Radioactivity in Food and the Environment, 2025



Environment Agency

Food Standards Agency food.gov.uk

Food Standards Scotland

Cyfoeth Naturiol Cymru Natural Resources Wales

NIEA Northern Ireland Environment Agency www.daera-ni.gov.uk

sepa Scottish Environment Protection Agency Buidheann Dìon Àrainneachd na h-Alba

This report was compiled by the Centre for Environment, Fisheries and Aquaculture Science on behalf of the Environment Agency, Food Standards Agency, Food Standards Scotland, Natural Resources Wales, Northern Ireland Environment Agency and the Scottish Environment Protection Agency.

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Radioactivity in Food and the Environment, 2025

RIFE 31

October 2026

Foreword

The UK's environmental regulators and food safety agencies are pleased to present the 31st edition of the Radioactivity in Food and the Environment (RIFE) report.

Radioactive substances have many beneficial uses, including their use in medical diagnostics and therapies and in power generation. They are unlikely to be harmful if controlled in the right way. Regulation aims to ensure these benefits can be realised, whilst keeping people and the environment safe. This regulation is embedded into relevant legislation, such as the Environmental Authorisations (Scotland) Regulations 2018, Environmental Permitting Regulations (England and Wales) 2016 and the Radioactive Substances (Modification of Enactments) Regulations (Northern Ireland) 2018. The independent monitoring of radioactivity in food and the environment is an important part of the regulatory process and provides reassurance to members of the public.

RIFE 31 sets out the findings of the monitoring programmes of radioactivity in food and the environment carried out in 2025 throughout the UK. These monitoring programmes are undertaken by the Environment Agency, Food Standards Agency, Food Standards Scotland, Natural Resources Wales, Northern Ireland Environment Agency, and the Scottish Environment Protection Agency.

The monitoring results and subsequent assessments presented in this report demonstrate that the exposure of members of the public to radiation, resulting from authorised discharges of radioactive waste and direct radiation, near nuclear and selected non-nuclear sites remained below the legal limit (1millisievert) in 2025.

General Summary

Radioactivity is all around us. It occurs naturally in the Earth's crust, it can be found in the food we eat, the water we drink, as well as the air we breathe. We are also exposed to artificial sources of radioactivity, such as in medical applications used in hospitals and nuclear power. It is a legal requirement to ensure that the radiation exposure from artificial radioactivity, from all sources, is kept as low as reasonably achievable and within the annual 1millisievert limit to protect the public and the environment.

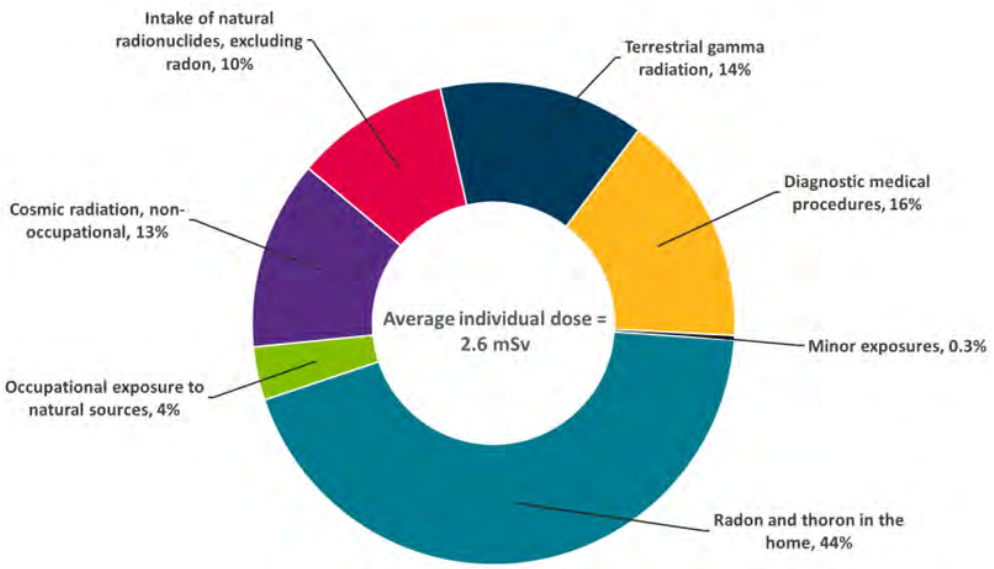
In the UK, the radiation exposure from artificial radioactivity comes from permitted or authorised releases from UK nuclear sites and other sites that use radioactive materials, such as hospitals, research or industrial facilities; these sites are known as non-nuclear sites.

The Radioactivity in Food and the Environment (RIFE) report is published each year by environmental regulators and food standards agencies. This report brings together all the results of monitoring of radioactivity in food and the environment by the RIFE partners (Environment Agency, Food Standards Agency, Food Standards Scotland, Natural Resources Wales, Northern Ireland Environment Agency and the Scottish Environment Protection Agency).

A qualitative comparison can be made between the exposure from artificial and natural sources of radioactivity, which are calculated using a different approach and pathways of exposure to those estimated for people who live or work near nuclear and non-nuclear sites. The UK Health Security Agency has published estimates of exposures to the UK population from naturally occurring and artificial sources of radioactivity (https://www.ukhsa-protectionservices.org.uk/UKionisingradiation/) [1]. The most recent values show that naturally occurring sources, particularly radon gas, accounted for around 84% of the exposure from all sources of radioactivity, with medical radiation contributing around 16%. Artificial radioactivity in the environment, from the nuclear industry and from past testing of nuclear weapons, accounted for less than 0.3% of the exposure to the UK population (see Figure GS). This figure shows the breakdown of the average UK population exposure,

- 44% from radon and thoron in the home (from naturally occurring sources)
- 16% from diagnostic medical procedures
- 14% from terrestrial gamma radiation
- 13% from cosmic radiation (non-occupational)
- 10% from intake of naturally occurring radionuclides, excluding radon
- 4% from occupational exposure to natural sources
- 0.3% from sources: including (but not limited to)
    - occupational exposure other than natural radon and cosmic radiation
    - discharges of radioactive material into the environment
    - nuclear weapons fallout
    - accidental releases of radioactive materials

Figure GS Average UK population exposure from natural and artificial sources of radioactivity (https://www.ukhsa-protectionservices.org.uk/UKionisingradiation/)



Headlines from the 2025 RIFE programme are:

For all sites

- exposure to the public from all sources of artificial radioactivity in food and the environment was low and within the legal limit of 1millisievert (mSv) per year[1]
- for the majority of samples and analytical results, between 2024 and 2025 there were no significant changes to the radioactivity measured (excluding naturally occurring radionuclides) in food and the environment

For nuclear sites

- in England, people living around the Cumbrian Coast (near Sellafield) were the most exposed from all sources of artificial and natural radioactivity. The exposure in 2025 was approximately 51% of the legal limit.
- in Scotland, people living close to the Hunterston site were estimated to be the most exposed from sources of artificial radioactivity. The exposure in 2025 was approximately 2.5% of the legal limit
- in Wales, people living near the Trawsfynydd site were estimated to be the most exposed from sources of artificial radioactivity. The exposure in 2025 was approximately 2% of the legal limit

For other areas

- in Northern Ireland, exposure to the public from sources of artificial radioactivity was estimated to be less than 1% of the legal limit
- a survey on the Channel Islands confirmed that the radiation exposure due to discharges from the French fuel reprocessing plant at La Hague and other local sources was estimated to be less than 0.5% of the legal limit
- food and sources of public drinking water that make up a general diet for people were analysed for radioactivity across the UK. Results show that the radiation exposure from artificial radionuclides in people's general diet was very small (less than 0.5% of the legal limit) in 2025

1. The average individual dose to a member of the UK population from all sources amounts to about 2.6 millisieverts (mSv) per year. This dose is primarily from natural sources of radioactivity. This chart will underestimate doses from nuclear discharges as the average member of the UK Population does not live near a nuclear discharge point.

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Technical Summary

This section is divided into the following topics to highlight the scope of this report:

- radiation exposures (doses[2]) to people living near UK nuclear licensed sites
- radioactivity concentrations in samples collected near UK nuclear licensed sites
- external dose rates measured near UK nuclear licensed sites
- UK nuclear licensed site incidents and non-routine surveys
- habits surveys near UK nuclear licensed sites
- monitoring of radioactivity at locations remote from UK nuclear licensed sites (overseas incidents, non-nuclear sites and regional monitoring across the UK)
- the environmental radioactivity monitoring programmes

Radiation exposure (doses) to people living near UK nuclear licensed sites

Radiation doses[2] to people living near nuclear licensed sites are assessed using data from radiological monitoring programmes, which cover both food and the environment. Radionuclide concentrations, dose rates, and information on the habits of people living near the sites are used to estimate doses. Where monitoring data were not available, some environmental concentrations were estimated by environmental transfer modelling of reported discharges. People's exposure to radiation (doses) can vary from year to year, due to changes in radionuclide concentrations and external dose rates. Changes in habits data and information, in particular food consumption, can also cause the estimates of dose to vary.

The dose quantity presented in this summary is known as the 'total dose'. This is made up of contributions from all sources of radioactivity from anthropogenic processes. Source-specific dose assessments are also carried out in some cases to provide additional information and to compare with the 'total dose' assessment method.

Figure S shows the 'total dose' in 2025 (as bars) across the UK, ranging from less than 0.005mSv to 0.51mSv in comparison to the dose limit to members of the public, represented by the blue bar. Table S contains the numerical values of the 'total dose' presented in Figure S and includes the major contributors to dose. The 'total dose' is due to the combined effects of authorised or permitted waste discharges and direct exposure from the site ('direct radiation') on those people most exposed to radiation near all nuclear licensed sites in the UK.

2. The monitoring results in this report are interpreted in terms of radiation exposures of the public, commonly termed 'doses'.

Figure S 'Total dose', in mSv y^{-1}, in the UK due to radioactive waste discharges and direct radiation, 2025 (Exposures to the Cumbrian Coastal Community receive a significant contribution to the dose from historical discharges of naturally occurring radionuclides from the former phosphate processing plant at Whitehaven).



Table S. 'Total dose' due to all sources at UK nuclear sites, 2025.

Establishment	Exposure, mSv[b] per year	Contributors[c]
Nuclear fuel production and processing		
Capenhurst	0.18	Direct radiation
Springfields	0.010	Direct radiation
Sellafield[d, e]	0.51	Crustaceans, ^{210}Po
Research establishments		
Dounreay	0.008	Direct radiation
Harwell	0.007	Gamma dose rate over riverbank
Winfrith	<0.005	Gamma dose rate over sediment
Nuclear power stations		
Berkeley and Oldbury	<0.005	Milk, 14C
Bradwell	<0.005	Gamma dose rate over sediment
Chapelcross	0.007	Milk, ^{14}C, ^{35}S[g], ^{90}Sr
Dungeness	0.010	Gamma dose rate over sediment
Hartlepool	0.007	Direct radiation, gamma dose rate over sediment
Heysham	0.017	Gamma dose rate over sediment
Hinkley Point	0.011	Gamma dose rate over sediment
Hunterston	0.007	Direct radiation
Sizewell	0.010	Direct radiation
Torness	0.010	Direct radiation, domestic fruit, ^{14}C, ^{90}Sr
Trawsfynydd	0.015	Direct radiation, exposure over sediment
Wylfa	0.006	Direct radiation, gamma dose rate over sediment
Defence establishment		
Aldermaston and Burghfield	0.10	Direct radiation
Barrow[f]	0.066	Gamma dose rate over sediment
Derby	0.006	Direct radiation
Devonport	<0.005	Fish, gamma dose rate over sediment, ^{241}Am[g]
Faslane	0.007	Fish, ^{137}Cs, ^{241}Am
Rosyth	0.007	Crustaceans, gamma dose rate over sediment, ^{241}Am[g]
Radiochemical production		
Grove Centre, Amersham	0.083	Direct radiation
Industrial and landfill		
Low Level Waste Repository[d, e]	0.51	Crustaceans, ^{210}Po
Whitehaven[d, e]	0.51	Crustaceans, ^{210}Po

a. Includes the effects of waste discharges and direct radiation from the site. May also include the far-field effects of discharges of liquid waste from Sellafield

b. Committed effective dose calculated using methodology of ICRP 60 to be compared with the annual dose limit of 1 mSv. Data are presented to 2 significant figures or 3 decimal places. Data below 0.005 mSv are reported as <0.005 mSv

c. Pathways and radionuclides that contribute more than 10% of the total dose. Some radionuclides are reported as being at the limits of detection

d. The doses from man-made and naturally occurring radionuclides were 0.020 and 0.49mSv, respectively. The source of man-made radionuclides was Sellafield; naturally occurring ones were from the phosphate processing works near Sellafield at Whitehaven. Minor discharges of radionuclides were also made from the LLWR site into the same area

e. The highest 'total dose' in 2025 due to Sellafield discharges was for people that spend time near sources of direct radiation on the LLWR site

f. Exposures at Barrow are largely due to discharges from the Sellafield site

g. The assessed contribution is based on data at limits of detection

Doses to individuals are estimated for those people most exposed to radiation; these individuals are known as a 'representative person'[3]. The estimated doses are compared with legal limits for the public. The method used to calculate doses to a representative person is based on guidance from the National Dose Assessment Working Group (NDAWG) [2]. NDAWG guidance proposes developing a series of habits profiles of people living and consuming food grown (or sourced) near nuclear sites. These are derived from habits survey data. Each habits profile provides information on an individual's food consumption and occupancy rates. Doses for each habits profile are calculated, and the 'representative person' is that profile which receives the highest dose.

In 2025, radiation doses from authorised or permitted releases of radioactivity to people living around nuclear licensed sites, remained below the UK national limit of 1millisievert (mSv, a measure of dose) per year (see Appendix 2 for explanation of dose units).

The locations where the public received the highest 'total doses' in 2025 were: the Cumbrian coastal community[4] near Sellafield (0.51mSv), Capenhurst (0.18mSv), and Aldermaston and Burghfield (0.10mSv). The doses received at Capenhurst and Aldermaston and Burghfield were dominated by direct radiation from sources on these sites.

Doses received by the Cumbrian coastal community near Sellafield arise from a range of contributing sources in the area, including historical discharges of naturally occurring radionuclides from a former phosphate processing plant, and to a lesser extent, current and historical discharge from both Sellafield and the LLWR. In 2025, the representative person was a high-rate crustacean consumer (who also consumed significant quantities of other seafood) and was unchanged from 2024. The estimated 'total dose' to the representative person was 0.51mSv in 2025. Most of this dose (0.49mSv) was due to historical discharges of naturally occurring radionuclides (Naturally Occurring Radioactive Material) from the former phosphate processing plant near Whitehaven. The remainder of the dose (0.020mSv) was due to permitted discharges of artificial radionuclides by Sellafield and the low level waste repository (LLWR) and includes a contribution from sources of direct radiation on the LLWR site. In 2024, the representative person received a dose of 0.20mSv (including a contribution of 0.18mSv and 0.018mSv related to historical discharges from the former phosphate processing plant and discharges from Sellafield and the LLWR, respectively). The increase in 'total dose' was mostly attributed to the higher concentrations of polonium-210 in crabs (at Parton) and to a lesser extent the change in habits information (increased crustacean consumption rates). The largest contribution to dose to seafood consumers in the Cumbrian coastal community was from the radionuclide polonium-210.

3. International Commission on Radiological Protection (ICPR) recommendations [3] use the term 'representative person' for assessing doses to members of the public. It is defined as 'an individual receiving a dose that is representative of the more highly exposed individuals in the population'. Radioactivity in Food and the Environment reports published before 2013 referred to an average dose to individuals in a group of people (the 'critical group') rather than to a single person. The 'representative person' concept is considered equivalent to the 'critical group'. Use of the concept of the representative person has been recommended by the ICRP and UK Health Security Agency (UKHSA) as a practical approach to assess the radiological impact of exposure to a source of radiation.

4. The Cumbrian coastal community is exposed to radioactivity from several sources, including current and historical discharges from the Sellafield site, the Low Level Waste Repository (LLWR) and historical discharges of naturally occurring radionuclides from the former phosphate processing plant near Whitehaven.

Polonium-210 can be a significant contributor of the dose to the most exposed members of the public because it has a relatively high ingestion dose coefficient (a factor used to convert an intake of radioactivity into a radiation dose) identified by the International Commission on Radiological Protection (ICRP). In the Cumbrian coastal area polonium-210 is present in the environment from natural sources and from Naturally Occurring Radioactive Material (NORM) from the former phosphate processing plant at Whitehaven. The discharge effects from the Sellafield site and the former phosphate processing plant both impact the same area and therefore the contributions to doses from both sources are considered in Section 3.3.1.

In Scotland, the highest dose was near the Hunterston nuclear power station, which is currently being decommissioned. The representative person was a consumer of locally produced foodstuffs, and the dose was primarily due to historical permitted discharges from the site. The source-specific[5] dose to adults was 0.021mSv in 2025, an increase from 2024 (0.006mSv).

The highest dose in Wales was near the Trawsfynydd nuclear power station, which is being decommissioned. The representative person was a consumer of locally produced foodstuffs, and the dose was primarily due to historical permitted discharges from the site. The source-specific dose[5] to 1-year-old infants was 0.021mSv in 2025; a decrease from 2024 (0.037mSv).

Radioactivity concentrations in samples collected near UK nuclear sites

There were no major variations in environmental concentrations of radioactivity (excluding naturally occurring radionuclides) in 2025 compared to those in 2024. Near Sellafield, the environmental concentrations of most radionuclides have declined over the past 3 decades, albeit much more slowly in recent years.

