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SUMMARY

The country-wide average strontium-90 deposition in New Zealand during 1984 was 0.6 MBq km^{-2} which is the lowest annual deposition since monitoring commenced in 1960, and less than 0.5% of the 1964 peak level (130 MBq km^{-2}). The deposition at Suva and Rarotonga was 0.2 MBq km^{-2}.

The total beta activity in air continued to be less than the limit of detection at all sites and the beta activity of rainwater is now due mainly to naturally occurring lead-210.

Strontium-90 and caesium-137 levels in dairy milk were similar to 1983 levels with annual means of 0.043 Bq gCa^{-1} and 0.17 Bq gK^{-1}, or 0.4% and <0.1% of reference levels, respectively.

CONTENTS

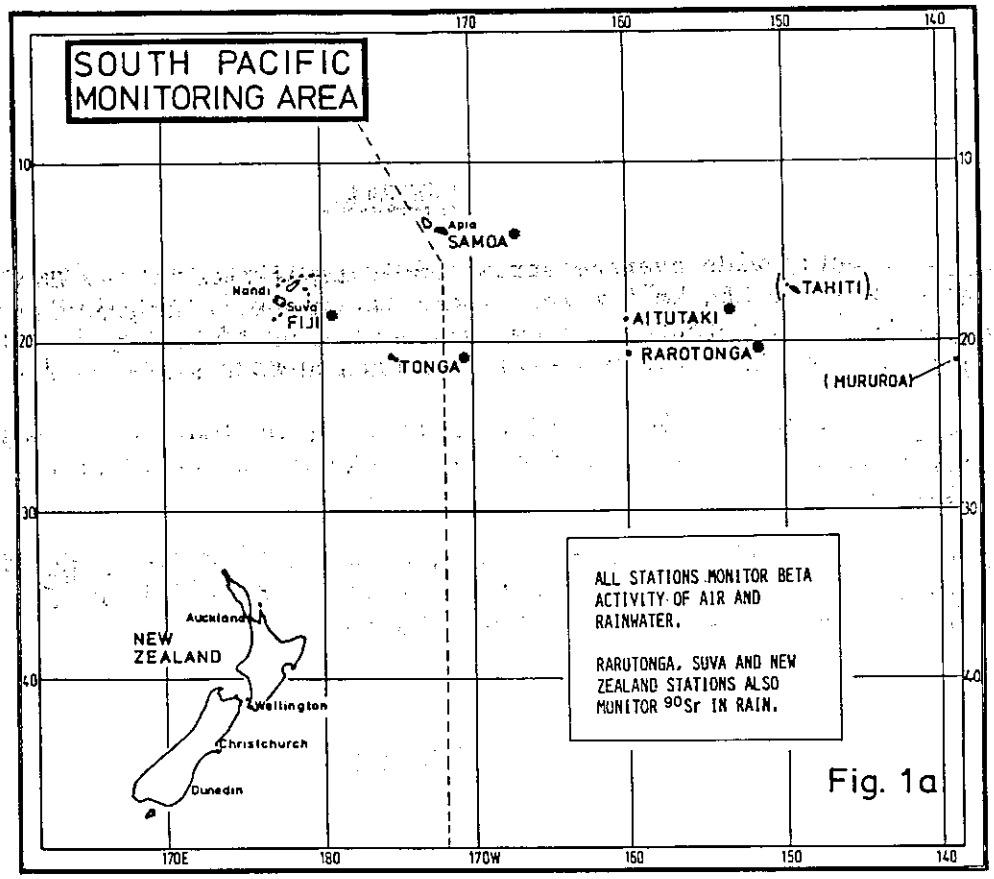

SOUTH PACIFIC
MONITORING AREA
170
160
150
140
10
20
30
40
Apia
SAMOA
Nandi
Suva
FIJI
TONGA
AITUTAKI
RAROTONGA
TAHITI
MURUROA
NEW
ZEALAND
Auckland
Wellington
Christchurch
Dunedin
ALL STATIONS MONITOR BETA ACTIVITY OF AIR AND RAINWATER.
RAROTONGA, SUVA AND NEW ZEALAND STATIONS ALSO MONITOR ^{90}Sr IN RAIN.
170E
180
170W

