 32 | 78.3 | 0.0000 ± 0.0098 | 0.019 ± 0.011 |
| Saga, SAGA | 32 | 51.7 | 0.008 ± 0.012 | 0.000 ± 0.013 |
| Nagasaki, NAGASAKI | 32 | 44.5 | 0.011 ± 0.012 | 0.016 ± 0.015 |
| Uto, KUMAMOTO | 32 | 61.7 | 0.015 ± 0.0073 | 0.0022 ± 0.0094 |
| Ooita, OOITA | 32 | 53.5 | 0.000 ± 0.010 | 0.000 ± 0.010 |
| Miyazaki, MIYAZAKI | 31 | 127.0 | 0.040 ± 0.015 | 0.006 ± 0.016 |
| Yonagusuku-machi, Okinawa | 28 | 30.0 | 0.0013 ± 0.0076 | 0.000 ± 0.011 |
| December, 1996 | | | | |
| Sapporo, HOKKAIDOU | 29 | 39.5 | 0.012 ± 0.011 | 0.017 ± 0.016 |
| Aomori, AOMORI | 36 | 86.2 | 0.009 ± 0.012 | 0.032 ± 0.016 |
| Morioka, IWATE | 36 | 49.8 | 0.019 ± 0.013 | 0.011 ± 0.012 |

| Location | Duration (days) | Precipitation (mm) | $^{90}Sr$ (MBq/km²) | $^{137}Cs$ (MBq/km²) |
|---|---|---|---|---|
| Onagawa-machi, MIYAGI | 37 | 26.0 | 0.019 ± 0.014 | 0.036 ± 0.016 |
| Yamagata, YAMAGATA | 36 | 50.3 | 0.0000 ± 0.0090 | 0.011 ± 0.010 |
| Ookuma-machi, FUKUSHIMA | 36 | 87.0 | 0.016 ± 0.012 | 0.012 ± 0.012 |
| Mito, IBARAKI | 36 | 87.5 | 0.013 ± 0.012 | 0.004 ± 0.016 |
| Kawachi-machi, TOCHIGI | 37 | 92.3 | 0.015 ± 0.012 | 0.015 ± 0.017 |
| Maebashi, GUNMA | 30 | 10.0 | 0.002 ± 0.013 | 0.012 ± 0.013 |
| Urawa, SAITAMA | 36 | 70.5 | 0.028 ± 0.019 | 0.030 ± 0.016 |
| Ichihara, CHIBA | 36 | 68.9 | 0.016 ± 0.013 | 0.018 ± 0.012 |
| Shinjuku, TOKYO | 36 | 68.9 | 0.000 ± 0.011 | 0.0000 ± 0.0097 |
| Yokohama, KANAGAWA | 27 | 63.6 | 0.000 ± 0.011 | 0.001 ± 0.011 |
| Kosugi-machi, TOYAMA | 36 | 230.4 | 0.0053 ± 0.0067 | 0.050 ± 0.014 |
| Fukui, FUKUI | 26 | 273.5 | 0.059 ± 0.080 | 0.020 ± 0.078 |
| Koufu, YAMANASHI | 36 | 50.5 | 0.031 ± 0.011 | 0.022 ± 0.011 |
| Gifu, GIFU | 36 | 80.5 | 0.008 ± 0.034 | 0.0000 ± 0.0087 |
| Shizuoka, SHIZUOKA | 36 | 157.5 | 0.003 ± 0.011 | 0.018 ± 0.013 |
| Nagoya, AICHI | 36 | 70.1 | 0.017 ± 0.014 | 0.020 ± 0.012 |
| Tsu, MIE | 36 | 65.5 | 0.023 ± 0.011 | 0.028 ± 0.013 |
| Ootsu, SHIGA | 31 | 112.6 | 0.012 ± 0.014 | 0.008 ± 0.015 |
| Kyoto, KYOTO | 26 | 97.0 | 0.046 ± 0.015 | 0.0000 ± 0.0093 |
| Kobe, HYOUGO | 29 | 93.6 | 0.002 ± 0.013 | 0.000 ± 0.014 |
| Nara, NARA | 36 | 95.8 | 0.032 ± 0.014 | 0.051 ± 0.017 |
| Wakayama, WAKAYAMA | 36 | 105.5 | 0.045 ± 0.018 | 0.026 ± 0.013 |
| Tottori, TOTTORI | 38 | 236.3 | 0.082 ± 0.018 | 0.027 ± 0.018 |
| Matsue, SHIMANE | 36 | 141.3 | 0.022 ± 0.0074 | 0.030 ± 0.0092 |
| Hiroshima, HIROSHIMA | 36 | 45.1 | 0.11 ± 0.032 | 0.024 ± 0.014 |
| Ishii-machi, TOKUSHIMA | 37 | 156.5 | 0.011 ± 0.0083 | 0.051 ± 0.014 |
| Takamatsu, KAGAWA | 26 | 33.0 | 0.021 ± 0.015 | 0.018 ± 0.017 |

| Location | Duration (days) | Precipitation (mm) | $^{90}Sr$ (MBq/km²) | $^{137}Cs$ (MBq/km²) |
|---|---|---|---|---|
| Matsuyama, EHIME | 36 | 60.5 | 0.008 ± 0.011 | 0.005 ± 0.011 |
| Dazaifu, FUKUOKA | 36 | 76.2 | 0.003 ± 0.011 | 0.032 ± 0.012 |
| Saga, SAGA | 36 | 96.3 | 0.014 ± 0.013 | 0.000 ± 0.014 |
| Nagasaki, NAGASAKI | 36 | 64.5 | 0.045 ± 0.019 | 0.020 ± 0.016 |
| Uto, KUMAMOTO | 35 | 58.1 | 0.014 ± 0.0072 | 0.044 ± 0.013 |
| Ooita, OOITA | 36 | 30.2 | 0.013 ± 0.011 | 0.000 ± 0.011 |
| Miyazaki, MIYAZAKI | 37 | 52.3 | 0.041 ± 0.014 | 0.023 ± 0.016 |
| Yonagusuku-machi, Okinawa | 35 | 93.5 | 0.026 ± 0.0094 | 0.016 ± 0.015 |
| January, 1997 | | | | |
| Sapporo, HOKKAIDOU | 36 | 40.5 | 0.020 ± 0.014 | 0.016 ± 0.012 |
| Aomori, AOMORI | 29 | 102.2 | 0.031 ± 0.016 | 0.002 ± 0.013 |
| Morioka, IWATE | 29 | 14.9 | 0.000 ± 0.012 | 0.001 ± 0.011 |
| Onagawa-machi, MIYAGI | 28 | 110.5 | 0.007 ± 0.013 | 0.025 ± 0.018 |
| Yamagata, YAMAGATA | 29 | 39.0 | 0.012 ± 0.012 | 0.020 ± 0.011 |
| Ookuma-machi, FUKUSHIMA | 29 | 14.5 | 0.009 ± 0.012 | 0.011 ± 0.011 |
| Mito, IBARAKI | 29 | 21.0 | 0.006 ± 0.012 | 0.000 ± 0.011 |
| Kawachi-machi, TOCHIGI | 29 | 23.0 | 0.004 ± 0.011 | 0.011 ± 0.016 |
| Maebashi, GUNMA | 35 | 13.0 | 0.020 ± 0.012 | 0.019 ± 0.011 |
| Urawa, SAITAMA | 29 | 17.3 | 0.032 ± 0.017 | 0.072 ± 0.019 |
| Ichihara, CHIBA | 29 | 39.2 | 0.005 ± 0.012 | 0.038 ± 0.013 |
| Shinjuku, TOKYO | 29 | 28.2 | 0.0095 ± 0.0080 | 0.002 ± 0.012 |
| Yokohama, KANAGAWA | 36 | 43.7 | 0.003 ± 0.010 | 0.073 ± 0.016 |
| Kosugi-machi, TOYAMA | 29 | 144.8 | 0.042 ± 0.0096 | 0.007 ± 0.013 |
| Fukui, FUKUI | 36 | 307.5 | 0.071 ± 0.096 | 0.063 ± 0.060 |
| Koufu, YAMANASHI | 29 | 7.5 | 0.023 ± 0.0090 | 0.019 ± 0.011 |
| Gifu, GIFU | 29 | 29.5 | 0.020 ± 0.014 | 0.017 ± 0.011 |
| Shizuoka, SHIZUOKA | 29 | 2.0 | 0.0057 ± 0.0094 | 0.040 ± 0.014 |

