Data of the 22nd Nuclear Explosion Test of the Poeple's Republic of China

US. Energy Research and Development Administration (US ERDA) announced for the 22nd nuclear explosion test of the People's Republic of China as follows:

(1) Date of test : September 17, 1977 (4:00 p.m. Japanese time)
(2) Scale of test : about 20 kilotons or less
(3) Place of test : the upper atomospheric level over the Lop Nor district, the western region of China.

The radioactivity surveillance was carried out for the period from September 19, to September 28, 1977. From the results of this surveillance, the effects of this nuclear explosion test were detected in the radioactivity measurement of rainwater, dry fallout, air-borne dusts in upper atomosphere, and raw milk samples. Survey on iodine-131 concentrations in raw milk was continued until October 11, 1977. The results of radioactivity surveillance were described in the following articles.

1) Gross Beta-Radioactivity in Upper Air.
(Japan Defence Agency)

Research and Development H.Q. of Japan Defence Agency has collected the dust samples in upper atomosphere of the northern, middle, and westeren regions of Japan during the period from September 19 to September 22, 1977, and has measured the gross beta-radioactivity of these samples.

A high radioactivity was measured in the samples collected from the upper atomosphere of the western region on September 21, 1977.

Results obtained are shown in Table 4.

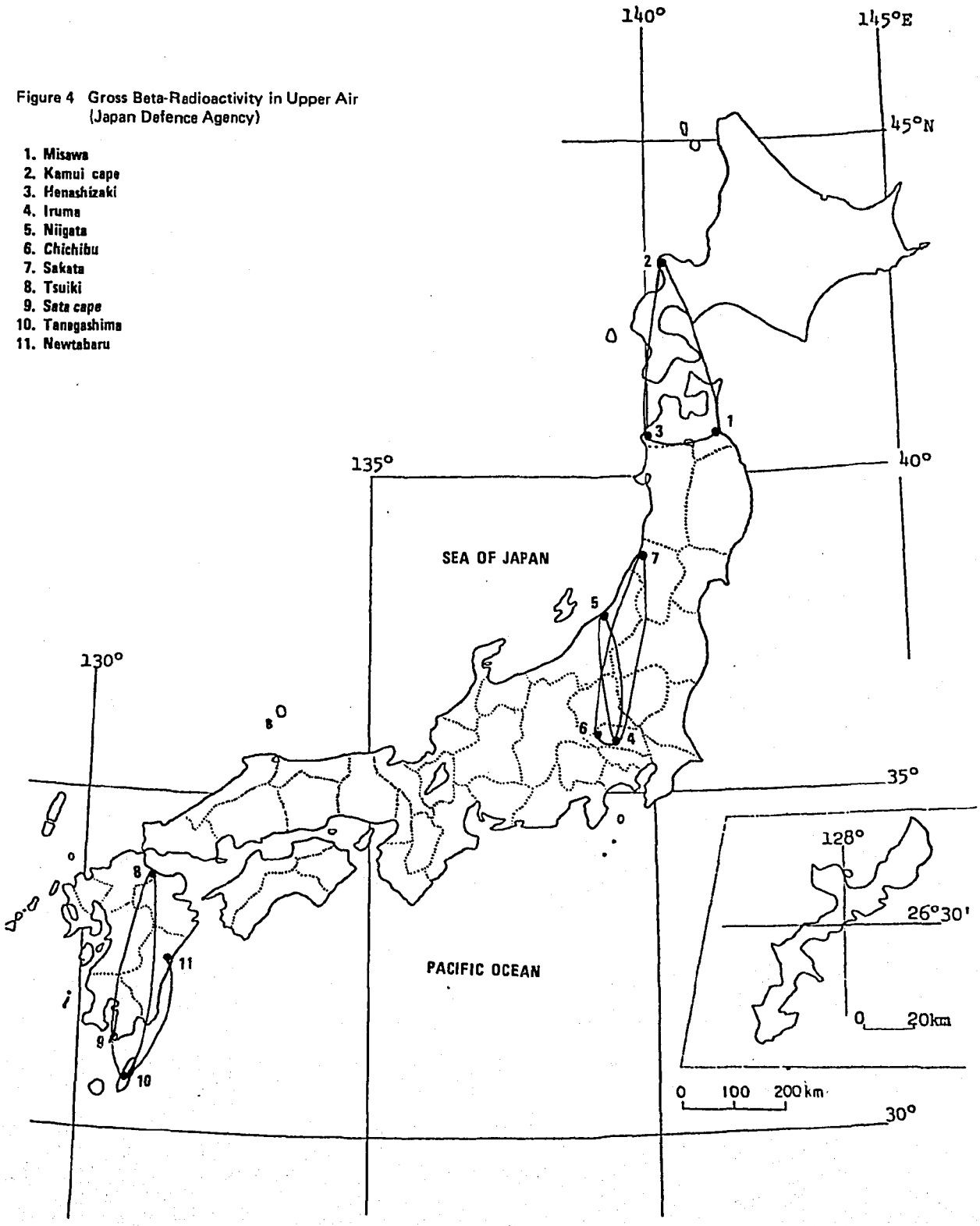
Figure 4 shows the sampling areas and the flight course.

Table 4. Gross Beta-Radioactivity in Upper Air
(Japan Defence Agency)

Area	Date	Time	Flight Course	Altitude (m)	Activity (pCi/m^3)
Northern Area (Misawa)	Sep. 19	9:09–12:01	Misawa – Kamui cape – Henashizaki – Misawa	10,000m 9,400m	0.44±0.03
Central Area (Iruma)	Sep. 20	9:24–10:51	Iruma – Niigata – Iruma	10,000m	0.14±0.01
	Sep. 20	12:40–14:00	Iruma – Chichibu – Sakata – Iruma	7,600m	0.92±0.01
	Sep. 22	13:00–13:50	Iruma – Niigata	5,000m	0.59±0.02
	Sep. 24	9:01–10:07	Iruma – Niigata	5,000m	1.11±0.02
Western Area (Tsuiki)	Sep. 21	8:52– 9:56	Tsuiki – Sata cape – Tanegashima – Newtabaru	5,000m	4.65±0.04
	Sep. 21	12:32–13:28	Tsuiki – Sata cape – Tanegashima – Tsuiki	6,300m	8.65±0.07

Figure 4 Gross Beta-Radioactivity in Upper Air
(Japan Defence Agency)

1. Misawa
2. Kamui cape
3. Henashizaki
4. Iruma
5. Niigata
6. Chichibu
7. Sakata
8. Tsuiki
9. Sata cape
10. Tanegashima
11. Newtabaru



2) Counting Rate Obtained with the Monitoring Posts.
(Japan Meteorological Agency)
(Japan Atomic Energy Research Institute)
(Prefectural Public Health Institutes and Laboratories)

Gross Beta-radioactivity in surface air was measured by Japan Meteorological Agency (2 Monitoring posts), Japan Atomic Energy Research Institute, and 20 prefectural monitoring posts. The relatively higher radioactivity was detected on the samples collected from the northern areas of Japan.

Results obtained are shown in Table 5.

Figure 5 shows the sites of monitoring posts in Japan.

Table 5. Counting Rate Obtained with the Monitoring Posts
(Japan Meteorological Agency)
(Japan Atomic Energy Agency)
(Prefectural Public Health Institutes and Laboratories)

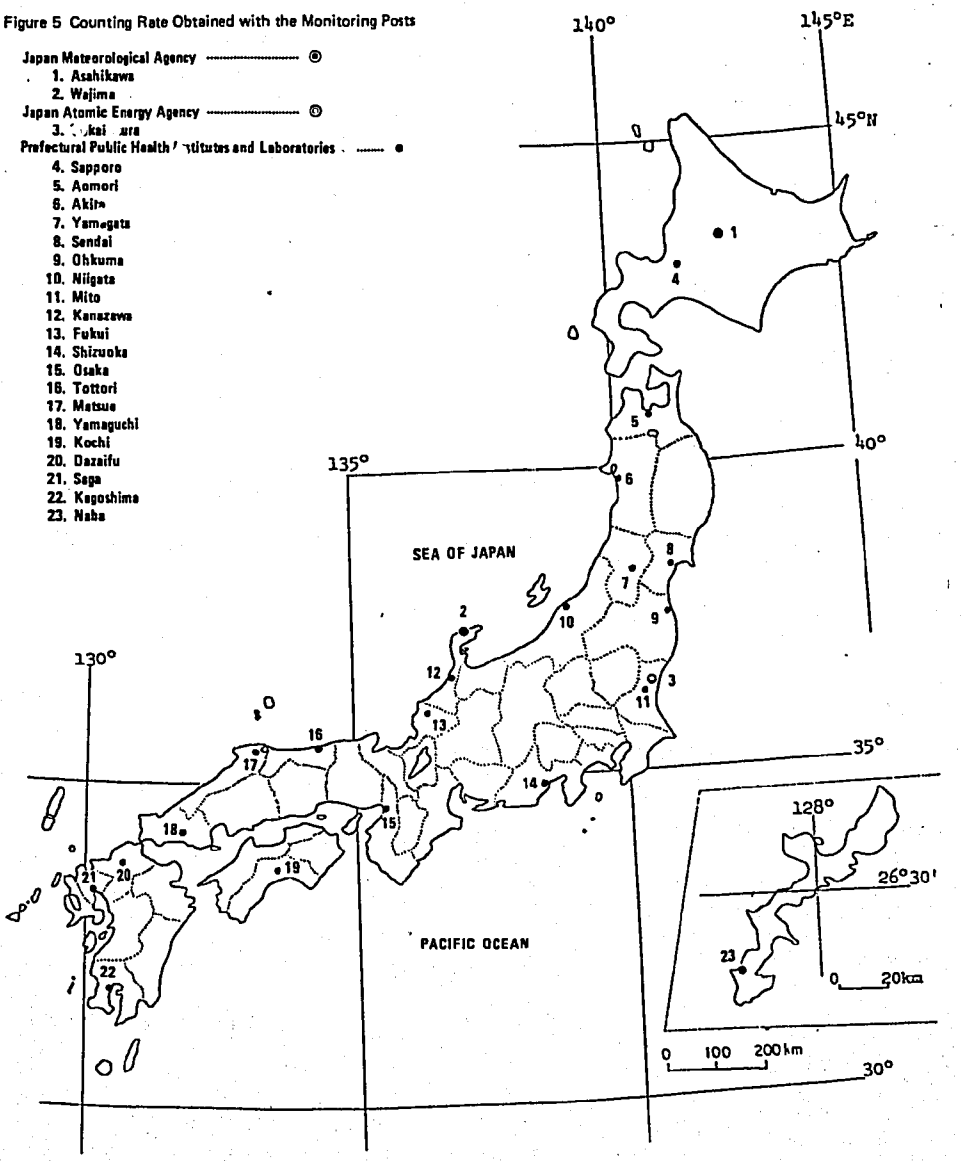
(CPS)