Fig. 1a

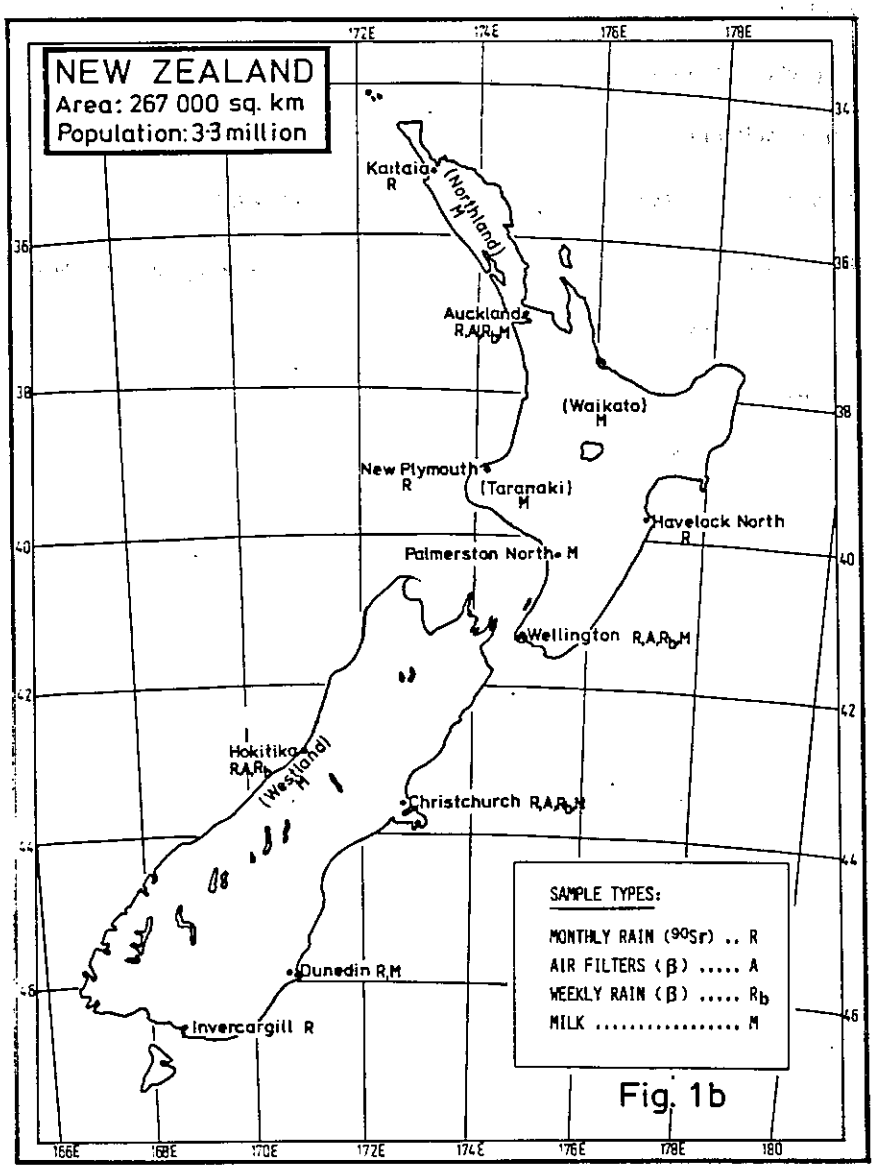

NEW ZEALAND
Area: 267 000 sq. km
Population: 3·3 million
172E
174E
176E
178E
34
36
38
40
42
44
46
Kaitaia R
(Northland) M
Auckland R,A,Rb,M
(Waikato) M
New Plymouth R
(Taranaki) M
Havelock North R
Palmerston North M
Wellington R,A,Rb,M
Hokitika R,A,Rb
(Westland) M
Christchurch R,A,Rb,M
Dunedin R,M
Invercargill R
SAMPLE TYPES:
MONTHLY RAIN (^{90}Sr) .. R
AIR FILTERS (β) ..... A
WEEKLY RAIN (β) ..... Rb
MILK ..... M
166E
168E
170E
172E
174E
176E
178E
180

Fig. 1b

INTRODUCTION

This report continues the series of reports on environmental radioactivity monitoring in the New Zealand and South Pacific areas, published since 1961.[1]

The National Radiation Laboratory has been conducting this monitoring since 1960; initially for radioactive fallout arising from Northern Hemisphere nuclear tests, then from the French testing programme which commenced in the Tuamotu Archipelago in 1966. In 1974 France terminated atmospheric nuclear tests and began a programme of underground testing in June 1975. The Laboratory's monitoring programme continued in order to monitor levels from pre-1975 tests and any venting to the atmosphere of fission products from the underground test series. The current programme consists of continuous air and rainwater beta (β) activity monitoring at 5 Pacific island and 4 New Zealand stations; the measurement of strontium-90 (^{90}Sr) in rainwater at 9 New Zealand and 2 Pacific island stations; and ^{90}Sr and caesium-137 (^{137}Cs) levels in dairy milk from 9 New Zealand regions.

