3 Year Report: 1996 – 1999

NORTHERN IRELAND RADIATION MONITORING CO-ORDINATING COMMITTEE

(A summary report of data formerly presented in three comprehensive annual reports.)

Produced by:
Geosciences Advisory Unit Southampton Oceanography Centre European Way

SOUTHAMPTON, SO14 3ZH

Central Laboratory Facility
Geosciences Advisory Unit
Southampton Oceanography Centre
European Way
SOUTHAMPTON
SO14 3ZH

Tel: 023 8059 2780
Fax: 023 8059 6450
Email: iwc@soc.soton.ac.uk

Project Co-ordinator
Dr Ian W Croudace

Senior Radiochemist
Phillip Warwick

Radiochemists
Jung Suk Oh Am & Pu isotopes
Frank Wigley ^{99}Tc

CONTENTS

SUMMARY

This report for the Northern Ireland Radiation Monitoring Co-ordinating Committee (NIRMCC) is a compilation of radiochemical data for samples submitted from participating authorities during the contract period April 1996 – March 1999. Samples taken from the marine, estuarine and terrestrial environment are examined and also a variety of locally produced foodstuffs

Very small levels of anthropogenic (man-made or artificial) radionuclides have been identified in many of the materials examined although none of the levels found is expected to be hazardous to the public. The levels represent a small fraction of the national legislative (cautionary) limits of radiation dose to members of the public. The maximum dose likely to be experienced by an adult living in Northern Ireland, derived from artificial sources of radioactivity, is small and within expected natural variations.

Data for the naturally occurring isotopes ^{40}K and ^{7}Be also are reported. The levels of these radioisotopes in natural materials are determined by their exposure to the atmosphere (for the cosmogenic radioisotope ^{7}Be) and the chemical composition of the sample. They are included for interest and for comparison with data presented by other groups. Additionally, they help put the reported anthropogenic radionuclide activities in context.

MAIN CONCLUSIONS FOR RESULTS APRIL 1996 - MARCH 1999

The results obtained are briefly discussed below and a full set of data is given in Appendix A.
Although anthropogenic (man-made or artificial) radionuclides have been identified in many of the materials examined none of the levels found is expected to be hazardous to the public. The levels represent a small fraction of the national legislative (cautionary) limits of radiation dose to members of the public. All the contamination values are well below the Investigation Levels (i.e. 10% GDL*; NRPB, 1996).

The Mini680 readings taken at the intertidal sediment sample locations are reported in Appendix C

INTERPRETATION OF GAMMA SPECTROMETRY RESULTS

The results from all environmental samples show the region to be one of low radiological significance as far as anthropogenic (man-made or artificial) radioactive materials are concerned. Anthropogenic radioisotopes of caesium and americium are seen in minute quantities in some samples from the marine environment. These are derived mostly BNFL Sellafield.

Caesium isotopes in terrestrial samples (soils and vegetation) are due to past depositions from the Chernobyl cloud and atmospheric weapons' testing. The levels are extremely low in all samples examined. The higher, though radiologically modest, level observed for Caesium-137 in venison submitted by Belfast and Fermanagh, are similarly derived from weapons' fallout and Chernobyl. After Chernobyl the uptake of caesium by heather resulted in eating restrictions on some venison from heather-eating deer. Red deer and sita deer are the dominant heather eaters, although fallow and roe deer also take a small amount of it.

Data for the naturally occurring isotopes ^{40}K and ^{7}Be are reported. The levels of these radioisotopes in natural materials are determined by their exposure to the atmosphere (for the cosmogenic radioisotope ^{7}Be) and the chemical composition of the sample. They are included for interest and for comparison with data presented by other groups (see reports issued by LARRMACC**)**. Additionally, they help place the reported anthropogenic radionuclide activities in context.

INTERPRETATION OF ALPHA SPECTROMETRY RESULTS

Transuranic radionuclides, plutonium and americium, originating from Sellafield discharges and from weapons' tests are all found to be low and should be of no radiological concern. This conclusion is clearly shown by comparing the Generalised Derived Limit (GDL) data with the measured sample activity data (Appendix A). The highest levels of contamination are found in fine-grained marine sediments.

INTERPRETATION TECHNETIUM-99 ANALYSES

The technetium results in samples from the marine environment for the year 1996-1999 reflect the continuing, but currently decreasing, discharges of Tc-99 from the Sellafield Plant. Edible materials (lobsters, prawns and dulse seaweed) do not show any levels of Tc-99 that would lead to any radiological concerns. The main concentrators of technetium are the seaweeds *Fucus vesiculosus* and *Ascophyllum nodosum*. The magnitude of the activity concentration for any particular species reflects the age of the plant, the contact time with contaminated seawater and the trends of marine currents from the eastern Irish Sea. Dulse, which is consumed by some people, is not a significant concentrator of Tc-99. It is known that lobsters can concentrate technetium but the results so far do not indicate any significant radiological problems.

COMPARATIVE RADIOMETRIC DATA

Reliability and consistency are checked comparing data from different monitoring groups or agencies. Quality assurance is evaluated by participating in intercomparison exercises with international organisations (eg: IAEA and NPL). Data produced by the Geosciences Advisory Unit (Southampton Oceanography Centre) laboratory are very satisfactory within the described criteria.

LONG TERM TRENDS

A selected set of data are given in Figure 1 to evaluate some long term trends with samples taken from the Northern Ireland environment. This shows variation in the activity of Cs-137 with time for sediments, periwinkles and seafish. The significant decline in Cs-137 activities is a result of improved clean-up of effluents by SIXEP (Site Ion-eXchange Plant) and EARP (Enhanced Actinide Recovery Plant). The trend for Tc-99 in seaweed shows there has been a significant increase in activity since 1994 but that it is currently decreasing. The trend in seaweed reflects the increase and subsequent decrease in discharge of Tc-99 from Sellafield (Figure 2)

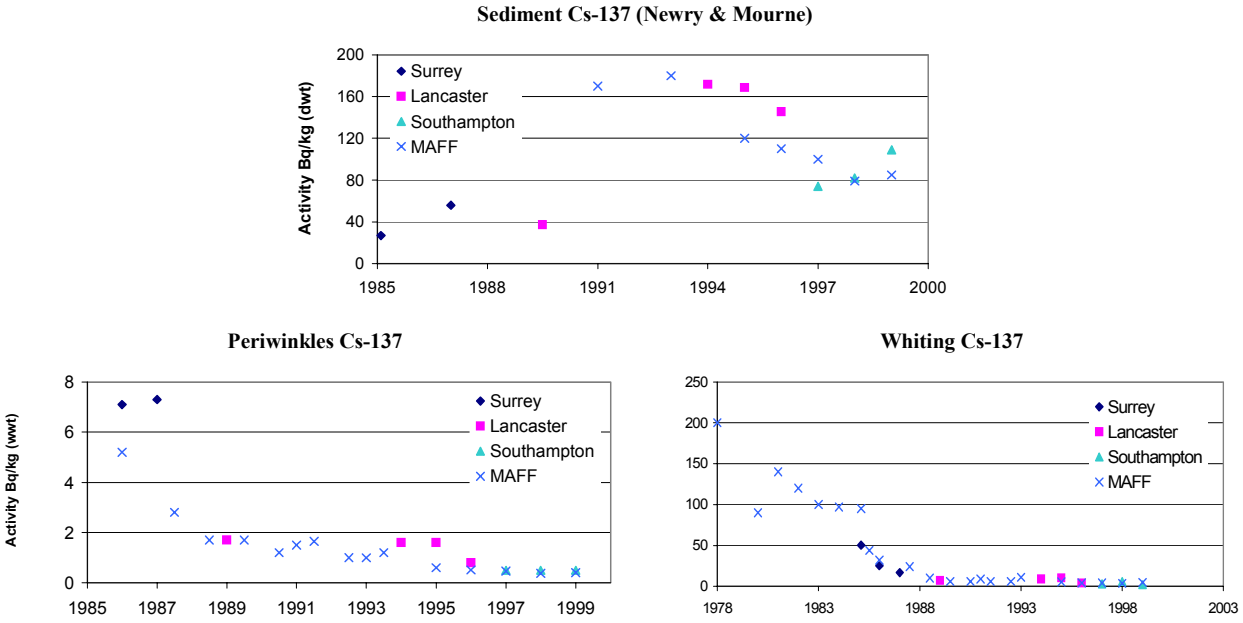


FIGURE 1:Variations in the activity (Bq/kg) of Cs-137 with time. (data taken from MAFF, Lancaster University, University of Surrey and University of Southampton reports)

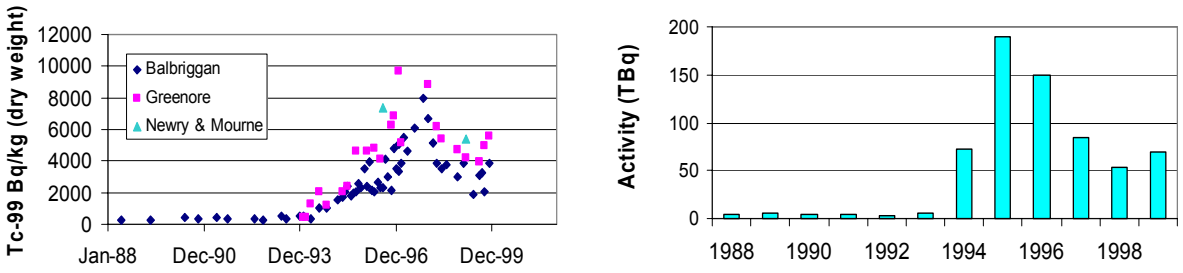


FIGURE 2: **Left: ^{99}Tc activity concentrations in *Fucus vesiculosus* sampled at Balbriggan and Greenore (Eastern Ireland) in the period 1988 – 1999. (Adapted from Smith *et al* 1997[1]). Extra data supplied by RPII.)**

Right: Sellafield discharges of ^{99}Tc to the Irish Sea 1988 – 1999 (BNFL 1999)

Notes:

[1] Smith V., Ryan R.W., Pollard D., Mitchell P.I., & Ryan T.P. Temporal and geographical distribution of ^{99}Tc in inshore waters around Ireland following increased discharges from Sellafield. Radioprotection - Colloques, 32, 71-77 (1997)

GENERAL INFORMATION
TO ASSIST IN UNDERSTANDING DATA TABLES

The data tables that follow contain information on the numerous samples that have been taken during the year, as to the type of sample, where it was taken, its radiological content and the sampling authority. There is also information drawn from other sampling bodies and compared with results found in this report.

The tables are set out as follows:-

1. **Appendix A: Results for the Year**

   This Appendix sets out the results for the years April 1996 - March 1999. A sample catalogue shows the type of samples submitted by each Local Authority, and the gamma spectrometry results are ordered by sample type for the terrestrial and marine environment.

2 **Appendix D: Instantaneous Gamma Monitoring**

   This Appendix compares measurements made by the Northern Ireland Radiation Monitoring Group results from monitoring undertaken by the Ministry of Agriculture, Fisheries and Food (MAFF) and British Nuclear Fuels plc (BNFL) at Sellafield.

All tables of results give the sample type, the date of sample collection and the measured level of radiological activity from man-made sources either in becquerels per kilogram (Bq/kg) or becquerels per litre (Bq/l). Results for the naturally occurring ^{40}Potassium and ^{7}Beryllium are given for comparison. Data showing a dash are below detection limits, whereas data with a less than value (e.g. < 1 Bq/kg) are at the detection limit and a signal is seen but too small to quantify.

