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Strontium-90 and Cesium-137 in Rain and Dry Fallout

(Japan Chemical Analysis Center)

Japan Chemical Analysis Center, commissioned by Science and Technology Agency of Japanese Government, has measured the level of strontium-90 and cesium-137 in rain and dry fallout samples collected at the various locations throughout Japan.

Sampling and pretreatment were performed by 29 prefectural public health laboratories.

The collection tray having an area of 5000 cm^2 is exposed to rain and dust for about a month. The depth of water in the tray is kept at 10 mm. Water in the tray and water used to wash the tray are combined with strontium and cesium carriers, and filtrate through the filter paper (TOYO No. 2). The filtration is then applied on a column filled with sodium type exchange resin (Dowex 50 WX-8, 50~100 mesh). The application speed is 80ml/min.

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

The results obtained during the period from April, 1974 to March, 1975 are shown in Table 1.

Table 1. ^{90}Sr and ^{137}Cs in Rain and Dry Fallout
– Apr., 1974 to Mar., 1975 –
(Japan Chemical Analysis Center)
(Continued from Table 6, No. 36 of this publication)

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Apr. 1974				
Aomori, AOMORI	30	74	0.030±0.001	0.023±0.001
Sendai, MIYAGI	30	112	0.17 ±0.00	0.071±0.002
Akita, AKITA	31	111	0.38 ±0.00	0.56 ±0.01
Yamagata, YAMAGATA	30	36	0.031±0.001	0.010±0.001
Fukushima, FUKUSHIMA	30	96	0.063±0.001	0.18 ±0.00
Mito, IBARAKI	30	133	0.12 ±0.00	0.22 ±0.00
TOKYO	30	170	0.080±0.003	0.18 ±0.00
Yokohama, KANAGAWA	30	185	0.19 ±0.00	0.21 ±0.00
Niigata, NIIGATA	28	58	0.092±0.002	0.19 ±0.00
Kanazawa, ISHIKAWA	38	213	0.29 ±0.00	0.41 ±0.01
Nagoya, AICHI	31	290	0.13 ±0.00	0.21 ±0.00
Osaka, OSAKA	33	62	0.074±0.001	0.13 ±0.00
Kobe, HYOGO	32	135	0.061±0.002	0.12 ±0.00
Wakayama, WAKAYAMA	30	157	0.048±0.002	0.13 ±0.00
Tottori, TOTTORI	30	128	0.10 ±0.00	0.16 ±0.00

Location	Duration (Days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Matsue, SHIMANE	31	123	0.098±0.002	0.20 ±0.00
Okayama, OKAYAMA	30	76	0.074±0.002	0.13 ±0.00
Hiroshima, HIROSHIMA	31	159	0.097±0.002	0.14 ±0.00
Yamaguchi, YAMAGUCHI	31	202	0.19 ±0.00	0.20 ±0.00
Hagi, YAMAGUCHI	32	126	0.13 ±0.00	0.20 ±0.00
Kochi, KOCHI	28	264	0.25 ±0.00	0.37 ±0.01
Fukuoka, FUKUOKA	30	152	0.10 ±0.00	0.13 ±0.00
Saga, SAGA	31	157	0.15 ±0.00	0.13 ±0.00
Nagasaki, NAGASAKI	30	162	0.16 ±0.00	0.20 ±0.00
Kagoshima, KAGOSHIMA	34	117	0.073±0.002	0.17 ±0.00
Naha, OKINAWA	31	243	0.14 ±0.00	0.29 ±0.01
May 1974				
Sapporo, HOKKAIDO	32	37	0.075±0.002	0.12 ±0.00
Aomori, AOMORI	31	84	0.009±0.001	0.002±0.001
Sendai, MIYAGI	31	57	0.14 ±0.00	0.24 ±0.00
Akita, AKITA	32	88	0.072±0.001	0.21 ±0.00
Yamagata, YAMAGATA	31	46	0.092±0.002	0.12 ±0.00
Fukushima, FUKUSHIMA	31	75	0.093±0.002	0.16 ±0.00
Mito, IBARAKI	31	73	0.12 ±0.00	0.23 ±0.01
TOKYO	32	51	0.073±0.002	0.11 ±0.00
Niigata, NIIGATA	30	99	0.052±0.001	0.080±0.002
Kanazawa, ISHIKAWA	31	110	0.14 ±0.00	0.23 ±0.00
Shizuoka, SHIZUOKA	31	134	0.12 ±0.00	0.21 ±0.00
Nagoya, AICHI	32	210	0.079±0.001	0.25 ±0.00
Osaka, OSAKA	32	62	0.025±0.001	0.055±0.002
Kobe, HYOGO	40	83	0.062±0.002	0.13 ±0.00
Wakayama, WAKAYAMA	31	117	0.044±0.001	0.078±0.002
Tottori, TOTTORI	31	50	0.035±0.001	0.009±0.001
Okayama, OKAYAMA	31	20	0.014±0.001	0.047±0.002
Hiroshima, HIROSHIMA	31	88	0.047±0.002	0.076±0.002
Yamaguchi, YAMAGUCHI	31	134	0.12 ±0.00	0.19 ±0.00
Hagi, YAMAGUCHI	33	42	0.026±0.001	0.043±0.002
Kochi, KOCHI	31	227	0.26 ±0.00	0.38 ±0.01
Fukuoka, FUKUOKA	31	105	0.051±0.001	0.029±0.001
Saga, SAGA	32	81	0.065±0.001	0.11 ±0.00
Nagasaki, NAGASAKI	31	172	0.085±0.002	0.13 ±0.00
Kagoshima, KAGOSHIMA	38	125	0.075±0.002	0.13 ±0.00
Jun. 1974				
Sapporo, HOKKAIDO	31	109	0.12 ±0.00	0.22 ±0.00
Aomori, AOMORI	30	90	0.018±0.001	0.039±0.002
Sendai, MIYAGI	30	226	0.18 ±0.00	0.26 ±0.00
Akita, AKITA	31	110	0.097±0.002	0.12 ±0.00
Yamagata, YAMAGATA	30	141	0.11 ±0.00	0.17 ±0.00

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Mito, IBARAKI	30	207	0.17 ±0.00	0.33 ±0.01
TOKYO	31	202	0.15 ±0.00	0.23 ±0.00
Niigata, NIIGATA	29	73	0.089±0.002	0.13 ±0.00
Kanazawa, ISHIKAWA	29	91	0.057±0.001	0.12 ±0.00
Fukui, FUKUI	31	65	0.086±0.002	0.095±0.002
Shizuoka, SHIZUOKA	35	509	0.16 ±0.00	0.28 ±0.00
Nagoya, AICHI	32	201	0.10 ±0.00	0.23 ±0.00
Osaka, OSAKA	28	205	0.089±0.002	0.14 ±0.00
Kobe, HYOGO	24	184	0.080±0.002	0.13 ±0.00
Wakayama, WAKAYAMA	32	122	0.076±0.002	0.15 ±0.00
Tottori, TOTTORI	31	81	0.090±0.002	0.12 ±0.00
Okayama, OKAYAMA	30	92	0.14 ±0.00	0.14 ±0.00
Hiroshima, HIROSHIMA	31	152	0.26 ±0.00	0.33 ±0.00
Kochi, KOCHI	31	352	0.20 ±0.00	0.31 ±0.01
Fukuoka, FUKUOKA	31	110	0.067±0.002	0.10 ±0.00
Saga, SAGA	30	229	0.10 ±0.00	0.13 ±0.00
Nagasaki, NAGASAKI	30	220	0.089±0.002	0.12 ±0.00
Kagoshima, KAGOSHIMA	28	249	0.027±0.001	0.039±0.002
Jul. 1974				
Aomori, AOMORI	31	166	0.065±0.001	0.083±0.002
Sendai, MIYAGI	31	192	0.12 ±0.00	0.21 ±0.00
Akita, AKITA	32	266	0.079±0.002	0.11 ±0.00
Yamagata, YAMAGATA	31	275	0.067±0.001	0.16 ±0.00
Fukushima, FUKUSHIMA	32	246	0.26 ±0.01	0.048±0.002
Mito, IBARAKI	31	131	0.069±0.002	0.11 ±0.00
TOKYO	32	349	0.12 ±0.00	0.20 ±0.00
Yokohama, KANAGAWA	31	287	0.059±0.002	0.16 ±0.00
Niigata, NIIGATA	29	192	0.049±0.001	0.057±0.002
Kanazawa, ISHIKAWA	30	481	0.041±0.001	0.089±0.002
Fukui, FUKUI	32	261	0.062±0.001	0.15 ±0.00
Shizuoka, SHIZUOKA	25	616	0.085±0.002	0.14 ±0.00
Nagoya, AICHI	32	692	0.085±0.002	0.17 ±0.00
Osaka, OSAKA	32	257	0.063±0.001	0.11 ±0.00
Kobe, HYOGO	30	215	0.028±0.001	0.047±0.002
Wakayama, WAKAYAMA	30	382	0.049±0.002	0.074±0.002
Tottori, TOTTORI	32	254	0.044±0.001	0.084±0.002
Matsue, SHIMANE	32	175	0.031±0.001	0.049±0.002
Okayama, OKAYAMA	31	175	0.052±0.001	0.098±0.003
Hiroshima, HIROSHIMA	31	207	0.049±0.001	0.061±0.002

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Kochi, KOCHI	30	453	0.063±0.001	0.10 ±0.00
Fukuoka, FUKUOKA	31	452	0.055±0.001	0.077±0.002
Saga, SAGA	33	357	0.038±0.001	0.086±0.002
Nagasaki, NAGASAKI	31	365	0.041±0.001	0.070±0.003
Kagoshima, KAGOSHIMA	36	169	0.022±0.001	0.036±0.002
Aug. 1974				
Sapporo, HOKKAIDO	31	185	0.054±0.001	0.093±0.002
Aomori, AOMORI	31	121	0.030±0.001	0.048±0.002
Sendai, MIYAGI	31	85	0.022±0.001	0.037±0.002
Akita, AKITA	32	176	0.036±0.001	0.070±0.003
Yamagata, YAMAGATA	32	184	0.002±0.000	0.029±0.001
Fukushima, FUKUSHIMA	33	43	0.023±0.001	0.040±0.002
Mito, IBARAKI	32	73	0.010±0.001	0.035±0.002
TOKYO	32	313	0.032±0.001	0.061±0.002
Yokohama, KANAGAWA	27	165	0.025±0.002	0.041±0.002
Niigata, NIIGATA	33	70	0.018±0.001	0.028±0.002
Kanazawa, ISHIKAWA	29	132	0.019±0.001	0.042±0.002
Shizuoka, SHIZUOKA	36	277	0.024±0.001	0.040±0.002
Nagoya, AICHI	32	159	0.030±0.001	0.039±0.002
Kyoto, KYOTO	31	233	0.024±0.001	0.56 ±0.01
Osaka, OSAKA	32	153	0.015±0.001	0.025±0.001
Wakayama, WAKAYAMA	33	184	0.022±0.001	0.069±0.002
Tottori, TOTTORI	33	85	0.078±0.001	0.18 ±0.00
Matsue, SHIMANE	33	57	0.034±0.001	0.051±0.002
Okayama, OKAYAMA	34	55	0.011±0.001	0.012±0.001
Hiroshima, HIROSHIMA	33	96	0.010±0.001	0.034±0.002
Kochi, KOCHI	32	376	0.037±0.001	0.067±0.002
Fukuoka, FUKUOKA	31	48	0.013±0.001	0.035±0.002
Saga, SAGA	32	18	0.009±0.001	0.009±0.001
Nagasaki, NAGASAKI	31	7	0.006±0.000	0.013±0.001
Kagoshima, KAGOSHIMA	33	127	0.018±0.001	0.030±0.001
Naha, OKINAWA	32	240	0.017±0.001	0.085±0.002
Sep. 1974				
Sapporo, HOKKAIDO	32	100	0.035±0.001	0.051±0.002
Sendai, MIYAGI	30	361	0.10 ±0.00	0.15 ±0.00
Akita, AKITA	31	129	0.049±0.001	0.078±0.002
Yamagata, YAMAGATA	31	184	0.020±0.001	0.035±0.002
Fukushima, FUKUSHIMA	31	222	0.038±0.001	0.10 ±0.00

