# Radioactivity Monitoring of the Irish Environment 2008

## Executive Summary

Radiological Protection Institute of Ireland
An Institiúid Éireannach um Chosaint Raideolaíoch

RPII-01/10

RADIATION UNITS

**Radioactivity** is measured in units called becquerels (Bq). One becquerel corresponds to one radioactive disintegration per second.

When measuring radioactive discharges to the environment or referring to the content of radioactive sources used in medicine, industry and education, it is more usual to talk in terms of kilobecquerels (kBq), megabecquerels (MBq), gigabecquerels (GBq) or terabecquerels (TBq)

1 kBq = 1000 Bq
1 MBq = 1,000,000 Bq
1 GBq = 1,000,000,000 Bq
1 TBq = 1,000,000,000,000 Bq

Much lower concentrations of radioactivity are normally found in the environment and so the measurement is often reported in units of millibecquerels (mBq). There are one thousand millibecquerels in a becquerel.

1 Bq = 1000 mBq

**Radiation Dose** When radiation interacts with body tissues and organs, the radiation dose received is a function of factors such as the type of radiation, the part of the body affected, the exposure pathway, etc. This means that one becquerel of radioactivity will not always deliver the same radiation dose. A unit called 'effective dose' has been developed to take account of the differences between different types of radiation so that their biological impact can be compared directly. Effective dose is measured in units called sieverts (Sv).

The sievert is a large unit, and in practice it is more usual to measure radiation doses received by individuals in terms of fractions of a sievert.

1 sievert = 1000 millisievert (mSv)
= 1,000,000 microsievert (μSv)
= 1,000,000,000 nanosievert (nSv)

In RPII reports the term 'effective dose' is often referred to as 'radiation dose' or simply 'dose'.

**Collective dose** is the sum of the radiation doses received by each individual in the population. This allows comparison of the total radiation dose received from different sources. Collective dose is reported in units of man sieverts (man Sv) or man millisieverts (man mSv).

**Per caput dose** is the collective dose divided by the total population. Per caput dose is reported in units of sieverts, or fractions of a sievert.

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# Executive Summary

This report presents the results of the environmental radioactivity monitoring programme carried out by the Radiological Protection Institute of Ireland (RPII) during 2008. The RPII has routinely monitored levels of radioactivity in the Irish environment since 1982 and this is the latest in the RPII's series of environmental monitoring reports. The RPII reviews and updates its environmental programme annually so as to ensure it remains relevant and continues to focus on the most important sources of radioactivity in the environment.

The principal aims of the RPII's monitoring programme are:

- to assess the level of radioactivity to which the Irish population is exposed as a result of radioactivity in the environment.
- to study trends and establish the geographical distribution of contaminating radionuclides so as to better understand the long term behaviour of artificial radioactivity in the food chain and the environment.
- to ensure that any increase in radiation levels resulting from an accidental release of radioactivity to the environment is detected and assessed rapidly.

## Exposure of the Population to Radioactivity

There are a number of different routes or pathways by which the public can be exposed to radiation. These include exposure by inhalation, when radioactive material is breathed into the lungs, exposure through ingestion when radioactive material is consumed and direct or external exposure from radioactive material.

Exposure to the Irish population from radioactivity in the environment is assessed by measuring the concentrations of radioactivity in food and the environment and by combining this radioactivity data with food consumption rates and other habit data.

During 2008 radioactivity was measured in a wide range of food and environmental materials including: air, water, milk, seafood, foodstuffs and complete meals.

The most significant source of artificial radioactivity in the Irish marine environment is the discharge of low level liquid radioactive waste from the Sellafield Nuclear Fuel Reprocessing Plant on the north east coast of England. In order to assess the exposure arising from this source extensive sampling of fish and shellfish landed at ports along the north east coast of Ireland is undertaken. The most exposed group of individuals to discharges from Sellafield have been identified as commercial oyster and mussel farmers working along the north east coastline and their families. Based on this data the radiation dose to a member of this most exposed group was assessed to be 0.4 μSv/y for 2008. This dose may be compared with the average radiation dose to a person living in Ireland of 3950 μSv/y from all sources of radiation.

Man made radioactivity is also present in the terrestrial environment due primarily to residual global fallout arising primarily from atmospheric testing of nuclear weapons in the 1950s and 1960s and releases from past nuclear accidents such as Chernobyl. Milk, because it is an important foodstuff for infants and children and is known to concentrate long lived radionuclides such as caesium-137 and strontium-90, is an important indicator of levels of artificial radioactivity in the terrestrial food chain. The estimated dose due to strontium-90 activity in milk was estimated to be 0.55 μSv for 2008. This was for the most exposed age group, assessed to be infants, children under the age of one year. It is very small compared to the background radiation. Radioactivity measurements on other foodstuffs confirm that levels of artificial radioactivity in the Irish food-chain remain very low and that Irish foodstuffs are free from harmful levels of radioactivity.

