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EUROPEAN ATOMIC ENERGY COMMUNITY - EURATOM

ENVIRONMENTAL RADIOACTIVITY
ISPRA 1968

by

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ABSTRACT

In this report are briefly described the measurements of environmental radioactivity performed during 1968 by the site survey group of the Protection Service.

Data are given on the concentrations of strontium-90, cesium-137 and other radionuclides in fallout, air, soil, waters, herbage, animal bones and foods.

KEYWORDS

ENVIRONMENT
RADIOACTIVITY
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CONTAMINATION
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RADIOACTIVE WASTES
ATMOSPHERE
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FOOD
FALLOUT
MILK
FISHES
BONES
VEGETABLES
SOILS
STRONTIUM 90
CESIUM 137
RADIATION DETECTORS
ALPHA DETECTION
BETA DETECTION
GAMMA DETECTION

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INTRODUCTION *)

This report summarizes the results of the environmental radioactivity measurements performed by the site survey group of the Protection Service.

The following reports on the same subject have already been published :

CNI	-	43	Misure di radioattività ambientale, Ispra 1958 - 59
CNI	-	95	Misure di radioattività ambientale, Ispra 1960
EUR	-	223i	Misure di radioattività ambientale, Ispra 1961
EUR	-	481i	Misure di radioattività ambientale, Ispra 1962
EUR	-	2213e	Environmental radioactivity, Ispra 1963
EUR	-	2509e	Environmental radioactivity, Ispra 1964
EUR	-	2965e	Environmental radioactivity, Ispra 1965
EUR	-	3554e	Environmental radioactivity, Ispra 1966
EUR	-	4088e	Environmental radioactivity, Ispra 1967

The main object of the measurements is the constant knowledge of the radioactivity levels on the site and in the environs of the Euratom Ispra Establishment, in order to identify and evaluate any radioactive contamination caused by the activities of the Establishment itself.

Most of the work is carried out in a laboratory equipped for chemical separation and radioactivity measurements (gamma and alpha spectrometry and low-level beta counting). The group also operates the area monitoring stations and a mobile unit. The geographical area surrounding the Establishment is represented in Figure 1.

The data obtained through the surveillance program

*) Manuscript received on 10 September 1969.

indicate that, also for the calendar year 1968, the environmental radiation exposure in the vicinity of the Establishment was due, almost exclusively, to natural sources and world-wide fallout.

The surveillance program adopted for 1968 is somewhat different from those of the previous years to match with the changed philosophy of the surveillance, the principles of which have been exposed elsewhere (1). As a consequence, some activities have been reduced or discontinued and some others have been implemented, following the criteria of emphasizing the surveillance of the critical nuclides, pathways of exposure and population groups. From our investigations these have been identified as follows :

Critical radionuclides	Critical pathways	Critical population groups
	GASEOUS EFFLUENTS	
^{41}A	Atmosphere	Cadrezzate residents
^{131}I	Atmosphere-Herbage-Milk	Cadrezzate infants
	LIQUID EFFLUENTS	
^{90}Sr	Lake Maggiore water-Drinking water	Residents of the Euratom Ispra village
^{137}Cs	Lake Maggiore water-fishes	Families of the professional fishermen

During 1968 an effort has been made in the development of emergency procedures and techniques and in the training of the monitoring teams and of the other staff members, charged with emergency responsabilities.

1. AIR RADIOACTIVITY

The monitoring of air radioactivity is actually carried out by means of 10 survey stations, located along the fence of the Establishment (see Figure 2).

The standard equipment of the stations at present includes : 1) paper filter ; 2) activated charcoal cartridge ; 3) thermoluminescence dosimeter ; 4) column collector ; 5) gamma radiation telemetering unit. Moreover 6 stations are equipped with continuously moving paper filter. Three of these devices have double scintillator detectors for the instantaneous telemetering of the alpha and beta activity of the dust collected on the filter.

The telemetering network has worked satisfactorily, giving only minor and unfrequent troubles during 1968, the first complete calendar year in which the entire system was in operation.

The daily values of the gross beta radioactivity in air, mean of the values measured in the single stations, are reported in Tables 1 to 4 and represented in Figure 3, along with the atmospheric precipitation data. An air radioactivity increase, due to the Chinese detonation of December 24, 1967, is apparent from these Tables approximately 8 - 10 days later.

The monthly mean of the gross beta radioactivity concentration and the concentration of some radionuclides in air are reported in Table 5. From this Table and from Figure 4, where the $^{89}Sr/^{90}Sr$ ratio in air and deposition is represented, it may be inferred that in the first half of the year the atmospheric radioactivity was largely influenced by the Chinese detonation of December. Successively, the persistence of the $^{89}Sr/^{90}Sr$ ratio at values around the unity seems to indicate the arrival of the debris injected into the stratosphere by the more powerful Chinese device of June 17, 1967. These two explosions are also responsible for the increased levels of the long-lived atmospheric radioactivity found in 1968 as compared with those observed in 1967. In fact, the experience of the previous years shows that, in the absence of new important injections into the stratosphere, the stratospheric radioactivity concentration measured at ground level decreases with a half-life of approximately one year.

This facts are well illustrated in Figure 5, where the air concentration of the most important long-lived radionuclides are represented since late 1961.

From this Figure and from the data in Table 5 it may also be seen that the activity of the SNAP ^{238}Pu has been slightly lower, though not the half, than during 1967. This seems to confirm a certain different behaviour of the ^{238}Pu debris in the transfer from the stratosphere to ground level air, which had already been noticed (2).

During 1968 an experiment was made to test the retention efficiency of the paper filters (Poelman-Schneider bleu) being used for the surveillance of air radioactivity. For this purpose, at two monitoring stations the normal filters have been replaced with more efficient filters (Poelman Schneider rose), for which the manufacturer gives an efficiency of 99.98% for a particle spectrum in the range 0.1 to 2 μm. These filters have been submitted to the radiochemical determination of ^{90}Sr and ^{239}Pu and the results compared with those obtained from the standard filters. The comparison is represented in Figure 6 in the form of a linear correlation.

The statistical analysis shows that with strong evidence the line drawn in Figure 6, of equation $y = 0.99\,x$, is significantly different neither from the least-squares line nor from the line of equation $y = x$. Therefore, it may be concluded that, under our conditions (linear velocity of air through the filter of about 0.13 m/sec) there is no difference between the two types of filters, i.e., the fraction of radioactive dust not retained by the Poelman-Schneider bleu filter is negligible.

2. RADIOACTIVITY OF ATMOSPHERIC PRECIPITATION AND DEPOSITION

Monthly samples of total (dry and wet) deposition are collected by stainless steel pots at Ispra (total collecting area 4 m^2) and, for reference purpose, in Milano (1 m^2). Gross beta counting and gamma spectrometry measurements, as well as radiochemical determinations of some radionuclides are performed on the dry residue obtained after evaporation. These deposition samples are in addition to those collected at the survey stations by the column collectors, which are conceived to give information concerning the routine or accidental releases of radioactivity by the Establishment installations.

Gross beta radioactivity, ^{90}Sr, ^{89}Sr, ^{137}Cs, ^{239}Pu and ^{238}Pu deposited at Ispra during 1968 are given in Table 6 and the same data, except plutonium, for Milano are reported in Table 7. Deposition values of 1968 for ^{90}Sr, ^{137}Cs and ^{239}Pu are 1.5 to 1.8 times higher than the corresponding values of 1967, while the ^{238}Pu activity deposited in the two years considered is almost the same.

Evidence of the influence of the Chinese nuclear detonations on the deposited radioactivity is provided through gamma spectrometry analyses, by the values of gross beta radioactivity and by the $^{89}Sr/^{90}Sr$ ratio. The data of gross beta radioactivity and of ^{90}Sr deposited at Ispra from 1958 through 1967 are represented in Figures 7 and 8 respectively.

3. RADIOACTIVITY OF WATERS

3.1. Control of liquid effluents

The radioactive liquid wastes produced in the Establishment are processed at the liquid decontamination facility. The autorization for releasing the decontaminated water into the sewer system of the Establishment is given only if the control shows that the activity to be discharged is within the limits allowed by the competent italian Authorities.

A further surveillance is carried out on the water of the Novellino brook, which carries all the liquid wastes of the Establishment into lake Maggiore. This task is accomplished by means of a monitoring station which has been described in details elsewhere (3).

The total activity released during 1968 and its composition are given in Table 8; it may be remarked that the levels involved are negligible, if compared with the radiological capacity of the environment interested.

An estimate of the contamination caused in the Novellino brook by the radioactive wastes has been made through gamma spectrometry analyses on bottom sediment samples collected at two locations on the stream. The observed ^{60}Co and ^{137}Cs concentrations are reported in Table 9; the first radionuclide is produced by the Establishment, whereas the second is mainly due to world-wide fallout.

3.2. Surface and under ground waters

Five liter water samples are collected monthly at 21 locations including lakes, streams, wells and tapwater. At two sites on lake Maggiore samples are taken also at depths of 25 and 50 m. All these samples are evaporated and counted for gross beta radioactivity. Flame photometric measurements of potassium, performed on each sample, allow subtraction from the gross radioactivity of the contribution due to the isotope 40 of this element.

In Tables 10 to 12 are reported the geographic coordinates of the sampling sites, the beta radioactivity concentration in the water of lake Maggiore and at the other sites, respectively.

Large samples (100 to 500 l) of water from four lakes (Maggiore, Varese, Comabbio and Monate) and from two streams (Ticino and Novellino) are submitted to gamma spectrometry and radiochemical determinations of single radionuclides. The data obtained from these analyses are reported in Table 13.

4. HERBAGE RADIOACTIVITY

Herbage contamination is monitored at six off-site locations and in five on-site areas (see maps in Figures 1 and 2). The former, at which also soil samples are collected, are in the neighbourhodd of the following villages : Barza, Brebbia, Ispra, Monvalle, Osmate and Taino.

Two kilograms (fresh weight) samples are collected monthly during the growing season (April to October) clipping randomly several sub-samples in different fields at each site. The samples are dried and submitted to gamma spectrometry ; the radiochemical determination of ^{90}Sr is performed on ashed aliquots of the samples. During 1968 this has been carried out only on a pooled annual sample for each site, whereas the ^{137}Cs concentration has been determined on the single samples by direct gamma spectrometry.

The data obtained from herbage analyses during 1968 are reported in Tables 14, 15, 15 bis and 16.

From the comparison of the data obtained on-site and off-site it may be observed that the levels of contamination are substantially the same and, as already mentioned, due to world-wide fallout.

5. ^{90}Sr AND ^{137}Cs IN MILK

One liter milk samples are collected twice a week in the dairies of four villages (Brebbia, Cadrezzate, Ispra and Osmate) and in the milk supply stations of Varese and Milano. Gamma spectrometry and radiochemical determinations of ^{90}Sr are performed on the pooled bi-monthly samples. The complete results of the analyses are reported in Tables 17 to 22 and partially (^{90}Sr only) represented in Figure 9.

6. ^{90}Sr AND ^{137}Cs IN FISHES

Three biological species from lakes Comabbio, Monate and Varese and five from lake Maggiore are sampled and submitted to gamma spectrometry and radiochemical determinations of ^{90}Sr.

The fish samples are supplied, on a quarterly basis, directly by the fisher-men of the lakes. As in the preceding years, also during 1968, some samples were not available, particularly in winter months.

The data on radioactivity in fishes are reported in Tables 23 to 26.

7. ^{90}Sr IN CALF-BONES

Femour samples of about 2 month old, milk fed calves are collected at the neighbour villages and analysed for their ^{90}Sr content. These analyses have been reduced and are actually performed twice a year on the samples collected at six sites.

The values of the ^{90}Sr concentration, expressed as pCi/g ash, are reported in Table 27.

8. ^{90}Sr IN VEGETABLES

Samples of some of the more largely consumed vegetable species, available on the market of Milano, are collected monthly and submitted to gamma spectrometry measurements.

Yearly pooled samples are processed for ^{90}Sr and ^{137}Cs determinations. The results are reported in Table 28.

