RADIOACTIVITY SURVEY DATA in Japan

NUMBER 11, MAY 1966
NUMBER 12, AUG. 1966

National Institute of Radiological Sciences
Chiba, Japan

In April 1963, in compliance with directives set forth by the Japan Atomic Energy Commisson, the Division of Radioactivity Survey, National Institute of Radiological Sciences was directed to:

1. Collect, record and maintain information on radiation from National and International sources.
2. Analyze the information collected.
3. Establish a radiation survey information exchange center.

As a part of the assignment, data from the Nationwide Radioactivity Survey Network were assembled and compiled in this publication, which is issued on a quarterly basis.

For further information on any subject reported in this issue, readers are referred to the contributors indicated in the table headings.

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Data of the Third Nuclear Test of the People's Republic of China

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National Institute of Radiological Sciences

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Meteorological Data

Gross Beta-activity and Radioactivity of Iodine in Rain and Dry Fallout

Part 1 *(Meteorological Agency)*

Since 1955, the Meteorological Agency has measured gross beta-activity in rain and dry fallout at local weather station.

At the 13 stations shown in Figure 1, rain samples were collected by the same method mentioned in the explanation on page 2, Issue No. 5 of this publication.

Survey data obtained during the period May 8th to 31th 1966 are shown in Tables 1 and 2.

Rain samples were counted 6 hours after sampling on while dust samples 20 hours after sampling.

The meteorological trajectory estimates that the radioactive debris emitted into the troposphere first passed about 10 kilometers of altitude (300 mb level) in the central part of Japan, one and a half days after the explosion.

Associated with this situation, a little fallout was first observed at the central station. High fallout readings, which were observed in the cases of the 1st and 2nd Chinese tests were not observed in five or six days after the explosion contrary to expectation.

The second small increase of the fallout appeared in the southern part of Japan 3 and a half days after the explosion and is associated with the mean westerly wind in the troposphere (500 mb level).

Figure 1. Fallout Observation Network of Meteorological Ageney

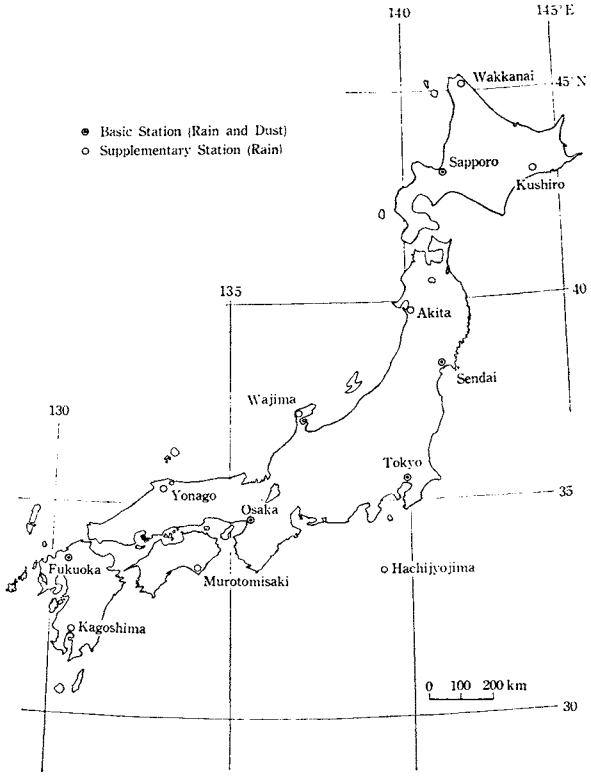


Table 1. Gross β-activity in Rain —May 8 to May 31, 1966—

Compiled by N. Murayama, H. Fujimoto, and H. Shimura and S. Maeshima.
(Meteorological Agenay)

※ Upper Rank: Concentration (pCi/cc)
Lower Rank: Deposition (mCi/km²)

Station	May	8	9	10	11	12	13	14	15	16	17	18	19
Wakkanai			0.0				0.3		0.5	0.2			
//			0.0	0.0			4.2		3.3	1.7			
Sapporo		0.0	0.0						0.2	0.1			
//		0.0	0.0						0.3	0.3			
Kushiro		0.0	0.0							0.0			
//		0.0	0.0							0.0			
Sendai		0.0			3.4					0.0			
//		0.0			4.4					0.0			
Akita		0.0	0.0	0.0	6.0				0.3	0.2	0.1		
//		0.0	0.0	0.0	46.0				3.6	4.6	0.6		
Tokyo		0.0			1.6					0.1			
//		0.0			13.0					2.0			
Wajima		0.0			0.1					0.0			
//		0·0			2.2					0.0			
Hachijojima		0.0	0.0			0.2			0.1	0.1			
//		0.0	0.0			3.0			0.5	1.5			
Osaka		0.0			4.8					0.1			
//		0.0			70.6					2.3			
Yonago		0.0			4.2				0.4	0.0			
//		0.0			93.0				9.0	0.0			
Murotomisaki									0.3				
//									0.4				
Fukuoka		0.0			0.0				0.0				
//		0.0			0.0				0.0				
Kagoshima		0.0			0.0				0.0				
//		0.0			0.0				0.0				