Station	Sep. 19 – Sep. 28		Normal State	
	Highest value	Lowest value	Highest value	Lowest value
(Japan Meteorological Agency)				
Asahikawa, HOKKAIDO	27.3	12.6	27.0	8.0
Wajima, ISHIKAWA	20.0	12.0	25.0	12.0
(Japan Atomic Energy Agency)				
Tokai-mura, IBARAKI	*5.8	*4.6	—	—
(Prefectural Institutes and Laboratories)				
Sapporo, HOKKAIDO	18.8	10.6	29.0	7.0
Aomori, AOMORI	15.7	8.2	28.2	5.0
Akita, AKITA	18.0	12.5	29.0	9.0
Yamagata, YAMAGATA	12.9	11.1	18.7	10.0
Sendai, MIYAGI	11.7	10.0	24.8	8.2
Okuma, FUKUSHIMA	14.0	12.8	20.8	11.3
Niigata, NIIGATA	22.0	19.5	37.3	18.8
Fukui, FUKUI	18.5	15.0	24.5	11.0
Kanazawa, ISHIKAWA	19.0	15.0	28.9	11.0
Shizuoka, SHIZUOKA	18.0	16.0	28.5	15.0
Osaka, OSAKA	16.5	13.6	17.5	11.4
Tottori, TOTTORI	22.4	18.5	35.8	13.0
Matsue, SHIMANE	17.9	14.3	39.7	13.0
Yamaguchi, YAMAGUCHI	26.0	20.0	43.5	17.0
Kochi, KOCHI	14.0	9.3	14.4	8.1

Station	Sep. 19 – Sep. 28		Normal State	
	Highest value	Lowest value	Highest value	Lowest value
Dazaifu, FUKUOKA	22.0	15.0	28.0	13.5
Saga, SAGA	17.1	13.5	24.2	10.4
Kagoshima, KAGOSHIMA	14.0	10.5	21.5	13.0
Naha, OKINAWA	12.0	10.5	12.0	10.0
Mito, IBARAKI	*3.5	*2.1	*5.1	*2.1

* Unit μR/h

Figure 5 Counting Rate Obtained with the Monitoring Posts



3) Gross Beta-Radioactivity in Rain and Dry Fallout

(Japan Meteorological Agency)
(National Institute of Radiological Sciences)
(Japan Atomic Energy Research Institute)
(Prefectural Public Health Institutes and Laboratories)

Gross Beta-radioactivity in rain water and dry fallout was measured by Japan Meteorological Agency (13 locations), National Institute of Radiological Sciences, Japan Atomic Energy Research Institute, and 32 prefectural public health institutes and laboratories.

The following higher concentrations and activities were detected on the samples collected at September 22: 21.3pCi/ml and 80.7mCi/km^2 in the samples of Akita prefecture, and the relatively higher levels than that of normals in the samples of other many districts.

The higher radioactivity, 104mCi/km^2, was detected on the samples collected at September 22 from Fukui prefecture, and the relatively higher levels than that of normals were also measured in the samples collected from Aichi prefecture and others.

Tables 6 and 7 show the results obtained by Japan Meteorological Agency, National Institute of Radiological Sciences, Japan Atomic Energy Research Institute, and 32 prefectural public health institutes and laboratories, respectively.

Figures 6 and 7 show the sampling locations by Japan Meteorological Agency, National Institute of Radiological Sciences, Japan Atomic Energy Research Institute, and 32 prefectural public health institutes and laboratories, respectively.

Table 6. Gross Beta-Radioactivity in Rain and Dry Fallout
(Japan Meteorological Agency)
(Japan Atomic Energy Agency)
(National Institute of Radiological Sciences)

Station \ Date	Sep. '77 18–19	19–20	20–21	21–22	22–23	23–24	24–25	25–26	26–27	27–28	28–29
(Japan Meteorological Agency)											
Wakkanai, HOKKAIDO			0.0 (0.0)	0.2 (3.0)					0.1 (1.0)		
Sapporo, HOKKAIDO	0.0 (0.0)		0.0 (0.0)	1.3 (41.0)					0.2 (0.8)		
Kushiro HOKKAIDO	0.0 (0.0)		0.0 (0.0)						0.4 (2.0)		
Sendai, MIYAGI	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)								
Akita, AKITA			0.0 (0.0)	6.0 (20.0)					1.8 (5.4)		
Chiyoda,TOKYO			0.0 (0.0)						0.0 (0.0)		
Wajima, ISHIKAWA				0.6 (2.0)							0.1 (0.4)
Osaka, OSAKA						0.1 (1.6)		0.5 (0.8)			0.1 (0.8)
Yonago, TOTTORI				0.6 (1.0)							0.0 (0.0)
Muroto-cape, KOCHI					0.0 (0.3)	0.0 (0.0)	0.1 (0.4)	0.1 (10.0)	0.0 (0.0)		0.1 (6.0)
Fukuoka, FUKUOKA				3.2 (3.2)		0.6 (2.0)	1.0 (4.0)	0.1 (2.0)			0.1 (0.8)
Kagoshima, KAGOSHIMA					0.3 (3.0)		0.0 (0.0)	0.0 (0.0)			0.0 (0.0)
Hachijyo-Island, TOKYO	0.0 (0.0)		0.0 (0.0)		0.0 (0.0)	0.0 (0.0)			0.1 (3.0)	0.0 (0.0)	

Station \ Date	Sep. '77 18–19	19–20	20–21	21–22	22–23	23–24	24–25	25–26	26–27	27–28	28–29
(Japan Atomic Energy Agency)											
Tokai-mura, IBARAKI		ND *(0.28)	*(ND)	*(ND)	*(ND)	*(ND)	*(0.38)	*(ND)	ND *(0.3)	*(ND)	
(National Institute of Radiological Sciences)											
Chiba, CHIBA		*(0.24)	*(ND)	*(0.05)	*(0.20)	*(0.04)	*(0.11)	*(0.18)	*(0.41)	*(0.01)	

Notes: 1) Upper row: Concentration (pCi/mℓ)
2) (Lower row): Deposition (mCi/km²)
In the ordinary condition, concentration and deposition of radioactive nuclides in rain and dry fallout samples were the values less than 1 pCi/mℓ and 2 ~ 3 mCi/km², respectively.
2) ND is under 6.5×10^{-8} μCi/mℓ
3) Japan Meteorological Agency, Japan Atomic Energy Agency
Daily rain and dry fallout samples were continuously collected during the period from 9:00 A.M.
4) *Collected with a Tray

The value were obtained 20 hours after the completion of collecting operation, which is from 09:30 to next 09:30 (about 24 hours) every day.

Table 7. Gross Beta-Radioactivity in Rain and Dry Fallout

(Prefectural Public Health Institutes and Laboratories)

Upper row : Concentration (pCi/mℓ)
(Lower row): Deposition (mCi/km²)

Location \ Date	Sep. '77 19–20	20–21	21–22	22–23	23–24	24–25	25–26	26–27	27–28
Sapporo, HOKKAIDO	ND (ND)		2.11 (66.5)					0.89 (3.58)	
Aomori, AOMORI	ND (ND)		20.18 (80.72)					1.65 (18.01)	
Akita, AKITA	ND (ND)		21.3 (55.3)					2.98 (12.71)	
Yamagata, YAMAGATA	0.05 (5.60)								
Sendai, MIYAGI	0.10 (0.16)	0.01 (0.45)							
Ohkuma, FUKUSHIMA	0.03 (7.0)								
Mito, IBARAKI	ND (ND)			— *(ND)	— *(0.02)	— *(0.05)	— *(ND)	0.08 (0.2)	— *(ND)
Ohmiya, SAITAMA	0.01 (0.73)							0.10 (0.4)	
Shinjyuku, TOKYO	ND (ND)							0 (0)	
Yokohama, KANAGAWA	0.02 (0.8)							0.13 (1.4)	
Niigata, NIIGATA	0.01 (0.12)							0.5 (4.24)	
Kanazawa, ISHIKAWA	0.06 (0.4)		9.95 (19.9)						
Fukui, FUKUI	0.03 (0.14)	— *(0.15)	*(104)						