| Location | Duration (days) | Precipitation (mm) | $^{90}Sr$ (MBq/km²) | $^{137}Cs$ (MBq/km²) |
|---|---|---|---|---|
| Nagoya, AICHI | 29 | 16.7 | 0.012 ± 0.018 | 0.000 ± 0.011 |
| Tsu, MIE | 29 | 8.5 | 0.000 ± 0.012 | 0.000 ± 0.012 |
| Ootsu, SHIGA | 34 | 22.8 | 0.023 ± 0.015 | 0.021 ± 0.012 |
| Kyoto, KYOTO | 34 | 36.0 | 0.041 ± 0.016 | 0.001 ± 0.011 |
| Kobe, HYOUGO | 36 | 25.2 | 0.024 ± 0.012 | 0.0022 ± 0.0099 |
| Nara, NARA | 29 | 38.1 | 0.003 ± 0.011 | 0.048 ± 0.017 |
| Wakayama, WAKAYAMA | 29 | 31.0 | 0.019 ± 0.020 | 0.010 ± 0.012 |
| Tottori, TOTTORI | 28 | 120.3 | 0.053 ± 0.0096 | 0.011 ± 0.012 |
| Matsue, SHIMANE | 29 | 117.2 | 0.016 ± 0.0055 | 0.029 ± 0.0095 |
| Hiroshima, HIROSHIMA | 29 | 22.8 | 0.15 ± 0.037 | 0.016 ± 0.014 |
| Ishii-machi, TOKUSHIMA | 28 | 18.5 | 0.0084 ± 0.0080 | 0.023 ± 0.011 |
| Takamatsu, KAGAWA | 39 | 38.5 | 0.000 ± 0.015 | 0.019 ± 0.013 |
| Matsuyama, EHIME | 29 | 75.0 | 0.007 ± 0.012 | 0.025 ± 0.011 |
| Dazaifu, FUKUOKA | 29 | 54.9 | 0.014 ± 0.0073 | 0.002 ± 0.011 |
| Saga, SAGA | 29 | 48.7 | 0.000 ± 0.012 | 0.004 ± 0.011 |
| Nagasaki, NAGASAKI | 29 | 42.5 | 0.000 ± 0.013 | 0.021 ± 0.012 |
| Uto, KUMAMOTO | 29 | 50.2 | 0.000 ± 0.011 | 0.006 ± 0.016 |
| Ooita, OOITA | 29 | 41.5 | 0.027 ± 0.013 | 0.0000 ± 0.0091 |
| Miyazaki, MIYAZAKI | 29 | 45.0 | 0.034 ± 0.015 | 0.073 ± 0.019 |
| Yonagusuku-machi, Okinawa | 30 | 136.5 | 0.0000 ± 0.0079 | 0.003 ± 0.014 |
| Febraly, 1997 | | | | |
| Sapporo, HOKKAIDOU | 29 | 82.0 | 0.015 ± 0.013 | 0.000 ± 0.011 |
| Aomori, AOMORI | 30 | 62.8 | 0.009 ± 0.012 | 0.008 ± 0.016 |
| Morioka, IWATE | 29 | 66.1 | 0.014 ± 0.0088 | 0.037 ± 0.017 |
| Onagawa-machi, MIYAGI | 29 | 52.5 | 0.000 ± 0.012 | 0.004 ± 0.015 |
| Yamagata, YAMAGATA | 29 | 69.9 | 0.023 ± 0.013 | 0.020 ± 0.013 |
| Ookuma-machi, FUKUSHIMA | 30 | 34.6 | 0.035 ± 0.014 | 0.012 ± 0.0096 |

| Location | Duration (days) | Precipitation (mm) | $^{90}Sr$ (MBq/km²) | $^{137}Cs$ (MBq/km²) |
|---|---|---|---|---|
| Mito, IBARAKI | 29 | 26.0 | 0.006 ± 0.011 | 0.031 ± 0.013 |
| Kawachi-machi, TOCHIGI | 28 | 9.5 | 0.035 ± 0.014 | 0.043 ± 0.017 |
| Maebashi, GUNMA | 29 | 6.0 | 0.030 ± 0.013 | 0.098 ± 0.017 |
| Urawa, SAITAMA | 29 | 15.7 | 0.030 ± 0.012 | 0.22 ± 0.023 |
| Ichihara, CHIBA | 29 | 19.9 | 0.003 ± 0.011 | 0.051 ± 0.016 |
| Shinjuku, TOKYO | 29 | 14.3 | 0.024 ± 0.011 | 0.0000 ± 0.0090 |
| Yokohama, KANAGAWA | 30 | 47.4 | 0.0000 ± 0.0095 | 0.11 ± 0.018 |
| Kosugi-machi, TOYAMA | 29 | 116.6 | 0.015 ± 0.0080 | 0.021 ± 0.012 |
| Fukui, FUKUI | 32 | 141.7 | 0.016 ± 0.065 | 0.13 ± 0.066 |
| Koufu, YAMANASHI | 29 | 28.5 | 0.0000 ± 0.0067 | 0.0046 ± 0.0086 |
| Gifu, GIFU | 29 | 51.0 | 0.000 ± 0.010 | 0.026 ± 0.012 |
| Shizuoka, SHIZUOKA | 29 | 76.0 | 0.020 ± 0.011 | 0.067 ± 0.015 |
| Nagoya, AICHI | 29 | 23.2 | 0.007 ± 0.015 | 0.002 ± 0.011 |
| Tsu, MIE | 29 | 25.0 | 0.012 ± 0.014 | 0.015 ± 0.011 |
| Ootsu, SHIGA | 29 | 49.4 | 0.018 ± 0.016 | 0.000 ± 0.011 |
| Kyoto, KYOTO | 30 | 32.5 | 0.046 ± 0.017 | 0.000 ± 0.011 |
| Kobe, HYOUGO | 29 | 27.4 | 0.0000 ± 0.0086 | 0.010 ± 0.011 |
| Nara, NARA | 29 | 40.3 | 0.016 ± 0.014 | 0.023 ± 0.015 |
| Wakayama, WAKAYAMA | 29 | 40.5 | 0.000 ± 0.010 | 0.005 ± 0.010 |
| Tottori, TOTTORI | 29 | 111.4 | 0.073 ± 0.010 | 0.028 ± 0.013 |
| Matsue, SHIMANE | 31 | 117.7 | 0.024 ± 0.0063 | 0.059 ± 0.011 |
| Hiroshima, HIROSHIMA | 26 | 41.0 | 0.095 ± 0.030 | 0.008 ± 0.014 |
| Ishii-machi, TOKUSHIMA | 29 | 19.0 | 0.017 ± 0.014 | 0.009 ± 0.011 |
| Takamatsu, KAGAWA | 29 | 17.0 | 0.000 ± 0.014 | 0.018 ± 0.013 |
| Matsuyama, EHIME | 29 | 56.0 | 0.000 ± 0.012 | 0.019 ± 0.013 |
| Dazaifu, FUKUOKA | 29 | 31.2 | 0.0069 ± 0.0065 | 0.010 ± 0.012 |
| Saga, SAGA | 29 | 16.0 | 0.017 ± 0.015 | 0.000 ± 0.015 |

| Location | Duration (days) | Precipitation (mm) | $^{90}Sr$ (MBq/km²) | $^{137}Cs$ (MBq/km²) |
|---|---|---|---|---|
| Nagasaki, NAGASAKI | 29 | 17.0 | 0.000 ± 0.011 | 0.000 ± 0.011 |
| Uto, KUMAMOTO | 29 | 56.8 | 0.024 ± 0.014 | 0.023 ± 0.016 |
| Ooita, OOITA | 29 | 29.0 | 0.035 ± 0.016 | 0.029 ± 0.026 |
| Miyazaki, MIYAZAKI | 29 | 52.1 | 0.0000 ± 0.0089 | 0.034 ± 0.016 |
| Yonagusuku-machi, Okinawa | 29 | 54.5 | 0.000 ± 0.012 | 0.012 ± 0.018 |
| March, 1997 | | | | |
| Sapporo, HOKKAIDOU | 33 | 34.5 | 0.0071 ± 0.0067 | 0.018 ± 0.012 |
| Aomori, AOMORI | 29 | 40.0 | 0.035 ± 0.015 | 0.025 ± 0.018 |
| Morioka, IWATE | 30 | 45.9 | 0.036 ± 0.0091 | 0.065 ± 0.018 |
| Onagawa-machi, MIYAGI | 30 | 41.0 | 0.023 ± 0.014 | 0.042 ± 0.017 |
| Yamagata, YAMAGATA | 30 | 15.8 | 0.003 ± 0.020 | 0.013 ± 0.020 |
| Ookuma-machi, FUKUSHIMA | 29 | 87.5 | 0.027 ± 0.012 | 0.024 ± 0.013 |
| Mito, IBARAKI | 30 | 79.5 | 0.032 ± 0.0086 | 0.029 ± 0.018 |
| Kawachi-machi, TOCHIGI | 30 | 92.9 | 0.016 ± 0.013 | 0.046 ± 0.017 |
| Maebashi, GUNMA | 30 | 58.5 | 0.061 ± 0.017 | 0.062 ± 0.017 |
| Urawa, SAITAMA | 30 | 69.0 | 0.053 ± 0.014 | 0.076 ± 0.016 |
| Ichihara, CHIBA | 30 | 100.5 | 0.036 ± 0.015 | 0.030 ± 0.014 |
| Shinjuku, TOKYO | 30 | 113.8 | 0.017 ± 0.0074 | 0.017 ± 0.012 |
| Yokohama, KANAGAWA | 32 | 125.7 | 0.014 ± 0.014 | 0.071 ± 0.017 |
| Kosugi-machi, TOYAMA | 30 | 77.8 | 0.037 ± 0.010 | 0.033 ± 0.013 |
| Fukui, FUKUI | 30 | 111.8 | 0.028 ± 0.056 | 0.000 ± 0.055 |
| Koufu, YAMANASHI | 30 | 56.0 | 0.015 ± 0.0085 | 0.011 ± 0.010 |
| Gifu, GIFU | 30 | 106.5 | 0.015 ± 0.011 | 0.000 ± 0.011 |
| Shizuoka, SHIZUOKA | 30 | 145.5 | 0.010 ± 0.012 | 0.032 ± 0.013 |
| Nagoya, AICHI | 30 | 84.6 | 0.018 ± 0.014 | 0.028 ± 0.012 |
| Tsu, MIE | 30 | 65.0 | 0.018 ± 0.014 | 0.012 ± 0.011 |
| Ootsu, SHIGA | 30 | 110.5 | 0.000 ± 0.013 | 0.011 ± 0.011 |

