

# ***Environmental Radioactivity Surveillance Programme 1994 - 1996***

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## 1 INTRODUCTION

This report presents the results of the terrestrial monitoring programme implemented by the Radiological Protection Institute of Ireland during the period 1994 to 1996 and is the latest in a series of periodic reports. This monitoring programme includes the routine sampling and testing for radioactivity of samples of air, rainwater, drinking water and milk. Sampling is undertaken in conjunction with Met Éireann, the Department of the Environment and Local Government, the Department of Agriculture and Food, local authorities and health boards. The results of the Institute's marine environmental monitoring programme are published in a separate series of reports which are available from the Institute.

Under Article 35 of the EURATOM Treaty, each Member State of the European Union is required to establish the facilities necessary to carry out continuous monitoring of the levels of radioactivity in the environment and to ensure compliance with the basic standards. The terrestrial monitoring programme fulfills Irish obligations under this provision. As required under Article 36 of the Treaty, information on this programme is communicated periodically to the Commission of the European Union. The Commission in turn publishes compilations of the information received from Member States [European Commission, 1996].

Figure 1 shows the locations of the stations at which continuous monitoring was undertaken during the current reporting period. The types of measurements made at each of these stations are listed in Table 1. Developments to the monitoring arrangements with respect to the previous programme as described by Sequeira *et al.* [1995] include an increase in the number of low volume airborne particulate monitoring stations from seven to nine and the implementation in 1996 of a revised schedule for monitoring drinking water supplies. The inclusion of external gamma dose rate monitoring data is also a feature of this report.

## 2 AIRBORNE RADIOACTIVITY

During the reporting period the Institute monitored airborne radioactivity at 11 stations of which 9 were equipped with low volume particulate samplers, one with a high volume particulate sampler and one with atmospheric krypton-85 measuring equipment. Low volume particulate samples were routinely assessed for total beta activity and high volume samples for gamma emitting radionuclides such as caesium-137 and beryllium-7. Atmospheric krypton-85 concentrations were measured at the Institute's laboratory in Clonskeagh.

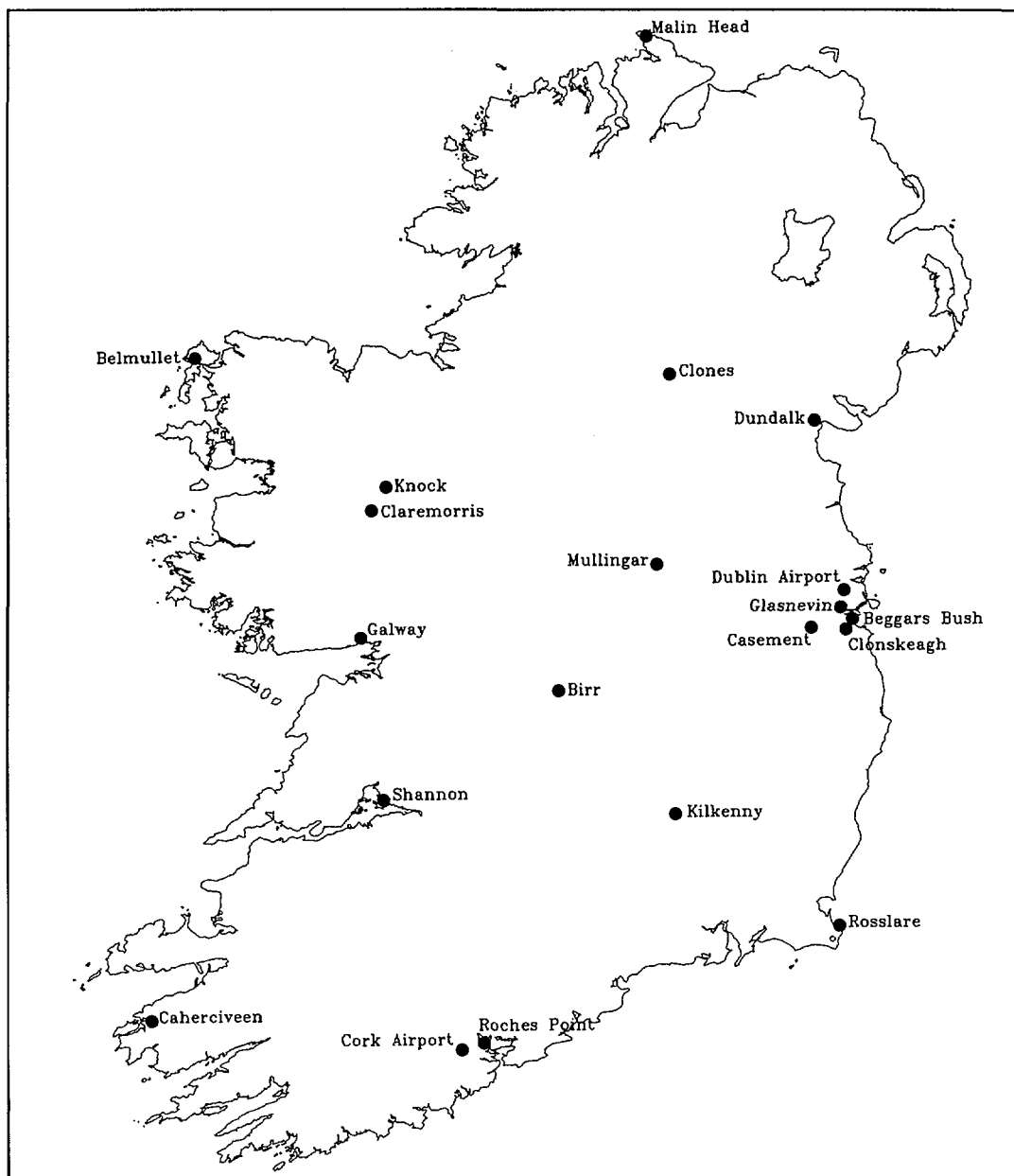


Figure 1 Sampling Stations

## 2.1 Low Volume Particulate Sampling

The locations of the low volume airborne particulate sampling stations are given in Table 1. Particulates are collected by drawing air continuously through a 47 mm glass microfibre filter. The sampling equipment includes a microprocessor based volume totaliser and has an unloaded flow rate of approximately  $10 \text{ m}^3/\text{h}$ . The sampling period used is normally 1 week and the volume of air sampled during this time typically ranges between  $500$  and  $1500 \text{ m}^3$ .

After sampling the filters are left in a dust free environment for three days before analysis to ensure that short lived naturally occurring radionuclides have first decayed to non-detectable levels. The filters are analysed for gross beta activity using a gas-flow proportional counter with a gross beta counting efficiency of 35% and a mean background of 2.8 cpm. The 95% detection limit for a two hour count is 15 mBq.

### **2.1.1 Results**

The ranges of gross beta activity concentrations in airborne particulates at the nine stations for the 1994-1996 period are presented in Tables 2 to 4. The activity levels observed were insignificant from a radiological protection perspective, not exceeding 1.5 mBq/m<sup>3</sup> at any station.

## **2.2 High Volume Particulate Sampling**

The high volume air sampler is located at the Geological Survey of Ireland at Beggars Bush in Dublin. The unit employs a large format (25 cm x 20 cm) particulate filter and has an unloaded flow rate of approximately 100 m<sup>3</sup>/h. Filters are bulked on a two monthly basis and are tested using high resolution gamma spectroscopy. The results of measurements carried out between 1994 and 1996 are presented in Table 5. These data are consistent with global fallout levels at these latitudes.

## **2.3 Krypton-85 Monitoring**

The Institute measures atmospheric krypton-85 concentrations at its laboratory in Clonskeagh. The krypton sampling system used at the Institute was designed and built by the radon research group at the University of Gent in Belgium. The measurement technique comprises separate sampling and measurement stages. The sampling stage is carried out at the Institute and the measurement stage at the University of Gent. Sampling involves drawing air over an activated charcoal trap at liquid nitrogen temperature, after which the krypton sample is transferred by distillation from the charcoal trap to a copper coil containing a quantity of molecular sieve. The copper coil is then sent to Belgium for analysis which involves gas chromatographic separation of krypton gas followed by liquid scintillation counting to determine the krypton-85 concentration. During the reporting period measurements were made approximately twice monthly on samples collected over two hours.