9. OTHER ACTIVITIES

During 1968 a special effort has been made for the development of the instruments and techniques and for the training of the teams to be employed in the event of an accidental release of radioactivity into the environment. This work has been performed on the basis of an emergency plan which had been developed previously in cooperation with the national and local Authorities.

The procedures which have been developed and adopted are described in details in a separate report to be published. Here only the general features of the emergency organization are described.

In the case of an accidental release of radioactivity to the environment, the monitoring control center (P.C.) is activated.

This is located in a room equipped with communication systems and where all the data and alarms from the telemetering air monitoring network are centralized (Figure 10).

On the basis of the meteorological information, vehicles equipped with portable instruments (Figure 11) and a radio unit are sent along pre-established routes to selected monitoring points in the sector (or sectors) likely to include the contaminated area.

The equipment on board of the vehicles (Figures 12) is suitable for the collection and field analysis of air, vegetation and milk samples and for the direct evaluation of the radioactivity deposited to the ground.

The standard equipment consists of : 1) a battery-operated high volume air sampler with paper and charcoal filters ; 2) a single channel NaI(Tl) gamma monitor ; 3) an instrument with large area scintillation alpha and beta detectors ; 4) a portable ionisation chamber for air-dose measurements ; 5) tools for sample collection ; 6) individual protective clothing.

NOTE The surveillance of soil radioactivity, of which no mention is made in this report, has not been discontinued. Persisting the actual operation conditions of the Establishment and considering the information already gained locally on the subject (4), it has been decide to carry on the surveillance on a bi-annual basis.

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Table 1

CONCENTRATION OF GROSS BETA RADIOACTIVITY

IN AIR AT ISPRA

1968

Day	JANUARY		FEBRUARY		MARCH	
	pCi/m^3	mm rain	pCi/m^3	mm rain	pCi/m^3	mm rain
1	0.85		0.34		0.25	
2	1.18		0.20		0.37	
3	2.01		0.08	5.4	0.29	
4	2.08		0.09	5.6	0.28	
5	1.09		0.28		0.46	
6	0.51		0.07	28.6	0.35	
7	0.05	2.0	0.08	2.8	0.12	31.0
8	0.10		0.05	27.8	0.17	
9	0.47	0.6	0.07	6.6	0.19	
10	0.43		0.12		0.32	
11	0.17		0.67		0.07	
12	0.26		0.83		0.42	
13	0.29		0.64		0.55	
14	0.44		0.37	0.4	0.48	
15	0.28		0.23	5.2	0.45	
16	0.30		0.14		0.31	0.4
17	0.82		0.15		0.33	
18	0.36		0.23		0.39	
19	0.36		0.27		0.39	
20	0.45		0.28		0.39	1.6
21	0.68		0.09	13.6	0.09	37.4
22	0.94		0.04	22.0	0.18	0.2
23	1.09		0.04	14.8	0.25	
24	0.40		0.02	30.6	0.25	
25	0.26		0.10		0.24	
26	0.14		0.19	0.2	0.23	
27	0.14		0.19	0.6	0.36	
28	0.15		0.30		0.41	
29	0.11		0.36		0.51	
30	0.41				0.50	
31	0.41				0.54	
Av. value	0.56		0.22		0.33	
Min.value	0.05		0.02		0.07	
Max.value	2.08		0.83		0.55	
Total precipit.		2.6		164.2		70.6

Table 2

CONCENTRATION OF GROSS BETA RADIOACTIVITY

IN AIR AT ISPRA

1968

Day	APRIL		MAY		JUNE	
	pCi/m^3	mm rain	pCi/m^3	mm rain	pCi/m^3	mm rain
1	0.53		0.30	0.8	0.31	11.2
2	0.54		0.10	14.6	0.42	
3	0.59	3.8	0.12	1.4	0.47	
4	0.59		0.33	32.0	0.39	3.4
5	0.12	20.2	0.42	17.6	0.23	
6	0.16	23.8	0.23	2.0	0.18	40.6
7	0.41	5.4	0.34	3.6	0.22	0.6
8	0.31	0.2	0.36		0.32	21.0
9	0.29		0.55	0.4	0.32	
10	0.36		0.54	0.6	0.26	
11	0.37		0.65	0.2	0.31	0.4
12	0.39	1.0	0.29	33.8	0.33	1.6
13	0.27	4.6	0.38		0.11	22.0
14	0.38	2.2	0.50		0.13	0.8
15	0.28	0.2	0.43		0.29	16.2
16	0.16		0.40		0.25	4.4
17	0.15		0.39		0.24	
18	0.28		0.28		0.34	
19	0.37		0.38	0.4	0.35	9.8
20	0.43		0.30	9.0	0.26	1.6
21	0.45		0.05	12.2	0.29	7.4
22	0.50		0.08	12.2	0.38	
23	0.52		0.42		0.35	24.6
24	0.59	0.8	0.47		0.35	0.6
25	0.68	0.2	0.50	0.6	0.26	
26	0.56		0.29	42.2	0.26	
27	0.52	0.6	0.17	42.0	0.27	
28	0.50	12.0	0.20	20.8	0.31	
29	0.17	12.4	0.23	6.0	0.32	
30	0.39	1.6	0.23	2.2	0.29	
31			0.20	0.6		
Av.value	0.40		0.34		0.30	
Min.value	0.12		0.05		0.11	
Max.value	0.68		0.65		0.47	
Total precipit.		89.0		255.2		166.2

Table 3

CONCENTRATION OF GROSS BETA RADIOACTIVITY IN AIR AT ISPRA

1968

Day	J U L Y		A U G U S T		S E P T E M B E R	
	pCi/m³	mm rain	pCi/m³	mm rain	pCi/m³	mm rain
1	0.28		0.31	1.4	0.15	
2	0.31		0.48	32.4	0.19	0.8
3	0.31		0.03	0.4	0.17	43.2
4	0.29	0.4	0.03		0.07	18.4
5	0.33		0.19	22.8	0.14	
6	0.59		0.19	9.0	0.16	
7	0.46		0.18	35.4	0.14	
8	0.44	0.4	0.18	17.4	0.17	
9	0.45		0.13	1.4	0.18	
10	0.43	1.8	0.19	3.6	0.23	1.8
11	0.37		0.17	0.2	0.12	40.8
12	0.64		0.16	0.6	0.15	0.2
13	0.35		0.17	40.0	0.19	0.2
14	0.20	51.8	0.15	0.4	0.19	21.6
15	0.33	0.2	0.09	0.2	0.13	96.8
16	0.26	5.2	0.17		0.13	
17	0.07	14.8	0.15	13.4	0.08	1.8
18	0.15		0.22	0.2	0.13	
19	0.19		0.32		0.12	
20	0.39		0.34		0.10	
21	0.35		0.27		0.12	1.6
22	0.31		0.25		0.14	0.2
23	0.30	4.2	0.22		0.11	
24	0.14	4.4	0.27	0.2	0.12	0.2
25	0.12	0.2	0.28		0.09	
26	0.17		0.26		0.11	
27	0.23		0.22	3.8	0.10	0.2
28	0.22		0.21	6.4	0.10	
29	0.21		0.11	34.2	0.10	
30	0.25		0.21	0.6	0.08	
3 31	0.25	1.0	0.14			
Av.value	0.30		0.20		0.13	
Min.value	0.07		0.03		0.07	
Max.value	0.64		0.48		0.23	
Total precipit.		84.4		224.0		227.8

Table 4

CONCENTRATION OF GROSS BETA RADIOACTIVITY

IN AIR AT ISPRA

1968

Day	OCTOBER		NOVEMBER		DECEMBER	
	pCi/m^3	mm rain	pCi/m^3	mm rain	pCi/m^3	mm rain
1	0.09		0.07	141.8	0.14	
2	0.07	0.2	0.07	151.6	0.13	
3	0.10	0.2	0.04	29.6	0.12	
4	0.08		0.02	31.6	0.11	
5	0.10	0.4	0.06	8.0	0.17	
6	0.09	0.2	0.04	8.2	0.20	
7	0.11	0.2	0.05	0.2	0.18	0.2
8	0.09	19.6	0.06	12.4	0.07	15.2
9	0.04	0.6	0.05	3.8	0.05	0.4
10	0.06	0.2	0.04	0.4	0.07	0.4
11	0.06	0.2	0.06	0.4	0.11	
12	0.09	0.4	0.07	1.8	0.12	
13	0.11	0.2	0.08		0.13	0.2
14	0.14		0.08	0.6	0.06	
15	0.10		0.06	3.8	0.16	
16	0.05	17.2	0.02	22.8	0.09	11.2
17	0.11	0.2	0.04	22.0	0.04	1.2
18	0.12	0.2	0.10	4.0	0.04	4.8
19	0.10	0.2	0.11		0.10	0.2
20	0.12		0.15		0.10	
21	0.10		0.16		0.12	
22	0.15	0.4	0.15	0.2	0.07	
23	0.17	0.2	0.14		0.09	0.2
24	0.16	0.2	0.12		0.08	
25	0.14	11.8	0.14	0.2	0.12	2.6
26	0.07	2.2	0.10	0.2	0.07	0.2
27	0.07	0.4	0.15	0.2	0.04	
28	0.07		0.11		0.06	
29	0.08	0.2	0.09	0.2	0.08	
30	0.12		0.11		0.09	
31	0.11	6.2			0.09	
Av.value	0.10		0.08		0.10	
Min.value	0.04		0.02		0.04	
Max.value	0.17		0.16		0.20	
Total precipit.		61.8		444.0		36.8

Table 5

AIR RADIOACTIVITY

1968

Month	Gross beta pCi/m^3	^{90}Sr $10^{-3} pCi/m^3$	^{89}Sr $10^{-3} pCi/m^3$	^{137}Cs $10^{-3} pCi/m^3$	^{239}Pu $10^{-5} pCi/m^3$	^{238}Pu $10^{-5} pCi/m^3$
January	0.56	1.6	18	1.9	4.9	1.5
February	0.22	1.3	13	2.5	5.7	1.4
March	0.33	3.0	19	4.3	8.6	1.3
April	0.40	4.0	12	6.4	12	2.4
May	0.34	4.2	6.0	7.0	12	2.4
June	0.30	3.6	3.0	5.9	8.7	1.5
July	0.30	4.4	2.3	6.4	8.9	1.4
August	0.20	2.5	1.8	4.6	8.9	1.2
September	0.13	1.7	0.65	2.8	6.2	1.2
October	0.10	0.82	0.95	1.8	3.4	0.68
November	0.08	0.91	0.77	1.6	3.1	0.50
December	0.10	1.0	1.2	2.1	3.4	0.50

Table 6

MONTHLY FALLOUT DEPOSITION

I S P R A

Month	Gross beta (1)		Strontium-90		^{89}Sr	Cesium-137		^{239}Pu	^{238}Pu	Precipitation
	mCi/Km^2	date (2)	mCi/Km^2	pCi/l	mCi/Km^2	mCi/Km^2	pCi/l	$\mu Ci/Km^2$	$\mu Ci/Km^2$	mm
January	1.0	8- 2	0.018	6.9	0.082	0.031	12	0.90	0.22	2.6 *
February	3.7	22- 3	0.084	0.51	0.92	0.13	0.79	1.5	0.51	164.2 **
March	4.7	18- 4	0.12	1.7	0.61	0.20	2.8	2.2	0.40	70.6 ***
April	15	15- 5	0.40	4.5	0.89	0.67	7.5	7.1	1.7	89.0
May	27	14- 6	-	-	-	1.2	4.7	13.7	2.7	255.2
June	12	12- 7	0.37	2.2	0.32	0.65	3.9	8.6	1.7	166.2
July	7.5	13- 8	0.21	2.5	0.12	0.35	4.1	3.7	0.70	84.4
August	11	16- 9	0.35	1.6	0.32	0.67	3.0	4.4	1.2	224.0
September	5.8	15-10	0.18	0.79	0.14	0.29	1.3	4.2	0.84	227.8
October	2.7	20-11	0.07	1.1	0.09	0.11	1.8	2.1	0.42	61.8
November	6.3	16-12	0.18	0.4	0.19	0.33	0.7	4.6	0.97	444.0
December	0.88	21- 1	0.03	0.82	0.02	0.04	1.0	1.0	0.20	36.8