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Mito, IBARAKI	29	167	0.028±0.001	0.027±0.001
TOKYO	31	122	0.029±0.001	0.052±0.002
Yokohama, KANAGAWA	29	213	0.027±0.001	0.052±0.002
Niigata, NIIGATA	31	213	0.048±0.001	0.079±0.002
Kanazawa, ISHIKAWA	29	406	0.061±0.001	0.078±0.002
Fukui, FUKUI	32	171	0.034±0.001	0.11 ±0.00
Shizuoka, SHIZUOKA	25	379	0.036±0.001	0.059±0.002
Nagoya, AICHI	30	165	0.028±0.001	0.048±0.002
Osaka, OSAKA	29	105	0.021±0.001	0.034±0.002
Kobe, HYOGO	32	222	0.031±0.001	0.041±0.002
Wakayama, WAKAYAMA	28	204	0.023±0.001	0.035±0.002
Tottori, TOTTORI	30	115	0.031±0.001	0.043±0.002
Matsue, SHIMANE	30	147	0.021±0.001	0.047±0.002
Okayama, OKAYAMA	30	114	0.024±0.001	0.031±0.001
Yamaguchi, YAMAGUCHI	31	245	0.020±0.001	0.019±0.001
Hagi, YAMAGUCHI	29	248	0.022±0.001	0.025±0.001
Kochi, KOCHI	31	546	0.036±0.001	0.060±0.002
Fukuoka, FUKUOKA	30	107	0.020±0.001	0.040±0.002
Saga, SAGA	31	67	0.011±0.001	0.010±0.001
Kagoshima, KAGOSHIMA	26	147	0.017±0.001	0.029±0.001
Naha, OKINAWA	31	152	0.021±0.001	0.030±0.001
Oct. 1974				
Sapporo, HOKKAIDO	32	131	0.038±0.001	0.085±0.002
Aomori, AOMORI	31	157	0.070±0.001	0.091±0.002
Sendai, MIYAGI	31	57	0.025±0.001	0.043±0.002
Akita, AKITA	32	182	0.051±0.001	0.087±0.002
Yamagata, YAMAGATA	29	53	0.021±0.001	0.028±0.001
Fukushima, FUKUSHIMA	32	38	0.007±0.001	0.014±0.001
Mito, IBARAKI	31	74	0.017±0.001	0.017±0.001
TOKYO	32	122	0.044±0.001	0.058±0.002
Yokohama, KANAGAWA	32	172	0.022±0.001	0.054±0.002
Niigata, NIIGATA	37	141	0.052±0.001	0.079±0.002
Kanazawa, ISHIKAWA	36	215	0.053±0.001	0.074±0.002
Fukui, FUKUI	29	170	0.037±0.001	0.072±0.002
Shizuoka, SHIZUOKA	30	148	0.024±0.001	0.046±0.002
Nagoya, AICHI	32	188	0.042±0.001	0.065±0.002
Kyoto, KYOTO	31	88	0.011±0.001	0.043±0.002
Osaka, OSAKA	31	169	0.013±0.001	0.024±0.001
Kobe, HYOGO	30	168	0.013±0.001	0.018±0.001
Wakayama, WAKAYAMA	31	99	0.018±0.001	0.027±0.001
Tottori, TOTTORI	32	109	0.016±0.001	0.023±0.001
Matsue, SHIMANE	32	96	0.026±0.001	0.025±0.001

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Okayama, OKAYAMA	32	215	0.016±0.001	0.022±0.001
Hiroshima, HIROSHIMA	32	166	0.009±0.001	0.021±0.001
Yamaguchi, YAMAGUCHI	30	147	0.013±0.001	0.019±0.001
Hagi, YAMAGUCHI	32	153	0.018±0.001	0.034±0.002
Kochi, KOCHI	29	198	0.031±0.001	0.043±0.002
Fukuoka, FUKUOKA	31	135	0.010±0.001	0.028±0.001
Saga, SAGA	33	199	0.005±0.001	0.030±0.001
Nagasaki, NAGASAKI	32	110	0.014±0.001	0.032±0.002
Kagoshima, KAGOSHIMA	39	164	0.012±0.001	0.010±0.001
Naha, OKINAWA	32	329	0.015±0.001	0.028±0.001
Nov. 1974				
Sapporo, HOKKAIDO	32	71	0.035±0.001	0.056±0.002
Sendai, MIYAGI	30	53	0.010±0.001	0.018±0.001
Akita, AKITA	31	125	0.058±0.002	0.082±0.002
Yamagata, YAMAGATA	31	87	0.024±0.001	0.046±0.002
Mito, IBARAKI	31	35	0.009±0.001	0.013±0.001
TOKYO	32	33	0.009±0.001	0.011±0.001
Yokohama, KANAGAWA	32	26	0.012±0.001	0.019±0.001
Niigata, NIIGATA	34	88	0.035±0.001	0.057±0.002
Kanazawa, ISHIKAWA	29	184	0.052±0.001	0.099±0.002
Fukui, FUKUI	32	192	0.064±0.001	0.092±0.003
Shizuoka, SHIZUOKA	32	42	0.015±0.001	0.023±0.005
Nagoya, AICHI	30	112	0.001±0.000	0.000±0.001
Kyoto, KYOTO	36	57	0.017±0.001	0.024±0.001
Osaka, OSAKA	32	77	0.009±0.001	0.015±0.001
Kobe, HYOGO	67	89	0.012±0.001	0.022±0.001*
Wakayama, WAKAYAMA	34	68	0.012±0.001	0.012±0.001
Tottori, TOTTORI	33	94	0.052±0.001	0.075±0.002
Matsue, SHIMANE	32	106	0.11 ±0.00	0.11 ±0.00
Okayama, OKAYAMA	32	35	0.011±0.001	0.017±0.001
Hiroshima, HIROSHIMA	33	23	0.013±0.001	0.035±0.002
Yamaguchi, YAMAGUCHI	35	31	0.019±0.001	0.025±0.001
Hagi, YAMAGUCHI	33	32	0.017±0.001	0.038±0.002
Kochi, KOCHI	32	71	0.032±0.001	0.022±0.001
Fukuoka, FUKUOKA	30	38	0.017±0.001	0.035±0.002
Saga, SAGA	30	54	0.006±0.000	0.017±0.001
Nagasaki, NAGASAKI	32	62	0.019±0.001	0.037±0.002
Kagoshima, KAGOSHIMA	26	99	0.015±0.001	0.025±0.001
Naha, OKINAWA	31	95	0.013±0.001	0.018±0.001

*) Average of November and December

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Dec. 1974				
Sapporo, HOKKAIDO	36	112	0.039±0.001	0.064±0.002
Aomori, AOMORI	31	180	0.022±0.001	0.034±0.001
Sendai, MIYAGI	27	22	0.013±0.001	0.024±0.001
Akita, AKITA	35	78	0.060±0.001	0.11 ±0.00
Yamagata, YAMAGATA	26	52	0.034±0.001	0.046±0.002
Fukushima, FUKUSHIMA	36	32	0.016±0.001	0.025±0.001
Mito IBARAKI	34	56	0.018±0.001	0.023±0.001
Yokohama, KANAGAWA	36	37	0.019±0.001	0.030±0.001
Niigata, NIIGATA	29	87	0.048±0.001	0.084±0.002
Kanazawa, ISHIKAWA	35	127	0.12 ±0.00	0.055±0.002
Fukui, FUKUI	36	188	0.10 ±0.00	0.15 ±0.00
Shizuoka, SHIZUOKA	34	61	0.026±0.001	0.039±0.002
Nagoya, AICHI	35	23	0.017±0.001	0.019±0.001
Kyoto, KYOTO	32	47	0.017±0.001	0.025±0.001
Osaka, OSAKA	32	43	0.012±0.001	0.016±0.001
Kobe, HYOGO	67	42	0.012±0.001	0.022±0.001*
Wakayama, WAKAYAMA	33	40	0.006±0.001	0.012±0.001
Tottori, TOTTORI	36	190	0.12 ±0.00	0.20 ±0.00
Matsue, SHIMANE	27	87	0.096±0.002	0.10 ±0.00
Okayama, OKAYAMA	35	45	0.013±0.001	0.019±0.001
Hiroshima, HIROSHIMA	35	58	0.025±0.001	0.036±0.001
Yamaguchi, YAMAGUCHI	32	81	0.022±0.001	0.038±0.002
Hagi, YAMAGUCHI	36	75	0.039±0.001	0.066±0.002
Kochi, KOCHI	35	83	0.027±0.001	0.040±0.002
Fukuoka, FUKUOKA	31	54	0.020±0.001	0.022±0.001
Saga, SAGA	30	67	0.012±0.001	0.022±0.001
Nagasaki, NAGASAKI	34	90	0.027±0.001	0.040±0.002
Kagoshima, KAGOSHIMA	39	172	0.026±0.001	0.024±0.001
Naha, OKINAWA	32	172	0.035±0.001	0.047±0.002
Jan. 1975				
Sapporo, HOKKAIDO	27	67	0.029±0.001	0.047±0.002
Aomori, AOMORI	31	189	0.043±0.001	0.057±0.002
Sendai, MIYAGI	35	49	0.011±0.001	0.013±0.001
Akita, AKITA	31	98	0.063±0.001	0.098±0.002
Yamagata, YAMAGATA	34	71	0.030±0.001	0.042±0.002
Fukushima, FUKUSHIMA	28	58	0.017±0.001	0.026±0.001
Mito, IBARAKI	26	61	0.012±0.001	0.023±0.001
TOKYO	27	59	0.019±0.001	0.033±0.002
Yokohama, KANAGAWA	27	73	0.016±0.001	0.029±0.001
Niigata, NIIGATA	31	110	0.068±0.002	0.10 ±0.00