The results of measurements carried out between 1994 and 1996 are presented in Tables 6 to 8. The uncertainty on individual measurements is typically  $\pm 5\%$ . A trend of increasing atmospheric krypton-85 concentrations was observed over the reporting period. This is illustrated in Figure 2 which shows measured concentrations at Clonskeagh since monitoring was commenced in 1993.

Because the measurements are made on samples collected over two hours, it is necessary, when calculating annual average concentrations, to avoid bias arising from short term fluctuations. For this reason, measurements exceeding 2.5 Bq/m<sup>3</sup> were treated as outliers and were excluded from annual mean calculations. The mean annual krypton-85 concentration, calculated on this basis, increased from 1.12 Bq/m<sup>3</sup> during 1994 to 1.30 Bq/m<sup>3</sup> during 1996 corresponding to an annual rate of increase of approximately 0.1 Bq/m<sup>3</sup> over the reporting period. This trend is in line with observations made elsewhere in western Europe [Poffijn, 1996; Weiss *et al.*, 1989].

Krypton-85, because of its inertness and its extremely low solubility, does not participate in metabolic processes. When present in the atmosphere it irradiates man primarily by beta skin dose due to immersion in a krypton cloud. Using the ICRP 30 dose coefficient for skin from submersion in a semi-infinite cloud [ICRP, 1979], the mean concentration measured during 1996 results in an annual equivalent dose to the skin of 0.5 µSv. The annual effective dose, calculated on the basis of ICRP 68 effective dose rates for inert gases [ICRP, 1994], is 0.01 µSv and so is more than an order of magnitude lower than the skin dose.

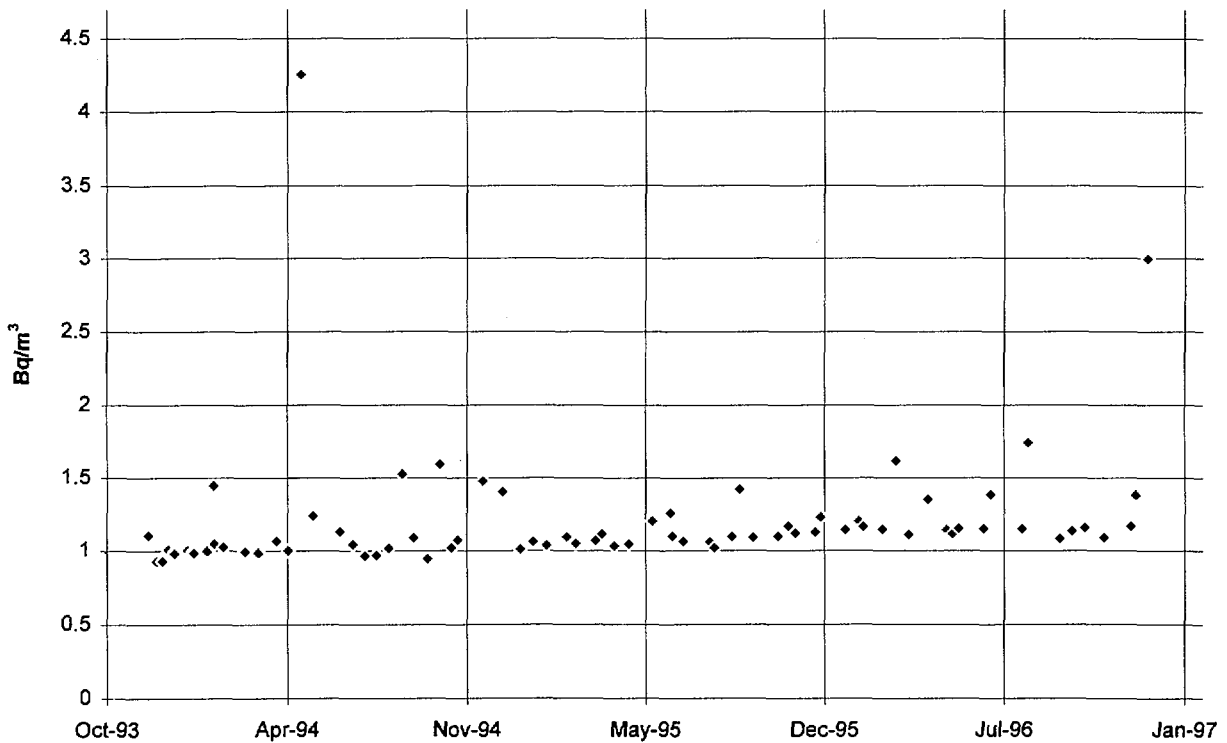


Figure 2 Atmospheric Krypton-85 Concentrations at Clonskeagh (Dublin), 1993 - 1996

## **3 RAINWATER**

### **3.1 Methods of Sampling and Analysis**

During the reporting period rainwater samples were collected monthly at each of the thirteen stations listed in Table 1. Each monthly collection from Clonskeagh was analysed individually while samples from all other stations were bulked proportionately on a quarterly basis in accordance with the monthly rainfall measurements. All samples were analysed for gross beta activity.

Samples are prepared for gross beta counting by evaporating a 500 ml aliquot to dryness onto a flat bottomed stainless steel planchette. The detection limit (95% confidence) for this procedure is typically 0.02 Bq/l. The results obtained in Bq/l are reported as wet deposition ( $\text{Bq/m}^2$ ) using the precipitation measurements for the collection site from Met Éireann data. The deposition ( $\text{Bq/m}^2$ ) is calculated for each measurement by multiplying the measured activity concentration (Bq/l) by the precipitation (mm) for the period of measurement.

### **3.2 Results**

Quarterly gross beta wet deposition measurements are presented with the rainfall data for individual stations in Tables 9 to 11. In the case of Clonskeagh the data reported are the mean of the individual monthly measurements weighted in accordance with the monthly rainfall

## **4 DRINKING WATER**

### **4.1 Methods of Sampling and Analysis**

In 1996 the Institute put into place a revised monitoring schedule for drinking water supplies. According to this schedule, the sampling programme is organised on a county basis so that, as a minimum, one supply from each county is sampled every four years. In addition, supplies to certain major population centres are sampled annually. Where practicable drinking water is sampled at the point at which the treated water is released into the distribution network. Sampling is normally carried out on behalf of the Institute by the relevant local authority or health board.

Samples are acidified with nitric acid as soon as practicable after sampling to minimise the adsorption of radioactivity on the walls of the bottle. A 500 ml aliquot from each sample is evaporated to dryness and analysed for gross alpha and beta activities. The detection limits (95% confidence) for this procedure are typically 20 mBq/l and 10 mBq/l for alpha and beta respectively.



Radium is measured by the co-precipitation of radium with barium sulphate followed by gamma spectroscopy after an ingrowth period to allow the daughter nuclides to reach secular equilibrium. Radium-226 is determined using the gamma rays of its daughters lead-214 and bismuth-214 while radium-228 is determined using the gamma rays of actinium-228.

Drinking water results were compared with the World Health Organization (WHO) recommended guideline activity concentrations of 100 mBq/l for gross alpha and 1000 mBq/l for gross beta activities [WHO, 1993]. These concentrations are based on a dose guideline of 0.1 mSv/year assuming a consumption rate of two litres per day and take into account a range of natural and artificial radionuclides which may be present in water. This reference dose represents approximately 5% of the average global dose attributable annually to natural background radiation. It should be noted that these guidelines refer to levels at which further investigation is recommended and are not maximum permitted concentrations.

## 4.2 Results

The results of the gross alpha and gross beta measurements carried out between 1994 and 1996 are presented in Tables 12 to 14. All of the measured gross beta activity concentrations were below the WHO gross beta guideline.