(1) - Potassium-40 equivalent (40 mg/cm^2)
(2) - Day and month of the gross beta measurement
* - Snow 1.0 cm ** - Snow 2.0 cm *** - Snow 3.0 cm

Table 7

MONTHLY FALLOUT DEPOSITION

M I L A N O

Month	Gross beta (1)		Strontium-90		^{89}Sr	Cesium-137		Precipitation
	mCi/Km^2	date (2)	mCi/Km^2	pCi/l	mCi/Km^2	mCi/Km^2	pCi/l	mm
January	1.6	8- 2	0.016	6.2	0.11	0.044	17	2.6 *
February	4.8	22- 3	0.10	0.78	0.55	0.17	1.3	128.2
March	3.3	18- 4	0.088	7.7	0.20	0.15	13	11.4
April	10	15- 5	0.30	7.2	0.78	0.50	12	41.8
May	14	14- 6	0.39	4.8	0.62	0.72	8.9	80.8
June	9.4	12- 7	0.25	2.3	0.14	0.44	4.0	109.0
July	6.3	13- 8	0.18	3.8	0.15	0.32	6.8	47.2
August	11	16- 9	0.31	1.5	0.39	0.67	3.2	200.8
September	3.2	15-10	0.08	1.3	0.07	0.15	2.5	59.8
October	1.4	20-11	0.04	0.8	0.06	0.07	1.2	52.0
November	2.3	16-12	0.07	0.7	0.06	0.13	1.2	105.0
December	1.8	21-1	0.04	0.7	0.07	0.07	1.2	57.6

(1) = Potassium-40 equivalent (40 mg/cm^2)
(2) = Day and month of the gross beta measurement
* = Snow 4.0 cm

Table 8

ACTIVITY OF THE LIQUIDS WASTED BY THE LIQUID DECONTAMINATION FACILITY

1968

	Total (mCi)	Concentration (1) (10^{-6} μCi/cm^3)
Gross beta	14.06	8.1
Gross alpha	0.0044	0.0025
Cobalt-60	2.47	1.4
Cesium-137	3.53	2.0
Cesium-134	3.45	2.0
Iodine-131	3.98	2.3
Strontium-90	0.21	0.12

Number of the releases : 13

Volume of wastes (m^3) : 1 746.6

(1) = Before release into the Establishment sewer system.

Table 9

^{60}Co and ^{137}Cs CONCENTRATION IN THE BOTTOM SEDIMENTS OF THE BROOK NOVELLINO

(pCi/g dry matter)

1968

Sampling date	Establishment fence		Mouth of the brook	
	^{137}Cs	^{60}Co	^{137}Cs	^{60}Co
March	0.95	0.83	0.72	0.84
June	0.84	0.48	0.53	0.41
September	1.0	0.47	0.86	0.40
December	1.1	0.50	1.1	0.20
Mean annual value	0.97	0.57	0.80	0.46

Data of gross beta radioactivity of samples of geographical and drinkable waters — Table 10

Siting of the stations of collection

Geographical and drinkable waters	Collection site	Lat. (N)	Long. (E)	Alt. (m)
River waters				
Acque Nere I	River-mouth	45°49'33"	8°37'23	193
Novellino	-	45°49'10"	8°37'25"	200
Acque Nere II	Bridge	45°48'50"	8°38'28"	207
Ticino	Sesto Calende	45°43'22"	8°37'36"	193
Lake waters				
Maggiore I	Luino	46°00'10"	8°44'45"	213
Maggiore II	Laveno	45°54'30"	8°37'15"	193
Maggiore III	Center of the lake	45°54'26"	8°34'31"	193
Maggiore IV	Center of the lake	45°54'26"	8°34'31"	193
Maggiore V	Center of the lake	45°54'26"	8°34'31"	193
Maggiore VI	Stresa	45°53'03"	8°32'20"	193
Maggiore VII	Arolo	45°51'40"	8°36'35"	225
Varese	-	45°49'00"	8°43'08"	238
Maggiore VIII	Lesa	45°49'45"	8°33'55"	193
Maggiore IX	Ispra bay	45°49'25"	8°37'10"	193
Maggiore X	Ispra port	45°48'50"	8°36'28"	193
Maggiore XI	Ranco	45°48'06"	8°33'08"	193
Maggiore XII	Ranco	45°48'06	8°33'08"	193
Maggiore XIII	Ranco	45°48'06"	8°33'08"	193
Monate	-	45°48'07"	8°38'55"	266
Comabbio	-	45°46'48"	8°41'38"	243
Maggiore XIV	Angera	45°46'18"	8°34'20"	200
Drinkable waters				
-	Cascina Casello well	45°48'40"	8°37'10"	213
-	Roccolo	45°48'11"	8°37'36"	247
-	Cascina Gabriella well	45°48'10"	8°36'30"	216
-	Cascina Baraggiola well	45°48'57"	8°37'23"	219
-	Cascina Antonietta well	45°49'25"	8°37'57"	211

Table 11

BETA RADIOACTIVITY SUBTRACTED POTASSIUM-40 IN THE WATER OF LAKE "MAGGIORE"

pCi/l

1968

	Sampling point		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
P1	Center of the lake	(surface)	2.1	2.0	1.8	1.8	1.8	3.2	2.5	2.6	< 0.5	1.6	1.9	2.3	2.01
P1	Center of the lake	(m 25)	0.9	1.2	0.7	2.1	2.9	2.0	1.7	1.8	1.2	2.7	1.5	1.9	1.72
P1	Center of the lake	(m 50)	1.5	1.2	1.3	1.5	2.5	2.3	1.9	1.6	1.9	0.9	1.7	1.9	1.68
P2	Ranco	(surface)	1.2	2.0	0.9	0.5	2.1	2.5	2.9	2.3	2.2	2.0	3.6	1.7	1.99
P2	Ranco	(m 25)	1.1	1.9	1.1	2.0	2.8	2.0	2.0	1.8	0.9	2.0	0.5	2.1	1.68
P2	Ranco	(m 50)	2.8	1.5	1.9	1.8	1.5	1.6	1.8	1.6	1.5	2.2	0.9	0.9	1.67
P3	Luino	(surface)	1.9	0.8	1.9	1.8	4.8	1.7	3.1	1.2	1.9	1.8	1.8	1.5	2.02
P4	Laveno	"	2.2	1.9	2.0	2.4	2.2	2.2	3.3	1.8	2.1	2.6	1.6	1.2	2.12
P5	Arolo	"	2.0	2.4	2.1	1.6	7.2	2.2	1.7	1.7	2.8	2.5	1.5	1.6	2.44
P6	Bay Ispra	"	1.6	2.0	0.8	1.6	3.1	3.8	3.1	2.7	2.5	1.9	1.9	2.5	2.29
P7	Port Ispra	"	2.5	1.0	2.7	2.2	5.6	3.0	2.9	3.3	3.0	2.5	1.3	2.7	2.72
P8	Angera	"	2.4	1.6	2.3	2.1	2.6	2.6	2.9	2.7	1.6	2.6	1.9	2.0	2.27
P9	Lesa	"	1.5	0.6	4.4	2.0	1.7	1.9	2.3	2.0	2.3	2.0	1.5	1.6	1.98
P10	Stresa	"	1.5	1.8	3.1	2.4	4.3	2.8	1.4	0.9	3.9	2.1	2.1	3.2	2.46
	Average value		1.80	1.56	1.93	1.84	3.22	2.41	2.39	2.00	2.02	2.10	1.69	1.94	

Table 12

BETA RADIOACTIVITY SUBTRACTED POTASSIUM-40 IN LAKES, STREAMS AND WELLS

NEAR TO THE ISPRA ESTABLISHMENT pCi/l

1968

	Sampling point	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	Lakes													
P11	Monate	7.0	5.2	6.6	5.5	5.8	9.2	8.6	9.0	8.6	7.8	7.7	6.9	7.32
P12	Comabbio	5.6	6.4	6.5	7.7	7.3	8.3	7.4	8.4	5.9	6.6	5.5	5.5	6.76
P13	Varese	4.1	3.8	3.2	4.9	4.5	6.3	5.1	4.2	4.1	2.5	3.5	3.6	4.15
	Rivers													
P14	Acqua Nera I	2.0	3.0	2.8	3.3	4.7	5.0	3.4	3.3	4.8	2.8	4.4	3.1	3.55
P15	Acqua Nera II	1.1	2.9	2.7	2.8	3.7	5.0	2.9	3.8	3.2	2.5	5.4	3.8	3.32
P16	Ticino	1.9	1.8	<0.5	0.5	3.1	1.4	2.5	2.3	1.1	1.7	2.3	2.3	1.78
	Drinkable Waters													
P17	Aqueduct Ispra	1.3	2.1	<0.5	0.8	1.0	2.2	1.9	1.4	<0.5	1.8	1.6	1.2	1.36
P18	Farm Casello	1.4	1.0	0.6	0.9	1.0	<0.5	1.2	0.7	4.3	<0.5	<0.5	<0.5	1.09
P19	Farm Gabriella	<0.5	0.9	<0.5	<0.5	1.2	1.6	1.8	<0.5	1.0	0.5	<0.5	0.7	0.85
P20	Farm Baraggiola	1.2	1.5	1.3	0.6	3.8	0.9	1.5	<0.5	0.6	0.9	0.9	2.3	1.33
P21	Farm Antonietta	1.1	1.7	1.0	0.5	<0.5	<0.5	<0.5	0.9	2.2	<0.5	<0.5	1.3	0.93

Table 13

RADIONUCLIDES IN LAKES AND STREAMS

1968

	Sampling period	^{90}Sr pCi/l	Ca mg/l	^{90}Sr pCi/g Ca	^{137}Cs pCi/l	K mg/l	^{137}Cs pCi/g K
Lake Maggiore	1st quarter	0.82	20.1	41	0.20	1.90	105
" "	2nd quarter	0.75	20.1	37	0.19	1.83	104
" "	3rd quarter	0.57	25	23	0.22	1.64	134
" "	4th quarter	0.67	19	35	0.10	2.07	48
Lake Comabbio	year	2.7	33	82	0.71	2.03	350
Lake Monate	year	3.8	13	292	0.56	1.18	470
Lake Varese	year	1.7	40	43	0.35	2.59	135
River Ticino	January-June	0.65	20.4 *	31	-	-	-
(Sesto Calende)	July-December	0.64	20.4 *	31	-	-	-
Brook Novellino	1st quarter	0.96	29.4	33	1.0	3.5	290
" "	2nd quarter	0.64	21.0	30	1.1	3.0	370
" "	3rd quarter	0.74	18.3	40	0.45	2.5	180
" "	4th quarter	0.65	22.6	29	0.35	4.0	88

* = Mean yearly value.

\- = Measurement not performed.

Table 14

MEAN CONCENTRATION OF ^{90}Sr and ^{137}Cs IN HERBAGE [1]

1968

Sampling site	^{90}Sr pCi/g	Ca mg/g	^{90}Sr pCi/g Ca	^{137}Cs pCi/g	K mg/g	^{137}Cs pCi/g K
Barza	2.3	14.4	160	0.71	22.9	31.0
Brebbia	2.1	15.6	135	0.64	24.9	25.7
Ispra	2.0	15.2	132	1.0	20.7	48.3
Monvalle	1.7	17.2	99	0.91	19.7	46.2
Osmate	3.5	18.0	194	0.91	21.2	42.9
Taino	2.0	14.4	139	0.74	25.2	29.4

(1) = Dry matter.