Location \ Date	Sep. '77 19–20	20–21	21–22	22–23	23–24	24–25	25–26	26–27	27–28
Shizuoka, SHIZUOKA								0.07 (0.54)	
Nagoya, AICHI	– *(0.08)	– *(0.06)	– *(0.16)	– *(22.55)	– *(0.74)	– *(0.47)	0.83 (4.6)	– *(0.16)	– *(0.67)
Kyoto, KYOTO		– *(0.55)	– *(0.1)		1.34 (4.68)	– *(0.85)	1.08 (2.98)	– *(0.45)	– *(0.23)
Osaka, OSAKA					0.67 (11.1)		1.17 (1.5)		
Kobe, HYOGO	– *(0.03)			– *(2.73)	– *(6.91)	– *(0.19)			– *(1.32)
Wakayama, WAKAYAMA			1.14 (1.14)		0.19 (2.76)		0.91 (13.05)		
Tottori, TOTTORI			1.15 (3.71)				5.22 (1.67)		
Matsue, SHIMANE		ND (ND)	0.20 (0.28)						
Okayama, OKAYAMA	– *(0.03)	– *(0.06)	– *(8.50)	– *(2.3)	2.47 *(5.39)	– *(1.89)	0.42 (1.91)	– *(0.15)	– *(0.28)
Hiroshima, HIROSHIMA					1.32 (4.42)	1.55 (6.21)			
Yamaguchi, YAMAGUCHI			2.76 (1.38)		0.98 (0.98)	0.38 (2.28)			
Kochi, KOCHI			2.71 (6.49)		0.09 (3.22)	0.43 (1.32)	0.27 (0.90)		
Matsuyama, EHIME				8.4 (4.2)	0.17 (2.7)	0.51 (1.71)	0.24 (0.50)		
Dazaifu, FUKUOKA			7.53 (12.05)		0.10 (0.29)	0.01 (0.05)	0.05 (0.63)		
Saga, SAGA			12.65 (23.99)	6.86 (5.83)	1.07 (4.42)	1.53 (5.06)	0.19 (1.64)		
Nagasaki, NAGASAKI			2.81 (1.69)		0.17 (2.62)	0.50 (2.77)	0.01 (0.33)		
Kagoshima, KAGOSHIMA				0.41 (5.26)		0.04 (0.61)	0.06 (0.08)		
Naha, OKINAWA		0.59 (1.50)	0.08 (0.14)					0.05 (0.11)	

Note: 1) In the ordinary condition, concentration and deposition or radioactive nuclides in rain and dry fallout samples were the values less than 1 pCi/mℓ and 2 ~ 3 mCi/km^2, respectively.

2) Daily rain and dry fallout samples were continuously collected during the period from 9.00 A.M.

3) * Collected with a tray

Figure 6 Gross Beta-Radioactivity in Rain and Dry Fallout

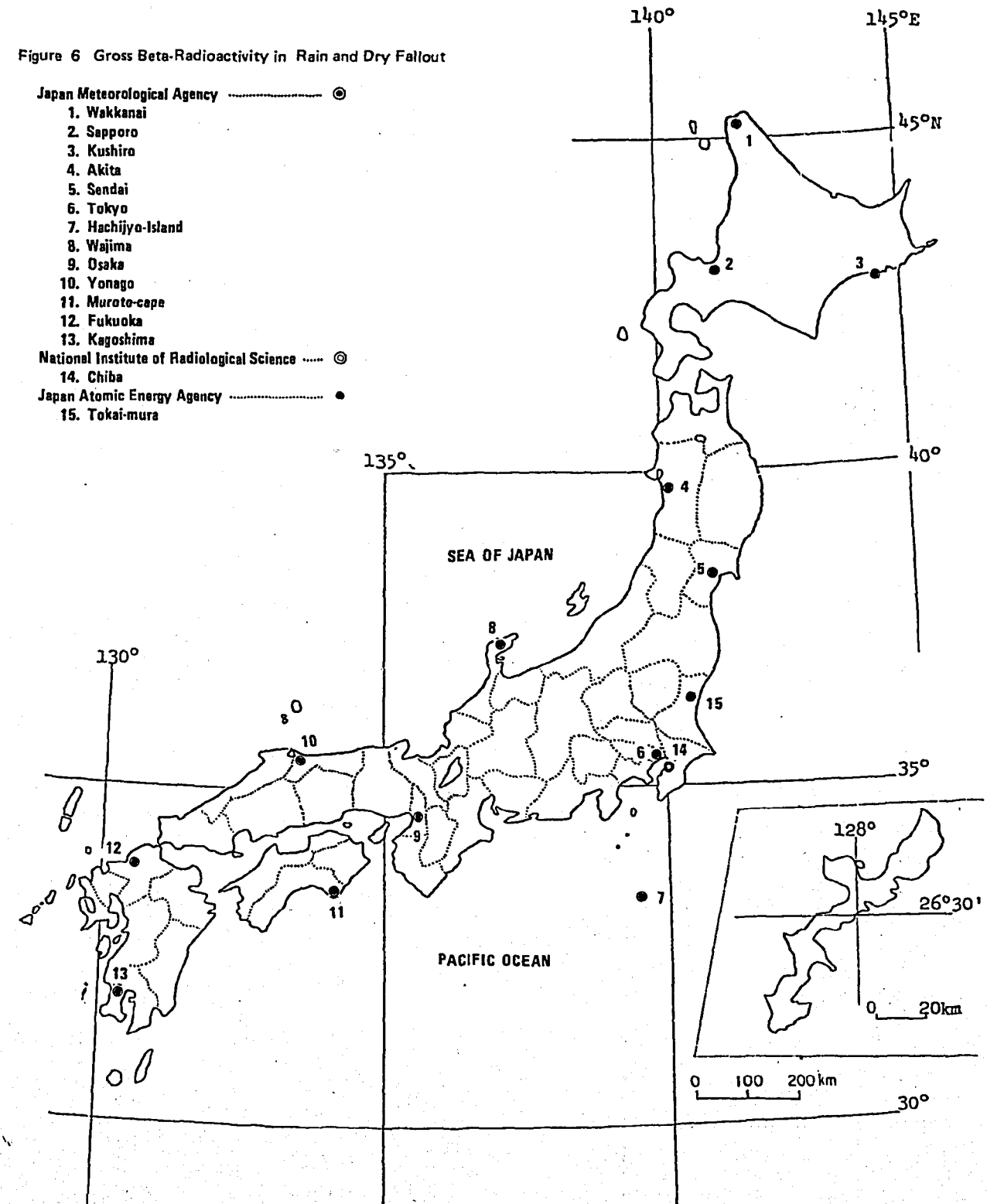
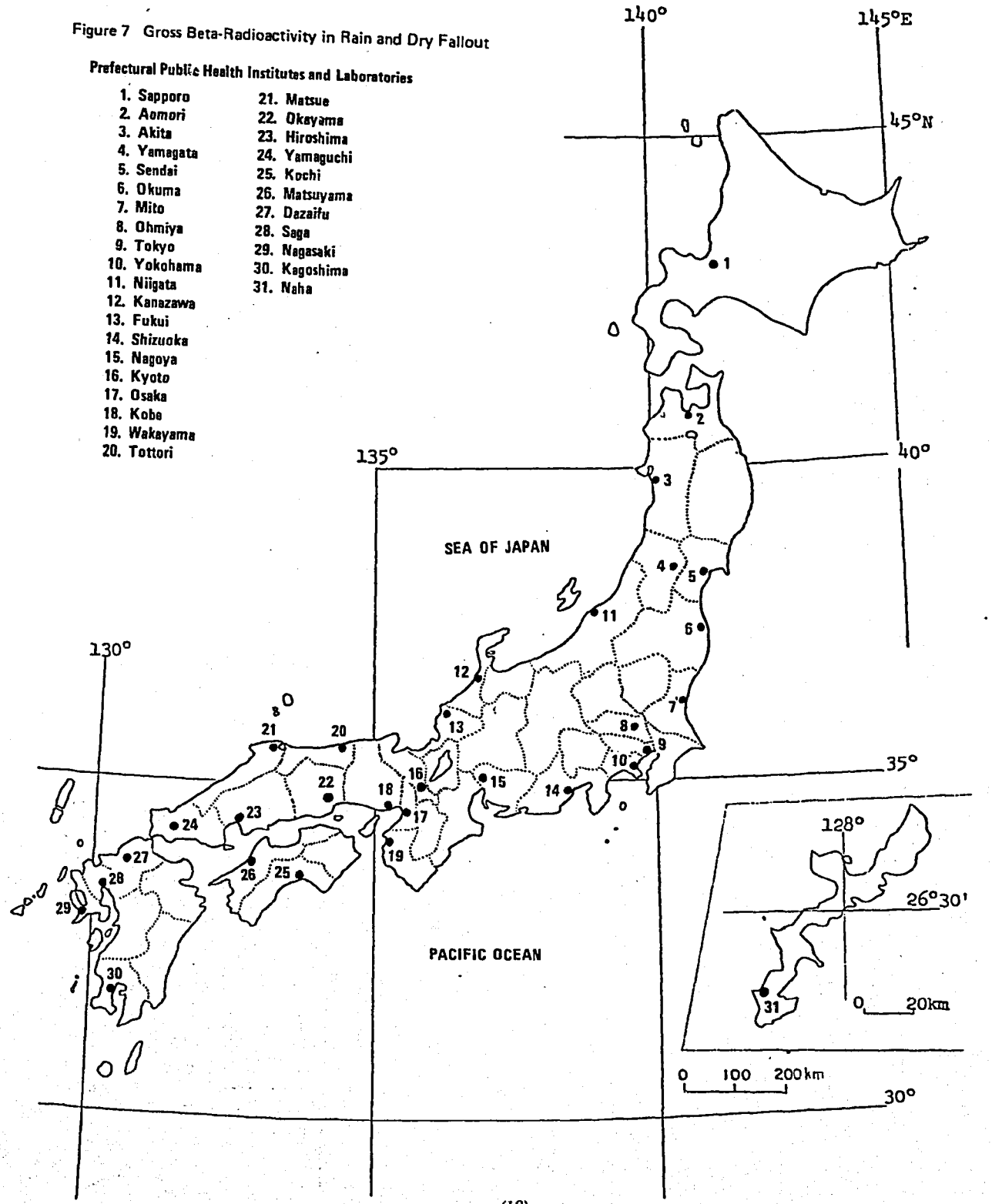


Figure 7 Gross Beta-Radioactivity in Rain and Dry Fallout



4) Gross Beta-Radioactivity in Air-Borne Dust.

