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AUSTRALIAN ATOMIC ENERGY COMMISSION
RESEARCH ESTABLISHMENT

LUCAS HEIGHTS RESEARCH LABORATORIES

AAEC TRITIUM LIST NO.6

1983-1984

by

G.E. CALF

R.C. STOKES

JULY 1985

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ABSTRACT

Details are given of the concentration of the environmental radioisotope, tritium, in monthly precipitation samples taken during the period 1983-1984, at eleven stations throughout Australia. Tritium levels in Australian rainfall have now been estimated for fifteen years and published in the AAEC E series of reports.

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The following descriptors have been selected from the INIS Thesaurus to describe the subject content of this report for information retrieval purposes. For further details please refer to IAEA-INIS-12 (INIS: Manual for Indexing) and IAEA-INIS-13 (INIS: Thesaurus) published in Vienna by the International Atomic Energy Agency.

AUSTRALIA; RADIATION MONITORING; RADIOACTIVITY; RAIN; RAIN WATER; TRITIUM

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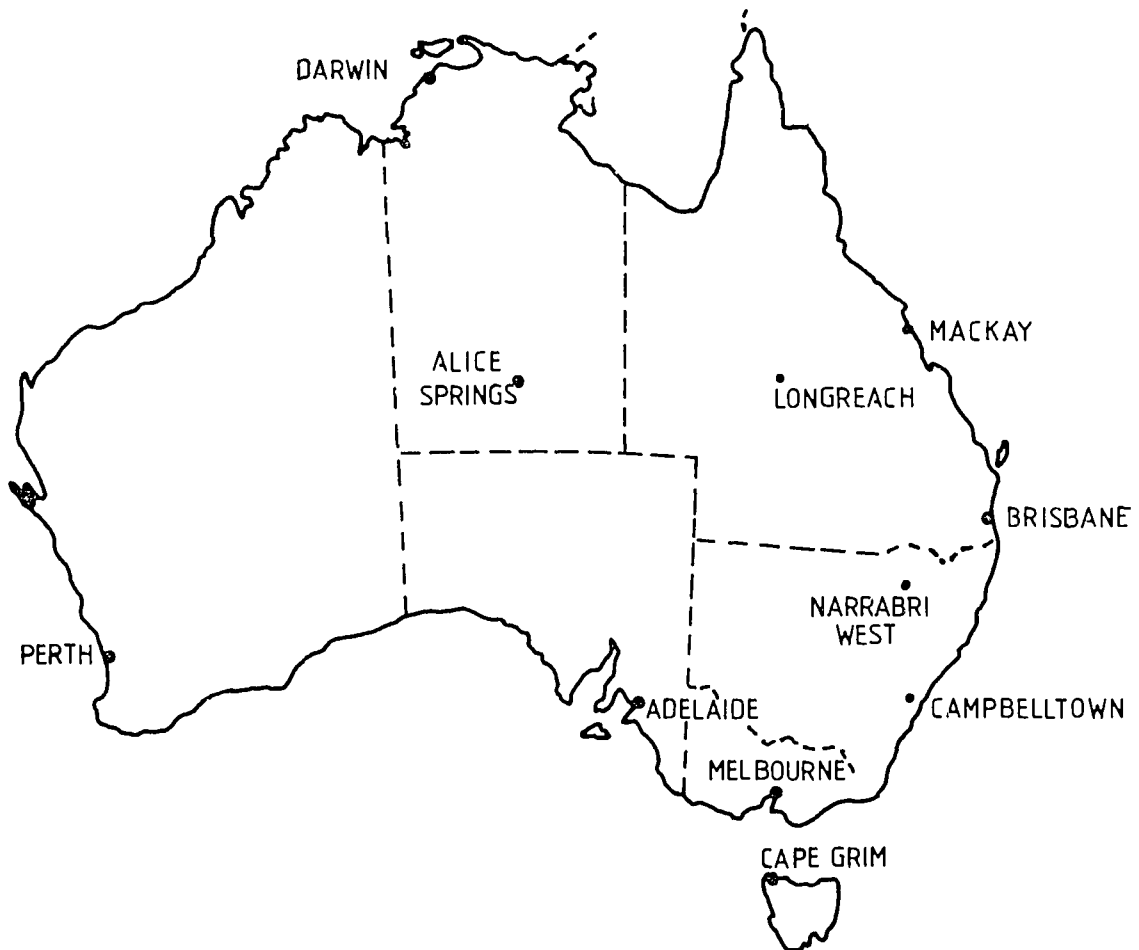
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1. INTRODUCTION