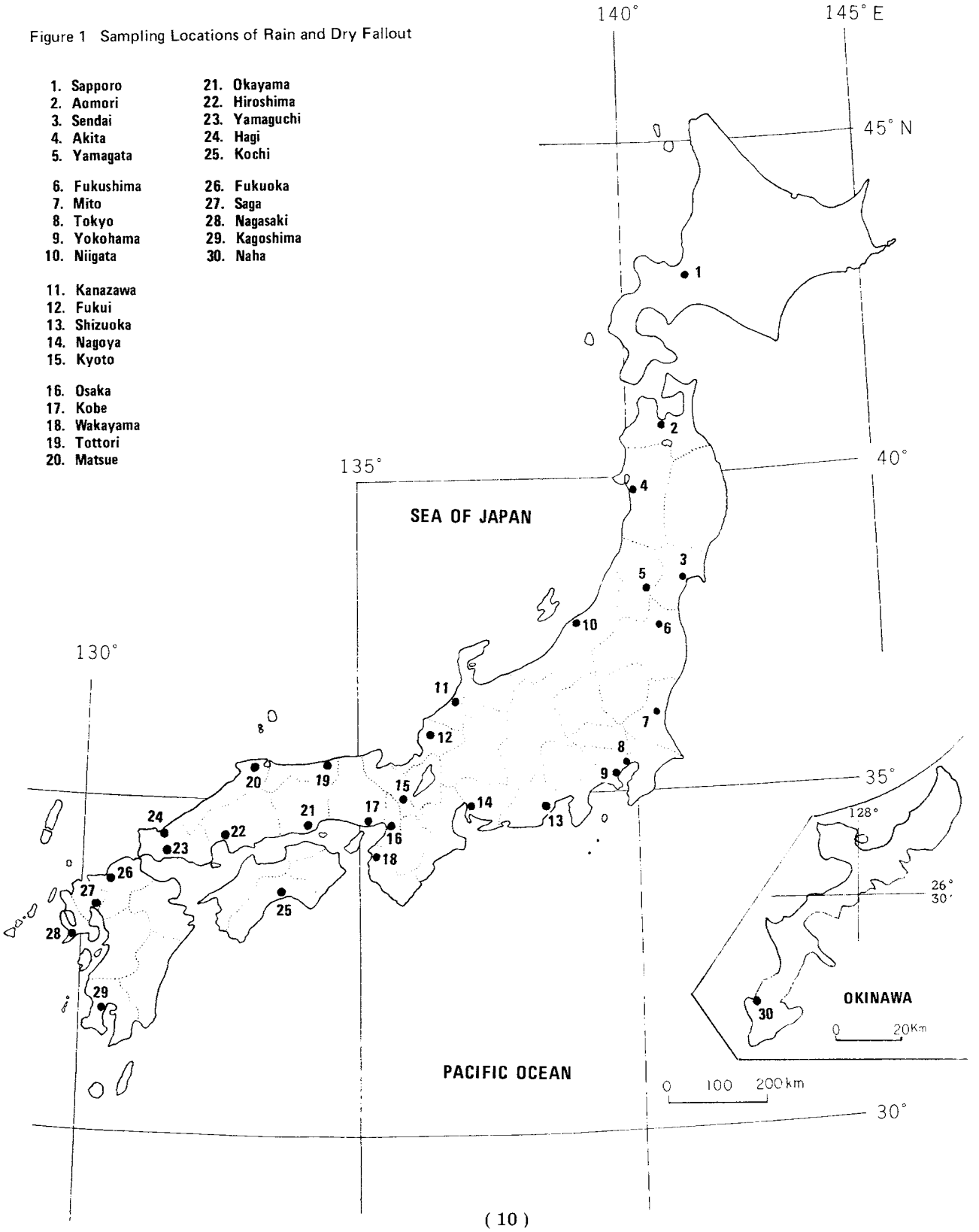
*) Average of November and December

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Kanazawa, ISHIKAWA	32	205	0.12 ±0.00	0.20 ±0.00
Fukui, FUKUI	27	361	0.14 ±0.00	0.23 ±0.00
Shizuoka, SHIZUOKA	31	132	0.037±0.001	0.063±0.002
Nagoya, AICHI	29	64	0.023±0.001	0.037±0.002
Kyoto, KYOTO	32	59	0.019±0.001	0.036±0.002
Osaka, OSAKA	27	42	0.020±0.001	0.036±0.002
Kobe, HYOGO	29	33	0.027±0.001	0.032±0.002
Wakayama, WAKAYAMA	30	64	0.026±0.001	0.047±0.002
Tottori, TOTTORI	28	199	0.13 ±0.00	0.23 ±0.00
Matsue, SHIMANE	36	105	0.19 ±0.00	0.20 ±0.00
Okayama, OKAYAMA	27	42	0.009±0.001	0.011±0.001
Hiroshima, HIROSHIMA	29	62	0.018±0.001	0.031±0.001
Yamaguchi, YAMAGUCHI	32	58	0.033±0.001	0.058±0.002
Hagi, YAMAGUCHI	32	109	0.062±0.001	0.091±0.002
Kochi, KOCHI	29	157	0.038±0.001	0.055±0.002
Fukuoka, FUKUOKA	31	94	0.028±0.001	0.046±0.002
Saga, SAGA	34	72	0.029±0.001	0.039±0.002
Nagasaki, NAGASAKI	29	107	0.024±0.001	0.077±0.002
Kagoshima, KAGOSHIMA	25	97	0.019±0.001	0.026±0.001
Naha, OKINAWA	33	196	0.032±0.001	0.052±0.002
Feb. 1975				
Sapporo, HOKKAIDO	29	62	0.018±0.001	0.034±0.001
Aomori, AOMORI	28	92	0.067±0.001	0.10 ±0.00
Sendai, MIYAGI	28	58	0.030±0.001	0.050±0.002
Akita, AKITA	29	101	0.083±0.001	0.13 ±0.00
Yamagata, YAMAGATA	31	88	0.060±0.001	0.060±0.002
Fukushima, FUKUSHIMA	30	73	0.019±0.001	0.033±0.001
Mito, IBARAKI	28	77	0.025±0.001	0.033±0.001
TOKYO	29	86	0.021±0.001	0.035±0.002
Yokohama, KANAGAWA	28	78	0.027±0.001	0.033±0.002
Niigata, NIIGATA	27	106	0.077±0.002	0.13 ±0.00
Kanazawa, ISHIKAWA	27	135	0.14 ±0.00	0.24 ±0.00
Fukui, FUKUI	31	200	0.21 ±0.00	0.24 ±0.00
Shizuoka, SHIZUOKA	23	81	0.018±0.001	0.037±0.002
Nagoya, AICHI	30	85	0.021±0.001	0.040±0.002
Kyoto, KYOTO	26	64	0.016±0.001	0.032±0.002
Osaka, OSAKA	28	68	0.025±0.001	0.042±0.002
Wakayama, WAKAYAMA	23	32	0.018±0.001	0.026±0.001
Tottori, TOTTORI	27	161	0.14 ±0.00	0.24 ±0.00
Matsue, SHIMANE	29	150	0.53 ±0.01	0.55 ±0.01
Okayama, OKAYAMA	29	35	0.018±0.001	0.030±0.001

Location	Duration (days)	Precipitation (mm)	^{90}Sr (mCi/km^2)	^{137}Cs (mCi/km^2)
Hiroshima, HIROSHIMA	29	31	0.018±0.001	0.041±0.002
Yamaguchi, YAMAGUCHI	26	100	0.065±0.002	0.13 ±0.00
Hagi, YAMAGUCHI	26	128	0.068±0.001	0.12 ±0.00
Kochi, KOCHI	24	27	0.019±0.001	0.020±0.001
Fukuoka, FUKUOKA	28	96	0.052±0.001	0.091±0.002
Saga, SAGA	32	99	0.046±0.001	0.063±0.002
Nagasaki, NAGASAKI	29	124	0.023±0.001	0.083±0.002
Kagoshima, KAGOSHIMA	29	152	0.030±0.001	0.18 ±0.00
Naha, OKINAWA	29	110	0.034±0.001	0.051±0.002
Mar. 1975				
Sapporo, HOKKAIDO	32	124	0.091±0.002	0.14 ±0.00
Aomori, AOMORI	31	100	0.039±0.001	0.063±0.002
Sendai, MIYAGI	31	144	0.14 ±0.00	0.18 ±0.00
Akita, AKITA	30	112	0.056±0.001	0.12 ±0.00
Yamagata, YAMAGATA	31	61	0.041±0.001	0.070±0.002
Fukushima, FUKUSHIMA	28	98	0.049±0.001	0.047±0.002
TOKYO	32	104	0.050±0.001	0.081±0.002
Yokohama, KANAGAWA	32	108	0.071±0.002	0.13 ±0.00
Niigata, NIIGATA	28	66	0.052±0.002	0.095±0.002
Kanazawa, ISHIKAWA	28	88	0.089±0.002	0.16 ±0.00
Fukui, FUKUI	30	99	0.11 ±0.00	0.20 ±0.00
Shizuoka, SHIZUOKA	35	171	0.081±0.001	0.16 ±0.00
Nagoya, AICHI	29	145	0.053±0.001	0.088±0.002
Kyoto, KYOTO	30	45	0.033±0.001	0.055±0.002
Osaka, OSAKA	30	44	0.023±0.001	0.040±0.002
Wakayama, WAKAYAMA	31	85	0.044±0.001	0.077±0.002
Tottori, TOTTORI	32	84	0.085±0.002	0.18 ±0.00
Matsue, SHIMANE	32	81	0.20 ±0.00	0.20 ±0.00
Okayama, OKAYAMA	32	33	0.026±0.001	0.048±0.002
Hiroshima, HIROSHIMA	30	84	0.044±0.001	0.082±0.002
Yamaguchi, YAMAGUCHI	32	99	0.076±0.001	0.13 ±0.00
Hagi, YAMAGUCHI	28	67	0.051±0.001	0.082±0.002
Kochi, KOCHI	30	200	0.004±0.000	0.042±0.002
Fukuoka, FUKUOKA	31	34	0.026±0.001	0.040±0.002
Saga, SAGA	29	22	0.029±0.001	0.036±0.002
Nagasaki, NAGASAKI	32	64	0.032±0.001	0.059±0.002
Kagoshima, KAGOSHIMA	33	91	0.020±0.001	0.029±0.001
Naha, OKINAWA	32	195	0.084±0.002	0.12 ±0.00

Figure 1 Sampling Locations of Rain and Dry Fallout

1. Sapporo
2. Aomori
3. Sendai
4. Akita
5. Yamagata
6. Fukushima
7. Mito
8. Tokyo
9. Yokohama
10. Niigata
11. Kanazawa
12. Fukui
13. Shizuoka
14. Nagoya
15. Kyoto
16. Osaka
17. Kobe
18. Wakayama
19. Tottori
20. Matsue
21. Okayama
22. Hiroshima
23. Yamaguchi
24. Hagi
25. Kochi
26. Fukuoka
27. Saga
28. Nagasaki
29. Kagoshima
30. Naha



Strontium-90 and Cesium-137 in Air-Borne Dusts

(Japan Chemical Analysis Center)

The levels of strontium-90 and cesium-137 in air-borne dusts have been determined by Japan Chemical Analysis Center under contract with Science and Technology Agency.

Dust samples were collected at 1 – 1.5 m above the ground surface with electrostatic precipitators or on filter papers by each prefectural public health laboratories in 9 prefectures.

The sample was ashed at 450°C in an electric muffle furnace. The ash to which both some carriers and hydrochloric acid were added, was destroyed under heating. The solution was dissolved into hydrochloric acid and filtered, after it was added with nitric acid and heated to dryness. The filtrate was analyzed for strontium-90 and cesium-137.

The radioactivity of the counting sample was measured with a lowbackground beta-ray spectrometer.

The activity data of the samples collected during the period from April, 1974 to March, 1975 are shown in Table 2. The sampling locations are shown in Figure 2.

Table 2. ^{90}Sr and ^{137}Cs in Air-Borne Dusts
– Apr., 1974 to Mar., 1975 –
(Japan Chemical Analysis Center)
(Continued from Table 2, No. 36 of this publication)

Location	Sampling period	Absorption volume (m^3)	^{90}Sr (10^{-3} pCi/m^3)	^{137}Cs (10^{-3} pCi/m^3)
Namie, FUKUSHIMA	05-06/74	6140	4.0 ±0.1	5.9 ±0.2
Mito, IBARAKI	04-06/74	16830	0.57±0.05	0.65±0.05
Niigata, NIIGATA	04-06/74	13000	1.3 ±0.1	3.5 ±0.3
Fukui, FUKUI	04-06/74	14656	1.0 ±0.1	1.7 ±0.1
Shizuoka, SHIZUOKA	04-06/74	3240	1.9 ±0.2	3.4 ±0.3
Osaka, OSAKA	04-06/74	7776	2.6 ±0.1	4.5 ±0.2
Tottori, TOTTORI	04-06/74	3229	4.9 ±0.3	7.6 ±0.4
Hiroshima, HIROSHIMA	04-06/74	3600	1.0 ±0.2	2.1 ±0.3
Nagasaki, NAGASAKI	04-06/74	7000	1.1 ±0.1	3.7 ±0.2
Namie, FUKUSHIMA	07-09/74	6196	1.1 ±0.1	1.8 ±0.2
Mito, IBARAKI	07-09/74	12924	0.17±0.04	0.29±0.07
Niigata, NIIGATA	07-09/74	13000	0.38±0.02	1.1 ±0.1
Fukui, FUKUI	07-09/74	15929	0.43±0.06	0.67±0.07
Shizuoka, SHIZUOKA	07-08/74	2160	0.42±0.09	0.66±0.15
Osaka, OSAKA	07-09/74	6480	1.2 ±0.1	1.6 ±0.1
Tottori, TOTTORI	07-09/74	3180	1.2 ±0.2	1.8 ±0.3
Hiroshima, HIROSHIMA	09 /74	1200	0.25±0.08	0.48±0.19
Nagasaki, NAGASAKI	07-09/74	5400	1.1 ±0.1	0.9 ±0.1
Namie, FUKUSHIMA	10-12/74	6471	0.71±0.05	1.0 ±0.1
Mito, IBARAKI	10-12/74	12132	0.16±0.02	0.17±0.02
Niigata, NIIGATA	10-12/74	12012	0.21±0.02	0.58±0.04
Fukui, FUKUI	10-12/74	15133	0.25±0.01	0.46±0.03
Shizuoka, SHIZUOKA	11 /74	2160	0.42±0.09	0.70±0.12

Location	Sampling period	Absorption volume (m^3)	^{90}Sr (10^{-3} pCi/m^3)	^{137}Cs (10^{-3} pCi/m^3)
Osaka, OSAKA	10-12/74	8438	0.69±0.04	1.2 ±0.1
Tottori, TOTTORI	10-12/74	3280	1.0 ±0.1	2.5 ±0.2
Hiroshima, HIROSHIMA	10-12/74	3600	0.25±0.06	0.28±0.06
Nagasaki, NAGASAKI	10-12/74	4500	0.80±0.04	0.92±0.09
Namie, FUKUSHIMA	02-03/75	4238	1.8 ±0.1	1.9 ±0.1
Mito, IBARAKI	01-03/75	11113	0.17±0.02	0.27±0.03
Niigata, NIIGATA	01-03/75	11000	0.25±0.02	0.66±0.04
Fukui, FUKUI	01-03/75	14921	0.30±0.02	0.42±0.03
Shizuoka, SHIZUOKA	03 /75	4320	1.0 ±0.1	1.5 ±0.1
Osaka, OSAKA	01-03/75	7830	0.87±0.04	1.4 ±0.1
Tottori, TOTTORI	01-03/75	3425	1.4 ±0.1	1.2 ±0.1
Hiroshima, HIROSHIMA	01-03/75	3600	0.36±0.06	0.49±0.08
Nagasaki, NAGASAKI	01-03/75	5400	1.2 ±0.1	2.8 ±0.1