In 2018, a review of the 2009 UK Radioactive Discharge strategy was published [4]. The review demonstrates clear evidence of progress being made by the UK in meeting the outcomes of the 2009 strategy and contributing towards the objectives of the OSPAR[6] radioactive substances strategy (RSS). Specifically, significant progress has been made towards achieving progressive and substantial reductions in radioactive discharges. As a result of the decrease in discharges, there has been a reduction in the concentrations of radionuclides in the marine environment and subsequently a reduction in the exposures of people to ionising radiation (see Appendix 2) [5].

The OSPAR Radioactive Substances Committee published its Fifth Periodic Evaluation in 2022, which demonstrated that Contracting Parties, including the UK, have successfully fulfilled the objectives of the OSPAR RSS for 2020 under the North-East Atlantic Environment Strategy (NEAES) 2010 – 2020. The contracting parties have also made significant progress against the ultimate aim of radionuclide concentrations in the environment near background values for naturally occurring radionuclides and close to zero for artificial radionuclides (see Section 1.3 for further details) [5]. The UK-specific outcomes in the fifth periodic evaluation (see Annex 2, [5]) reinforce the findings of the 2018 review of the 2009 UK strategy for radioactive discharges.

5. See Section 1.2, Appendix 2 and Appendix 5 for more information.
6. The Oslo and Paris Convention for the protection of the marine environment of the North-East Atlantic.

External dose rates measured near UK nuclear sites

Radioactivity in sediments in intertidal areas can potentially contribute to the total radiation exposure to members of the public. For this reason, 'in situ' measurements of radiation dose rates are taken over exposed areas of sediment. These 'external doses' are included in the assessment of doses to the public where they are higher than natural background rates. To determine the dose to the public from any radioactivity that may be present because of authorised or permitted discharges, natural background rates are subtracted from the measured dose rates in the assessment.

There were no major changes in external dose rates in intertidal areas in 2025 compared with 2024. At most locations, the external dose rates were close to background rates. Rates were higher in some estuaries near Sellafield (up to twice the background rate) and in the Ribble Estuary, which is in the Eastern Irish Sea.

UK nuclear sites incidents and non-routine surveys

During 2025, as a result of an ongoing programme of monitoring by Sellafield Limited, radioactive items (particles and objects[7]) from Sellafield were detected on Cumbrian beaches and removed (52 finds in the 2025 calendar year). The advice from the UK Health Security Agency (UKHSA) and the Food Standards Agency (FSA) is that the risk to the public from the radioactive particles and larger objects found on West Cumbrian beaches is very low. A programme of work is in place to meet the primary aim of providing reassurance that overall risks to beach users remain at, or below, those estimated in the UKHSA risk assessment. UKHSA published a summary report assessing the risk to people's health from radioactive objects on beaches around the Sellafield site in February 2020 [6].

At Dounreay, the comprehensive beach monitoring programme continued for fragments of irradiated nuclear fuel (particles). Last year, the number of particles recovered and the range in radioactivity content were similar to those observed in recent years. Fishing restrictions in a specific area around Dounreay are still in force under the Food and Environment Protection Act (FEPA) 1985 [7].

Special (or 'ad hoc') sampling related to nuclear licensed site operation is carried out at sites when needed or to provide one-off data sets. No such need arose in 2025.

7. 'Particles and objects' are terms used which encompass discrete radioactive items which can range in radioactivity concentration, size and origin. 'Particles' include radioactive scale, fragments of irradiated nuclear fuel and incinerated waste materials (less than 2mm in diameter). 'Objects' are larger radioactive artefacts and stones which have radioactive contamination on their surface and are larger than 2mm in size.

Habits surveys near UK nuclear sites

For 'total dose' assessments, habits data are used to define one or more hypothetical individuals[8] (for each pathway).

In 2025, the regular programmes of habits surveys continued using existing methods. Surveys were carried out at Barrow, Sellafield and Sizewell in England, and at Dounreay in Scotland.

These habits surveys give site-specific information on the diet and occupancy habits of people near nuclear sites. The findings were used to confirm the adequacy of current monitoring programmes, to strengthen and update them with a better representation of relevant exposure pathways, and to improve the assessment of doses to members of the public near nuclear sites.

Monitoring of radioactivity at locations remote from UK nuclear sites

Monitoring in the UK and surrounding seas was carried out to assess the impact of: (1) historical contamination from non-nuclear sites, (2) the concentrations of radioactivity across the UK (measured as part of the regional monitoring programme) and (3) overseas incidents that may have introduced radioactivity into the environment.

1) Historical contamination from non-nuclear sites

In the past, liquid waste slurry (regarded as NORM) containing thorium and uranium was discharged from the former phosphate processing plant into the Irish Sea. These discharges have resulted in increased concentrations of naturally occurring radionuclides in the environment through the production of radioactive decay products (from the radioactive decay of radionuclides previously discharged to sea).

Historically, the concentrations of lead-210 (and polonium-210, discussed previously) in fish and shellfish have been found to be higher than the maximum expected concentration ranges due to naturally occurring radioactivity. Estimates of the enhanced concentrations in seafood are made by subtracting the median of the expected natural concentration range of these radionuclides from the measured values. These radionuclides are important in that small changes in values above background significantly influence their contribution to the combined dose.

Tritium was detected in the leachate from some solid waste disposal sites at low levels. There are authorised and permitted disposal routes which enable the disposal of waste to a solid waste disposal facility that can contain tritium. Examples include contaminated personal protective equipment or sampling equipment from hospitals and industrial sites or due to disposals of gaseous tritium light devices (such as fire exit signs) from public and commercial buildings.

8. A hypothetical individual is used in radiological dose assessments as it is often not possible to identify a specific member of a population whose habits are likely to result in them receiving a dose towards the upper end of the range seen in that population when variability and uncertainty in exposure pathways and source of radiation are considered. Use of the concept of the representative person has been recommended by the ICRP and UKHSA as a practical approach to assess the radiological impact of exposure to a source of radiation.

2) Scottish non-nuclear sites

The Scottish Environment Protection Agency (SEPA) undertake a targeted radiological monitoring programme to investigate the impacts of the non-nuclear sector on the environment, and human health, particularly along the River Clyde in Glasgow.

Work to address radioactive contamination is ongoing at Dalgety Bay, Fife. Public protection measures have been established with. the FEPA Order issued by Food Standards Scotland (FSS) (then FSA in Scotland), prohibiting the collection of seafood from the Dalgety Bay area, remaining in force. The remediation contract was awarded by the MOD in February 2020 and an Environmental Authorisations (Scotland) Regulations (EASR) permit for the required work was granted in May 2021. Remediation work took place between 2021 and 2023. The area will now undergo a period of evaluation to assess whether the remedial works have been successful.

Further details can be found in Section 7.7 of this report and on request by emailing RSEnquiries@sepa.org.uk.

3) Regional monitoring of radioactivity across the UK

Regional monitoring in areas remote from nuclear licensed sites continued in 2025 to:

1. establish the extent of long-distance transport of radioactivity from UK and other nuclear sites
2. identify any general contamination of the food supply and the environment
3. provide data in compliance with UK obligations under the OSPAR Convention

Monitoring of artificial radioactivity in Northern Ireland is undertaken primarily to assess the long-distance transport of radioactivity historically discharged from Sellafield. Consumer doses in Northern Ireland were estimated to be less than 1% of the annual limit of 1mSv for members of the public in 2025. A survey on the Channel Islands confirmed that doses due to discharges from the French reprocessing plant at La Hague and other local sources were less than 0.5% of the legal limit.

Food and sources of public drinking water that make up a general diet for people were analysed for radioactivity across the UK. In 2025, artificial radionuclides only contributed a small proportion of the total public radiation dose in people's general diet, and this was much less than 0.5% of the legal limit.

The distribution of radionuclides in coastal seas continues to be monitored in areas remote from nuclear sites. This supports the UK's marine environmental policies and international treaty commitments. Government research vessels are used in the sampling programme, and the results have been used to show trends in the quality of the UK's coastal seas. These surveys, together with the results of monitoring at nuclear sites, contribute to the UK data submitted to the OSPAR Commission. These data also help measure progress towards the UK government and devolved administrations' objectives for improving the state of the marine environment, through the UK's Marine Strategy, particularly Descriptor 8 – Contaminants. More information on Descriptor 8 can be found at https://moat.cefas.co.uk/pressures-from-human-activities/contaminants/.

4) Overseas incidents

The accident at the Fukushima Dai-ichi nuclear power station in Japan in March 2011 resulted in significant quantities of radioactivity being released. Subsequent controls on imported food and animal feed products from Japan to the UK mainland were revoked in June 2022. The European Union (EU) revoked its controls in July 2023.

Screening instruments are used at importation points of entry to the UK as a general check on possible contamination from unknown sources. In 2025, no significant radioactivity (above screening levels) was detected at entry points and there was no need to introduce food safety controls on any consignments.

The environmental radioactivity monitoring programmes

The environmental monitoring programmes in this report are carried out on behalf of the Environment Agency, FSA, FSS, Natural Resources Wales (NRW), Northern Ireland Environment Agency (NIEA) and SEPA and are independent of the industries discharging radioactive wastes. The programmes include monitoring in support of the Scottish Government, Channel Island states, Department of Agriculture Environment and Rural Affairs (DAERA), Department for Energy Security & Net Zero (DESNZ), Department for Environment, Food & Rural Affairs (Defra), NRW and the Welsh Government. The monitoring programmes involve specialist laboratories working together, each with rigorous quality assurance procedures, and a wide range of sample collectors throughout the UK.

Overall, around 10,000 analyses and dose rate measurements were completed in 2025. The analytical results of the environmental radioactivity monitoring programmes are reported in tables in the relevant sections (Sections 3 to 8). The values provided in the tables are given in 3 different forms:

1. measurable values (referred to as ‘positively detected’)
2. ‘less than values’ (that is, the lowest activity concentration, or dose rate measurement, that can be reliably detected for a given analytical method)
3. not detected (ND) values (meaning that insufficient evidence is available to determine the existence of a radionuclide)

More information about the programmes described in this report is available from the sponsoring agencies. Their contact details can be found on the inside front and back covers of this report. The results of the analysis of food samples collected near nuclear sites in England and Wales are published on the FSA’s data portal (https://data.food.gov.uk/catalog/datasets/ae416fc9-7144-4e83-b8c9-386b665c604c).

1 Introduction

Overview

- The Radioactivity in Food and the Environment (RIFE) report represents the collaboration between the UK's environment and food standards agencies. The monitoring programme is independent of the nuclear industry's own programmes.
- The RIFE report provides an independent and transparent check on food safety and the public's exposure to radiation against relevant UK legislation.
- The monitoring programme results help the UK meet its international treaty obligations.
- Annual radiation doses are summarised for nuclear and selected non-nuclear sites; all doses were below the annual legal limit of 1mSv in 2025.

This section:

1. describes the scope and purpose of the UK monitoring programmes
2. provides an overview of the main sources of radiation in a regulatory context
3. outlines the management radioactive liabilities in the UK
4. describes solid waste disposal at sea
5. summarises other sources of radioactivity
6. provides a summary of the key results in terms of radiation exposures at each nuclear and selected non-nuclear sites in 2025

1.1 Scope and purpose of the monitoring programmes

In England and Wales, the Food Standard Agency (FSA) and the Environment Agency[9] carry out food and environmental (including seawater, sediments, dose rate) monitoring, respectively. The Scottish Environment Protection Agency (SEPA) (working closely with Food Standards Scotland (FSS) on its programme) and the Northern Ireland Environment Agency (NIEA) both undertake food and environmental monitoring in Scotland and Northern Ireland, respectively. Food monitoring includes the collection and analysis of cow's milk (unless otherwise specified in this report). Surveillance of food imports through points of entry continued in 2025. The regular national programme of monitoring of sources of drinking water, air and rain continued on behalf of the Department for Energy Security & Net Zero (DESNZ), NIEA and the Scottish Government. The FSA and SEPA (as part of the joint SEPA and FSS monitoring programme) also carry out UK monitoring of milk and canteen meals that are collected remotely from nuclear sites. Annual surveys of seas around the UK (including locations away from nuclear sites) are monitored on behalf of DESNZ. The Environment Agency, NIEA, Natural Resources Wales (NRW) and SEPA are collectively referred to as the UK environment agencies. FSA and FSS are collectively referred to as the UK food standards agencies.

9. The Environment Agency has an agreement with Natural Resources Wales (NRW) to undertake some specific activities on its behalf including radiological environmental monitoring and Radioactive Substances Regulation of nuclear sites in Wales

The RIFE report and the associated monitoring programmes were designed to conform to the requirements of Article 36 of the Euratom Treaty (see Section 8 and Appendix 1 in previous RIFE reports (for example, [8] for more details).

The monitoring programmes have several purposes:

- environmental and food monitoring results are used to estimate and assess public radiation doses, confirm that permit and authorisation conditions provide adequate protection, and demonstrate compliance with legal dose limits; ongoing monitoring helps to establish the long-term trends in concentrations of radioactivity over time near, and at distance from, nuclear sites
- the results are also used to check for bioaccumulation of radioactivity in the food chain
- monitoring the environment provides indicators of radionuclide dispersion around each nuclear site

Most of the monitoring carried out and presented in this report concerns the local effects of current and historical discharges from nuclear sites in the UK. Monitoring of food and environmental media at locations remote from nuclear sites is also undertaken, providing information on background concentrations of radionuclides.

In previous years, the Environment Agency (with NRW providing advice on monitoring in Wales), the FSA, FSS and SEPA have all completed reviews of their environmental radioactivity monitoring programmes. Further information is available in earlier RIFE reports (for example, [9]). Reviews are carried out to ensure the monitoring programmes are appropriate and are consistent with advice in the agency technical guidance [10,11], resulting in an adjustment and consolidation of the monitoring activities around some sites. The monitoring programmes may also vary from year to year due to sample and location availability.

The FSA has responsibility for food safety in England, Northern Ireland, and Wales, and FSS has this responsibility in Scotland. The environment agencies are responsible for regulating environmental protection in England, Northern Ireland, Wales, and Scotland. This includes the regulation of radioactive discharges and radioactive waste disposal from nuclear and non-nuclear sites.

1.2 Sources of radiation exposure

1.2.1 Radioactive waste disposal from nuclear sites

The permits (see Appendix 1) issued by the environment agencies to nuclear sites require operators to use best available techniques (England and Wales) or best practicable means (Scotland) and minimise the volume and activity of all forms of radioactive waste generated[10]. The UK environment agencies consider that the terms best practicable means and best practicable environmental option (BEPO) as broadly equivalent to the application of Best Available Techniques [12,13]. They also limit any liquid or gaseous discharges and specify appropriate arrangements for the disposal of solid low-level waste (LLW) to a suitable disposal site.

10. The application of BAT does not apply under Radioactive Substances (Modification of Enactments) Regulations (Northern Ireland) 2018

Solid LLW from nuclear sites may be sent for treatment or transferred to the low level waste repository (LLWR) for disposal. Solid wastes containing low quantities of radioactivity can also be disposed of at permitted solid waste disposal sites (see Section 7). Solid LLW from Dounreay, intended for disposal, can be transferred to the Dounreay LLW facility.

Figure 1.1 shows the nuclear sites, and their respective nuclear sectors, that produce waste containing artificial radionuclides, across the UK. Nuclear sites are permitted or authorised to dispose of radioactive waste and are also regulated by the Office of Nuclear Regulation under the Nuclear Installations Act 1965 [14]. The monitoring programmes reported here cover all these sites.

Permitted or authorised discharges, disposals of radioactive wastes and solid waste transfers (in Scotland) from nuclear establishments in 2025, are given in Appendix 1 (Table A1.1 to Table A1.4, inclusive). The tables also list the site discharge and disposal limits that are specified or, in the case of the Ministry of Defence (MOD), administratively agreed. In 2025, discharges and disposals were all below permitted/authorised limits.

These discharge limits are set through an assessment process, initiated either by the operator or the relevant environment agency. In support of the process, prospective assessments of doses to the public are made assuming discharges at the specified limits [15]. Using this conservative assumption, discharge limits are set so that doses to the public will be below the source and site dose constraints of 0.3 and 0.5mSv per year, respectively [15]. The determination of discharge limits considers a comprehensive range of pathways including the consumption of food. When determining the limits, the effect of the planned discharges on the environment and wildlife is taken into account.

The discharges and disposals made by sites do not normally fluctuate significantly. However, from time to time there may be unplanned events that cause unintended leakages, spillages or other emissions that are different to the normal or expected pattern of discharges. These events must be reported to the environment agencies and may lead to follow up action, including reactive monitoring by the site, the environment agencies, or the food standards agencies. Where monitoring took place because of these events, the results are presented and discussed in the relevant site text later in this report. Appendix 1 (Table A1.5) summarises the types of events that occurred in 2025.

Figure 1.1 Current nuclear sites in the UK, 2025. (Some operations are undergoing decommissioning).



1.2.2 Radioactive waste disposal from non-nuclear sites

Discharges of radioactive waste from non-nuclear sites such as hospitals, industrial sites and research establishments are also regulated under relevant environmental legislation, but not subject to the Nuclear Installations Act. Occasionally, radioactivity is detected in the environment during monitoring programmes because of discharges from these sites. For example, iodine-131 discharged from hospitals is occasionally detected in river and marine samples. Some very low level solid radioactive wastes are disposed of from non-nuclear sites to approved solid waste treatment or disposal sites (for controlled burial, incineration, or other treatment or disposal methods). There is also a radiological impact due to historical discharges of naturally occurring radionuclides, at enhanced concentrations, from non-nuclear industrial activity. This includes radionuclides discharged from the former phosphate processing plant near Whitehaven, and so monitoring is carried out near this site.