Table 15

CESIUM-137 IN HERBAGE (1)

1968

Sampling site	Sampling date	R(2)	^{137}Cs pCi/g	K mg/g	^{137}Cs pCi/g K
Barza	16 - 4	5.34	0.68	29.1	23
Brebbia	"	5.63	0.43	29.3	15
Ispra	"	5.71	0.57	30.2	19
Monvalle	"	6.25	0.97	18.6	52
Osmate	"	8.00	0.83	30.0	28
Taino	"	8.00	0.68	31.8	21
Barza	15 - 5	6.06	1.1	19.7	56
Brebbia	"	6.66	0.97	26.0	37
Ispra	"	5.96	1.1	25.8	43
Monvalle	"	6.45	0.88	31.0	28
Osmate	"	6.90	1.1	11.0	100
Taino	"	7.55	0.80	23.7	34
Barza	18 - 6	6.15	1.1	23.9	46
Brebbia	17 - 6	6.45	0.83	25.8	32
Ispra	"	5.71	1.1	16.3	67
Monvalle	"	5.00	0.76	16.5	46
Osmate	18 - 6	6.78	0.83	23.8	35
Taino	"	6.25	0.81	25.9	31

(1) = Values are given per weight unity of dry matter.

(2) = Weight ratio of the fresh matter at the collection to the dry matter.

Table 15 bis

CESIUM-137 IN HERBAGE (1)

1968

Sampling site	Sampling date	$R^{(2)}$	^{137}Cs pCi/g	K mg/g	^{137}Cs pCi/g K
Barza	16 - 7	5.71	0.64	20.6	31
Brebbia	17 - 7	5.80	0.62	23.0	27
Ispra	""	6.66	0.90	16.7	54
Monvalle	""	7.85	1.5	15.9	94
Osmate	""	5.12	0.82	17.9	46
Taino	""	6.66	0.86	19.0	45
Barza	12 - 8	5.89	0.55	15.6	35
Brebbia	""	5.71	0.74	23.2	32
Ispra	""	6.66	1.1	23.6	47
Monvalle	""	8.34	0.66	21.7	30
Osmate	""	7.15	1.1	23.0	48
Taino	""	7.40	0.77	29.1	26
Barza	18 - 9	6.06	0.52	25.3	21
Brebbia	""	5.89	0.59	21.6	27
Ispra	""	6.66	1.1	19.4	57
Monvalle	""	5.96	0.81	14.9	54
Osmate	""	6.15	1.0	16.3	61
Taino	""	5.96	0.70	25.7	27
Barza	16 - 10	5.40	0.40	26.5	15
Brebbia	""	6.66	0.32	25.3	13
Ispra	""	4.71	1.1	12.6	87
Monvalle	""	6.25	0.81	19.6	41
Osmate	""	5.00	0.66	26.2	25
Taino	""	5.00	0.57	20.9	27

(1) = Values are given per weight unity of dry matter.

(2) = Weight ratio of the fresh matter at the collection to the dry matter.

Table 16

^{137}Cs and ^{90}Sr IN HERBAGE WITHIN THE ESTABLISHMENT

(pCi/g dry matter)

1968

Sampling date \ ZONE (1)	1	2	3	4	5	Mean
Cesium-137						
April	0.51	0.39	0.50	1.2	0.52	0.62
May	0.96	0.85	0.75	1.9	1.4	1.17
June	0.85	0.45	0.65	1.8	1.2	0.99
July	0.97	0.32	0.53	1.8	0.59	0.84
August	0.49	0.31	1.1	1.3	1.4	0.92
September	0.57	0.54	1.3	0.97	0.69	0.81
October	0.36	0.46	0.42	1.6	0.69	0.71
Mean	0.67	0.47	0.75	1.51	0.93	0.87
Strontium-90	1.7	1.9	2.0	5.3	2.8	2.74

(1) = See map in Figure 2.

Table 17

STRONTIUM-90 AND CESIUM-137 IN MILK

BREBBIA

1968

Month	^{90}Sr pCi/l	Ca g/l	^{90}Sr pCi/g Ca	^{137}Cs pCi/l	K g/l	^{137}Cs pCi/g K
January - February	32	0.98	33	82	1.58	52
March - April	32	1.15	28	85	1.57	54
May - June	42	1.20	35	68	1.57	43
July - August	35	1.07	33	63	1.58	40
September - October	33	1.17	28	71	1.54	46
November - December	32	1.27	25	83	1.58	53

Table 18

STRONTIUM-90 AND CESIUM-137 IN MILK

CADREZZATE

1968

Month	^{90}Sr pCi/l	Ca g/l	^{90}Sr pCi/g Ca	^{137}Cs pCi/l	K g/l	^{137}Cs pCi/g K
January - February	35	1.05	33	85	1.50	57
March - April	37	1.17	32	78	1.50	52
May - June	40	1.27	32	66	1.50	44
July - August	36	1.10	33	70	1.47	48
September - October	36	1.25	29	76	1.45	52
November - December	34	1.25	27	75	1.55	48

Table 19

STRONTIUM-90 AND CESIUM-137 IN MILK

I S P R A

1968

Month	^{90}Sr pCi/l	Ca g/l	^{90}Sr pCi/g Ca	^{137}Cs pCi/l	K g/l	^{137}Cs pCi/g K
January - February	32	1.00	32	106	1.61	66
March - April	27	1.02	26	106	1.55	68
May - June	37	1.27	29	108	1.55	70
July - August	26	1.10	24	95	1.45	65
September - October	29	1.22	24	101	1.42	68
November - December	28	1.22	23	102	1.56	65

Table 20

STRONTIUM-90 AND CESIUM-137 IN MILK

O S M A T E

1968

Month	^{90}Sr pCi/l	Ca g/l	^{90}Sr pCi/g Ca	^{137}Cs pCi/l	K g/l	^{137}Cs pCi/g K
January - February	36	1.03	35	64	1.52	42
March - April	29	1.02	28	58	1.48	39
May - June	42	1.30	32	21	1.53	14
July - August	40	1.15	35	71	1.49	48
September - October	34	1.20	28	65	1.49	44
November - December	32	1.27	25	88	1.72	51

Table 21

STRONTIUM-90 AND CESIUM-137 IN MILK

V A R E S E

1968

Month	^{90}Sr pCi/l	Ca g/l	^{90}Sr pCi/g Ca	^{137}Cs pCi/l	K g/l	^{137}Cs pCi/g K
January - February	24	1.02	24	52	1.48	35
March - April	24	1.07	22	55	1.54	36
May - June	30	1.27	24	51	1.51	34
July - August	26	1.07	24	60	1.55	39
September - October	26	1.22	21	57	1.53	37
November - December	22	1.27	17	63	1.51	42

Table 22

STRONTIUM-90 AND CESIUM-137 IN MILK

M I L A N O

1968

Month	^{90}Sr pCi/l	Ca g/l	^{90}Sr pCi/g Ca	^{137}Cs pCi/l	K g/l	^{137}Cs pCi/g K
January - February	7.7	0.97	8	14	1.50	9
March - April	6.3	1.02	6.2	14	1.52	9
May - June	8	1.10	7	59	1.47	40
July - August	8.1	0.97	8.4	18	1.40	13
September - October	8.3	1.17	7	13	1.41	9
November - December	6.9	1.15	6	16	1.47	11

Table 23

CESIUM-137 IN LAKE MAGGIORE FISHES (1)

1968

Biological species	Sampling date	^{137}Cs pCi/g	K mg/g	^{137}Cs pCi/g K
Perca fluviatilis	7 - 3	0.37	2.72	136
Scardinius erythrophtalmus	7 - 3	0.16	2.92	55
Lepomis gibbosus (2)	-	-	-	-
Alburnus alborella	7 - 3	0.3	2.74	110
Coregonus sp. ("bondella")	-	-	-	-
Perca fluviatilis	6 - 6	0.53	3.06	173
Scardinius erythrophtalmus	7 - 6	0.23	3.25	71
Lepomis gibbosus	7 - 6	0.17	2.86	59
Alburnus alborella	19 - 6	0.43	3.56	120
Coregonus sp.("bondella")	18 - 6	0.24	2.97	81
Perca fluviatilis	17 - 9	0.33	3.02	109
Scardinius erythrophtalmus	17 - 9	0.21	2.67	79
Lepomis gibbosus	-	-	-	-
Alburnus alborella	17 - 9	0.29	2.27	128
Coregonus sp. ("bondella")	17 - 9	0.20	2.76	73
Perca fluviatilis	9 - 12	0.41	2.81	146
Scardinius erythrophtalmus	-	-	-	-
Lepomis gibbosus	-	-	-	-
Alburnus alborella	9 - 12	0.28	2.56	109
Coregonus sp. ("bondella")	11 - 12	0.20	3.08	65

(1) = Values are given per weight unity of fresh matter.
(2) = Referred as "Eupomotis gibbosus" in the previous year.
\- = Sample not available.

Table 24

STRONTIUM-90 IN LAKE MAGGIORE FISHES [1]

1968 [2]

Biological species	March - June collection			September - December collection		
	^{90}Sr pCi/g	Ca mg/g	^{90}Sr pCi/g Ca	^{90}Sr pCi/g	Ca mg/g	^{90}Sr pCi/g Ca
Perca fluviatilis	0.10	12.8	8	0.11	11.7	9
Scardinius erythrophtalmus	0.21	16.0	13	0.16	13.4	12
Lepomis gibbosus (3)	0.09	12.8	7	-	-	-
Alburnus alborella	0.08	8.9	9	0.09	8.2	11
Coregonus sp. ("bondella")	0.05	5.2	10	0.07	6.2	11

(1) = Values are given per weight unity of fresh matter.

(2) = Measurements carried out on pooled samples from March-June collections and September-December collections.

(3) = Referred as "Eupomotis gibbosus" in the previous year.

\- = Sample not available.

CESIUM-137 IN LAKE FISHES (1)

Table 25

1968

Biological species	Sampling date	^{137}Cs pCi/g	K mg/g	^{137}Cs pCi/g K	Sampling date	^{137}Cs pCi/g	K mg/g	^{137}Cs pCi/g K
LAKE VARESE								
Perca fluviatilis	-	-	-	-	16 - 9	0.26	3.45	75
Scardinius erythrophtalmus	12 - 3	0.32	2.68	119	16 - 9	0.30	2.85	105
Lepomis gibbosus (2)	-	-	-	-	16 - 9	0.18	2.97	61
Perca fluviatilis	19 - 6	0.18	2.91	62	10 - 12	0.24	3.19	75
Scardinius erythrophtalmus	5 - 6	0.27	2.82	96	9 - 12	0.30	3.12	96
Lepomis gibbosus	5 - 6	0.13	3.03	43	19 - 12	0.13	2.86	45
LAKE COMABBIO								
Perca fluviatilis	-	-	-	-	19 - 9	1.0	3.47	288
Scardinius erythrophtalmus	11 - 3	0.52	2.88	180	19 - 9	0.66	3.19	207
Lepomis gibbosus	-	-	-	-	-	-	-	-
Perca fluviatilis	24 - 6	1.2	3.18	377	-	-	-	-
Scardinius erythrophtalmus	24 - 6	0.52	3.11	167	10 - 12	0.59	2.92	202
Lepomis gibbosus	-	-	-	-	-	-	-	-
LAKE MONATE								
Perca fluviatilis	-	-	-	-	20 - 9	2.2	3.61	609
Scardinius erythrophtalmus	14 - 3	0.89	2.95	302	20 - 9	0.94	3.27	287
Lepomis gibbosus	14 - 3	2.2	2.90	760	20 - 9	1.7	3.03	561
Perca fluviatilis	20 - 6	2.1	3.32	633	-	-	-	-
Scardinius erythrophtalmus	6 - 6	1.1	3.22	342	-	-	-	-
Lepomis gibbosus	19 - 6	1.6	3.09	509	-	-	-	-

(1) = Values are given per weight unity of fresh matter.

(2) = Referred as "Eupomotis gibbosus" in the previous year.

\- = Sample not available.