A becquerel describes the rate at which radioactive decay takes place and corresponds to the decay or disintegration of one radioactive atom per second. It is an extremely small measure of radioactivity.

A radionuclide is an unstable form of an element that emits radioactivity. The following radionuclides are referred to in the tables (with the abbreviations used given after):-

NATURAL

^{40}Potassium	-	^{40}K
^{7}Beryllium	-	^{7}Be

ANTHROPOGENIC

^{131}Iodine	-	^{131}I
^{134}Caesium	-	^{134}Cs
^{137}Caesium	-	^{137}Cs
^{60}Cobalt	-	^{60}Co
^{238}Plutonium	-	^{238}Pu
^{239,240}Plutonium	-	^{239,240}Pu
^{241}Americium	-	^{241}Am
^{99}Technetium	-	^{99}Tc

Note

Other conventions may be used in other literature e.g. ^{99}Technetium may also be referred to as Technetium-99 or Tc-99.

To assist with understanding the significance of the radiological levels reported, Generalised Derived Limits (GDLs) are included after the tables where appropriate. They are basically cautionary indicators of levels that should not be exceeded for specific materials and particularly foodstuffs.

SAMPLE CATALOGUE BY AUTHORITY

**** NORTHERN GROUP**

*** Antrim**

15/10/96	Honey

*** Ballymena**

20/08/96	Other foods
20/08/96	Fresh water fish
20/08/96	Fresh water fish
13/01/09	Grass
22/09/97	Fresh water fish
10/11/97	Rootcrop
26/01/98	Water
21/09/98	Fresh water fish

*** Carrickfergus**

21/08/96	Seaweed
06/06/97	Estuarine
22/09/97	Estuarine
10/11/97	Shellfish
21/09/98	Sediment
09/11/98	Sediment
08/03/99	Shellfish

*** Coleraine**

20/08/96	Meat
21/08/96	Seaweed
21/08/96	Seafish
14/10/96	Shellfish
14/10/96	Seafish
14/01/97	Shellfish
06/06/97	Seafish
22/09/97	Estuarine
10/11/97	Other foods
26/01/98	Honey
08/03/99	Sediment

*** Larne**

20/08/96	Seaweed
20/08/96	Seaweed
20/08/96	Seafish
20/08/96	Shellfish
15/10/96	Seaweed
15/10/96	Sediment
14/01/97	Shellfish
09/06/97	Estuarine
22/09/97	Seaweed
10/11/97	Mussels
26/01/98	Seaweed
19/09/98	Shellfish
09/11/98	Shellfish

*** Magherafelt**

22/09/97 t	Fresh water fish
10/11/97	Grass
21/09/98	Fresh water fish

*** Moyle**

20/08/96	Seafish
20/08/96	Shellfish
21/08/96	Seafish
09/10/96	Seafish
13/01/97	Shellfish
06/05/97	Seafish
10/11/97	Seaweed
26/01/98	Seaweed
22/08/98	Seafish
22/09/97	Fresh water fish

**** SOUTHERN GROUP**

*** Armagh**

15/10/96	Other foods
15/10/96	Seafish
10/11/97	Honey

**** SOUTHERN GROUP**

*** Armagh**

21/09/98	Honey
05/03/99	Seafish
05/03/99	Shellfish

*** Banbridge**

21/08/96	Seafish
09/06/97	Grass
26/01/98	Water
8/09/98	Honey
04/03/99	Water

*** Craigavon**

21/08/96	Fresh water fish
21/08/96	Fresh water fish
21/08/96	Meat
21/08/96	Honey
19/09/97	Meat
19/09/97	Seafish
10/11/97	Fresh water fish
22/06/98	Meat
22/09/98	Meat
22/09/98	Seafish

*** Dungannon**

20/08/96	Grass
20/08/96	Meat
19/09/97	Other foods
22/09/97	Meat
22/09/98	Other foods
22/09/98	Other foods
06/11/98	Grass
06/11/98	Meat

*** Newry & Mourne**

20/08/96	Seaweed
20/08/96	Sediment
14/10/96	Seafish
14/10/96	Shellfish
13/01/97	Shellfish
09/06/97	Seasweed
09/06/97	Estuarine
10/11/97	Shellfish
23/01/98	Whiting
25/01/98	Shellfish
22/06/98	Seaweed
22/06/98	Sediment
05/11/98	Shellfish
09/11/98	Shellfish
05/03/99	Shellfish

**** EASTERN GROUP**

*** Ards**

21/08/96	Seaweed
21/08/96	Shellfish
21/08/96	Seafish
21/08/96	Sediment
14/01/97	Honey
14/01/97	Seafish
14/01/97	Honey
09/06/97	Shellfish
10/11/97	Seaweed
10/11/97	Shellfish
10/11/97	Sediment
23/01/98	Meat
22/06/98	Shellfish
22/06/98	Sediment
21/09/98	Shellfish
08/03/99	Seaweed

**** EASTERN GROUP**

*** Castlereagh**

21/08/96	Grass
22/09/97	Grass
22/01/98	Meat
08/03/99	Grass

*** Down**

21/08/96	Seafish
21/08/96	Fresh water fish
21/08/96	Seaweed
21/08/96	Honey
13/01/97	Grass
14/01/97	Meat
13/01/97	Grass
09/06/97	Fresh water fish
09/06/97	Seaweed
22/09/97	Seaweed
22/09/97	Honey
22/09/97	Seafish
26/01/98	Seafish
26/01/98	Shellfish
23/06/98	Grass
23/06/98	Shellfish
22/09/98	Seaweed
04/11/98	Seaweed
09/11/98	Honey
04/03/99	Shellfish

*** Lisburn**

20/08/96	Meat
21/08/96	Fresh water fish
09/06/97	Meat
22/09/97	Fresh water fish
23/06/98	Fresh water fish
06/11/98	Fresh water fish
08/03/99	Grass

*** North Down**

21/08/96	Seafish
15/10/96	Meat
15/10/96	Meat
22/09/97	Estuarine

**** WESTERN GROUP**

*** Derry**

20/08/96	Seaweed
20/08/96	Sediment
21/08/96	Seaweed
19/08/96	Shellfish
21/08/96	Seafish
21/08/96	Fresh water fish
21/08/96	Grass
21/08/96	Meat
14/10/96	Sediment
15/10/96	Shellfish
15/10/96	Meat
14/01/97	Shellfish
14/01/97	Fresh water fish
09/06/97	Seaweed
22/09/97	Seaweed
22/09/97	Grass
22/09/97	Estuarine
10/11/97	Shellfish
26/01/98	Shellfish
26/01/98	Water
23/06/98	Meat
23/06/98	Seafish
23/06/98	Seaweed
22/09/98	Seaweed
05/03/99	Grass

**** WESTERN GROUP**

*** Fermanagh**

09/06/97	Meat
06/11/97	Meat
05/11/98	Meat
02/03/99	Meat

*** Limavady**

19/08/96	Shellfish
14/01/97	Sediment
14/01/97	Seaweed
10/11/97	Sediment
26/01/98	Sediment
26/01/98	Seaweed
21/09/98	Sediment
09/11/98	Seaweed
08/03/99	Seaweed

*** Omagh**

22/09/98	Fresh water fish
09/11/98	Water
08/03/99	Water

*** Strabane**

09/06/97	Grass
10/11/97	Grass
05/03/99	Sediment*

**** BELFAST CITY**

20/08/96	Shellfish
20/08/96	Seafish
20/08/96	Seaweed
21/08/96	Meat
14/10/96	Honey
14/10/96	Fresh water fish
09/01/97	Meat
14/01/97	Grass
14/01/97	Soil
14/01/97	Sediment
09/06/97	Seaweed
09/06/97	Shellfish
22/09/97	Shellfish
22/09/97	Fresh water fish
22/09/97	Honey
10/11/97	Shellfish
10/11/97	Meat
10/11/97	Seafish
22/01/98	Sediment
23/01/98	Water
26/01/98	Shellfish
26/01/98	Meat
26/01/98	Soil
22/06/98	Grass
22/06/98	Meat
22/06/98	Soil
22/06/98	Seaweed
18/09/98	Meat
18/09/98	Fresh water fish
18/09/98	Shellfish
04/11/98	Sediment
06/11/98	Shellfish
05/03/99	Water
08/03/99	Honey
08/03/99	Seaweed
21/09/98	Shellfish

TABLE 1
MONITORING THE TERRESTRIAL ENVIRONMENT - GAMMA SPECTROMETRY

Date	Authority	Type	Locality	Activity (Bq/kg wet weight) ^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Fresh water Fish**							
*** Northern Group Public Health Committee**							
20/08/96	Ballymena	Trout	Retail outlet	-	<1	-	134
20/08/96	Ballymena	Trout	Locally caught	-	<1	-	131
22/09/97	Ballymena	Trout	Clough	-	<1	-	123
22/09/97	Magherafelt	Eels	Lough Neagh	-	<1	-	62
21/09/98	Ballymena	Trout	Clough	-	<1	-	123
21/09/98	Magherafelt	Eels	Lough Neagh	-	2	-	87
*** Southern Group Public Health Committee**							
21/08/96	Craigavon	Pollan	Hagans Point	-	2	-	112
21/08/96	Craigavon	Eels	Tolans Point	-	2	-	102
10/11/97	Craigavon	Pollan	Lough Neagh	-	2	-	110
*** Eastern Group Public Health Committee**							
21/08/96	Down	Trout	Killileagh	-	<1	-	126
21/08/96	Lisburn	Trout	Maze	-	<1	-	149
09/06/97	Down	Trout	Killyleagh	-	<1	-	141
22/09/97	Lisburn	Trout	Maze	-	<1	-	79
23/06/98	Lisburn	Trout	Springwater Meadow	-	<1	-	130
06/11/98	Lisburn	Trout	Maze	-	<1	-	112
*** Western Group Public Health Committee**							
21/08/96	Derry	Trout	Derry (orig N W fish farm)	-	<1	-	105
14/01/97	Derry	Trout	North west region	-	<1	-	111
22/09/98	Omagh	Trout	Omagh	-	<1	-	115
*** Belfast City Council**							
14/10/96	Belfast	Trout	Crumlin	-	<1	-	114
22/09/97	Belfast	Trout	Crumlin	-	<1	-	124
18/09/98	Belfast	Trout	Crumlin	-	<1	-	153
GENERALISED DERIVED LIMITS				**3000**	**4000**		

				Activity (Bq/kg wet weight) ^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Grass – (from sites that are cultivated or grazed by animals)**							
Eastern Group Public Health Committee							
23/06/98	Down	Arable	Ballynahinch	-	-	121	46
08/03/99	Lisburn	Arable	Hillsborough	-	-	320	124
GENERALISED DERIVED LIMITS				**2000**	**3000**		

				Activity (Bq/square metre) ^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Grass – (from sites that are neither cultivated nor grazed by animals)**							
*** Northern Group Public Health Committee**							
13/01/09	Ballymena	-	Glenwherry	-	<1	-	20
10/11/97	Magherafelt	-	Maghera	-	-	62	156

Note:
- below the limit of detection

* Grass – (from sites that are neither cultivated nor grazed by animals)