Station	May	20	21	22	23	24	25	26	27	28	29	30	31
Wakkanai												1.1	0.1
//												5.6	1.0
Sapporo												0.1	0.1
//												1.0	0.7
Kushiro													0.0
//													0.0
Sendai					0.1	0.3	0.2					0.2	
//					2.0	1.6	0.7					2.6	
Akita					0.1							0.2	
//					0.3							1.4	
Tokyo				0.1	0.0	0.0		0.4				0.1	
//				1.0	0.0	0.0		0.6				2.0	
Wajima					0.0							0.1	
//					0.0							2.2	
Hachijojima				0.0	0.1							0.2	0.1
//				0.0	8.2							0.7	0.7
Osaka			0.1	0.1	0.0						0.0	0.1	
//			0.4	1.3	0.0						0.0	2.6	
Yonago			0.3	0.0	0.0	0.0					0.1	0.5	
//			1.0	0.0	0.0	0.0					0.7	0.8	
Murotomisaki													
//													
Fukuoka			0.1		0.0						0.1		
//			0.8		0.0						1.1		
Kagoshima		0.0	0.0	0.0							0.1	0.0	
//		0.0	0.0	0.0							3.6	0.0	

Table 2. Gross β-activity in Dust —May 6 to May 29, 1966—
Compiled by N. Murayama, H. Fujimoto, and H. Shimura and S. Maeshima.
(Meteorological Agency)

(pCi/m³)

Station	May	6	7	8	9	10	11	12	13	14	15	16	17
Sapporo		0.0			0.2		0.0	0.2	0.2	0.2	0.0	0.2	0.2
Sendai		0.5			0.2	0.5	3.4	0.2	0.5	0.2	0.5	0.2	0.0
Tokyo		0.4			0.4		0.5	0.2	0.5	1.0	0.3	0.2	0.2
Osaka		1.0			0.5		0.5	0.5	3.6	0.5	0.9	0.2	0.3
Fukuoka		1.0			0.7		0.0	0.5	0.5	1.0	0.2	0.2	0.2

Station	May	18	19	20	21	22	23	24	25	26	27	28	29
Sapporo		0.2	0.2	0.5			0.2		0.2		0.5		
Sendai		0.2	0.5	0.5			0.0		0.2		0.5		
Tokyo		0.6	0.7	0.6			0.2		0.3		0.9		
Osaka		0.7	0.5	0.9			0.3		0.2		1.2		
Fukuoka		0.5	0.5	1.0			0.0		0.2		0.7	0.2	

Figures 2 and 3 show the features mentioned above. These conditions suggest that the explosion occurred at a comparatively higher level.

Concentration of radioactivity in rain and in dust suspended close to the ground were first detected on the 11th day and subsequently on the 13th day, and remained low during the following period. A slight increase at the end of May was perhaps associated with the return following a passage around the earth.

Figure 2. The Meteorological Trajectory at that Time
The Third Nuclear Test was carried out by The People's Republic of China.

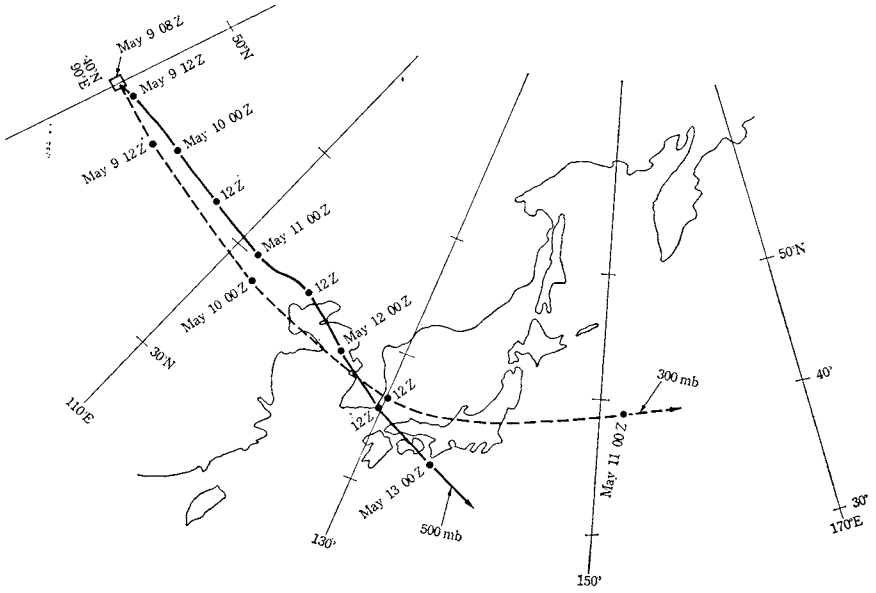
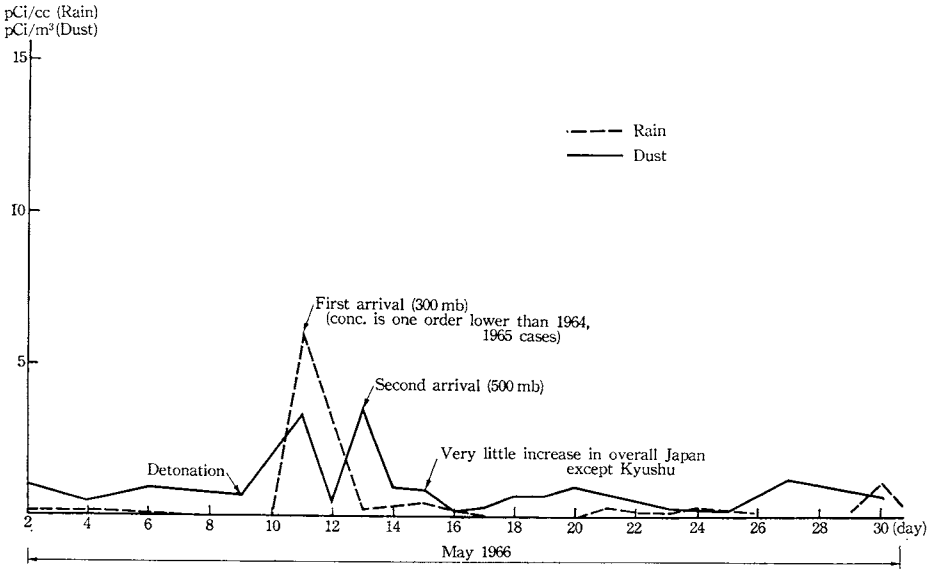