(Japan Meteorological Agency)
(National Institute of Radiological Sciences)
(Japan Atomic Energy Research Institute)
(Prefectural Public Health Institutes and Laboratories)

Gross beta-radioactivity in the samples of air-borne dust was measured by Japan Meteorological Agency (5 Locations), National Institute of Radiological Sciences, Japan Atomic Energy Research Institute, and 13 prefectural public health institutes and laboratories.

The higher radioactivities with compared to that of normal level were measured in the samples collected from Nagasaki, Saga, Fukuoka, Fukui, and Niigata prefectures. The relatively higher activities were also observed on the samples collected from various regions in Japan.

Tables 8, 9, 10 and 11 show the results obtained by Japan Meteorological Agency, National Institute of Radiological Sciences, Japan Atomic Energy Research Institute, and 13 prefectural public health institutes and laboratories, respectively.

The sampling locations are given in Figures 8 and 9, respectively by Japan Meteorological Agency, National Institute of Radiological Sciences, Japan Atomi Energy Research Institute, and 13 prefectural public health institutes and laboratories.

Table 8. Gross Beta-Radioactivity in Air-Borne Dust
(Japan Meteorological Agency)

(pCi/m^3)

Station \ Date	Sep. '77 19–20	20–21	21–22	22–23	23–24	24–25	25–26	26–27	27–28
Sapporo	0.3	0.9	0.3	0.3	0.3	0.4	0.3	0.4	1.4
Sendai	0.2	0.0	1.1	0.2	0.4	8.0	0.1	0.4	1.1
Tokyo	0.1	0.2	0.4	0.2	0.3	1.9	1.3	0.6	0.7
Osaka	0.3	0.5	1.3	0.5	6.0	5.0	6.0	2.2	2.3
Fukuoka	0.2	0.6	0.2	4.9	13.0	4.9	9.0	10.0	3.1

Notes: 1) Normal value is under 1 pCi/m^3.
2) The figures were obtained 20 hours after the completion of collecting operation, which is from 09:00 to 14:00 (about 5 hours) every day.

Table 9. Gross Beta-Radioactivity in Air-Borne Dust
(National Institute of Radiological Sciences)

(pCi/m^3)

Time after dust sampling \ Date	Sep. '77 19–20	20–21	21–22	22–23	23–24	24–25	25–26	26–27	27–28
80 min.	0.82	1.75	2.54	2.30	3.63	13.89	3.40	1.41	1.95
24 hr.	0.05	0.64	1.39	0.44	1.29	9.69	0.58	0.53	0.74
48 hr.	–	0.40	0.95	0.30	0.76	8.18	0.23	0.29	0.51

Note: The value were obtained 20 hours after the completion of collecting operation, which is from 10:00 to next 10:00 (about 24 hours) every day.

Table 10. Gross Beta-Radioactivity in Air-Borne Dust

(Japan Atomic Energy Agency)

(pCi/m^3)

Time after dust sampling \ Date	Sep. '77 19–20	20–21	21–22	22–23	23–24	24–25	25–26	26–27	27–28
100 min.	0.71	1.04	3.21	2.13	3.84	6.80	4.19	1.98	1.89
24 hr.	0.09	0.56	2.03	0.52	1.31	4.80	0.69	0.55	0.86
48 hr.	0.05	0.43	1.62	0.29	0.83	3.63	0.30	0.33	0.62

Note: The value were obtained 20 hours after the completion of collecting operation, which is from 09:20 to next 09:20 (about 24 hours) every day.

Table 11. Gross Beta-RAdioactivity in Air-Borne Dust

(Prefectural Public Health Institutes and Laboratories)

(pCi/m^3)

Station \ Date	Sep. '77 19–20	20–21	21–22	22–23	23–24	24–25	25–26	26–27	27–28
Niigata, NIIGATA	0.26	2.5	1.9	4.7	11.3	11.3	7.5	3.7	3.6
Okuma, FUKUSHIMA	–	0.8	0.35	0.75	2.25	3.6	1.18	1.14	1.25
Mito, IBARAKI	0.05	1.7	–	ND	3.5	7.86	1.4	1.57	2.2
Shizuoka, SHIZUOKA	–	ND	0.03	–	–	–	–	–	–
Fukui, FUKUI	0.89	3.16	2.60	4.74	27.4	15.16	11.71	6.16	6.44
*Osaka, OSAKA	0.75	0.08	1.97	1.71	2.79	6.6	6.27	1.89	1.55
	1.55	2.19	1.24	3.47	4.17	8.38	5.07	4.41	–
Nagoya, AICHI	0.55	–	2.95	5.96	5.62	10.10	9.14	–	4.82
Yokohama, KANAGAWA	–	–	0.9	2.9	2.3	5.9	1.6	1.5	0.6
Matsue, SHIMANE	3.1	3.1	0.5	3.3	7.5	14.2	12.3	11.1	2.5
Dazaifu, FUKUOKA	3.85	2.84	1.50	19.9	19.0	8.4	–	10.6	4.04
Saga, SAGA	–	1.2	1.6	18.7	16.7	3.0	3.3	14.6	3.9
Nagasaki, NAGASAKI	–	0.43	0.23	***3.62	**14.5	2.6	**2.65	**4.49	2.44
				8.02	7.49		1.26	4.66	
				37.63					
Naha, OKINAWA	–	1.62	0.34	0.11	0.10	0.25	0.55	0.2	0.05

Notes: * Upper row : From 10:00 to 14:00 (about 4 hours) every day.
Lower row: From 18:10 to next 9:10 (about 15 hours) every day.
** Twice measurement
*** Thrice measurement

Figure 8 Gross Beta-Radioactivity in Air-Borne Dust

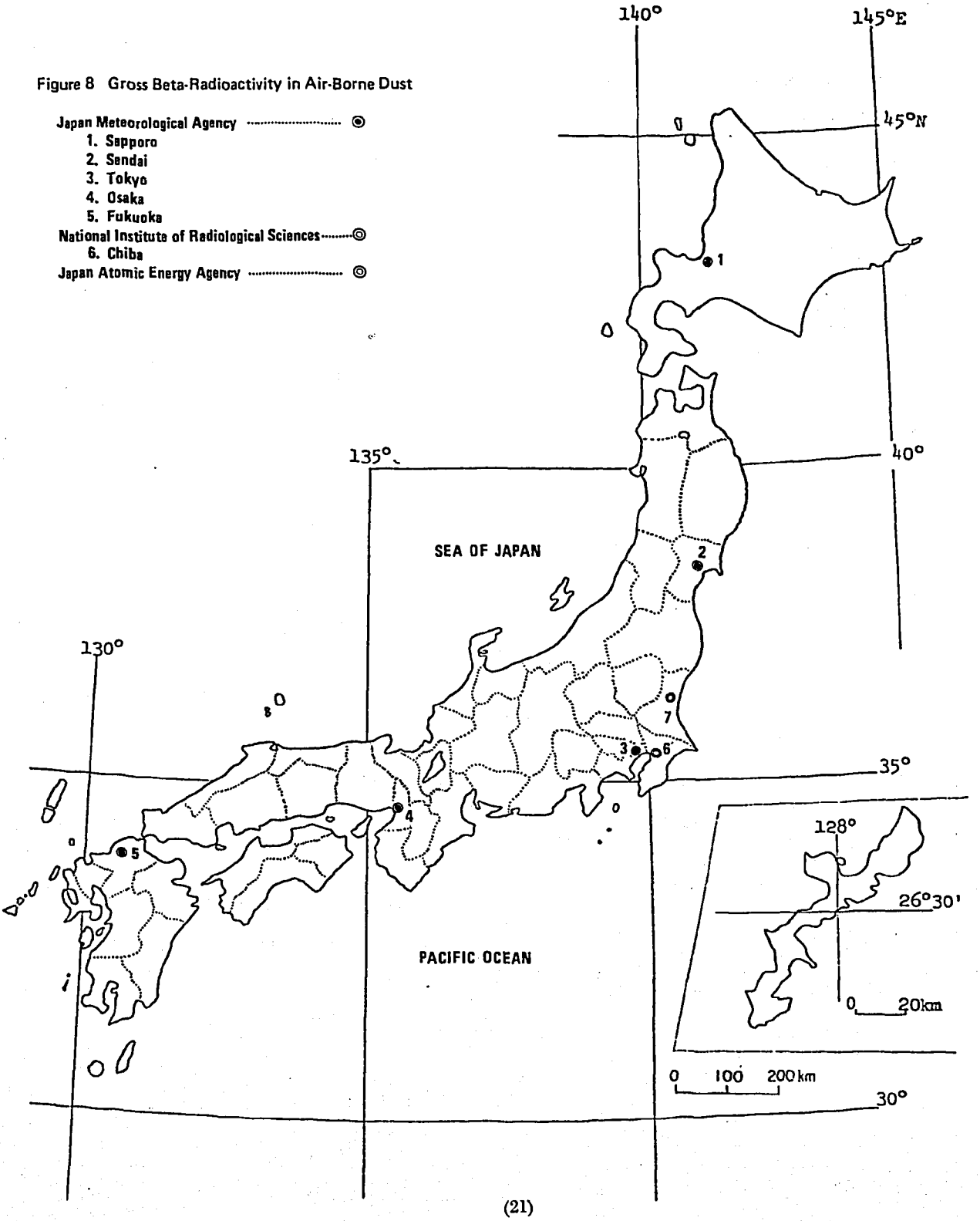
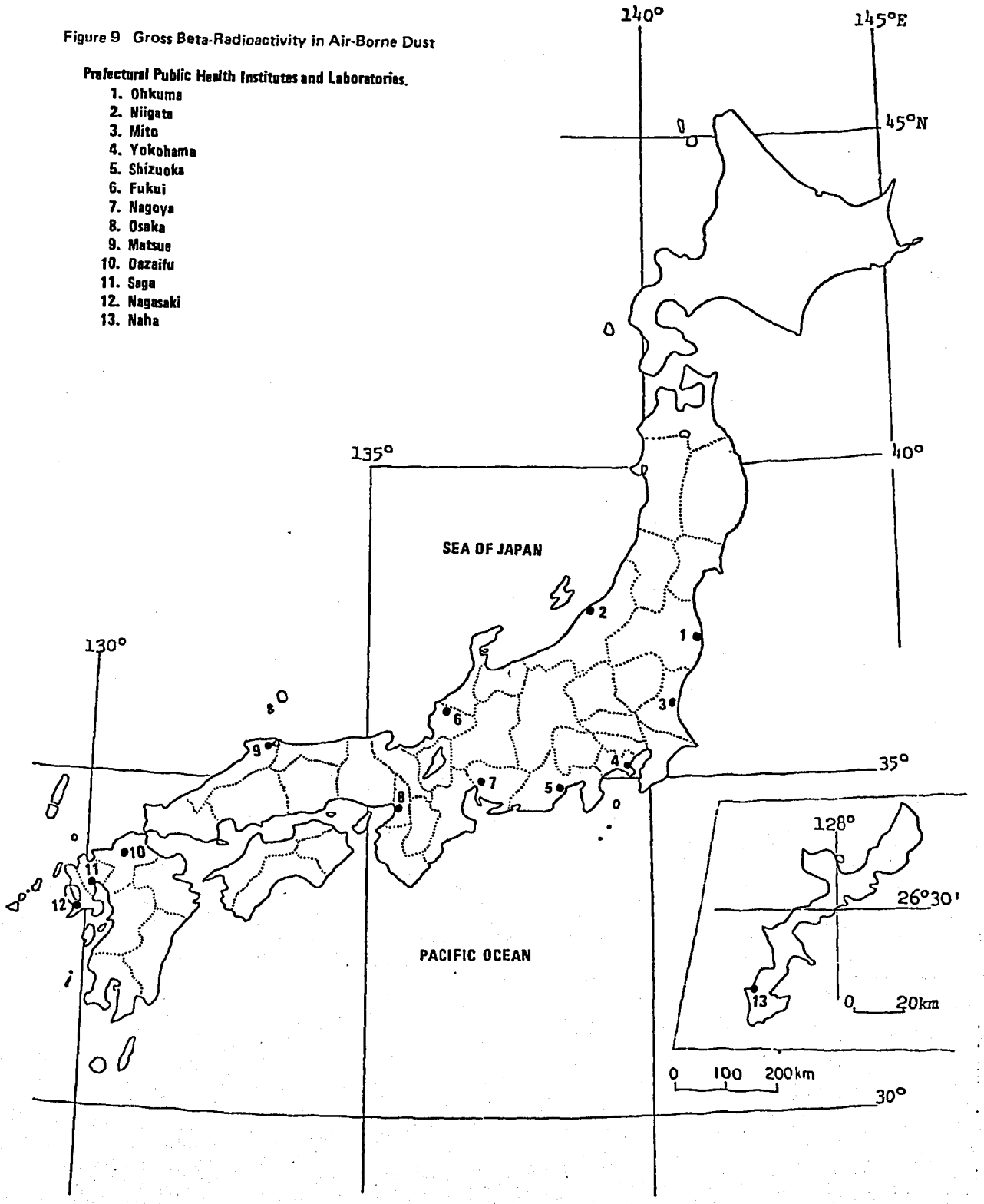