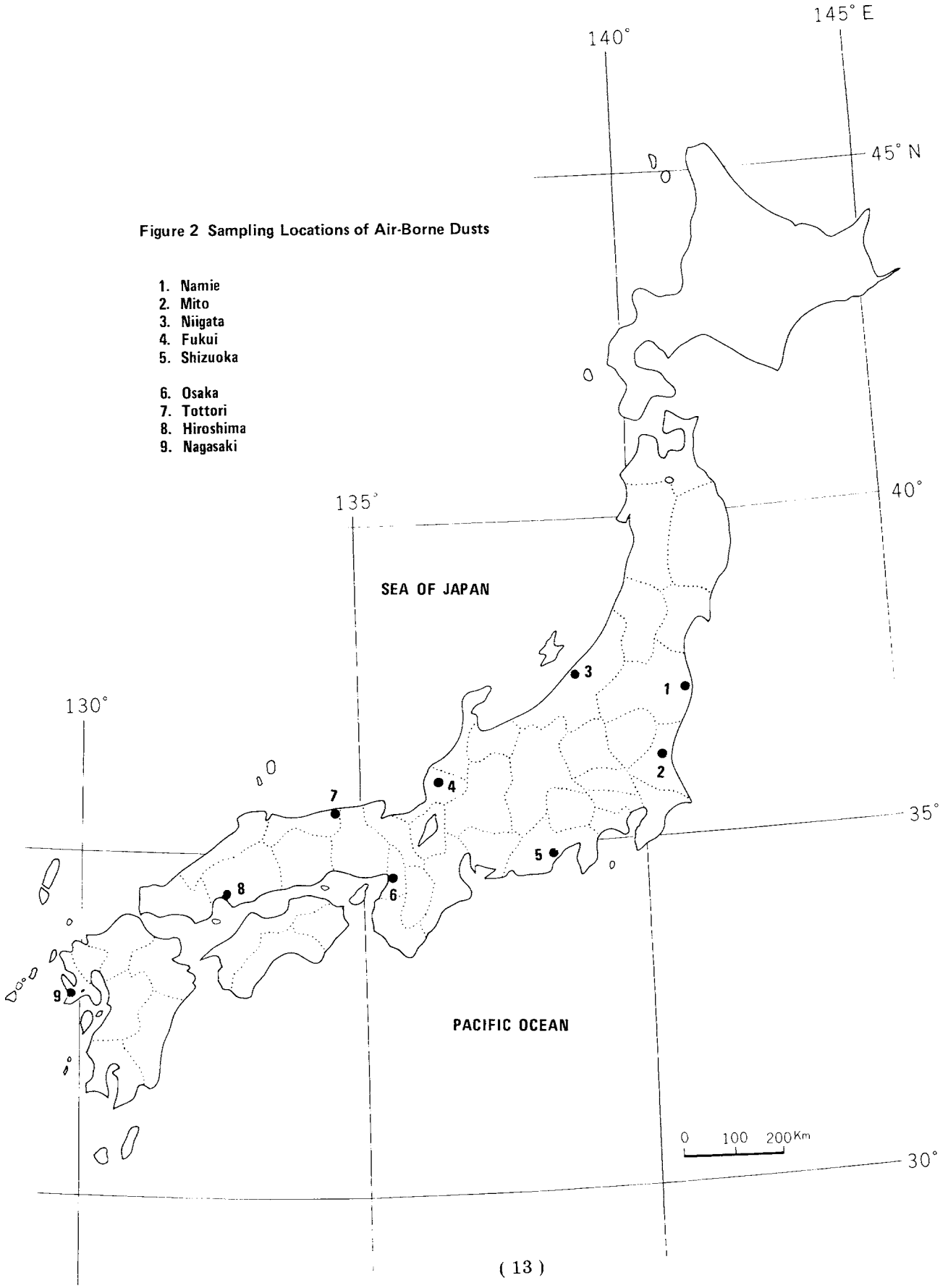


Figure 2 Sampling Locations of Air-Borne Dusts

1. Namie
2. Mito
3. Niigata
4. Fukui
5. Shizuoka
6. Osaka
7. Tottori
8. Hiroshima
9. Nagasaki

Marine Data

Radioactivity in Marine Products, Sea Water and Marine Sediments

(Japan Chemical Analysis Center)

Japan Chemical Analysis Center has conducted analysis of marine samples such as marine fishes, shells, sea weeds, sea water and marine sediments.

Samplings were performed by each local public health laboratories 1 – 3 times a year. The sampling locations are shown in Figures 3, 4 and 5. These samples were sent to Japan Chemical Analysis Center and analyzed for strontium-90 and cesium-137 content, using the methods recommended by Science and Technology Agency.

The results obtained are shown in Tables 3, 4 and 5.

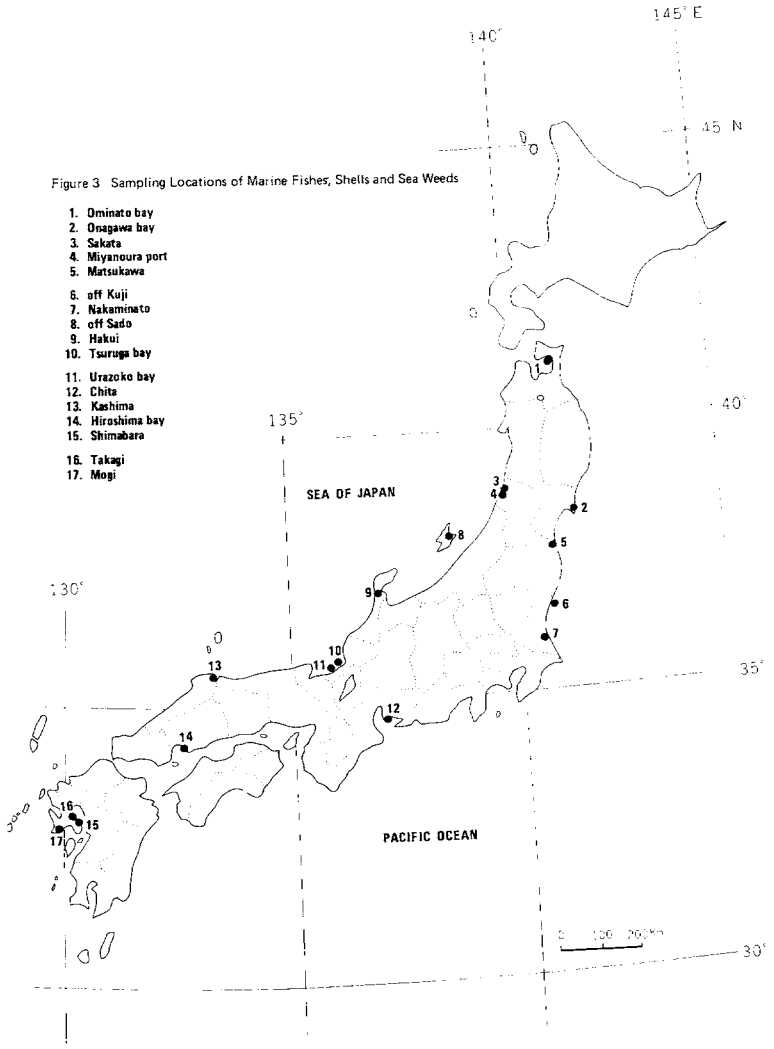


Figure 3 Sampling Locations of Marine Fishes, Shells and Sea Weeds

Table 3. ^{90}Sr and ^{137}Cs in Marine Fishes, Shells and Sea Weeds
– May, 1974 to Feb., 1975 –
(Japan Chemical Analysis Center)
(Continued from Table 6 ~ Table 8, No. 35 of this publication)

Sample's name* (scientific name)	Location	Ash (%)	Ash (g)	Ca (%)	K (%)	^{90}Sr (pCi/kg)	^{90}Sr S.U	^{137}Cs (pCi/kg)	^{137}Cs C.U
May 1974									
Lateolabrax japonicus	off Kuji, IBARAKI	3.52	30	32.3	3.49	1.4±0.3	0.12±0.03	5.2±0.5	4.2 ±0.4
Hijikia fusiforme	Nakaminato, IBARAKI	4.19	30	2.55	38.7	3.8±0.3	3.6 ±0.8	14 ±1	0.86±0.04
Trachurus japonicus	Tsuruga bay, FUKUI	3.34	30	24.2	10.6	1.2±0.2	0.15±0.02	17 ±1	4.7 ±0.2
Undaria pinnatifida	Urazoko bay, FUKUI	4.28	30	3.56	19.6	2.3±0.3	1.5 ±0.2	19 ±1	2.2 ±0.1
Turbo cornutus	Tsuruga, FUKUI	3.97	30	8.21	7.14	1.6±0.3	0.49±0.09	3.3±0.4	1.2 ±0.1
Jun. 1974									
Pleuronectidae	Miyanoura, YAMAGATA	2.84	30	22.5	9.53	0.9±0.2	0.15±0.03	7.7±0.5	2.8 ±0.2
Mugil cephalus	Matsukawa, FUKUSHIMA	2.65	30	30.0	2.89	2.8±0.3	0.35±0.04	1.8±0.3	2.4 ±0.3
Undaria pinnatifida	Sado, NIIGATA	3.52	35	3.30	29.8	1.5±0.2	1.3 ±0.2	9.3±0.6	0.9 ±0.1
Sillago sihama	Chita, AICHI	3.84	40	24.0	7.80	1.0±0.1	0.10±0.01	5.0±0.5	1.7 ±0.2
Venerupis phillippinarum	Chita, AICHI	1.95	10	3.83	14.3	1.9±0.2	2.6 ±0.3	5.3±0.7	1.9 ±0.3
Hapalogenys nigripinnis	Kashima, SHIMANE	4.50	30	6.44	18.6	4.2±0.7	1.4 ±0.2	18 ±1	2.2 ±0.1
Turbo cornutus	Kashima, SHIMANE	1.01	10	7.47	12.8	0.5±0.2	0.7 ±0.3	4.2±0.3	3.2 ±0.3
Sebastiscus marmoratus	Kashima, SHIMANE	5.72	30	28.3	4.76	1.8±0.5	0.11±0.03	8.0±0.7	2.9 ±0.3
Jul. 1974									
Pleuronectidae	Onagawa bay, MIYAGI	2.89	30	23.6	12.1	0.8±0.2	0.12±0.02	13 ±1	3.6 ±0.2
Undaria pinnatifida	Onagawa bay, MIYAGI	2.73	30	4.23	22.2	3.8±0.4	3.3 ±0.3	7.4±0.4	1.2 ±0.1
Undaria pinnatifida	Sakata, YAMAGATA	4.47	40	5.15	17.7	5.6±0.3	2.4 ±0.1	2.2±0.4	0.28±0.05
Haliotis gigantea	off Kuji, IBARAKI	1.62	30	1.33	10.9	0.2±0.1	0.9 ±0.5	2.7±0.2	1.5 ±0.1
Trachurus japonicus	off Sado, NIIGATA	3.27	30	23.9	10.4	1.4±0.2	0.18±0.03	15 ±1	4.4 ±0.2
Pleuronectidae	off Sado, NIIGATA	2.65	25	21.6	12.4	1.0±0.1	0.17±0.02	7.2±0.5	2.2 ±0.2
Sebastes inermis	Hakui, ISHIKAWA	4.41	40	32.5	5.49	2.3±0.2	0.16±0.02	12 ±1	5.0 ±0.3
Undaria pinnatifida	Hakui, ISHIKAWA	3.37	30	2.75	15.3	1.7±0.2	1.8 ±0.2	5.9±0.5	1.1 ±0.1
Seriola quinqueradiata	Hakui, ISHIKAWA	3.37	30	26.3	8.40	1.1±0.1	0.13±0.01	16 ±1	5.7 ±0.3
Pleuronectidae	Hiroshima bay, HIROSHIMA	3.33	30	24.1	10.3	1.8±0.2	0.22±0.03	7.9±0.6	2.3 ±0.2

Sample's name* (scientific name)	Location	Ash (%)	Ash (g)	Ca (%)	K (%)	^{90}Sr (pCi/kg)	^{90}Sr S.U	^{137}Cs (pCi/kg)	^{137}Cs C.U
Venerupis phillippinarum	Hiroshima bay, HIROSHIMA	1.67	5	5.22	15.1	0.7±0.3	0.8 ±0.4	5.0±0.9	2.0±0.4
Undaria pinnatifida	Shimabara, NAGASAKI	0.53	5	8.97	13.3	1.9±0.2	4.0 ±0.4	1.0±0.3	1.4±0.4
Venerupis phillippinarum	Takaki, NAGASAKI	0.73	5	9.79	7.60	0.4±0.1	0.6 ±0.5	6.0±0.5	11 ±1
Saurida undosquamis	Mogi, NAGASAKI	3.64	30	24.1	10.4	0.4±0.2	0.04±0.03	11 ±1	3.0±0.2
Aug. 1974									
Venerupis phillippinarum	Matsukawa, FUKUSHIMA	1.35	10	4.81	6.32	0.4±0.4	0.6 ±0.6	3.2±0.1	3.8±0.1
Sep. 1974									
Undaria pinnatifida	Matsukawa, FUKUSHIMA	1.30	25	3.25	0.95	2.9±0.3	6.9 ±0.7	0.5±0.1	4.0±0.8
Oct. 1974									
Pleuronectidae	Ominato bay, AOMORI	2.82	30	24.7	10.8	1.4±0.2	0.20±0.03	6.2±0.5	2.0±0.2
Pecten yessoensis	Ominato bay, AOMORI	2.14	25	2.87	10.8	0.2±0.2	0.3 ±0.2	6.5±0.4	2.8±0.2
Nov. 1974									
Babylonia japonica	off Sado, NIIGATA	1.17	10	9.65	12.5	1.3±0.2	1.1 ±0.2	1.9±0.3	1.3±0.2
Sillago sihama	Chita, AICHI	4.33	40	25.3	6.70	0.8±0.2	0.07±0.02	6.5±0.5	2.2±0.2
Mylio macrocephalus	Hiroshima bay, HIROSHIMA	4.93	50	29.3	6.50	1.2±0.2	0.08±0.01	7.5±0.5	2.3±0.2
Argyrosomus argentatus	Mogi, NAGASAKI	4.29	40	26.2	7.10	1.3±0.2	0.11±0.02	10 ±1	3.3±0.2
Dec. 1974									
Oncorhynchus keta	Sakata, YAMAGATA	1.90	20	21.0	11.2	0.6±0.2	0.14±0.05	8.2±0.5	3.9±0.2
Jan. 1975									
Undaria pinnatifida	Chita, AICHI	3.67	30	2.26	21.3	1.2±0.2	1.5 ±0.3	5.3±0.5	0.7±0.1
Feb. 1975									
Porphyra tenera	Hiroshima bay, HIROSHIMA	0.67	5	0.95	24.0	0.3±0.1	4 ±2	1.3±0.3	0.8±0.2