Figure 3. Temporal Variation Gross β-activity in Rain and Dust near the Ground. (Maxiumum Value: in Japan)



Part 2 *(Meteorological Research Institute, Tokyo)*

The Meteorological Research Iostitute, Tokyo, is measuring beta-radioactivity in rain and dry fallout collected in a tray at the institute.

Results of measurements obtained during the period from May 7, to Jun 10, 1966, when the effect of Chinese atomic bomb was noticed, are shown in Table 3.

Table 3. Deposits of Radioactive follout —May 7 to Jun. 10, 1966—

By Y. Miyake, K. Saruhashi, Y. Katsuragi
T. Kanazawa, and Y. Sugimura
(Meteorological Research Institute, Tokyo)

Date of Sampling	Collection time (hr)	Total β-activity (mCi/km²)	Remarks
May 1966			
9AM, 7th to 9AM, 8th	24	0.47	rain (31.2 mm)
〃 9th 〃 〃 10th	〃	0.03	Dry fallout
〃 10th 〃 〃 11th	〃	23.3	rain (6.7 mm)
〃 11th 〃 〃 12th	〃	0.04	dry fallout
〃 12th 〃 〃 13th	〃	0.03	〃
〃 13th 〃 〃 14th	〃	0.04	〃
〃 14th 〃 〃 15th	〃	0.07	rain (0.3 mm)
〃 15th 〃 〃 16th	〃	0.56	rain (24.7 mm)
〃 16th 〃 〃 17th	〃	0.11	dry fallout
〃 17th 〃 〃 18th	〃	0.03	〃
〃 18th 〃 〃 19th	〃	0.02	〃
〃 19th 〃 〃 20th	〃	0.02	〃
〃 20th 〃 〃 21th	〃	0.03	〃

Table 3. Deposits of Radioactive fallout —May 7 to Jun. 10, 1966— (*continued*)

Date of Sampling	Collection time (hr)	Total β-activity (mCi/km^2)	Remarks
9AM, 21th to 9AM, 22th	24	0.84	rain (20.2 mm)
〃 22th 〃 〃 24th	48	2.67	rain (81.5 mm)
〃 24th 〃 〃 25th	24	0.03	dry fallout
〃 25th 〃 〃 26th	〃	1.04	rain (2.4 mm)
〃 26th 〃 〃 27th	〃	0.03	dry fallout
〃 27th 〃 〃 28th	〃	0.06	〃
〃 29th 〃 〃 30th	〃	12.25	rain (19.7 mm)
〃 30th 〃 〃 31st	〃	0.29	dry fallout
〃 31st 〃 〃 1st	〃	2.32	rain (1.0 mm)
Jun 1966			
9AM, 1st to 9AM, 2nd	24	15.84	rain (29.3 mm)
〃 2st 〃 〃 3rd	〃	0.36	dry fallout
〃 3th 〃 〃 4th	〃	0.12	〃
〃 4th 〃 〃 5th	〃	5.76	rain (35.2 mm)
〃 6th 〃 〃 7th	〃	0.07	dry fallout
〃 7th 〃 〃 8th	〃	1.93	rain (5.0 mm)
〃 8th 〃 〃 9th	〃	0.03	dry fallout
〃 9th 〃 〃 10th	〃	8.94	rain (87.5 mm)

Part 3 *(National Institute of Radiological Sciecnes)*

Daily rain and dry fallout samples were continuously (9AM. to 9AM) collected by the National Institute of Radiological Sciences at Chiba city, to determine the gross beta-activity and activity of radio-iodine.

Gross beta-radioactivity was measured using the standard of uranium oxide (U_3O_8) with a Geiger Müller counter. After the addition of an iodine carrier to the fallout samples, the iodine was chemically separated for radioactivity determination, using an iodine-131 standard with a beta-ray low back ground counter.