The RPII monitors radioactivity in major drinking water supplies in rotation so that major supplies from each county are sampled at least once every four years. During 2008 supplies from Carlow, Cavan, Clare, Cork, Donegal and Dublin were tested. Drinking water samples are assessed for compliance with the radioactivity standards set out in the Drinking Water Directive. All drinking water samples tested during 2008 were found to be in compliance with the radioactivity standards set out in the Drinking Water Directive.

The RPII programme also monitors airborne radioactivity through its network of on- and off-line samplers. External gamma dose rates are also monitored. No exceptional activity was detected in outdoor air during 2008. The levels were consistent with those recorded in previous years. For 2008 the average annual dose from inhalation of caesium-137 was estimated at 8.0 x $10^{-5}$ µSv.

## Trends and Geographic distribution

In general the levels of radioactivity measured in air and terrestrial foodstuffs are very similar to those reported in recent years. This is to be expected since these are influenced primarily by levels of residual global fallout which change very slowly.

Concentrations of radioactivity measured in the Irish marine environment are broadly similar to those reported in recent years and are consistent with the general downward trend which has been observed over the last three decades. Figure A shows a radiation dose from caesium -137 to the typical seafood consumer over the period 1982 to 2008.

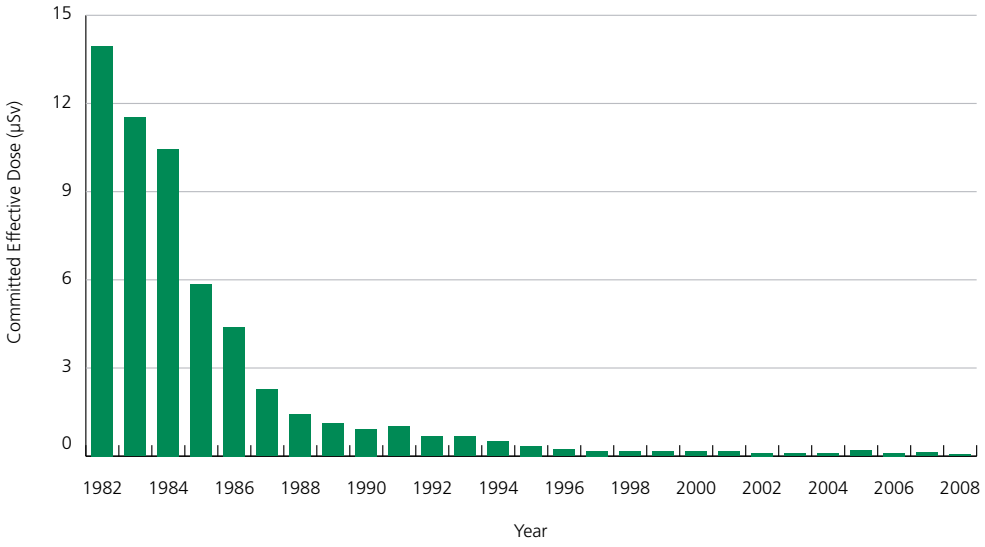


Figure A – Committed effective doses to typical seafood consumer from caesium-137, 1982-2008

In line with previous years the highest concentrations of Sellafield derived radioactivity in the Irish marine environment are found along the north east coast. Concentrations measured south of Dublin are generally lower while concentrations measured along the south and west coast are generally consistent with global fallout levels. Figure B shows the mean concentrations of the radionuclide caesium-137 measured in coastal seawater during 2008.

While in general Sellafield discharges into the Irish Sea have been falling since the 1980s, discharges of the radionuclide technetium-99 increased sharply in 1994 due to changes in waste treatment at the plant. Discharges of this radionuclide peaked in 1995 and reduced substantially after 2004 following the introduction of new waste treatment at the plant. These reductions in discharges have led to reductions in technetium-99 activity concentrations in seafood landed at Irish ports and in the Irish marine environment. By 2008 levels of technetium in the Irish marine environment had effectively fallen back to those observed in the early 1990s.