Date	Authority	Type	Locality	Activity (Bq/square metre) ^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Southern Group Public Health Committee**							
20/08/96	Dungannon [1]	-	Aughnacloy	-	-	60	104
09/06/97	Banbridge	-	Banbridge	-	-	4	63
06/11/98	Dungannon	-	Derganagh	-	-	117	209
• **Eastern Group Public Health Committee**							
21/08/96	Castlereagh [1]	-	Dundonald	-	-	58	150
13/01/97	Down	-	Ballynahinch	-	-	35	59
22/09/97	Castlereagh	-	Dundonald	-	-	12	25
26/01/98	Down	-	Ballyhinch	-	-	44	47
08/03/99	Castlereagh	-	Dundonald	-	-	54	192
*** Western Group Public Health Committee**							
21/08/96	Derry [1]	-	Waterside	-	-	16	132
09/06/97	Stabane	-	Sion Mills	-	-	42	435
22/09/97	Derry	-	Derry	-	-	68	99
10/11/97	Stabane	-	Plumbridge	-	-	99	189
05/03/99	Derry	-	Claudy	-	-	112	158
*** Belfast City Council**							
14/01/97	Belfast	-	Ormeau Park	-	2	28	153
26/01/98	Belfast	-	Belfast	-	-	16	43
22/06/98	Belfast	-	Belfast	-	-	32	164
GENERALISED DERIVED LIMITS				**3000**	**2000**		

* Honey

Date	Authority	Type	Locality	Activity (Bq/kg) ^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Northern Group Public Health Committee**							
15/10/96	Antrim	-	Cullybackey (orig Co Down)	-	4	-	71
26/01/98	Coleraine	-	Balleymoney	-	<1	-	30
*** Southern Group Public Health Committee**							
21/08/96	Craigavon	Heather	England	<1	56	-	80
10/11/97	Armagh	-	Benburn	-	-	-	16
18/09/98	Banbridge	-	Banbridge	-	4	-	90
21/09/98	Armagh	-	Armagh	-	<1	-	-
*** Eastern Group Public Health Committee**							
21/08/96	Down	Heather	Dundrum	<1	30	-	36
14/01/97	Ards	Honeycomb	Newtownards	<1	49	-	91
14/01/97	Ards	-	Newtownards	-	<1	-	33
22/09/97	Down	Heather	Dundrum	-	7	-	36
09/11/98	Down	Heather	Dundrum	-	15	-	26
*** Belfast City Council**							
14/10/96	Belfast	-	Loughinisland	-	1	-	43
22/09/97	Belfast	-	Loughinisland	-	1	-	99
08/03/99	Belfast	Heather	Belfast	-	<1	-	60
GENERALISED DERIVED LIMITS				**1200**[2]	**1700**[2]		

Notes:
- - below the limit of detection
- <1 activity seen but near the detection limit
- [1] Results for these samples are expressed as Bq/kg
- [2] Calculated from NRPB-GS7. They are for an adult critical group assuming a consumption rate of 25 kg/yr & an effective dose equivalent limit of 1mSv/yr.

* Meat

Date	Authority	Type	Locality	Activity (Bq/kg wet weight) ^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Northern Group Public Health Committee**							
20/08/96	Coleraine	Lamb	Garvagh	<1	39	-	406
*** Southern Group Public Health Committee**							
20/08/96	Dungannon	Lamb	Dungannon (origin Londonderry)	-	<1	-	125
21/08/96	Craigavon	Venison	England	<1	37	-	108
19/09/97	Craigavon	Lamb	Craigavon	-	<1	-	118
22/09/97	Dungannon	Venison	Caledon	-	<1	-	90
22/06/98	Craigavon	Venison	Downpatrick		<1	-	109
22/09/98	Craigavon	Venison	Colebrook	-	10	-	107
06/11/98	Dungannon	Lamb	Markethill	-	<1	-	101
*** Eastern Group Public Health Committee**							
20/08/96	Lisburn	Lamb	Dromara	-	1	-	112
15/10/96	North Down	Lamb	Ballywalter	-	<1	-	109
15/10/96	North Down	Venison	Bangor	-	<1	-	106
14/01/97	Down	Lamb	Crossgar	-	<1	-	74
09/06/97	Lisburn	Lamb	Craigavon	-	-	-	130
22/01/98	Castlereagh	Venison	Clandeboye	-	<1	-	118
23/01/98	Ards	Lamb	Newtownards	-	-	-	68
*** Western Group Public Health Committee**							
21/08/96	Derry	Lamb	Derry	-	2	-	140
15/10/96	Derry	Lamb	Local supermarket	-	<1	-	105
09/06/97	Fermanagh	Venison	Enniskillen	<1	8	-	138
06/11/97	Fermanagh	Venison	Brookborough	2	209	-	107
23/06/98	Derry	Lamb	N W farm	-	-	-	95
05/11/98	Fermanagh	Venison	Brookeborough	-	8	-	121
02/03/99	Fermanagh	Venison	Brookeborough	-	-	-	108
*** Belfast City Council**							
21/08/96	Belfast	Lamb	Belfast (origin Killinchey)	-	<1	-	96
09/01/97	Belfast	Venison	Shanes Castle	<1	101	<1	104
10/11/97	Belfast	Lamb	Killinchy	-	<1	-	101
26/01/98	Belfast	Venison	Antrim	-	56	-	111
22/06/98	Belfast	Venison	Belfast (origin Antrim)	<1	37	<1	127
18/09/98	Belfast	Lamb	Killinchey	-	<1	-	110

GENERALISED DERIVED LIMITS

Cattle	**1000**	**2000**
Sheep	**2000**	**3000**

* Other foods (other than rootcrop)

Date	Authority	Type	Locality	Activity (Bq/kg wet weight) ^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Northern Group Public Health Committee**							
20/08/96	Ballymena	Mushrooms	Local hotel (origin Armagh)	-	<1	-	158
10/11/97	Coleraine	Mushrooms	Coleraine	-	15	-	170
*** Southern Group Public Health Committee**							
15/10/96	Armagh	Inky caps	Palace Demesne	-	-	-	86
19/09/97	Dungannon	Mushrooms	Garvey Aughnaccloh	-	-	-	216
22/09/98	Dungannon	Yellow mushrooms	Various countries	-	-	-	110
22/09/98	Dungannon	Brown mushrooms	Various countries	-	-	-	-

GENERALISED DERIVED LIMITS

Vegetables (other than rootcrop)	**700**	**1000**

Notes:
- below the limit of detection
< activity seen but near the detection limit

* Rootcrop

Date	Authority	Type	Locality	Activity (Bq/kg wet weight) ^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Northern Group Public Health Committee**							
10/11/97	Ballymena	Potatoes	Glenwherry	-	<1	-	163
GENERALISED DERIVED LIMITS				**400**	**600**		

*Soil

Date	Authority	Type	Locality	^{131}I	^{54}Mn	^{65}Zn	^{57}Co	^{58}Co	^{60}Co	^{134}Cs	^{137}Cs	^{7}Be	^{40}K
				Activity (Bq/kg dry weight)									
*** Belfast City Council**													
14/01/97	Belfast	Soil	Ormeau Park	-	-	-	-	-	-	-	18	-	540
26/01/98	Belfast		Belfast	-	-	-	-	-	-	-	21	6	718
GENERALISED DERIVED LIMITS										**1000**	**600**		

* Water

Date	Authority	Type	Locality	Activity (Bq/litre) ^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Northern Group Public Health Committee**							
26/01/98	Ballymena	Well	Ballymena	-	-	-	-
*** Southern Group Public Health Committee**							
26/01/98	Banbridge	Well	Gilford	-	-	-	-
04/03/99	Banbridge	Well	Stramore Road	-	-	-	-
*** Western Group Public Health Committee**							
26/01/98	Derry	Well	Derry	-	-	-	-
09/11/98	Omagh	Spring	Not known	-	-	-	-
08/03/99	Omagh	Spring	Gortin Glen	-	-	-	-
*** Belfast City Council**							
23/01/98	Belfast	Tap	Belfast	-	-	-	8
05/03/99	Belfast	Well	-	-	-	-	-
GENERALISED DERIVED LIMITS							
			Drinking water	**90**	**100**		
			Fresh water	**1**	**2**		

Note:
- below the limit of detection

TABLE 2
MONITORING THE MARINE ENVIRONMENT - GAMMA SPECTROMETRY

* Fish

Date	Authority	Type	Locality	Activity (Bq/kg wet weight) ^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Northern Group Public Health Committee**							
20/08/96	Larne	Cod	Carnlough Bay	-	2	-	135
21/08/96	Coleraine	Whiting	Portstewart Bay	-	1	-	126
09/10/96	Moyle	Cod	Ballintoy Coast	-	-	-	-
14/10/96	Coleraine	Plaice	Portstewart Bay	-	<1	-	106
06/05/97	Moyle	Plaice	off Ballycastle	-	<1	-	129
06/06/97	Coleraine	Whiting	Portstewart Bay	-	<1	-	157
22/08/98	Moyle	Whiting	North Channel		2	-	137
*** Southern Group Public Health Committee**							
21/08/96	Banbridge	Whiting	Kilkeel	-	3	-	121
14/10/96	Newry & Mourne	Whiting	Kilkeel	-	2	-	94
15/10/96	Armagh	Whiting	Kilkeel	-	1	-	119
19/09/97	Craigavon	Lemon sole	Portavogie	-	2	-	108
23/01/98	Newry & Mourne	Whiting	Kilkeel	-	3	-	105
*** Eastern Group Public Health Committee**							
21/08/96	Down	Whiting	Irish Sea	-	3	-	104
21/08/96	North Down	Haddock	Portavogie	-	2	37	166
21/08/96	Ards	Whiting	Portavogie	-	4	-	116
14/01/97	Ards	Whiting	Portavogie	-	3	-	125
22/09/97	Down	Whiting	Isle of Man		8	-	113
26/01/98	Down	Whiting	Down	-	5	-	118
*** Western Group Public Health Committee**							
21/08/96	Derry	Whiting	N W Coast	-	<1	-	93
23/06/98	Derry	Kippers	Lough Foyle	-	-	-	78
*** Belfast City Council**							
20/08/96	Belfast	Whiting	Portavogie	-	2	-	120
10/11/97	Belfast	Whiting	Portavogie	-	2	-	76
GENERALISED DERIVED LIMITS					**700**		

* Seaweed

Date	Authority	Type	Locality	Activity (Bq/kg wet weight) ^{241}Am	^{131}I	^{54}Mn	^{65}Zn	^{57}Co	^{58}Co	^{60}Co	^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Northern Group Public Health Committee**														
21/08/96	Carrickfergus	-	Carrickfergus	-	-	-	-	-	-	-	-	1	4	251
10/11/97	Moyle	Dulse	Ballintoy Harbour	-	-	-	-	-	-	-	-	<1	1	59
26/01/98	Moyle	-	Moyle	-	-	-	-	-	-	-	-	1	-	359
26/01/98	Larne	-	Sandy Bay	-	-	-	-	-	-	-	-	1	5	346
Southern Group Public Health Committee														
22/06/98	Newry & Mourne	Fucus vesiculosus	Warrenpoint	-	-	-	-	-	-	-	-	2	-	343
*** Eastern Group Public Health Committee**														
21/08/96	Down	Dulse	Sheepland Harbour	-	-	-	-	-	-	-	-	5	8	1016
09/06/97	Down	Dulse	St Johns Point	-	-	-	-	-	-	-	-	2	-	475
22/09/97	Down	Fucus ceranoides	Ardglass	-	-	-	-	-	-	-	-	1	2	262
10/11/97	Ards	Fucus vesiculosus	Portavogie	-	-	-	-	-	-	-	-	2	7	308
22/09/98	Down	Fucus vesiculosus	Sheepland Harbour	-	-	-	-	-	-	-	-	1	-	183
04/11/98	Down	Dulse	Sheepland/Killough	-	-	-	-	-	-	-	-	2	-	323
08/03/99	Ards	Fucus vesiculosus	Portavogie	-	<1	-	-	-	-	-	-	2	6	405