Table 26

STRONTIUM-90 IN LAKE FISHES (1)

1968 (2)

Sampling site	Perca fluviatilis			Scardinius erythrophtalmus			Lepomis gibbosus (3)		
	^{90}Sr pCi/g	Ca mg/g	^{90}Sr pCi/g Ca	^{90}Sr pCi/g	Ca mg/g	^{90}Sr pCi/g Ca	^{90}Sr pCi/g	Ca mg/g	^{90}Sr pCi/g Ca
Lake Varese	0.15	16.7	9	0.99	27.1	37	0.25	19.8	13
Lake Comabbio	0.60	16.1	37	0.86	17.3	50	-	-	-
Lake Monate	1.5	16.8	89	2.6	18.2	143	1.5	16.5	91

(1) = Values are given per weight unity of fresh matter.

(2) = Measurements carred out on a pooled sample from the March, June, September and December collections.

(3) = Referred as "Eupomotis gibbosus" in the previous year.

\- = Sample not available.

Table 27

STRONTIUM-90 IN CALF BONES

1968

Sampling site	Sampling date	^{90}Sr pCi/g ash	^{90}Sr (1) pCi/g Ca
Brebbia	January - June	6.0	16
Cadrezzate	" "	12	32
Ispra	" "	8.6	23
Monvalle	" "	14	38
Osmate	" "	13	35
Taino	" "	7.4	20
Brebbia	July - December	10	27
Cadrezzate	" "	4.7	13
Ispra	" "	8.8	24
Monvalle	" "	3.1	8
Osmate	" "	10	27
Taino	" "	11	30

(1) - Calcium concentration in bone ash has been assumed constant as 37.0% .

Table 28

STRONTIUM-90 IN VEGETABLES (1)

1968

Species	^{90}Sr pCi/Kg	Ca g/Kg	^{90}Sr pCi/g Ca
Chard - ("Beta Vulgaris")	30	0.78	38
Carrots - ("Daucus Carota")	18	0.46	39
Cabbage - ("Brassica Oleracea")	35	0.86	41
Haricots - ("Phaseolus Vulgaris")	37	0.68	54
Lettuce - ("Lactuca Sativa")	10	0.46	22
Potatoes - ("Solanum Tuberosum")	13	0.22	59
Tomatoes - ("Lycopersicon Esculentum")	< 5	0.14	< 36

(1) - Concentration values are referred to fresh matter and are obtained from pooled samples made up for each species, with about 20 samples collected during the year.

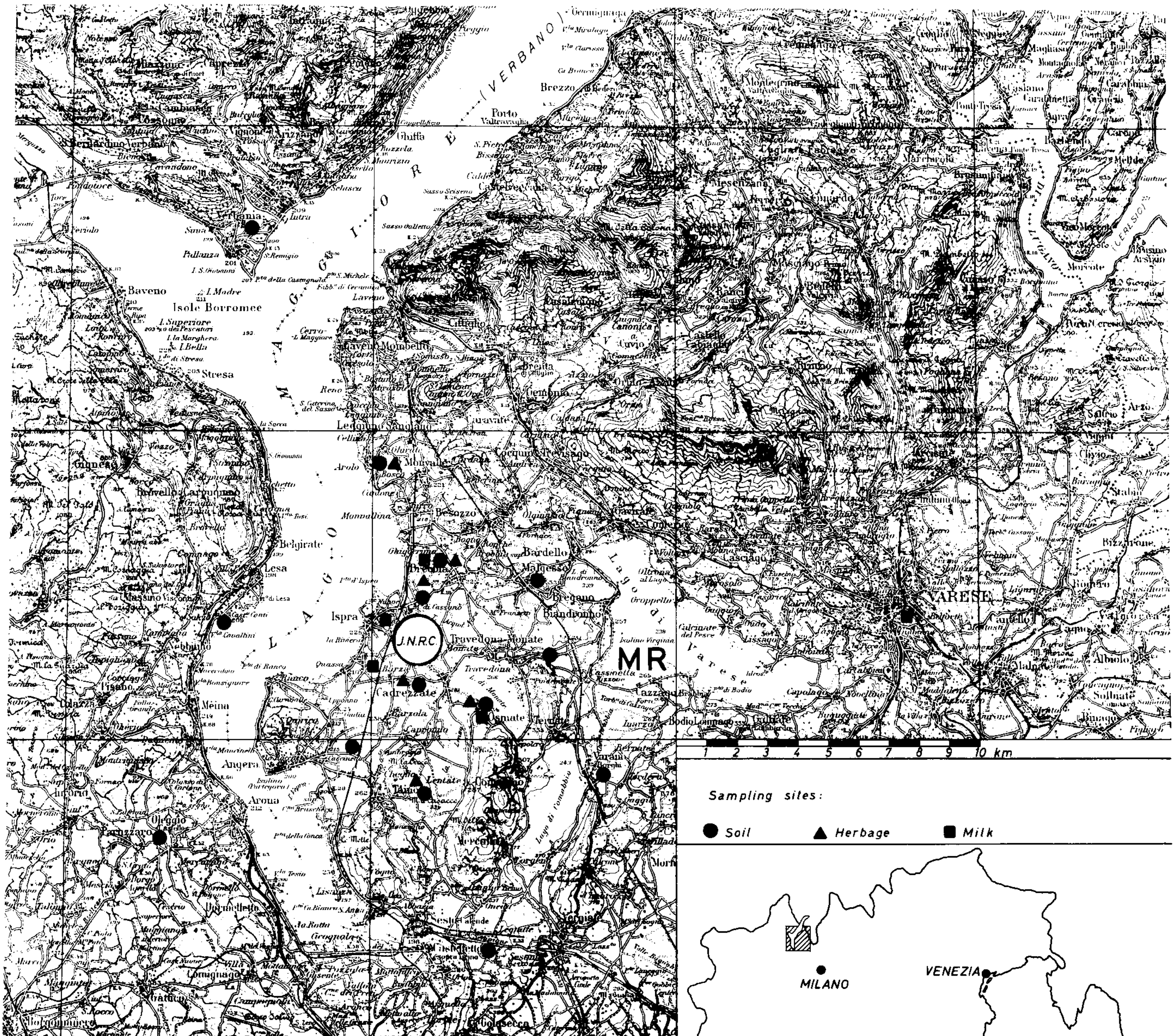
J.N.R.C.
MR
1 2 3 4 5 6 7 8 9 10 km
Sampling sites:
Soil
Herbage
Milk
MILANO
VENEZIA
GENOVA