| Location | Duration (days) | Precipitation (mm) | $^{90}Sr$ (MBq/km$^2$) | $^{137}Cs$ (MBq/km$^2$) |
|---|---|---|---|---|
| Kyoto, KYOTO | 33 | 116.5 | 0.048 ± 0.017 | 0.000 ± 0.012 |
| Kobe, HYOUGO | 32 | 83.1 | 0.010 ± 0.011 | 0.007 ± 0.013 |
| Nara, NARA | 30 | 141.3 | 0.007 ± 0.013 | 0.012 ± 0.012 |
| Wakayama, WAKAYAMA | 30 | 77.5 | 0.026 ± 0.014 | 0.016 ± 0.012 |
| Tottori, TOTTORI | 30 | 54.5 | 0.078 ± 0.011 | 0.060 ± 0.015 |
| Matsue, SHIMANE | 28 | 62.5 | 0.026 ± 0.0064 | 0.024 ± 0.0085 |
| Hiroshima, HIROSHIMA | 33 | 96.6 | 0.068 ± 0.029 | 0.0000 ± 0.0095 |
| Ishii-machi, TOKUSHIMA | 30 | 79.0 | 0.069 ± 0.032 | 0.13 ± 0.021 |
| Takamatsu, KAGAWA | 30 | 69.5 | 0.011 ± 0.014 | 0.0000 ± 0.0077 |
| Matsuyama, EHIME | 30 | 93.5 | 0.002 ± 0.013 | 0.000 ± 0.012 |
| Dazaifu, FUKUOKA | 30 | 79.5 | 0.011 ± 0.0070 | 0.011 ± 0.011 |
| Saga, SAGA | 30 | 123.3 | 0.000 ± 0.011 | 0.0045 ± 0.0096 |
| Nagasaki, NAGASAKI | 30 | 72.5 | 0.000 ± 0.014 | 0.004 ± 0.012 |
| Uto, KUMAMOTO | 30 | 109.0 | 0.000 ± 0.012 | 0.0000 ± 0.0084 |
| Ooita, OOITA | 30 | 89.3 | 0.002 ± 0.011 | 0.012 ± 0.012 |
| Miyazaki, MIYAZAKI | 30 | 144.1 | 0.005 ± 0.014 | 0.039 ± 0.014 |
| Yonagusuku-machi, Okinawa | 30 | 100.5 | 0.030 ± 0.017 | 0.001 ± 0.012 |

(1)-2 Strontuim-90 and Cesium-137 in Rain and Dry Fallout (for WHO program)
(from Oct. 1996 to Mar. 1997 )

-continued from No, 118 of this publication-

Table (1)-2 : Strontium-90 and Cesium-137 in Rain and Dry Fallout

| Location | Duration (days) | Precipitation (mm) | $^{90}$Sr (MBq/km$^2$) | $^{137}$Cs (MBq/km$^2$) |
|---|---|---|---|---|
| October, 1996 | | | | |
| Akita, AKITA | 32 | 161.9 | 0.052 ± 0.018 | 0.0045 ± 0.0075 |
| Chiba, CHIBA | 32 | 80.6 | 0.000 ± 0.011 | 0.000 ± 0.011 |
| Niigata, NIIGATA | 32 | 75.3 | 0.000 ± 0.011 | 0.033 ± 0.016 |
| Kanazawa, ISHIKAWA | 31 | 114.0 | 0.023 ± 0.014 | 0.013 ± 0.0095 |
| Nagano, NAGANO | 32 | 47.1 | 0.011 ± 0.013 | 0.000 ± 0.011 |
| Osaka, OSAKA | 32 | 106.9 | 0.024 ± 0.010 | 0.010 ± 0.011 |
| Okayama, OKAYAMA | 32 | 110.4 | 0.0086 ± 0.0065 | 0.000 ± 0.014 |
| Yamaguchi, YAMAGUCHI | 32 | 56.5 | 0.0000 ± 0.0051 | 0.0000 ± 0.0093 |
| Kochi, KOCHI | 32 | 137.2 | 0.051 ± 0.011 | 0.018 ± 0.014 |
| Kagoshima, KAGOSHIMA | 32 | 10.5 | 0.027 ± 0.012 | 0.010 ± 0.015 |
| November, 1996 | | | | |
| Akita, AKITA | 32 | 237.7 | 0.066 ± 0.023 | 0.006 ± 0.011 |
| Chiba, CHIBA | 32 | 109.6 | 0.005 ± 0.013 | 0.025 ± 0.013 |
| Niigata, NIIGATA | 32 | 218.2 | 0.015 ± 0.013 | 0.034 ± 0.013 |
| Kanazawa, ISHIKAWA | 28 | 250.0 | 0.017 ± 0.012 | 0.017 ± 0.011 |
| Nagano, NAGANO | 33 | 37.6 | 0.0020 ± 0.0091 | 0.010 ± 0.0099 |
| Osaka, OSAKA | 32 | 63.6 | 0.0089 ± 0.0077 | 0.008 ± 0.011 |
| Okayama, OKAYAMA | 32 | 40.0 | 0.015 ± 0.010 | 0.0000 ± 0.0099 |
| Yamaguchi, YAMAGUCHI | 32 | 56.5 | 0.0051 ± 0.0061 | 0.000 ± 0.015 |
| Kochi, KOCHI | 32 | 45.3 | 0.034 ± 0.013 | 0.000 ± 0.011 |
| Kagoshima, KAGOSHIMA | 32 | 79.0 | 0.037 ± 0.014 | 0.022 ± 0.015 |
| December, 1996 | | | | |
| Akita, AKITA | 36 | 200.8 | 0.012 ± 0.018 | 0.039 ± 0.014 |
| Chiba, CHIBA | 36 | 57.4 | 0.010 ± 0.012 | 0.027 ± 0.011 |
| Niigata, NIIGATA | 36 | 228.8 | 0.029 ± 0.0088 | 0.035 ± 0.017 |
| Kanazawa, ISHIKAWA | 31 | 391.0 | 0.055 ± 0.016 | 0.027 ± 0.012 |

| Location | Duration (days) | Precipitation (mm) | $^{90}Sr$ (MBq/km²) | $^{137}Cs$ (MBq/km²) |
|---|---|---|---|---|
| Nagano, NAGANO | 30 | 47.3 | 0.000 ± 0.020 | 0.000 ± 0.014 |
| Osaka, OSAKA | 36 | 106.3 | 0.000 ± 0.018 | 0.000 ± 0.015 |
| Okayama, OKAYAMA | 36 | 48.4 | 0.020 ± 0.011 | 0.002 ± 0.012 |
| Yamaguchi, YAMAGUCHI | 36 | 68.5 | 0.030 ± 0.014 | 0.012 ± 0.015 |
| Kochi, KOCHI | 36 | 120.0 | 0.075 ± 0.018 | 0.012 ± 0.011 |
| Kagoshima, KAGOSHIMA | 26 | 83.0 | 0.051 ± 0.016 | 0.032 ± 0.016 |
| January, 1997 | | | | |
| Akita, AKITA | 29 | 148.6 | 0.000 ± 0.015 | 0.037 ± 0.013 |
| Chiba, CHIBA | 29 | 32.2 | 0.018 ± 0.015 | 0.045 ± 0.013 |
| Niigata, NIIGATA | 29 | 87.5 | 0.040 ± 0.0094 | 0.046 ± 0.018 |
| Kanazawa, ISHIKAWA | 34 | 169.5 | 0.022 ± 0.013 | 0.040 ± 0.018 |
| Nagano, NAGANO | 34 | 46.6 | 0.0000 ± 0.0081 | 0.000 ± 0.010 |
| Osaka, OSAKA | 29 | 32.3 | 0.041 ± 0.019 | 0.019 ± 0.018 |
| Okayama, OKAYAMA | 29 | 24.4 | 0.000 ± 0.011 | 0.0000 ± 0.0092 |
| Yamaguchi, YAMAGUCHI | 29 | 54.5 | 0.021 ± 0.012 | 0.014 ± 0.012 |
| Kochi, KOCHI | 29 | 30.5 | 0.063 ± 0.017 | 0.0000 ± 0.0097 |
| Kagoshima, KAGOSHIMA | 36 | 30.0 | 0.075 ± 0.018 | 0.027 ± 0.014 |
| Febraly, 1997 | | | | |
| Akita, AKITA | 29 | 103.1 | 0.019 ± 0.014 | 0.036 ± 0.013 |
| Chiba, CHIBA | 29 | 19.3 | 0.054 ± 0.018 | 0.25 ± 0.023 |
| Niigata, NIIGATA | 29 | 75.2 | 0.032 ± 0.0090 | 0.063 ± 0.020 |
| Kanazawa, ISHIKAWA | 31 | 39.0 | 0.000 ± 0.012 | 0.014 ± 0.012 |
| Nagano, NAGANO | 29 | 41.4 | 0.0000 ± 0.0082 | 0.0000 ± 0.0097 |
| Osaka, OSAKA | 29 | 32.0 | 0.027 ± 0.015 | 0.0000 ± 0.0099 |
| Okayama, OKAYAMA | 29 | 25.2 | 0.000 ± 0.011 | 0.0000 ± 0.0079 |
| Yamaguchi, YAMAGUCHI | 29 | 44.0 | 0.020 ± 0.0075 | 0.003 ± 0.012 |
| Kochi, KOCHI | 29 | 33.5 | 0.053 ± 0.011 | 0.006 ± 0.012 |

| Location | Duration (days) | Precipitation (mm) | $^{90}Sr$ (MBq/km²) | $^{137}Cs$ (MBq/km²) |
|---|---|---|---|---|
| Kagoshima, KAGOSHIMA | 29 | 33.5 | 0.046 ± 0.017 | 0.004 ± 0.012 |
| March, 1997 | | | | |
| Akita, AKITA | 30 | 66.5 | 0.021 ± 0.012 | 0.020 ± 0.013 |
| Chiba, CHIBA | 30 | 91.1 | 0.003 ± 0.014 | 0.088 ± 0.022 |
| Niigata, NIIGATA | 30 | 76.6 | 0.059 ± 0.012 | 0.050 ± 0.020 |
| Kanazawa, ISHIKAWA | 32 | 19.5 | 0.047 ± 0.015 | 0.039 ± 0.014 |
| Nagano, NAGANO | 30 | 40.4 | 0.011 ± 0.012 | 0.018 ± 0.011 |
| Osaka, OSAKA | 29 | 102.2 | 0.012 ± 0.018 | 0.000 ± 0.013 |
| Okayama, OKAYAMA | 30 | 78.1 | 0.000 ± 0.013 | 0.0000 ± 0.0088 |
| Yamaguchi, YAMAGUCHI | 30 | 112.5 | 0.000 ± 0.012 | 0.004 ± 0.012 |
| Kochi, KOCHI | 30 | 160.0 | 0.045 ± 0.018 | 0.024 ± 0.012 |
| Kagoshima, KAGOSHIMA | 32 | 153.0 | 0.021 ± 0.014 | 0.037 ± 0.014 |