Three samples were found to exceed WHO gross alpha guidelines. These were collected at Ahascragh, County Galway in July 1994 (326 mBq/l), Dunboyne, County Meath in August 1996 (185 mBq/l) and Monasterevin, County Kildare in December 1996 (239 mBq/l). Further investigation of each of these drinking water sources was undertaken. The strategy adopted was firstly to determine radium-226 and radium-228 concentrations in order to calculate the ingestion dose due to radium, and secondly, to re-sample the source in order to establish if the measured concentrations were likely to persist over a period of a full year. Ingestion doses were calculated on the basis of a daily per capita consumption rate of 2 litres and using ICRP 68 dose conversion coefficients [ICRP,1994].

For the three samples, the measured radium concentrations and the corresponding estimated annual ingestion doses are presented in Table 15. The dose calculated on the basis of the radium in the Ahascragh sample was < 0.053 mSv. On re-sampling in January 1995 the total alpha concentration was found to be 75 mBq/l. The radium doses for the Dunboyne and Monasterevin samples were estimated to be < 0.006 and < 0.007 mSv respectively. These sources are being re-examined. It was concluded, on the basis of the samples tested, that no significant health risk is posed by any of these supplies.

## **5 MILK**

### **5.1 Methods of Sampling and Analysis**

The Institute, in conjunction with the Department of Agriculture and Food, routinely monitors the levels of artificial radioactivity in Irish milk. During the period 1994 to 1996, milk was sampled monthly at 10 milk processing plants. Milk from each station was bulked quarterly and analysed for strontium-90 and gamma emitting radionuclides.

The activity of gamma emitting radionuclides is measured using high resolution gamma spectroscopy. The strontium-90 activity in milk samples is determined by radiochemical separation involving liquid-liquid extraction followed by Cerenkov counting of yttrium-90. Typical detection limits (95% confidence) for caesium-134, caesium-137 and strontium-90 were 0.3 Bq/l, 0.2 Bq/l and 0.05 Bq/l respectively.

### **5.2 Results**

The results of measurements of radioactivity in milk samples are presented in Tables 17 to 19. In general the data are similar to those for the previous reporting period. In all cases strontium-90 concentrations were found to be less than or equal to 0.1 Bq/l. Caesium-134 was below the detection limit for all samples and caesium-137 was detected in only 3 out of a total of 120 samples. When taken with previous data these results reflect the continued reduction in global fallout levels due to radioactive decay and reduced bioavailability.

## **6 EXTERNAL GAMMA DOSE RATE**

The external gamma dose rate is monitored continuously at the locations listed in Table 1. The dose rate is recorded every twenty minutes and the readings transmitted automatically to the Institute's computer database at Clonskeagh. This monitoring network provides early notification of any abnormal increase in the dose rate at a station. Each station is fitted with an alarm which would be triggered in the event of a high reading. Arrangements are in place to notify the Institute's Duty Officer immediately of such an occurrence.

The average gamma dose rate for each of the monitoring stations ranged between 63 nSv/h and 93 nSv/h. The measured dose rate at individual stations is subject to natural variation due to factors such as statistical fluctuations associated with the measurement and radon washout. Radon washout occurs when radon daughters in the atmosphere are brought to ground level by heavy rainfall resulting in increased dose rate readings. This increase in dose rate may persist for a period of a few

hours. During the reporting period radon washout events resulting in increases of approximately 60 nSv/h above background were observed at Dundalk during November 1995 and at Cork Airport in December 1995

The maximum and minimum dose rate readings for each month, at each station, over the period 1994 - 1996 are presented in Table 16

## **7 CONCLUSIONS**

During the period covered by this report the Institute continued to monitor radioactivity in the Irish terrestrial environment so as to assess the levels to which the Irish public are exposed. Some enhancements were made to the programme during the period with the addition of two new low volume particulate sampling stations and the inclusion of external gamma dose rate monitoring data.

Atmospheric concentrations of krypton-85, which is released to atmosphere as a result of nuclear fuel reprocessing, continued to rise over the period reflecting the gradual build up of this radionuclide in the troposphere of the northern hemisphere. The measured concentrations of strontium-90 in milk and caesium-137 in air and milk are consistent with global fallout levels at these latitudes. No abnormal readings were observed during this reporting period for gamma dose rate, radioactivity in airborne particulates or radioactivity in rainwater. Significant variation in the concentrations of natural radioactivity was observed between drinking water supplies and it is recommended that further monitoring of natural radioactivity in drinking water be undertaken during future programmes.

The levels of anthropogenic radioactivity recorded during this reporting period in air, rainwater, drinking water and milk continue to be insignificant from a radiological safety point of view.

## **8 ACKNOWLEDGEMENTS**

The valuable assistance provided by the officers of Met Éireann, the Department of the Environment and Local Government, the Department of Agriculture and Food and participating local authorities and health boards in providing and processing samples is acknowledged with gratitude.

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**Table 1          Sampling Stations**

Station	County	Measurement Types
Beggars Bush	Dublin	Airborne particulates (high volume)
Belmullet	Mayo	Rainwater
Birr	Offaly	Rainwater, Gamma dose rate
Cahirciveen	Kerry	Airborne particulates, Rainwater, Gamma dose rate
Casement	Dublin	Gamma dose rate
Claremorris	Mayo	Rainwater, Gamma dose rate
Clones	Monaghan	Airborne particulates, Rainwater, Gamma dose rate
Clonskeagh	Dublin	Airborne particulates, Krypton-85, Rainwater, Gamma dose rate
Cork Airport	Cork	Gamma dose rate
Dublin Airport	Dublin	Rainwater
Dundalk	Louth	Airborne particulates, Gamma dose rate
Galway	Galway	Airborne particulates
Glasnevin	Dublin	Airborne particulates
Kilkenny	Kilkenny	Rainwater, Gamma dose rate
Knock Airport	Mayo	Gamma dose rate
Malin Head	Donegal	Rainwater, Gamma dose rate
Midleton	Cork	Airborne particulates
Mullingar	Westmeath	Airborne particulates, Rainwater
Roches Point	Cork	Rainwater
Rosslare	Wexford	Airborne particulates, Rainwater, Gamma dose rate
Shannon Airport	Clare	Rainwater, Gamma dose rate

**Table 2 Radioactivity in Airborne Particulates, 1994**

Month	Gross Beta Activity Range (number of readings), mBq/m <sup>3</sup>				
	Cahirciveen	Clones	Clonskeagh	Dundalk	Galway
January	0.10 (1)	0.18 - 0.23 (4)	0.11 - 0.19 (4)	0.05 (1)	0.09 - 0.24 (4)
February	0.12 - 0.29 (4)	0.15 - 0.53 (4)	0.13 - 0.46 (4)	0.02 - 0.40 (3)	0.15 - 0.33 (3)
March	0.10 - 0.12 (2)	0.12 - 0.33 (5)	0.11 - 0.23 (5)	0.11 - 0.26 (4)	0.04 - 0.29 (2)
April	0.12 - 0.22 (3)	0.13 - 0.36 (4)	0.13 - 0.21 (4)	0.15 - 0.21 (4)	0.20 - 0.33 (3)
May	0.08 - 0.54 (5)	0.26 - 0.77 (4)	0.19 - 0.35 (4)	0.16 - 0.39 (4)	0.22 - 0.47 (2)
June	0.09 - 0.28 (4)	0.21 - 0.55 (4)	0.14 - 0.32 (6)	0.13 - 0.39 (4)	0.30 - 0.42 (3)
July	0.09 - 0.37 (3)	0.23 - 0.57 (5)	0.19 - 0.26 (4)	0.22 - 0.34 (4)	0.13 - 0.26 (4)
August	0.11 - 0.37 (3)	0.18 - 0.37 (4)	0.19 - 0.30 (4)	0.15 - 0.23 (4)	0.12 - 0.47 (5)
September	0.15 - 0.34 (5)	0.17 - 0.52 (5)	0.17 - 0.32 (5)	0.16 - 0.24 (4)	0.17 - 0.39 (4)
October	0.18 - 1.30 (4)	0.22 - 0.70 (4)	0.16 - 0.60 (3)	0.18 - 0.36 (3)	0.02 - 0.57 (3)
November	0.11 - 0.32 (3)	0.14 - 0.30 (4)	0.20 - 0.30 (4)	0.17 - 0.46 (3)	0.20 - 0.94 (4)
December	0.13 - 0.85 (4)	0.18 - 0.23 (2)	0.16 - 0.65 (4)	0.23 - 0.84 (3)	0.95 (1)