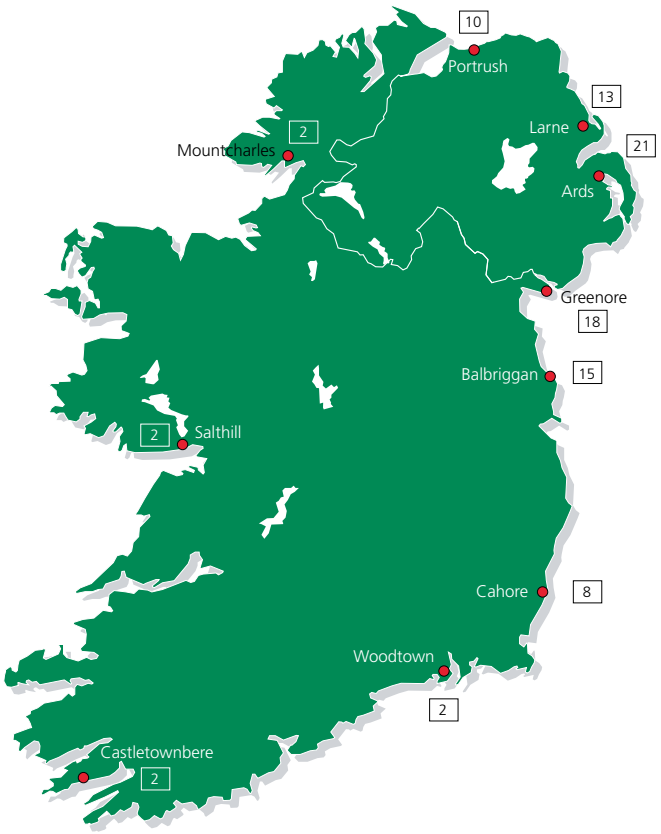


Figure B – Mean concentrations of caesium-137 measured in seawater during 2008.

## Monitoring for accidental releases

The RPII operates a national network of permanent monitoring stations which continuously assess the levels of radioactivity in the environment through the collection of aerosol and rainwater samples and the measurement of ambient gamma dose rate. This network is designed to allow a rapid assessment of environmental contamination to be made in the event of a radiological emergency. The locations of the permanent monitoring stations are shown in Figure C. No abnormal levels of radioactivity were recorded at any of the stations during 2008.

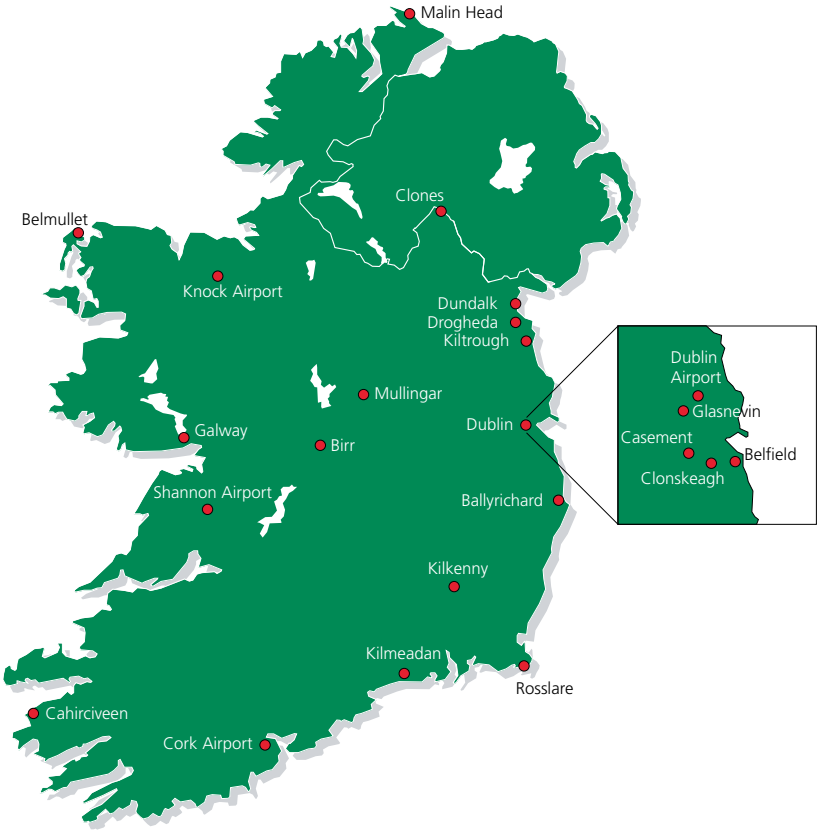


Figure C – Permanent monitoring network for radioactivity measurement

## Conclusion

The data presented in this report confirm that while the levels of artificial radioactivity in the Irish environment are detectable they are low and are continuing to decrease. They do not pose a significant risk to the human health of the Irish population.

Activity concentrations of radionuclides in airborne particulates were low and consistent with measurements made in recent years. Radioactivity levels in milk, mixed diet and a wide range of foodstuffs were low and, for the majority of samples, below the detection limits. All drinking waters tested for gross alpha and gross beta activities were found to comply with relevant national and EU standards for water quality.

The doses incurred by the Irish public in 2008 as a result of artificial radioactivity in the marine environment are small when compared to dose limits or to natural radiation doses received by the Irish public. The dose to the most exposed individuals, members of the oyster and mussel farmers critical group was approximately 0.04% of the annual dose limit of 1000 μSv for members of the public from practices involving controllable sources of radiation. These doses may also be compared with the average annual dose to a person in Ireland from all sources of radioactivity of 3950 μSv.

In general, levels of artificial radioactivity in the Irish environment remain fairly constant and are broadly consistent with levels reported previously. It must be emphasised that the levels of radioactive contamination present in the marine environment, do not warrant any modification of the habits of people in Ireland, either in respect of consumption of seafood or any other use of the amenities of the marine environment.

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