Routine monitoring is not usually undertaken around non-nuclear sites; however, some limited monitoring programmes are undertaken in Cumbria, Lancashire and Northamptonshire (Section 7). In Scotland, SEPA carries out routine sampling in the Firth of Clyde and at solid waste disposal sites to assess the impact of non-nuclear premises on the environment. Additionally, to ensure the doses from combined discharges to a sewer network are assessed properly, SEPA periodically undertakes intensive sampling at major sewage treatment plants to monitor the combined discharges from the non-nuclear industry.

Section 7 gives information on discharges from non-nuclear sites. The process for setting discharge limits is described in Section 1.2.1.

1.2.3 Radioactive waste disposal from future nuclear sites (Nuclear new build)

As regulators of nuclear new build in England and Wales, the Office of Nuclear Regulation (ONR), the Environment Agency and NRW, are working together to ensure that any new nuclear power stations built in the UK meet high standards of safety, security, environmental protection, and waste management through the generic design assessment process. The steps undertaken by the regulators are described in previous RIFE reports [16]. More information on the generic design assessment process can be found here: https://www.gov.uk/guidance/new-nuclear-power-stations-assessing-reactor-designs and https://www.onr.org.uk/generic-design-assessment/assessment-of-reactors/. The process for setting discharge limits is described in Section 1.2.1.

Currently, only 2 sites, Hinkley Point C and Sizewell C have received approval for power generation.

NNB Generation Company (HPC) Limited is continuing the construction of a new twin UK European Pressurised Reactor™ (EPR™) nuclear power station at Hinkley Point C in Somerset. The ONR and Environment Agency continue to regulate both the construction and the development of the operating organisation. The Environment Agency regulates environmental matters at the site through permits covering both construction-related and operational activities. The development of NNB Generation Company (HPC) Limited is of interest to both regulators to ensure that the company has the competences and resources required to secure safety, security, and environment protection throughout construction and operation as it prepares itself to be an operator.

The ONR and the Environment Agency are continuing to work with Sizewell C Limited (previously NNB GenCo (SZC) Limited) that is constructing a new nuclear power station at Sizewell C, Suffolk. The radioactive substances permit and the nuclear site licence were issued by the Environment Agency and the ONR in 2023 and 2024, respectively. The project replicates the Hinkley Point C station.

In November 2025, Wylfa in North Wales was selected as the deployment site for the first fleet of Small Modular Reactors, with Rolls-Royce SMR Ltd being selected as the preferred technology partner.

Further plans to develop and build new nuclear power station in England and Wales have been outlined in the UK government's 'Civil Nuclear: Roadmap to 2050', published in 2024 [17]. The Scottish Government does not support the building of new nuclear power plants in Scotland, under current technologies [18].

1.3 Managing radioactive liabilities in the UK

The UK government has been managing radioactive waste for many decades in accordance with the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [251]. This convention aims to ensure that individuals, society, and the environment are protected from the harmful effects of ionising radiation, from the management of spent nuclear fuel and radioactive waste. Further information relevant to the UK demonstrating compliance under the Joint Convention is available in earlier RIFE reports (for example, [19]). The most recent UK national report was presented at the 8th Review Meeting in March 2025 [20].

The UK is a contracting party to the Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention'). This provides a framework for preventing and eliminating pollution in the north-east Atlantic, including the seas around the UK [21,22]. The North-East Atlantic Environment Strategy (NEAES) 2030 includes a new strategic objective:
"OSPAR will prevent pollution by radioactive substances in order to safeguard human health and to protect the marine environment, with the ultimate aim of achieving and maintaining concentrations in the marine environment at near background values for naturally occurring radioactive substances and close to zero for human made radioactive substances."

This strategic objective will be delivered through 4 operational objectives as described in [22,23]. The outcomes of the 2020 Radioactive Substances Strategy (RSS) have been described in previous RIFE reports.

The importance of an integrated approach to stewardship of the marine environment has long been established in the UK. The reports 'Safeguarding Our Seas' [24] and 'Charting Progress 2' [25], provided an initial strategy and assessment on the state of the UK seas. Further information concerning other individual and fully integrated assessments is available in earlier RIFE reports (for example, [26]).

Following its withdrawal from the Euratom Treaty, the UK is no longer required to report these data to the European Commission and has agreed a Nuclear Cooperation Agreement (NCA) with the European Union (EU), ensuring both parties continue working together on civil nuclear matters including safeguards, safety, and security.

The Environment Agency, FSA, FSS, NRW, NIEA, SEPA and DESNZ have produced 3 RIFE summary reports, which support the UK's OSPAR and Joint Convention obligations, and these are available via the main RIFE report page.

In 2010, the Marine Strategy Regulations 2010 [27] came into force. These Regulations require the Secretary of State, Scottish Ministers, the Welsh Ministers and certain government departments in Northern Ireland to take action to achieve or maintain good environmental status (GES) in our seas (subject to certain exceptions) through the production of a "Marine Strategy" for all UK waters and that this is coordinated across the 4 UK Administrations. The UK Marine Strategy provides the framework for assessing and taking measures to achieve and maintain GES in our seas. It covers a wide range of biodiversity and marine environment descriptors including contaminants, and contaminants in seafood. Data in the RIFE report is used to support the UK Marine Strategy to demonstrate where GES has been achieved and maintained. More information on Descriptor 8 (contaminants) can be found at https://moat.cefas.co.uk/pressures-from-human-activities/contaminants/.

The UK Marine Strategy is split into 3 parts:

- part 1 - updated assessment Good Environmental Status (GES) of UK seas, published in 2026, to include an assessment towards achieving GES and revised targets or indicators.
- part 2 - setting out the UK marine monitoring programmes, published in 2014 and 2021 (to take account of the revised part 1)
- part 3 – programme of measures, published in 2015 and 2025

Further details on the UK Marine Strategy can be found on: https://moat.cefas.co.uk/.

The Nuclear Decommissioning Agency (NDA), a non-departmental public body, manages the decommissioning and clean-up of the civil public sector nuclear sites. The NDA reports to DESNZ and is responsible to Scottish ministers. The role of the NDA is strategic, developing and implementing an overall strategy for addressing the UK's civil nuclear legacy. The NDA's strategic objective is to manage radioactive waste and dispose of it where possible, or place it in safe, secure, and suitable storage, in line with the UK and devolved administrations' policies. The Energy Act 2004 [28] requires the NDA to review and publish its strategy every 5 years. Its most recent strategy was published in 2026 [29] and the business plan for 2026 to 2029 is available [30]. In 2025 the NDA's subsidiary body Nuclear Waste Services Ltd (NWS) published an inventory and forecast of radioactive wastes in the UK [31,32] and a Mission Progress Report in 2024 [33].

Solid LLW requiring management continues to be produced by both nuclear and non-nuclear sites. The current UK Strategy for the management of solid LLW from the nuclear industry, published in 2016 [34], promotes the application of the waste hierarchy and the use of risk-informed, fit-for-purpose waste management routes for LLW based on the characteristics of the waste. Whilst some LLW is disposed of at near-surface disposal facilities such as the LLWR and the Dounreay LLW Facility, operators are therefore encouraged to consider alternative management options, including reuse, recycling and treatment, where these represent an optimised solution.

In 2024, DESNZ, the Scottish Government, Department of Agriculture, Environment and Rural Affairs and the Welsh Government published the UK policy framework for the management of radioactive substances and nuclear decommissioning [35].

The NDA is responsible for implementing UK and Welsh Government policies on the long-term management of higher activity radioactive waste (HAW) either through geological disposal or, in the case of less hazardous HAW, disposal at near-surface facilities. It is also responsible for implementing Scottish Government policy, which is that the long-term management of all HAW should be in near-surface facilities [36,37] . Facilities should be located as near to the site where the waste is produced as possible. Guidance to site operators and regulatory position statements on the management of HAW on licensed sites has been issued by the Environment Agency, NRW, SEPA and the ONR [38,39].

The UK government's initial framework on geological disposal was set out in 2008 [40], and last updated in 2024 [35]. The Scottish Government, Welsh Government and Northern Ireland Executive each have responsibility for determining disposal policy in their respective areas. Further information on the aspects of Geological Disposal Facility (GDF) is available on the GOV.UK website: https://www.gov.uk/government/collections/geological-disposal-facility-gdf-for-high-activity-radioactive-waste and GDF (Geological Disposal Facility) - GOV.UK (https://www.gov.uk/guidance/gdf-geological-disposal-facility).

The Committee on Radioactive Waste Management (CoRWM) continues to provide independent scrutiny of the government's long-term management, storage, and disposal of radioactive waste. This committee has published its annual report for 2025 [41], proposed work programme for 2026 (https://www.gov.uk/government/publications/committee-on-radioactive-waste-management-corwm-programme-of-work-2025/corwm-proposed-programme-of-work-2025-accessible-webpage) and a position paper on Radioactive Waste Burning by Nuclear transmutation [42].

The environment agencies published guidance on requirements for authorisation for geological and for near-surface disposal facilities in 2009 [43–45]. They launched consultations on updated guidance, in late 2024 for England, Wales and Northern Ireland, and in early 2025 for separate guidance in Scotland. They aim to publish their finalised guidance in late 2026. In May 2019, SEPA issued guidance on the decommissioning of non-nuclear facilities (for example, individual laboratories) from the use radioactive of radioactive substances [46].

Decommissioning of many nuclear sites in Great Britain is currently underway. In 2018, the 'Guidance on Requirements for Release of Nuclear Sites from Radioactive Substances Regulation', referred to as 'GRR' was published [47]. This guidance describes what operators must do to release sites from radioactive substances regulation and is also available via: https://www.gov.uk/government/publications/decommissioning-of-nuclear-sites-and-release-from-regulation/decommissioning-of-nuclear-sites-and-release-from-regulation.

Some industrial activities give rise to wastes containing elevated concentrations of naturally occurring radionuclides, commonly referred to as Naturally Occurring Radioactive Material (NORM) Further information relevant to the UK NORM Waste Strategy, published in 2014, is available in earlier RIFE reports (for example, [26]).

1.4 Solid radioactive waste disposal at sea

In the past, packaged solid waste of low radioactivity concentrations was disposed of deep in the North Atlantic Ocean, the last disposal of this type was in 1982. The UK government announced at the OSPAR Ministerial meeting in 1998 that it was stopping disposal of this material at sea. At that meeting, Contracting Parties agreed that there would no longer be any exception to prohibiting the dumping of radioactive substances, including radioactive waste [48]. The environmental impact of the deep ocean disposals was assessed by detailed mathematical modelling and has been shown to be negligible [49]. Disposals of small amounts of waste also took place from 1950 to 1963 in a part of the English Channel known as the Hurd Deep. The results of environmental monitoring of this area are presented in Section 8 and confirms that the radiological impact of these disposals was insignificant.

In England, the Marine Management Organisation administers a range of statutory controls that apply to marine works on behalf of the Secretary of State for Environment, Food and Rural Affairs. This includes issuing licences under the Marine and Coastal Access Act 2009 [50] for the disposal of dredged material at sea. In Northern Ireland, Scotland and Wales, licences for disposal of dredged material at sea are the responsibility of Department of Agriculture Environment and Rural Affairs (DAERA), the Scottish Government (Marine Scotland) and NRW, respectively.

The protection of the marine environment is considered before a licence is issued. Since dredged materials will contain varying concentrations of radioactivity from natural and artificial sources, assessments are carried out, when appropriate, to provide reassurance that there is no significant risk to the food chain, human health or the marine environment from the disposal. Guidance on exemption criteria for radioactivity in relation to sea disposal is available [51]. The International Atomic Energy Agency (IAEA) has published a system of assessment that can be applied to dredged spoil disposal [52,53] and which has been adapted to reflect operational practices in England and Wales [54].

1.5 Other sources of radioactivity

There are several other anthropogenic sources of radioactivity that may affect the food chain and the environment. These could include disposals of material from offshore installations, transport incidents, satellite re-entry, releases from overseas nuclear installations and the operation of nuclear-powered submarines. UK Health Security Agency (UKHSA) has assessed incidents involving the transport of radioactive materials in the UK [55]. UKHSA have also considered the effects of discharges into the marine environment from the oil and gas industry, with the estimated highest individual dose (per head of population) being less than 0.001mSv per year [56]. Submarine berths in the UK are monitored by the MOD (for example, [57]). General monitoring of the British Isles is carried out as part of the programmes described in this report, to detect any significant effects from the sources above. No such effects were found in 2025. Low concentrations of radionuclides were detected in the marine environment around the Channel Islands (Section 8), and these may be partly due to discharges from the nuclear fuel reprocessing plant at La Hague in France.

The effects of exploration for, and extraction of, gas from shale rock have been investigated in the UK with support from DESNZ. Further details on shale gas development and hydraulic fracturing ("fracking") in the UK is available on the GOV.UK website: https://www.gov.uk/government/publications/about-shale-gas-and-hydraulic-fracturing-fracking/developing-shale-oil-and-gas-in-the-uk.

Further information on the previous involvement by each of the environment agencies to support engagement with industry, and other related issues to shale gas extraction, is available in earlier RIFE reports (for example, RIFE 29 [23]).

Another potential source of radioactivity in the UK is land which has been contaminated by radioactivity from historical activities. The Environmental Protection Act 1990 provides the basis for a regulatory regime for identifying and remediating contaminated land. In the UK, there is a duty to inspect land under Part ll A of the Environmental Protection Act 1990, but there must be reasonable grounds for inspecting land for radioactivity. Reasonable grounds are defined in the statutory guidance.

DESNZ issued guidance for radioactive contaminated land to local authorities and the Environment Agency, which was last updated in 2018 [58]. Clear dose criteria are set for homogeneous and heterogeneous contamination. Also, the risk (probability or frequency of occurrence) of receiving the dose should be considered for the designation of radioactive contaminated land. To date, no site has been legally designated as 'radioactive contaminated land' due to radioactivity in England and Wales.

Equivalent legislation exists as Statutory Instruments in Northern Ireland through the Radioactive Contaminated Land Regulations (Northern Ireland) 2006 and subsequent amending legislation introduced in 2007 and 2010 [59,60].

In 2007, the Radioactive Contaminated Land (Scotland) Regulations came into force by amending Part ll A of the Environmental Protection Act 1990. SEPA has powers to inspect land that may be contaminated with radioactivity, to decide if land should be identified as radioactive contaminated land and require remediation if considered necessary. Revised Statutory Guidance was issued to SEPA in 2009. This guidance is broadly similar to that issued to the Environment Agency. In Scotland, clear dose criteria are set for homogeneous and heterogeneous contamination. Also, the risk (probability or frequency of occurrence) of receiving the dose should be considered for the designation of radioactive contaminated land. To date, no site has been designated as 'contaminated land' due to radioactivity in Scotland.

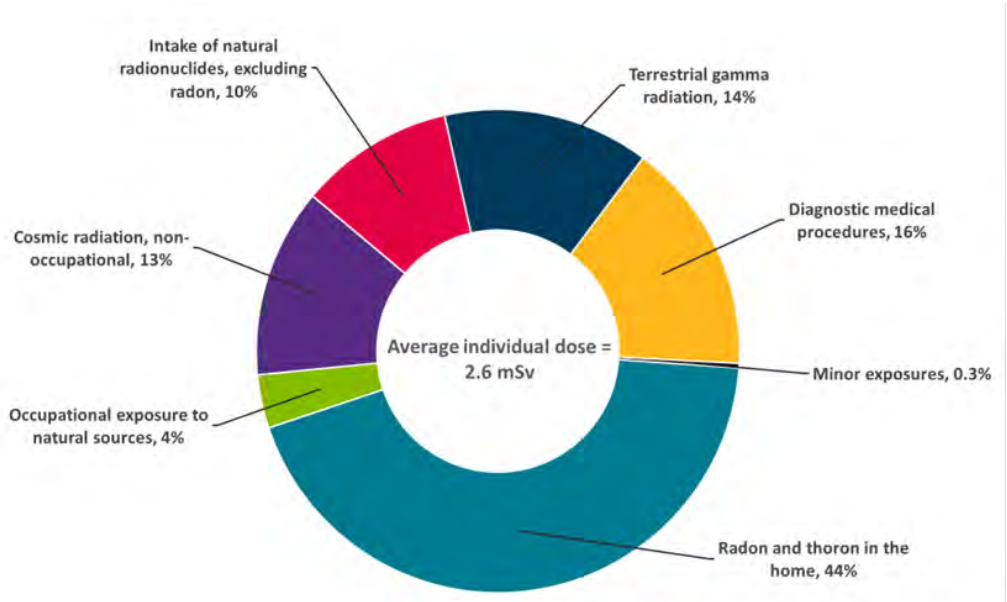
The contribution of aerial radioactive discharges from UK installations to concentrations of radionuclides in the marine environment has been studied [61]. The main conclusion was that aerial discharges do not make a significant contribution to activity concentrations in the marine environment. On occasion, the effects of aerial discharges may be detected in the aquatic environment, and conversely the effects of aquatic discharges may be detected on land. Where this is found, appropriate comments are made in this report.