Figure 1

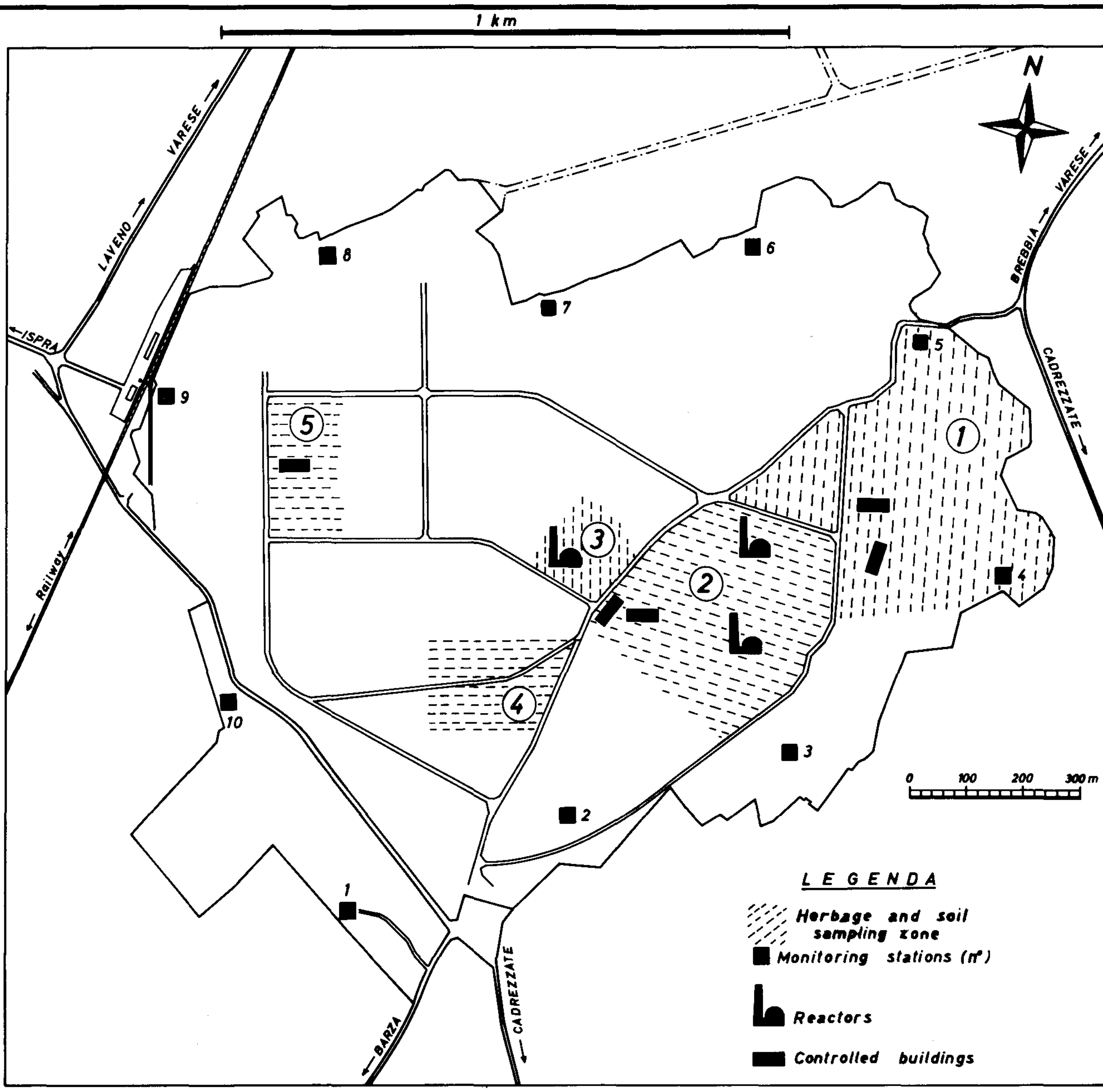

Figure 2

C.C.R.N. EURATOM ISPRA - SERV. PROTEZIONE
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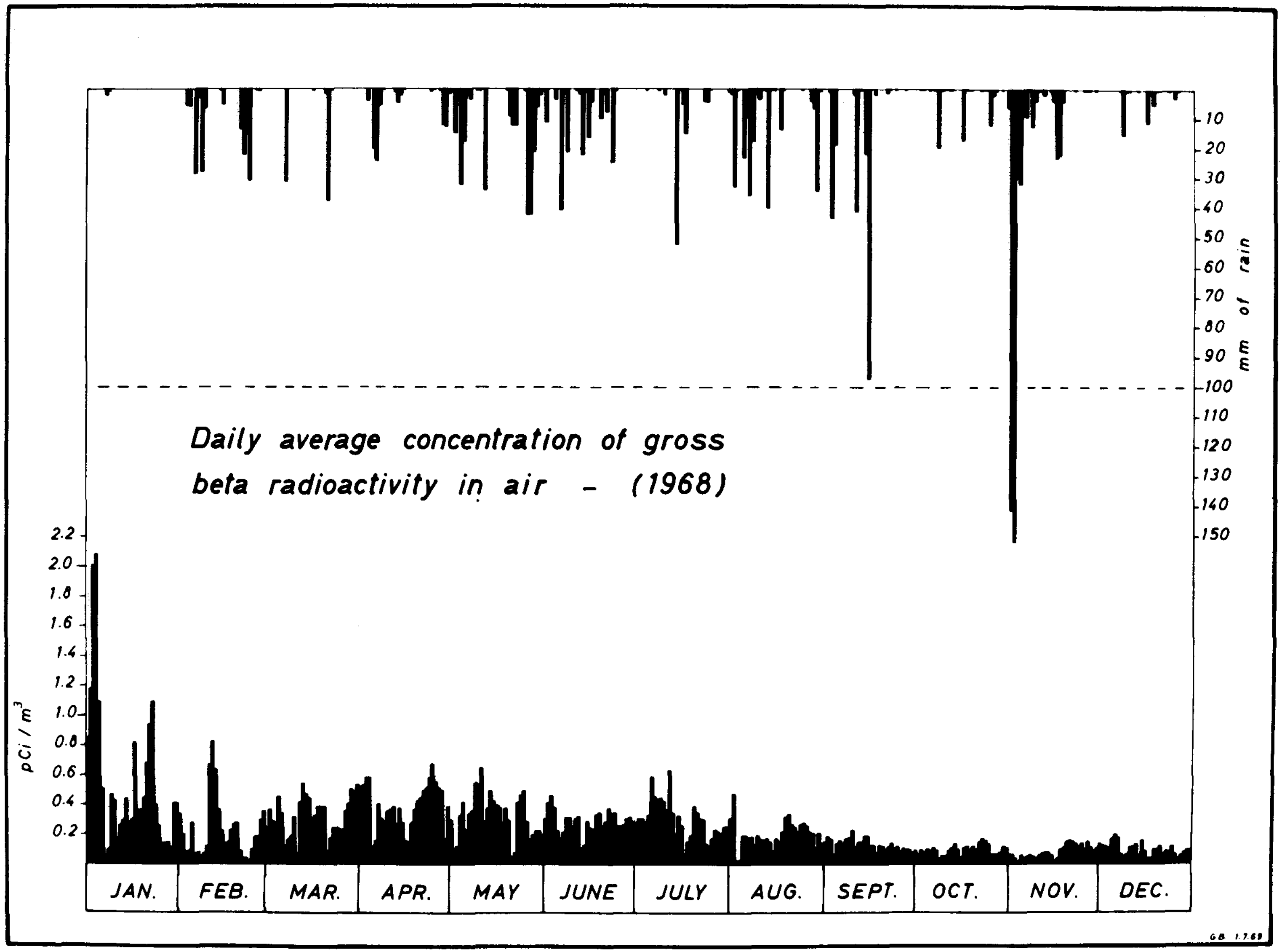
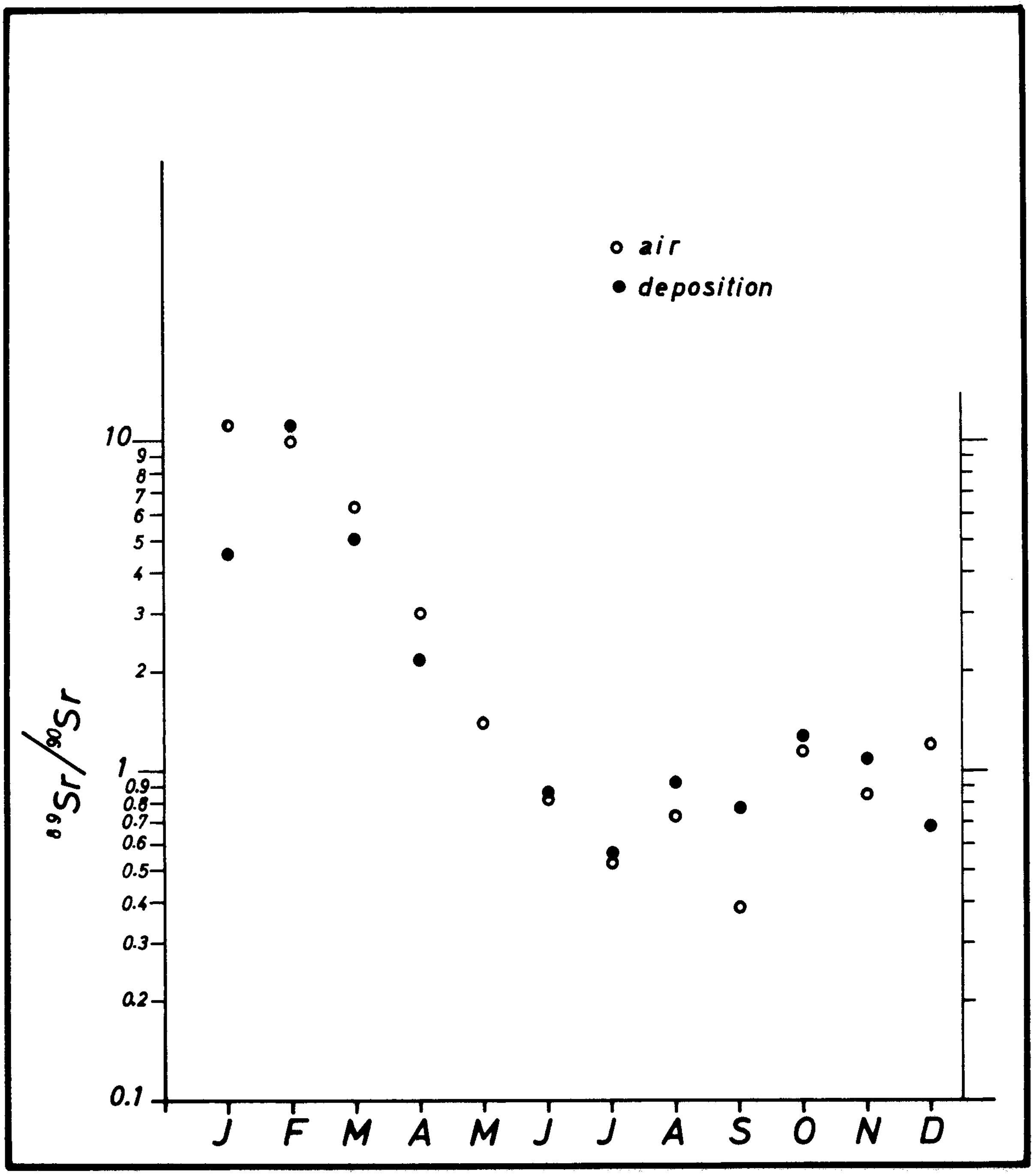

Daily average concentration of gross
beta radioactivity in air – (1968)
pCi / m³
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
mm of rain
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
JAN.
FEB.
MAR.
APR.
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
GB 1.7.69

Figure 3



G.B. 3.7.69

Figure 4

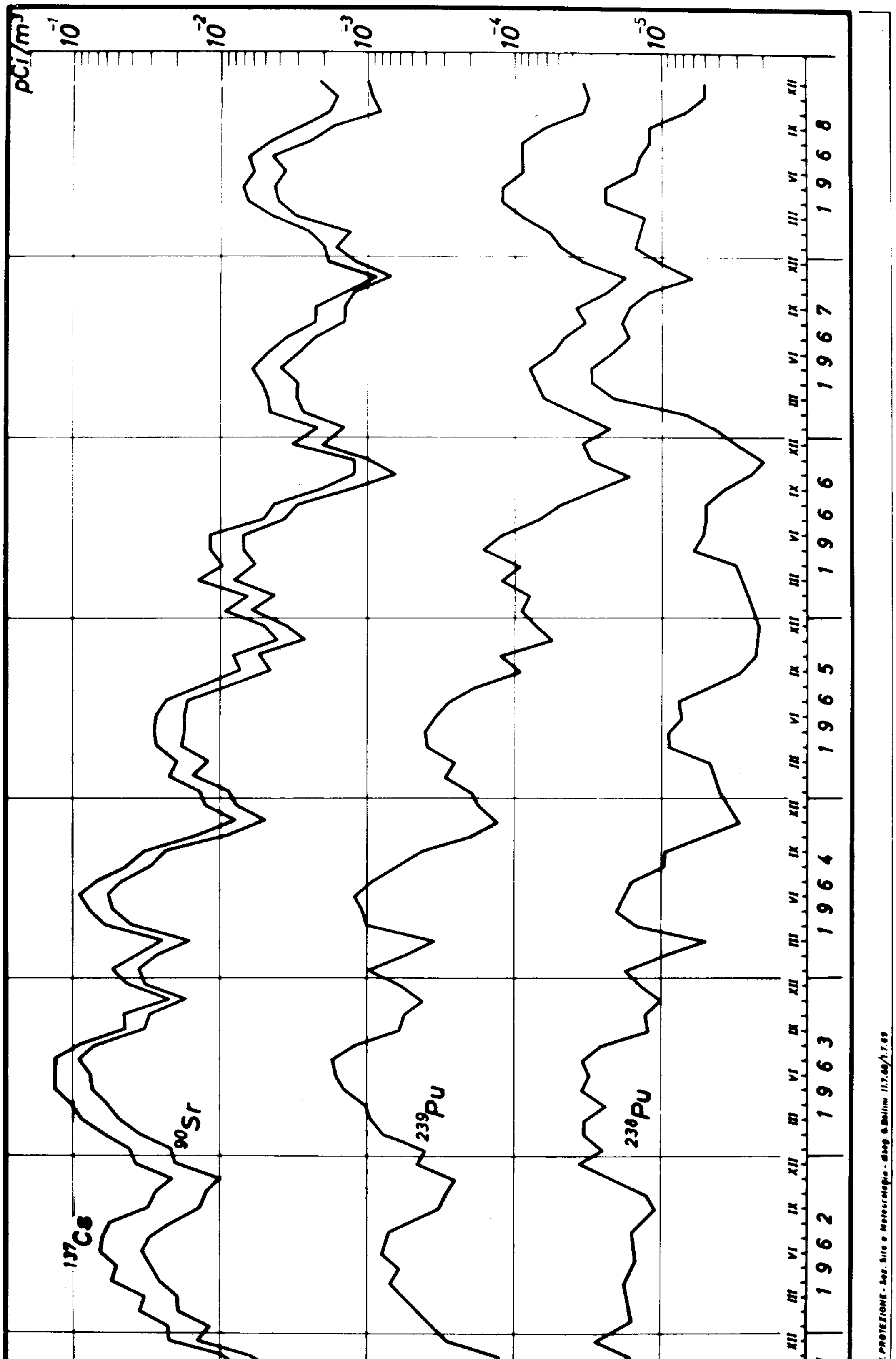
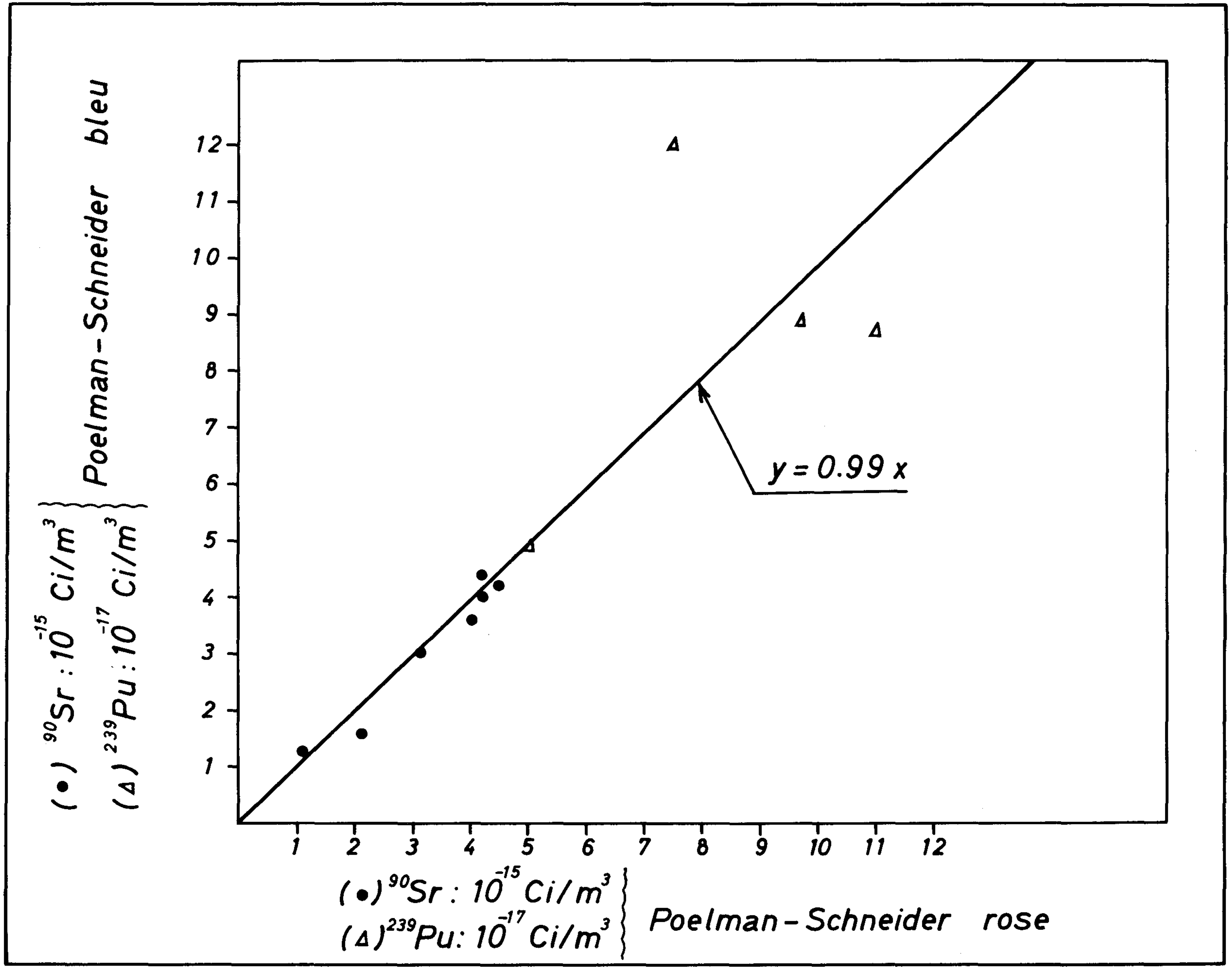