Results obtained during the period 10 May to 11 July 1966 on gross beta-activity and radioactive iodine are shown in Table 4.

On the evening of 9 May, 1966, the third nuclear explosion test was carried out by the People's Republic of China. Initial precipitation of fallout was remarkably observed in the early morning of 11 May, 1966. Second increase of radioactivity observed in the end of May, 1966 may depend upon first circulated fallout around the earth.

Gross beta-radioactivity and radioactivity of iodine in rain collected in early morning of 11, May 1966 are also indicated in Table 5.

Table 4. Gross β-radioactivity and Radioactivity of Iodine in Rain and Dry Fallout collected in a tray at Chiba City —May 10 to Jul. 11,1966—

By M. Saiki, H. Kamada, Y. Ohmomo, E. Nakano and H. Yamaguchi
(National Institute of Radiological Sciences)

Date of Sampling	Date of Determination	Gross β-activity (mCi/km^2)	β-activity of Iodine at the Time of Sampling (mCi/km^2)	Remarks
10～11 May 1966	11 May 1966	29.4	<13.8	rain (10 mm)
11～12 〃	12 〃	7.7	< 0.18	
12～13 〃	13 〃	0.1	< 0.09	
13～14 〃	14 〃	0.4	< 0.10	
14～15 〃	15 〃	0.4	< 0.12	
15～16 〃	16 〃	0.4	< 0.03	rain (45 mm)
16～17 〃	17 〃	0.2	< 0.02	
17～18 〃	18 〃	0.0	< 0.00	
18～19 〃	19 〃	0.1	< 0.00	
19～23 〃	23 〃	0.4		rain (>50 mm)
23～26 〃	26 〃	2.3		〃 (12 mm)
26～30 〃	30 〃	6.2		〃 (15 mm)
30～ 2 Jun 1966	2 Jun 1966	6.6		〃 (30 mm)
2～ 6 〃	6 〃	2.8		〃 (30 mm)
6～ 8 〃	8 〃	2.7		〃 (10 mm)
8～11 〃	11 〃	2.4		〃 (>50 mm)
11～18 〃	20 〃	1.8		〃 (>50 mm)
18～20 〃	20 〃	0.3		
20～21 〃	22 〃	0.6		
21～22 〃	22 〃	0.5		
22～23 〃	23 〃	0.1		
23～24 〃	24 〃	0.4		
24～25 〃	27 〃	0.1		
25～27 〃	29 〃	0.1		
27～29 〃	5 Jul 1966	0.5		
29～30 〃	5 〃	0.5		
30～ 2 Jul 1966	6 〃	0.3		
2～ 4 〃	6 〃	0.0		
4～ 7 〃	11 〃	0.1		rain
7～ 8 〃	12 〃	0.3		
8～11 〃	18 〃	0.6		

Table 5. Gross β-radioactivity and Radioactivity of Iodine in Rain collected at Chiba City —11, May 1966—

by M. Saiki and G. Tanaka
(National Institute of Radiological Sciences)

Date of Sampling	Date of Determination	Gross β-activity (pCi/l)	Gross β-activity (mCi/km^2)	activity of Iodine (pCi/l)	activity of Iodine (mCi/km^2)	Ratio $\frac{\text{activity of Iodine}}{\text{gross } \beta\text{-activity}} \times 100$	Remarks
11, May 1966	11, May 1966	3420	17.4	508	2.5	14.6	Rain (10 mm)

Gross Beta-Radioactivity in Upper Air

(Research and Development H. Q., Japan Defense Agency)

Since 1960, Research and Development H. Q., Japan Defense Agency has measured the beta-radioactivity of dust in the lower layer of the stratosphere and tropopause using aircraft as collectors.

The samples were taken over three areas of Japan using gummed paper and dust samplers attached to the front of the aircraft wings.

The sampling flight was made using two aircraft at the same time, one of which made a normal sampling flight and the other only upward and downward flight. The difference between the amounts of radioactivity of the samples collected by the two aircraft is taken as the value at the flight altitude.

Figure 4 shows three sampling areas of Japan, and Table 6 shows the results obtained.

Figure 5 shows monthly variation of gross beta-activity at three altitudes in the Chubu sky area since October, 1964.

Figure 4. Three Sampling Areas of Japan.