Only a small proportion of the public's exposure to ionising radiation originates from anthropogenic sources of radioactivity. All sources of ionising radiation exposure to the UK population are reviewed by UKHSA, the most recent report was published in June 2025: https://www.ukhsa-protectionservices.org.uk/UKionisingradiation/ [1]. The most significant source of exposure was from natural radiation (radon and thoron gases). Figure 1.2 provides a breakdown of the exposure to the UK population by source;

- 44% from radon and thoron in the home (from naturally occurring sources)
- 16% from diagnostic medical procedures
- 14% from terrestrial gamma radiation
- 13% from cosmic radiation (non-occupational)
- 10% from intake of naturally occurring radionuclides, excluding radon
- 4% from occupational exposure to natural sources
- 0.3% from other sources, including (but not limited to)
    - o occupational exposure other than natural radon and cosmic radiation
    - o discharges of radioactive material into the environment
    - o nuclear weapons fallout
    - o accidental releases of radioactive materials

The average individual dose from exposure to all significant sources of ionising radiation was estimated to be about 2.6mSv per year, the same as that reported in the previous reviews [62,63]. Environmental sources of radiation contributed approximately 84% (2.2 mSv per year) of the average individual dose received from all sources. This was dominated by exposure to naturally occurring sources of radiation although there is significant variation across the UK due to local geology and other factors. Only about 0.3% of the annual dose was from artificial sources; and of this, the majority was from radionuclides released during historical testing of nuclear weapons in the atmosphere (global fallout) from the 1950s and 1960s (hereafter referred to as 'nuclear weapons testing'), with exposure to radionuclides routinely discharged by industry contributing less than 0.01% to the total dose. As the average member of the UK population does not live near a nuclear discharge point, the doses from nuclear discharges will be underestimated.

Figure 1.2 Average UK population exposure from natural and artificial sources of radioactivity (https://www.ukhsa-protectionservices.org.uk/UKionisingradiation/)[1]



1.6 Summary of radiation doses

1.6.1 The assessment process

Most of the monitoring was carried out to determine the effects of discharges from nuclear and non-nuclear sites on the food people consume and their environment. The results are used to estimate and assess annual radiation doses to the public that can then be compared with the relevant dose limits. Dose assessments are retrospective in that they apply to 2025 using monitoring results for that year. The radioactivity concentrations and dose rates reported are spot measurements that reflect the combined radiological impact of all discharges.

In this report, 2 main types of retrospective doses are assessed, 'total dose' and 'source-specific' doses.

'Total dose' assessments consider the doses from radioactive discharges (gaseous and liquid) to the environment from nuclear sites combined with the dose from radiation sources on site (direct radiation). This assessment gives an estimate of the annual 'total dose' to people living near the nuclear sites. The 'total dose' assessment is the main method for estimating radiation exposure to the public.

Source-specific assessments estimate the annual dose from individual sources of radioactivity and associated exposure pathways (see Appendix 2, and Appendix 5 for more information). These dose assessments provide reassurance on the robustness and reasonableness of the annual 'total dose' method (which is the preferred assessment type [15]) and provide information for a range of additional exposure pathways. The sum of the doses from specific sources (terrestrial and aquatic) cannot be directly compared to the assessment of 'total dose' from all sources. This is because the assessment methods use different ways of defining the most exposed people.

The sources considered, habits and monitoring data used, and the dose calculations are described in this report. The primary purpose of each assessment approaches is to identify and assess the main exposure pathways at each site and to demonstrate compliance with the dose limit of 1mSv y^{-1}.

Exposure from direct radiation may be a significant contributor to dose, close to a nuclear site, due to radiation emitting from sources on the site[11]. The ONR is responsible for regulating direct radiation. In 2018, EDF revised its method of direct radiation dose [64]. Therefore, values since 2018 will differ from the generic values given previously. The operators of nuclear sites provide estimates of direct radiation doses to the ONR (Table 1.1); annual exposure data are then made available for use in 'total dose' assessments. These dose assessments use recent habits survey data from which different habits profiles have been created using an agreed method [65].

11.At some locations separate nuclear sites are situated adjacent to one another, for example some EDF Energy operated power stations have a neighbouring Nuclear Restoration Services decommissioning station. As these are operated by different employers, workers at one station are considered to be 'informed workers' for the purpose of assessing direct radiation exposure to the other station. Doses to workers are considered differently to those for the public and therefore are not included in 'total dose' assessments.

Both types of assessment consider those people in the population most exposed to radiation (the 'representative person'). The results from both types of assessments are compared with legal limits (1mSv y^{-1} for members of the public and 50mSv y^{-1} specifically for skin exposure). The effective doses (defined in Appendix 2) are calculated and compared with the legal dose limit of 1mSv per year for members of the public. All legal radiation dose limits in the UK are based on recommendations made by the International Commission on Radiological Protection (ICRP) [3], which are consistent with Basic Safety Standards Directive 13 [66]. The radiation dose specifically to skin is also assessed in some cases and compared with the legal limit for skin exposure.

The radiation doses resulting from human activities may be compared with doses received from naturally occurring sources of radioactivity. The average individual radiation dose in the UK population (in 2025) from natural radiation was estimated by UKHSA to be approximately 2.2mSv per year (https://www.ukhsa-protectionservices.org.uk/UKionisingradiation/) [1]

Radiation exposures to some specific groups of workers are included in the assessment of doses from nuclear sites. These are people who may receive exposure as a consequence of their work activities, such as fishers, farmers, and sewage workers. It is appropriate to compare their doses to the dose limit for members of the public [67]. Those people who specifically work with ionising radiation have their radiation doses assessed and recorded as part of their employer's programme to assess occupational exposure [68].

1.6.2 'Total dose' results for 2025

The results of the assessment for each site are summarised in Table 1.2 (see also Figure S and Table S in the Technical Summary). These data are presented in 3 parts. Part A shows the representative person receiving the highest annual doses from gaseous discharges and direct radiation pathways. Part B shows the representative person receiving the highest annual doses from liquid discharges. Part C shows the representative person receiving the highest annual dose from all pathways and sources; occasionally, the people receiving the highest doses from all pathways and sources are different from those in parts A and B. In some cases, the selection of profiles may be driven by the inclusion of pathways that have higher consumption/occupancy rates than in the respective profiles, for example, for Capenhurst, part A, the profile selected (infant poultry meat consumers) is due to the additional contribution from consumption of root vegetables. The major contributions to the total dose are provided. The use of radionuclide concentrations reported at the limits of detection provide an upper estimate of doses calculated for pathways based on these measurements. The full output from the assessment for each site can be provided by contacting one of the agencies listed on the inside front or back covers of this report or downloaded from https://www.gov.uk/government/publications/radioactivity-in-food-and-the-environment-rife-reports.

In all cases, doses estimated for 2025 were less than the annual limit of 1mSv for members of the public. The people most affected from gaseous discharges and direct radiation varied from site to site but the dominant pathway was often direct radiation (from the relevant site), where it was applicable. The people most affected from liquid discharges were generally adults eating seafood or people who spend long periods of time over contaminated sediments, which are coastal or other areas that are impacted by liquid discharges.

The representative person who received the highest annual 'total dose' (0.51mSv), is from the Cumbrian Coastal Community (near Sellafield) who consumed crustaceans at high rates, together with other seafood. The 'total dose' (from all sources) at this site is combined with the effects of all local sources, including specifically the effects of historical discharges of natural radionuclides from the former phosphate processing plant. The next highest annual 'total doses' were received by people living near the Capenhurst (0.18mSv) and Aldermaston and Burghfield (0.10mSv) sites these doses were almost entirely due to direct radiation from the site.

1.6.3 'Total dose' trends

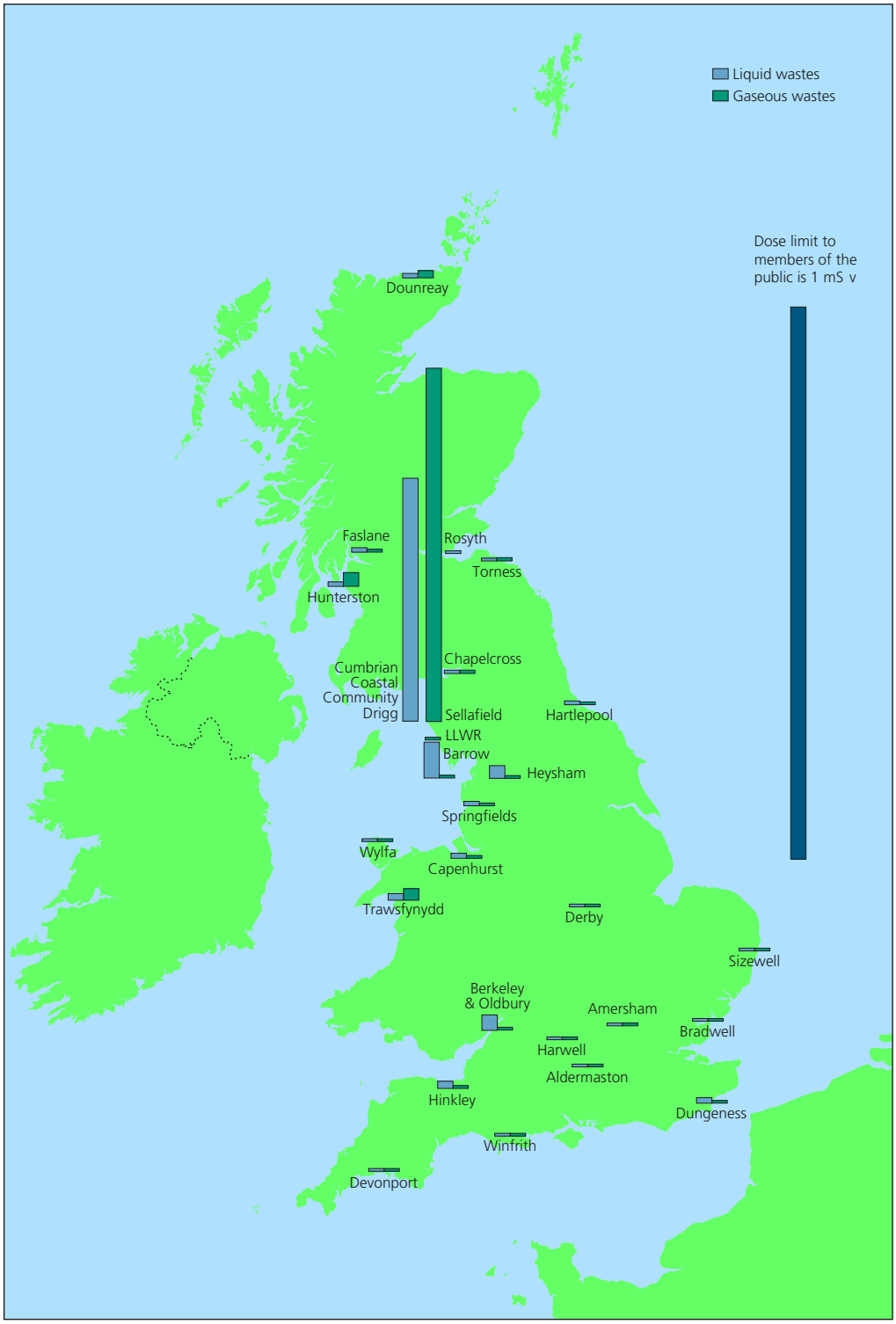
Data for the time-series of annual 'total dose' from 2008 to 2025 is given in Table 1.3. In all cases, the assessed 'total doses' were less that the 1mSv dose limit to members of the public. Detailed plots and discussion on the trends are given in the relevant site sections and supporting texts.

1.6.4 Source-specific dose results for 2025

The results of the source-specific assessments for the sites assessed in the UK are summarised in Figure 1.3 and Table 1.4, which contains numerical data and the major contributors to dose. Figure 1.3 shows the assessed source-specific doses for 2025, both from gaseous and liquid sources, compared to the 1mSv dose limit to members of the public. Doses ranged from less than 0.005mSv (at many sites) to 0.44mSv from all liquid sources along the Cumbrian Coast, including a significant contribution to the dose from historical discharges of naturally occurring radionuclides from the former phosphate processing plant at Whitehaven. Doses from gaseous discharges, ranged from less than 0.005mSv to 0.64mSv, the latter from consumption of terrestrial foods around Sellafield (primarily caesium-137 in wild wood pigeon, discussed in Section 3.3.3.12). These assessments focus on the effect of gaseous or liquid waste discharges, unlike the assessment of 'total dose' which includes all sources including the effect of direct radiation.

At some sites, source-specific doses were higher than the corresponding total dose assessments. This difference comes from the use of different assessment assumptions. Source-specific assessments use conservative assumptions when combining the exposure effects from different food consumption pathways, whereas total dose assessments use more realistic assumptions about patterns of exposure. The estimates from the source-specific assessments provide reassurance that the 'total dose' approach is reasonable. Radiation doses to all age groups (see Section 2.6 for the age groups used), calculated using the source-specific method, were all found to be below the legal limit of 1mSv per year.

Figure 1.3 Source-specific doses, in mSv y^{-1}, in the UK, 2025. (Exposures to the Cumbrian Coastal Community receive a significant contribution to the dose from historical discharges of naturally occurring radionuclides from the former phosphate processing plant at Whitehaven). Small doses less than or equal to 0.005mSv are recorded as being 0.005mSv.



The most significant exposures from seafood (fish and crustacean shellfish) consumption were to the Cumbrian coastal community. The majority of the dose was from historical discharges of naturally occurring radionuclides from the former phosphate processing plant. The most important pathways and radionuclides at each site were similar to those found for 'total dose'.

The most significant exposures from consumption of terrestrial foods were to people close to the Sellafield site. The majority of the dose was from enhanced levels of caesium-137 found in wild wood pigeon.

1.6.5 Protecting the environment

This report focuses primarily on risks to members of the public and on demonstrating that radiation doses remain below regulatory limits. However, the environment agencies also consider the protection of wildlife and the environment from radiation exposure caused by human activity. The 2007 recommendations of the International Commission on Radiological Protection (ICRP) concluded that a systematic approach to the radiological assessment of non-human species was required to support the management of radiation effects in the environment [3]. The ICRP, introduced the concept of Reference Animals and Plants (RAPs) for a system of radiological environmental protection [69]. The ICRP has published its aims covering:

1. prevention or reduction of the frequency of deleterious (harmful) radiation effects on biota (animals and plants) to a level where they would have a negligible impact on the maintenance of biological diversity
2. the conservation of species and the health and status of natural habitats, communities, and ecosystems [70]. No dose limits are proposed to apply, but a set of derived consideration reference levels for representative species are recommended for use in assessing the impact of different sources of exposure

In the UK, the current legislative measures for protection of wildlife from radiation are implemented through The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019, known as the 'Habitats Regulations' [71].

Under the 'Habitats Regulations', the Environment Agency, NRW and SEPA are required to review existing authorisations or permits to ensure that no authorised activity or permission has an adverse effect, either directly or indirectly, on the integrity of Natura 2000[12] habitat sites. Similarly, for any new or varied authorisation or permit, applicants must assess the potential effects of proposed discharges on reference organisms representing species that may be adversely affected.

The assessment of impacts on wildlife and plants (non-human) species is also considered during the determination of applications for new and varied environment permits. Further information concerning assessment of dose rates to reference organisms is available in earlier RIFE reports (for example, [72]) and Environment Agency reports [73,74].

SEPA has carried out a pressures and impacts assessment from radioactive substances on Scotland's water environment. The study concluded that there was no adverse impact on the aquatic environment as a result of authorised discharges of radioactive substances, although it recognised that there may be a need for further data to support this conclusion. SEPA has included a specific habitats assessment in any new authorisation granted by the agency.

12.Natura 2000 is made up of sites designated as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). SACs and SPAs in the UK no longer form part of the EU's Natura 2000 ecological network. The 2019 Regulations have created a national site network on land and at sea, including both the inshore and offshore marine areas in the UK

Table 1.1 Individual doses - direct radiation pathway, 2025

Site	Exposure[a] mSv
Nuclear fuel production and reprocessing	
Capenhurst	0.18
Sellafield	0.003
Springfields	0.010
Research establishments	
Dounreay	0.006
Harwell	NDA[b]
Winfrith (NRS)	NDA[b]
Nuclear power stations	
Berkeley	Bgd[c]
Bradwell	Bgd[c]
Chapelcross	0.006
Dungeness	0.006[d]
Hartlepool	0.005
Heysham	0.005[e]
Hinkley Point	<0.001[f]
Hunterston	0.007[g]
Oldbury	Bgd[c]
Sizewell	0.009[h]
Torness	0.007
Trawsfynydd	0.005
Wylfa	0.001
Defence establishments	
Aldermaston	0.10
Barrow	Bgd[c]
Burghfield	0.010
Derby	0.006
Devonport	Bgd[c]
Faslane	Bgd[c]
Rosyth	<0.001
Dounreay (Vulcan)	Bgd[c]

Table 1.1 continued

Site	Exposure[a] mSv
Radiochemical production	
Grove Centre, Amersham	0.080
Industrial and landfill sites	
Low Level Waste Repository	0.023
Lillyhall (Cycliffe UK limited)	<0.001
Tradebe-Inutec (Winfrith)	<0.001[i]

* At some locations separate nuclear licensed sites are situated adjacent to one another, for example some EDF operated power stations have a neighbouring decommissioning Magnox station. As these are operated by different employers, workers at one station are considered to be 'informed workers' to the other station. Doses to workers are considered differently to those for the general public and therefore are not included in 'total dose' assessments

[a] Values presented in main table to 2 significant figures or 3 decimal places. Values below 0.001 are reported as <0.001
For EDF sites, the highest dose, irrespective of age group and activity is reported

[b] NDA = No dose assessment made – after investigation, elevated dose rates were found originate from other sources or measurement errors and were not attributable to the site

[c] Doses not significantly different from natural background radiation

[d] Dose value from Dungeness A to members of the public presented in table and used in 'total dose' assessment. The dose from Dungeness B (0.0043) not used in assessments.
The dose to workers at Dungeness A from Dungeness B was 0.0087. The dose to workers at Dungeness B from Dungeness A was 0.043

[e] Dose value from Heysham 1 to members of the public presented in table and used in 'total dose' assessment. The dose from Heysham 2 (0.0037) not used in assessments

[f] Dose value from Hinkley B to members of the public presented in table and used in 'total dose' assessment. The dose from Hinkley A (Bgd[c]) was not used in assessments.
The dose to workers at Hinkley A from Hinkley B was 0.0012. The dose to workers at Hinkley B from Hinkley A was NDA[b]. The dose to workers at Hinkley C from Hinkley A was NDA[b]
The dose to workers at Hinkley C from Hinkley B was 0.0005

[g] Dose value from Hunterston B to members of the public presented in table and used in 'total dose' assessments. Dose value from Hunterston A (0.0010) was not used in assessments.
The dose to workers at Hunterson A from Hunterson B was 0.0013. The dose to workers at Hunterston B from Hunterston A was 0.0070

[h] Dose value from Sizewell B to members of the public presented in table and used in 'total dose' assessments. Dose value from Sizewell A (0.0010) was not used in assessments.
The dose to workers at Sizewell A from Sizewell B was 0.014. The dose to workers at Sizewell B from Sizewell A was NDA[b]. The dose to workers at Sizewell C from Sizewell B was 0.022

[i] The dose to workers at Winfrith (NRS) from Tradebe-Inutec (Winfrith) was 0.010. The dose to workers at Tradebe-Inutec (Winfrith) from Winfrith (NRS) was NDA[b].