From 1970 to 1982, monthly precipitation samples were collected for the Australian Atomic Energy Commission from 16 stations in Australia.

Previous publications include data from 1970 to 1974 [Calf et al. 1976], 1975 to 1976 [Calf et al. 1977], 1977 to 1978 [Calf and Stokes 1979], 1979 to 1980 [Calf and Stokes 1981], and 1981 to 1982 [Calf and Stokes 1983].

In 1983, sampling was discontinued at Claredale, Bundaberg, Charleville and Toowoomba in Queensland, Ryde in New South Wales, and Cape Grim was substituted for Hobart in Tasmania. Since 1983, monthly precipitation samples have been collected from 11 stations in Australia shown below.



2. STATION DATA

Basic information, including latitude, longitude and altitude, are given for each location for which the tritium activity is reported.

3. SAMPLE ANALYSIS

Samples are composites from the total precipitation at a station during one calendar month and were assayed using methods reported by Calf et al. [1975]. The tritium concentration, given in tritium units (TU), has been corrected for decay to the last day of the sampling month. One TU is defined as one atom of tritium per 10^{18} atoms of hydrogen and is equivalent to 118 m Bq (3.19 pCi) per litre of water if a half-life of 12.43 years is assumed. All results have an estimated standard deviation of 8.5 per cent or 0.4 TU, whichever is the larger.

4. RESULTS

Yearly weighted means for tritium, weighted by the total amount of precipitation, have been calculated according to the formula

$$\text{Weighted mean} = \frac{\Sigma(\text{monthly precipitation} \times \text{monthly tritium concentration})}{\Sigma(\text{monthly precipitation})}$$

The figures in parenthesis represent the percentage of the total precipitation for which tritium data are available to calculate the weighted means.

Tritium levels in Australian rainfall have been estimated for 15 years. The results show that the tritium concentration in rainfall is still decreasing at most monitoring stations.

5. ACKNOWLEDGEMENTS

We are pleased to acknowledge the assistance of the Department of Science and the Environment's Bureau of Meteorology, the Water Resources Commission of NSW and the Water Resources Commission of Queensland in collecting the samples and relaying the relevant monthly precipitation values.

6. REFERENCES

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TABLES 1-11
MONTHLY TRITIUM PRECIPITATION DATA

The following reference symbols apply to all tables in this set:

- (a) Precipitation in mm.
- (b) TU = tritium unit.

TABLE 1

ADELAIDE

Station: 023054

Latitude: 34 57S

Longitude: 138 32E

Altitude: 6.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1983	01	12	rain	6.2
	02	2		
	03	112		6.3
	04	80		5.9
	05	45		6.9
	06	27		5.7
	07	89		5.5
	08	78		6.5
	09	61		8.1
	10	49		8.9
	11	8		6.6
	12	13		8.9
Sum		576		
Weighted Mean				6.6(99.7%)
1984	01	18	rain	6.6
	02	2		5.9
	03	24		5.0
	04	20		4.4
	05	40		4.9
	06	31		4.1
	07	67		4.2
	08	80		6.6
	09	46		5.7
	10	22		8.7
	11	35		5.6
	12	5		7.4
Sum		390		
Weighted Mean				5.6(100.0%)