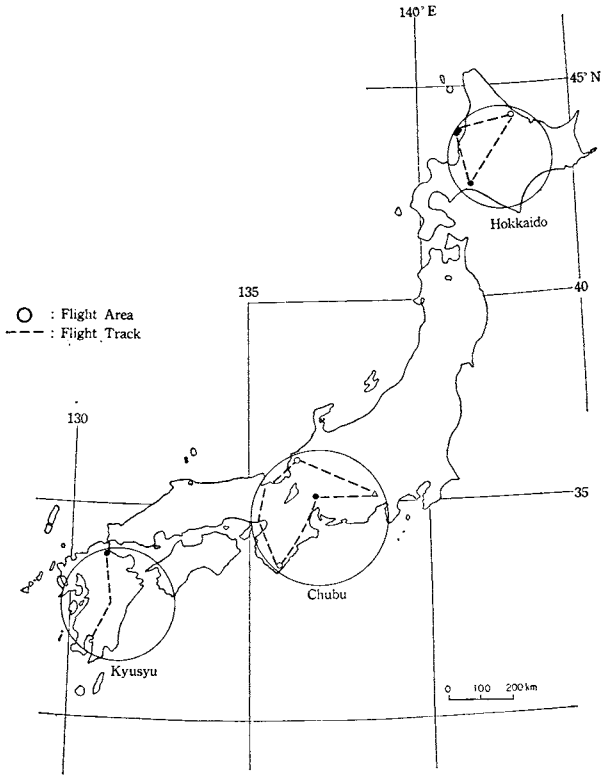


Table 6. Gross β-radioactivity in Upper Air —May 10 to 25, 1966—

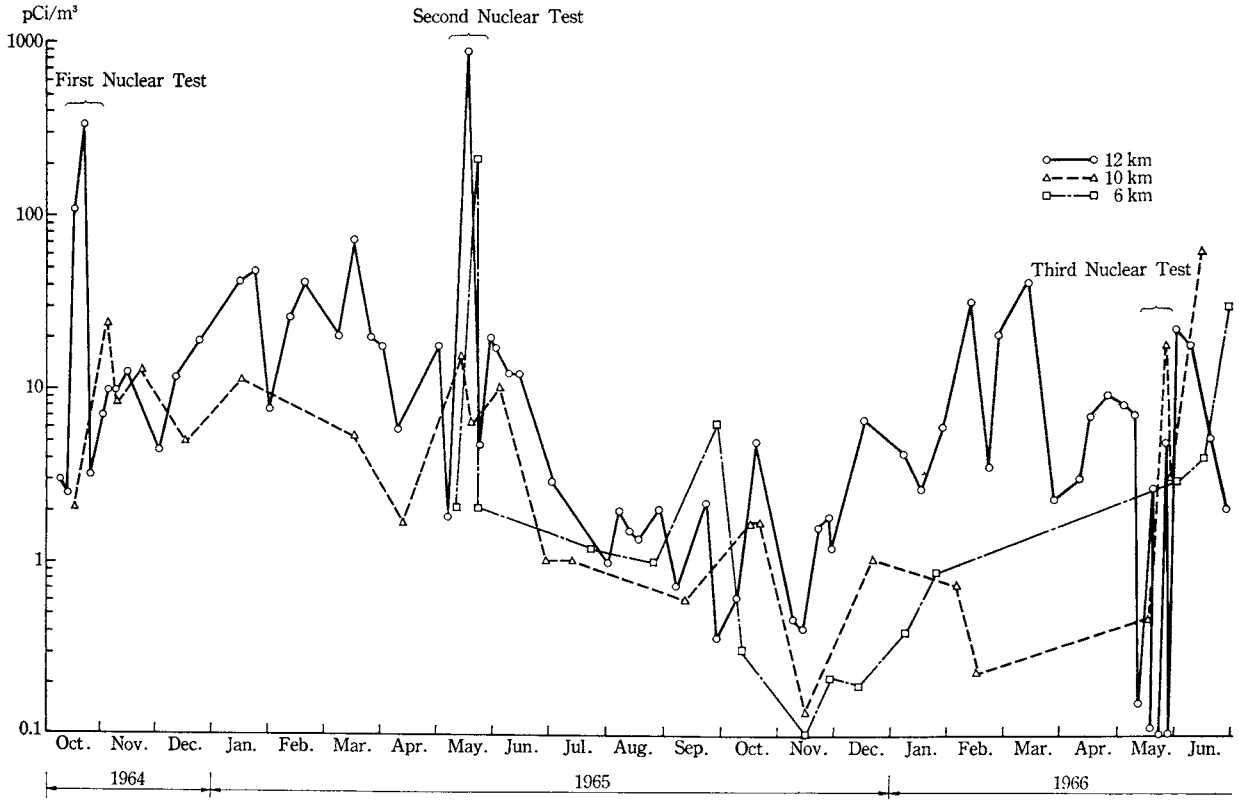
By T. Urai and T. Igarashi

(Research and Development H. Q., Japan Defense Agency)

(pCi/m³)

Sky Area	Hokkaido		Chubu			Kyushu	
	12,000 m	10,000 m	12,000 m	10,000 m	6,000 m	12,000 m	10,000 m
1966							
10 May	0.58		0.16			–	
11 〃		4.04		0.49			0.52
12 〃	–		2.7			–	
13 〃		3.1		–		–	0.1
14 〃			0.1			0.7	
15 〃							
16 〃	0.3		–			0.2	
17 〃		15.7		18.8			–
18 〃	17.0		5.1			1.7	
19 〃		6.3		3.3			0.6
23 〃	2.5						–
25 〃		5.1	–				24.0

Figure 5. Monthly Variation of Gross Beta-activity in Chubu Sky Area.
—Oct. 1964 to Jun. 1966—



Highly Radioactive Fallout Particles

Part 1 *(National Institute of Radiological Sceinces)*

Shortly after the explosion, several particles (diameter: 10~20 micron) having high radioactivity of about 20~300 mμCi were collected on the roof of building of National Institute of Radiological Sciences, Chiba City. The Particles could be easily detected with a Geiger-Müller survey meter of end window type. Hot particles were isolated from accompanying dust by fractionation with acetone. The radio-autograph and micro-photograph of isolated hot particle were shown in Figure 6.