Monitoring and sample collecting stations are shown in Fig. 1, a and b.

Fallout levels in recent years, particularly since 1976, have been very low and reports covering this period have been abbreviated. Earlier annual reports[1] and special reports on French atmospheric tests[2] give information on terms of reference, potential health hazard, reference levels, and technical information.

The following reference levels, against which reported levels may be compared, have been adopted for New Zealand: mixed fission products between 10 and 80 days old (total β activity), in rain - 220 Becquerels (Bq) per litre, in air - 11 Bq per cubic metre; ^{90}Sr in milk - 10 Bq per gram of calcium (Ca); ^{137}Cs in milk - 260 Bq per gram of potassium (K). One litre of milk contains approximately 1.2 g of calcium and 1.4 g of potassium.

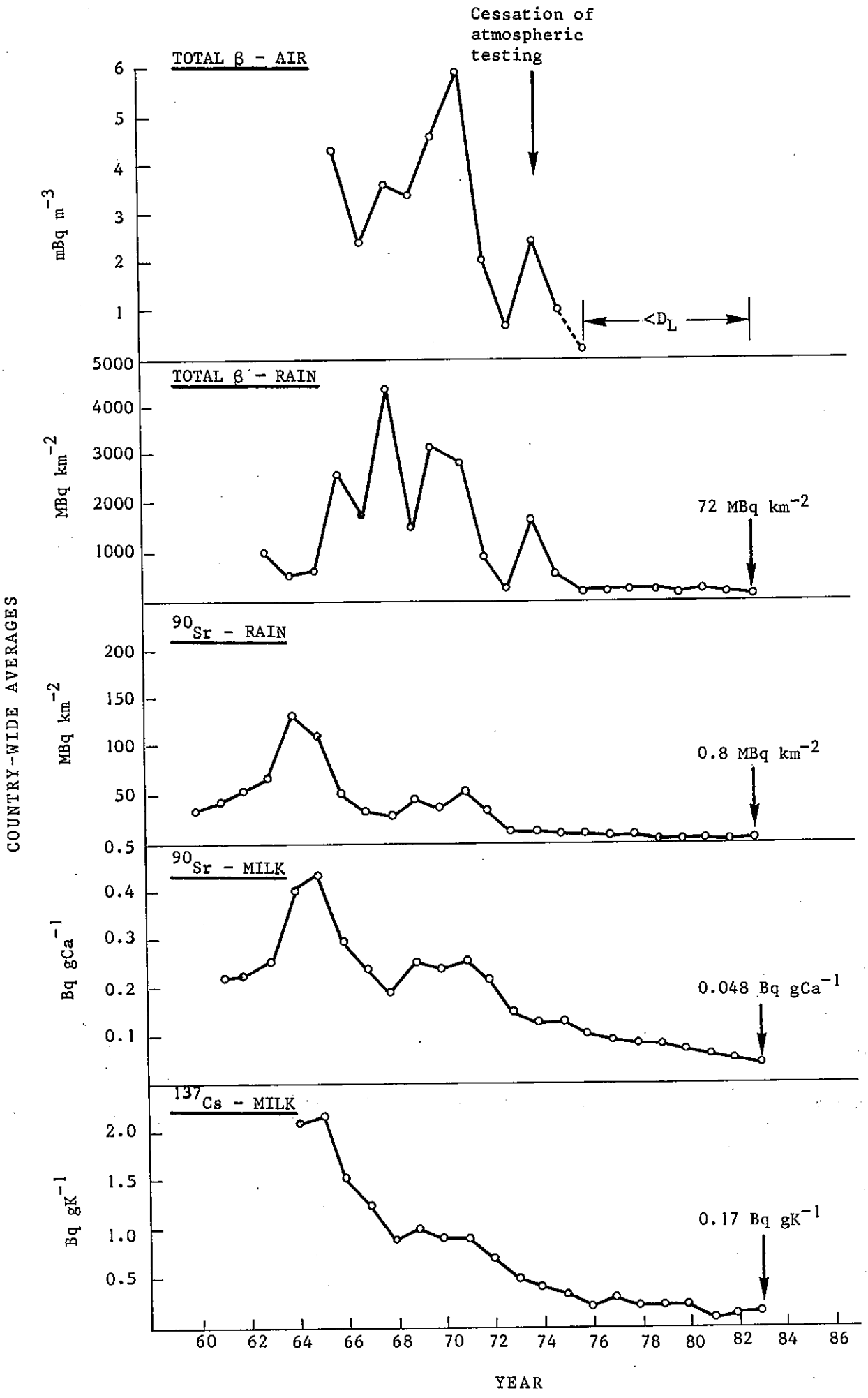
Detection limits quoted in this report are upper 95% confidence limits calculated from the formula: $L_D = 4.65\sqrt{B}$, where L_D is the detection limit in net counts and B is the background counts during the counting interval.[3]