*) **Scientific name** — **Japanese name**

Lateolabrax japonicus ..... **Suzuki**
Hijikia fusiforme ..... **Hijiki**
Trachurus japonicus ..... **Maaji**
Undaria pinnatifida ..... **Wakame**
Turbo cornutus ..... **Sazae**
Pleuronectidae ..... **Karei**
Mugil cephalus ..... **Bora**
Sillago sihama ..... **Kisu**
Venerupis phillippinarum ..... **Asari**
Hapalogenys nigripinnis ..... **Higedai**
Sebastiscus marmoratus ..... **Kasago**
Haliotis gigantea ..... **Awabi**
Sebastes inermis ..... **Mebaru**
Seriola quinqueradiata ..... **Buri**
Saurida undosquamis ..... **Maeso**
Babylonia japonica ..... **Bai**
Mylio macrocephalus ..... **Chinu (Kurodai)**
Argyrosomus argentatus ..... **Ishimochi**
Pecten yessoensis ..... **Hotategai**
Oncorhynchus keta ..... **Sake**
Porphyra tenera ..... **Asakusanori**

Table 4. ^{90}Sr and ^{137}Cs in Sea Water
– May, 1974 to Dec., 1974 –
(Japan Chemical Analysis Center)
(Continued from Table 4, No. 35 of this publication)

Prefecture	Location	Depth (m)	Cl (‰)	Sample volume analyzed (ℓ)	^{90}Sr (pCi/ℓ)	^{137}Cs (pCi/ℓ)
May 1974						
FUKUSHIMA	Namie	surface	18.4	36	0.11±0.01	0.20±0.01
FUKUSHIMA	Okuma	"	18.7	35	0.09±0.01	0.17±0.01
Jun. 1974						
MIYAGI	Shiogama bay	"	13.3	20	0.29±0.02	0.43±0.03
MIYAGI	Onagawa bay	"	17.2	22	0.16±0.01	0.19±0.02
YAMAGATA	Sakata (North) bay	"	18.0	43	0.14±0.01	0.14±0.01
HYOGO	Kobe port	"	17.9	42	0.15±0.01	0.16±0.02
NAGASAKI	Nagasaki port	"	18.6	40	0.15±0.01	0.15±0.01
Jul. 1974						
AOMORI	Mutsu bay	"	18.5	40	0.22±0.01	0.83±0.02
AOMORI	Hachinohe port	"	18.1	40	0.22±0.01	0.31±0.02
AKITA	Hirasawa port	"	17.5	39	0.16±0.03	0.15±0.01
IBARAKI	Hitachi	"	18.5	42	0.19±0.01	0.21±0.01
IBARAKI	Tokai	"	18.4	43	0.18±0.01	0.15±0.01
IBARAKI	Oarai	"	17.7	38	0.14±0.01	0.16±0.01
NIIGATA	off Hiyoriyama	"	18.8	38	0.19±0.01	0.16±0.01
ISHIKAWA	Togi	"	18.8	42	0.15±0.01	0.21±0.02
AICHI	Ise bay	"	11.3	41	0.25±0.01	0.10±0.01
HIROSHIMA	Hiroshima bay	"	13.3	45	0.15±0.01	0.16±0.01
KAGOSHIMA	Gumisaki	"	17.3	47	0.11±0.01	0.15±0.01
Aug. 1974						
HOKKAIDO	Furuu	"	16.6	44	0.17±0.02	0.17±0.01
KANAGAWA	Odawa bay	"	16.7	39	0.14±0.01	0.15±0.01
FUKUI	Uchiura bay	"	18.5	39	0.15±0.01	0.23±0.01
FUKUI	Niyu bay	"	18.2	40	0.16±0.01	0.17±0.01
FUKUI	Urazoko bay	"	18.9	40	0.36±0.02	0.18±0.01
KYOTO	Miyazu bay	"	17.3	40	0.15±0.01	0.15±0.01
SHIMANE	off Wadani	"	19.2	44	0.16±0.01	0.21±0.01
SHIMANE	off Mitsu	"	19.2	43	0.12±0.01	0.18±0.01
FUKUOKA	Hakata port	"	16.9	41	0.15±0.01	0.12±0.01
SAGA	Imari bay	"	17.2	37	0.17±0.01	0.21±0.01
SAGA	Sea of Ariake	"	15.1	40	0.16±0.01	0.17±0.01

Prefecture	Location	Depth (m)	Cl (‰)	Sample volume analyzed (ℓ)	^{90}Sr (pCi/ℓ)	^{137}Cs (pCi/ℓ)
Sep. 1974						
OSAKA	Osaka port (B)	〃	13.2	40	0.20±0.01	0.13±0.01
YAMAGUCHI	off Aio	〃	18.3	41	0.17±0.01	0.18±0.01
SHIZUOKA	Numazu	〃	16.5	42	0.10±0.01	0.13±0.01
SHIZUOKA	off Numazu	〃	19.5	42	0.15±0.01	0.14±0.01

Figure 4 Sampling Locations of Sea Water

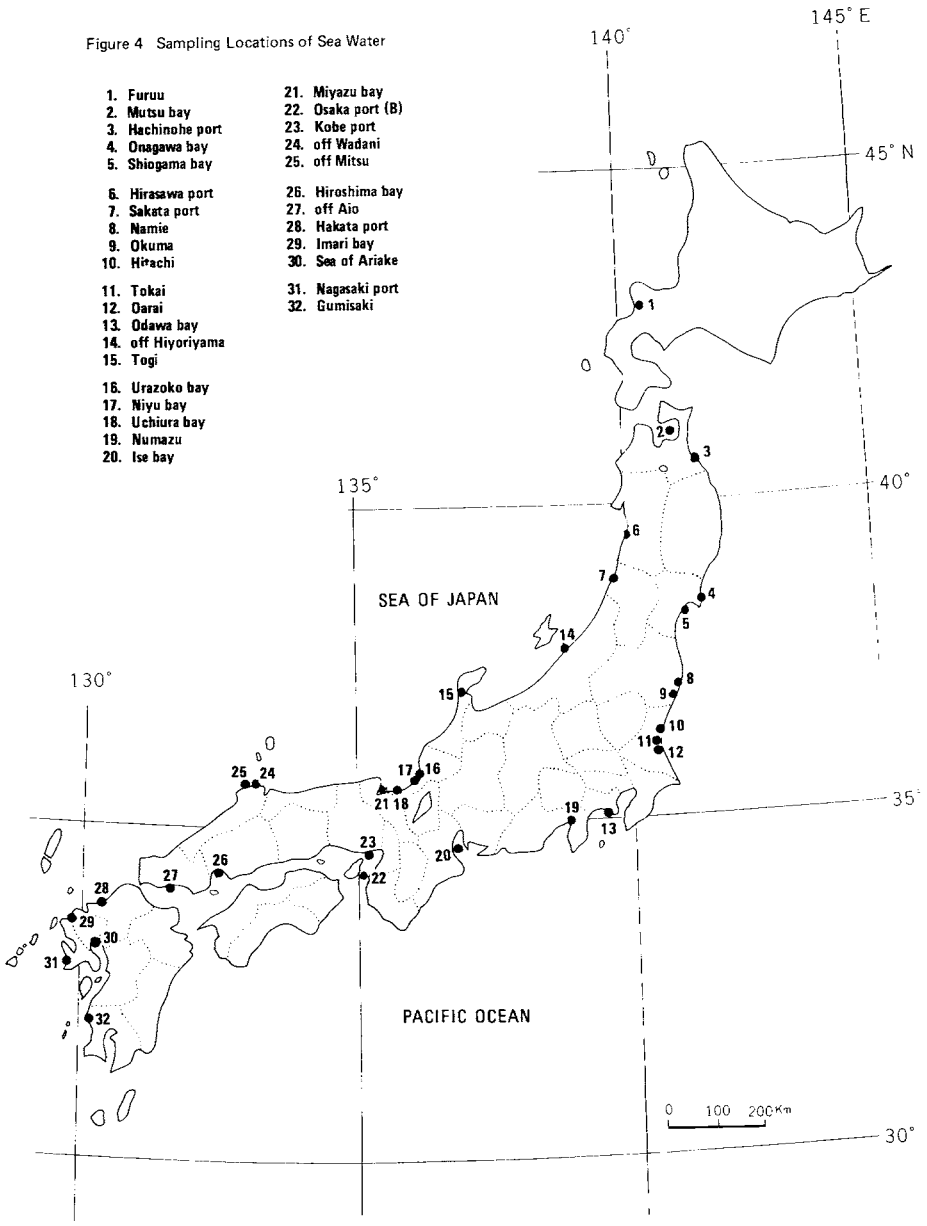
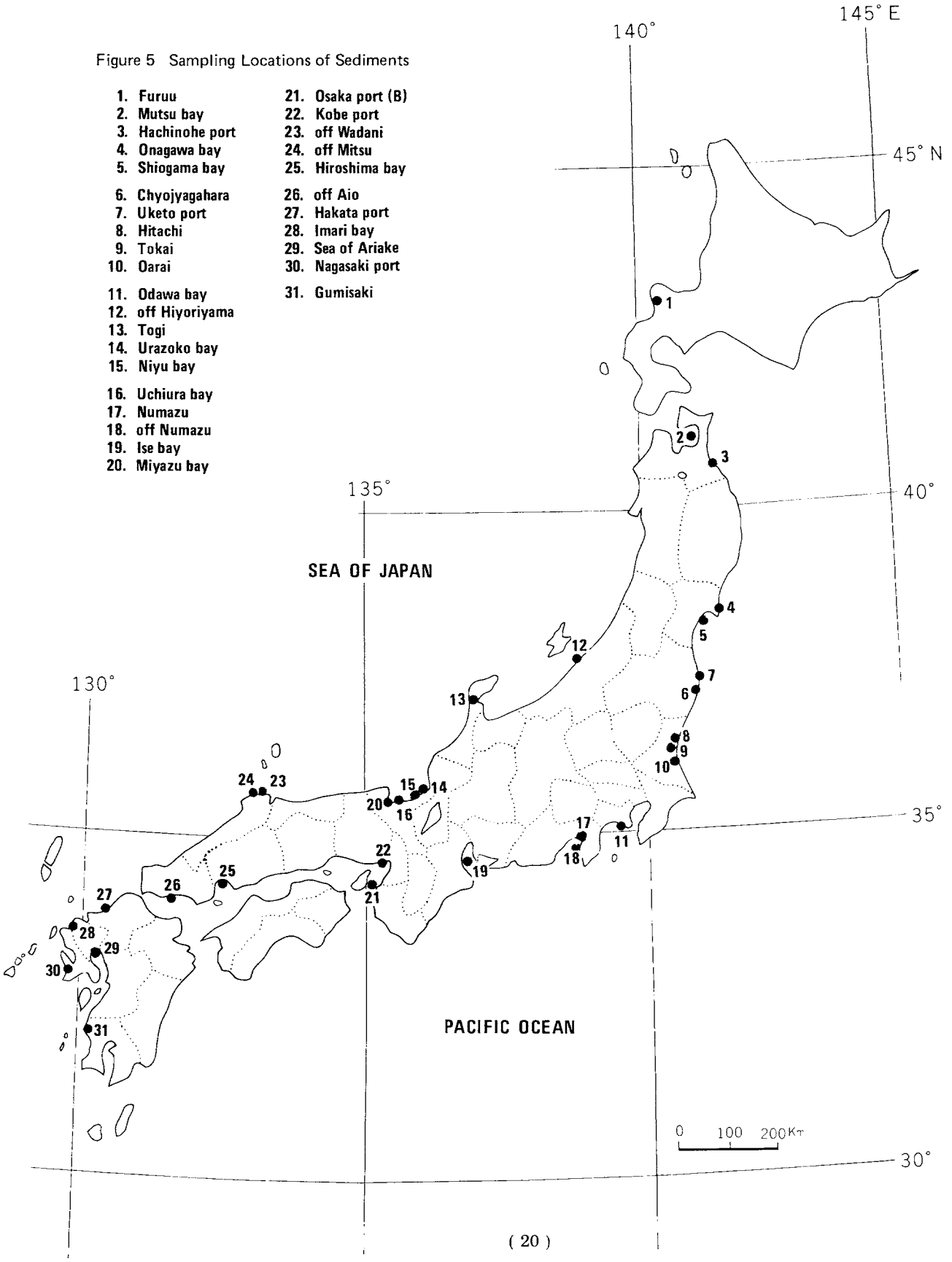