The daily variation of gamma-ray spectrum of highly radioactive fallout particle (above 74,000 cpm ≒ above 300 mμCi) collected 11 May, 1966 is shown in Figure 7.

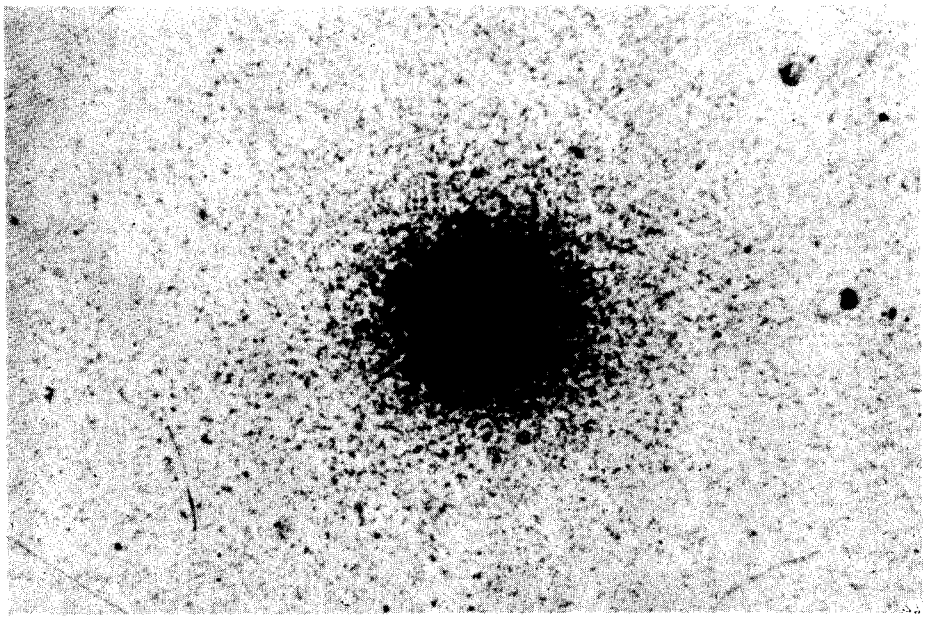
According to energy distribution and decay curves of peaks of gamma-ray spectrum, main gamma-ray emmitting radionuclides of the particle are estimated.

The major radioactivity are originated from Tc-99 m (half-life 6.04h), Ce-143 (half-life 33h) and Nb-97 m (half -life 1 m)-Nb-97 (half-life 72.1 m) at 11 May, 1966. From 17 May, peak of gamma-ray puls height of La-140 (haff-life 40.2h) were clearly shown. On 23 May, dominant radioactivity of Zr-95 (half-life 63.3d)-Nb-95 (half-life 35d) and a slight radioactivity of La-140 and Ce-143 and trace radioactivity of Tc-99m were observed. The main radioactivity on 2 June, 1966, seems to be originated from Zr-95-Nb-95, Ce-141 (half-life 32d) and La-140.

Figure 6. Highly Radioactive Fallout Particles of Third Nuclear Test by The People's Republic of China
(collected 11, May 1966 at Chiba City)

By M, Saiki, H. Kamada and K. Yamada
(National Institute of Radiological Sciences)

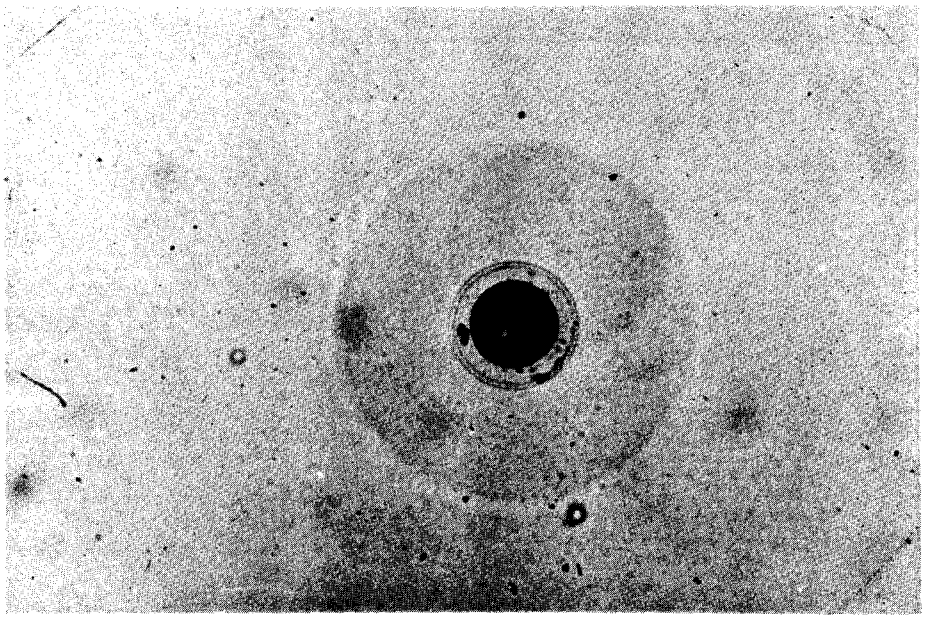
10 μ



(1)