Table 1.2 'Total dose', in mSv y^{-1}, integrated across pathways at nuclear sites in the UK, 2025.

Site	Representative person[a]	Exposure[b], mSv Total	Dominant contributions[c]
A Gaseous releases and direct radiation from the site			
Aldermaston and Burghfield	Adult game meat consumers	0.10[d]	Direct radiation
Barrow	Adult root vegetable consumers	<0.005	Gamma dose rate over sediment, root vegetables, ^{137}Cs[e]
Berkeley and Oldbury	Infant milk consumers	<0.005	Milk, ^{14}C
Bradwell	Prenatal children of other vegetable consumers	<0.005	Green vegetables, ^{14}C
Capenhurst	Infant poultry meat consumers	0.18[d]	Direct radiation
Chapelcross	Infant milk consumers	0.007	Milk, ^{14}C, ^{35}S[e], ^{90}Sr
Derby	Local child inhabitants (0.25 - 0.5km)	0.006d	Direct radiation
Devonport	Adult potato consumers	<0.005	Crustaceans, Fish, ^{14}C, ^{241}Am[e]
Dounreay	Local adult inhabitants (0.5-1km)	0.008	Direct radiation
Dungeness	Local adult inhabitants (0.25 - 0.5km)	0.008	Direct radiation, gamma dose rate over sediment
Faslane	Adult consumers of marine plants and algae	<0.005	Gamma dose rate over sediment, honey, ^{137}Cs
Grove Centre, Amersham	Prenatal children of local inhabitants (0 - 0.25km)	0.083[d]	Direct radiation
Hartlepool	Local adult inhabitants (0.25-0.5km)	0.005	Direct radiation
Harwell	Local adult inhabitants (0 - 0.25km)	<0.005[d]	External and inhalation, ^{222}Rn
Heysham	Local adult inhabitants (0 - 0.25km)	0.008	Direct radiation, gamma dose rate over sediment, external and inhalation, ^{14}C
Hinkley Point	Infant milk consumers	<0.005	Milk, ^{14}C, ^{35}S, ^{60}Co
Hunterston	Prenatal children of local inhabitants (0.5 - 1km)	0.007	Direct radiation
Low Level Waste Repository	Local Adult inhabitants (0 - 0.25km)	0.029	Crustaceans, direct radiation, ^{210}Po
Rosyth	Local adult inhabitants (0.5 - 1km)	<0.005	Direct radiation, gamma dose rate over sediment
Sellafield	Adult game meat consumers	0.30[d]	Crustaceans, poultry, ^{137}Cs, ^{210}Po
Sizewell	Local adult inhabitants (0 - 0.25km)	0.010	Direct radiation
Springfields	Local infant inhabitants (0 - 0.25km)	0.010[d]	Direct radiation
Torness	Prenatal children of domestic fruit consumers	0.010	Direct radiation, domestic fruit, ^{14}C, ^{90}Sr
Trawsfynydd	Local adult inhabitants (0.5 - 1km)	0.005	Direct radiation
Winfrith	Infant milk consumers	<0.005	Milk, ^{14}C
Wylfa	Local adult inhabitants (0.5 - 1km)	<0.005	Direct radiation, gamma dose rate over sediment
B Liquid releases from the site			
Aldermaston and Burghfield	Adult occupants over riverbank	<0.005	Gamma dose rate over riverbank
Barrow[f]	Adult occupants on houseboats	0.066	Gamma dose rate over sediment
Berkeley and Oldbury	Adult occupants over sediment	<0.005	Gamma dose rate over sediment, fish, ^{241}Am
Bradwell	Adult occupants on houseboats	<0.005	Gamma dose rate over sediment
Capenhurst	Child occupants on water	0.10	Direct radiation
Chapelcross	Prenatal children of occupants on water	0.006	Gamma dose rate over sediment
Derby	Infant consumers of locally sourced water	<0.005	Water, 60Co[e]
Devonport	Adult consumers of marine plants and algae	<0.005	Fish, gamma dose rate over sediment, ^{241}Am[e]
Dounreay	Adult occupants over sediment	0.007	Gamma dose rate over sediment
Dungeness	Adult occupants over sediment	0.010	Gamma dose rate over sediment
Faslane	Adult sea fish consumers	0.007	Fish, ^{137}Cs, ^{241}Am
Grove Centre, Amersham	Adult occupants over riverbank	<0.005	Gamma dose rate over riverbank

Table 1.2 continued

Site	Representative person[a]	Exposure[b], mSv Total	Dominant contributions[c]
Hartlepool	Adult occupants over sediment	0.006	Direct radiation, gamma dose rate over sediment
Harwell	Adult occupants over riverbank	0.007	Gamma dose rate over riverbank
Heysham	Adult occupants over sediment	0.017	Gamma dose rate over sediment
Hinkley Point	Adult occupants over sediment	0.011	Gamma dose rate over sediment
Hunterston	Adult sea fish consumers	0.006	Fish, ^{137}Cs, ^{241}Am
Low Level Waste Repository[g]	Adult crustacean consumers	0.51[h, i]	Crustaceans, ^{210}Po
Rosyth	Adult crustacean consumers	0.007	Crustaceans, gamma dose rate over sediment, ^{241}Am[e]
Sellafield[g]	Adult crustacean consumers	0.51[h, i]	Crustaceans, ^{210}Po
Sizewell	Adult occupants over sediment	0.007	Direct radiation, gamma dose rate over sediment
Springfields	Adult occupants over sediment	0.009	Gamma dose rate over sediment
Torness	Adult fish consumers	<0.005	Direct radiation, fish, ^{241}Am
Trawsfynydd	Adult occupants over sediment	0.015	Direct radiation, exposure over sediment
Whitehaven[g]	Adult crustacean consumers	0.51[h, i]	Crustaceans, ^{210}Po
Winfrith	Adult occupants over sediment	<0.005	Gamma dose rate over sediment
Wylfa	Adult occupants over sediment	0.006	Direct radiation, gamma dose rate over sediment
C All sources			
Aldermaston and Burghfield	Adult game meat consumers	0.10[d]	Direct radiation
Barrow[f]	Adult occupants on houseboats	0.066	Gamma dose rate over sediment
Berkeley and Oldbury	Infant milk consumers	<0.005	Milk, ^{14}C
Bradwell	Adult occupants on houseboats	<0.005	Gamma dose rate over sediment
Capenhurst	Local child inhabitants (0.5 - 1km)	0.18[d]	Direct radiation
Chapelcross	Infant milk consumers	0.007	Milk, ^{14}C, ^{35}S[e], ^{90}Sr
Derby	Local child inhabitants (0.25 - 0.5km)	0.006[d]	Direct radiation
Devonport	Adult consumers of marine plants and algae	<0.005	Fish, gamma dose rate over sediment, ^{241}Am[e]
Dounreay	Local adult inhabitants (0.5-1km)	0.008	Direct radiation
Dungeness	Adult occupants over sediment	0.010	Gamma dose rate over sediment
Faslane	Adult sea fish consumers	0.007	Fish, ^{137}Cs, ^{241}Am
Grove Centre, Amersham	Prenatal children of local inhabitants (0 - 0.25km)	0.083[d]	Direct radiation
Hartlepool	Local adult inhabitants (0-0.25)	0.007	Direct radiation, gamma dose rate over sediment
Harwell	Adult occupants over riverbank	0.007	Gamma dose rate over riverbank
Heysham	Adult occupants over sediment	0.017	Gamma dose rate over sediment
Hinkley Point	Adult occupants over sediment	0.011	Gamma dose rate over sediment
Hunterston	Prenatal children of local inhabitants (0.5 - 1km)	0.007	Direct radiation
Low Level Waste Repository[g]	Adult crustacean consumers	0.51[h, i]	Crustaceans, ^{210}Po
Rosyth	Adult crustacean consumers	0.007	Crustaceans, gamma dose rate over sediment, ^{241}Am[e]
Sellafield[g]	Adult crustacean consumers	0.51[h, i]	Crustaceans, ^{210}Po
Sizewell	Local adult inhabitants (0 - 0.25km)	0.010	Direct radiation
Springfields	Local infant inhabitants (0 - 0.25km)	0.010[d]	Direct radiation
Torness	Prenatal children of domestic fruit consumers	0.010	Direct radiation, domestic fruit, ^{14}C, ^{90}Sr
Trawsfynydd	Adult occupants over sediment	0.015	Direct radiation, exposure over sediment
Whitehaven[g]	Adult crustacean consumers	0.51[h, i]	Crustaceans, ^{210}Po

Table 1.2 continued

Site	Representative person[a]	Exposure[b], mSv Total	Dominant contributions[c]
Winfrith	Adult occupants over sediment	<0.005	Gamma dose rate over sediment
Wylfa	Adult consumers of marine plants and algae	0.006	Direct radiation, gamma dose rate over sediment

a. Selected on the basis of providing the highest dose from the pathways associated with the sources as defined in A, B or C
b. Data are presented to 2 significant figures or 3 decimal places. Data below 0.005 mSv are reported as <0.005 mSv
c. Pathways and radionuclides that contribute more than 10% of the total dose. Some radionuclides are reported as being at the limits of detection and based on these measurements, an upper estimate of dose is calculated
d. Includes a component due to natural sources of radionuclides
e. The assessed contribution is based on data at limits of detection
f. Exposures at Barrow are largely due to discharges from the Sellafield site
g. The effects of liquid discharges from Sellafield, Whitehaven and the LLWR are considered together when assessing exposures at these sites because their effects are manifested in a common area of the Cumbrian coast
h. The doses from man-made and naturally occurring radionuclides were 0.020 and 0.49mSv respectively. The source of naturally occurring radionuclides was a phosphate processing works near Sellafield at Whitehaven. Minor discharges of radionuclides were also made from the LLWR near Drigg into the same area
i. The highest 'total dose' in 2025 due to Sellafield discharges was for people that spend time near sources of direct radiation on the LLWR site

Table 1.3 Trends in 'total dose' (mSv y^{-1}) from all sources at nuclear sites in the UK, 2008 to 2025.

Site	2008	2009	2010	2011	2012	2013	2014	2015	2016
Aldermaston and Burghfield	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Barrow[b]					0.057	0.076	0.055	0.051	0.082
Berkeley and Oldbury	0.041	0.058	0.011	0.006	0.014	0.010	<0.005	<0.005	0.006
Bradwell	0.070	0.098	0.13	0.048	<0.005	<0.005	<0.005	0.017	0.036
Capenhurst	0.17	0.19	0.26	0.095	0.085	0.080	0.17	0.13	0.17
Chapelcross	0.021	0.017	0.029	0.037	0.011	0.024	0.014	0.022	0.026
Derby		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Devonport	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dounreay	0.078	0.063	0.047	0.018	0.017	0.012	0.012	0.010	0.058
Dungeness	0.40	0.32	0.022	0.021	0.015	0.021	0.021	0.014	0.021
Faslane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.009
Grove Centre, Amersham	0.22	0.22	0.22	0.22	0.22	0.22	0.14	0.14	0.15
Hartlepool	0.026	0.027	0.025	0.025	0.015	0.024	0.027	0.022	0.020
Harwell	0.020	0.023	0.018	0.017	0.018	0.010	0.016	0.017	0.015
Heysham	0.046	0.049	0.057	0.025	0.025	0.028	0.023	0.023	0.019
Hinkley Point	0.045	0.055	0.014	0.014	0.013	0.022	0.022	0.016	0.013
Hunterston	0.077	0.067	0.067	0.050	0.032	0.021	0.021	0.025	0.021
Low Level Waste Repository[c]	0.47	0.28	0.18	0.18	0.30	0.061	0.22	0.42	0.41
Rosyth	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.017
Sellafield[c]	0.47	0.28	0.18	0.18	0.30	0.076[d]	0.22	0.42	0.41
Sizewell	0.031	0.026	0.020	0.021	0.021	0.021	0.020	0.021	0.021
Springfields	0.16	0.15	0.17	0.13	0.068	0.060	0.050	0.050	0.038
Torness	0.022	0.022	0.025	0.020	0.020	0.020	0.020	0.020	0.021
Trawsfynydd	0.031	0.018	0.028	0.012	0.025	0.017	0.013	0.014	0.019
Whitehaven[c]	0.47	0.28	0.18	0.18	0.30	0.061	0.22	0.42	0.41
Winfrith	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.014	0.019
Wylfa	0.011	0.011	0.007	0.008	0.006	<0.005	0.007	0.013	0.008

Table 1.3 continued

Site	2017	2018	2019	2020	2021	2022	2023	2024	2025
Aldermaston and Burghfield	0.010	0.010	<0.005	<0.005	0.008	<0.005	0.011	0.010	0.10
Barrow[b]	0.074	0.046	0.057	0.061	0.044	0.030	0.042	0.061	0.066
Berkeley and Oldbury	<0.005	<0.005	<0.005	<0.005	0.013	<0.005	<0.005	<0.005	<0.005
Bradwell	0.011	0.011	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005
Capenhurst	0.17	0.16	0.17	0.17	0.17	0.14	0.15	0.22	0.18
Chapelcross	0.035	0.019	0.007	0.018	0.018	0.009	0.010	0.007	0.007
Derby	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.007	0.006
Devonport	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dounreay	0.010	0.035	0.01	0.009	0.026	0.010	0.028	0.021	0.008
Dungeness	0.021	0.022	0.037	0.012	0.012	0.011	<0.005	0.010	0.010
Faslane	<0.005	0.010	0.007	0.008	0.007	0.007	<0.005	0.005	0.007
Grove Centre, Amersham	0.15	0.14	0.14	0.14	0.083	0.086	0.089	0.087	0.083
Hartlepool	0.031	0.012	0.013	0.017	0.012	0.011	0.015	0.007	0.007
Harwell	0.046	0.028	0.010	0.008	<0.005	<0.005	<0.005	0.008	0.007
Heysham	0.025	0.010	0.018	0.010	0.015	0.016	0.015	0.016	0.017
Hinkley Point	0.032	0.041	0.021	0.023	0.030	0.015	0.032	0.014	0.011
Hunterston	0.023	<0.005	<0.005	0.005	0.006	<0.005	0.013	0.006	0.007
Low Level Waste Repository[c]	0.25	0.37	0.24	0.31	0.21	0.24	0.23	0.20	0.51
Rosyth	0.026	0.010	<0.005	<0.005	0.011	0.006	0.008	0.011	0.007
Sellafield[c]	0.25	0.37	0.25	0.31	0.21	0.24	0.23[e]	0.20[e]	0.51[e]
Sizewell	0.021	0.026	0.010	0.017	0.016	0.011	0.010	0.014	0.010
Springfields	0.028	0.075	0.14	0.047	0.031	0.032	0.040	0.017	0.010
Torness	0.021	<0.005	<0.005	0.006	0.005	0.006	0.007	0.011	0.010
Trawsfynydd	0.024	0.017	0.005	0.012	0.010	0.009	0.007	0.010	0.015
Whitehaven[c]	0.25	0.37	0.25	0.31	0.21	0.24	0.23	0.20	0.51
Winfrith	0.038	0.027	0.027	0.014	0.006	0.028	0.054	0.015	<0.005
Wylfa	<0.005	0.006	<0.005	0.006	0.005	0.014	<0.005	0.008	0.006

a. Where no data is given, no assessment was undertaken due to a lack of suitable habits data at the time.
Data are presented to 2 significant figures or 3 decimal places.
Data below 0.005 mSv are reported as <0.005 mSv.

b. Exposures at Barrow are largely due to discharges from the Sellafield site

c. The effects of liquid discharges from Sellafield, Whitehaven and the LLWR are considered together when assessing exposures at these sites

d. The highest exposure due to operations at Sellafield was to people living in houseboats near Barrow

e. The highest 'total dose' in these years due to Sellafield discharges was for people that spend time near sources of direct radiation on the LLWR site

Table 1.4 Source-specific doses, in mSv y^{-1}, due to discharges of radioactive waste in the United Kingdom, 2025.