Table 5. ^{90}Sr **and** ^{137}Cs **in Sediments**
– May, 1974 to Dec., 1974 –
(Japan Chemical Analysis Center)
(Continued from Table 5, No. 35 of this publication)

Prefecture	Location	Sampled depth (m)	Sampled weight (g)	^{90}Sr (pCi/kg)	^{137}Cs (pCi/kg)
May 1974					
FUKUSHIMA	Uketo port	3	100	3±2	62±6
FUKUSHIMA	Chyojyagahara	9	"	2±1	10±3
Jun. 1974					
MIYAGI	Shiogama bay	4.5	"	9±2	250±10
MIYAGI	Onagawa bay	12	"	6±1	59±5
HYOGO	Kobe port	6.8	"	32±3	280±10
NAGASAKI	Nagasaki port	18	"	3±1	82±6
Jul. 1974					
AOMORI	Mutsu bay	13	"	10±2	170±10
AOMORI	Hachinohe port	3	"	17±2	260±10
IBARAKI	Hitachi	10	"	3±2	55±5
IBARAKI	Tokai	20	"	2±1	82±6
IBARAKI	Oarai	12	"	6±2	49±2
NIIGATA	off Hiyoriyama	12	"	3±2	150±10
ISHIKAWA	Togi	20	"	5±1	30±4
AICHI	Ise bay	20	"	9±2	270±10
HIROSHIMA	Hiroshima bay	35	"	18±2	300±10
KAGOSHIMA	Gumisaki	3	"	1±1	49±5
Aug. 1974					
HOKKAIDO	Furuu	5	"	3±1	62±6
KANAGAWA	Odawa bay	7	"	3±1	230±10
FUKUI	Uchiura bay	10~15	"	13±2	210±10
FUKUI	Niyu bay	4~5	"	8±2	30±4
KYOTO	Miyazu bay	44	"	15±3	360±10
SHIMANE	off Wadani	33	"	2±1	73±6
SHIMANE	off Mitsu	17	"	4±1	39±4
FUKUOKA	Hakata port	11	"	10±2	260±10
SAGA	Imari bay	9	"	16±3	440±10
SAGA	Sea of Ariake	7.5	"	7±2	250±10
Sep. 1974					
FUKUI	Urazoko bay	15~20	"	21±1	270±10
OSAKA	Osaka port (B)	19	"	5±2	320±10
YAMAGUCHI	off Aio	5	"	1±2	46±5
Dec. 1974					
SHIZUOKA	Numazu	30	"	7±1	66±5
SHIZUOKA	off Numazu	30	"	12±2	280±10

Figure 5 Sampling Locations of Sediments

1. Furuu
2. Mutsu bay
3. Hachinohe port
4. Onagawa bay
5. Shiogama bay
6. Chyojyagahara
7. Uketo port
8. Hitachi
9. Tokai
10. Oarai
11. Odawa bay
12. off Hiyoriyama
13. Togi
14. Urazoko bay
15. Niyu bay
16. Uchiura bay
17. Numazu
18. off Numazu
19. Ise bay
20. Miyazu bay
21. Osaka port (B)
22. Kobe port
23. off Wadani
24. off Mitsu
25. Hiroshima bay
26. off Aio
27. Hakata port
28. Imari bay
29. Sea of Ariake
30. Nagasaki port
31. Gumisaki



External Dose Data

External Doses of Radiations from Fallout

(National Institute of Radiological Sciences)

External dosages of radiations from fallout materials due to the nuclear test explosions have been observed in Chiba since 1962[1].

The observing location is indicated in Figure 6. The measuring apparatus used is a scintillation survey meter with a NaI (Tl) crystal, and sometimes a plastic scintillation counter[2] and an ionization chamber are used for comparison.

Measurements are made in an open field at one meter above the grassy ground.

Monthly and yearly external doses since 1962 are shown in Table 6. Some of these data were reported in previous reports (data from 1962 to 1965 were in Radioactivity Survey Data in Japan, No. 7 (1965), from 1965 to 1967 were in No. 15 (1967) and from 1967 to 1968 were in No. 19 (1968))

Reference:

(1) F. Yamazaki, M. Okano, T. Nagahara and H. Watanabe: External Doses of Radiation from Fallout in Tokyo and its Vicinity, *Journal of Radiation Research, 5* (2), 113 (1964)

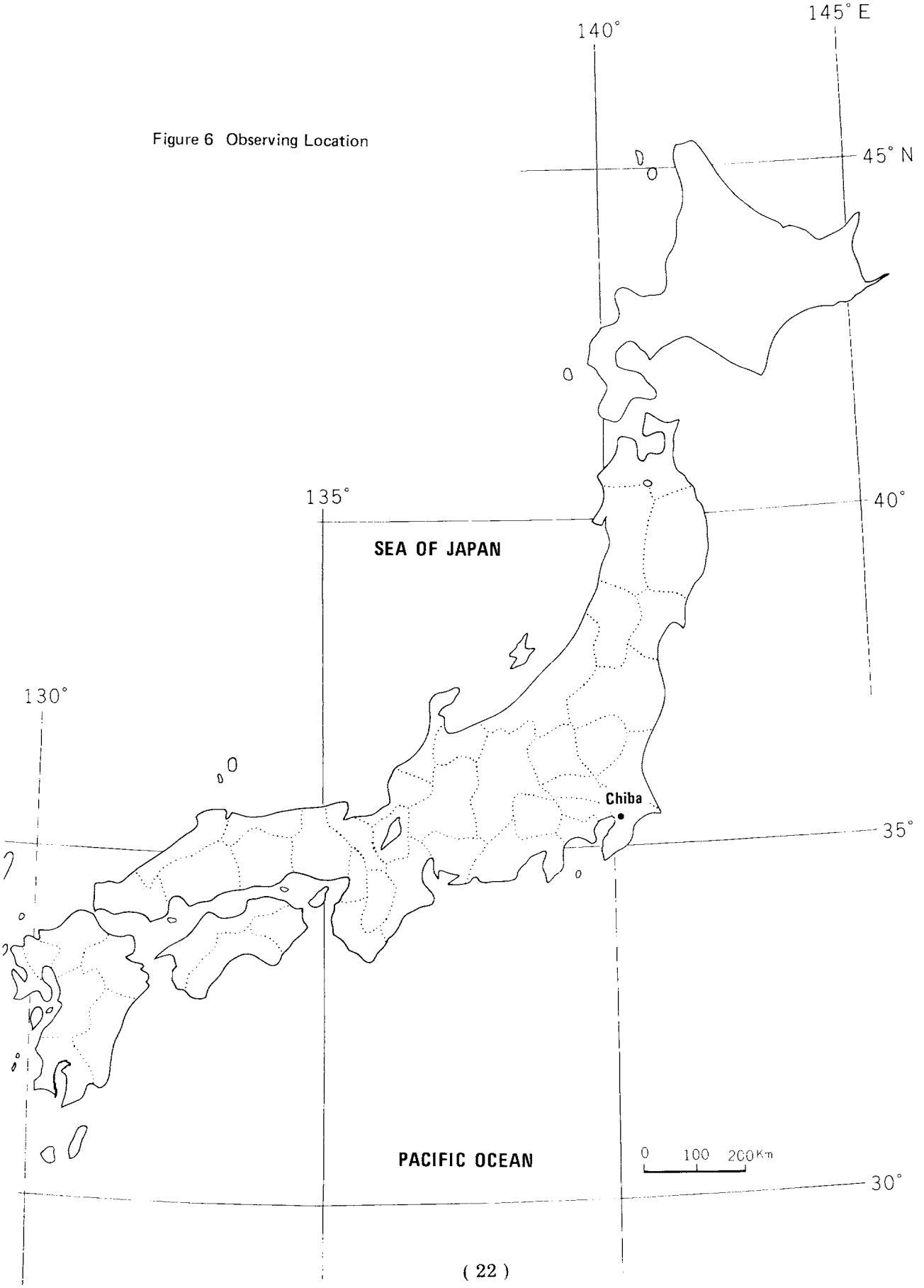
(2) T. Doke, Y. Takami, A. Nakamoto and A. Sasaki: Measurements of Radiation Doses due to Background Gamma Rays by Plastic Scintillators, *Journal of Radiation Research, 1* (1), 46 (1960)

Table 6. Monthly and Yearly External Doses due to Fallout in Chiba
– Jan., 1962 to Dec., 1974 –
by H. Watanabe
(National Institute of Radiological Sciences)

(mR)

Year	Month												Total
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Mov.	Dec.	
1962	2.7	1.7	2.7	3.5	2.5	4.2	3.9	2.7	2.6	4.2	5.0	3.9	39.6
1963	3.3	3.0	3.0	3.8	4.1	5.2	5.4	4.1	2.1	3.1	2.3	1.8	45.1
1964	1.3	1.2	1.3	1.2	1.5	1.6	1.3	1.0	0.9	1.4	0.6	0.7	14.0
1965	0.4	0.6	1.1	0.5	1.0	1.1	0.6	0.8	0.6	0.6	0.3	0.1	7.7
1966	0.0	0.4	0.2	0.4	0.6	0.7	0.9	0.7	0.5	0.4	0.7	1.6	7.1
1967	4.3	0.8	1.2	0.5	0.6	0.3	0.4	1.0	1.0	0.9	0.2	0.7	11.9
1968	0.6	0.4	0.4	0.3	0.3	0.6	0.8	0.8	0.3	0.6	0.6	0.4	6.1
1969	0.5	0.3	0.2	0.4	0.4	0.6	0.6	0.8	0.6	0.6	0.4	0.7	6.1
1970	0.6	0.4	0.5	0.4	0.4	0.5	0.7	0.7	0.7	0.4	0.4	0.2	5.9
1971	0.3	0.2	0.1	0.4	0.4	0.5	0.4	0.4	0.4	0.3	0.5	0.4	4.3
1972	0.7	0.4	0.4	0.3	0.3	0.4	0.2	0.3	0.1	0.2	0.3	0.3	3.9
1973	0.3	0.2	0.2	0.1	0.0	0.2	0.3	0.2	0.3	0.2	0.3	0.3	2.6
1974	0.2	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.2	1.8

Figure 6 Observing Location



External Exposure due to Natural Radiations

(National Institute of Radiological Sciences)

A field survey of exposure rates due to natural radiations has been conducted throughout the Chugoku district of Japan during October 1972.

The situation of the Chugoku district in Japan is shown in Figure 7. Distribution of observed locations in the district is indicated in Figure 8. In each location, measurements of exposures at 1 to 6 sites, one of where contained 5 stations at least, were made. A total of 94 sites were measured.

Observations were made using a spherical ionization chamber and several scintillation surveymeters. The spherical plastic ionization chamber of which inner diameter and wall thickness are respectively 200 mm and 3 mm (acrylate) has adequate sensitivity for field survey. The chamber was used as a standard of apparatus, but it is difficult to observe all locations only by the apparatus, so that a surveymeter with a NaI (Tl) 1"ϕx1" scintillator was used for regular measurements. Two types of surveymeters, the one with a 2"ϕx2" NaI (Tl) scintillator and the other with a 3"ϕx3" NaI (Tl) scintillator, were used as auxiliary devices. In 11 sites, both the chamber and the surveymeter were used for measurement of given stations and their readings were compared for drawing a relationship between them.

Practically the direct reading of the surveymeter were reduced into the corresponding value of the plastic chamber through the relationships of linear proportion. Systematic error at caliblation (^{60}Co) and reading error (random) of the plastic chamber were within ±6% (maximum over all error) and within ±3.5% (standard error for 6μR/hr) respectively. Reading error of the surveymeter is about ±3% (standard error for 6μR/hr).

Measurements in open bare field were made at one meter above the ground and outdoor gamma-ray exposure rates (μR/hr) were due to cosmic rays as well as terrestrial radiation, so that it may be considered that the contribution of fallout due to artificial origin was very slight.

Gamma-ray exposure rates due to natural radiations in each location are shown in Table 7, and population exposure due to natural radiations in each prefecture of the Chugoku district is shown in Table 8.