(2) Strontium-90 and Cesium-137 in Airborne Dust
(from Oct. 1996 to Mar. 1997 )

-continued from No.118 of this publication-

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

| Location | Sampling period | Absorption volume ($m^2$) | $^{90}Sr$ (mBq/$m^3$) | $^{137}Cs$ (mBq/$m^3$) |
|---|---|---|---|---|
| October~December, 1996 | | | | |
| Morioka, IWATE | 10~12 | 11,184.0 | 0.00017 ± 0.00048 | 0.00029 ± 0.00037 |
| Akita, AKITA | 10~12 | 10,800.0 | 0.00070 ± 0.00055 | 0.00000 ± 0.00026 |
| Yamagata, YAMAGATA | 10~12 | 12,960.0 | 0.00053 ± 0.00042 | 0.00054 ± 0.00046 |
| Ookuma-machi, FUKUSHIMA | 10~12 | 11,836.7 | 0.00000 ± 0.00030 | 0.00067 ± 0.00047 |
| Mito, IBARAKI | 10~12 | 8,991.5 | 0.00000 ± 0.00048 | 0.00046 ± 0.00038 |
| Kawachi-machi, TOCHIGI | 10~12 | 13,946.0 | 0.00000 ± 0.00034 | 0.00006 ± 0.00025 |
| Maebashi, GUNMA | 10~12 | 13,962.9 | 0.00000 ± 0.00038 | 0.00014 ± 0.00026 |
| Ichihara, CHIBA | 10~12 | 9,720.6 | 0.00000 ± 0.00032 | 0.00000 ± 0.00053 |
| Yokohama, KANAGAWA | 10~12 | 10,899.0 | 0.00000 ± 0.00029 | 0.00000 ± 0.00049 |
| Niigata, NIIGATA | 10~12 | 10,145.0 | 0.00000 ± 0.00040 | 0.00000 ± 0.00052 |
| Kosugi-machi, TOYAMA | 10~12 | 18,488.0 | 0.00026 ± 0.00030 | 0.00031 ± 0.00019 |
| Fukui, FUKUI | 10~12 | 13,113.9 | 0.00030 ± 0.00029 | 0.00048 ± 0.00043 |
| Koufu, YAMANASHI | 10~12 | 14,360.0 | 0.00000 ± 0.00035 | 0.00000 ± 0.00024 |
| Nagano, NAGANO | 10~12 | 11,820.0 | 0.00000 ± 0.00037 | 0.0014 ± 0.00053 |
| Gifu, GIFU | 10~12 | 11,454.0 | 0.00011 ± 0.00041 | 0.00000 ± 0.00049 |
| Hamaoka-machi, SHIZUOKA | 10~12 | 10,100.0 | 0.00036 ± 0.00057 | 0.00008 ± 0.00037 |
| Nagoya, AICHI | 10~12 | 11,579.0 | 0.00042 ± 0.00032 | 0.00063 ± 0.00049 |
| Ootsu, SHIGA | 10~12 | 10,857.0 | 0.00024 ± 0.00033 | 0.00000 ± 0.00047 |
| Tsu, MIE | 10~12 | 13,680.0 | 0.00000 ± 0.00037 | 0.00000 ± 0.00028 |
| Kyoto, KYOTO | 10~12 | 9,778.0 | 0.00057 ± 0.00039 | 0.00017 ± 0.00060 |
| Osaka, OSAKA | 10~12 | 14,344.0 | 0.00019 ± 0.00025 | 0.00000 ± 0.00033 |
| Kobe, HYOUGO | 10~12 | 10,291.0 | 0.0010 ± 0.00059 | 0.00000 ± 0.00049 |
| Nara, NARA | 10~12 | 10,786.1 | 0.00067 ± 0.00049 | 0.00018 ± 0.00047 |
| Wakayama, WAKAYAMA | 10~12 | 10,368.0 | 0.00000 ± 0.00051 | 0.00000 ± 0.00033 |

| Location | Sampling period | Absorption volume ($m^2$) | $^{90}Sr$ (mBq/$m^3$) | $^{137}Cs$ (mBq/$m^3$) |
|---|---|---|---|---|
| Tottori, TOTTORI | 10～12 | 14,797.0 | 0.00000 ± 0.00025 | 0.00051 ± 0.00027 |
| Okayama, OKAYAMA | 10～12 | 12,815.0 | 0.00014 ± 0.00038 | 0.00032 ± 0.00031 |
| Hiroshima, HIROSHIMA | 10～12 | 8,928.0 | 0.00000 ± 0.00033 | 0.00000 ± 0.00043 |
| Yamaguchi, YAMAGUCHI | 10～12 | 18,018.0 | 0.00012 ± 0.00020 | 0.00061 ± 0.00033 |
| Tokushima, TOKUSHIMA | 10～12 | 10,080.0 | 0.00000 ± 0.00033 | 0.00062 ± 0.00056 |
| Takamatsu, KAGAWA | 10～12 | 15,126.2 | 0.00000 ± 0.00029 | 0.00000 ± 0.00023 |
| Saga, SAGA | 10～12 | 7,499.4 | 0.00000 ± 0.00041 | 0.00055 ± 0.00069 |
| Nagasaki, NAGASAKI | 10～12 | 10,368.0 | 0.00039 ± 0.00036 | 0.00053 ± 0.00051 |
| Uto, KUMAMOTO | 10～12 | 10,313.0 | 0.00067 ± 0.00065 | 0.00000 ± 0.00033 |
| Ooita, OOITA | 10～12 | 10,451.0 | 0.00013 ± 0.00046 | 0.00000 ± 0.00049 |
| Miyazaki, MIYAZAKI | 10～12 | 14,508.0 | 0.00046 ± 0.00039 | 0.00006 ± 0.00021 |
| January～March,1997 | | | | |
| Morioka, IWATE | 1～ 3 | 11,849.0 | 0.00005 ± 0.00042 | 0.00039 ± 0.00027 |
| Akita, AKITA | 1～ 3 | 10,800.0 | 0.00000 ± 0.00050 | 0.00000 ± 0.00033 |
| Yamagata, YAMAGATA | 1～ 3 | 12,960.0 | 0.00000 ± 0.00036 | 0.00000 ± 0.00026 |
| Mito, IBARAKI | 1～ 3 | 9,072.6 | 0.00000 ± 0.00050 | 0.0031 ± 0.00061 |
| Kawachi-machi, TOCHIGI | 1～ 3 | 14,030.4 | 0.00000 ± 0.00040 | 0.00000 ± 0.00024 |
| Maebashi, GUNMA | 1～ 3 | 13,253.8 | 0.00005 ± 0.00044 | 0.00000 ± 0.00029 |
| Ichihara, CHIBA | 1～ 3 | 10,014.5 | 0.00025 ± 0.00033 | 0.00016 ± 0.00057 |
| Yokohama, KANAGAWA | 1～ 3 | 10,295.0 | 0.0013 ± 0.00063 | 0.00000 ± 0.00036 |
| Niigata, NIIGATA | 1～ 3 | 10,145.0 | 0.00006 ± 0.00054 | 0.00000 ± 0.00031 |
| Kosugi-machi, TOYAMA | 1～ 3 | 18,392.0 | 0.00000 ± 0.00027 | 0.00004 ± 0.00020 |
| Fukui, FUKUI | 1～ 3 | 13,342.8 | 0.00000 ± 0.00036 | 0.00000 ± 0.00025 |
| Koufu, YAMANASHI | 1～ 3 | 13,952.0 | 0.00000 ± 0.00043 | 0.00000 ± 0.00025 |
| Nagano, NAGANO | 1～ 3 | 12,489.0 | 0.00064 ± 0.00050 | 0.00000 ± 0.00040 |