**Table 2 (continued) Radioactivity in Airborne Particulates, 1994**

Month	Gross Beta Activity Range (number of readings), mBq/m <sup>3</sup>			
	Glasnevin	Midleton	Mullingar	Rosslare
January	0.00 - 0.26 (8)	(0)	0.15 - 0.27 (3)	0.11 - 0.30 (3)
February	0.17 - 0.80 (8)	(0)	0.09 - 0.43 (2)	0.22 - 0.81 (3)
March	0.00 - 0.34 (9)	0.22 - 0.54 (3)	0.12 - 0.19 (3)	0.10 - 0.69 (4)
April	0.00 - 0.23 (7)	0.19 - 0.49 (7)	0.11 - 0.19 (4)	0.24 - 0.31 (3)
May	0.00 - 0.56 (9)	0.21 - 0.30 (2)	0.15 - 0.43 (5)	0.23 - 0.47 (5)
June	0.16 - 0.51 (8)	0.21 (1)	0.15 - 0.39 (4)	0.24 - 0.41 (4)
July	0.00 - 0.40 (9)	0.17 - 0.32 (4)	0.15 - 0.24 (4)	0.23 - 0.51 (5)
August	0.00 - 0.34 (9)	0.23 - 0.36 (3)	0.16 - 0.28 (4)	0.15 - 0.27 (4)
September	0.21 - 0.37 (9)	0.28 - 0.33 (3)	0.15 - 0.27 (4)	0.30 - 0.59 (5)
October	0.00 - 0.80 (8)	0.20 - 0.72 (3)	0.16 - 0.38 (4)	0.31 - 1.40 (3)
November	0.00 - 0.95 (9)	0.19 - 0.42 (2)	0.08 - 0.37 (4)	0.73 (1)
December	0.00 - 0.67 (9)	0.15 - 0.67 (5)	0.08 - 0.17 (4)	0.36 - 0.59 (2)

**Table 3 Radioactivity in Airborne Particulates, 1995**

Month	Gross Beta Activity Range (number of readings), mBq/m <sup>3</sup>				
	Cahirciveen	Clones	Clonskeagh	Dundalk	Galway
January	0.09 - 0.12 (3)	0.06 - 0.22 (4)	0.09 - 0.20 (4)	0.10 - 0.27(5)	0.27 (1)
February	0.07 - 0.08 (2)	0.15 - 0.35 (3)	0.10 - 0.27 (5)	0.11 - 0.13 (2)	0.09 - 0.28 (3)
March	0.16 - 0.27 (4)	0.14 - 0.28 (4)	0.12 - 0.29 (4)	0.10 - 0.97 (5)	0.08 - 0.27 (3)
April	0.24 - 0.56 (4)	0.28 - 0.52 (4)	0.28 - 0.49 (4)	0.06 - 0.33 (3)	0.17 - 0.45 (3)
May	0.19 - 0.35 (4)	0.26 - 0.48 (4)	0.27 - 0.47 (4)	0.21 - 0.41 (3)	0.39 - 0.47 (3)
June	0.28 - 0.45 (2)	0.11 - 0.43 (5)	0.14 - 0.38 (6)	0.11 - 0.48 (5)	0.37 (1)
July	0.12 - 0.64 (3)	0.25 - 0.30 (4)	0.24 - 0.34 (4)	0.22 - 0.24 (2)	0.20 - 0.57 (2)
August	0.25 - 0.61(4)	0.41 - 0.61 (4)	0.24 - 0.63 (5)	0.31 (1)	0.21 - 0.59 (2)
September	0.21 - 0.40 (4)	0.25 - 0.52 (4)	0.25 - 0.46 (4)	0.21 - 0.44 (5)	0.27 - 0.32 (3)
October	0.16 - 0.36 (3)	0.26 - 0.82 (3)	0.21 - 0.54 (3)	0.17 (1)	0.22 - 0.25 (4)
November	0.13 - 0.38 (4)	0.12 - 0.35 (5)	0.18 - 0.43 (6)	0.17 - 0.27 (3)	0.10 - 0.33 (4)
December	0.35 - 0.45 (2)	0.37 (1)	0.33 - 0.46 (3)	0.18 - 0.59 (3)	0.27 - 0.38 (2)

**Table 3 (continued) Radioactivity in Airborne Particulates, 1995**

Month	Gross Beta Activity Range (number of readings), mBq/m <sup>3</sup>			
	Glasnevin	Midleton	Mullingar	Rosslare
January	0.00 - 0.46 (9)	0.33 (1)	0.05 - 0.17 (4)	0.19 - 0.37 (3)
February	0.00 - 0.40 (9)	0.18 - 0.52 (2)	0.07 - 0.16 (4)	0.12 - 0.90 (4)
March	0.14 - 0.38 (9)	0.22 (1)	0.09 - 0.15 (4)	0.32 - 0.59 (4)
April	0.00 - 0.74 (7)	0.80 (1)	0.13 - 0.49 (5)	0.31 - 0.55 (2)
May	0.00 - 0.59 (8)	0.39 (1)	0.20 - 0.28 (4)	0.31 - 0.60 (4)
June	0.00 - 0.57 (9)	(0)	0.11 (1)	0.16 - 0.53 (5)
July	0.22 - 0.50 (9)	(0)	0.15 - 0.35 (4)	0.15 - 0.36 (4)
August	0.20 - 0.85 (8)	(0)	0.26 - 0.36 (3)	0.15 - 0.54 (5)
September	0.22 - 0.45 (6)	(0)	0.17 - 0.28 (5)	0.13 - 0.33 (4)
October	0.29 - 0.64 (3)	0.32 (1)	0.16 - 0.24 (3)	0.24 - 0.28 (2)
November	0.13 - 0.33 (5)	0.22 - 0.42 (4)	0.09 - 0.13 (2)	0.10 - 0.77 (3)
December	0.31 - 0.46 (2)	0.27 - 0.49 (2)	0.10 - 0.15 (3)	0.42 - 0.42 (2)

**Table 4 Radioactivity in Airborne Particulates, 1996**

Month	Gross Beta Activity Range (number of readings), mBq/m <sup>3</sup>				
	Cahirciveen	Clones	Clonskeagh	Dundalk	Galway
January	0.15 - 0.32 (4)	0.17 - 0.47 (3)	0.19 - 0.28 (4)	0.09 - 0.25 (3)	0.13 - 0.49 (3)
February	0.16 - 1.40 (5)	0.17 - 1.10 (5)	0.14 - 1.20 (6)	0.15 - 1.20 (2)	0.11 - 0.92 (3)
March	0.21 - 0.37 (4)	0.15 - 0.77 (4)	0.28 - 0.52 (4)	0.25 - 0.30 (2)	0.27 - 0.35 (2)
April	0.14 - 0.59 (4)	0.10 - 0.26 (4)	0.20 - 0.25 (2)	0.21 - 0.41 (4)	0.11 - 0.67 (4)
May	0.09 - 0.38 (5)	0.14 - 0.28 (5)	0.18 - 0.19 (2)	0.07 - 0.29 (4)	0.15 - 0.35 (4)
June	0.14 - 0.42 (3)	0.13 - 0.33 (4)	(0)	0.16 - 0.24 (3)	0.14 - 0.31(4)
July	0.10 - 0.31 (4)	0.12 - 0.40 (4)	(0)	0.12 - 0.30 (3)	0.10 - 0.36 (3)
August	0.15 - 0.30 (5)	0.17 - 0.46 (5)	(0)	0.18 - 0.59 (5)	0.23 - 0.26 (2)
September	0.31 - 0.62 (4)	0.19 - 0.60 (4)	0.45 - 0.50 (3)	0.27 - 0.50 (2)	0.18 - 0.60 (4)
October	0.09 - 0.36 (5)	0.12 - 0.29 (4)	0.14 - 0.38 (5)	0.16 - 0.33 (3)	0.12 - 0.29 (4)
November	0.11 - 0.27 (4)	0.12 - 0.20 (4)	0.14 - 0.24 (4)	0.14 (1)	0.09 - 0.18 (4)
December	0.14 - 0.68 (4)	0.11 - 0.40 (2)	0.12 - 0.40 (4)	0.03 (1)	0.16 (1)