Table 7. Gamma-ray Exposure Rates due to Natural Radiations in each Location of the Chugoku district – October 1972

by S. Abe, K. Arai, T. Ido and K. Fujimoto
(National Institute of Radiological Sciences)

Prefecture		Location*	Exposure Rate (μR/hr)	Apparatus**	Number of Sites in each Location	Number of Stations in each Location
Tottori	1	Tottori	11.1	B, C	2	10
	2	Kurayoshi	10.6	B, C	1	7
	3	Yonago	8.3	B, C	2	10
	4	Sakaiminato	7.3	B, C	1	5
	5	Nichinan	8.5	B, C	1	5
	6	Hino	10.7	B, C	1	5
	7	Ningyo-toge	13.3	B, C	1	3
	8	Chizu	11.3	B, C	1	5
	9	Wakasa	10.4	A, B, C	1	6

Prefecture	Location*		Exposure Rate (μR/hr)	Apparatus**	Number of Sites in each Location	Number of Stations in each Location
Shimane	10	Yasugi	10.9	B, C	1	5
	11	Matsue	9.4	B, C	2	10
	12	Kashima	6.6	A, B, C	6	28
	13	Hirata	7.4	B, C	1	5
	14	Izumo	7.4	B, C	1	5
	15	Oda	7.8	B, C	1	5
	16	Gotsu	9.3	B, C	1	5
	17	Hamada	7.2	A, B, C	1	5
	18	Masuda	8.4	B, C	1	5
	19	Nichihara	9.1	B, C	1	6
	20	Mizuho	8.2	B, C	1	5
	21	Tombara	7.5	B, C	1	5
	22	Kamo	8.2	A, B, C	1	5
Okayama	23	Sakuto	7.8	B, C	1	5
	24	Tsuyama	9.5	B, C	1	5
	25	Katsuyama	10.0	B, C	1	5
	26	Niimi	9.9	B, C	1	5
	27	Takahashi	10.3	B, C	1	5
	28	Ibara	10.6	B, C	1	5
	29	Kasaoka	12.8	B, C	1	5
	30	Kurashiki	8.7	A, B, C	3	15
	31	Tamano	12.5	B, C	1	5
	32	Okayama	11.3	A, B, C	4	20
	33	Bizen	9.6	B, C	1	5
	34	Takebe	10.2	B, C	1	5
Hiroshima	35	Yuki	6.7	B, C	1	5
	36	Shobara	14.9	B, C	1	5
	37	Miyoshi	8.5	B, C	1	5
	38	Yachiyo	8.4	B, C	1	5
	39	Kake	8.8	B, C	1	5
	40	Saeki	12.3	B, C	1	5
	41	Otake	11.3	B, C	1	5
	42	Hiroshima	10.3	A, B, C	5	25
	43	Kure	10.2	B, C	3	16
	44	Saijo	11.1	B, C	1	5
	45	Takehara	9.8	B, C	1	5
	46	Mihara	8.5	B, C	1	5
	47	Onomichi	10.8	B, C	2	10
	48	Fukuyama	9.9	A, B, C	3	16
	49	Fuchu	9.4	B, C	1	5
	50	Kozan	12.7	B, C	1	5
Yamaguchi	51	Iwakuni	13.4	B, C	2	11
	52	Ato	8.8	B, C	1	5
	53	Hagi	8.7	A, B, C	1	5

Prefecture	Location*		Exposure Rate (μR/hr)	Apparatus**	Number of Sites in each Location	Number of Stations in each Location
Yamaguchi	54	Nagato	10.9	B, C	1	6
	55	Hohoku	11.7	B, C	1	5
	56	Shimonoseki	8.7	B, C	3	15
	57	Onoda	8.6	B, C	1	6
	58	Ube	10.7	B, C	2	11
	59	Hofu	11.2	B, C	1	5
	60	Tokuyama	9.3	B, C	2	10
	61	Kudamatsu	7.5	B, C	1	6
	62	Hikari	7.7	B, C	1	5
	63	Yanai	7.5	B, C	1	5
	64	Yamaguchi	10.8	B, C	2	10
	65	Shuho	5.3	B, C	1	5
	66	Mine	9.2	B, C	1	5

* c.f. Fig. 8
** A : Spherical Ionization Chamber
B : Surveymeter with 2"ϕ x 2" NaI (Tℓ) Scintillator
C : Surveymeter with 1"ϕ x 1" NaI (Tℓ) Scintillator

Table 8. Population Exposure due to Natural Radiations in Each Prefecture of the Chugoku District

by S. Abe, K. Arai, T. Ido and K. Fujimoto
(National Institute Radiological Sciences)

Prefecture	Exposure Rate ± Standard Deviation (μR/hr)	Population* (x 1000)	Number of Sites
Tottori	9.7±1.5	569	11
Shimane	8.4±1.1	774	19
Okayama	10.3±1.4	1707	17
Hiroshima	10.2±0.9	2436	25
Yamaguchi	9.8±1.7	1511	22
Chugoku	9.9±1.4	6997	94

* 1970 National Census

Figure 7 The Situation of the Chugoku District in Japan

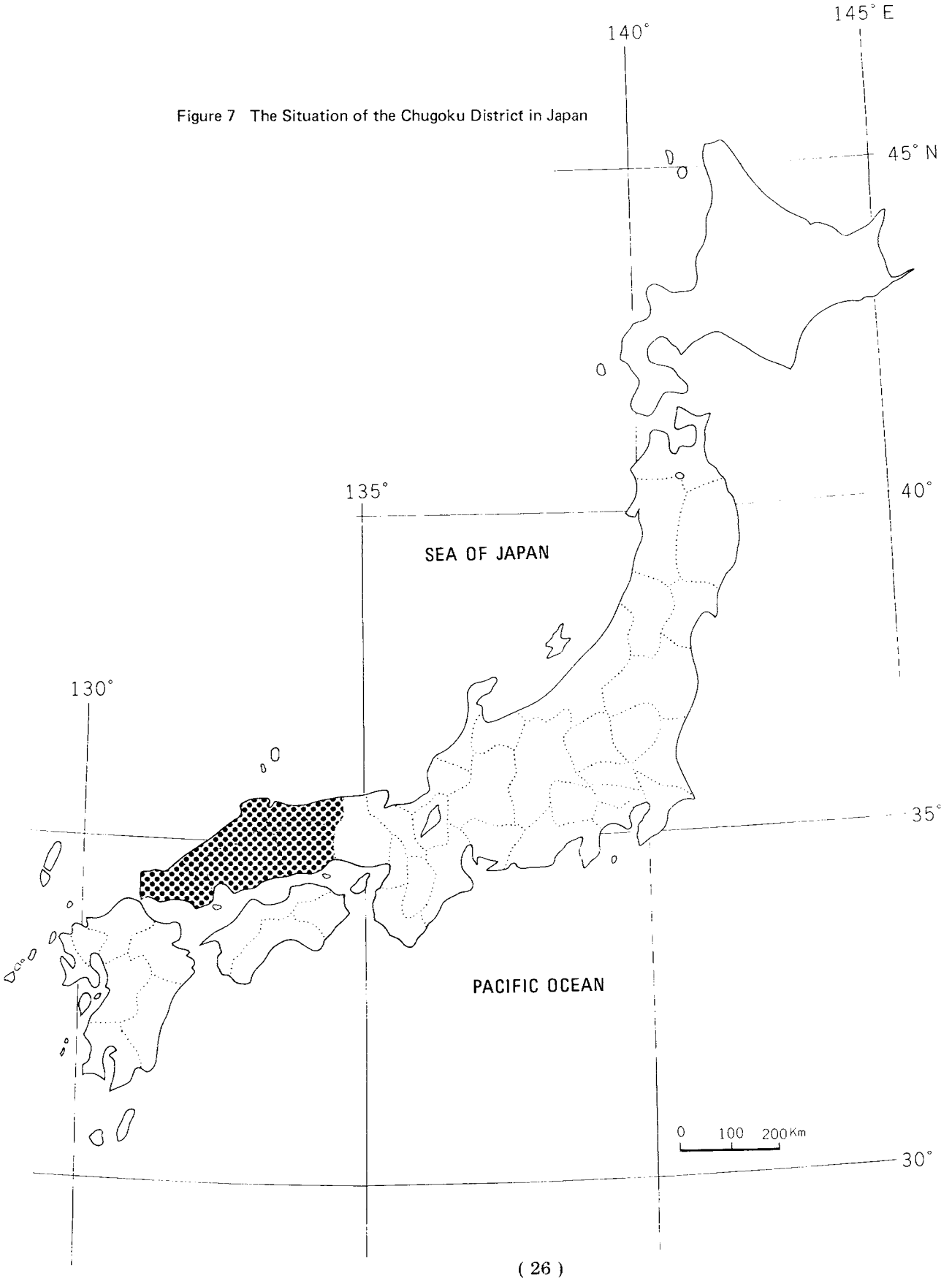
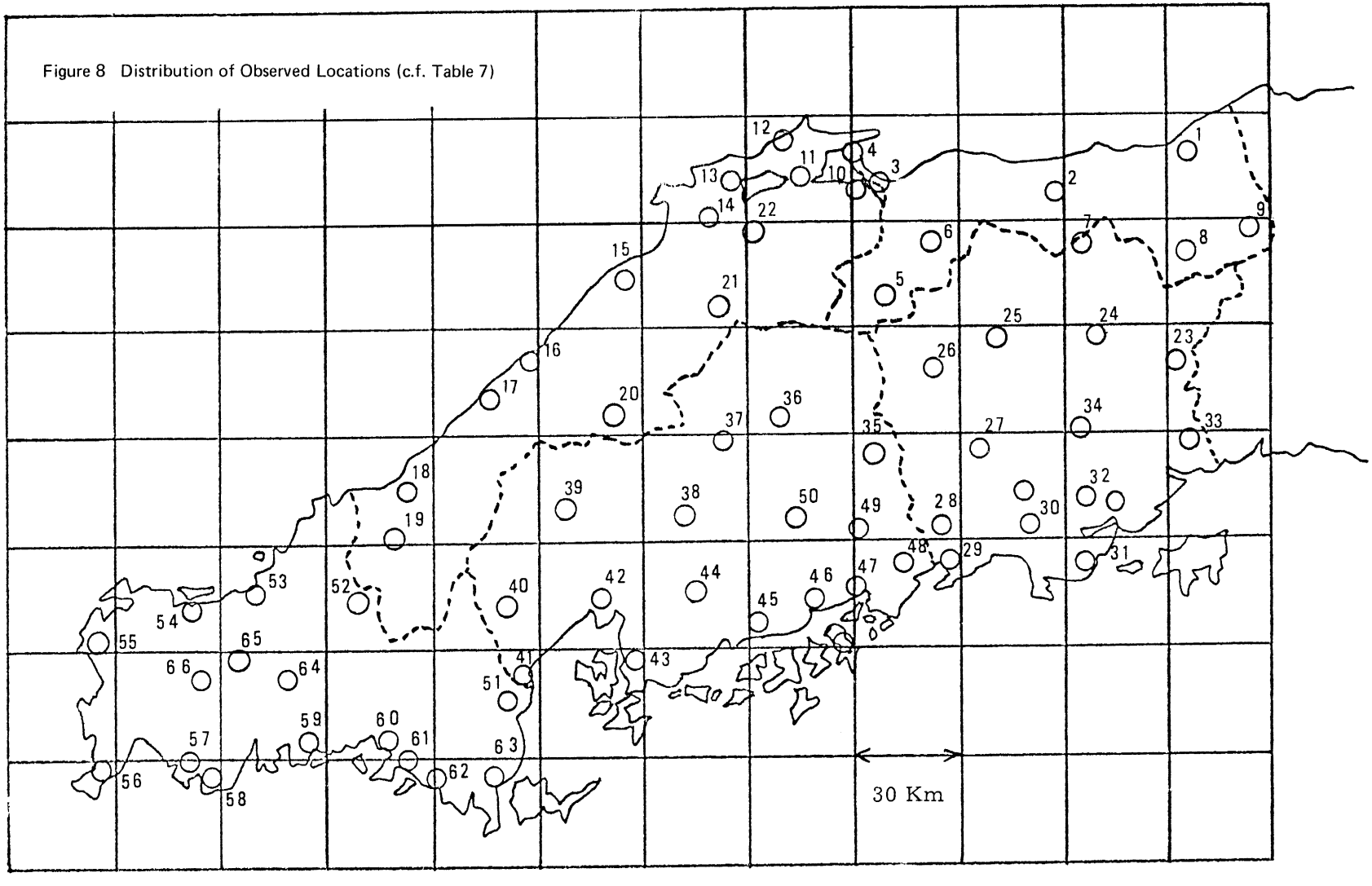


Figure 8 Distribution of Observed Locations (c.f. Table 7)



Human Data

Strontium-90 in Human Bone

(National Institute of Radiological Sciences)

Since 1959, the concentration of strontium-90 in the human bone samples collected from several districts in Japan has determined at the National institute of Radiological Sciences. Natural or stable strotium has also been analyzed.

Radiochemical separation using fuming nitric acid[1] and radioactivity measurement by a low background beta counter (ICN–Tracerlab OMNI/GUARD) has been employed. Natural strontium was determined by atomic absorption spectroscopy after removal of phosphate using an anion exchange resin column[2].

Results obtained for the samples collected in 1972 are partly listed in Table 9~10. Distribution of strontium-90 in four age groups and its trends during the period from 1962 to 1972 are shown in Table 11 and in Fig. 9, respectively.

Reference:

(1) Joint WHO/FAO Expert Committee: World Health Organization Technical Report Series, No. 173 (1959).

(2) G. Tanaka *et al.*, *Nippon Kagaku Kaishi, 89* (2), 175 (1968).