pCi/m³
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
^{137}Cs
^{90}Sr
^{239}Pu
^{238}Pu
1961
1962
1963
1964
1965
1966
1967
1968

Figure 5



y = 0.99 x
(•) 90Sr : 10-15 Ci/m3
(Δ) 239Pu : 10-17 Ci/m3
Poelman-Schneider bleu
Poelman-Schneider rose

Figure 6

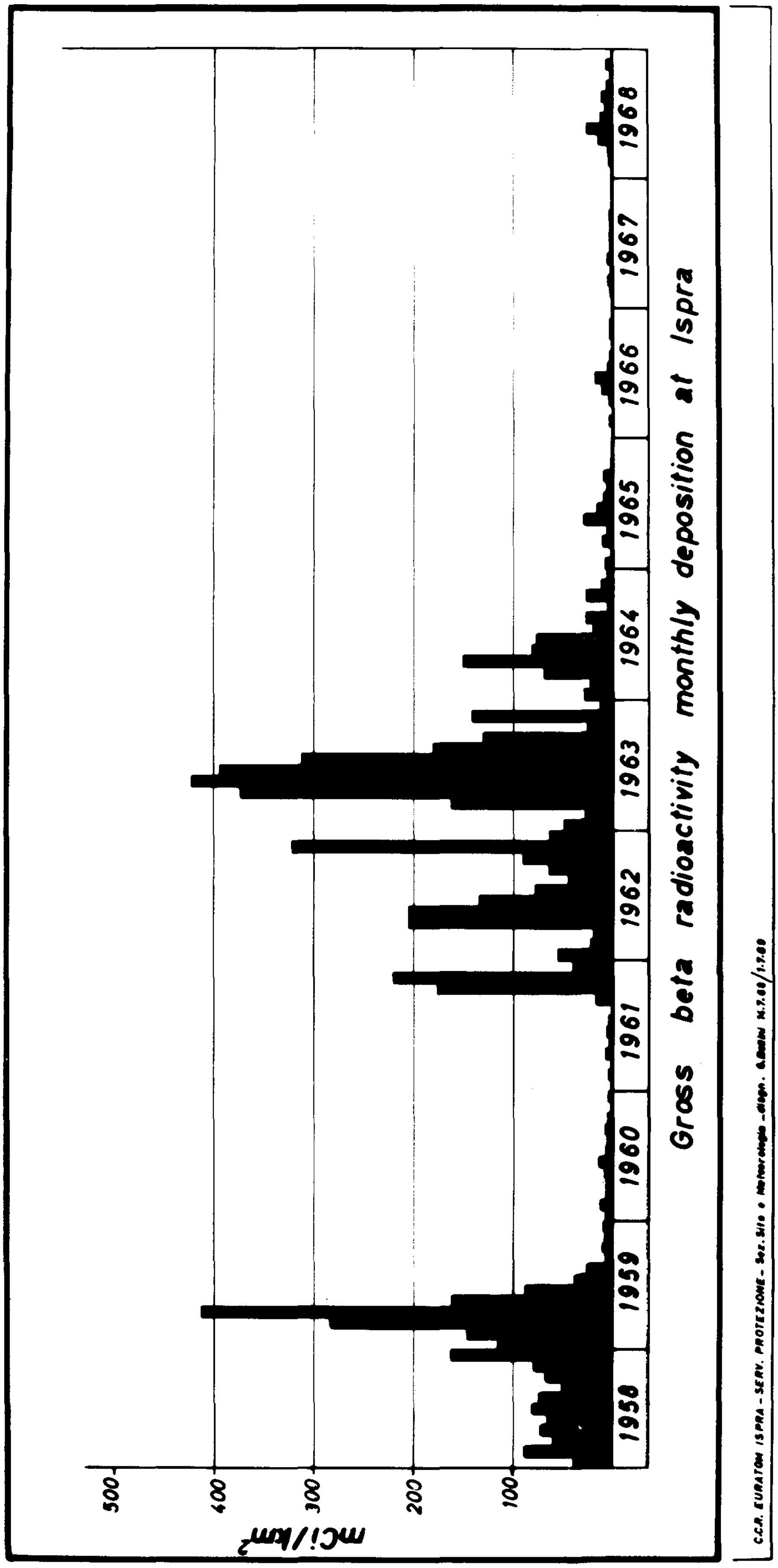

Gross beta radioactivity monthly deposition at Ispra
mCi/km²
500
400
300
200
100
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968

Figure 7

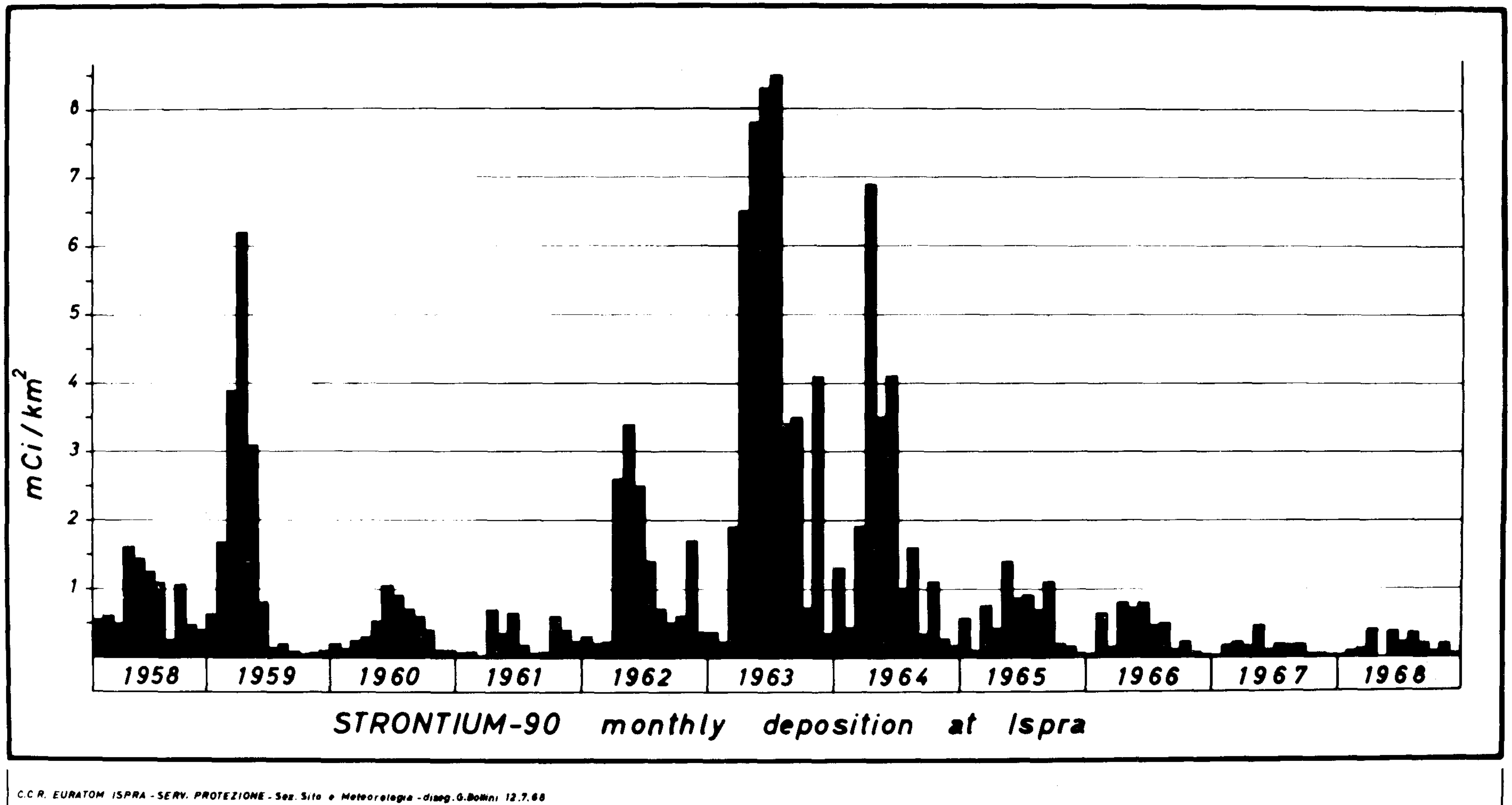

mCi / km²
8
7
6
5
4
3
2
1
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
STRONTIUM-90 monthly deposition at Ispra
C.C.R. EURATOM ISPRA - SERV. PROTEZIONE - Sez. Sito e Meteorologia - diseg. G. Bollini 12.7.68