Establishment	Radiation exposure pathways	Gaseous or liquid source[a]	Exposure, mSv[b] per year	Contributors[c]
Nuclear fuel production and processing				
Capenhurst	Inadvertent ingestion of water and sediment and external[d,i]	L	0.009	Ext
	Terrestrial foods, external and inhalation near site[e]	G	<0.005[g]	$^{3}H^{h}$, ^{234}U, ^{235}U, ^{238}U
Springfields	Fish, shrimp and wildfowl consumption and external in intertidal areas	L	0.008	Ext, ^{137}Cs
	Terrestrial foods, external and inhalation near site[e]	G	<0.005[g]	^{234}U, ^{235}U, ^{238}U
	External in intertidal areas (children playing)[d,i]	L	<0.005	Ext
	External in intertidal areas (farmers)	L	<0.005	Ext
Sellafield[l]	Fish and shellfish consumption and external in intertidal areas (2021-2025 surveys) (excluding naturally occurring radionuclides)[m]	L	0.034	Ext, ^{241}Am
	Fish and shellfish consumption and external in intertidal areas (2021-2025 surveys) (including naturally occurring radionuclides)[n]	L	0.44	^{210}Po
	Fish and shellfish consumption and external in intertidal areas (2025 surveys) (excluding naturally occurring radionuclides)[m]	L	0.032	Ext, ^{241}Am
	Terrestrial foods, external and inhalation near Sellafield	G	0.64	^{137}Cs
	Terrestrial foods at Ravenglass[e]	G/L	0.013	^{90}Sr, $^{106}Ru^{h}$
	External in intertidal areas (Ravenglass)[i]	L	0.007	Ext, ^{241}Am
	Occupancy of houseboats (Barrow)[q]	L	0.065	Ext
	External (skin) to bait diggers	L	0.087[j]	Beta
Research establishments				
Culham	Water consumption[k]	L	<0.005	$^{137}Cs^{h}$
Dounreay	Fish and shellfish consumption and external in intertidal areas	L	0.008	Ext
	Terrestrial foods, external and inhalation near site	G	0.013	^{137}Cs, $^{238}Pu^{h}$, $^{239+240}Pu^{h}$, $^{241}Am^{h}$
Harwell	Fish consumption and external to anglers	L	0.007	Ext
	Terrestrial foods, external and inhalation near site[e]	G	<0.005	^{137}Cs, ^{222}Rn
Winfrith	Fish and shellfish consumption and external in intertidal areas	L	<0.005	Ext, ^{241}Am
	Terrestrial foods, external and inhalation near site[e]	G	<0.005	^{14}C
Nuclear power production				
Berkeley and Oldbury	Fish and shellfish consumption and external in intertidal areas	L	<0.005	Ext, ^{241}Am
	Occupancy of houseboats	L	0.028	Ext
	Terrestrial foods, external and inhalation near site[e]	G	<0.005	^{14}C
Bradwell	Fish and shellfish consumption and external in intertidal areas	L	<0.005	Ext, ^{241}Am
	Terrestrial foods, external and inhalation near site[e]	G	<0.005	^{14}C
Chapelcross	Wildfowl and fish consumption and external in intertidal areas	L	0.006	Ext
	Terrestrial foods, external and inhalation near site[e]	G	0.006	^{14}C, $^{35}S^{h}$, ^{90}Sr

Table 1.4 continued

Establishment	Radiation exposure pathways	Gaseous or liquid source[a]	Exposure, mSv[b] per year	Contributors[c]
Dungeness	Fish and shellfish consumption and external in intertidal areas	L	0.010	Ext, ^{241}Am
	Terrestrial foods, external and inhalation near site[e]	G	<0.005	^{14}C, ^{35}S[h], ^{60}Co[h]
Hartlepool	Fish and shellfish consumption and external in intertidal areas	L	0.007	Ext, ^{131}I[h]
	Terrestrial foods, external and inhalation near site[e]	G	<0.005	^{14}C, ^{35}S[h], ^{60}Co[h]
Heysham	Fish and shellfish consumption and external in intertidal areas	L	0.023	Ext, ^{241}Am
	External in intertidal areas (turf cutters)	L	<0.005	Ext
	Terrestrial foods, external and inhalation near site[e]	G	<0.005	^{14}C, ^{60}Co[h]
Hinkley Point	Fish and shellfish consumption and external in intertidal areas	L	0.013	Ext, ^{241}Am
	Terrestrial foods, external and inhalation near site[e]	G	<0.005	^{14}C, ^{35}S, ^{60}Co[h]
Hunterston	Fish and shellfish consumption and external in intertidal areas	L	0.008	^{137}Cs, $^{239+240}$Pu, ^{241}Am
	Terrestrial foods, external and inhalation near site	G	0.025	^{137}Cs
Sizewell	Fish and shellfish consumption and external in intertidal areas	L	<0.005	Ext, ^{241}Am
	Terrestrial foods, external and inhalation near site[e]	G	0.005	^{14}C, ^{35}S
Torness	Fish and shellfish consumption and external in intertidal areas	L	<0.005	^{241}Am
	Terrestrial foods, external and inhalation near site[e]	G	0.006	^{14}C, ^{35}S, ^{90}Sr
Trawsfynydd	Fish consumption and external to anglers	L	0.012	Ext
	Terrestrial foods, external and inhalation near site[e]	G	0.021	^{241}Am
Wylfa	Fish and shellfish consumption and external in intertidal areas	L	<0.005	Ext, ^{241}Am
	Terrestrial foods, external and inhalation near site[e]	G	<0.005	^{14}C, ^{35}S[h]
Defence establishments				
Aldermaston & Burghfield	Fish consumption and external to anglers	L	<0.005	Ext, ^{131}I
	Terrestrial foods, external and inhalation near site[e]	G	<0.005[g]	^{3}H[h], ^{137}Cs[h], ^{234}U, ^{235}U, ^{238}U
Barrow	Occupancy of houseboats[q]	L	0.065	Ext
	Terrestrial food consumption[f]	G	<0.005	^{3}H[h], ^{137}Cs[h]
Derby	Water consumption, fish and shellfish consumption and external to anglers[k]	L	<0.005	^{60}Co[h]
	Terrestrial foods, external and inhalation near site[d]	G	<0.005	^{234}U, ^{238}U
Devonport	Fish and shellfish consumption and external in intertidal areas	L	<0.005	^{14}C, ^{241}Am[h]
	Occupancy of houseboats	L	<0.005	Ext
	Terrestrial foods, external and inhalation near site[f]	G	<0.005	^{3}H[h]
Faslane	Fish and shellfish consumption and external in intertidal areas	L	0.008	Ext, ^{137}Cs, ^{241}Am
	Terrestrial food consumption	G	<0.005	^{137}Cs
Rosyth	Fish and shellfish consumption and external in intertidal areas	L	0.005	Ext, ^{241}Am[h]

Table 1.4 continued

Establishment	Radiation exposure pathways	Gaseous or liquid source[a]	Exposure, mSv[b] per year	Contributors[c]
Radiochemical production				
Grove Centre, Amersham	Fish consumption and external to anglers	L	<0.005	Ext
	Terrestrial foods, external and inhalation near site[e]	G	<0.005	^{222}Rn
Industrial and landfill				
Low Level Waste Repository	Terrestrial foods[e]	G	<0.005	^{90}Sr, ^{106}Ru[h], ^{129}I[h], ^{137}Cs
	Fish and shellfish consumption and external in intertidal areas (2021-2025 surveys) (including naturally occurring radionuclides)[l, n]	L	0.44	^{210}Po
	Water consumption[k]	L	<0.005	^{137}Cs[h], ^{210}Po[h]
Whitehaven	Fish and shellfish consumption and external in intertidal areas (2021-2025 surveys) (excluding artificial radionuclides)[l,o]	L	0.41	^{210}Po
	Fish and shellfish consumption and external in intertidal areas (2021-2025 surveys) (including artificial radionuclides)[l,p]	L	0.44	^{210}Po

* Source-specific dose assessments are performed to provide additional information and as a check on the 'total dose' assessment method

a. Dominant source of exposure. G for gaseous wastes. L for liquid wastes or surface water near solid waste sites. See also footnote 'c'

b. Unless otherwise stated represents committed effective dose calculated using methodology of ICRP-60 to be compared with the annual dose limit of 1 mSv (see Section 2). Exposures due to marine pathways include the far-field effects of discharges of liquid waste from Sellafield. Unless stated otherwise, the representative person is represented by adults
Data are presented to 2 significant figures or 3 decimal places. Data below 0.005 mSv are reported as <0.005 mSv

c. The contributors that give rise to more than 10% to the dose; either 'ext' to represent the whole body external exposure from beta or gamma radiation, 'beta' for beta radiation of skin or a radionuclide name to represent a contribution from internal exposure. The source of the radiation listed as contributing to the dose may not be discharged from the site specified, but may be from those of an adjacent site or other sources in the environment such as weapons fallout

d. 10-year-old

e. 1-year-old

f. Prenatal children

g. Includes a component due to natural sources of radionuclides

h. The assessed contribution is based on data at limits of detection

i. Includes a component due to inadvertent ingestion of water or sediment or inhalation of resuspended sediment where appropriate

j. Exposure to skin including a component due to natural sources of beta radiation, to be compared with the dose limit of 50 mSv (see Appendix 1)

k. Water is from rivers and streams and not tap water

l. The estimates for marine pathways include the effects of liquid discharges from the LLWR. The contribution due to the LLWR is negligible

m. Excluding the effects of enhanced concentrations due to the legacy of discharges of naturally occurring radionuclides from a phosphate processing works, Whitehaven

n. Including the effects of enhanced concentrations due to the legacy of discharges of naturally occurring radionuclides from a phosphate processing works, Whitehaven

o. Excluding the effects of artificial radionuclides from Sellafield

p. Including the effects of artificial radionuclides from Sellafield

q. Exposures at Barrow are largely due to discharges from the Sellafield site

2 Methods of sampling, measurement and presentation used in this report

This section explains the scope of the monitoring programmes presented in this report (hereafter referred to as 'programmes') and summarises the methods and data used to measure and assess radioactivity in food and the environment. The bulk of the programmes, assessment methods and supporting datasets used in 2025 were broadly unchanged from previous years, with no special sampling was required for unusual short-term increases in discharges or inadvertent releases. However, the main changes are summarised below:

Assessment and presentation

- new habits data - consumption and occupancy rates have been updated with the benefit of recent habits survey results at Barrow, Sellafield and Sizewell in England, and Dounreay in Scotland

Accompanying this report is a further set of files giving full details of each assessment of 'total dose' summed over all sources at each site.

The appendices of this report contain further details on:

- modelling to support or supplement the results of monitoring (Appendix 3)
- consumption, occupancy and other habits data (Appendix 4)
- dosimetric data (Appendix 5)
- estimates of concentrations of natural radionuclides (Appendix 6)

Guidance on planning and implementing routine environmental radiological monitoring programmes has been published https://www.gov.uk/guidance/environmental-radiological-monitoring-planning-and-implementing and by SEPA [21]. In recent years, the Environment Agency (with NRW providing advice on monitoring in Wales), FSA, FSS and SEPA have all completed reviews of their environmental radioactivity monitoring programmes. Further information is available in earlier RIFE reports [19,72] and in Section 1.1.

2.1 Sampling programmes

The primary purpose of the programmes is to measure the quantities of radioactivity in food and the environment. Results are used to demonstrate that the safety of the public is not compromised and that doses, resulting from discharges of radioactivity, are below the statutory dose limits (see Section 1 for more details). The scope in 2025 extends throughout the UK (and the Channel Islands) and is undertaken independently of the industries which discharge wastes to the environment. Samples of food, water and other materials are collected and analysed in specialist laboratories. In situ measurements of radiation dose rates and contamination are also made and the results of the programmes are assessed in terms of limits and trends in this report. Subsidiary objectives for the programmes are:

- to provide information for assessing the impact of radioactivity in the environment on non-human species
- to enable indirect confirmation of compliance with authorised or permitted waste disposals
- to determine whether undisclosed releases of radioactivity have occurred from sites
- to establish a baseline to judge the importance of accidental releases of radioactivity should they occur
- to demonstrate compliance with international obligations, such as The Oslo and Paris Convention for the Protection of the marine environment of the North-East Atlantic (OSPAR)

Routine sampling is focused on nuclear sites licensed under the Nuclear Installations Act, 1965 [14]. The programmes also serve to provide information to assist the environment agencies to fulfil statutory duties, which are further described in Section 1.1. Additional sampling is conducted in areas remote from nuclear sites to establish the general safety of the food chain, sources of drinking water and the environment. These data provide background activity concentrations against which results from areas near nuclear sites can be compared to show the variation in the quantities of radioactivity across the UK. Quantities of radioactivity in the environment can also be affected by disposals of radioactive waste from nuclear sites abroad and show the legacy of atmospheric fallout from both past nuclear weapons testing and the nuclear reactor accidents (such as at Chernobyl in Ukraine in 1986).

Various methods for undertaking sampling and analysis are available. The programmes are primarily directed towards widespread contamination where exposure through contact or consumption can reasonably be expected. Where a source of potential exposure to particles of radioactivity is concerned, the likelihood of encounter is an important factor. This is considered separately in this report in site-specific programmes targeted at contamination from radioactive particles on beaches near Sellafield (Section 3.3.3.6) and Dounreay (Section 5.2.3).

The programmes can be divided into 3 main sectors, generally based on the source of radioactivity in the environment:

1. nuclear sites discharging gaseous and liquid radioactive wastes
2. selected non-nuclear sites and solid waste disposal sites
3. UK regional monitoring and overseas accidents

2.1.1 Nuclear sites

Nuclear sites are the primary focus of the monitoring programmes because they represent the most significant permitted/authorised sources of radioactive waste discharges. Sampling and direct monitoring is conducted close to most of the sites shown in Figure 1.1. Radionuclides from historical liquid discharges at Sellafield can be detected in the marine environment in many parts of north European waters. Therefore, programmes for this site extend beyond national boundaries.

The frequency and type of measurement and the materials sampled vary from site to site and are chosen to be representative of existing exposure pathways. Information on local peoples' diets and way of life, from habits surveys, are used to inform the exposure pathways. Detailed information on the scope of the programme at individual sites is given in the tables of results. The routine programme is supplemented by additional monitoring if applicable, for example, in response to incidents or reports of unusual or high discharges of radioactivity with the potential to enter the food chain or the environment. Results of both routine and additional monitoring are included in this report.

The main aim of the programme is to monitor the environment and food consumed by people who live or work near nuclear sites, to estimate doses for those small groups of people who are more at risk of exposure to radioactivity from these sources. It is assumed that if the most exposed people have a dose below the national and international legal limit then doses to the wider population will also be below those limits. For liquid wastes, the pathways that are the most relevant to discharges are the ingestion of seafood and freshwater fish, drinking water and external exposure from contaminated materials. For gaseous wastes, the effects are due to the ingestion of terrestrial foods, inhalation of airborne activity and external exposure from material in the air and deposited on the ground. Inhalation of airborne activity and external exposure from airborne material and surface deposition are difficult to assess by direct measurement but can be assessed using environmental models. The main part of the monitoring is therefore directed at a variety of foodstuffs and measurements of external dose rates on the shores of seas, rivers and lakes. The programme also includes some environmental indicators that provide historical and contextual information on trends in environmental radioactivity.

2.1.2 Selected non-nuclear site and solid waste disposal sites

Although the emphasis of the monitoring programme is the nuclear sector, a small proportion of the monitoring programmes are focussed on other activities that may have a radiological impact on people and the food chain. This part of the programme considers the effect of disposals of naturally occurring and artificial radionuclides from non-nuclear industries and of disposal into solid waste disposal sites, other than at Dounreay (considered separately in Section 5).

The impact of the non-nuclear industry was studied at several locations in 2025 including East Northants Resource Management Facility (near Kings Cliffe), Clifton Marsh (Lancashire), Lillyhall (Cumbria), the River Clyde (Glasgow) and Whitehaven (see Section 7). As in recent years, a small-scale programme was undertaken near Hartlepool (see Section 4.1.4), in addition to that directed at the effects of the power station itself. Sampling and analysis reflected the nature of the sources (of radioactivity) under study and, where appropriate, included consideration of the enhanced concentrations of naturally occurring radionuclides from non-nuclear industrial activity. There are also occasional specific programmes that consider, for example, the effects of land contaminated with historical sources of radioactivity and discharges from non-nuclear sites such as hospitals.

The distribution of solid waste disposal sites considered in 2025 is shown in Figure 7.1. Sites were studied to assess the extent of radiological contamination, resulting from leachates from the site, re-entering the terrestrial environment (leachates accumulating in surface waters close to the sites).

2.1.3 UK regional monitoring and fallout in the UK from overseas accidents

The programme of regional monitoring considers the quantities of radioactivity in the environment in areas away from specific sources as an indication of general radiological contamination of the food supply and the environment. The component parts of this programme are:

- monitoring of the Channel Islands and Northern Ireland
- dietary surveys
- sampling of milk
- drinking water sources, groundwater, rain and airborne particulates
- seawater surveys
- fallout in the UK from overseas accidents

Channel Islands and Northern Ireland

The programmes for the Channel Islands and Northern Ireland are designed to complement that for the rest of the UK and to take into account the possibility of long-range transport of radionuclides.

Channel Islands monitoring is conducted on behalf of the Channel Island States. It consists of sampling and analysis of seafood and indicator materials as a measure of the potential effects of UK and French disposals into the English Channel and historical disposal of solid waste in the Hurd Deep.

Monitoring on the Isle of Man for foodstuffs and indicator materials ceased in 2013 and 2016 [8,75], respectively. Monitoring of the marine environment was primarily directed at the effects of disposals from Sellafield.

The Northern Ireland programme is directed at the far-field effects of disposals of liquid radioactive wastes into the Irish Sea. Seafood and indicator materials are collected from a range of coastal locations including marine loughs, and dose rates are monitored on beaches.