Note:
- below the limit of detection

* Seaweed

Activity (Bq/kg wet weight)

Date	Authority	Type	Locality	^{241}Am	^{131}I	^{54}Mn	^{65}Zn	^{57}Co	^{58}Co	^{60}Co	^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Western Group Public Health Committee**														
14/01/97	Limavady	Fucus vesiculosus	R Roe, Limavady	-	-	-	-	-	-	-	-	<1	38	134
09/06/97	Derry	Mixed	Culmore Point	-	<1	-	-	-	-	-	-	<1	2	246
22/09/97	Derry	Fucus vesiculosus	Derry	-	-	-	-	-	-	-	-	1	6	309
26/01/98	Limavady	-	Lough Foyle	-	-	-	-	-	-	-	-	1	16	265
23/06/98	Derry	Dulse	N W Coast	-	-	-	-	-	-	-	-	-	-	257
22/09/98	Derry	Fucus vesiculosus	Longfield Bank	-	-	-	-		-	-	-	2	-	258
09/11/98	Limavady	Balls Point		-	-	-	-	-	-	-	-	<1	11	270
08/03/99	Limavady	Fucus vesiculosus	Carrickhugh Bridge	-	-	-	-	-	-	-	-	1	13	193
*** Belfast City Council**														
20/08/96	Belfast	Dulse	Ballywalter	-	-	-	-	-	-	-	-	7	-	1771
09/06/97	Belfast	Dulse	Ballywalter	2	-	-	-	-	-	-	-	9	5	2308
22/06/98	Belfast	Dulse	Ballywalter (shop bought) [1]	-	-	-	-	-	-	-	-	6	-	2304

* Sediment

Activity (Bq/kg dry weight)

Date	Authority	Type	Locality	^{241}Am	^{54}Mn	^{65}Zn	^{57}Co	^{58}Co	^{60}Co	^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Northern Group Public Health Committee**													
15/10/96	Larne	Estuarine	Larne Lough	5	-	-	-	-	-	-	65	29	538
06/06/97	Carrickfergus	Estuarine	Carrickfergus	1	-	-	-	-	-	-	6	3	218
09/06/97	Larne	Estuarine	Larne Lough	6	-	-	-	-	-	-	102	16	476
22/09/97	Carrickfergus	Estuarine	Boneybefore	4	-	-	-	-	-	-	16	10	314
22/09/97	Coleraine	Estuarine	Castlerock	<1	-	-	-	-	-	-	1	1	233
21/09/98	Carrickfergus	Estuarine	Carrickfergus	4	-	-	-	-	-	-	16	13	332
09/11/98	Carrickfergus	Estuarine	Larne Lough	1	-	-	-	-	-	-	6	2	200
08/03/99	Coleraine	Harbour	Castlerock	-	-	-	-	-	-	-	<1	-	137
*** Southern Group Public Health Committee**													
20/08/96	Newry & Mourne	Estuarine	Warrenpoint	6	-	-	-	-	-	-	74	36	676
09/06/97	Newry & Mourne	Estuarine	Warrenpoint	4	-	-	-	-	-	-	82	25	772
22/06/98	Newry & Mourne	Estuarine	Warrenpoint	9	-	-	-	-	-	-	109	69	703
*** Eastern Group Public Health Committee**													
21/08/96	Ards	Estuarine	Millisle	-	-	-	-	-	-	-	8	8	373
22/09/97	North Down	Estuarine	Ballyholme	1	-	-	-	-	-	-	5	-	264
10/11/97	Ards	Estuarine	Millisle		-	-	-	-	-	-	10	-	337
22/06/98	Ards	Estuarine	Millisle	2	-	-	-	-	-	-	12	-	350
*** Western Group Public Health Committee**													
14/10/96	Derry	Estuarine	Lough Foyle	24	-	-	-	-	-	<1	84	27	725
14/01/97	Limavady	Estuarine	R Roe, Lough Foyle	1	-	-	-	-	-	-	5	24	198
22/09/97	Derry	Estuarine	Derry	8	-	-	-	-	-	-	38	76	495
10/11/97	Limavady	Estuarine	R Roe, Limavady	4	-	-	-	-	-	-	22	40	410
26/01/98	Limavady	Estuarine silt	Lough Foyle	3	-	-	-	-	-	-	10	17	239
21/09/98	Limavady	Estuarine	Lough Foyle	1	-	-	-	-	-	-	5	11	283
05/03/99	Strabane	Estuarine	Lifford Bridge	-	-	-	-	-	-	-	22	10	373
*** Belfast City Council**													
14/01/97	Belfast	Estuarine	Belfast Lough	8	-	-	-	-	-	-	29	11	576
22/01/98	Belfast	-	Belfast Lough	5	-	-	-	-	-	-	17	10	498
04/11/98	Belfast	Estuarine	Belfast Lough	4	-	-	-	-	-	-	12	6	464
GENERALISED DERIVED LIMITS										**2000**	**5000**		

Notes:

- below the limit of detection
< activity seen but near the detection limit
[1] Reported as dry–weight

Date	Authority	Type	Locality	Activity (Bq/kg wet weight)									
				^{241}Am	^{54}Mn	^{65}Zn	^{57}Co	^{58}Co	^{60}Co	^{134}Cs	^{137}Cs	^{7}Be	^{40}K
*** Shellfish**													
*** Northern Group Public Health Committee**													
20/08/96	Larne	Mussels	Larne Lough	-	-	-	-	-	-	-	<1	2	74
14/10/96	Coleraine	Crabs	Skerries, Portrush	-	-	-	-	-	-	-	-	-	50
10/11/97	Larne	Mussels	Millbay, Larne Lough	-	-	-	-	-	-	-	<1	-	29
10/11/97	Carrickfergus	Mussels	Greenisland	-	-	-	-	-	-	-	1	-	79
19/09/98	Larne	Lobster	Larne Lough	-	-	-	-	-	-	-	1	-	107
09/11/98	Larne	Lobster	Larne Lough	-	-	-	-	-	-	-	-	-	77
08/03/99	Carrickfergus	Mussels	Carrickfergus	-	-	-	-	-	-	-	<1	-	83
*** Southern Group Public Health Committee**													
14/10/96	Newry & Mourne	Mussels	Warrenpoint	-	-	-	-	-	-	-	<1	-	77
10/11/97	Newry & Mourne	Lobster	Kilkeel	-	-	-	-	-	-	-	<1	-	70
25/01/98	Newry & Mourne	Mussels	Warrenpoint	-	-	-	-	-	-	-	1	-	81
05/11/98	Newry & Mourne	Prawns	Irish Sea	-	-	-	-	-	-	-	2	-	125
09/11/98	Newry & Mourne	Mussels		-	-	-	-	-	-	-	<1	-	60
05/03/99	Newry & Mourne	Nephrops Tails	Irish Sea	-	-	-	-	-	-	-	<1	-	133
*** Eastern Group Public Health Committee**													
21/08/96	Ards	Periwinkle	Portavogie	-	-	-	-	-	-	-	<1	2	87
09/06/97	Ards	Winkles	Portavogie	-	-	-	-	-	-	-	<1	-	81
10/11/97	Ards	Prawns	Portavogie	-	-	-	-	-	-	-	1	-	52
26/01/98	Down	Prawns	Down	-	-	-	-	-	-	-	<1	-	85
22/06/98	Ards	Winkles	Portavogie	-	-	-	-	-	-	-	<1	3	50
23/06/98	Down	Lobster	St John Pt, Ballyhoman	-	-	-	-	-	-	-	<1	-	86
04/03/99	Down	Prawns	Ardglass	-	-	-	-	-	-	-	1	-	90
*** Western Group Public Health Committee**													
19/08/96	Derry	Mussels	Longfield Bank	-	-	-	-	-	-	-	<1	2	72
15/10/96	Derry	Mussels	Lough Foyle	-	-	-	-	-	-	-	<1	-	54
14/01/97	Derry	Mussels	Lough Foyle	-	-	-	-	-	-	-	<1	-	73
10/11/97	Derry	Mussels	Lough Foyle	-	-	-	-	-	-	-	<1	-	59
26/01/98	Derry	Mussels	Lough Foyle	-	-	-	-	-	-	-	<1	2	62
*** Belfast City Council**													
20/08/96	Belfast	Mussels	Cuan Oysters	-	-	-	-	-	-	-	<1		61
09/06/97	Belfast	Mussels	Dundrum Bay	-	-	-	-	-	-	-	<1	-	81
22/09/97	Belfast	Lobster	Ballyhanan/Ardglass	-	-	-	-	-	-	-	<1	-	68
10/11/97	Belfast	Mussels	Killinchy	-	-	-	-	-	-	-	<1	-	83
26/01/98	Belfast	Mussels	Killinchy	-	-	-	-	-	-	-	<1	-	73
18/09/98	Belfast	Prawns	Ardglass	-	-	-	-	-	-	-	1	-	100
06/11/98	Belfast	Lobster	Ballyhornan/Ardglass	-	-	-	-	-	-	-	<1	-	64
GENERALISED DERIVED LIMITS													
		Molluscs								**3000**	**4000**		
		Crustacea								**3000**	**4000**		

Notes:
- - below the limit of detection
- <1 activity seen but near the detection limit