TABLE 2
ALICE SPRINGS

Station: 015590

Latitude: 23 49S

Longitude: 133 54E

Altitude: 545.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1983	01	23	rain	10.2
	02	1		
	03	357		4.7
	04	68		5.7
	05	0		
	06	0		
	07	0		
	08	12		6.8
	09	1		
	10	22		7.7
	11	19		6.9
	12	46		7.4
Sum		549		
Weighted Mean				5.5(99.6%)
1984	01	105	rain	4.7
	02	1		
	03	1		
	04	28		7.1
	05	0		
	06	0		
	07	25		6.5
	08	6		9.0
	09	29		6.1
	10	32		6.7
	11	4		7.6
	12	58		4.6
Sum		289		
Weighted Mean				5.5(99.3%)

TABLE 3
BRISBANE

Station: 040214

Latitude: 27 28 S

Longitude: 153 02 E

Altitude: 38.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1983	01	84	rain	5.3
	02	112		3.9
	03	79		3.8
	04	113		4.7
	05	300		3.7
	06	273		4.9
	07	50		3.9
	08	56		4.2
	09	22		4.3
	10	76		5.1
	11	206		3.3
	12	100		4.6
Sum		1471		
Weighted Mean				4.2(100.0%)
1984	01	93	rain	3.0
	02	57		2.5
	03	42		5.0
	04	262		3.6
	05	57		5.2
	06	57		3.1
	07	155		3.8
	08	29		
	09	37		5.0
	10	97		3.9
	11	96		5.1
	12	59		5.4
Sum		1041		
Weighted Mean				3.9(97.2%)

TABLE 4
CAMPBELLTOWN

Station: 068081

Latitude: 34 05 S

Longitude: 150 49 S

Altitude: 75.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1983	01	29	rain	9.2
	02	9		6.6
	03	236		3.5
	04	47		4.9
	05	98		3.5
	06	65		3.5
	07	18		8.1
	08	23		6.8
	09	37		9.3
	10	132		7.4
	11	68		4.1
	12	76		6.9
Sum		838		
Weighted Mean				5.2(100.0%)
1984	01	112	rain	5.0
	02	97		7.1
	03	75		4.4
	04	84*		4.2
	05	43		3.7
	06	62		3.4
	07	122		4.0
	08	10		8.4
	09	34		10.2
	10	30		8.6
	11	176		5.9
	12	71		4.5
Sum		916*		
Weighted Mean				5.3

* Incomplete Data

TABLE 5
CAPE GRIM

Station : A 52000101

Latitude: 40 68 S

Longitude: 144 69 E

Altitude: 94.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1983	01	28	rain	3.7
	02	28		6.8
	03	97		5.0
	04	81		3.0
	05	57		4.5
	06	56		3.8
	07	120		5.2
	08	68		5.3
	09	44		5.3
	10	27		4.6
	11	49		5.1*
	12	25		6.0
Sum		680		
Weighted Mean			4.7(94.6%)	
1984	01	17	rain	5.1
	02	21		4.4
	03	82		3.7
	04	42		4.6
	05	57		2.8
	06	46		5.2
	07	93		3.7
	08	116		5.1
	09	125		4.1
	10	43		4.6
	11	63		4.3
	12	31		3.6
Sum		736		
Weighted Mean			4.2(100.0%)	

* Tritium activity represents only 12 mm of months rainfall.

TABLE 6

DARWIN

Station : 014015

Latitude: 12 25 S

Longitude: 130 52 E

Altitude: 31.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1983	01	216	rain	4.0
	02	272		5.1
	03	676		4.5
	04	209		3.3
	05	14		
	06	0		
	07	0		
	08	0		
	09	18		
	10	146		3.7
	11	157		4.2
	12	177		3.4
Sum		1885		
Weighted Mean				4.1(98.3%)
1984	01	419	rain	3.3
	02	586		3.0
	03	359		2.5
	04	151		4.2
	05	0		
	06	0		
	07	0		
	08	45		3.2
	09	67		3.0
	10	33		3.2
	11	162		3.9
	12	127		3.6
Sum		1949		
Weighted Mean				3.2(100.0%)