Figure 8

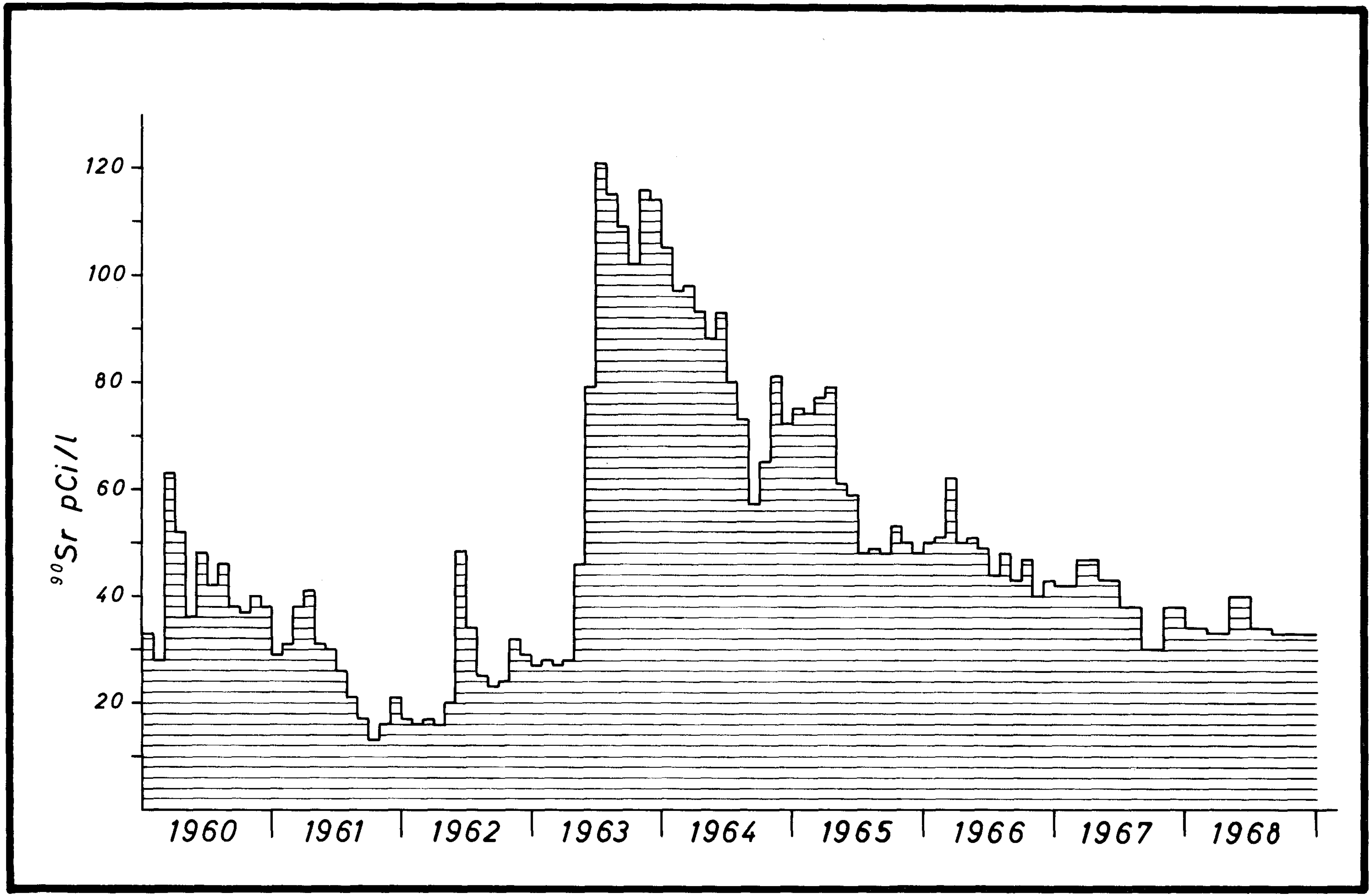

120
100
80
60
40
20
^{90}Sr pCi/l
1960
1961
1962
1963
1964
1965
1966
1967
1968

Figure 9

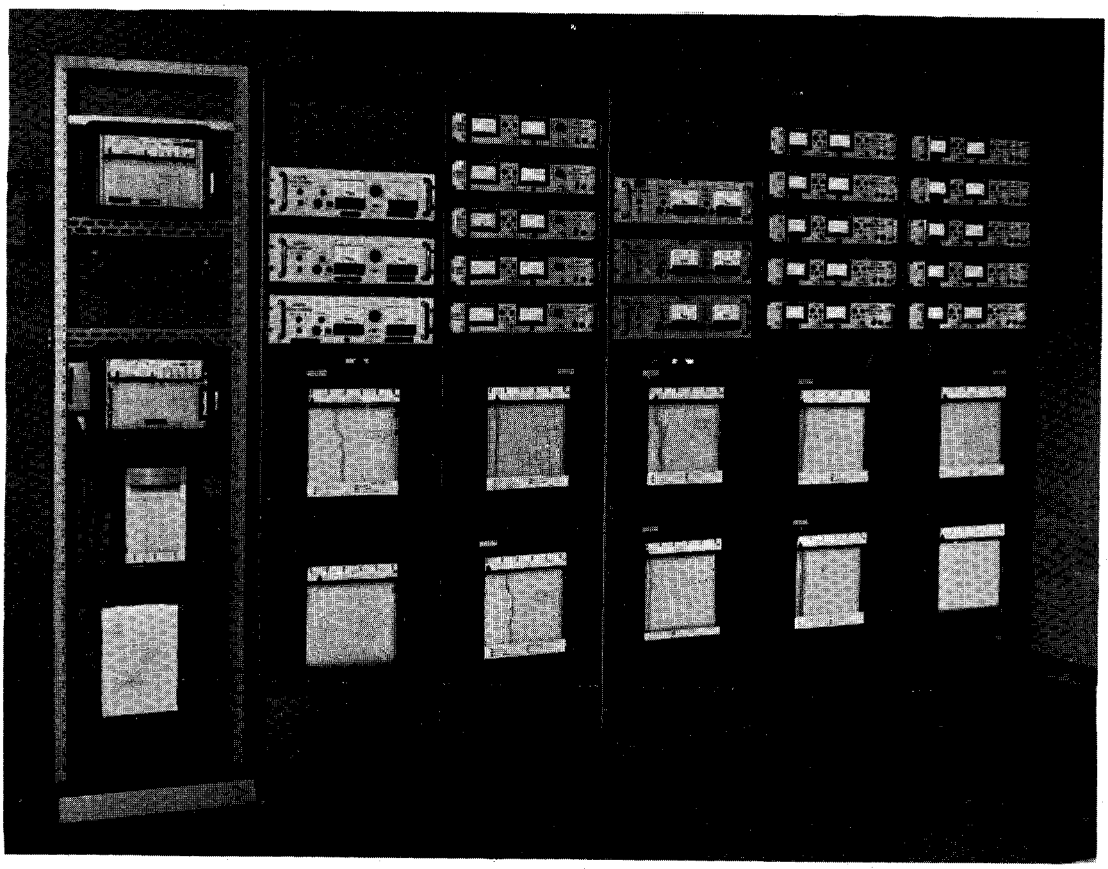


Figure 10

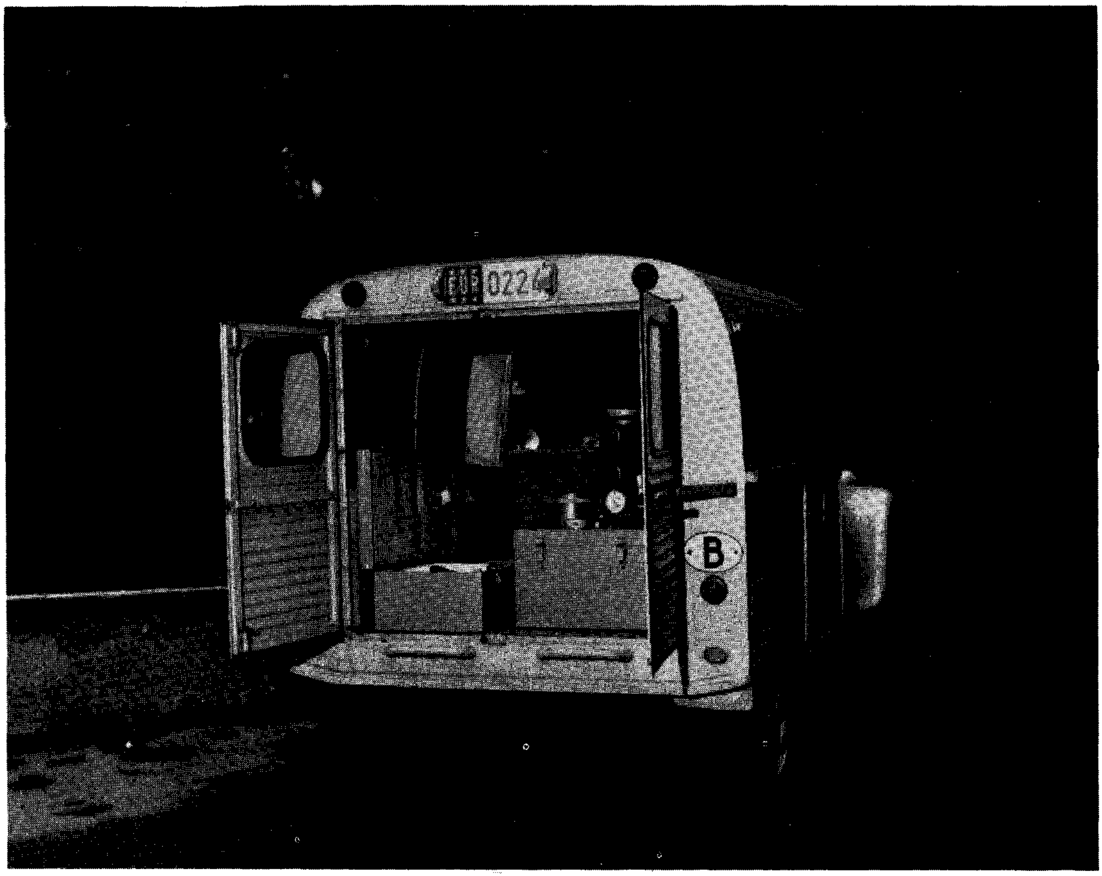


Figure 11

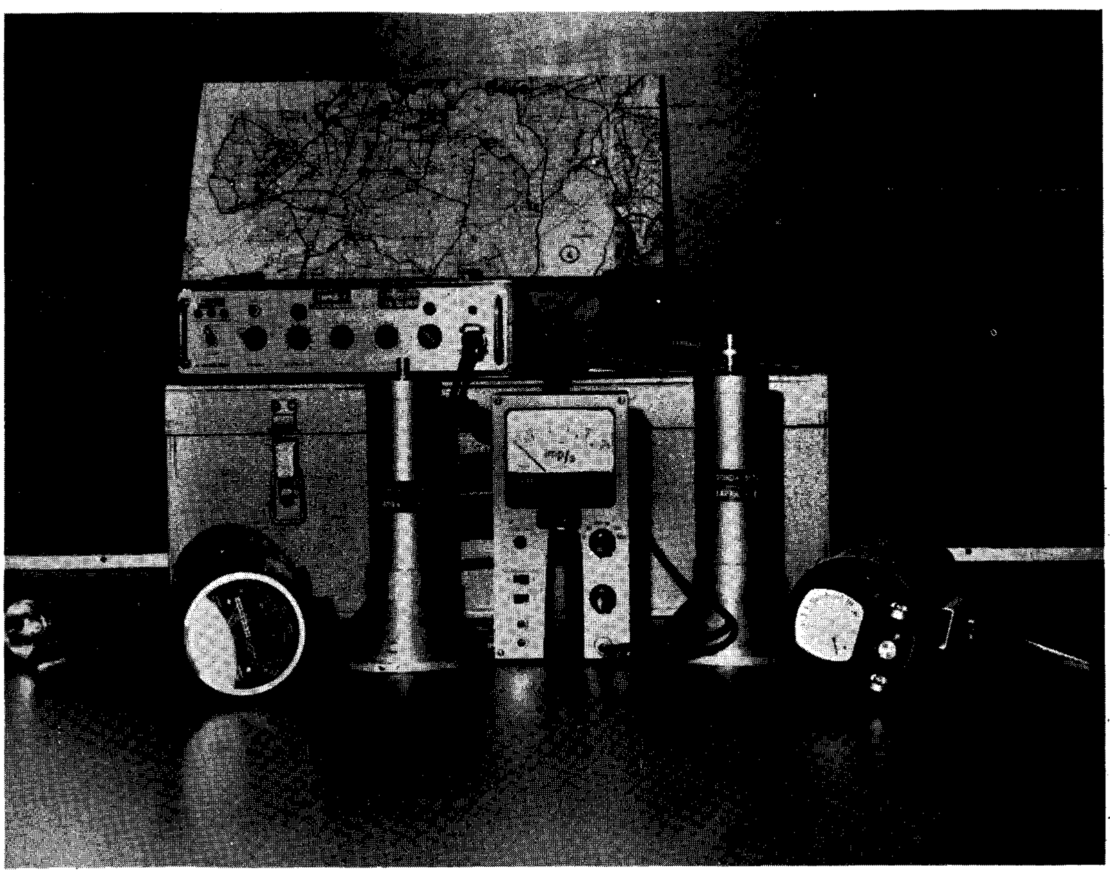


Figure 12

To disseminate knowledge is to disseminate prosperity — I mean general prosperity and not individual riches — and with prosperity disappears the greater part of the evil which is our heritage from darker times.

Alfred Nobel

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