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AUSTRALIAN ATOMIC ENERGY COMMISSION  
RESEARCH ESTABLISHMENT

LUCAS HEIGHTS RESEARCH LABORATORIES

AAEC TRITIUM LIST NO. 5

1981-1982

by

G.E. CALF  
R.C. STOKES

June 1983

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ABSTRACT

Details are given of the concentration of the environmental isotope tritium in monthly precipitation samples taken at 16 stations, situated throughout Australia, during the period 1981-1982. Tritium levels in Australia have now been estimated for 13 years; the results show a significant decrease in tritium concentration in rainfall at all monitoring stations.

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

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## 1. INTRODUCTION

Since 1970, monthly precipitation samples have been collected for the Australian Atomic Energy Commission from sixteen stations in Australia. Previous publications included data from 1970 to 1974 [Calf et al. 1976], 1975 to 1976 [Calf et al. 1977], 1977 to 1978 [Calf and Stokes 1979] and 1979 to 1980 [Calf and Stokes 1981]. Precipitation survey stations are shown in Figure 1.



FIGURE 1

## 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 3.19 pCi (118 mBq) 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

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

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

### 5. ACKNOWLEDGEMENTS

We wish 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 1-16  
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 : 023034

Latitude: 34 57S

Longitude: 138 32E

Altitude: 6.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	20	rain	7.6
	02	3		10.8
	03	42		8.5
	04	1		
	05	47		5.3
	06	138		7.2
	07	96		7.0
	08	82		7.3
	09	29		5.4
	10	34		5.7
	11	30		6.8
	12	15		7.6
Sum		537		
Weighted Mean				6.9 (99.8%)
1982	01	22	rain	7.1
	02	6		7.5
	03	47		4.3
	04	56		4.8
	05	39		3.5
	06	42		8.3
	07	18		5.4
	08	17		10.4
	09	20		5.3
	10	10		7.1
	11	1		
	12	8		8.3
Sum		286		
Weighted Mean				5.9 (99.6%)

TABLE 2

ALICE SPRINGS

Station : 015590

Latitude: 23 49S

Longitude: 133 54E

Altitude: 545.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	93	rain	4.6
	02	19		9.9
	03	1		
	04	0		
	05	7		9.5
	06	7		11.2
	07	13		7.3
	08	0		
	09	5		8.4
	10	7		
	11	65		9.9
	12	93		5.4
Sum		310		
Weighted Mean				6.6 (97.4%)
1982	01	5	rain	19.5
	02	186		4.7
	03	49		6.2
	04	4		15.4
	05	0		
	06	0		
	07	2		25.3
	08	0		
	09	17		8.5
	10	5		18.1
	11	0		
	12	26		9.3
Sum		294		
Weighted Mean				6.3 (100%)

TABLE 3

BRISBANE

Station : 040223

Latitude: 27 26S

Longitude: 153 05E

Altitude: 6.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	133	rain	4.1
	02	371		4.2
	03	19		3.9
	04	187		3.2
	05	92		2.3
	06	54		4.2
	07	39		6.3
	08	22		6.7
	09	1		12.7
	10	27		3.5
	11	408		5.3
	12	128		6.1
Sum		1481		
Weighted Mean				4.5 (100%)
1982	01	234	rain	4.9
	02	95		5.3
	03	207		3.2
	04	80		5.2
	05	72		3.5
	06	2		
	07	7		7.0
	08	34		5.4
	09	63		6.4
	10	70		5.5
	11	16		8.4
	12	208		4.7
Sum		1088		
Weighted Mean				4.7 (99.8%)

TABLE 4

BUNDABERG

Station : 039015

Latitude: 24 52S

Longitude: 152 21E

Altitude: 14.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	117	rain	3.0
	02	158		2.8
	03	65		2.2
	04	70		3.0
	05	187		3.0
	06	36		9.0
	07	38		4.9
	08	23		5.7
	09	3		3.5
	10	36		3.8
	11	172		3.3
	12	68		3.8
Sum		973		
Weighted Mean				3.4 (100%)
1982	01	295	rain	3.3
	02	195		5.3
	03	210		3.0
	04	41		3.1
	05	113		2.3
	06	3		
	07	11		5.3
	08	12		5.6
	09	29		5.6
	10	28		
	11	6		5.0
	12	42		3.7
Sum		985		
Weighted Mean				3.6 (96.9%)