Figure 9 Gross Beta-Radioactivity in Air-Borne Dust



5) Iodine-131 Concentrations in Raw Milk.

(National Institutes under the control of Ministry of Agriculture)
(National Institute of Radiological Sciences)
(Prefectural Public Health Institutes and Laboratories)

Concentration of iodine-131 in raw milk was determined by 3 national institutes under the control of Ministry f Agriculture, National Institute of Radiological Sciences, and 13 prefectural public health institutes and laboratories.

A high concentration of iodine-131 was detected in the samples collected from Aomori and Akita prefectures. Tables 12, 13 and 14 show the results obtained by 3 national institutes under the control of Ministry of Agriculture, National Institute of Radiological Sciences, and 13 prefectural public health institutes and laboratories, respectively.

The sampling locations are shown in Figures 10.

Table 12. Iodine-131 in Milk
(National institutes under the control of Ministry of Agriculture)

(pCi/ℓ)

Station \ Date	Sep. '77 20(E)	21(M)	22(+)	24(M)	25(M)
Hokkaido National Agricultural Experiment Station (Sapporo, HOKKAIDO)	+	+	+	+	–
National Institute of Animal Industry (Chiba, CHIBA)	–	–	–	12.3	–
Kyushu Agricultural Experiment Station (Kumamoto, KUMAMOTO)	–	–	–	+	+

Notes: 1) (E) ····· Evning
(M) ····· Morning
2) Methods for measurement, are the Beta-ray spectrometry in National Institute of Animal Industry, and the gamma-ray spectrometry in Hokkaido and Kyushu Agricultural Experimental Stations.
3) "+" means the effects qualitatively detectable, but not significant numerical values calculated as pCi/ℓ.

Table 13. Iodine-131 in Milk
(National Institute of Radiological Sciences)

(pCi/ℓ)

Date (time)	Sep. 19	20	21	22	23	24	25	26	27	28
Concentration (pCi/ℓ)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Note: Detectable limit ····· 50 pCi/ℓ.

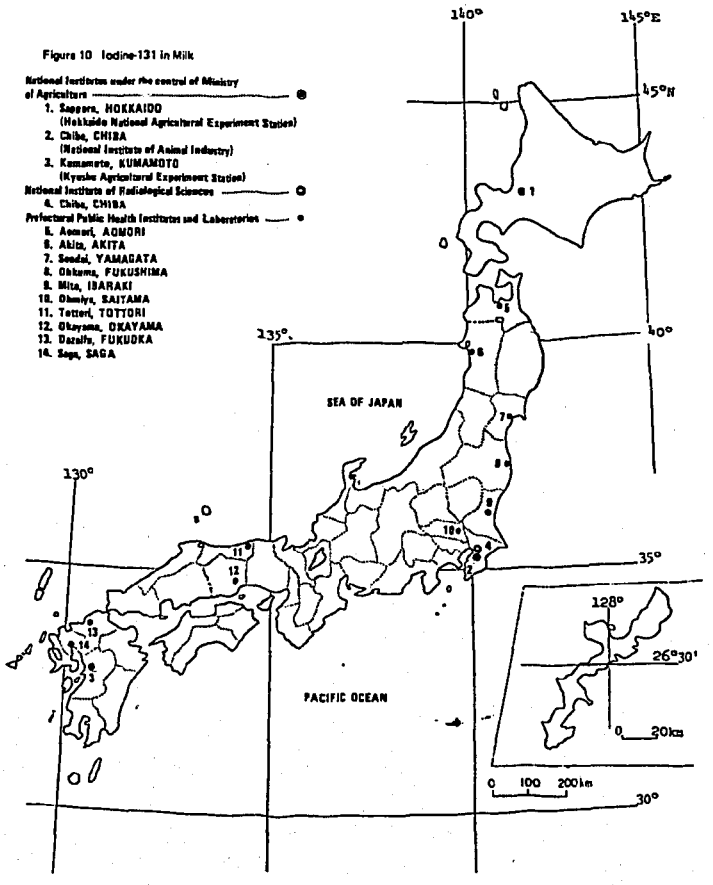
Table 14. Iodine-131 in Milk

(Prefectural Public Health Institutes and Laboratories)

(pCi/ℓ)

Station \ Date	Sept. 20	21	22	23	24	25	26	27	28	Oct. 29	30	1	2	3	4	5	6	7
Sapporo, HOKKAIDO	ND	ND	ND	ND	ND	ND	ND	ND										
Aomori, AOMORI	ND	ND	ND	196.9		160.0	101.4	172.4	168.2	60.6	99.3			126.6			ND	
Akita, AKITA			ND	ND	ND			ND	ND	175	141	128		111	105	84		79
Sendai, MIYAGI	ND	ND		ND	ND	ND	ND	ND										
Ohkuma, FUKUSHIMA		ND		ND	ND	ND	ND	ND	ND									
Mito, IBARAKI				ND														
Tottori, TOTTORI	ND	ND	ND		ND		50.2	59.3	ND									
Dazaifu, FUKUOKA		ND	ND	ND			ND		ND									
Saga, SAGA	ND	ND	ND	ND	ND	ND	ND	ND	ND									
Okayama, OKAYAMA	ND	ND	ND	ND	ND	ND	ND	ND	ND									
Ohmiya, SAITAMA	ND	ND	ND	ND	ND	ND	ND	ND	ND									

Notes: In Akita prefecture, the radioactivity was measured at Akita city and the southern parts of prefecture during the period from September 22 to 28 and from September 29 to October 11, respectively.



6) Analysis of Radionuclides and Hot Particles

Airborne dusts and hot particles collected from Fukushima and Ibaraki prefectures were analysed using Ge(Li) semiconductor instrument. Following radionuclides caused by this nuclear explosion test were detected: ^{239}Np, ^{144}Ce, ^{132}I, ^{140}Ba, ^{140}La, ^{95}Zr-^{95}Nb, ^{137}Cs and others.