| Location | Sampling period | Absorption volume ($m^3$) | $^{90}Sr$ (mBq/$m^3$) | $^{137}Cs$ (mBq/$m^3$) |
|---|---|---|---|---|
| Gifu, GIFU | 1～ 3 | 11,634.0 | 0.00000 ± 0.00038 | 0.00020 ± 0.00033 |
| Hamaoka-machi, SHIZUOKA | 1～ 3 | 10,280.0 | 0.00065 ± 0.00060 | 0.0012 ± 0.00043 |
| Nagoya, AICHI | 1～ 3 | 11,297.0 | 0.00000 ± 0.00048 | 0.00017 ± 0.00035 |
| Ootsu, SHIGA | 1～ 3 | 11,022.0 | 0.0013 ± 0.00056 | 0.00000 ± 0.00030 |
| Tsu, MIE | 1～ 3 | 14,330.0 | 0.00000 ± 0.00034 | 0.00003 ± 0.00028 |
| Kyoto, KYOTO | 1～ 3 | 9,927.0 | 0.00020 ± 0.00034 | 0.00000 ± 0.00060 |
| Osaka, OSAKA | 1～ 3 | 14,753.0 | 0.00000 ± 0.00031 | 0.00000 ± 0.00024 |
| Kobe, HYOUGO | 1～ 3 | 10,211.0 | 0.00000 ± 0.00052 | 0.00000 ± 0.00030 |
| Nara, NARA | 1～ 3 | 10,801.7 | 0.00000 ± 0.00038 | 0.00000 ± 0.00032 |
| Wakayama, WAKAYAMA | 1～ 3 | 10,368.0 | 0.00000 ± 0.00053 | 0.00000 ± 0.00025 |
| Tottori, TOTTORI | 1～ 3 | 14,734.0 | 0.00004 ± 0.00034 | 0.00055 ± 0.00029 |
| Okayama, OKAYAMA | 1～ 3 | 12,866.0 | 0.00041 ± 0.00048 | 0.00000 ± 0.00030 |
| Hiroshima, HIROSHIMA | 1～ 3 | 10,676.0 | 0.00000 ± 0.00031 | 0.00072 ± 0.00039 |
| Yamaguchi, YAMAGUCHI | 1～ 3 | 18,792.0 | 0.00000 ± 0.00027 | 0.00031 ± 0.00018 |
| Tokushima, TOKUSHIMA | 1～ 3 | 10,080.0 | 0.00071 ± 0.00039 | 0.00000 ± 0.00055 |
| Takamatsu, KAGAWA | 1～ 3 | 14,937.0 | 0.00072 ± 0.00040 | 0.00000 ± 0.00025 |
| Saga, SAGA | 1～ 3 | 8,437.3 | 0.0011 ± 0.00078 | 0.00063 ± 0.00049 |
| Nagasaki, NAGASAKI | 1～ 3 | 10,368.0 | 0.00078 ± 0.00063 | 0.00000 ± 0.00032 |
| Uto, KUMAMOTO | 1～ 3 | 9,726.0 | 0.00038 ± 0.00062 | 0.00000 ± 0.00038 |
| Ooita, OOITA | 1～ 3 | 10,398.0 | 0.00000 ± 0.00054 | 0.00000 ± 0.00032 |
| Miyazaki, MIYAZAKI | 1～ 3 | 13,041.0 | 0.00032 ± 0.00049 | 0.00036 ± 0.00031 |
| **Febraly~March,1997** | | | | |
| Ookuma-machi, FUKUSHIMA | 2～ 3 | 7,599.0 | 0.00033 ± 0.00077 | 0.00000 ± 0.00045 |

(3) Strontium-90 and cesium-137 in Service Water
(from Oct. 1996 to Mar. 1997)

-continued from No, 118 of this publication-

Table (3) :Strontium-90 and cesium-137 in Service Water

| Location | pH | $^{90}Sr$ (mBq/ ℓ) | | $^{137}Cs$ (mBq/ ℓ) | |
|---|---|---|---|---|---|
| (Source Water) | | | | | |
| November, 1996 | | | | | |
| Kisarazu, CHIBA | 7.4 | 2.4 | ± 0.12 | 0.064 | ± 0.054 |
| December, 1996 | | | | | |
| Urawa, SAITAMA | 7.8 | 0.08 | ± 0.27 | 0.000 | ± 0.058 |
| Katsushika, TOKYO | 7.3 | 1.2 | ± 0.13 | 0.088 | ± 0.063 |
| Tsukui-machi, KANAGAWA | 8.1 | 0.50 | ± 0.062 | 0.051 | ± 0.073 |
| Nagano, NAGANO | 7.46 | 0.89 | ± 0.16 | 0.17 | ± 0.061 |
| Inuyama, AICHI | 6.8 | 1.8 | ± 0.12 | 0.10 | ± 0.059 |
| Moriguchi, OSAKA | 7.2 | 3.0 | ± 0.21 | 0.023 | ± 0.070 |
| Fukuoka, FUKUOKA | 7.20 | 2.1 | ± 0.13 | 0.038 | ± 0.058 |
| January, 1997 | | | | | |
| Sapporo, HOKKAIDOU | 6.9 | 1.1 | ± 0.14 | 0.060 | ± 0.052 |
| Kyoto, KYOTO | 7.52 | 2.5 | ± 0.20 | 0.018 | ± 0.064 |
| (Tap Water) | | | | | |
| October, 1996 | | | | | |
| Sendai, MIYAGI | — | 2.1 | ± 0.19 | 0.036 | ± 0.070 |
| November, 1996 | | | | | |
| Fukushima, FUKUSHIMA | 8.16 | 2.0 | ± 0.18 | 0.000 | ± 0.063 |
| Ichihara, CHIBA | 7.8 | 1.9 | ± 0.18 | 0.028 | ± 0.056 |
| Nagano, NAGANO | 7.21 | 0.62 | ± 0.069 | 0.071 | ± 0.078 |
| Shinguu, WAKAYAMA | 6.5 | 1.3 | ± 0.16 | 0.000 | ± 0.048 |
| Hiroshima, HIROSHIMA | 7.05 | 1.3 | ± 0.20 | 0.000 | ± 0.045 |
| December, 1996 | | | | | |
| Wakkanai, HOKKAIDOU | 6.8 | 1.4 | ± 0.14 | 0.000 | ± 0.073 |
| Aomori, AOMORI | 7.2 | 1.2 | ± 0.11 | 0.24 | ± 0.080 |

| Location | pH | $^{90}Sr$ (mBq/ ℓ) | | $^{137}Cs$ (mBq/ ℓ) | |
|---|---|---|---|---|---|
| Akita, AKITA | 5.96 | 2.8 | ± 0.23 | 0.15 | ± 0.064 |
| Yamagata, YAMAGATA | 7.1 | 2.0 | ± 0.12 | 0.054 | ± 0.079 |
| Mito, IBARAKI | 7.8 | 1.1 | ± 0.09 | 0.076 | ± 0.078 |
| Kawachi-machi, TOCHIGI | 7.28 | 1.3 | ± 0.14 | 0.071 | ± 0.048 |
| Urawa, SAITAMA | 6.5 | 0.69 | ± 0.10 | 0.000 | ± 0.062 |
| Katsushika, TOKYO | 7.3 | 1.1 | ± 0.11 | 0.11 | ± 0.062 |
| Yokohama, KANAGAWA | 7.3 | 0.52 | ± 0.088 | 0.028 | ± 0.072 |
| Niigata, NIIGATA | 7.12 | 3.0 | ± 0.23 | 0.091 | ± 0.051 |
| Kanazawa, ISHIKAWA | 6.91 | 2.4 | ± 0.12 | 0.000 | ± 0.056 |
| Fukui, FUKUI | 6.58 | 0.49 | ± 0.097 | 0.000 | ± 0.065 |
| Koufu, YAMANASHI | 6.5 | 0.99 | ± 0.086 | 0.073 | ± 0.060 |
| Gifu, GIFU | 7.20 | 0.62 | ± 0.11 | 0.035 | ± 0.074 |
| Shizuoka, SHIZUOKA | 7.7 | 0.79 | ± 0.097 | 0.030 | ± 0.051 |
| Nagoya, AICHI | 6.7 | 1.6 | ± 0.12 | 0.076 | ± 0.057 |
| Ootsu, SHIGA | 6.7 | 2.9 | ± 0.14 | 0.000 | ± 0.046 |
| Tsu, MIE | 7.0 | 2.3 | ± 0.12 | 0.041 | ± 0.057 |
| Osaka, OSAKA | 7.3 | 3.8 | ± 0.19 | 0.053 | ± 0.087 |
| Kobe, HYOUGO | 6.85 | 1.0 | ± 0.12 | 0.11 | ± 0.076 |
| Nara, NARA | 7.2 | 2.4 | ± 0.12 | 0.062 | ± 0.050 |
| Tottori, TOTTORI | 7.3 | 0.55 | ± 0.073 | 0.000 | ± 0.052 |
| Matsue, SHIMANE | − | 3.4 | ± 0.22 | 0.11 | ± 0.061 |
| Okayama, OKAYAMA | 6.8 | 2.2 | ± 0.11 | 0.000 | ± 0.037 |
| Ube, YAMAGUCHI | 7.2 | 3.2 | ± 0.79 | 0.094 | ± 0.070 |
| Takamatsu, KAGAWA | 7.60 | 1.9 | ± 0.14 | 0.000 | ± 0.045 |
| Matsuyama, EHIME | 7.7 | 1.7 | ± 0.12 | 0.039 | ± 0.050 |
| Kochi, KOCHI | 7.7 | 1.4 | ± 0.09 | 0.000 | ± 0.066 |

| Location | pH | $^{90}Sr$ (mBq/ ℓ) | | $^{137}Cs$ (mBq/ ℓ) | |
|---|---|---|---|---|---|
| Fukuoka, FUKUOKA | 6.90 | 2.8 | ± 0.20 | 0.094 | ± 0.061 |
| Saga, SAGA | 7.30 | 1.4 | ± 0.18 | 0.012 | ± 0.042 |
| Nagasaki, NAGASAKI | 7.7 | 1.2 | ± 0.09 | 0.017 | ± 0.059 |
| Uto, KUMAMOTO | 7.76 | 0.17 | ± 0.044 | 0.006 | ± 0.055 |
| Ooita, OOITA | 6.61 | 0.68 | ± 0.11 | 0.21 | ± 0.094 |
| Miyazaki, MIYAZAKI | 7.08 | 0.81 | ± 0.12 | 0.000 | ± 0.046 |
| Kagoshima, KAGOSHIMA | 7.7 | 0.57 | ± 0.095 | 0.072 | ± 0.084 |
| January, 1997 | | | | | |
| Morioka, IWATE | 6.9 | 1.2 | ± 0.18 | 0.10 | ± 0.054 |
| Kyoto, KYOTO | 7.54 | 2.9 | ± 0.26 | 0.000 | ± 0.053 |
| Naha, Okinawa | 7.80 | 5.3 | ± 0.28 | 0.006 | ± 0.048 |