MONITORING PROCEDURES

1. Total β activity in air

The air monitoring programme involved the collection of aerosol particles by pumping air through glass fibre filters (Whatman GF/A) at nominal flow rates of 5 $m^3\ h^{-1}$ at New Zealand stations (Auckland, Wellington, Hokitika, Christchurch) and 1 $m^3\ h^{-1}$ at island stations (Fiji, Samoa, Tonga, Aitutaki, Rarotonga). Diaphragm pumps (Thomas types 727 and 107) were used with 11 cm and 5.5 cm diameter filters, at New Zealand and island stations respectively with corresponding limits of detection of 0.3 mBq m^{-3} and 1.1 mBq m^{-3} (mBq = millibecquerel). The filters were changed 3 times each week and were stored for at least 4 days after collection to allow the decay of short-lived naturally occurring β activity before activity measurement by a gas-flow proportional counter (Beckman Wide-βII, 20 minutes counting time). Hereafter, the term "total β activity" refers to residual radioactivity of fission products and the long-lived naturally occurring radionuclide lead-210 (^{210}Pb).

FIGURE 2: TRENDS IN FALLOUT LEVELS IN NEW ZEALAND



2. Total β activity in rainwater

During 1984 funnel-and-bottle rainwater collections were made at the stations providing air filter samples. The bottles were exposed for 1-week periods before the collected rainwater was evaporated to dryness on a stainless steel planchet and the β activity of the residue determined with 20 minutes counting times as above. New Zealand stations used 16.5 cm diameter funnels while island stations used 10 cm funnels. Results are reported as quarterly total depositions in megabecquerels (MBq) per square kilometre, and as quarterly average concentrations in Bq per litre of rainwater. Limits of detection were 2 MBq km^{-2} and 6 MBq km^{-2} at New Zealand and island stations respectively.

3. ^{90}Sr deposition

Rainwater was collected in 30 cm diameter stainless steel pots exposed for 1-month periods at each of the 9 New Zealand stations (Fig. 1b), Suva and Rarotonga. The collected rainwater (containing strontium and lead carriers) was passed through a cation exchange resin column on site. The resin was mailed to the Laboratory for strontium recovery and measurement of ^{90}Sr levels. Because of low deposition rates in recent years samples collected since 1976 have been aggregated quarterly for greater sensitivity of measurement. The ^{210}Pb deposition was measured incidentally. Details of analytical techniques have been published previously.[4] Limits of detection of ^{90}Sr were 0.1 MBq km^{-2} and 0.001 Bq l^{-1}.

4. ^{90}Sr and ^{137}Cs in milk

Since 1965 measurements have been made on cows' milk samples collected monthly from 9 stations (Fig. 1b). Milk powders were collected from all but the Wellington station, with liquid samples being supplied in winter months when the powder processes were not operating. Wellington supplied only liquid milk. The monthly collections were aggregated into quarterly samples. ^{137}Cs was measured by gamma spectroscopy with 2500 minute counts of 90 g (average) samples; the ^{90}Sr procedure has been published previously.[4]

Results are presented below as Bq ^{90}Sr per gram of calcium and Bq ^{137}Cs per gram of potassium. Limits of detection were 0.002 Bq ^{90}Sr gCa^{-1} and 0.04 Bq ^{137}Cs gK^{-1}.

TRENDS IN RESULTS TO 1983

Trends in levels of beta activity in air and rain, ^{90}Sr in rain and milk, and ^{137}Cs in milk, since monitoring began are shown in Fig. 2 where New Zealand average levels are plotted. (Tables of data may be found in earlier reports.)[1] In all cases the levels have been decreasing steadily since the cessation of atmospheric weapons tests.

During the French tests, 1966-1974, total β activity in air showed some latitude dependence with levels in Auckland, for example, usually being higher than those in Christchurch; with means for that period of 4.0 and 2.8 mBq m^{-3} respectively. At Pacific island stations levels were significantly higher with levels of up to 230 mBq m^{-3} being recorded.[2]

Since 1976, however, the total β activity of air has been below the limit of detection at all sites, i.e., <0.3 mBq m^{-3} at New Zealand sites and <1.1 mBq m^{-3} at island sites.[5]

Total β activity levels in rainwater have been relatively uniform since 1976 with annual depositions ranging from 30-250 MBq km^{-2} and average concentrations of 0.02-0.15 Bq l^{-1}; following earlier peak levels of 7600 MBq km^{-2} at Hokitika in 1968 and up to 20 000 MBq km^{-2} at island sites.[1,2] In 1983 the average deposition at New Zealand and island sites was 70 MBq km^{-2}.[5] Naturally occurring ^{210}Pb now accounts for the major proportion of the total β activity as described later in this report.