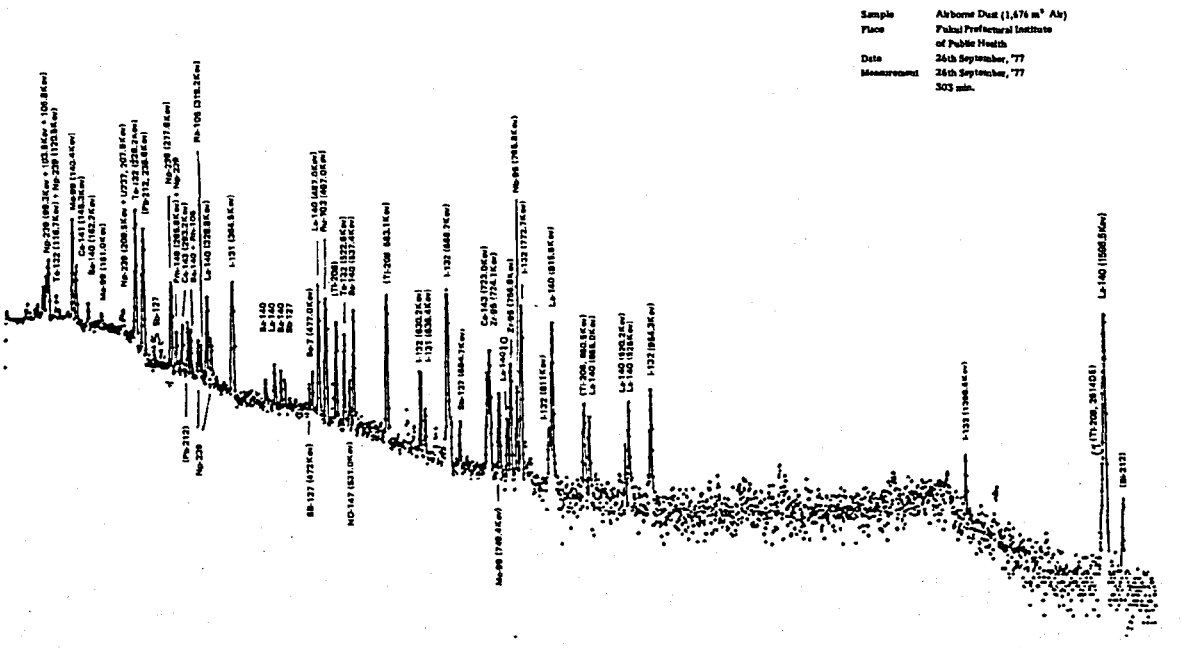
Hot particles were detected in the samples collected from Ibaraki prefecture at September 21, 1977.

Frequency and maximum radioactivity were 2 particles per 6 m^2 and 34900 pCi/per particle, respectively.

And these hot particles were also detected in other several prefectures.

Figures 11, 12 and 13 show the examples of γ-spectrum using Ge(Li) semiconductor instrument for airborne dusts and hot particles collected from Fukui, Fukushima, and ibaraki prefectures, respectively.

Figure 11 Spectrum of Radionuclides in Airborne Dust Analyzed by the Ge(LI) Semi-conductor (Fukui prefecture)



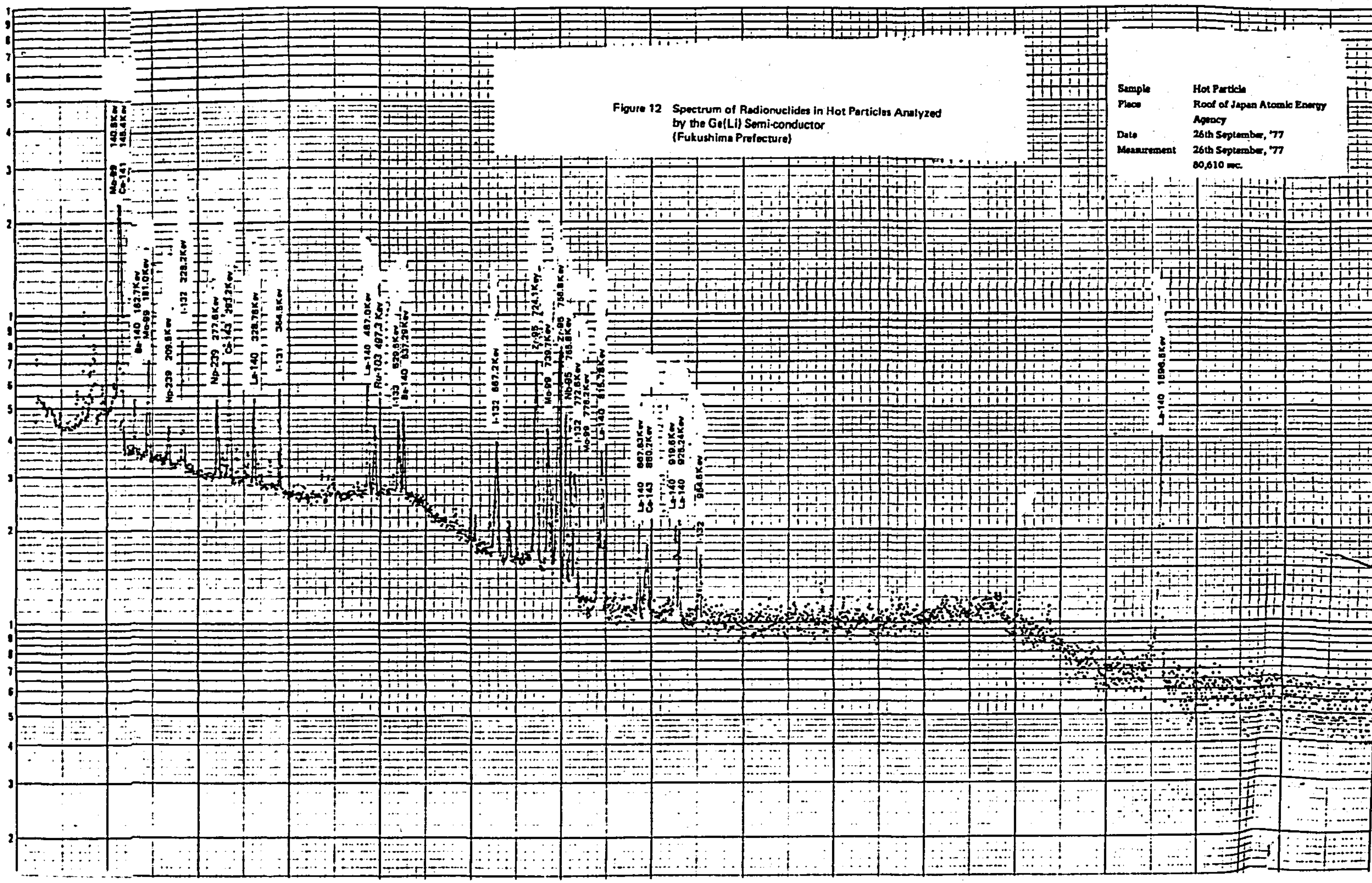


Figure 12 Spectrum of Radionuclides in Hot Particles Analyzed by the Ge(Li) Semi-conductor (Fukushima Prefecture)

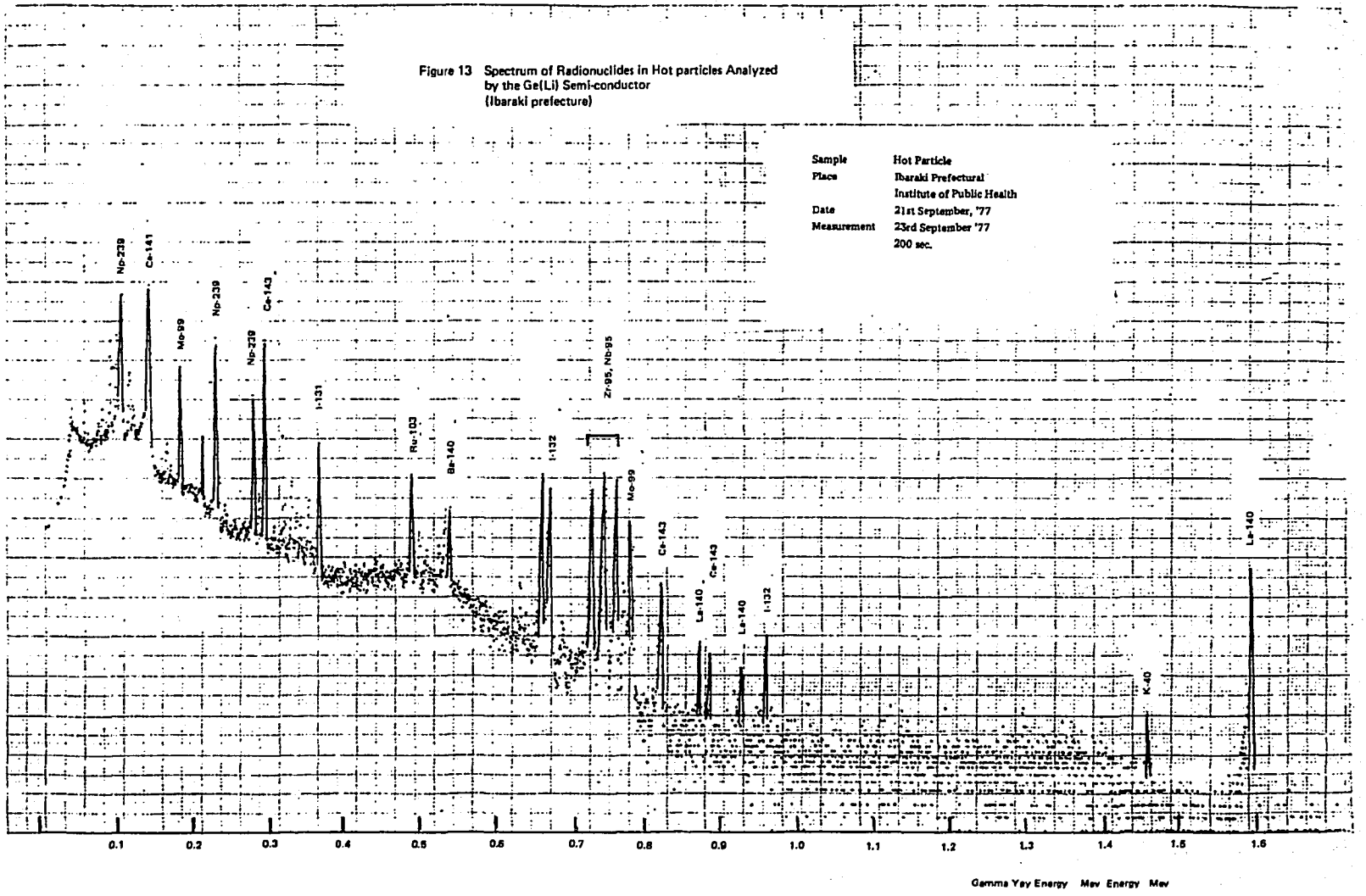


Figure 13 Spectrum of Radionuclides in Hot particles Analyzed by the Ge(Li) Semi-conductor (Ibaraki prefecture)

7) Nuclear local Follout in Japan with the Test

(Observation Division, Japan Meteorological Agency)

1. Introduction

An atmospheric nuclear explosion with a yield of 20 kiloton or less was detected in the neighborhood of Lake Lop Nor (40°N, 90°E) western China at about 07 GMT (16 JST) 17 September 1977. This was China's 22nd of such tests. The following is a brief report on the correlation between the subsequent fallout observations in Japan and upper air trajectory.