(4) Strontium-90 and cesium-137 in Freshwater
(from Oct. 1996 to Mar. 1997)

-continued from No, 118 of this publication-

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

| Location | pH | $^{90}Sr$ (mBq/ ℓ) | | $^{137}Cs$ (mBq/ ℓ) | |
|---|---|---|---|---|---|
| (FreshWater) | | | | | |
| October, 1996 | | | | | |
| Shobara, HIROSHIMA | 7.02 | 0.65 | ± 0.17 | 0.10 | ± 0.080 |
| November, 1996 | | | | | |
| Niigata, NIIGATA | 6.80 | 3.3 | ± 0.16 | 0.23 | ± 0.071 |
| December, 1996 | | | | | |
| Suwa, NAGANO | 6.8 | 0.94 | ± 0.14 | 0.18 | ± 0.068 |
| Uji, KYOTO | 7.04 | 0.11 | ± 0.077 | 0.000 | ± 0.046 |

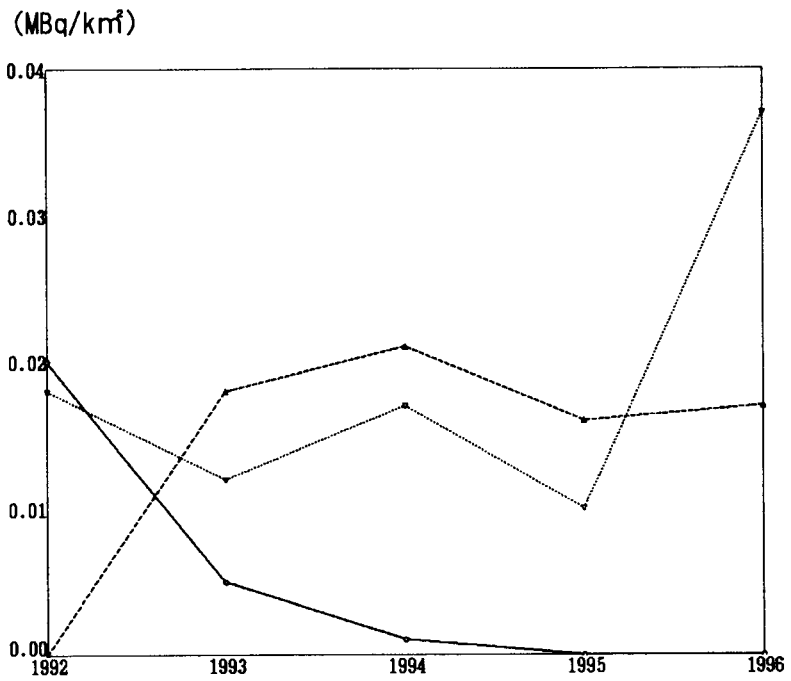
(5) Strontium-90 and Cesium-137 in Soil
(from Oct. 1996 to Mar. 1997)
-continued from No. 118 of this publication-

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

| Location | Sampling Depth (cm) | $^{90}Sr$ (Bq/kg) (dried Soil) | $^{90}Sr$ (MBq/km$^2$) | $^{137}Cs$ (Bq/kg) (dried Soil) | $^{137}Cs$ (MBq/km$^2$) |
|---|---|---|---|---|---|
| October, 1996 | | | | | |
| Akita, AKITA | 0～ 5 | 3.3 ± 0.21 | 110 ± 7 | 21 ± 0.5 | 740 ± 17 |
| | 5～20 | 4.1 ± 0.24 | 440 ± 26 | 15 ± 0.4 | 1600 ± 40 |
| December, 1996 | | | | | |
| Saga, SAGA | 0～ 5 | 0.48 ± 0.066 | 15 ± 2.1 | 2.7 ± 0.18 | 88 ± 5.9 |
| | 5～20 | 0.45 ± 0.062 | 68 ± 9.4 | 2.3 ± 0.17 | 350 ± 25 |

## ＊＊ Rain and Dry Fallout (for domestic program) ＊＊

<Strontium-90>




<Cesium-137>

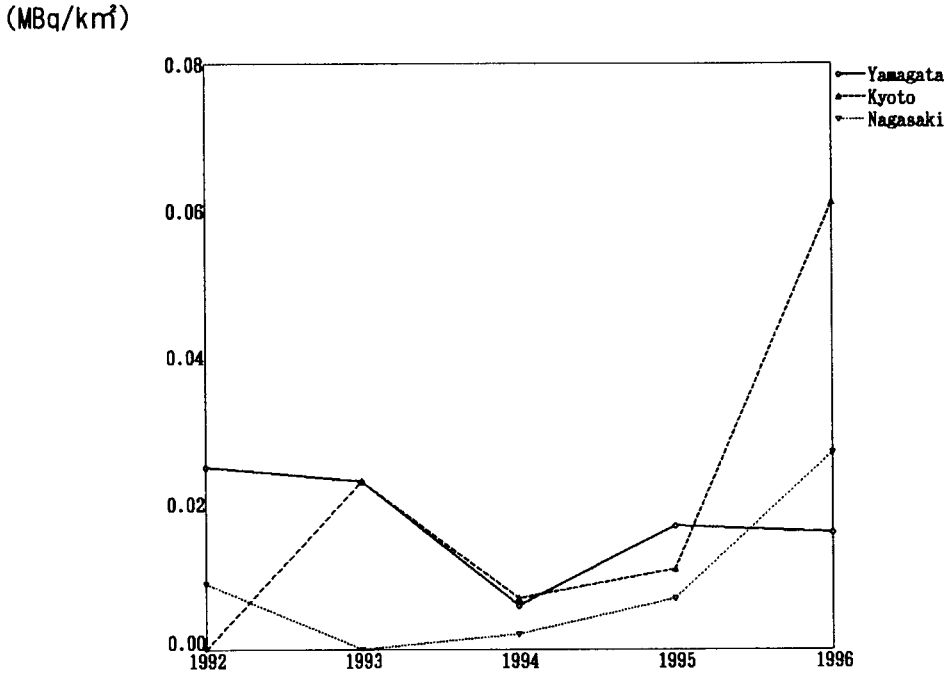
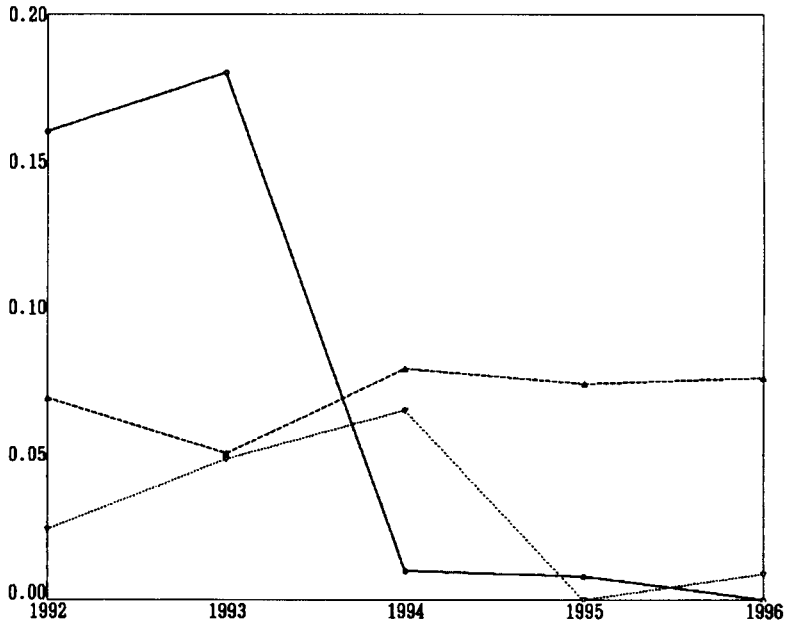