TABLE 3
RESULTS OF TRANSURANIC ELEMENT DETERMINATIONS

Date	Authority	Details	Locality	Activity (Bq/kg wet weight)		
				^{238}Pu	$^{239/240}$Pu	^{241}Am
*** Northern Group Public Health Committee**						
20/08/96	Moyle	Crab	Antrim Coast	0.02	0.06	0.15
20/08/96	Moyle	Mackerel	Rathlin Island	-	-	0.02
21/08/96	Moyle	Whiting	Rathlin Island	-	-	-
09/10/96	Moyle	Cod	Ballintoy Coast	-	-	0.01
15/10/96	Larne	Sediment	Larne Lough	0.84	5.08	5.79
06/06/97	Carrickfergus	Estuarine	Carrickfergus	0.35	1.54	1.45
09/06/97	Larne	Estuarine	Larne Lough	0.96	5.33	7.45
22/09/97	Coleraine	Estuarine sediment	Castlerock	0.11	0.61	0.63
10/11/97	Moyle	Dulse	Ballintoy Harbour	0.15	0.76	0.24
10/11/97	Larne	Mussels	Millbay, Larne Lough	0.03	0.11	0.09
08/03/99	Coleraine	Sediment[3]	Castlerock	0.16	0.76	0.53
08/03/99	Carrickfergus	Mussels	Carrickfergus	0.04	0.19	0.24
*** Southern Group Public Health Committee**						
20/08/96	Newry & Mourne	Sediment	Warrenpoint	1.18	6.94	6.1
21/08/96	Banbridge	Whiting	Kilkel	-	-	-
13/01/9	Newry & Mourne	Mussels	Warrenpoint & Carlingford	-	0.07	0.11
09/06/97	Newry & Mourne	Estuarine	Warrenpoint	1.53	9.05	6.4
19/09/97	Craigavon	Lemon sole	Portavogie	0.00	0.01	0.02
10/11/97	Newry & Mourne	Lobster A (tail)	Kilkeel	0.11	0.2	0.04
		Lobster B (tail)		-	-	<0.01
		Lobster C (tail)		-	-	<0.01
		Lobster D (tail)		-	-	<0.01
25/01/98	Newry & Mourne	Mussels	Warrenpoint	0.04	0.16	0.13
22/06/98	Newry & Mourne	Sediment[3]	Warrenpoint	2.18	12.74	7.44
22/06/98	Newry & Mourne	Sediment (repeat)[3]	Warrenpoint	2.14	13.96	8.48
09/11/98	Newry & Mourne	Mussels	Warrenpoint	0.02	0.11	<0.3
*** Eastern Group Public Health Committee**						
21/08/96	Ards	Sediment	Millisle	0.43	1.64	1.62
21/08/96	Ards	Periwinkle	Portavogie	-	0.07	0.16
14/01/97	Ards	Whiting	Portavogie	-	-	-
09/06/97	Ards	Estuarine	Millisle	0.26	1.49	1.05
22/09/97	North Down	Estuarine sediment	Ballyholme	0.31	1.38	1.26
22/09/97	Down	Whiting	Isle of Man	0.01	0.03	0.04
26/01/98	Down	Whiting	Down	-	-	<0.01
22/06/98	Ards	Sediment[3]	Millisle	0.66	2.77	2.57
22/06/98	Ards	Sediment (repeat)[3]	Millisle	0.48	2.96	3.1
*** Western Group Public Health Committee**						
19/08/96	Limavady	Mussels	Balls Point	0.02	0.06	0.13
20/08/96	Derry	Sediment	River Foyle at Foyle Bridge	1.76	10.01	17.49
05/03/99	Strabane	Sediment[3]	Lifford Bridge	<0.06	<0.06	.0.06
08/03/99	Limavady	Fucus vesiculosus	Carrickhugh Bridge	0.02	0.13	0.19
*** Belfast City Council**						
20/08/96	Belfast	Whiting	Portavogie	-	-	-
20/08/96	Belfast	Mussels	Cuan Oysters	0.02	0.05	0.05
14/01/97	Belfast	Sediment	Belfast Lough	1.01	5.31	11.23
14/01/97	Belfast (duplicate)	Sediment	Belfast Lough	0.98	5.41	10.74
09/06/97	Belfast	Mussels	Dundrum Bay	0.02	0.08	0.07
22/09/97	Belfast	Lobster A (tail)	Ballyhanan/Ardglass	-	0.13	na
		Lobster B (tail)		-	0.27	na
		Lobster C (tail)		-	0.13	na
		Lobster D (tail)		-	0.08	na
10/11/97	Belfast	Whiting	Portavogie	-	-	-
26/01/98	Limavady	Estuarine silt	Lough Foyle	0.97	5.62	5.24
26/01/98	Belfast	Mussels	Killinchy	-	0.04	0.04
04/11/98	Belfast	Estuarine	Belfast Lough	0.64	3.66	3.62

Notes
- below the limit of detection.
[1] For infants of 1 year.
[2] Only the edible fraction included.
[3] The GDLs for sediment are for a dry weight.

TABLE 3
RESULTS OF TRANSURANIC ELEMENT DETERMINATIONS

GENERALISED DERIVED LIMITS

Fresh water fish[1]	**20**	**200**	**200**
Sediment[3]			
Marine	**100000**	**90000**	**80000**
Fresh water	**400000**	**300000**	**300000**
Seafish[2]	**40**	**40**	**50**
Shellfish			
Molluscs[2]	**200**	**200**	**200**
Crustacea[2]	**200**	**200**	**200**
Soil	**5000**	**5000**	**5000**

Notes
[1] For infants of 1 year.
[2] Only the edible fraction included.
[3] The GDLs for sediment are for a dry weight.

TABLE 4
MONITORING THE MARINE ENVIRONMENT - ANALYSIS FOR TECHNETIUM-99

Date	Authority	Details	Locality	Activity (Bq/kg wet weight) ^{99}Tc
*** Northern Group Public Health Committee**				
20/08/96	Larne	Ascophyllum nodosum	Millbay Larne Lough	1740
20/08/96	Larne	Fucus vesiculosus	Millbay Larne Lough	302
21/08/96	Coleraine	Fucus serratus	Portrush	46
15/10/96	Larne	Seaweed	Larne Lough	329
13/01/97	Moyle	Lobster	Rathlin Island	58
14/01/97	Coleraine	Lobster	Westbay, Portrush	65
14/01/97	Larne	Lobster	Island Magee	24
22/09/97	Larne	Fucus vesiculosus	Sandy Bay, Larne	542
10/11/97	Moyle	Dulse	Ballintoy Harbour	61
22/08/98	Moyle	Whiting	North Channel	<3
19/09/98	Larne 2	Lobster	Larne Lough	73
09/11/98	Larne 3	Lobster	Larne Lough	62
*** Southern Group Public Health Committee**				
20/08/96	Newry & Mourne	Fucus serratus	Newry & Mourne Coast	403
09/06/97	Newry & Mourne	Ascophyllum nodosum	Warrenpoint	2800
10/11/97	Newry & Mourne	Lobster A (edible parts)	Kilkeel	45
		Lobster B (edible parts)		93
		Lobster C (edible parts)		48
		Lobster D (edible parts)		69
22/06/98	Newry & Mourne	Fucus vesiculosus	Warrenpoint	686
05/11/98	Newry & Mourne	Prawns	Irish Sea	48
05/03/99	Armagh	Nephrops Tails	Irish Sea	88.5
*** Eastern Group Public Health Committee**				
21/08/96	Down	Dulse	Sheepland Harbour, Ardglass	2132
21/08/96	Ards	Fucus vesiculosus	Portavogie	1787
09/06/97	Down	Dulse	St Johns Point	87
10/11/97	Ards	Prawns	Portavogie	112
26/01/98	Down	Prawns	Down	55
23/06/98	Down	Lobster (edible flesh)	St John Point, Ballyhoman	48
21/09/98	Ards	Prawns	Portavogie	80
22/09/98	Down	Fucus vesiculosus	Sheepland Harbour	1144
04/11/98	Down	Dulse	Sheepland/Killough	9
04/03/99	Down	Prawns	Irish Sea	86.4
08/03/99	Ards	Fucus vesiculosus	Portavogie	1664
*** Western Group Public Health Committee**				
20/08/96	Derry	Fucus serratus	River Foyle, New Bridge	7
21/08/96	Derry	Dulse	North West Coast	<7
05/03/99	Strabane	Sediment*	Irish Sea	<4
08/03/99	Limavady	Fucus vesiculosus	Carrickhugh Bridge	24
*** Belfast City Council**				
20/08/96	Belfast	Dulse	Ballywalter	20
09/06/97	Belfast	Dulse	Ballywalter (shop bought)	34
22/09/97	Belfast	Lobster A (edible parts)	Ballyhanan/Ardglass	399
		Lobster B (edible parts)		608
		Lobster C (edible parts)		304
		Lobster D (edible parts)		185
22/06/98	Belfast	Dulse	Ballywalter (shop bought) [1]	3
18/09/98	Belfast	Prawns	Ardglass	79
06/11/98	Belfast	Lobster A	Ballyhornan/Ardglass	80
06/11/98	Belfast	Lobster B	Ballyhornan/Ardglass	83
06/11/98	Belfast	Lobster C	Ballyhornan/Ardglass	73
06/11/98	Belfast	Lobster D	Ballyhornan/Ardglass	177

Note:
- below the limit of detection
[1] This result is on a dry weight basis.

Sample site information: April 1996 – March 1999 APPENDIX B

* Northern Group Public Health Committee

Site Number	Group	Sample type	Location	Grid Reference	Gamma	Alpha	Tc-99
1	Ballymena	Freshwater fish	Clough	D 114 131	✓		
2	Ballymena	Rootcrop	Glenwherry	J 234 996	✓		
3	Carrickfergus	Shellfish	Greenisland	J 375 842	✓	✓	
4	Carrickfergus	-	Carrickfergus	J 38 84	✓		
5	Carrickfergus	Sediment	Boneybefore	J 429 882	✓		
6	Carrickfergus	Sediment, shellfish	Larne Lough	J 445 997	✓		✓
7	Coleraine	Sediment	Castlerock	C 85 37	✓	✓	
8	Coleraine	Shellfish	Skerries, Portrush	C 865 941	✓		
9	Coleraine	Sediment	Castlerock	C 752 362		✓	
10	Larne	Seaweed	Sandy Bay, Larne	D 417 029			✓
11	Larne	-	Sandy Bay	D 419 029	✓		
12	Larne	Shellfish	Larne Lough	J 445 997	✓		
13	Larne	Shellfish	Millbay, Larne Lough	J 444 990	✓	✓	
14	Larne	Seaweed	Millbay Larne Lough	J 444 996			✓
15	Magherafelt	Grass	Maghera	C 793 018	✓		
16	Magherafelt	Freshwater fish	Lough Neagh	J 989 908	✓		
17	Moyle	Seaweed	Ballintoy Sediment	D 037 455	✓	✓	✓
18	Moyle	Fish	Ballintoy Coast	D 045 458	✓		
19	Moyle	Fish	Rathlin Island	D 065 492		✓	
20	Moyle	Seaweed	Moyle	D 145 420	✓		
21	Moyle	Fish, shellfish	Rathlin Island	D 175 446	✓		✓
22	Moyle	Shellfish	Antrim Coast	D 283 256		✓	
23	Moyle	Fish	Ballycastle	D 445 205	✓		

* Southern Group Public Health Committee

24	Armagh	-	Benburn	H 819 458	✓		
25	Armagh	Vegetables	Palace Demesne	H 877 444	✓		
26	Armagh	-	Armagh	H 878 450	✓		
27	Banbridge	Water	Stramore Road	J 063 482	✓		
28	Banbridge	Waterl	Gilford	J 065 484	✓		
29	Banbridge	Grass	Banbridge	J 116 489	✓		
30	Banbridge	-	Banbridge	J 135 473	✓		
31	Craigavon	Meat	Colebrook	H 410 445	✓		
32	Craigavon	Meat	Downpatrick	J 080 535	✓		
34	Craigavon	Fish	Portavogie	J 661 594	✓	✓	
34	Dungannon	Vegetables	Garvey Aughnaccloh	H 639 530	✓		
35	Dungannon	Meat	Caledon	H 750 440	✓		
36	Dungannon	Meat	Markethill	H 795 630	✓		
37	Newry & Mourne	Seaweed, sediment	Warrenpoint	J 142 180	✓	✓	✓
38	Newry & Mourne	Shellfish	Warrenpoint	J 150 183	✓	✓	
39	Newry & Mourne	Seaweed	Warrenpoint	J 153 186			
40	Newry & Mourne	Shellfish	Warrenpoint	J 154 183	✓		
41	Newry & Mourne	Shellfish	Warrenpoint & Carlingford	J 183 153		✓	
42	Newry & Mourne	Fish	Kilkeel	J 316 142	✓		
43	Newry & Mourne	Shellfish	Kilkeel	J 317 142	✓	✓	✓

* Eastern Group Public Health Committee

44	Ards	Meat	Newtownards	J 545 738	✓		
45	Ards	Seaweed	Portavogie	J 661 620	✓		✓
46	Ards	Sediment	Millisle	J 601 755	✓	✓	
47	Castlereagh	Grass	Dundonald	J 422 710	✓		
48	Castlereagh	Grass	Dundonald	J 422 726	✓		
49	Castlereagh	Meat	Clandeboye	J 474 795	✓		
50	Down	Freshwater fish	Killyleagh	J 505 550	✓		
51	Down	Grass ????	Ballynahinch	J 354 554	✓		
52	Down	Heather ???	Dundrum	J 405 365	✓		
53	Down	Seaweed	Sheepland Sediment	J 581 390	✓		✓
54	Down	Seaweed	St Johns Point	J 526 332	✓		✓
55	Down	Seaweed	Ardglass	J 563 370			
56	Down	Seaweed	Sheepland/Killough	J 540 362	✓		✓
57	Lisburn	Freshwater fish	Maze	J 215 605	✓		
58	Lisburn	Grass	Hillsborough	J 265 548	✓		
59	Lisburn	Meat	Craigavon	J 172 584	✓		
60	North Down	Meat	Ballywalter	J 620 680	✓		
61	North Down	Meat	Bangor	J 480 795	✓		
62	North Down	Sediment	Ballyholme	J 525 825	✓	✓	