2. Records at Japanese monitoring posts

Available data are Gamma-ray emission rate recorded at 18 monitoring posts scattered all over Japan; two are under Japan Meteorological Agency and 16 are run by the prefectures. Figure 14 shows isochronos of fallout arrival based on clearly recognizable onset of increase in intensity and maxima. Figure 15 is of the five monitoring posts located in the Japan-Sea-side areas, for the days centered around 21 September; the plot is at about 30-minute intervals for 21st and 12-hour mean values for the other days. The cps curves for the five sites shown in Figure 15 are similar in shape with each other though the cps values are different. (These curves remind us of the energy flow curve when an amount of energy is suddenly impressed upon a circuit having a certain degree of resistance.) The curves suggest that the gamma-ray source was a mass of nuclear debris transported over a distance comparatively free from the effect of large atmospheric disturbances. A large cps value at Wajima prior to the arrival of the fallout there, was caused by rainfall.

3. Upper air trajectory and local fallout arrival time

Figure 15 shows the trajectories (pursuit lines of upper winds) at the 300, 500 and 600 mb levels starting at 40°N, 90°E at 07 GMT 17 September and ending on 23rd. The trajectories at the 700 mb level and lower are omitted since the lower air mass remained in the Chinese main land or in the Maritime Province of Siberia or in Vietnam untill as late as 25th.

Agreement of the arrival time is not so good between these three trajectories and fallout observations given in Figure 14. This discrepancy is because of ours not allowing for the fact that the height of the initial blast cloud was rather low and that the mass of debris was not horizontally transported, instead it descended slowly while dispersing horizontally. We asumed four fall speeds, 3 cm/sec from about 10,000 m to 0 m, 2.5 cm/sec for 8500-0 m, 2 cm/sec for 7000-0 m, and 1.5 cm/sec for 5000-0 m. (If we assumed 1 cm/sec for 3500-0 m, the arrival at Japan should have become very late on account of the wind field.)

Figure 17 shows, on the basis of this assumption, the relationship between the fallout arrival time and the probable height of initial nuclear cloud-particle. Thin broken lines in Figure 16 are the trajectories based on the height of nuclear cloud-particles estimated from Figure 17 at 12-hour intervals and the wind at pertinent height levels. The relationship between the fall rate and the diameter of the particles is, according to Dr. R. Koike (1958), as follows. Particles of about 19 micronmeter may fall at about 3 cm/sec, 15 micronmeter at about 2 cm/sec, and 13 micronmeter at about 1 cm/sec (see Table 15).

With dispersion near the ground surface considered, comparison of Figure 14 and Figure 16 suggests that the local fallout detected in Japan on 21st was mainly those which produced at 6000–9000 m height over the test site and descended at about 2–3 cm/sec (around 15 micronmeter particles) while being carried by the wind.

As the bomb yield was estimated at 20 kiloton or less, our deduction basing on nuclear cloud height of approximately 8000–9000 is considered to be reasonable.