**Table 4 (continued) Radioactivity in Airborne Particulates, 1996**

Month	Gross Beta Activity Range (number of readings), mBq/m <sup>3</sup>			
	Glasnevin	Midleton	Mullingar	Rosslare
January	0.09 - 0.80 (5)	0.06 - 0.83 (5)	0.04 - 0.20 (4)	0.19 (1)
February	0.17 - 0.32 (4)	0.18 - 0.67 (4)	(0)	0.75 (1)
March	0.22 - 0.57 (4)	0.17 - 0.48 (4)	0.05 - 0.19 (5)	0.33 - 0.34 (2)
April	0.15 - 0.50 (4)	0.10 - 0.33 (4)	0.09 - 0.23 (4)	(0)
May	0.17 - 0.25 (5)	0.12 - 0.29 (5)	0.09 - 0.15 (4)	0.09 - 0.20 (4)
June	0.15 - 0.32 (4)	0.11 - 0.14 (2)	0.08 - 0.19 (5)	0.16 - 0.31 (4)
July	0.10 - 0.53 (5)	0.08 - 0.25 (3)	0.08 (1)	0.12 - 0.45 (4)
August	0.14 - 0.55 (4)	0.12 - 0.35 (4)	0.19 (1)	0.13 - 0.56 (6)
September	0.26 - 0.57 (4)	0.19 - 0.43 (4)	0.31 - 0.46 (2)	0.24 - 0.38 (4)
October	0.13 - 0.36 (5)	0.15 - 0.24 (4)	0.09 - 0.16 (3)	0.15 - 0.34 (3)
November	0.10 - 0.17 (4)	0.10 - 0.20 (3)	0.09 - 0.20 (5)	0.16 - 0.23 (2)
December	0.11 - 0.15 (3)	0.13 - 0.16 (2)	0.08 - 0.14 (3)	0.16 - 0.33 (2)



**Table 5 Caesium-137 and Beryllium-7 in Air at Beggars Bush (Dublin), 1994 to 1996**

Sampling Period		Activity Concentration in Air, Bq/m <sup>3</sup>	
start date	end date	Cs-137	Be-7
29-Aug-94	11-Oct-94	1.23E-06	2.46E-03
18-Oct-94	2-Dec-94	1.62E-06	2.61E-03
14-Dec-94	30-Jan-95	2.06E-06	2.70E-03
27-Apr-95	28-Jun-95	8.45E-07	1.87E-03
3-Jan-96	6-Mar-96	1.59E-06	4.10E-03
6-Mar-96	10-Apr-96	6.56E-06	6.65E-03
3-May-96	11-Jun-96	1.06E-06	2.41E-03
11-Jun-96	23-Aug-96	8.55E-07	2.62E-03

**Table 6 Krypton-85 in Air at Clonskeagh (Dublin), 1994**

Sampling Date	Wind Direction	Kr-85 Bq/m <sup>3</sup>
5-Jan-94	W	1.004
11-Jan-94	S	0.995
12-Jan-94	S-SW	0.983
27-Jan-94	W-NW	0.998
3-Feb-94	E-SE	1.447
4-Feb-94	E-SE	1.048
14-Feb-94	E-SE	1.025
10-Mar-94	W-NW	0.996
25-Mar-94	NW	0.987
14-Apr-94	N	1.068
27-Apr-94	SW	1.002
11-May-94	S	4.256
25-May-94	SE	1.245
24-Jun-94	SE	1.131
8-Jul-94	W	1.045
21-Jul-94	NW-W	0.966
3-Aug-94	S	0.971
17-Aug-94	NW	1.019
1-Sep-94	N-NE	1.527
14-Sep-94	NE	1.089
29-Sep-94	SW	0.946
13-Oct-94	SE	1.593
26-Oct-94	W	1.023
2-Nov-94	S	1.074
30-Nov-94	SE	1.479
22-Dec-94	SW	1.407

**Table 7      Krypton-85 in Air at Clonskeagh (Dublin), 1995**

Sampling Date	Wind Direction	Kr-85 Bq/m <sup>3</sup>
11-Jan-95	NW	1.011
25-Jan-95	SE-E	1.063
9-Feb-95	E	1.037
4-Mar-95	W	1.097
14-Mar-95	NW	1.051
5-Apr-95	W	1.073
12-Apr-95	W	1.115
26-Apr-95	NE	1.033
12-May-95	N	1.048
8-Jun-95	N	1.207
28-Jun-95	E-NE	1.262
30-Jun-95	E-NE	1.1
12-Jul-95	S	1.063
11-Aug-95	SE-S	1.061
16-Aug-95	SW	1.02
5-Sep-95	S	1.101
13-Sep-95	S	1.422
28-Sep-95	NW	1.092
26-Oct-95	SW-W	1.101
7-Nov-95	SW	1.173
15-Nov-95	NE	1.123
7-Dec-95	SE	1.129
13-Dec-95	NE	1.234

**Table 8 Krypton-85 in Air at Clonskeagh (Dublin), 1996**

Sampling Date	Wind Direction	Kr-85 Bq/m <sup>3</sup>
10-Jan-96	S-SW	1.146
25-Jan-96	E	1.208
30-Jan-96	E	1.167
20-Feb-96	NE	1.149
6-Mar-96	E	1.615
20-Mar-96	E	1.113
12-Apr-96	SE	1.352
2-May-96	NE	1.146
8-May-96	NE	1.118
15-May-96	NE	1.157
12-Jun-96	W	1.155
19-Jun-96	NE	1.388
24-Jul-96	NW	1.154
31-Jul-96	W	1.74
4-Sep-96	E	1.086
18-Sep-96	SE	1.142
2-Oct-96	W	1.161
23-Oct-96	S	1.095
22-Nov-96	NW	1.174
27-Nov-96	NW	1.385
10-Dec-96	E	2.995

**Table 9 Deposition of Radioactivity by Rainfall, 1994**

Station	Gross Beta Deposition, Bq/m <sup>2</sup> (Rainfall, mm)			
	January to March	April to June	July to September	October to December
Belmullet	23.11 (444.5)	10.79 (145.8)	21.04 (266.3)	22.64 (359.4)
Birr	< 12 (283.2)	< 8 (200.5)	8.74 (213.1)	NM
Cahirciveen	< 22 (540.6)	< 14 (340.9)	43.43 (394.8)	22.77 (474.3)
Claremorris	< 17 (419.5)	12.23 (222.4)	< 13 (319.2)	14.21 (384.1)
Clones	< 13 (316.1)	8.64 (205.7)	22.55 (242.5)	16.15 (269.2)
Clonskeagh	< 14 (254.4)	22.70 (132.9)	< 11 (214.6)	72.62 (188.6)
Dublin Airport	14.76 (254.4)	5.32 (132.9)	14.34 (214.6)	NM
Kilkenny	12.84 (329.2)	< 8 (203.8)	15.52 (258.6)	10.75 (210.8)
Malin Head	< 17 (416.6)	12.05 (200.9)	< 10 (247.9)	42.11 (323.9)
Mullingar	20.74 (324)	36.23 (201.3)	40.79 (226.6)	45.02 (264.8)
Rosslare	26.49 (344)	25.80 (172)	27.19 (226.6)	15.06 (295.2)
Shannon	16.31 (407.7)	13.43 (258.2)	19.90 (211.7)	12.86 (357.3)