Fig. 1−1

# ＊＊ Rain and Dry Fallout (for WHO program) ＊＊

<Strontium-90>




<Cesium-137>

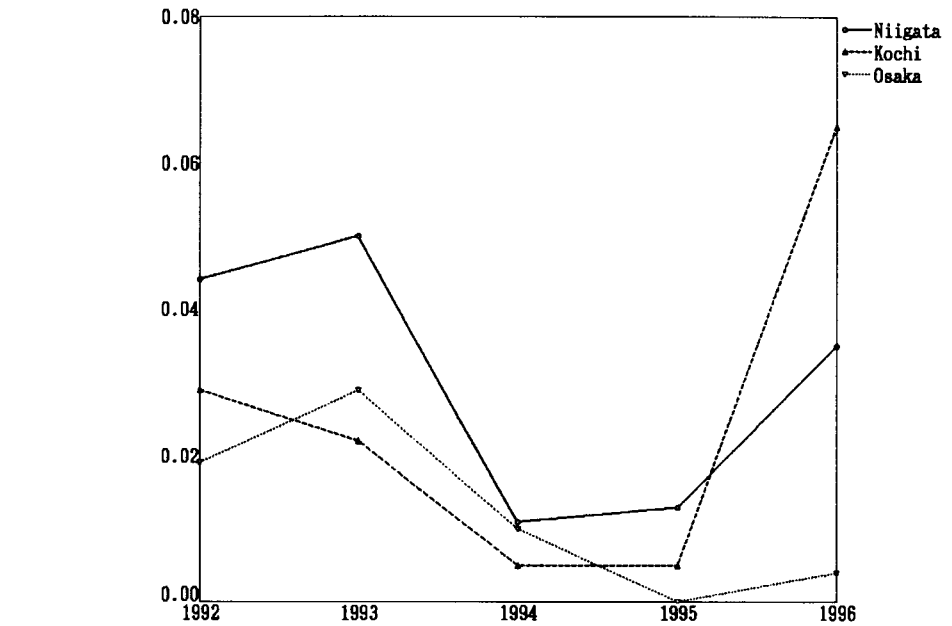
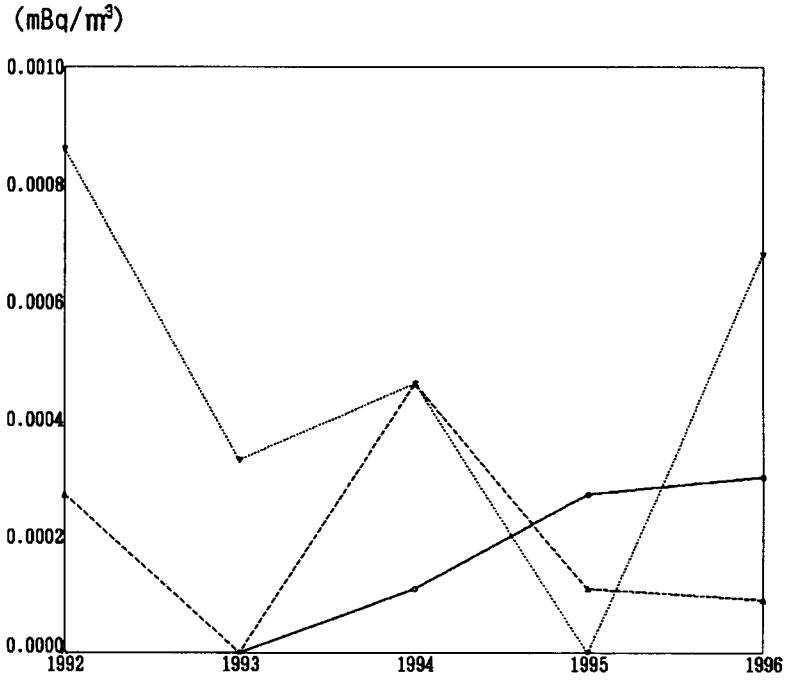



Fig. 1-2

## * * Airborne Dust * *

<Strontium-90>




<Cesium-137>

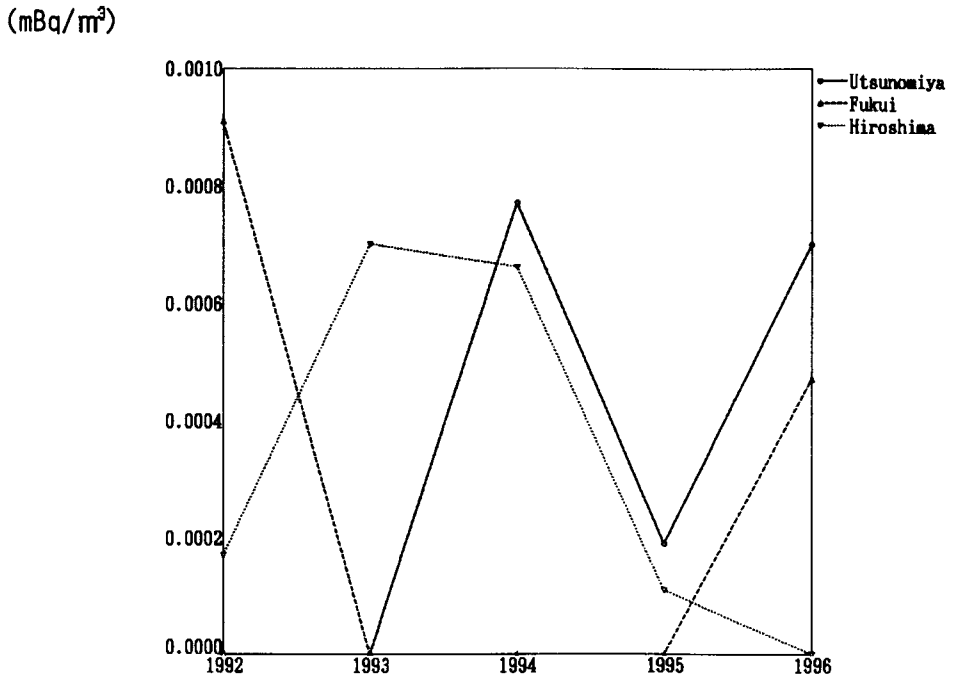
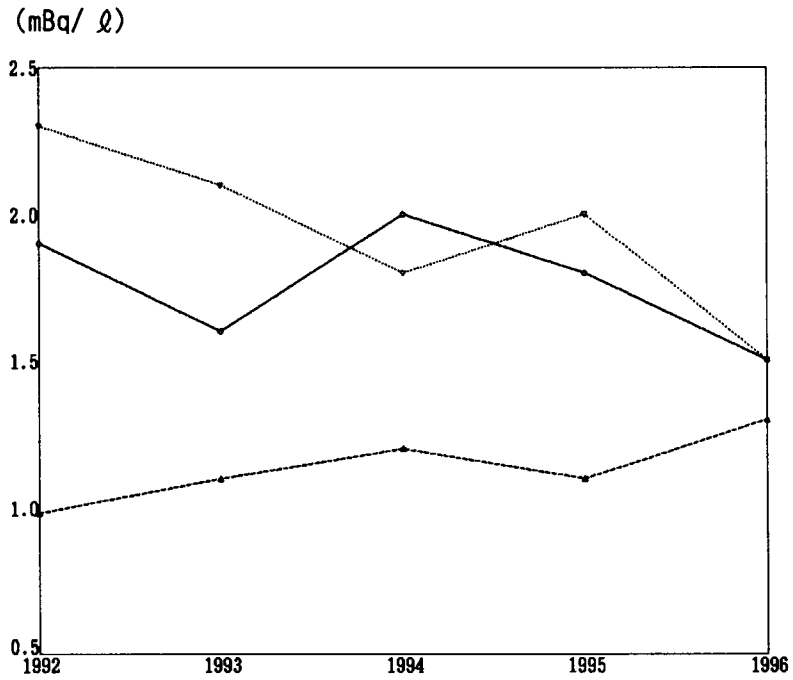



Fig. 2

# ＊ ＊ Service Water (Source Water) ＊ ＊

<Strontium-90>




<Cesium-137>

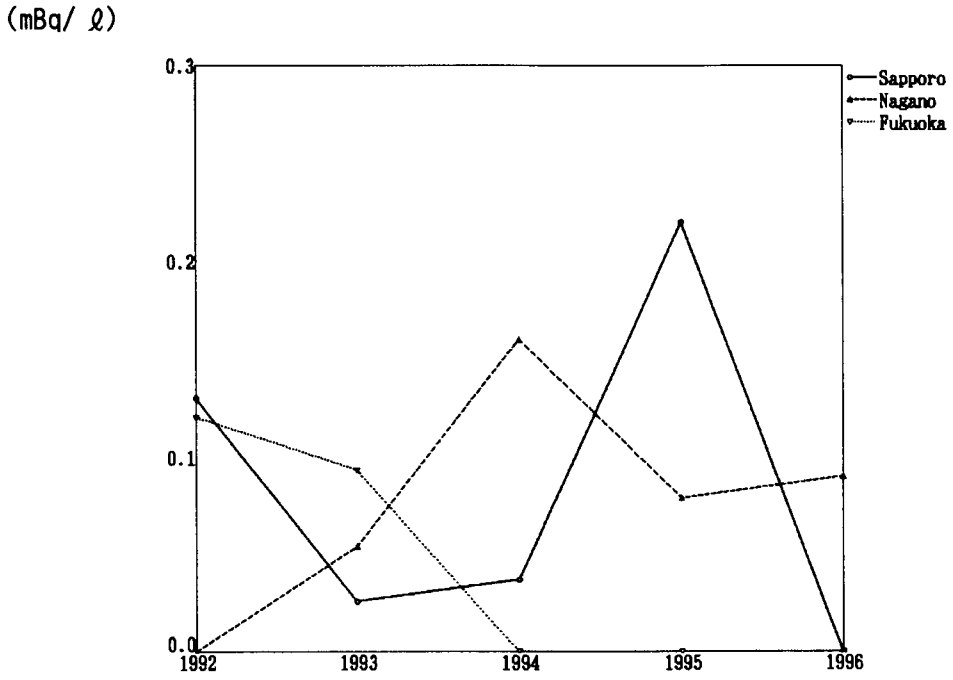
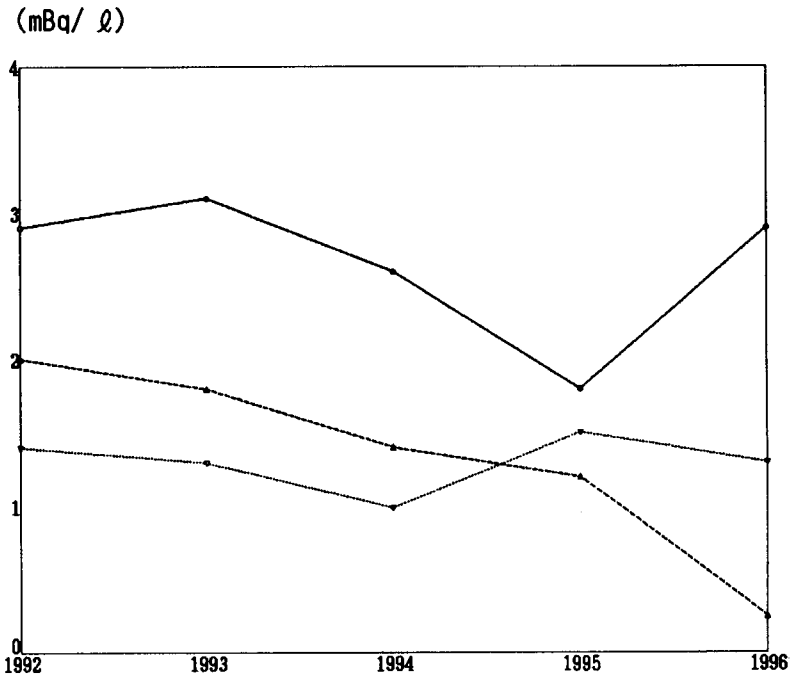