TABLE 7
LONGREACH

Station : 036031

Latitude: 23 26 S

Longitude: 144 17 E

Altitude: 191.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1983	01	11	rain	
	02	9		7.4
	03	27		5.9
	04	82		4.4
	05	81		3.2
	06	39		3.4
	07	5		7.7
	08	18		
	09	1		
	10	3		
	11	89		6.4
	12	16		
Sum		381		
Weighted Mean				4.2(87.1%)
1984	01	115	rain	4.0
	02	60		3.0
	03	19		4.2
	04	4		
	05	1		
	06	2		
	07	112		4.5
	08	2		
	09	16		5.8
	10	5		
	11	13		7.4
	12	30		4.7
Sum		379		
Weighted Mean				4.1(96.3%)

TABLE 8

MACKAY

Station : 033119

Latitude: 21 07 S

Longitude: 149 13 E

Altitude: 6.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1983	01	156	rain	3.7
	02	29		3.4
	03	209		3.2
	04	130		3.1
	05	546		2.5
	06	53		3.6
	07	27		3.0
	08	7		5.4
	09	22		2.9
	10	33		3.6
	11	121		3.6
	12	49		2.4
Sum		1382		
Weighted Mean				3.0(100.0%)
1984	01	117	rain	2.6
	02	180		2.6
	03	56		2.3
	04	96		2.4
	05	65		1.8
	06	27		2.6
	07	94		3.3
	08	1		5.0
	09	32		5.0
	10	29		5.4
	11	7		3.6
	12	117		3.1
Sum		821		
Weighted Mean				2.8(100.0%)

TABLE 9
MELBOURNE

Station : 096071

Latitude: 37 49 S

Longitude: 144 58 E

Altitude: 34.7 m

Year	Month	Precipitation (a)	Type	TU (b)
1983	01	30	rain	8.0
	02	1		
	03	46		6.0
	04	40		7.0
	05	55		6.3
	06	32		6.3
	07	64		7.2
	08	58		7.2
	09	82		10.7
	10	114		9.2
	11	70		9.1
	12	20		10.2
Sum		612		
Weighted Mean				8.2(99.8%)
1984	01	70		6.5
	02	19		6.6
	03	38		6.4
	04	52		6.8
	05	10		9.7
	06	24		6.0
	07	41		7.2
	08	52		6.5
	09	115		6.7
	10	41		6.3
	11	55		6.1
	12	46		5.8
Sum		563		
Weighted Mean				6.5(100.0%)

TABLE 10
NARRABRI WEST

Station : 053030

Latitude: 30 20 S

Longitude: 149 45 E

Altitude: 212.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1983	01	128	rain	7.8
	02	75		6.8
	03	36		5.7
	04	99		3.9
	05	189		3.4
	06	24		4.7
	07	36		5.9
	08	50		4.9
	09	81		8.8
	10	98		9.9
	11	105		5.3
	12	52		6.7
Sum		973		
Weighted Mean				6.1(100.0%)
1984	01	307	rain	5.4
	02	113		5.7
	03	44		6.6
	04	68		4.0
	05	2		
	06	2		5.6
	07	160		4.4
	08	15		6.3
	09	33		6.7
	10	60		6.4
	11	76		7.6
	12	8		
Sum		888		
Weighted Mean				5.5(98.9%)

TABLE 11

PERTH

Station : 009021

Latitude: 31 56 S

Longitude: 115 58 E

Altitude: 20.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1983	01	1	rain	11.0
	02	22		4.5
	03	4		5.9
	04	16		3.7
	05	23		3.7
	06	232		4.5
	07	114		4.7
	08	138		4.0
	09	100		4.1
	10	9		3.8
	11	45		5.5
	12	17		7.6
Sum		721		
Weighted Mean				4.5(100.0%)
1984	01	1	rain	
	02	4		7.1
	03	29		6.0
	04	60		3.9
	05	143		3.5
	06	114		4.0
	07	82		4.1
	08	112		4.3
	09	103		4.2
	10	26		4.6
	11	61		4.7
	12	13		3.1
Sum		748		
Weighted Mean				4.1(99.9%)