NM = not measured

**Table 10 Deposition of Radioactivity by Rainfall, 1995**

Station	Gross Beta Deposition, Bq/m <sup>2</sup> (Rainfall, mm)							
	January to March		April to June		July to September		October to December	
Belmullet	< 19	(472.5)	8.27	(131.2)	< 8	(189.1)	31.02	(443.2)
Birr	< 13	(333)	4.22	(84.3)	6.524	(138.8)	< 11	(272.5)
Cahirciveen	25.37	(551.6)	< 9	(222.6)	19.24	(231.8)	16.74	(452.5)
Claremorris	20.01	(425.7)	< 5	(124.2)	< 8	(192.6)	20.56	(337.1)
Clones	< 13	(324.8)	6.98	(99.7)	9.84	(175.8)	18.53	(363.4)
Clonskeagh	< 14	(244.6)	7.31	(88.9)	33.16	(121)	26.95	(255.6)
Dublin Airport	< 10	(244.6)	3.56	(88.9)	10.16	(121)	15.08	(255.6)
Kilkenny	< 12	(307.9)	5.05	(112.3)	15.39	(109.9)	< 12	(302.2)
Malin Head	20.93	(486.7)	< 6	(149.4)	8.88	(189)	15.22	(354)
Mullingar	59.53	(330.7)	14.21	(94.7)	< 6	(152.6)	14.63	(318)
Rosslare	13.30	(271.5)	10.18	(92.5)	16.67	(128.2)	22.98	(310.5)
Shannon	23.01	(451.1)	12.93	(117.5)	14.20	(177.5)	14.38	(281.9)

**Table 11 Deposition of Radioactivity by Rainfall, 1996**

Station	Gross Beta Deposition, Bq/m <sup>2</sup> (Rainfall, mm)							
	January to March		April to June		July to September		October to December	
Belmullet	30.79	(279.9)	7.94	(203.5)	9.89	(224.8)	14.35	(422.1)
Birr	9.92	(268.2)	5.87	(143.2)	< 7	(177)	4.74	(249.6)
Cahirciveen	16.67	(476.2)	12.83	(291.6)	12.84	(285.4)	31.00	(508.2)
Claremorris	NM		10.29	(171.5)	< 8	(203.7)	NM	
Clones	18.34	(215.8)	< 7	(180)	12.46	(259.6)	6.34	(275.8)
Clonskeagh	25.74	(227.3)	20.22	(145.8)	5.78	(163)	11.45	(262)
Dublin Airport	20.91	(227.3)	6.39	(148.7)	8.97	(163)	14.41	(262)
Kilkenny	27.85	(348.1)	< 6	(147.3)	5.75	(179.8)	3.57	(274.5)
Malin Head	9.92	(132.2)	< 8	(208.4)	6.15	(245.9)	9.42	(336.3)
Mullingar	23.32	(233.2)	16.24	(178.5)	4.87	(180.4)	7.76	(277)
Rosslare	55.76	(398.3)	23.72	(169.4)	5.89	(120.3)	20.81	(273.8)
Shannon	13.91	(278.2)	5.55	(129)	15.46	(184.1)	11.56	(304.1)

NM = not measured

**Table 12 Gross Alpha and Beta Activities in Drinking Water, 1994**

County	Source	Raw / Treated	Sampling Date	Activity Concentration (mBq/l)	
				Gross Alpha	Gross Beta
Cork	Inniscarra Reservoir (R. Lee)	Raw	18 July	< 11	89 ± 8
Cork	Inniscarra Reservoir (R. Lee)	Treated	18 July	< 12	116 ± 9
Cork	R. Lee	Raw	9 August	59 ± 11	434 ± 25
Cork	R. Lee / Infiltration Gallery	Treated	9 August	< 12	110 ± 9
Cork	Infiltration Gallery	Raw	9 August	61 ± 11	417 ± 23
Cork	Groundwater (Tramor Road, Cork)	Raw	8 August	< 31	138 ± 12
Dublin	Bohernabreena Reservoir (R. Dodder)	Raw	13 July	< 12	48 ± 7
Dublin	Bohernabreena Reservoir (R. Dodder)	Treated	13 July	86 ± 10	45 ± 7
Galway	Surface spring (Ahascragh)	Raw	18 July	326 ± 37	153 ± 15
Galway	Groundwater (Athenry)	Raw	18 July	66 ± 18	126 ± 14
Galway	Groundwater (Barnaderg)	Raw	18 July	37 ± 19	301 ± 21
Galway	Groundwater (Cloonmore / Roscahill)	Raw	18 July	61 ± 19	98 ± 13
Galway	Groundwater (Kilchreest)	Raw	18 July	68 ± 18	72 ± 12
Galway	Groundwater (Kilcolgan / Clarinbridge)	Raw	18 July	< 21	139 ± 14
Galway	Groundwater (Kilconly)	Raw	18 July	35 ± 16	150 ± 15
Galway	Groundwater (Menlough)	Raw	18 July	76 ± 20	292 ± 21
Galway	R. Corrib (New Waterworks)	Raw	18 July	< 16	76 ± 8
Galway	R. Corrib (New Waterworks)	Treated	18 July	< 16	88 ± 9
Galway	R. Corrib (Old Waterworks)	Treated	18 July	< 17	129 ± 10
Kildare	R. Liffey	Raw	20 July	32 ± 14	88 ± 9
Kildare	R. Liffey	Treated	20 July	22 ± 9	81 ± 8
Sligo	Lough Gill	Raw	21 October	< 15	70 ± 9
Sligo	Lough Gill	Treated	21 October	< 15	69 ± 9
Sligo	Kinsellagh Reservoir	Raw	21 October	< 18	64 ± 9
Sligo	Kinsellagh Reservoir	Treated	21 October	< 16	53 ± 8
Sligo	Lough Easkey	Raw	24 October	< 11	277 ± 17
Sligo	Lough Easkey	Treated	24 October	< 9	49 ± 8
Sligo	Lough Talt	Raw	24 October	< 15	62 ± 10
Sligo	Lough Talt	Treated	24 October	< 12	52 ± 8
Sligo	Groundwater (Riverstown)	Raw	21 October	77 ± 19	118 ± 10
Wicklow	Poulaphouca Reservoir (R. Liffey)	Raw	14 July	< 9	47 ± 7
Wicklow	Poulaphouca Reservoir (R. Liffey)	Treated	14 July	< 7	29 ± 6
Wicklow	Roundwood (R. Vartry)	Raw	29 July	22 ± 6	52 ± 7
Wicklow	Roundwood (R. Vartry)	Treated	29 July	38 ± 7	64 ± 7

**Table 13 Gross Alpha and Beta Activities in Drinking Water, 1995**

County	Source	Raw / Treated	Sampling Date	Activity Concentration (mBq/l)	
				Gross Alpha	Gross Beta
Galway	Surface spring (Ahascragh)	Raw	23 January	75 ± 37	123 ± 16
Galway	Groundwater (Castleblakeney / Ballymacward)	Raw	23 January	37 ± 19	91 ± 12
Galway	Groundwater (Danganbeg)	Raw	23 January	< 27	192 ± 17
Galway	Groundwater (Doone)	Raw	23 January	43 ± 21	95 ± 13
Galway	Groundwater (Kilbannon)	Raw	23 January	42 ± 20	168 ± 15
Galway	Groundwater (Kilkerran / Moylough)	Raw	23 January	86 ± 22	148 ± 15
Galway	Groundwater (Lowville)	Raw	23 January	62 ± 24	110 ± 13
Galway	Groundwater (Tuam)	Raw	23 January	< 25	176 ± 15