Radio-autograph (×550)

10 μ

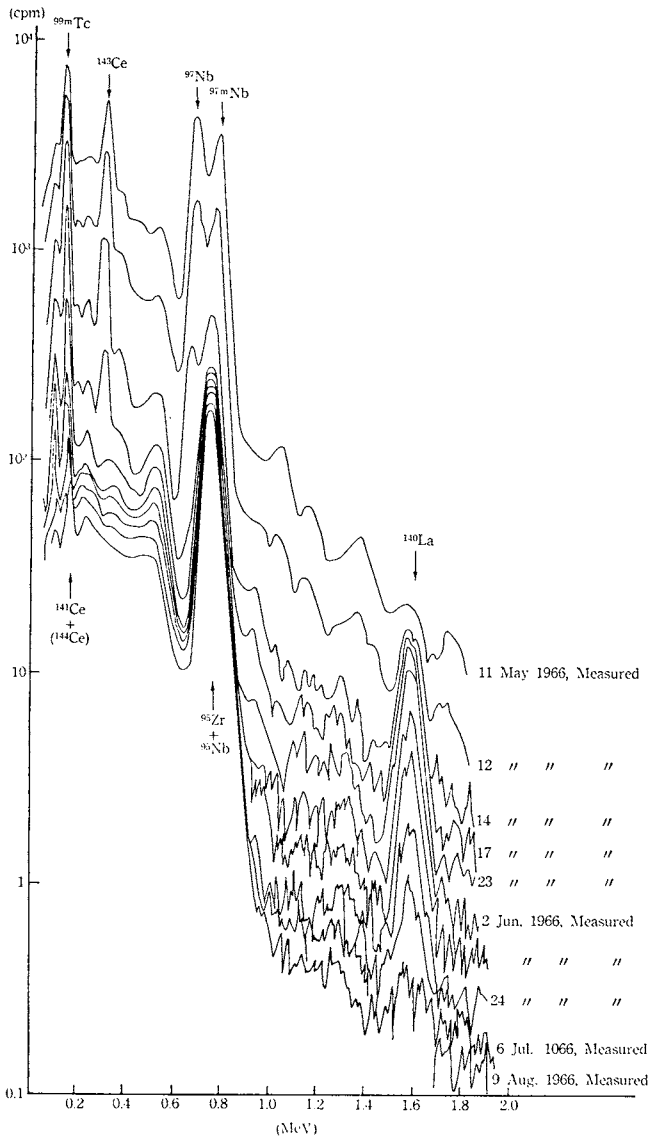


(2)

Micro-photograph (×550)

Gross-beta : about 5,500 cpm
Diameter : 20 μ
Colour : Black blue

Figure 7. Gamma-ray Spectrum of Highly Radioactive Fallout Particle.
by M. Saiki, H. Kamada and Z. Murakoshi
(National Institute of Radiological Sciences)



Part 2 *(Meteorological Research Institute)*

The Meteorological Research Institute carried out radiochemical analysis of fallout particles collected on 11th May when the effects of 3rd Chinese bomb was detected.

Results obtained are indicated in Table 7.

Table 8 shows the contents and the ratio of Uranium-237 and Neptunium-239 in fallout particles originated from bombs by the People's Republic of China.

Table 7. Radiochemical Analysis of Giant Particles
—May 25, 1966—

By Y. Miyake, K. Saruhashi, Y. Katsuragi,
T. Kanazawa and Y. Sugimura
(Meteorological Research Institute, Tokyo)

Nuclides	(Percentage in Activity) Fission and induced product
^{239}Np	0.5%
^{237}U	0.9
^{99}Mo, ^{132}Te / ^{103}Ru, ^{106}Ru	5.1
^{95}Zr, ^{95}Nb	14.8
^{89}Sr, ^{90}Sr / ^{140}Ba	6.1
The rare-earth elements	72.6

Table 8. Contents and The Ratio of ^{237}U and ^{239}Np of Chinese Bomb Debris

By Y. Miyake, K. Saruhashi, Y. Katsuragi T. Kanazawa,
and Y. Sugimura
(Meteorological Research Institute, Tokyo)

Date of Nuclear Test	Days after Nuclear Test		(Percentage in Activity) Fission and induced Products
Oct. 16, 1964	5	^{237}U	2.5 %
		^{239}Np	64.0
		$^{237}U/^{239}Np$	0.04
May 14, 1965	7	^{237}U	1.0 %
		^{239}Np	31.2
		$^{237}U/^{239}Np$	0.03
May 9, 1966	5	^{237}U	0.6 %
		^{239}Np	2.8
		$^{237}U/^{239}Np$	0.2
	7	^{237}U	0.8 %
		^{239}Np	2.5
		$^{237}U/^{239}Np$	0.3

Dietary Data

Radioactive Iodine in Milk

(National Institute of Radiological Sciences and National Institute of Animal Industry)

Concentrations of radioactive iodine in Milk were determined by National Institute of Radiological Sciences during the period 10 to 31 May, 1966.