The ^{90}Sr deposition rate has also decreased to low levels over recent years. The large-scale Northern Hemisphere (USSR and USA) nuclear tests in 1961 and 1962 resulted in delayed stratospheric fallout over New Zealand. Maximum depositions occurred in 1964 with a station average of 130 MBq km^{-2} y^{-1}.[1] During 1966-1974 41 nuclear devices were reported to have been exploded by France, most of them being in the low to medium yield (kiloton) range.[2] The annual deposition of ^{90}Sr in New Zealand increased again to a second smaller maximum of 51 MBq km^{-2} y^{-1} (average) in 1971. Depositions have decreased since then and the 1983 average for New Zealand was 0.8 MBq km^{-2}, or less than 1% of the 1964 maximum.[5]

The trends in levels of ^{137}Cs and ^{90}Sr in milk have paralleled that of ^{90}Sr in rainwater. Average concentrations of ^{90}Sr in New Zealand milk reached 0.43 Bq gCa^{-1} in 1965, before decreasing to 0.19 Bq gCa^{-1} in 1968.[1] Levels increased slightly during the French tests of 1969-71. With the decreasing deposition since 1973, concentrations in milk have again decreased reaching an average concentration of 0.048 Bq gCa^{-1} in 1983.[5] Similarly, the highest ^{137}Cs concentration (New Zealand average 2.2 Bq gK^{-1}) was recorded in 1965, with levels decreasing since then to 0.17 Bq gK^{-1} in 1983.[5] The "soil effect" leading to relatively high ^{137}Cs concentrations in Taranaki milk has been the subject of a special survey (Annual Report 1977).[1]

1984 MONITORING RESULTS

Summaries of results for 1984 are given in Tables 1-4. The precision of measurement, when given, is based on a counting error of 2 Poisson standard deviations (95% confidence level).

1. Total β activity in air

Monthly average levels of β activity in air did not exceed the limit of detection at any station; i.e., <0.3 mBq m^{-3} at New Zealand stations and <1.1 mBq m^{-3} at Pacific island stations.

2. Total β activity in rain

The mean annual β activity deposition at New Zealand stations during 1984 was 64 MBq km^{-2} with a mean concentration in rainwater of 0.05 Bq l^{-1}. The maximum quarterly deposition was 39 ± 8 MBq km^{-2} recorded at Hokitika during October-December. Annual deposition at Pacific island stations ranged from 15 MBq km^{-2} at Tonga to 61 MBq km^{-2} at Rarotonga, with concentrations ranging from 0.01 to 0.04 Bq l^{-1}. The island mean was 45 MBq km^{-2}.

These levels were similar to 1983 levels (New Zealand mean 72 MBq km^{-2}, island mean 65 MBq km^{-2})[5] and concentrations were very small fractions of the reference level (220 Bq l^{-1}).

3. ^{90}Sr deposition

The annual ^{90}Sr deposition at New Zealand sites ranged from 0.2 MBq km^{-2} at Christchurch to 0.8 MBq km^{-2} at Hokitika, with a country-wide mean of 0.6 MBq km^{-2}. The annual deposition at Suva and Rarotonga was 0.2 MBq km^{-2}.

The concentration of ^{90}Sr in rainwater was <0.001 Bq l^{-1} at all stations.

Strontium-90 deposition was thus the lowest yet recorded (the 1983 New Zealand mean was 0.8 MBq km^{-2}, Suva 0.7 MBq km^{-2}, Rarotonga 0.4 MBq km^{-2})[5] and was <0.5% of the 1964 maximum level.

4. ^{90}Sr and ^{137}Cs in milk

Quarterly average ^{90}Sr levels in milk ranged from 0.017 Bq gCa^{-1} to 0.125 Bq gCa^{-1} with a country-wide annual mean of 0.043 Bq gCa^{-1}, similar to the 1983 mean of 0.048 Bq gCa^{-1},[5] and representing approximately 0.4% of the reference level (10 Bq gCa^{-1}).

Quarterly average ^{137}Cs levels in milk ranged from <0.04 Bq gK^{-1} to 0.82 Bq gK^{-1} with a country-wide mean of 0.17 Bq gK^{-1}, equal to the 1983 mean and representing <0.1% of the reference level (260 Bq gK^{-1}).