**Table 14 Gross Alpha and Beta Activities in Drinking Water, 1996**

County	Source	Raw / Treated	Sampling Date	Activity Concentration (mBq/l)	
				Gross Alpha	Gross Beta
Cavan	Lough Acanon	Treated	9 September	53 ± 12	134 ± 13
Clare	Groundwater (Ennis)	Treated	1 August	27 ± 14	111 ± 9
Cork	R. Lee	Treated	25 September	< 20	121 ± 13
Cork	R. Lee / Infiltration Gallery	Treated	25 September	< 19	109 ± 12
Donegal	Groundwater (Carndonagh)	Treated	9 December	35 ± 17	116 ± 13
Donegal	Killybegs Dam	Treated	10 December	< 9	36 ± 6
Donegal	Lough Mourne	Treated	10 December	13 ± 6	49 ± 7
Donegal	Lough Eske	Treated	10 December	31 ± 7	52 ± 7
Donegal	Lough Keel	Treated	11 December	19 ± 7	50 ± 7
Donegal	Lough Keel and Lough Salt	Treated	17 December	< 9	51 ± 7
Galway	R. Corrib (New Waterworks)	Treated	20 August	< 13	78 ± 8
Kildare	R. Liffey	Treated	6 September	72 ± 20	153 ± 14
Kildare	Groundwater (Monasterevin)	Treated	18 December	239 ± 24	165 ± 15
Laois	Groundwater (Portlaoise)	Treated	1 July	86 ± 24	89 ± 12
Limerick	Groundwater (Rathkeale / Kilcolman)	Raw	18 July	49 ± 19	72 ± 11
Longford	Lough Forbes	Treated	8 August	18 ± 9	75 ± 8
Longford	Groundwater (Lanesboro)	Treated	8 August	< 44	98 ± 13
Meath	River Blackwater (Navan)	Treated	28 August	< 15	167 ± 12
Meath	Groundwater (Dunboyne)	Treated	28 August	185 ± 37	124 ± 14
Offaly	Mountain stream (Kinnitty)	Treated	25 July	42 ± 18	76 ± 8
Offaly	Groundwater (Toberdaly)	Treated	26 July	30 ± 18	58 ± 11
Offaly	Groundwater (Tully)	Treated	30 July	< 38	67 ± 11
Offaly	Groundwater (Holmishill and Agall)	Treated	30 July	< 29	52 ± 11
Offaly	R. Clodiagh, R. Gorragh and 5 boreholes	Treated	30 July	37 ± 15	119 ± 10
Roscommon	Groundwater (Ballinagard)	Treated	20 August	< 34	110 ± 13
Wexford	R. Sow	Treated	30 October	< 25	158 ± 14
Wexford	Groundwater (Barnadown)	Treated	30 October	< 22	71 ± 11

**Table 15 Radium-226 and Radium-228 in Drinking Water, 1994 to 1996**

County	Source	Raw /	Sampling Date	Activity Concentration (mBq/l)		Annual Dose (mSv)
		Treated		Ra-226	Ra-228	
Galway	Groundwater (Ahascragh)	Raw	18 Jul 1994	227 ± 50	< 88	< 0.05
Meath	Groundwater (Dunboyne)	Treated	28 Aug 1996	< 12	< 22	< 0.006
Kildare	Groundwater (Monasterevin)	Treated	18 Dec 1996	< 13	< 24	< 0.007

**Table 16 External Gamma Dose Rates, 1994 to 1996**

Station	Birr			Cahirciveen		
	(Monthly Ranges) nSv/h			(Monthly Ranges) nSv/h		
	1994	1995	1996	1994	1995	1996
<b>Jan</b>	57-70	56-75	55-77	70-89	71-92	78-100
<b>Feb</b>	57-74	56-75	57-75	69-90	70-89	75-96
<b>Mar</b>	57-71	56-74	58-86	69-86	69-90	76-108
<b>Apr</b>	56-71	55-76	55-82	63-90	69-91	75-103
<b>May</b>	57-78	56-72	57-76	71-95	67-87	77-105
<b>Jun</b>	56-72	55-73	57-73	61-96	69-89	72-116
<b>Jul</b>	56-69	58-77	58-73	71-84	73-91	70-113
<b>Aug</b>	57-71	58-109	56-88	71-84	73-99	67-85 <sup>(1)</sup>
<b>Sep</b>	56-70	59-76	57-76	70-85	77-102	70-90
<b>Oct</b>	56-83	57-91	56-77	68-94	74-98	68-93
<b>Nov</b>	56-72	58-91	57-79	70-90	74-108	70-98
<b>Dec</b>	57-73	58-78	58-73	71-98	76-100	69-87
(1) New detector fitted						

Station	Casement			Claremorris		
	(Monthly Ranges) nSv/h			(Monthly Ranges) nSv/h		
	1994	1995	1996	1994	1995	1996
<b>Jan</b>	62-80	63-80	66-91	80-100	70-96	68-84
<b>Feb</b>	63-88	64-80	65-88	80-105	68-94	67-83
<b>Mar</b>	63-76	62-80	63-90	79-98	65-80	65-104
<b>Apr</b>	62-77	63-78	65-86	77-96	66-80	65-80
<b>May</b>	62-85	64-79	65-97	79-102	64-80	62-79
<b>Jun</b>	60-80	63-80	65-81	76-97	66-80	67-77
<b>Jul</b>	61-78	64-80	67-85	73-93	67-86	65-99
<b>Aug</b>	64-90	67-85	65-112	77-94	68-98	61-83
<b>Sep</b>	67-80	62-85	64-85	82-97	69-94	65-83
<b>Oct</b>	69-80	66-88	67-108	- <sup>(2)</sup>	66-88	67-86
<b>Nov</b>	62-91	67-130	66-104	- <sup>(2)</sup>	66-109	- <sup>(1)</sup>
<b>Dec</b>	61-81	65-93	64-84	- <sup>(2)</sup>	66-89	
(1) Station moved to Knock Airport						
(2) Fault in detector						

**Table 16 (Continued) External Gamma Dose Rates, 1994 to 1996**

Station	Clones			Clonskeagh		
	(Monthly Ranges) nSv/h			(Monthly Ranges) nSv/h		
	1994	1995	1996	1994	1995	1996
<b>Jan</b>	61-80	62-80	64-82	74-90	74-92	73-99
<b>Feb</b>	63-83	62-81	63-84	73-97	71-89	74-91
<b>Mar</b>	62-76	59-80	62-89	74-86	72-90	74-114
<b>Apr</b>	61-76	60-77	63-82	72-88	64-89	72-99
<b>May</b>	62-78	62-78	63-79	71-98	73-94	71-93
<b>Jun</b>	61-77	61-76	62-78	72-87	72-89	73-94
<b>Jul</b>	60-75	62-83	64-86	72-86	73-91	72-95
<b>Aug</b>	61-75	63-81	64-95	73-86	75-91	73-105
<b>Sep</b>	61-77	64-82	63-83	73-87	76-91	73-100
<b>Oct</b>	62-92	62-90	64-89	73-92	75-93	72-102
<b>Nov</b>	60-78	61-117	64-81	71-101	74-132	72-101
<b>Dec</b>	61-77	63-84	64-82	73-94	72-97	72-96

Station	Cork Airport			Dundalk		
	(Monthly Ranges) nSv/h			(Monthly Ranges) nSv/h		
	1994	1995	1996	1994	1995	1996
<b>Jan</b>	- <sup>(1)</sup>	70-88	77-106	92-112	91-111	85-111
<b>Feb</b>	- <sup>(1)</sup>	71-89	74-96	92-115	91-109	81-103
<b>Mar</b>	70-87	72-92	70-127	90-107	89-109	83-107
<b>Apr</b>	72-97	74-93	74-98	92-108	85-151	80-106
<b>May</b>	71-105	74-90	77-100	93-114	88-111	83-103
<b>Jun</b>	73-91	75-98	76-98	94-111	88-104	83-102
<b>Jul</b>	73-90	75-98	82-106	92-108	86-106	87-106
<b>Aug</b>	74-91	71-102	82-121	91-114	90-106	84-104
<b>Sep</b>	79-91	83-116	83-109	91-108	88-114	86-108
<b>Oct</b>	79-96	76-109	81-118	93-134	84-119	80-127
<b>Nov</b>	72-100	78-123	78-100	88-150	84-153	80-99
<b>Dec</b>	72-102	74-146	78-107	91-110	81-115	80-102