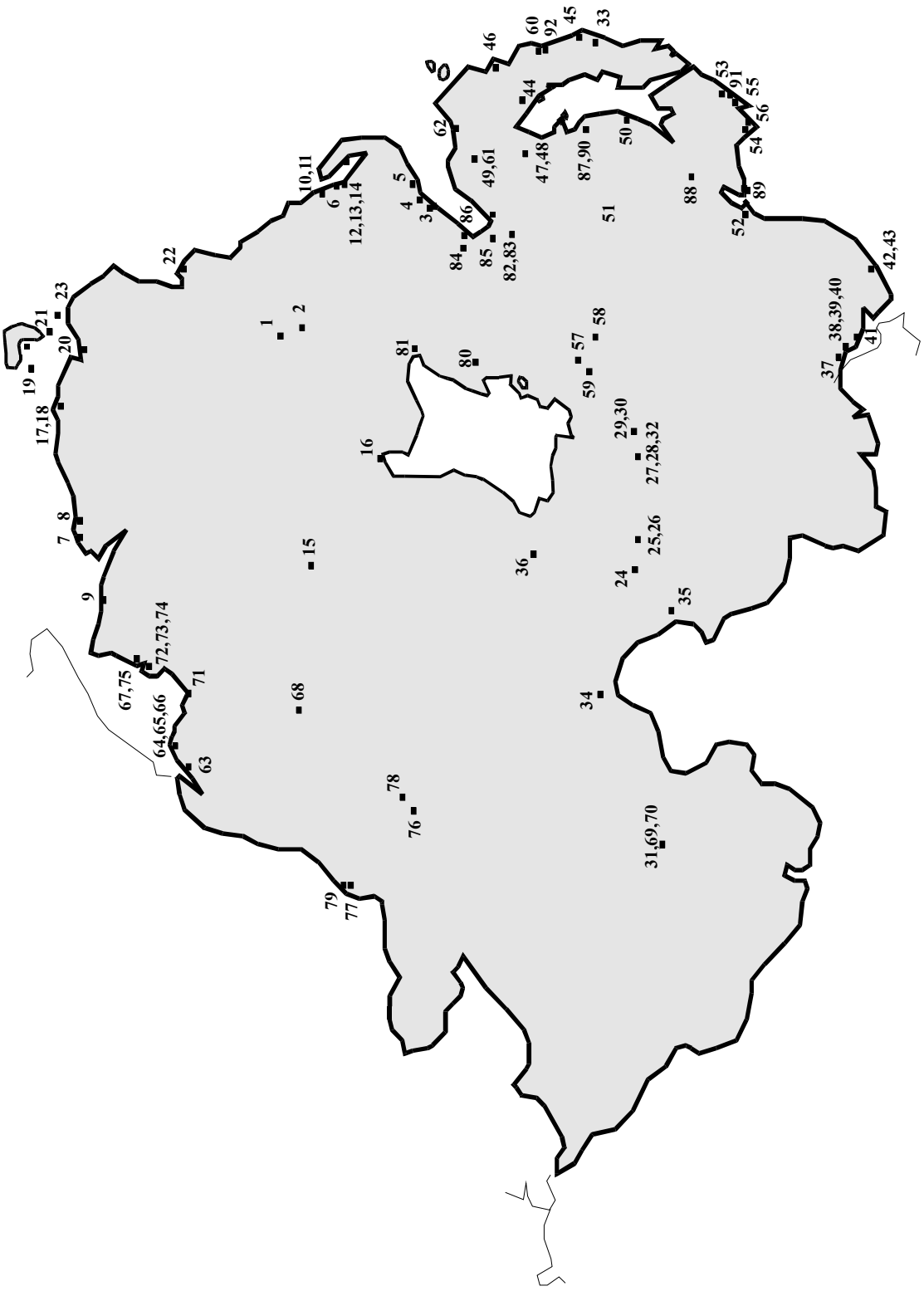
NB grid references not given for all samples

*** Western Group Public Health Committee**

Site Number	Group	Sample type	Location	Grid Reference	Gamma	Alpha	Tc-99
63	Derry	Grass, seaweed, sediment	Derry	C 448 188	✓		
64	Derry	Seaweed	Longfield Bank	C 545 237	✓		
65	Derry	Shellfish	Longfield Bank	C 545 245	✓		
66	Derry	Water	Derry	C 553 043	✓		
67	Derry	Shellfish	Lough Foyle	C 626 304			
68	Derry	Grass	Claudy	C595 014	✓		
69	Fermanagh	Meat	Brookeborough	H 411 446	✓		
70	Fermanagh	Meat	Brookborough	H 418 446	✓		
71	Limavady	Sediment	Lough Foyle	C 600 227	✓		
72	Limavady	Sediment	Lough Foyle	C 625 280	✓		
73	Limavady	Seaweed, sediment	R Roe, Lough Foyle	C 626 300	✓		
74	Limavady	Seaweed, sediment, shellfish	R Roe, Limavady	C 626 304	✓		
75	Limavady	Sediment	Balls Point	C 644 300	✓		
76	Omagh	Water	Gortin Glen	H 485 824			
77	Stabane	Grass	Sion Mills	H 347 945	✓		
78	Stabane	Grass	Plumbridge	H 521 915	✓		
79	Strabane	Sediment	Lifford Bridge	C 334 983	✓	✓	✓

*** Belfast City Council**

80	Belfast	Freshwater fish	Crumlin	J 150 780	✓		
81	Belfast	Meat	Shanes Castle	J 13 89	✓		
82	Belfast	Grass, soil	Belfast	J 326 692	✓		
83	Belfast	Grass, soil	Belfast	J 326 695	✓		
84	Belfast	Water	Belfast	J 28 80	✓		
85	Belfast	Grass, soil	Ormeau Park	J 340 720	✓		
86	Belfast	Sediment	Belfast Lough	J 350 794	✓	✓	
87	Belfast	Meat	Killinchy	J 51 62	✓		
88	Belfast	Honey	Loughinisland	J 390 460	✓		
89	Belfast	Shellfish	Dundrum Bay	J 44 35	✓	✓	
90	Belfast	Shellfish	Killinchy	J 52 61	✓	✓	
91	Belfast	Shellfish	Ballyhornan/Ardglass	J 57 38	✓		✓
92	Belfast	Seaweed	Ballywalter (shop bought) [@]	J 63 69	✓		✓



NORTHERN IRELAND SAMPLE SITES FOR THE PERIOD APRIL 1996 – MARCH 1999

NB grid references not given for all samples

NORTHERN IRELAND CONTINUOUS MONITORING ARGUS NETWORK

In 1994 the Northern Ireland Radiation Monitoring Co-Ordinating Committee (NIRMCC) investigated the feasibility of installing a network of gamma radiation monitoring stations within District councils in Northern Ireland. These unattended stations would be required to provide regular updated information reliably about background gamma radiation and, in the event of an increase in background, would be required to provide a comprehensive alert warning capability automatically.

Representatives from NIRMCC visited a number of sites in the North-East of England where a variety of installed systems were available in a geographically small area. It was recognised that, in addition to providing information on background gamma radiation and alerting in an emergency, provision of an automated system would significantly reduce the staff resources required for the manual operation of the Mini680 instruments for instantaneous gamma monitoring of background.

Following a report of this visit a specification of the equipment needed for a networked system was prepared and quotations were sought from prospective suppliers in Great Britain. A detailed assessment of each system was undertaken together with costs and a recommendation made to NIRMCC that Argus be employed to install a network of five outstations in Northern Ireland linked to a host computer to be based in Belfast.

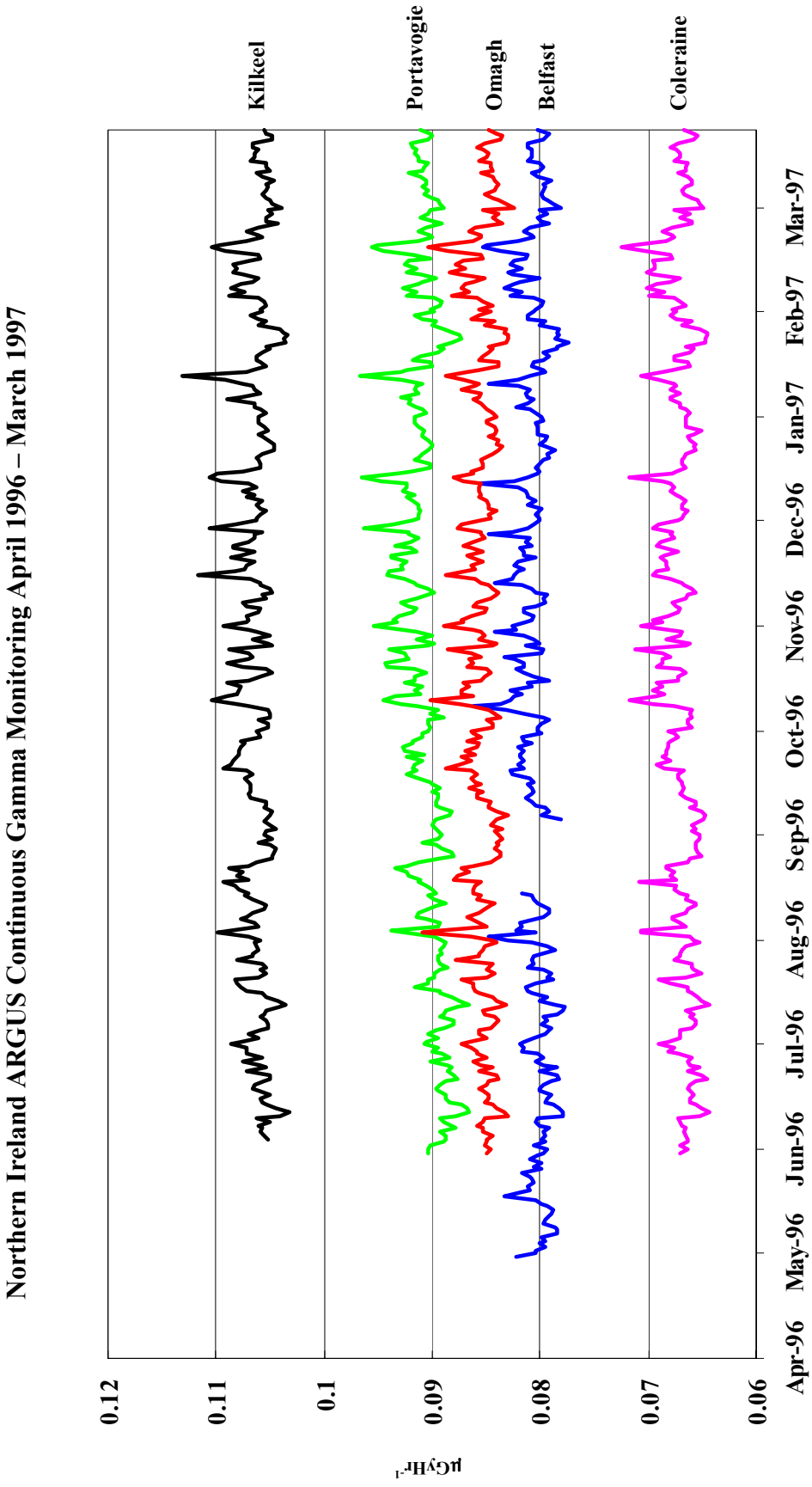
In April 1996 the equipment was installed and made operational at the sites named below and a 24-hour communications procedure was evolved to provide notification of an alert from any outstation to a designated contact officer.