TABLE 5

CAMPBELLTOWN

Station : 068081

Latitude: 34 07S

Longitude: 150 49E

Altitude: 65.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	38	rain	6.3
	02	153		4.7
	03	14		3.5
	04	167		3.9
	05	87		4.0
	06	34		6.0
	07	45		8.7
	08	8		15.3
	09	8		
	10	140		8.0
	11	110		6.4
	12	100		7.8
Sum		904		
Weighted Mean				5.9 (99.1%)
1982	01	36	rain	5.1
	02	22		5.9
	03	105		5.5
	04	6		6.8
	05	4		7.0
	06	27		6.0
	07	17		8.2
	08	0		
	09	152		4.4
	10	28		6.8
	11	7		5.7
	12	9		8.6
Sum		413		
Weighted Mean				5.4 (100%)

TABLE 6

CHARLEVILLE

Station : 044021

Latitude: 26 25S

Longitude: 146 17E

Altitude: 303.9 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	34	rain	5.3
	02	32		5.5
	03	34		5.6
	04	24		4.1
	05	103		4.4
	06	66		10.3
	07	43		4.5
	08	1		
	09	1		
	10	43		6.2
	11	36		6.1
	12	10		9.8
Sum		427		
Weighted Mean				6.0 (99.5%)
1982	01	65	rain	6.6
	02	1		7.4
	03	116		5.6
	04	6		
	05	13		6.5
	06	0		
	07	1		
	08	0		
	09	8		14.1
	10	9		10.5
	11	1		
	12	25		8.1
Sum		245		
Weighted Mean				6.5 (96.7%)

TABLE 7

CLAREDALE\*

Station : 033001

Latitude: 19 35S

Longitude: 147 24E

Altitude: 10.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	558	rain	3.6
	02	268		2.9
	03	50		2.1
	04	45		4.1
	05	114		3.8
	06	50		
	07	11		3.9
	08	0		
	09	0		
	10	4		8.2
	11	188		3.1
	12	38		4.4
Sum		1326		
Weighted Mean				.3 (96.2%)
1982	01	103	rain	4.5
	02	23		4.1
	03	194		3.6
	04	18		3.9
	05	13		14.2
	06	11		6.7
	07	0		16.6
	08	7		
	09	2		4.0
	10	0		
	11	5		
	12	24		3.5
Sum		400		
Weighted Mean				4.2 (97.0%)

\* The precipitation figures are for Ayr, which is situated 28 km from Claredale: No precipitation figures for Claredale are available.

TABLE 8

DARWIN

Station : 014015

Latitude: 12 25S

Longitude: 130 52E

Altitude: 31.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	906	rain	3.7
	02	214		3.2
	03	420		3.3
	04	52		5.1
	05	7		12.5
	06	0		
	07	1		
	08	36		6.9
	09	130		4.5
	10	29		4.5
	11	143		3.2
	12	226		4.0
Sum		2164		
Weighted Mean				3.7 (99.9%)
1982	01	644	rain	5.3
	02	225		4.2
	03	278		3.7
	04	51		4.8
	05	0		
	06	0		
	07	0		
	08	8		8.2
	09	16		5.1
	10	1		
	11	184		3.8
	12	88		4.5
Sum		1495		
Weighted Mean				4.6 (99.9%)

TABLE 9

HOBART

Station : 094029

Latitude: 42 53S

Longitude: 147 20E

Altitude: 55.2 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	18	rain	10.8
	02	12		5.7
	03	57		4.7
	04	72		4.0
	05	33		4.1
	06	74		6.1
	07	44		5.6
	08	106		9.5
	09	35		6.7
	10	48		6.0
	11	21		7.8
	12	28		3.6
Sum		548		
Weighted Mean				6.3 (100%)
1982	01	36	rain	7.4
	02	24		6.9
	03	77		5.3
	04	12		5.8
	05	58		4.3
	06	35		4.1
	07	35		4.7
	08	9		10.0
	09	64		5.4
	10	9		5.5
	11	25		4.8
	12	14		6.4
Sum		398		
Weighted Mean				5.4 (100%)

TABLE 10

LONGREACH

Station : 036031

Latitude: 23 26S

Longitude: 144 17E

Altitude: 191.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	104	rain	3.8
	02	26		4.5
	03	5		4.5
	04	54		4.6
	05	51		2.7
	06	41		
	07	79		3.3
	08	2		
	09	0		
	10	30		8.5
	11	25		5.2
	12	35		8.8
Sum		452		
Weighted Mean				4.1 (90.5%)
1982	01	60	rain	6.5
	02	19		9.0
	03	76		5.8
	04	7		6.5
	05	1		
	06	0		
	07	0		
	08	0		
	09	0		
	10	0		
	11	3		8.3
	12	7		6.8
Sum		173		
Weighted Mean				6.5 (99.4%)