Milk Samples were taken mainly from a farm and a milk collecting center located in the northern part of Chiba prefecture, and the remaining samples were collected from farms in Akazaki, Niigata and Sapporo.

Sampling locations are indicated in Figure 8. The iodine was chemically separated and measured by using an iodine-131 standard with a beta-ray low back ground counter.

Results obtained are shown in Table 9 and 10.

Figure 8. Milk Sampling locations

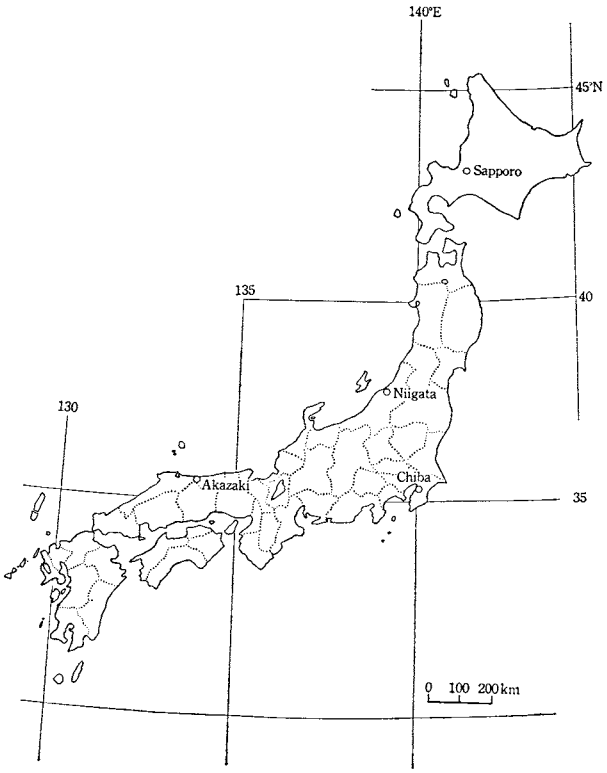


Table 9. Radioactive Iodine in Milk collected from The Northern Part of Chiba Prefecture. —May 10 to 31, 1966—

By M. Saiki, Y. Ohmomo, H. Yamaguchi and *H. Danbara
*(National Institute of Radiological Sciences, *National Institute of Animal Industry)*

Date of Sampling	Date of Determination	Radioactive Iodine (pCi/l)	Sample from
10 May 1966	11 May 1966	not detected	Farm
11 〃	11 〃	〃	〃
11 〃	11 〃	〃	Milk collecting center
12 〃	12 〃	42	Farm
12 〃	12 〃	10	Milk collecting center
13 〃	13 〃	12	Farm
13 〃	13 〃	9	Milk collecting center
14 〃	14 〃	10	Farm
14 〃	14 〃	8	Milk collecting center
15 〃	15 〃	4	Farm
15 〃	15 〃	2	Milk collecting center
16 〃	16 〃	4	Farm
16 〃	16 〃	not detected	Milk collecting center
17 〃	17 〃	4	Farm
17 〃	17 〃	5	Milk collecting center
18 〃	19 〃	3	Farm
18 〃	19 〃	not detected	Milk collecting center
25 〃	25 〃	2	Farm
31 〃	31 〃	2	Milk collecting center

Table 10. Radioactive Iodine in Milk from 3 locations in Japan. —May 13 to 21, 1966—

By M. Saiki, Y. Ohmomo, H. Yamaguchi and* H. Danbara
*(National Institute of Radiological Sciences, *National Institute of Animal Industry)*

Date of Sampling	Date of Determination	Radioactive Iodine (pCi/l)	Sample from
13 May 1966	14 May 1966	10	Farm in Akazaki
〃	〃	8	〃 Niigata
〃	〃	3	〃 Sapporo
17 May 1966	19 May 1966	4	〃 Akazaki
〃	〃	2	〃 Niigata
〃	〃	not detected	〃 Sapporo
21 May 1966	25 May 1966	3	〃 Akazaki
〃	〃	1	〃 Niigata
〃	〃	not detected	〃 Sapporo

Contributor

The results quoted in this Issue were contributed by the following Institute.

Institute and Address	Item
Meteorological Agency 7, Ote-machi-1-chome, Chiyoda-ku, Tokyo	Fallout
Meteorological Research Institute Kita-4-chome, Koenji, Suginami-ku, Tokyo	Fallout, Fallout Particles
Research and Development H. Q., Japan Defense Agency 13, Mita, Meguro-ku, Tokyo	Upper Air
National Institute of Animal Industry 959, Aoba-cho, Chiba-shi	Milk
National Institute of Radiological Sciences 9-1, Anagawa-4-chome, Chiba-shi	Fallout, Fallout Particles, Milk