Table 9. ^{90}Sr in Human Fetal Bone in 1972

by G. Tanaka, H. Kawamura and Y. Matsumoto
(National Institute of Radiological Sciences)

Location	Age (month)	Sex	Month of death	Number*	Name of bone	^{90}Sr (pCi/gCa)	Natural Sr (mg/gCa)
Tokyo	Fetus (8)	Male	May 1972	1	Whole skeleton	0.53±0.08**	0.217
"	" (8)	Female	Aug. "	1	"	0.59±0.10	0.217
"	" (9)	"	Jun. "	1	"	0.78±0.05	0.242
"	" (9)	"	Jun. "	1	"	0.64±0.09	0.214
"	" (9)	Male, Female	Jul. "	2	"	0.81±0.10	0.247
"	" (10)	Male	Apr. "	1	"	0.93±0.07	0.269
"	" (10)	Female	Apr. "	1	"	0.91±0.13	0.246
"	" (10)	"	Apr. "	1	"	0.82±0.13	0.229
"	" (10)	"	Apr. "	1	"	0.65±0.08	0.241
"	" (10)	Male	May "	1	"	0.79±0.09	0.262

Location	Age (month)	Sex	Month of death	Number*	Name of bone	^{90}Sr (pCi/gCa)	Natural Sr (mg/gCa)
Tokyo	Fetus (10)	Female	May 1972	1	Whole skeleton	0.90±0.15	0.265
"	" (10)	Male	May "	1	"	0.67±0.04	0.223
"	" (10)	Female	May "	1	"	0.66±0.09	0.225
"	" (10)	"	May "	1	"	0.66±0.10	0.196
"	" (10)	"	Jun. "	1	"	0.69±0.12	0.223
"	" (10)	"	Jun. "	1	"	0.86±0.08	0.234
"	" (10)	"	Jun. "	1	"	0.68±0.06	0.235
"	" (10)	Male	Jun. "	1	"	0.90±0.09	0.268
"	" (10)	"	Jun. "	1	"	0.90±0.05	0.258
"	" (10)	Female	Jun. "	1	"	0.71±0.07	0.227
"	" (10)	"	Jun. "	1	"	0.77±0.19	0.240
"	" (10)	Male	Jun. "	1	"	0.84±0.09	0.256
"	" (10)	"	Jun. "	1	"	0.71±0.11	0.277
"	" (10)	"	Jun. "	1	"	0.74±0.02	0.216
"	" (10)	"	Jun. "	1	"	0.61±0.11	0.236
"	" (10)	Male	Jul. "	1	"	0.69±0.10	0.225
"	" (10)	"	Jul. "	1	"	0.64±0.18	0.240
"	" (10)	"	Jul. "	1	"	0.65±0.06	0.253
"	" (10)	Female	Aug. "	1	"	0.78±0.07	0.258
"	" (10)	Male	Sep. "	1	"	0.84±0.09	0.270

* Number of the samples pooled. ** 95% C.L.

Table 10. ^{90}Sr in Human Bone in 1972

by G. Tanaka, H. Kawamura and Y. Matsumoto
(National Institute of Radiological Sciences)

Location	Age	Sex	Time of death	Number*	Name of bone	^{90}Sr (pCi/gCa)
Tokyo	3d	Male, Female	Jan. 1972	4	Vertebra	1.17±0.05 **
"	13d	Male	Feb. "	3	"	1.34±0.13
"	2m	Male, Female	Jan. "	4	"	1.66±0.10
"	3m	"	Sep. "	2	"	2.18±0.38
"	3m	Male	Aug. "	2	"	1.71±0.26
"	5m	"	Feb. "	2	"	2.63±0.14
"	7m	Female	Jul. "	1	"	2.52±0.27
"	8m	"	Aug. "	2	"	2.66±0.28
"	9m	Male, Female	Jun. "	2	"	2.81±0.22
"	1y	Male	Feb. "	2	"	2.67±0.15

Location	Age	Sex	Time of death	Number*	Name of bone	^{90}Sr (pCi/gCa)
Tokyo	1y	Male	Jul. 1972	2	Vertebra	3.07±0.34**
"	3y	Male, Female	Jun. "	2	"	1.95±0.23
"	4y	Male	Jun. "	1	Rib	1.05±0.16
"	5y	Female	Mar. "	1	"	1.50±0.23
"	5y	"	Jul. "	1	Radius and ulna	2.06±0.12
"	5y	"	Jul. "	1	Vertebra	1.83±0.24
"	6y	Male	Aug. "	1	"	1.09±0.17
"	6y	Female	Aug. "	1	Radius and ulna	1.17±0.10
"	6y	"	Aug. "	1	Vertebra	1.01±0.12
"	7y	"	May "	1	Radius and ulna	1.25±0.09
"	7y	"	May "	1	Vertebra	1.16±0.13
"	7y	Male	Oct. "	1	"	0.95±0.34
"	8y	"	Jul. "	1	Radius and ulna	0.80±0.08
"	10y	"	Sep. "	1	Sacrum	1.34±0.09
"	10y	"	Sep. "	1	Vertebra	0.79±0.04
"	11y	"	Jul. "	1	Rib	1.45±0.16
"	11y	"	Jul. "	1	Radius and ulna	1.63±0.18
"	13y	"	Feb. "	1	Vertebra	1.19±0.15
"	13y	Female	Aug. "	1	"	2.31±0.11
"	13y	"	Aug. "	1	Skull	2.30±0.13
"	14y	"	Jan. "	1	"	1.37±0.21
"	14y	Male	Mar. "	1	Radius and ulna	1.56±0.17
"	14y	"	Mar. "	2	Rib	1.36±0.11
"	15y	"	Jun. "	1	Vertebra	1.07±0.15
"	15y	"	Jun. "	1	Rib	1.16±0.08
"	15y	Male	Sep. "	1	Vertebra	1.43±0.03
"	15y	"	Sep. "	1	Rib	1.37±0.07
"	15y	"	Sep. "	1	Radius and ulna	1.90±0.08
"	16y	"	Nov. "	1	Rib	1.35±0.11
"	16y	"	Nov. "	1	Radius and ulna	1.18±0.09
"	17y	"	Oct. "	1	Vertebra	1.22±0.12
"	17y	"	Oct. "	1	Radius and ulna	1.61±0.15
"	18y	"	Mar. "	2	Rib	1.73±0.09
"	18y	"	Mar. "	1	Sacrum	1.74±0.17
"	19y	Female	Feb. "	1	Radius and ulna	1.54±0.16
"	19y	"	Feb. "	1	Vertebra	1.63±0.14
"	19y	Male	May "	1	"	0.97±0.07
"	19y	"	May "	1	Rib	0.69±0.05
"	19y	"	May "	1	Skull	1.13±0.11

*) Number of the samples pooled. **) 95% C.L.

(To be continued)

Location	Age	Sex	Time of death	Number*	Name of bone	^{90}Sr (pCi/gCa)
Tokyo	19y	Male	Jul. 1972	1	Vertebra	1.32±0.12**
"	19y	"	Jul. "	1	Radius and ulna	1.87±0.08
"	20y	"	Jun. "	1	Vertebra	1.46±0.09
"	20y	"	Jun. "	1	Sacrum	2.55±0.06
"	20y	"	Aug. "	1	Vertebra	0.92±0.08
"	20y	"	Aug. "	1	Radius and ulna	1.17±0.07
"	20y	"	Sep. "	1	Sacrum	1.09±0.08
"	20y	"	Oct. "	1	Skull	1.67±0.10
"	20y	"	Nov. "	1	Radius and ulna	1.70±0.10
"	20y	"	Dec. "	1	Sacrum	1.33±0.05
"	21y	"	Jun. "	1	Radius and ulna	2.04±0.16
"	22y	"	Feb. "	1	Skull	3.35±0.09
"	22y	"	Feb. "	1	Sacrum	3.11±0.14
"	22y	"	Feb. "	1	Rib	3.34±0.42
"	22y	"	Aug. "	1	Vertebra	1.91±0.07
"	22y	"	Aug. "	1	Radius and ulna	2.00±0.14
"	22y	"	Aug. "	1	Skull	3.25±0.09
"	23y	"	Jul. "	1	Rib	1.35±0.09
"	24y	Female	May "	1	Vertebra	1.26±0.08
"	24y	"	May "	1	Radius and ulna	0.95±0.05
"	24y	"	May "	1	Sacrum	1.19±0.11
"	24y	"	Aug. "	1	Vertebra	1.16±0.14
"	24y	"	Aug. "	1	Rib	1.17±0.10
"	24y	Male	Sep. "	1	"	1.46±0.21
"	25y	Female	Apr. "	1	Vertebra	1.29±0.10
"	25y	"	Jul. "	1	Radius and ulna	2.61±0.20
"	25y	"	Jul. "	1	Rib	1.53±0.08
"	26y	Male	Aug. "	1	Radius and ulna	1.12±0.05
"	26y	"	Aug. "	1	Vertebra	1.19±0.15
"	27y	"	Jun. "	1	Radius and ulna	0.68±0.05
"	27y	"	Jun. "	1	Sacrum	1.06±0.20
"	29y	Female	Oct. "	1	Vertebra	1.15±0.12
"	29y	"	Oct. "	1	Rib	1.20±0.21
"	30y	Male	Jul. "	1	Vertebra	1.07±0.08
"	35y	"	Sep. "	1	"	1.00±0.17

*) Number of the samples pooled. **) 95% C.L.

Table 11. ^{90}Sr Concentration in Human Bone of Different Age Groups in 1972

Age group	Number*	^{90}Sr (pCi/gCa)	
		Min.~Max.	Mean ±S.d.
Fetus	30	0.53~0.93	0.75±0.11
0 – 4y	13	1.05~3.07	2.11±0.65
5 - 19y	38	0.69~2.31	1.40±0.38
> 20y	33	0.87~2.84	1.62±0.75

* Number of analysis.

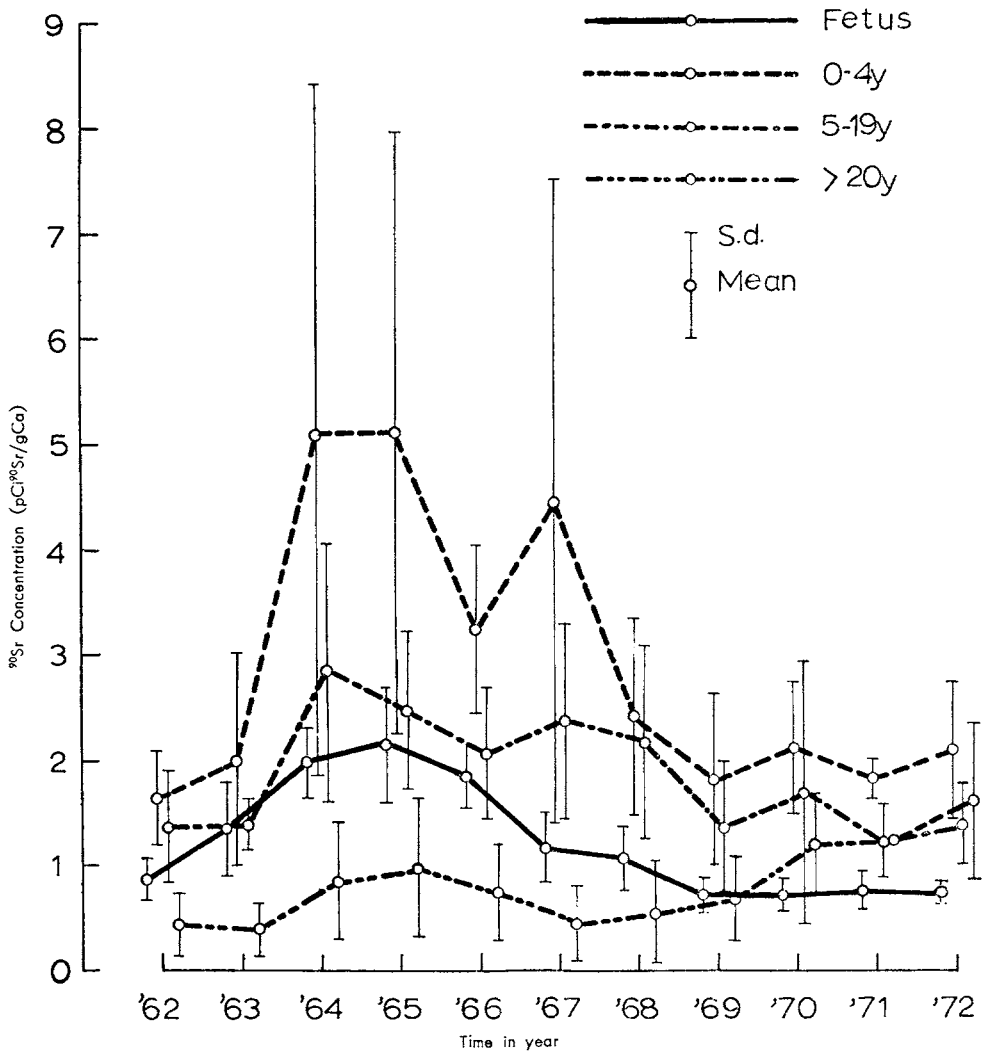


Figure 9 Trends in ^{90}Sr Concentration in Human Bone of Different Age Groups in Japan

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