TABLE 11

MACKAY

Station : 033119

Latitude: 21 07S

Longitude: 149 13E

Altitude: 6.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	289	rain	3.1
	02	306		3.5
	03	86		
	04	180		3.1
	05	154		2.0
	06	39		7.9
	07	33		3.9
	08	17		5.3
	09	10		3.6
	10	8		2.8
	11	119		3.8
	12	118		3.8
Sum		1359		
Weighted Mean				3.2 (93.7%)
1982	01	106	rain	3.4
	02	123		4.8
	03	293		2.4
	04	243		2.4
	05	72		2.8
	06	15		2.9
	07	8		4.9
	08	25		3.7
	09	20		3.3
	10	0		
	11	3		
	12	72		3.5
Sum		980		
Weighted Mean				3.0 (99.7%)

TABLE 12

MELBOURNE

Station : 086071

Latitude: 37 49S

Longitude: 144 58E

Altitude: 34.7 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	40	rain	7.8
	02	33		7.9
	03	44		5.0
	04	21		3.6
	05	107		4.1
	06	56		12.0
	07	66		6.2
	08	81		10.9
	09	17		11.1
	10	55		10.4
	11	54		10.8
	12	28		8.6
Sum		602		
Weighted Mean				8.1 (100%)
1982	01	51	rain	7.0
	02	9		10.9
	03	55		6.6
	04	36		6.3
	05	49		4.7
	06	30		6.6
	07	13		7.0
	08	29		11.7
	09	44		5.4
	10	41		4.7
	11	18		10.0
	12	47		8.6
Sum		422		
Weighted Mean				6.9 (100%)

TABLE 13

NARRABRI

Station : 053030

Latitude: 30 20S

Longitude: 149 45E

Altitude: 212.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	2	rain	5.7
	02	86		
	03	0		
	04	30		
	05	81		
	06	51		
	07	59		
	08	9		
	09	20		
	10	76		
	11	67		
	12	56		
Sum		547		
Weighted Mean				5.3 (75.0%)
1982	01	56	rain	6.3
	02	38		
	03	111		
	04	4		
	05	13		
	06	3		
	07	14		
	08	0		
	09	41		
	10	22		
	11	6		
	12	98		
Sum		406		
Weighted Mean				5.8 (93.3%)

TABLE 14

PERTH

Station : 009021

Latitude: 31 56S

Longitude: 115 58E

Altitude: 20.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	1	rain	
	02	12		5.6
	03	6		5.8
	04	32		3.9
	05	160		3.8
	06	159		5.3
	07	153		4.0
	08	132		4.7
	09	58		5.1
	10	35		3.5
	11	35		3.9
	12	8		9.6
Sum		791		
Weighted Mean				4.5 (99.9%)
1982	01	72	rain	6.7
	02	7		5.7
	03	17		5.5
	04	0		
	05	56		4.0
	06	169		5.2
	07	153		5.2
	08	74		5.7
	09	84		7.2
	10	26		5.1
	11	2		6.5
	12	5		4.4
Sum		665		
Weighted Mean				5.6 (100%)

TABLE 15

RYDE

(SYDNEY REGIONAL OFFICE\*)

Station: 066062

Latitude: 33 52S

Longitude: 151 12E

Altitude: 92.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	59	rain	4.2
	02	207		4.3
	03	43		4.4
	04	119		2.3
	05	91		4.5
	06	60		4.1
	07	38		11.2
	08	7		15.3
	09	6		11.4
	10	207		5.1
	11	125		5.9
	12	76		7.6
Sum		1038		
Weighted Mean				5.0 (100%)
1982	01	52	rain	4.6
	02	26		5.1
	03	183		4.5
	04	17		5.7
	05	13		6.9
	06	107		3.6
	07	153		5.3
	08	25		13.2
	09	170		5.0
	10	51		5.9
	11	19		6.8
	12	22		5.3
Sum		838		
Weighted Mean				5.1 (100%)

\* The precipitation figures are for Sydney Regional Office which is situated 12 km from Ryde. No precipitation figures for Ryde are available.

TABLE 16

TOOWOOMBA

Station : 041103

Latitude: 27 35S

Longitude: 151 56E

Altitude: 675.0 m

Year	Month	Precipitation (a)	Type	TU (b)
1981	01	95	rain	3.8
	02	421		3.8
	03	67		3.0
	04	156		4.2
	05	62		3.1
	06	80		8.5
	07	91		4.6
	08	29		10.4
	09	39		9.0
	10	24		5.0
	11	170		9.0
	12	245		6.0
Sum		1479		
Weighted Mean				5.3 (100%)
1982	01	152	rain	4.0
	02	146		5.6
	03	108		5.1
	04	68		6.4
	05	48		3.8
	06	4		13.6
	07	39		8.0
	08	18		8.9
	09	79		9.8
	10	84		7.3
	11	15		7.1
	12	135		6.9
Sum		896		
Weighted Mean				6.2 (100%)