Fig. 3-1

## ＊ ＊ Service Water (Tap Water) ＊ ＊

<Strontium-90>




<Cesium-137>

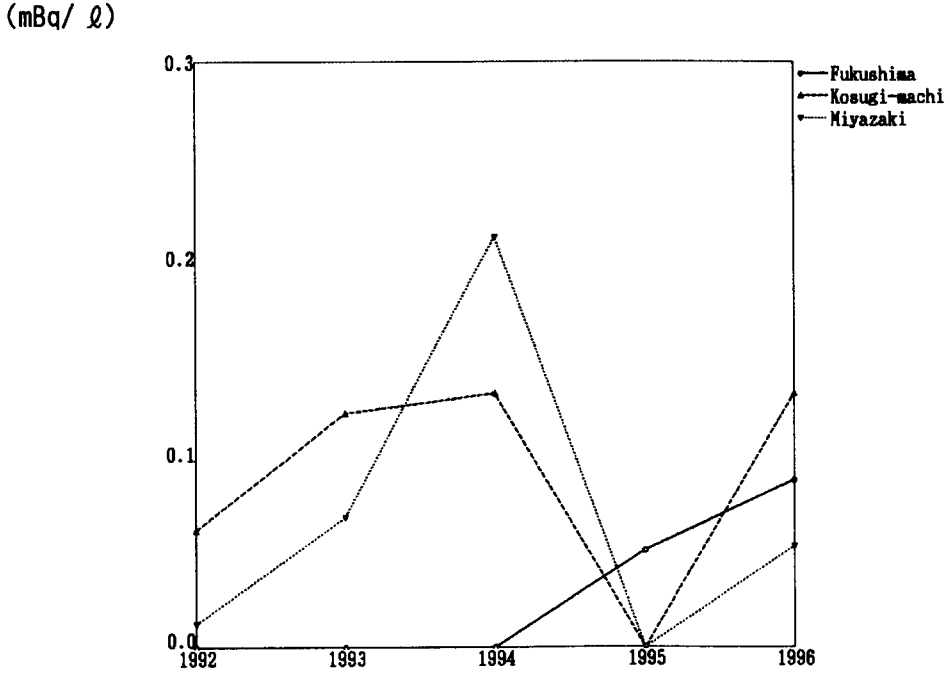



Fig. 3-2

# * * Fresh Water * *

<Strontium-90>

(mBq/ ℓ)


<Cesium-137>

(mBq/ ℓ)

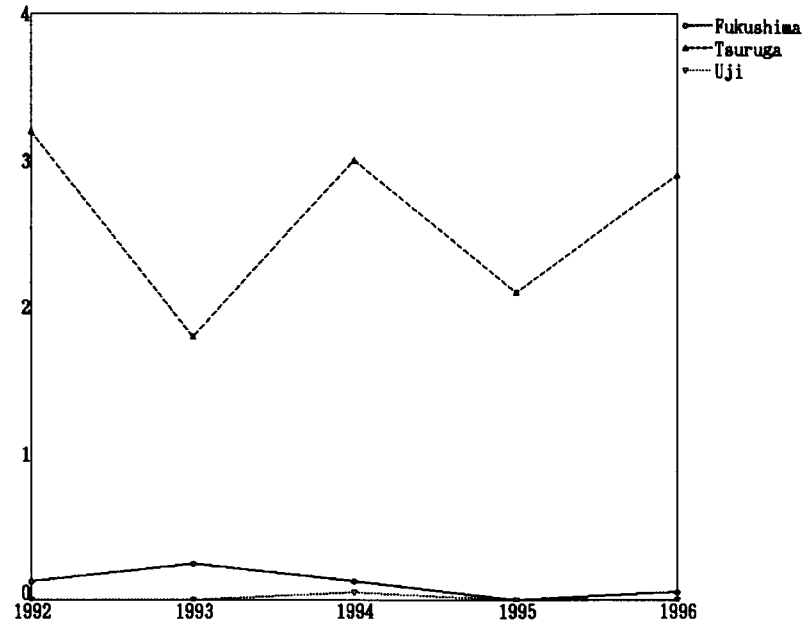
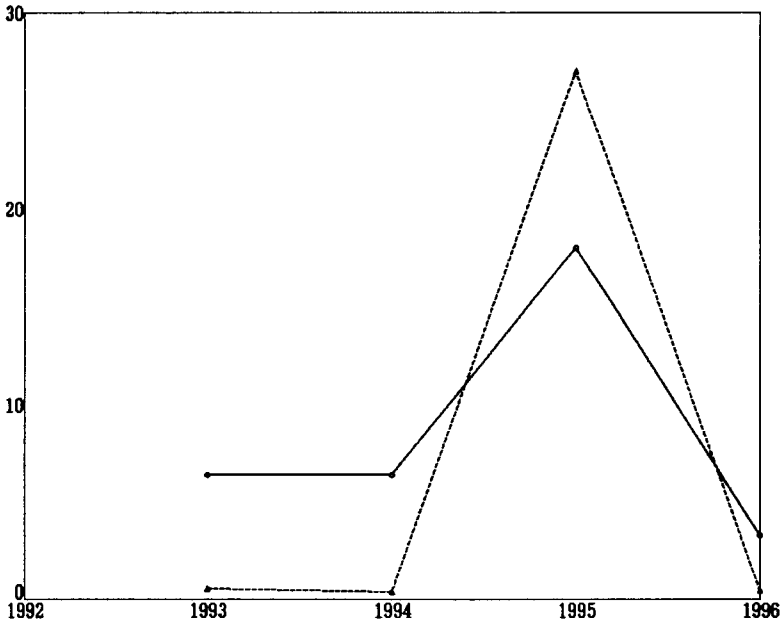



Fig. 4

＊ ＊ Soil ＊ ＊

<Strontium-90>




<Cesium-137>

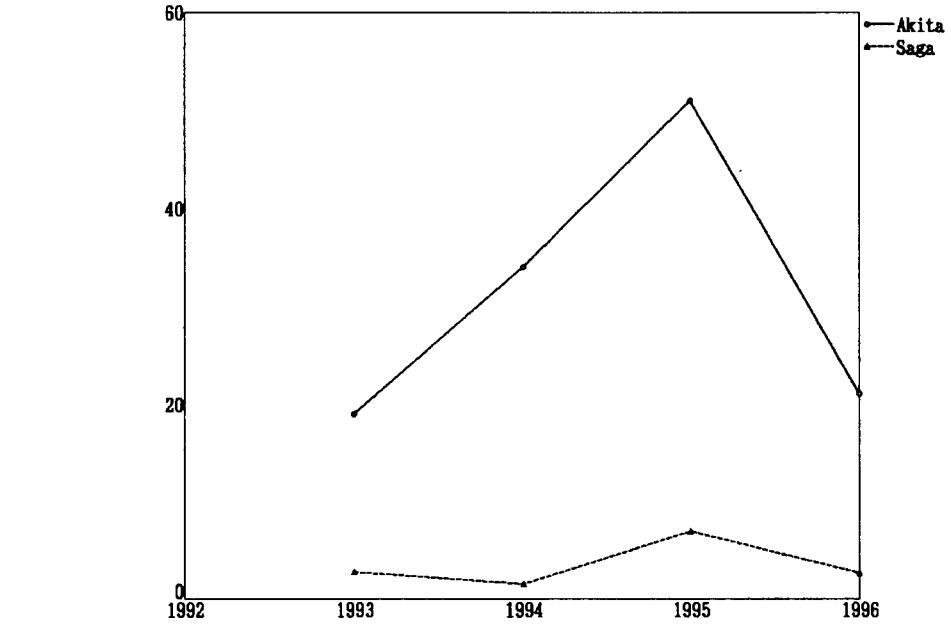



Fig. 5

# * * Sampling Locations in Japan * *

1: Sapporo
2: Aomori
3: Morioka
4: Akita
5: Sendai
6: Yamagata
7: Fukushima
8: Niigata
9: Mito
10: Utsunomiya
11: Chiba
12: Urawa
13: Shinjuku
14: Maebashi
15: Nagano
16: Yokohama
17: Toyama
18: Kouhu
19: Kanazawa
20: Shizuoka
21: Gifu
22: Fukui
23: Nagoya
24: Tsu
25: Ootsu
26: Kyoto
27: Nara
28: Osaka
29: Tottori
30: Kobe
31: Wakayama
32: Okayama
33: Matsue
34: Tokushima
35: Takamatsu
36: Hiroshima
37: Kochi
38: Matsuyama
39: Yamaguchi
40: Ooita
41: Fukuoka
42: Saga
43: Kumamoto
44: Miyazaki
45: Nagasaki
46: Kagoshima
47: Naha