5. ^{210}Pb deposition

Lead-210 is a naturally occurring radionuclide produced in the atmosphere by decay of radon. Since 1967 its concentrations have been measured in the rainwater samples collected for ^{90}Sr evaluation. Its deposition rate is relatively constant and during the period 1967-1983 the country-wide annual average depositions were in the range 52 ± 12 MBq km^{-2}.[5]

The average annual depositions over that period ranged from 23 ± 5 MBq km^{-2} at Christchurch to 122 ± 24 MBq km^{-2} at Hokitika.[5]

During 1984 depositions ranged from 20 MBq km^{-2} to 101 MBq km^{-2}, with a country-wide annual average of 50 MBq km^{-2} which were within the above normal range.

This natural ^{210}Pb, which is a β emitting radionuclide, is thus largely responsible for the total β activity of rain recorded above. Because ^{210}Pb is a natural product the β activity of rainwater is not expected to decrease much below present levels.

MISCELLANEOUS, SPECIAL SURVEYS, PROJECTS

1. Training session for an IAEA Fellow

Miss K Potipin, Office of Atomic Energy for Peace, Thailand received training in radiochemistry and environmental monitoring techniques during the tenure of a 12-month IAEA fellowship. A research project was also completed in that time.[6]

2. International intercomparisons

The Laboratory took part in one intercomparison during 1984: analysis of a U.S. Environmental Protection Agency milk sample for iodine-131, ^{137}Cs, ^{90}Sr and potassium.

3. Port monitoring during nuclear ship visits

Monitoring of radioactivity of shellfish collected before and after the visit of "USS Queenfish" to Auckland was conducted. No change in levels was detected.

4. Natural radionuclides in New Zealand coals

In preparation for a survey of concentrations of uranium, thorium and radium in New Zealand coals, techniques for analysis of these radionuclides were developed during 1984.

5. Mururoa Mission

The analysis of samples collected at Mururoa was completed in January 1984. Samples included plankton, shellfish, fish, coral, soils and coconuts which were analysed for gamma emitting radionuclides, ^{90}Sr and plutonium-239.

PROPOSED CHANGES IN THE FALLOUT MONITORING PROGRAMME

The fallout monitoring results described above indicate that levels of artificial radioactivity in the New Zealand and Pacific island regions are steadily decreasing. They have, in fact, decreased to levels near or below the Laboratory's limits of detection over recent years. In view of this, it is proposed to increase the sensitivity of the air monitoring programme and reduce the commitment to the less sensitive monitoring procedures which no longer provide meaningful data.

The proposed new monitoring programme will involve the following:

(a) the installation of higher volume (100 m^3 h^{-1}) air pumps at Rarotonga, Kaitaia and Hokitika, with analysis of filters for gamma-emitting fission products.

(b) the restriction of ^{90}Sr in rain measurements to Rarotonga, Kaitaia and Hokitika only.

(c) the restriction of total β activity of rainwater and air filter measurements to Rarotonga, Hokitika and Christchurch only.

(d) The restriction of milk monitoring to Auckland, Taranaki and Westland only.

The high volume air pumps will increase monitoring sensitivity approximately two orders of magnitude over the present system and the three sites chosen will provide a latitudinal range of monitoring. They will also provide a monitoring service similar to that operated by other agencies such as the United Kingdom Atomic Energy Authority, and the United States Department of

Energy, thus facilitating comparisons of data. It is planned to install these pumps during 1985 and to run them in conjunction with the entire present monitoring system before later reducing to the modified programme. The maintenance of the present system at selected sites only will ensure continuity of the present data base. The withdrawn equipment would remain available for redeployment if necessary in the future.

ACKNOWLEDGEMENT

We gratefully acknowledge the assistance given by the staff of this and other Government Departments, especially the New Zealand Meteorological Service and managers of milk processing plants. Without their co-operation this monitoring programme would not have been possible. The Laboratory's Environmental Radioactivity and Chemistry Section organized the monitoring and analysed the samples. This report was compiled by the Section Head, Dr K M Matthews. He was assisted technically by Miss M-J Okey.

The previous Section Head, Mr L P Gregory, retired on 16 March 1984. Mr Gregory was largely responsible for the initial development of methods, and guided the operation of the monitoring network up to the time of his retirement. The Laboratory is grateful to him for his valuable and thorough service during that time.