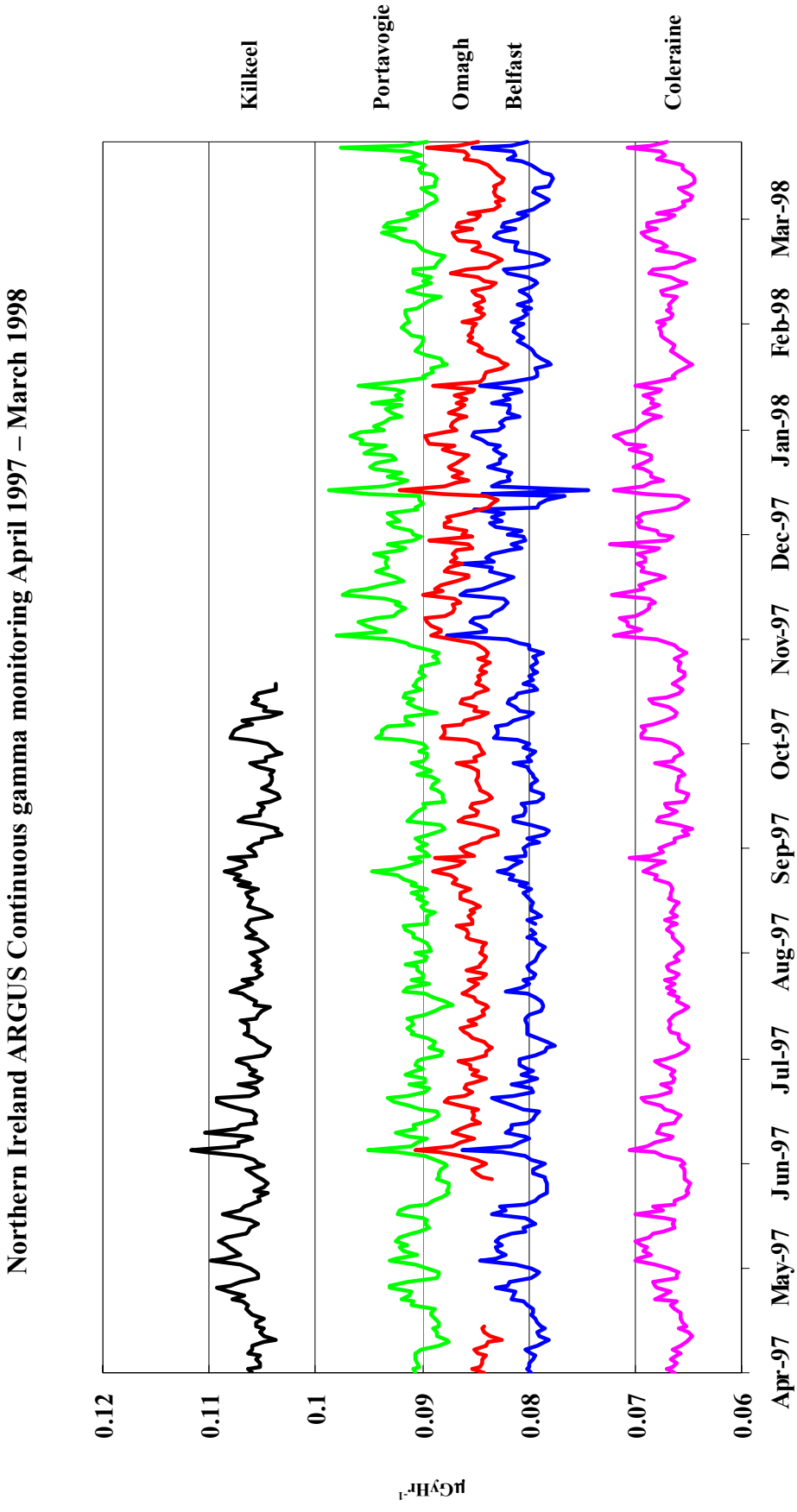
Authority	**Site of Outstation**
Belfast City Council	Dunbar Street, Belfast
EGEHC	Harbour Master's Office, Portavogie
WGEHC	Mountjoy Road, Omagh
SGEHC	Sports Centre, Kilkeel
Northern Group Systems	Cloonavin, Coleraine

Belfast City Council is the designated lead local authority for Northern Ireland and provides a duty officer for processing emergencies.

Argus Data Logging

Each outstation has its own remote station management software allowing background gamma readings to be accumulated over ten minute periods, recording and uploading results to the host computer in Belfast by modem. Each outstation can be accessed remotely by PC using a Windows-based software package known as ADVENT. Local data can be downloaded using a spreadsheet or graph, plotting average reading at two hourly intervals in micrograys/hour. The host computer in Belfast also checks and maintains each outstation at all times, ensuring optimum reliability and data integrity. Any other station within the ARGUS network of over forty sites across the United Kingdom can be accessed from the host computer at any time.


Northern Ireland ARGUS Continuous Gamma Monitoring April 1996 – March 1997
Kilkeel
Portavogie
Omagh
Belfast
Coleraine
0.12
0.11
0.1
0.09
0.08
0.07
0.06
μGyHr-1
Apr-96
May-96
Jun-96
Jul-96
Aug-96
Sep-96
Oct-96
Nov-96
Dec-96
Jan-97
Feb-97
Mar-97


Northern Ireland ARGUS Continuous gamma monitoring April 1997 – March 1998
Kilkeel
Portavogie
Omagh
Belfast
Coleraine
0.12
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μGyHr-1
Apr-97
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Jun-97
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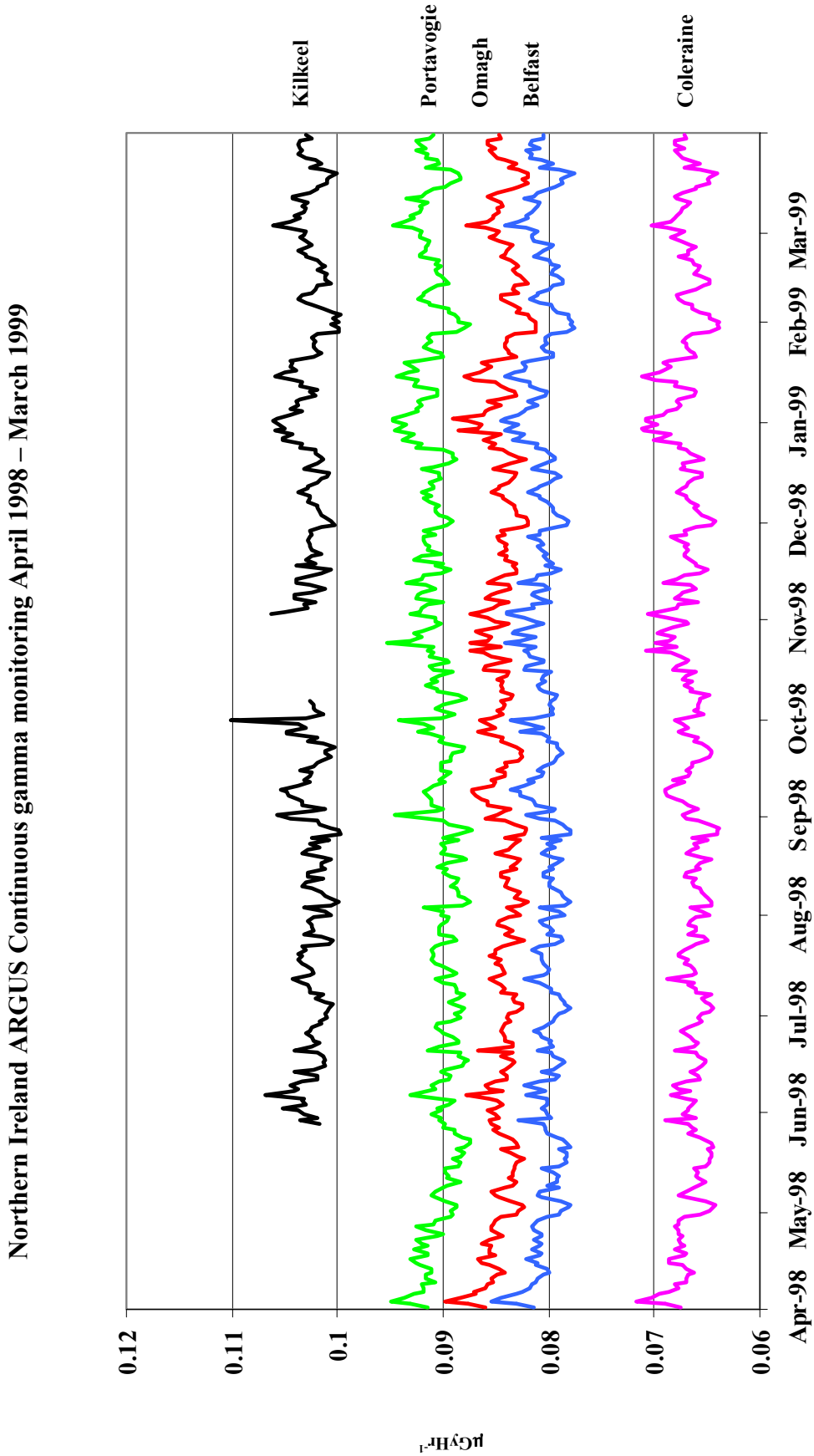
Oct-97
Nov-97
Dec-97
Jan-98
Feb-98
Mar-98


Northern Ireland ARGUS Continuous gamma monitoring April 1998 – March 1999
Kilkeel
Portavogie
Omagh
Belfast
Coleraine
0.12
0.11
0.1
0.09
0.08
0.07
0.06
μGyHr-1
Apr-98
May-98
Jun-98
Jul-98
Aug-98
Sep-98
Oct-98
Nov-98
Dec-98
Jan-99
Feb-99
Mar-99

SELECTED GAMMA DOSERATE COMPARATIVE DATA

The following instantaneous gamma monitoring was done at intertidal localities while sampling sediment for gamma, alpha or technetium analysis.

Source	Ground type	Locality	Activity ($\mu Gy/h^{-1}$)
1	Silt	Belfast Lough (1/97)	0.07
	Silt	Belfast Lough (1/97)	0.08
	Silt	Warrenpoint, Newry & Mourne (6/97)	0.088
	Silt	Derry (9/97)	0.068
	Silt	Balls Point, Limavady (11/97)	0.052
		Millisle (11/97)	0.055
	Silt	Carrickhugh, Limavady (1/98)	0.05
	Silt	Warrenpoint, Newry & Mourne (6/98)	0.08
	Silt	Ballymacran Bank, Limavady (9/98)	0.05
2	Sand	Sellafield (1995)	0.07
	Salt marsh	Ravenglass - Carlton Marsh (1995)	0.26
	Mud	Ravenglass - Raven Villa (1995)	0.12
	Sand	Seascale (1995)	0.07
	Sand	Drigg (1995)	0.07
	Mud	Whitehaven - Inner harbour (1995)	0.37
	Sand	Sellafield (1997)	0.073
	Salt marsh	Ravenglass - Carlton Marsh (1997)	0.25
	Mud and sand	Ravenglass - Raven Villa (1997)	0.13
	Sand	Seascale (1997)	0.074
	Sand	Drigg (1997)	0.069
	Mud	Whitehaven - Inner harbour (1997)	0.21
3	Sand	Sellafield (1996)	0.10
	Mud/silt	Ravenglass - Raven Villa (1996)	0.12
	Mud	Whitehaven - Inner harbour (1996)	0.20
	Sand	Sellafield (1997)	0.13
	Mud/silt	Ravenglass - Raven Villa (1997)	0.13
	Mud	Whitehaven - Inner harbour (1997)	0.13

Notes:

1. Results from Northern Ireland Radiation Monitoring Group (1996 - 1999).
2. Results from 'Radioactivity in Food & the Environment 1995', Ministry of Agriculture, Fisheries and Food.
3 Results from 1996 Annual Report of BNFL Sellafield.