Figure 14 Isochrone of Distinguished γ Activity by Fallout

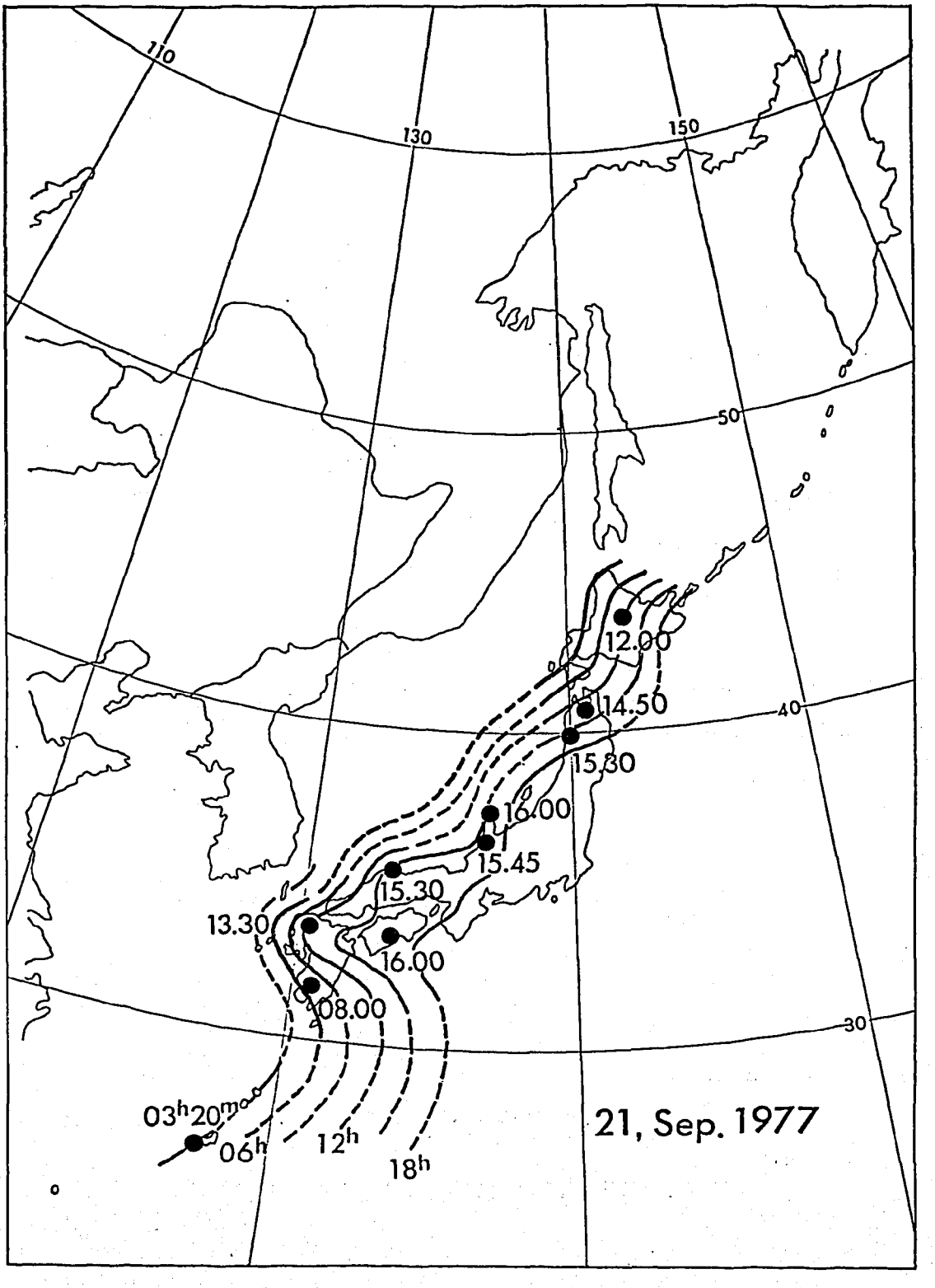


Figure 15 Variations of γ Activity

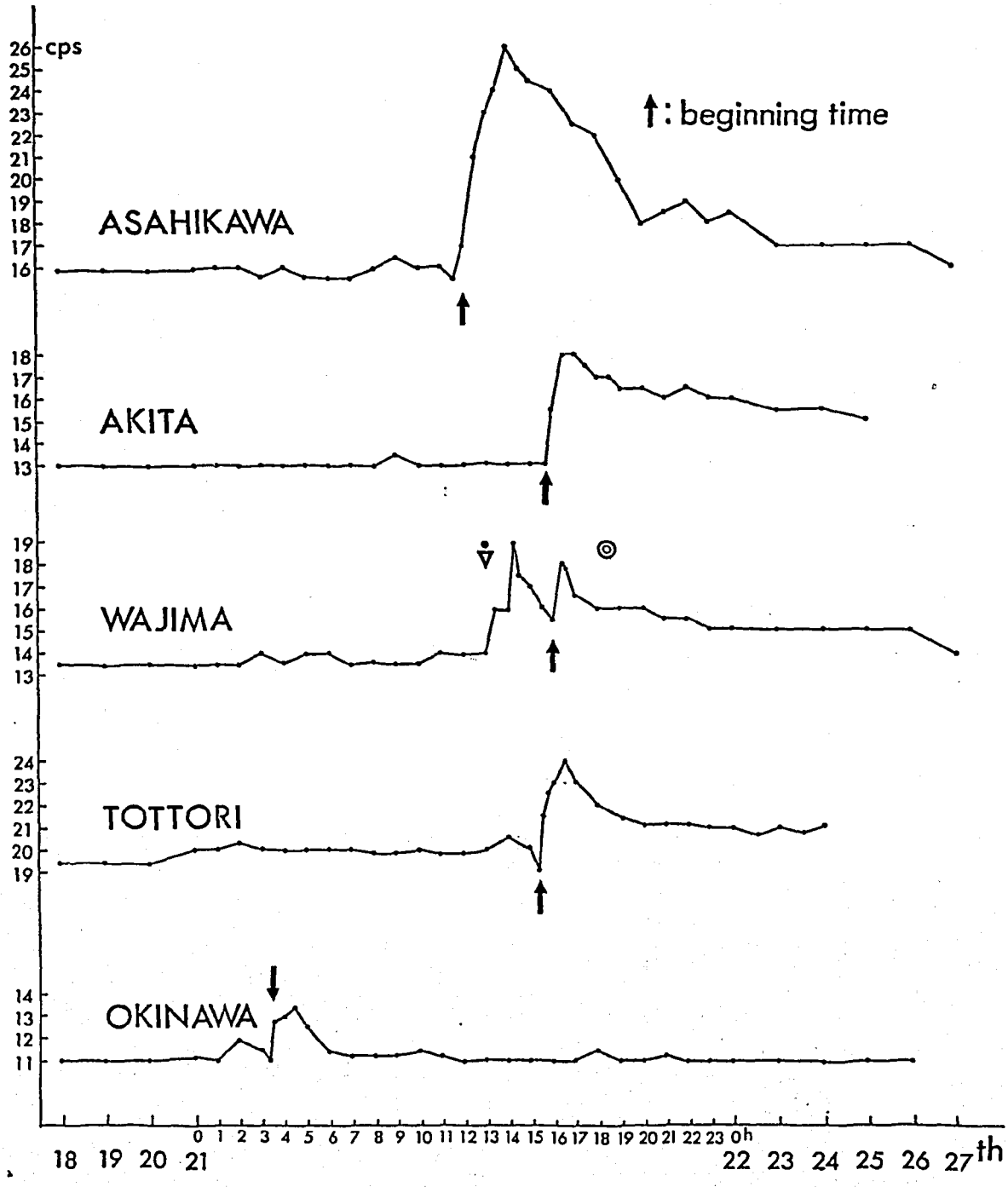


Figure 16 Pursuit Lines of Upper winds and Fallouts

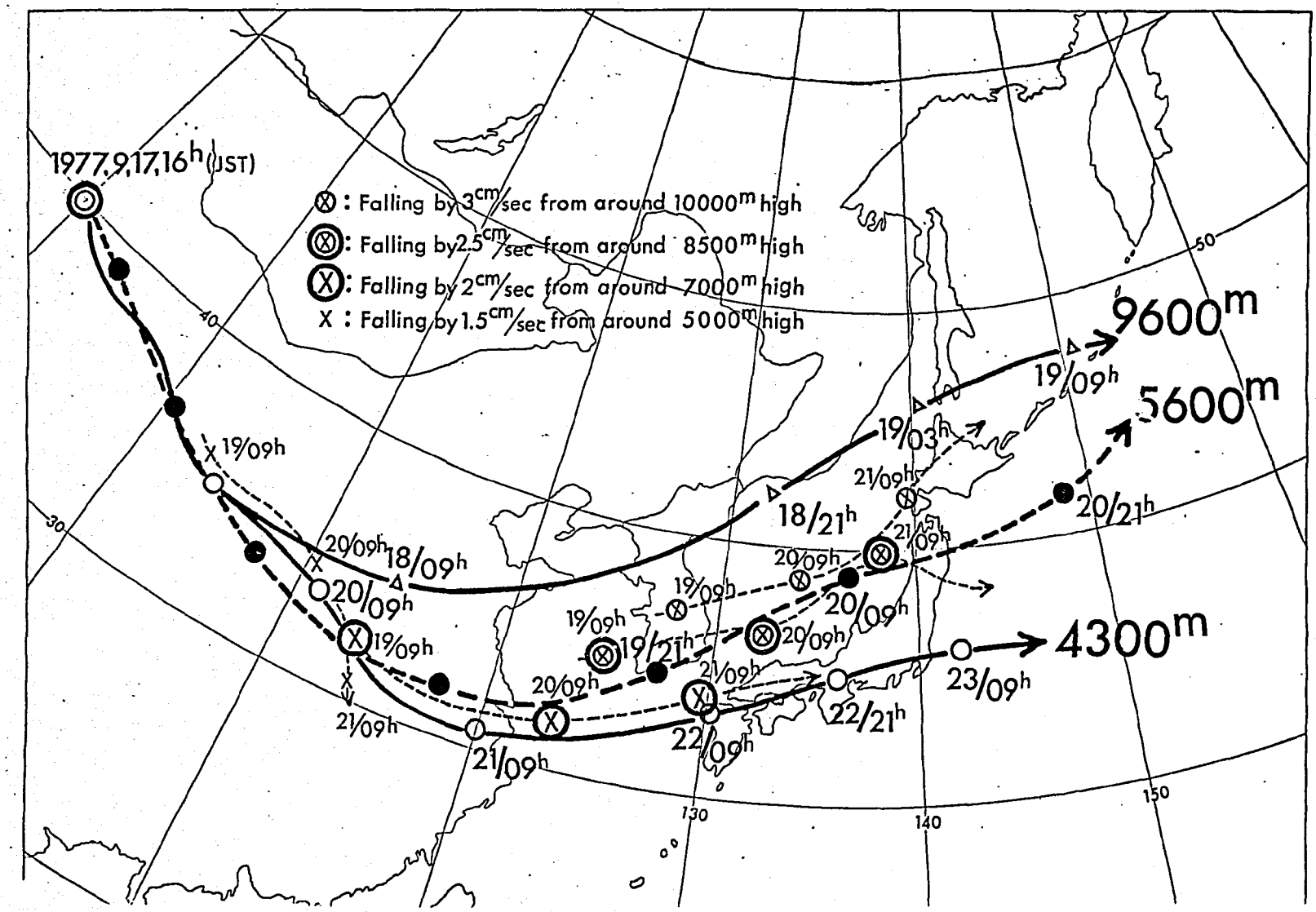


Figure 17 Fallout Prognostic Elevation

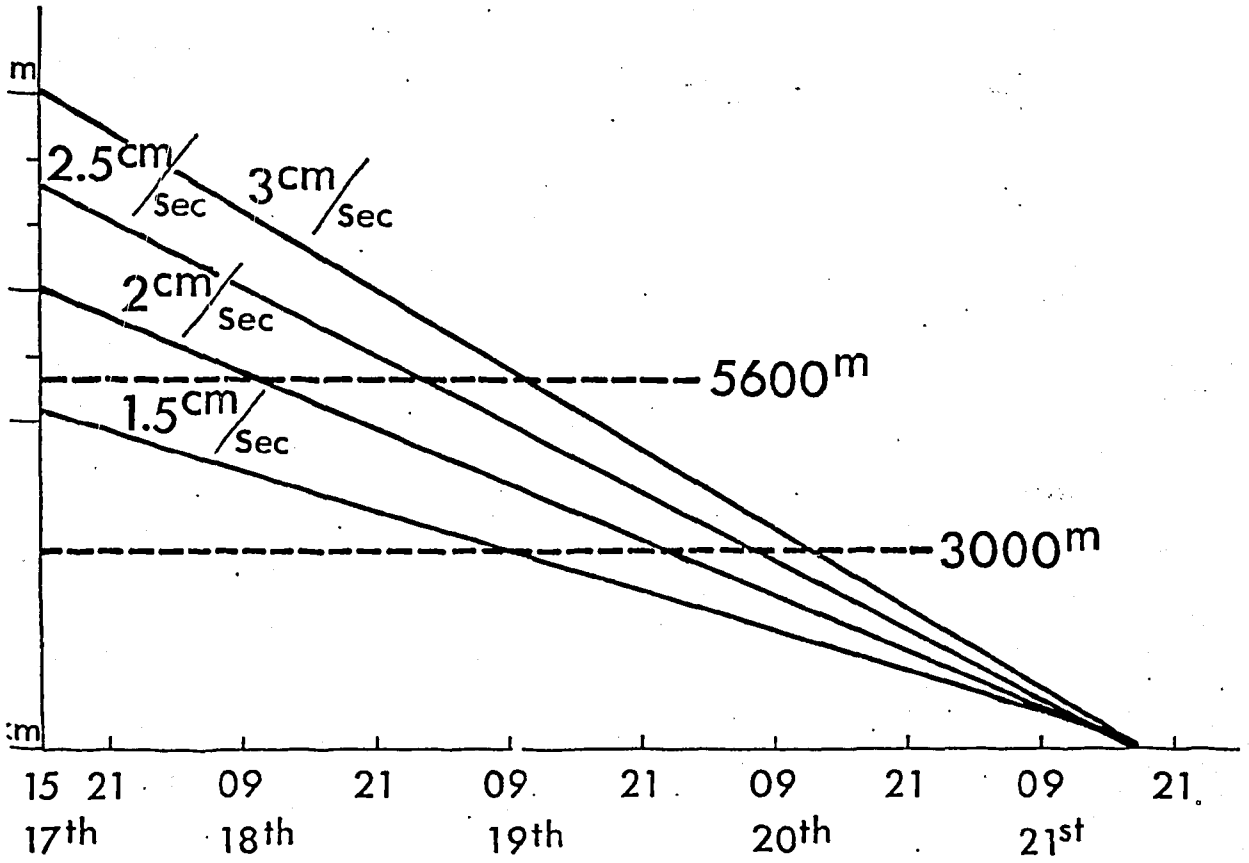


Table 15. Time of fall from 40,000 feet height to ground in the case of dust likes sand (particle dencity = 2.7g/cm³),
by R.Koike

Particle dia (μ)	Time of fall (hr.)	Particle dia (μ)	Time of fall (hr)(day)
840	0.37	33	40(1.7)
250	0.69	16	170(7.1)
150	1.95	8	680 (29)
75	7.90	5	1.700 (71)