General diet

The purpose of the general diet survey programme is to provide information on radionuclides in the food supply to the wider population, rather than to those living near particular sources of radiological contamination such as the nuclear industry. This programme is based on sampling and analysis of canteen meals throughout the UK. It provides background information that is useful in interpreting site-related measurements and helps ensure that significant sources of radiological contamination are identified and appropriately reflected in site-specific monitoring programmes.

Specific foods, freshwater, rain and airborne particulates

Further background information on the relative concentrations of radionuclides is gained from the sampling and analysis of milk. Freshwater, rain and airborne particulates are also analysed to add to the understanding of radionuclide intakes by the population via ingestion and inhalation and as general indicators of the state of the environment.

Milk sampling took place at dairies throughout the UK in 2025.

Meat and crop monitoring of naturally occurring and artificial radionuclides, as a check on general food contamination, remote from nuclear sites, ceased in 2014. However, in 2025, surveillance of imported food at ports of entry using radiation screening equipment continued as a means of detecting the effects of overseas incidents. If screening and subsequent sample analysis shows quantities of radioactivity that fail to comply with UK food standards, which are retained from EU directives or regulations, then the consignments are removed from the UK market.

Freshwater used for the supply of drinking water was sampled throughout England, Northern Ireland, Scotland and Wales. Regular measurements of radioactivity in air and rainwater were also made.

Seawater surveys

Seawater surveys are conducted in the seas around the UK on behalf of the DESNZ to provide information on radionuclide concentrations and information on water transport mechanisms in the coastal seas of northern Europe. Such information is used to support international studies of the health of the seas under the auspices of the OSPAR Conventions [76] (to which the UK is a signatory) and in support of research on the fate of radionuclides discharged to sea. These surveys are conducted using government research vessels and are supplemented by a programme of spot sampling of seawater at coastal locations.

Fallout in the UK from overseas accidents

Monitoring of the long-range effects of the Fukushima Dai-Ichi accident started across the UK in March 2011. Samples from all sectors of the environment were taken and analysed by gamma spectrometry. The most significant radionuclides to monitor were iodine-131 and caesium-137, which were prevalent in the release from the accident. Very low activity concentrations were detected, and the extended programme ceased later in 2011. Further details of the programme and the results are given in the RIFE report for 2011 [77].

Monitoring of the effects of the 1986 Chernobyl accident was undertaken in relation to the upland contamination of lakes. Earlier RIFE reports have provided detailed results of monitoring by the environment agencies and FSA [78]. Sheep monitoring ceased in 2012 due to the removal of restrictions on the movement, sale and slaughter of sheep in parts of Cumbria and North Wales. Sampling for freshwater fish in locations affected by Chernobyl ceased in 2014.

2.2 Methods of measurement

There are 2 basic types of measurement made:

1. dose rates are measured directly in the environment
2. samples collected from the environment are analysed for their radionuclide content in a laboratory

2.2.1 Sample analysis

Analysis of samples varies depending on the nature of the radionuclide under investigation. The types of analysis can be broadly categorised into 2 groups:

1. gamma-ray spectrometry
2. radiochemical methods

The former is a cost-effective method of detecting a wide range of (gamma-emitting) radionuclides, commonly found in radioactive wastes, and is used for most samples. Radiochemical methods consist of a range of analyses involving the application of chemical separation and purification techniques to quantify the concentrations of alpha- and beta-emitting radionuclides. These are sensitive determinations, but generally more labour intensive. These methods are only used if alpha and beta concentration data are required for specific radionuclides and are not detectable using gamma-ray spectrometry (see Section 2.4 for discussion on limits of detection).

Several laboratories analysed samples in the monitoring programmes described in this report. Their main responsibilities were as follows:

- Cefas Centre for Environment, Fisheries and Aquaculture Science, gamma-ray spectrometry and radiochemical analysis of food samples in England, Wales, Northern Ireland and the Channel Islands
- SOCOTEC SOCOTEC UK Limited, gamma-ray spectrometry and radiochemical analysis of environmental samples (including analysis of drinking water) in England and Wales
- UKHSA UK Health Security Agency, gamma-ray spectrometry and radiochemical analysis of food and environmental samples from Scotland, air and rain samples in England, Wales and Northern Ireland, and freshwater for Northern Ireland

Each laboratory operates quality control procedures to the standards required by the UK environment and food standards agencies and have their analytical procedures independently assessed by the UK Accreditation Service. This ensures the requirements from the international standard ISO 17025 [79] are maintained. Regular calibration of detectors is undertaken, and intercomparison exercises are held with participating laboratories. The quality assurance procedures and data are made available to the UK environment agencies, FSA and FSS for auditing. The methods of measurement include alpha and gamma-ray spectrometry; beta and Cerenkov scintillation counting; and alpha and beta counting using proportional detectors.

Corrections are made for the radioactive decay of short-lived radionuclides between the time of sample collection and measurement in the laboratory. This is particularly important for sulphur-35 and iodine-131. If a sample is bulked from a sequence of samples over time, the date of collection of the bulked sample is assumed to be in the middle of the bulking period. Otherwise, the actual collection date for the sample is used. In a few cases where short-lived radionuclides are part of a

radioactive decay chain, the additional activity ('in-growth' and equilibrium status) produced from radioactive decay of parent and daughter radionuclides after sample collection is also considered. Where necessary, corrections to the activity present at the time of measurement are made to take account for this.

The analysis of foodstuffs is conducted on the part of the sampled material that is normally eaten, for example, shells of shellfish and the pods of some legumes are discharged before analysis. Most other foodstuffs are analysed raw, as it is conceivable that all the activity could be consumed in the raw foodstuff. Some shellfish samples are cooked (boiled) to represent processing by members of the public and therefore, some activity will be lost as a consequence. Several studies have investigated the loss of activity of caesium-137, strontium-90 and polonium-210, which are dependent upon cooking method [80–88]. The retention factors for caesium-137 in bivalve molluscs varied from 0.49 to 1.30 [83,88]. The Uddin [80] and Johansen [81] studies suggest lower retention factors when samples are boiled or steamed, rather than grilled or fried, with ^{210}Po retention factors of 0.58 and 0.56 for crustacean and bivalve molluscs, respectively [81]. The depuration of transuranic radionuclides from edible winkles has been studied by Swift [89].

2.2.2 Measurement of dose rates and contamination

Measurements of gamma dose in air over intertidal and other areas are normally made at 1 metre above the ground using RadEye SX Survey Meters or Mini Instruments[13] environmental radiation meters type 6-80, with both types of meters connected to compensated Geiger-Muller tubes, type MC-71. In some scenarios, for example, for people living on houseboats or for wildfowlers lying on the ground, measurements at other distances from the ground may be made. External beta doses are measured on contact with the source, for example fishing nets, using Mini Instruments[13], Smart ION and Electra PB19RD monitors. These portable instruments are calibrated against recognised reference standards, and the inherent instrument background is subtracted. There are 2 quantities that can be presented as measures of external gamma dose rate, total gamma dose rate or terrestrial gamma dose rate. Total gamma dose rate includes all sources external to the measuring instrument. Terrestrial gamma dose rate excludes cosmic sources of radiation but includes all others. In this report, the total gamma dose rate is presented. UKHSA reports terrestrial gamma dose rates to SEPA. Terrestrial gamma dose rate is converted to total gamma dose rate by the addition of 0.037μGy h^{-1} which approximates the contribution made by cosmic radiation [90].

Gamma monitoring of radiological contamination on beaches is undertaken, on behalf of SEPA, using similar instrumentation to that for measurements of dose rates. The aim is to cover a large area including strandlines where radioactive debris may become deposited. At Dalgety Bay (Section 7.7) and Dounreay (Section 5.1), in Scotland, and at Sellafield (Section 3.3.3), in Cumbria, special monitoring procedures are in place due to the potential presence of radioactive particles on beaches. Further information regarding Dalgety Bay, Dounreay, and Sellafield is provided elsewhere in this report.

13. The reference to proprietary products in this report should not be construed as an official endorsement of those products, nor is any criticism implied of similar products which have not been mentioned

2.3 Presentation of results

The tables of monitoring results contain summarised values of observations obtained during the year under review. The data are generally rounded to 2 significant figures. Values near to the limits of detection will not have the precision implied by using 2 significant figures. Observations at a given location, for activity concentrations and dose rates, may vary throughout the year. This variability may be due to changes in rates of discharge, different environmental conditions and uncertainties arising from the methods of sampling and analysis.

The method of presentation of the summarised results allows the data to be interpreted in terms of public radiation exposures for comparison with agreed safety standards.

For milk samples, the most appropriate quantity for use in assessments is the arithmetic mean in the year sampled from the farm with the highest mean activity concentration. This is labelled 'max' in the tables of results to distinguish it from the values that are averaged over a range of farms. For other terrestrial foods, an alternative approach is adopted since it is recognised that the possible storage of foods harvested during a particular time of the year has to be taken into account. Greater public exposures would be observed coincidentally with foods being harvested at times of elevated radiological contamination. For such foods, as well as the mean value, the maximum activity concentration (labelled 'max' in the tables) observed for each radionuclide is presented at any time in the relevant year and forms the basis for the assessment of dose.

Results are presented, where a sample is taken or a measurement is made, for each location or source of supply. Sample collectors are instructed to obtain samples from the same location during the year. Spatial averaging is therefore not generally undertaken, though it is inherent in the nature of some collected samples. A fish may move some tens of kilometres in an environment of changing concentrations in seawater, sediments and lower trophic levels. The resulting quantity of radiological contamination therefore represents an average over a large area. Similarly, cows providing milk at a farm may feed on grass and other fodder collected over a distance of a few kilometres of the farm. In the case of dose rate measurements, the position where the measurement is conducted is within a few metres of other measurements made within a year. Each observation consists of the mean of many instrument readings at a given location.

The numbers of farms that were sampled to provide information on activities in milk at nuclear sites are indicated in the tables of results. Milk samples collected weekly or monthly are generally bulked to provide quarterly samples for analysis each year. Otherwise, the number of sampling observations in the tables of concentrations refers to the number of samples that were prepared for analysis during the year. In the case of small animals such as molluscs, one sample may include several hundred individual animals.

The number of sampling observations does not necessarily indicate the number of individual analyses conducted for a specific radionuclide. In particular, determinations by radiochemical methods are sometimes conducted less frequently than those by gamma-ray spectrometry. However, results are often based on bulking of samples such that the resulting determination remains representative.

Only results that are the most relevant for assessing the impact of radionuclide concentrations in food and the environment are provided in each site table. This ensures that reporting of the more meaningful results is manageable. For example, gamma-ray spectrometry can provide many 'less than values' and may not be reported. To identify the most relevant values to be included in each individual table, one or more of the following conditions is required:

1. all radionuclide results (both positively detected and 'less than values') are reported in the site table if the radionuclide is specified in the relevant permit or authorisation (as indicated for each site in Appendix 1, Table A1.1 and Table A1.2)
2. all radionuclide results (both positively detected and 'less than values') are reported that have been analysed using a radiochemistry method (for example, plutonium radionuclides)
3. for any radionuclide that is reported as positively detected in the previous 5 years of annual reporting, all activity concentration data of that radionuclide are reported (they are only excluded from the table after 5 continuous years of reporting 'less than values')
4. for any radionuclide that is reported as positively detected in one of the samples, all activity concentration data of that radionuclide are reported for other samples presented in the table (terrestrial and marine) in that year
5. naturally occurring radionuclides measured by gamma-ray spectrometry (for example potassium-40) are not usually reported unless the intention is to establish whether there is any enhancement above the expected background concentrations (for example from landfill sites)

2.4 Detection limits

There are 2 main types of results presented in the tables:

1. positively detected values
2. values preceded by a 'less than' symbol (<)

Where the results are an average of more than one value, and each value is positive, the result is positive.

Alternatively, where there is a mixture of data, or all data are at the limit of detection (LoD) or minimum reporting level, the result is preceded by a 'less than' symbol. Gamma-ray spectrometry can provide many 'less than values'.

Limits of detection are governed by various factors relating to the measurement method used and these are described in earlier reports [91]. There are also a few results quoted as 'not detected' (ND) by the methods used. This refers to the analysts' judgement that there is insufficient evidence to determine whether the radionuclide is present or absent.

2.5 Additional information

The main aim of this report is to present all the results of routine monitoring from the programmes described previously. However, it is necessary to carry out some averaging for clarity and to exclude some basic data that may be of use only to those with specific research interests. Full details of the additional data are available from the environment agencies and FSA. Provisional results of concentrations of radionuclides in food samples collected in the vicinity of nuclear sites in England, Northern Ireland (milk and canteen meals) and Wales are published on the FSA's data portal (https://data.food.gov.uk/catalog/datasets/ae416fc9-7144-4e83-b8c9-386b665c604c).

The main categories of additional data are:

- data for individual samples prior to averaging
- uncertainties in measurements
- data for very short-lived radionuclides supported by longer-lived parents
- data which are not relevant to a site's discharges for naturally occurring radionuclides and for artificial radionuclides below detection limits
- measurements conducted as part of the research programme described in Appendix 7

Very short-lived radionuclides such as yttrium-90, rhodium-103m, rhodium-106m, barium-137m and protactinium-234m (formed by decay of strontium-90, ruthenium-103, ruthenium-106, caesium-137 and thorium-234, respectively) are taken into account for calculating exposures to members of the public. They are not listed in the tables of results. As a first approximation, their concentrations can be taken to be the same as those of their respective parents. The effects of these short-lived radionuclides are included in the dose coefficients and mean beta and gamma energies (Appendix 5).

In the discussion of changes in discharges, the factors listed below are considered:

- is the change in discharge greater than +/- 10% of the percent of annual limit between years
- has there been an order of magnitude change in the discharges
- has the discharge gone from Nil to a finite value (or vice versa)

2.6 Radiation protection standards

The monitoring results in this report are interpreted in terms of radiation exposures of the public, commonly termed 'doses'. This section describes the dose standards that apply in ensuring protection of the public. Previous UK practice is described in previous RIFE reports [92].

Current UK radiological protection law is retained from the 2013 Basic Safety Standards Directive [66]. This EU directive implemented the ICRP's 2007 general recommendations for a system of radiological protection, set out in ICRP Publication 103 [3]. The Directive's requirements were transposed into UK legislation and include dose limits for members of the public, including limits on effective dose and equivalent doses to the skin and lens of the eye. Any changes in UK radiological protection law and standards will be taken into account for future issues of this RIFE report.

The respective national legislative frameworks, which are equivalent, governing radiological protection, including regulation of public exposure to radioactive wastes are described below

- For England and Wales, the requirements are set out in Schedule 23 'radioactive substances activities' of the Environmental Permitting (England and Wales) Regulations 2016 (EPR 16) [93]
- In Northern Ireland, the Radioactive Substances (Modification of Enactments) Regulations (Northern Ireland) 2018 (RSR 18) [94] by amending the Radioactive Substances Act 1993 (RSA 93) [95].
- in Scotland the requirements are set out in the Environmental Authorisations (Scotland) Regulations 2018 (EASR) [96], Schedule 8 'radioactive substances activities'. EASR was amended in 2025 to provide an integrated authorisation framework, bringing together the authorisation, procedural and enforcement arrangements relating to water, waste management, industrial activities and radioactive substances.

A guidance document was also published in 2018, providing the scope of and exceptions from the radioactive substances legislation in England, Wales, and Northern Ireland [97].

To transpose the requirements of Basic Safety Standards Directive 13, the Ionising Radiations Regulations 2017 (IRR 17) [68] came into force in 2018 (replacing the Ionising Radiations Regulations 1999). The Ionising Radiations Regulations 2017 controls the radiation exposure of workers and the public apart from that resulting from the permitted disposal of radioactive waste, which is regulated by the environment agencies under the various permitting legislation described previously.

The Environment Agency, NRW and SEPA also have broader responsibilities under the Environment Act 1995 [98] for environmental protection including determining general concentrations of pollution in the environment. The Environment Act 1995, does not apply to Northern Ireland.

The mean annual dose received by the 'representative person' is compared with the relevant dose limit. The term 'representative person' refers to those people most exposed to radiation. In this report, they are usually members of the public consuming large quantities of locally harvested food (high-rate consumers) or spending long periods of time in locations being assessed for external exposure. The dose limits apply to all age groups. Doses received by an individual will be age dependent because of differences in their physiology, anatomy and dietary habits. The embryo or foetus (prenatal child) can also receive higher doses than its mother. Consequently, doses have been assessed for different age groups; for example, adults, children (10-year-old), infants (1-year-old) and prenatal children, and from this information it is possible to determine which of these age groups receives the highest dose. Each age group is subject to different factors, including, but not limited to physiological development stages, breathing rates, diet, gender, and smoking/non-smoking.

For drinking water, water quality regulations [99–102], prescribe the requirements on the quality of water intended for human consumption in respect of radioactive substances and is retained from the 2013 EU Basic Safety Standards Directive [103]. These regulations specify threshold values for gross alpha, gross beta, radon, tritium and 'Indicative Dose'. Above these values, UK regulatory bodies shall assess whether the presence of radioactive substances in drinking water poses a risk to human health that requires action and, where necessary, take remedial action to improve the quality of water to a level which complies with the requirement for the protection of human health from a radiation protection point of view. Drinking water is taken to include bottled waters (spring and drinking).

In situations that present a novel exposure pathway for members of the public, 'potential' exposure routes and standards are determined, and these are discussed further in relation to particles of radioactivity [104]. For contamination known to be due to radioactive particles in the UK, a site-specific assessment is considered in the relevant section of this report.