THE NUCLEAR ENVIRONMENT

Radioactivity in the environs of Northern Ireland is derived mainly from weapons testing, Chernobyl and BNFL Sellafield. This appendix contains information on the activities at Sellafield and brief summaries of recent nuclear incidents and events.

BNFL SELLAFIELD

British Nuclear Fuels plc (BNFL) is concerned mainly with the design and production of fuel for nuclear reactors and its reprocessing after irradiation. The company also operates a solid waste disposal site and nuclear power plant that supplies electricity to the national grid. Regular monitoring is carried out of the environmental consequences of discharges of radioactive waste from four BNFL sites in England, namely Sellafield, Drigg, Springfields and Capenhurst. These nuclear sites are responsible for the largest discharges of radioactive material and were the prime focus of Ministry of Agriculture, Fisheries and Food (MAFF) & Environment Agency monitoring. The Food Standards Agency has now assumed the responsibility formerly taken by MAFF. Most sampling and direct monitoring is conducted in the site's immediate vicinity. However, because of the ability to detect the effects of the discharges of liquid effluent from BNFL Sellafield in many parts of north-European waters, the programme for this site extends beyond national boundaries.

Operations and facilities at Sellafield include fuel element storage and decommissioning, the Magnox and oxide fuel reprocessing plants and the Calder Hall Magnox nuclear power station. Radioactive waste discharges include a very minor contribution from the adjoining UKAEA Windscale facilities. The most significant discharges are made from the BNFL fuel element storage ponds and the reprocessing plants, through which pass irradiated Magnox and oxide fuel from the UK nuclear power programme, and some fuel from abroad. [1]

Authorisation for discharge is given by the Environment Agency. At the end of 1999 the discharge limit for Tc-99 was reduced from 200TBq/y to 90TBq/y. A review of all discharges from Sellafield commenced in 1999 with an initial public consultation.

Notes:

[1] Taken from 'Radioactivity in Food & the Environment 1995', Food Standards Agency.

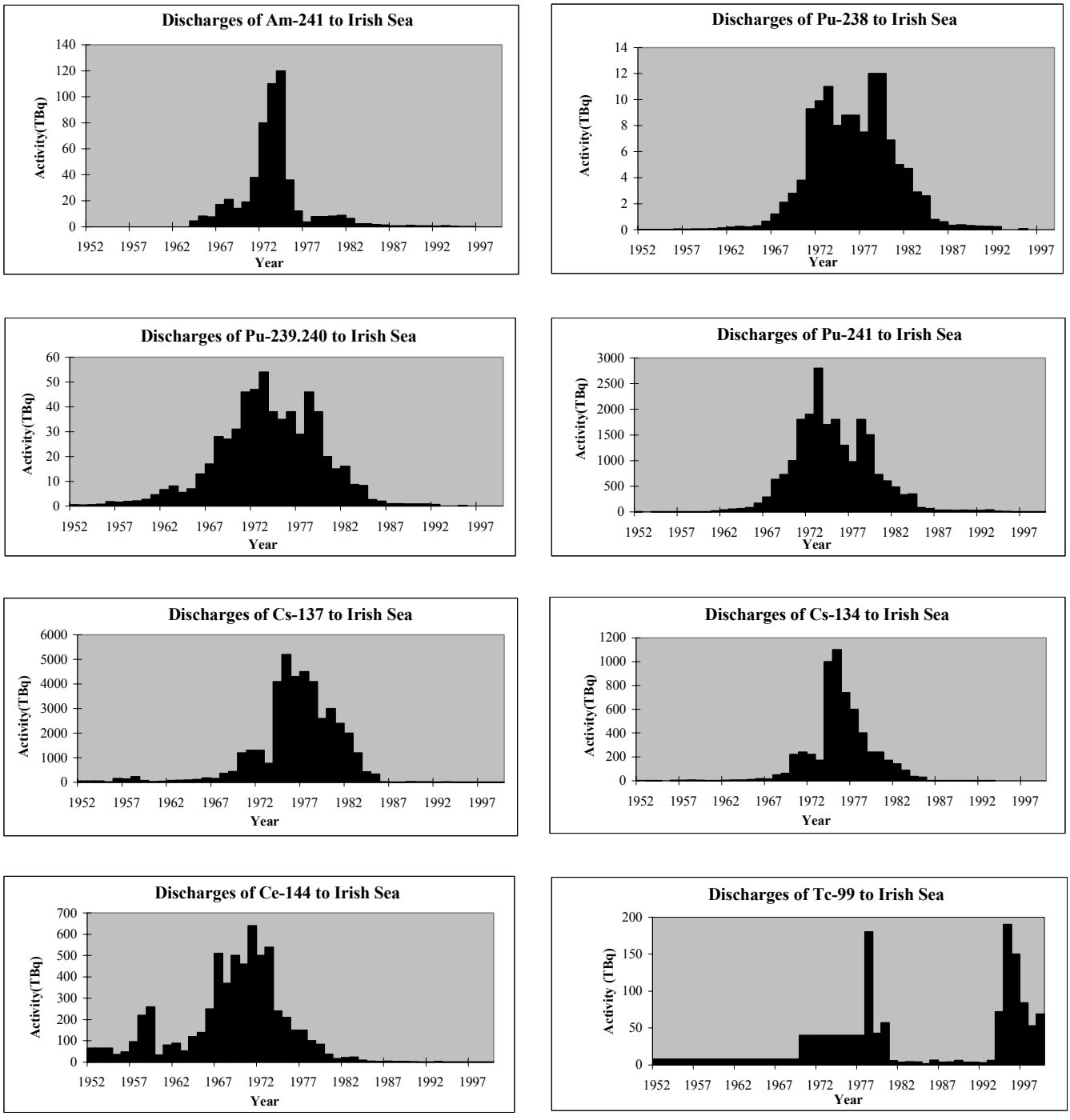


FIGURE 5: Sellafield Discharges to the Irish Sea, 1950 – 1999 (BNFL 1999)

TABLE 1
SELLAFIELD DISCHARGES TO THE IRISH SEA, 1994 - 1999 (BNFL 1999)

Nuclide	Annual discharge (Terabecquerel) **						Authorised Limit (TBq) [a]
	1994	1995	1996	1997	1998	1999	
Tritium	1700	2700	3000	2600	2300	2500	31,000
Americium-241	0.38	0.11	0.07	0.05	0.05	0.03	0.3
Antimony-125	12	9.3	6.7	3.4	0.05	7.9	-
Caesium-134	0.61	0.51	0.27	0.30	0.32	0.34	6.6
Caesium-137	14	12	10	7.9	7.5	9.1	75
Carbon-14	8.2	12	11	4.4	3.7	5.8	20.8
Cerium-144	0.84	1.1	0.78	0.49	0.76	0.60	8
Cobalt-60	0.11	1.3	0.43	1.5	2.4	0.89	13
Curium-242	0.009	0.031	0.009	0.004	0.006	0.003	-
Curium-243+244	0.003	0.008	0.007	0.004	0.003	0.002	-
Europium-152	0.22	0.18	0.14	0.12	0.16	0.11	-
Europium-154	0.11	0.14	0.08	0.16	0.10	0.05	-
Europium-155	0.11	0.076	0.05	0.06	0.09	0.04	-
Iodine-129	0.16	0.25	0.41	0.52	0.55	0.48	2
Iron-55	0.09	0.04	0.04	0.002	0.01	0.02	-
Manganese-54	0.07	0.08	0.05	0.01	0.040.07	0.04	-
Neptunium-237	0.33	0.18	0.04	0.03	0.04	0.04	-
Nickel-63	0.40	0.41	0.34	0.12	0.4	0.58	-
Niobium-95	1.2	0.40	0.63	0.18	0.35	0.08	*
Plutonium alpha	0.66	0.31	0.21	0.15	0.14	0.11	0.7
Plutonium-241	14	7.7	4.4	3.3	3.5	2.9	27
Promethium-147	0.54	0.61	0.42	0.39	0.39	0.41	-
Ruthenium-103	0.21	0.19	0.2	0.13	0.15	0.13	-
Ruthenium-106	6.7	7.3	9.0	9.8	5.6	2.7	63
Silver-110m	0.18	0.12	0.13	0.12	0.12	0.09	-
Strontium-89	0.33	0.38	0.29	0.33	0.88	0.60	-
Strontium-90	29	28	16	37	18	31	48
Sulphur-35	0.39	0.65	0.88	0.13	0.43	0.32	-
Technicium-99	72	190	150	84	53	69	200
Zinc-65	0.11	0.17	0.12	0.03	0.14	0.07	-
Zirconium-95	2.1	0.34	0.52	0.18	0.30	0.10	9
Total alpha [b]	1.0	0.40	0.27	0.18	0.17	0.13	1.0
Total beta [b]	125	190	140	140	0.86	110	400
Uranium (kg)	400	1300	1200	760	550	540	2040

Notes:

** million million becquerel, 10^{12}Bq,

* Niobium-95 and Zirconium-95 have a combined authorised limit of 9TBq

[a] Applied from 1st January 1995. Different limits applied in previous years.

[b] Total alpha and total beta are overall control measures that do not reproduce precisely the contributions of individual nuclides.

Gray	A measure of absorbed dose being the amount of energy imparted to unit mass of matter such as tissue. Symbol Gy. 1Gy = 1 joule per kilogram.
Half-life	The time taken for the activity of a radionuclide to lose half its value by decay. Symbol t•.
ICRP	International Commission on Radiological Protection.
Ion	Electrically charged atom or grouping of atoms.
Ionisation	The process by which a neutral atom or molecule acquires electric charge. The production of ions.
Mass number	The number of protons plus neutrons in the nucleus of an atom. Symbol A.
Molecule	The smallest portion of a substance that can exist by itself and retain the properties of the substance.
Neutron	An elementary particle with unit atomic mass and no electric charge.
Nucleus	The core of an atom, occupying little of the volume, containing most of the mass, and bearing positive electric charge.
Nuclide	A species of atom characterised by the number of protons and neutrons and, in some cases, by the energy state of the nucleus.
Order of magnitude	Quantity given to the nearest power of ten.
Proton	An elementary particle with unit atomic mass and unit positive electric charge.
Radiation	The process of emitting energy as waves or particles. The energy thus radiated. Frequently used for ionising radiation in the text.
Radioactive	Possessing radioactivity.
Radioactivity	The property of radionuclides of spontaneously emitting ionising radiation normally associated with nuclear decay to another nuclide.
Radon	An unstable, chemically inert, heavy gas produced during the decay of natural uranium and thorium. Radon and its daughters accumulate in soil and may be drawn into dwellings through slight under-pressure. Radon activity generally represents the main contribution to the dose received by members of the public.
Sievert	See effective dose equivalent. An S.I. unit of radiation dose.
X-ray	A discrete quantity of energy, without mass or charge, that is propagated as a wave. Emitted by an x-ray machine and during radioactive processes. See gamma ray.