<sup>(1)</sup> Fault in detector

Station	Kilkenny			Knock Airport		
	(Monthly Ranges) nSv/h			(Monthly Ranges) nSv/h		
	1994	1995	1996	1994	1995	1996
<b>Jan</b>	60-76	59-77	52-83			
<b>Feb</b>	60-73	59-79	61-77			
<b>Mar</b>	58-78	56-76	58-86			
<b>Apr</b>	59-76	57-80	59-90			61-79 <sup>(1)</sup>
<b>May</b>	60-83	60-76	59-76			60-76
<b>Jun</b>	60-73	60-79	60-75			58-73
<b>Jul</b>	59-73	61-77	61-79			58-75
<b>Aug</b>	60-73	62-113	59-95			58-78
<b>Sep</b>	59-77	- <sup>(1)</sup>	58-78			57-79
<b>Oct</b>	60-90	- <sup>(1)</sup>	60-79			59-74
<b>Nov</b>	59-83	60-115	60-81			61-83
<b>Dec</b>	59-75	60-88	60-76			61-78

<sup>(1)</sup> Fault in detector

<sup>(1)</sup> Detector system installed April 1996



**Table 16 (Continued) External Gamma Dose Rates, 1994 to 1996**

Station	Malin Head			Rosslare		
	(Monthly Ranges) nSv/h			(Monthly Ranges) nSv/h		
	1994	1995	1996	1994	1995	1996
<b>Jan</b>	74-95	72-95	70-95	58-77	57-77	60-99
<b>Feb</b>	74-100	63-87	66-85	60-91	58-76	61-80
<b>Mar</b>	73-90	62-78	69-85	60-77	59-82	56-86
<b>Apr</b>	74-89	62-88	70-100	59-75	60-77	59-83
<b>May</b>	73-91	64-77	70-101	59-82	61-85	62-81
<b>Jun</b>	74-96	64-87	74-104	60-76	61-73	61-75
<b>Jul</b>	72-96	66-95	58-107 <sup>(1)</sup>	60-74	60-86	61-78
<b>Aug</b>	75-92	68-85	50-82	61-75	58-86	61-83
<b>Sep</b>	74-91	71-96	56-74	60-77	63-83	62-81
<b>Oct</b>	73-97	70-90	56-73	60-91	60-81	60-95
<b>Nov</b>	75-99	70-115	55-73	59-83	62-122	63-82
<b>Dec</b>	74-94	67-87	56-75	60-83	60-101	57-79

<sup>(1)</sup>New detector fitted

Station	Shannon Airport		
	(Monthly Ranges) nSv/h		
	1994	1995	1996
<b>Jan</b>	79-96	56-76	63-82
<b>Feb</b>	79-109	60-87	63-83
<b>Mar</b>	79-98	59-75	64-87
<b>Apr</b>	78-98	59-78	64-81
<b>May</b>	60-103	61-73	65-83
<b>Jun</b>	60-85	53-76	63-85
<b>Jul</b>	59-71	62-90	63-90
<b>Aug</b>	59-72	63-80	61-92
<b>Sep</b>	59-74	66-82	64-86
<b>Oct</b>	54-81	62-80	61-79
<b>Nov</b>	60-74	64-94	62-83
<b>Dec</b>	59-79	63-85	57-75

**Table 17 Radioactivity in Milk, 1994**

County	Activity Concentration (Bq/l)							
	January to March		April to June		July to September		October to December	
	Cs-137	Sr-90	Cs-137	Sr-90	Cs-137	Sr-90	Cs-137	Sr-90
Kilkenny	< 0.12	< 0.06	< 0.12	0.07	< 0.19	0.07	< 0.17	0.06
Cavan	< 0.09	< 0.05	< 0.25	0.06	< 0.18	0.06	< 0.24	< 0.05
Louth	< 0.12	< 0.05	< 0.12	0.07	< 0.19	< 0.06	< 0.22	< 0.06
Monaghan	< 0.11	< 0.05	< 0.15	< 0.06	< 0.17	< 0.06	< 0.17	< 0.05
Cork	< 0.13	< 0.06	< 0.13	0.09	< 0.20	< 0.07	< 0.18	< 0.06
Kerry	< 0.17	< 0.07	< 0.13	< 0.05	< 0.19	< 0.07	< 0.17	< 0.06
Dublin	< 0.12	< 0.05	< 0.12	< 0.06	< 0.19	< 0.06	< 0.17	< 0.06
Roscommon	< 0.12	< 0.08	< 0.14	< 0.06	0.60	< 0.06	< 0.15	< 0.06
Tipperary	< 0.19	< 0.05	< 0.13	< 0.06	< 0.13	< 0.07	< 0.18	< 0.06
Waterford	< 0.12	0.06	< 0.13	< 0.07	< 0.18	< 0.05	< 0.17	< 0.06

**Table 18 Radioactivity in Milk, 1995**

County	Activity Concentration (Bq/l)							
	January to March		April to June		July to September		October to December	
	Cs-137	Sr-90	Cs-137	Sr-90	Cs-137	Sr-90	Cs-137	Sr-90
Kilkenny	< 0.14	< 0.05	< 0.14	< 0.08	< 0.16	< 0.04	< 0.23	< 0.05
Cavan	< 0.13	< 0.05	< 0.24	< 0.07	< 0.13	< 0.05	< 0.18	< 0.05
Louth	< 0.22	0.06	< 0.22	< 0.07	< 0.23	< 0.05	< 0.19	< 0.05
Monaghan	< 0.23	< 0.05	< 0.22	< 0.05	< 0.15	< 0.06	< 0.14	< 0.04
Cork	< 0.23	< 0.05	< 0.22	< 0.06	< 0.22	< 0.05	< 0.23	< 0.04
Kerry	< 0.21	< 0.05	< 0.25	< 0.06	< 0.16	< 0.04	< 0.18	< 0.05
Dublin	< 0.14	< 0.09	< 0.22	< 0.07	< 0.22	< 0.04	< 0.22	0.09
Roscommon	< 0.14	< 0.05	< 0.23	< 0.06	0.43	0.08	< 0.25	0.05
Tipperary	< 0.22	< 0.05	< 0.14	< 0.06	< 0.23	< 0.05	< 0.23	0.05
Waterford	< 0.14	< 0.06	< 0.14	< 0.06	< 0.23	< 0.05	< 0.26	< 0.04

**Table 19 Radioactivity in Milk, 1996**

County	Activity Concentration (Bq/l)							
	January to March		April to June		July to September		October to December	
	Cs-137	Sr-90	Cs-137	Sr-90	Cs-137	Sr-90	Cs-137	Sr-90
Kilkenny	< 0.23	< 0.04	< 0.21	< 0.04	< 0.25	< 0.06	< 0.19	< 0.04
Cavan	< 0.18	0.05	< 0.24	0.09	< 0.20	0.08	< 0.17	< 0.04
Louth	< 0.25	< 0.04	< 0.14	0.05	< 0.21	< 0.04	< 0.18	< 0.05
Monaghan	< 0.21	< 0.04	< 0.20	0.06	< 0.21	0.07	< 0.15	< 0.04
Cork	< 0.19	0.05	< 0.14	< 0.04	< 0.20	0.04	< 0.17	< 0.04
Kerry	< 0.18	< 0.05	< 0.19	< 0.05	< 0.23	0.08	< 0.26	0.07
Dublin	< 0.18	< 0.04	< 0.14	0.06	< 0.29	< 0.04	< 0.19	< 0.04
Roscommon	< 0.19	< 0.04	< 0.26	0.09	0.32	0.04	< 0.26	0.08
Tipperary	< 0.22	< 0.04	< 0.23	0.07	< 0.25	< 0.04	< 0.3	< 0.05
Waterford	< 0.15	0.09	< 0.21	0.07	< 0.26	0.10	< 0.24	0.05