A C McEwan
Director

Published with the authority of the Director-General of Health

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(2) "Environmental Radioactivity: Fallout from Nuclear Weapons Tests Conducted by France in the South Pacific ... and comparisons with previous test series." Reports NRL-F/47 (1972) - summarising all monitoring results since 1966, NRL-F/49 (1972), NRL-F/51 (1973), NRL-F/53 (1974).

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TABLE 1 - Total β Activity in Rain: 1984 (Weekly Collections):
Cumulative Rainfall (mm)
Cumulative Deposition (MBq km^{-2})
Weighted Mean Concentration (Bq l^{-1})

New Zealand Stations	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1984
Auckland					
mm	335	277	272	321	*1205*
MBq km^{-2}	17 ± 10	12 ± 7	17 ± 7	24 ± 7	*70 ± 33*
Bq l^{-1}	0.05 ± 0.03	0.04 ± 0.03	0.06 ± 0.03	0.07 ± 0.02	*0.06 ± 0.01*
Wellington					
mm	290	172	383	217	*1062*
MBq km^{-2}	14 ± 6	8 ± 9	9 ± 7	16 ± 7	*47 ± 15*
Bq l^{-1}	0.05 ± 0.02	0.04 ± 0.05	0.02 ± 0.02	0.07 ± 0.03	*0.04 ± 0.01*
Hokitika					
mm	654	410	564	878	*2506*
MBq km^{-2}	28 ± 7	12 ± 7	15 ± 7	39 ± 8	*94 ± 15*
Bq l^{-1}	0.04 ± 0.01	0.03 ± 0.02	0.03 ± 0.02	0.04 ± 0.01	*0.04 ± 0.01*
Christchurch					
mm	200	93	159	134	*586*
MBq km^{-2}	12 ± 6	10 ± 6	12 ± 7	16 ± 7	*50 ± 13*
Bq l^{-1}	0.06 ± 0.03	0.11 ± 0.07	0.08 ± 0.04	0.12 ± 0.05	*0.08 ± 0.02*
Weighted Means					
MBq km^{-2}	*17 ± 3*	*11 ± 4*	*13 ± 4*	*23 ± 4*	*64*
Bq l^{-1}	*0.04 ± 0.01*	*0.04 ± 0.02*	*0.04 ± 0.01*	*0.05 ± 0.01*	*0.05 ± 0.01*

Pacific Islands Stations					
Nandi, Fiji					
mm		(592)	87	206	*(885)*
MBq km^{-2}	NS	(11 ± 14)	4 ± 15	9 ± 13	*(24 ± 24)*
Bq l^{-1}		(0.02 ± 0.02)	0.05 ± 0.2	0.04 ± 0.06	*(0.04 ± 0.01)*
Samoa					
mm	839	572	530	876	*2817*
MBq km^{-2}	14 ± 22	31 ± 21	0 ± 20	3 ± 20	*48 ± 42*
Bq l^{-1}	0.02 ± 0.03	0.05 ± 0.04	0.00 ± 0.04	0.00 ± 0.02	*0.01 ± 0.01*
Tonga					
mm	654	343	229	438	*1664*
MBq km^{-2}	5 ± 20	6 ± 19	0 ± 19	4 ± 20	*15 ± 39*
Bq l^{-1}	0.01 ± 0.04	0.02 ± 0.06	0.00 ± 0.08	0.01 ± 0.05	*0.01 ± 0.03*
Aitutaki					
mm	678	271	151	612	*1712*
MBq km^{-2}	15 ± 20	12 ± 17	3 ± 19	25 ± 22	*55 ± 39*
Bq l^{-1}	0.02 ± 0.03	0.04 ± 0.06	0.02 ± 0.13	0.04 ± 0.04	*0.03 ± 0.02*
Rarotonga					
mm	734	413	302	680	*2129*
MBq km^{-2}	4 ± 16	10 ± 13	33 ± 17	14 ± 17	*61 ± 32*
Bq l^{-1}	0.01 ± 0.04	0.02 ± 0.03	0.11 ± 0.06	0.02 ± 0.02	*0.02 ± 0.01*

NS No sample
(① Incomplete sample collection for period

TABLE 2 - Strontium-90 in Rain: 1984:
Rainfall (mm)
Deposition (MBq km^{-2})
Concentration (Bq l^{-1})

New Zealand Stations		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	*Total*	*Av*
Kaitaia	mm	369	288	389	169	*1215*	
	MBq km^{-2}	0.3	<0.1	0.2	<0.1	*0.6*	
	Bq l^{-1}	<0.001	<0.001	<0.001	<0.001		*<0.001*
Auckland	mm	388	231	289	256	*1164*	
	MBq km^{-2}	0.1	0.2	<0.1	<0.1	*0.4*	
	Bq l^{-1}	<0.001	<0.001	<0.001	<0.001		*<0.001*
New Plymouth	mm	493	325	360	357	*1535*	
	MBq km^{-2}	0.3	0.1	0.1	0.2	*0.7*	
	Bq l^{-1}	<0.001	<0.001	<0.001	<0.001		*<0.001*
Havelock North	mm	179	79	233	99	*590*	
	MBq km^{-2}	<0.1	<0.1	<0.1	<0.1	*0.2*	
	Bq l^{-1}	<0.001	<0.001	<0.001	<0.001		*<0.001*
Wellington	mm	286	171	435	225	*1117*	
	MBq km^{-2}	0.2	<0.1	0.1	<0.1	*0.4*	
	Bq l^{-1}	<0.001	<0.001	<0.001	<0.001		*<0.001*
Hokitika	mm	702	581	724	903	*2910*	
	MBq km^{-2}	0.1	<0.1	0.5	0.2	*0.8*	
	Bq l^{-1}	<0.001	<0.001	<0.001	<0.001		*<0.001*
Christchurch	mm	132	79	126	141	*478*	
	MBq km^{-2}	<0.1	<0.1	<0.1	<0.1	*0.2*	
	Bq l^{-1}	<0.001	<0.001	0.001	<0.001		*<0.001*
Dunedin	mm	273	119	194	137	*723*	
	MBq km^{-2}	NS	<0.1	<0.1	<0.1	*(0.2)*	
	Bq l^{-1}	-	<0.001	<0.001	<0.001		*(<0.001)*
Invercargill	mm	NR	NR	218	256	*(474)*	
	MBq km^{-2}	NS	NS	<0.1	<0.1	*(0.1)*	
	Bq l^{-1}	-	-	<0.001	<0.001		*(<0.001)*
Average (Omitting Invercargill)	*mm*	*353*	*234*	*344*	*286*	*1217*	
	MBq km^{-2}	*0.2*	*0.1*	*0.2*	*0.1*	*0.6*	
	Bq l^{-1}	*<0.001*	*<0.001*	*<0.001*	*<0.001*		*<0.001*
Pacific Island Stations							
Suva, Fiji	mm	729	903	338	530	*2500*	
	MBq km^{-2}	<0.1	<0.1	<0.1	<0.1	*0.2*	
	Bq l^{-1}	<0.001	<0.001	<0.001	<0.001		*<0.001*
Rarotonga	mm	713	399	258	324	*1694*	
	MBq km^{-2}	<0.1	<0.1	<0.1	<0.1	*0.2*	
	Bq l^{-1}	<0.001	<0.001	<0.001	<0.001		*<0.001*

NS No sample
NR No reading
( ) Incomplete sample collection for period
The counting error for deposition results was approximately ± 0.08 MBq km^{-2}

TABLE 3 - ^{90}Sr in Milk 1984: (Bq gCa^{-1})

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	*Av*
Northland	0.049	0.037	0.025	0.039	*0.038*
Auckland	0.038	0.040	0.046	0.037	*0.040*
Waikato	0.054	0.042	0.045	0.040	*0.045*
Taranaki	0.070	0.125	0.090	0.049	*0.084*
Palmerston North	0.034	0.032	0.020	0.026	*0.028*
Wellington	0.036	0.037	0.041	0.034	*0.037*
Westland	0.061	0.064	0.068	0.068	*0.065*
Christchurch	0.021	0.019	0.038	0.017	*0.024*
Dunedin	0.026	0.021	0.032	0.021	*0.025*
Average	*0.043*	*0.046*	*0.045*	*0.037*	*0.043*

The counting error was approximately ± 0.002 Bq gCa^{-1}

TABLE 4 - ^{137}Cs in Milk 1984: (Bq gK^{-1})

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	*Av*
Northland	0.12	0.11	0.13	0.20	*0.14*
Auckland	0.11	0.14	0.08	0.10	*0.11*
Waikato	0.40	0.31	0.25	0.33	*0.32*
Taranaki	0.82	0.74	0.55	0.57	*0.67*
Palmerston North	0.04	<0.04	<0.04	<0.04	*<0.04*
Wellington	<0.04	0.07	0.08	0.06	*0.06*
Westland	0.17	0.15	0.04	0.12	*0.12*
Christchurch	0.06	0.11	<0.04	<0.04	*0.06*
Dunedin	<0.04	0.09	0.05	0.04	*0.06*
Average	*0.20*	*0.20*	*0.14*	*0.17*	*0.17*

The counting error was approximately ± 0.03 Bq gK^{-1}