Accidental releases will be assessed against UK and ICRP standards in emergency situations [3,105]. In addition, it is government policy that food intervention levels retained from EU standards will be taken into account for setting discharge limits. Guidelines for radionuclides in foods following accidental radiological contamination for use in international trade has been published by the Codex Alimentarius Commission [106].

2.7 Assessment methods

Calculations of exposures to members of the public in this report are primarily based on the environmental monitoring data for the year shown under study. The methods used have been assessed for conformity with the principles endorsed by the UK National Dose Assessment Working Group [67], and were found to be compatible [107]. The methods used in RIFE are comparable to those used elsewhere [108]. The dose assessment models, PC-CREAM 08® and the Initial Radiological Assessment Tool version 2 have been subjected to thorough intercomparison exercises [109,110]. There are 2 types of dose assessment made. The first type gives an estimate of the 'total dose' to people around the nuclear sites. It considers the effects of all sources, that is the discharges of gaseous and liquid wastes and direct radiation from sources on the site premises [65]. The stages of the assessment are described below.

1. obtain the consumption and occupancy data from habits surveys
2. use the 'cut-off' method to group individuals whose consumption or occupancy is within a factor of 3 of the observed maximum
3. habits profiles for the group determined by averaging the habits rates of all individuals in the group
4. repeat steps 2 and 3 for all pathways identified in habits survey (for example, occupancy for direct radiation, milk consumption)
5. doses to each profiled group calculated (using concentrations of radionuclides in food and environmental dose rates). The group with the highest dose near each site becomes the representative person

The second type of assessment is focused on specific sources of radioactivity and their associated pathways (see Section 1.6 and Appendix 2 in this report for additional information). It serves as a check on the robustness of the 'total dose' assessment and is also compatible with the approach used prior to the introduction of 'total dose' in 2004.

'Total dose' assessments include doses from direct radiation. The estimates of direct radiation dose are provided by The ONR based on information supplied by industry [111]. Both types of assessment provide information on 2 other main pathways:

- ingestion of foodstuffs
- external exposure from contaminated materials in the aquatic environment

Collective doses are beyond the scope of this report. They are derived using modelling techniques. The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) has published an assessment of individual and collective doses to members of the public from exposure to ionising radiation, including nuclear power production and related nuclear fuel cycle facilities and natural sources of ionising radiation [112].

Monitoring data is also used to assess doses from other pathways [113] :

- drinking water
- inadvertent ingestion of water and sediments
- inhalation of re-suspended soil and sediment

In addition, models are used to supplement the monitoring data in 3 situations:

- atmospheric dispersion models are used for non-food pathways where monitoring is not an effective method of establishing concentrations or dose rates in the environment. The doses from external exposure and inhalation are included as an hourly dose rate in 'total dose' and as an annual dose in the 'source-specific' assessments
- food chain models provide additional data to fill gaps and to adjust for high limits of detection
- modelling of exposures of sewage workers is undertaken for discharges from the Atomic Weapons Establishment (AWE) Aldermaston and the Grove Centre, Amersham

Full details of the models used are given in Appendix 3.

For pathways involving intakes of radionuclides, the data required for assessment are:

- concentrations in foodstuffs, drinking water sources, sediments or air
- the amounts eaten, drunk or inhaled
- the dose coefficients that relate an intake or activity to a dose

For external radiation pathways, the data required are:

- the dose rate from the source, for example a beach or fisher's nets
- the time spent near the source

In both cases, the assessment estimates exposures from these pathways for people who are likely to be most exposed

2.8 Concentrations of radionuclides in foodstuffs, drinking water sources, sediments and air

In nearly all cases, the concentrations of radionuclides are determined by monitoring and are given in the main text of this report. The concentrations chosen for the assessment are intended to be representative of the intakes of the most exposed consumers in the population. All of the positively determined concentrations tabulated are included irrespective of the origin of the radionuclide. In some cases, this means that the calculated exposures could include contributions due to disposals from other sites as well as from fallout from nuclear weapon testing and activity deposited following a nuclear reactor accident (such as at Chernobyl in 1986). Where possible, corrections for 'background' concentrations of naturally occurring radionuclides are made in the calculations of dose (see Section 2.12).

For aquatic foodstuffs, drinking water sources, sediments and air, the assessment is based on the mean concentration near the site in question. For milk, the mean concentration at a nearby farm with the highest individual result is used in the dose assessment. This procedure accounts for the possibility that any farm close to a site can act as the sole source of supply of milk to high-rate consumers.

For other foodstuffs, the maximum activity concentrations are selected for the assessment. This allows for the possibility of storage of food harvested at a particular time when the peak quantities in a year may have been present in the environment.

The tables of activity concentrations include 'less than values' as well as positive determinations. This is particularly evident for gamma-ray spectrometry of terrestrial foodstuffs. Where a result is presented as a 'less than value', the dose assessment methodology treats it as if it were a positive determination in the following scenarios:

1. when that radionuclide is specified in the relevant permit or authorisation (gaseous or liquid)
2. when that radionuclide was determined using radiochemical methods
3. when a positive result is reported for that radionuclide in another sample from the same sector of the environment at the site (aquatic or terrestrial)

Although this approach may produce an overestimation of dose, particularly at sites where activity concentrations are low, it ensures that estimated exposures are unlikely to be understated.

2.9 Consumption, drinking and inhalation rates

2.9.1 Source-specific assessments

In the assessment of the effects of disposals of liquid effluents, the amounts of fish and shellfish consumed are determined by site-specific dietary habits surveys. Data are collected primarily by direct interviews with potential high-rate consumers who are often found in fishing communities. Children are rarely found to eat large quantities of seafood, and their resulting doses are invariably less than those of adults. The calculations presented in this report are therefore representative of adult seafood consumers or their unborn children if the prenatal children age group is more restrictive.

In assessments of terrestrial foodstuffs, the amounts of food consumed are derived from national surveys of diet and are defined for 3 age groups: adults, children (10-year-old) and infants (1-year-old) (based on [114]). Adult consumption rates are used in the assessment of doses to prenatal children. For each food type, consumption rates at the 97.5th percentile of consumers have been taken to represent the people consuming a particular foodstuff at a high rate (the consumption rate of the 'representative person').

Drinking and inhalation rates are general values for the population, adjusted according to the times spent in the locations being studied.

The consumption, drinking and inhalation rates are given in Appendix 4. Estimates of dose are based on the most up to date information available at the time of writing the report. Where appropriate, the data from site-specific surveys are averaged over a period of 5 years following the recommendation of the report of the consultative exercise on dose assessments [115].

The assessment of terrestrial foodstuffs is based on 2 assumptions:

1. that the foodstuffs eaten by the most exposed individuals are those that are sampled for the purposes of monitoring, see references [116,117] for previous investigations into key marine environmental indicators and uncommon seafoods, respectively
2. that the consumption of such foodstuffs is sustained wholly by local sources

The 2 food groups resulting in the highest dose are taken to be consumed at high consumption rates, while the remainder are consumed at mean rates. The choice of 2 food groups at the higher consumption rates is based on statistical analysis of national diet surveys. This shows that only a very small percentage of the population were critical rate consumers in more than 2 food groups [118]. Locally grown cereals are not considered in the assessment of exposures as it is considered highly unlikely that a significant proportion of cereals will be made into locally consumed (as opposed to nationally consumed) foodstuffs, notably bread.

2.9.2 'Total dose' assessments

The 'total dose' assessments are based on consumption and occupancy data collected from site-specific surveys which are targeted at those most likely to be exposed around the site. The habits profiles that give rise to the highest doses in the assessment of RIFE data are given in files that accompany this report. Care should be taken in using these data in other circumstances because the profile leading to the highest doses may change if the measured or forecast concentrations and dose rates change.

2.10 Dose coefficients

Dose calculations for intakes of radionuclides by ingestion and inhalation are based on the compendium of dose coefficients taken from ICRP Publication 119 [119] and from ICRP 88 [120] and National Radiological Protection Board (NRPB) [121]. The ICRP has published part 1 of its revised dose coefficients to members of the public and has completed consultations on parts 2 and 3. UK regulators are currently reviewing these revised values with a view to implementing them in dose assessment calculations (including those in RIFE) at a suitable timescale agreed with DESNZ and other relevant stakeholders.

These coefficients (often referred to as 'dose per unit intake') relate the committed dose received to the amount of radioactivity ingested or inhaled. The dose coefficients used in this report are provided in Appendix 5 for ease of reference. Dose coefficients are available for multiple age groups.

The dose assessments include the use of appropriate gut uptake factors (proportion of radioactivity being absorbed from the digestive tract). Where there is a choice of gut uptake factors for a radionuclide, we have generally chosen the one that gives the highest predicted exposure. Where results for total tritium are available, we have assumed that the tritium content is wholly in an organic form. However, we have also considered specific research work of relevance to the foods considered in this report. This affects the assessments for tritium, polonium, plutonium, and americium radionuclides as discussed in Appendix 5.

2.11 External exposure

In the assessment of external exposure, there are 2 factors to consider:

1. the dose rate from the source
2. the time spent near the source

In the case of external exposure to penetrating gamma radiation, uniform whole-body exposure has been assumed. The radiation as measured is in terms of the primary quantity known as 'air

kerma rate', a measure of the energy released when the radiation passes through air. This has been converted into exposure using the factor 1milligray = 0.85mSv [122]. This factor applies to a rotational geometry with photon energies ranging from 50keV to 2MeV. This is appropriate for the instrument used whose sensitivity is much reduced below 50keV, and to the geometry of deposits of artificial radionuclides. Applying an isotropic geometry gives a value of 0.70Sv Gy^{-1}, which would be more appropriate for natural background radiation. The choice of 0.85 will therefore tend to overestimate dose rates for the situations considered in this report which include both artificial and natural radiation.

For external exposure of skin, the measured quantity is radiological contamination in Bq cm^{-2}. In this case, dose rate factors in Sv y^{-1} per Bq cm^{-2} are used, which are calculated for a depth in tissue of 7mg cm^{-2} [123]. The time spent near sources of external exposure are determined by site-specific habits surveys in a similar manner to consumption rates of seafood. The occupancy and time spent handling fishing gear are given in Appendix 4.

2.12 Subtraction of 'background' activity concentrations

For assessing internal exposures in seafood due to the ingestion of carbon-14 and radionuclides in the uranium and thorium decay series, 'background' activity concentrations are subtracted. Background carbon-14 concentrations in terrestrial foods are also subtracted. The estimates of background activity concentrations are given in Appendix 6. For assessing the effect of external exposures to gamma radiation, dose rates due to background are subtracted. Since measurements were made previously as part of the monitoring programmes reported here, the gamma dose rate backgrounds in the aquatic environment are taken to be 0.05μGy h^{-1} for sandy substrates, 0.07μGy h^{-1} for mud and salt marsh and 0.06μGy h^{-1} for other substrates. These data are compatible with those presented in [124]. Where it is difficult to distinguish the result of a dose rate measurement from natural background, the method of calculating exposures based on the concentrations of artificial radionuclides in sediments is used [125]. Estimates of external exposures to beta radiation include a component due to naturally occurring (and un-enhanced) sources because of the difficulty in distinguishing between naturally occurring and artificial contributions. Such estimates are therefore conservative, compared with the relevant dose limit that excludes natural sources of radiation.

2.13 Uncertainties in dose assessment

Various methods are used to reduce the uncertainties in the process of the dose estimation of the representative person. These address the following main areas of concern:

- programme design
- sampling and in situ measurement
- laboratory analysis
- description of pathways to humans
- radiation dosimetry
- calculational and presentational error

Quantitative estimation of uncertainties in doses is beyond the scope of this report.

3 Nuclear fuel production and reprocessing

Highlights

- For nuclear fuel production and reprocessing sites assessed in 2025 the 'total dose' for the representative person was 51% (or less) of the annual dose limit

Capenhurst, Cheshire

- 'total dose' for the representative person was 0.18mSv and decreased in 2025 compared to 2024

Springfields, Lancashire

- 'total dose' for the representative person was 0.010mSv and decreased in 2025 compared to 2024

Cumbrian coastal area, including Sellafield, Cumbria

- 'total dose' for the Cumbrian coastal community was 0.51mSv and increased in 2025 compared to 2024
- the highest 'total dose' was from seafood, dominated by the effects of historical discharges of naturally occurring radionuclides from the former phosphate processing plant. Historical discharges from the Sellafield site made a lesser contribution

This section considers the results of monitoring, by the Environment Agency, FSA, NIEA and SEPA, of 3 sites in the UK associated with civil nuclear fuel production and reprocessing.

3.1 Capenhurst, Cheshire

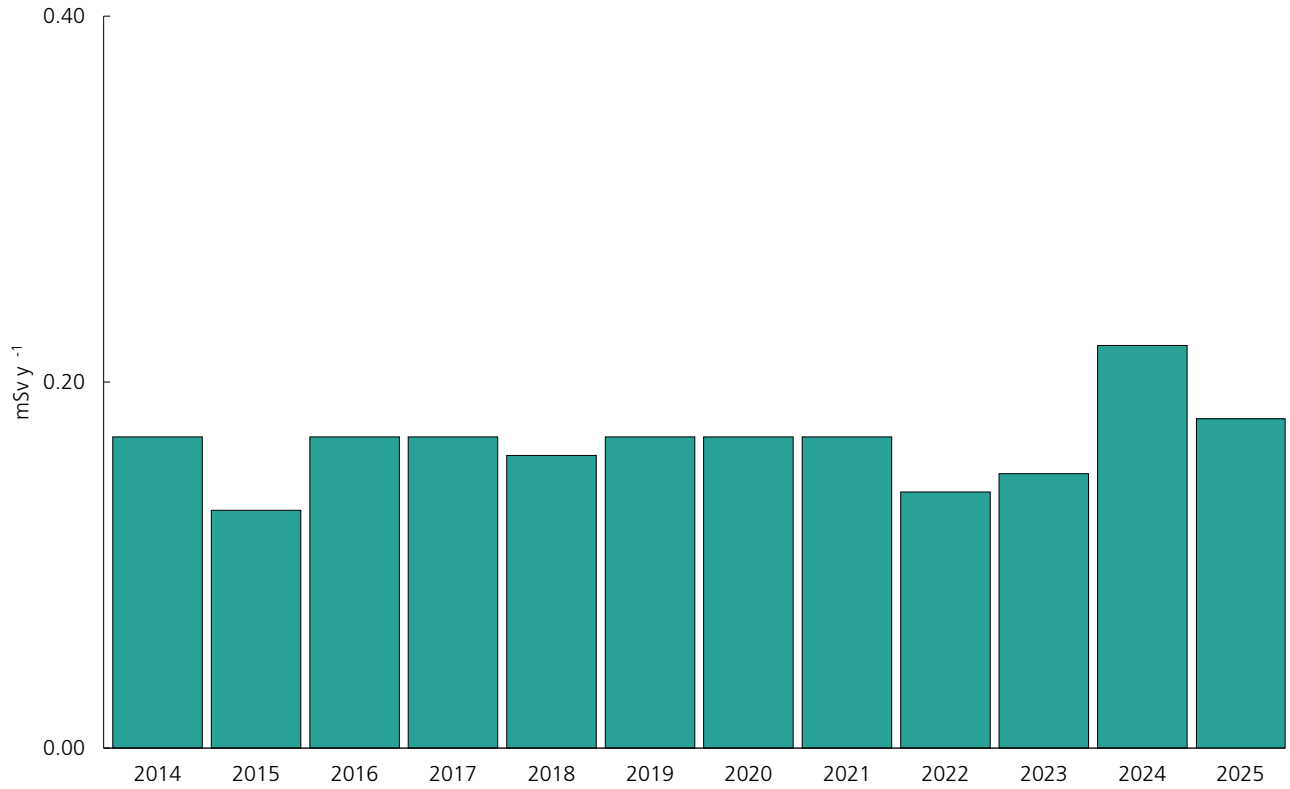
The Capenhurst site is located near Ellesmere Port and is home to uranium enrichment plants and associated facilities. The major operators at the site are Urenco UK Limited (UUK), Urenco Nuclear Stewardship Limited (UNS) and Urenco ChemPlants Limited (UCP); they each have their own permits. Urenco UK Limited operates 3 plants producing enriched uranium for nuclear fuel production. Urenco Nuclear Stewardship Limited manages assets owned by the NDA, comprising uranic material storage facilities and activities associated with decommissioning, Urenco Nuclear Stewardship Limited also manage radioactive wastes on behalf of all 3 operators. Urenco ChemPlants Limited are currently commissioning a new facility on a separate part of the site, to allow safer long-term storage of depleted uranium. This facility, the Tails Management Facility, de-converts uranium hexafluoride (UF6 or "Hex") to uranium oxide (U^3O^8). This allows the uranium to be stored in a more chemically stable oxide form for potential future reuse in the nuclear fuel cycle. This process recovers hydrofluoric acid for reuse in the chemical industry.

The most recent habits survey to determine the consumption and occupancy rates by members of the public was undertaken in 2021 [126].

3.1.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was 0.18mSv in 2025 (Table 3.1), or 18% of the dose limit to members of the public. This is a decrease from 0.22mSv in 2024 due to a lower estimate of direct radiation, which is the dominant contribution to dose from the site. The representative person was a child living close to the site, unchanged from 2024. The trend in annual 'total dose' over the period 2014 to 2025 is given in Figure 3.1. The 'total dose' at Capenhurst ranged from 0.13mSv in 2015 to 0.22mSv in 2024 and all were below the dose limit to members of the public. Any changes in annual 'total dose' over time were due to changes in the estimates of direct radiation from the site.

Figure 3.1 'Total dose', in mSv y^{-1}, at Capenhurst, 2014 to 2025.

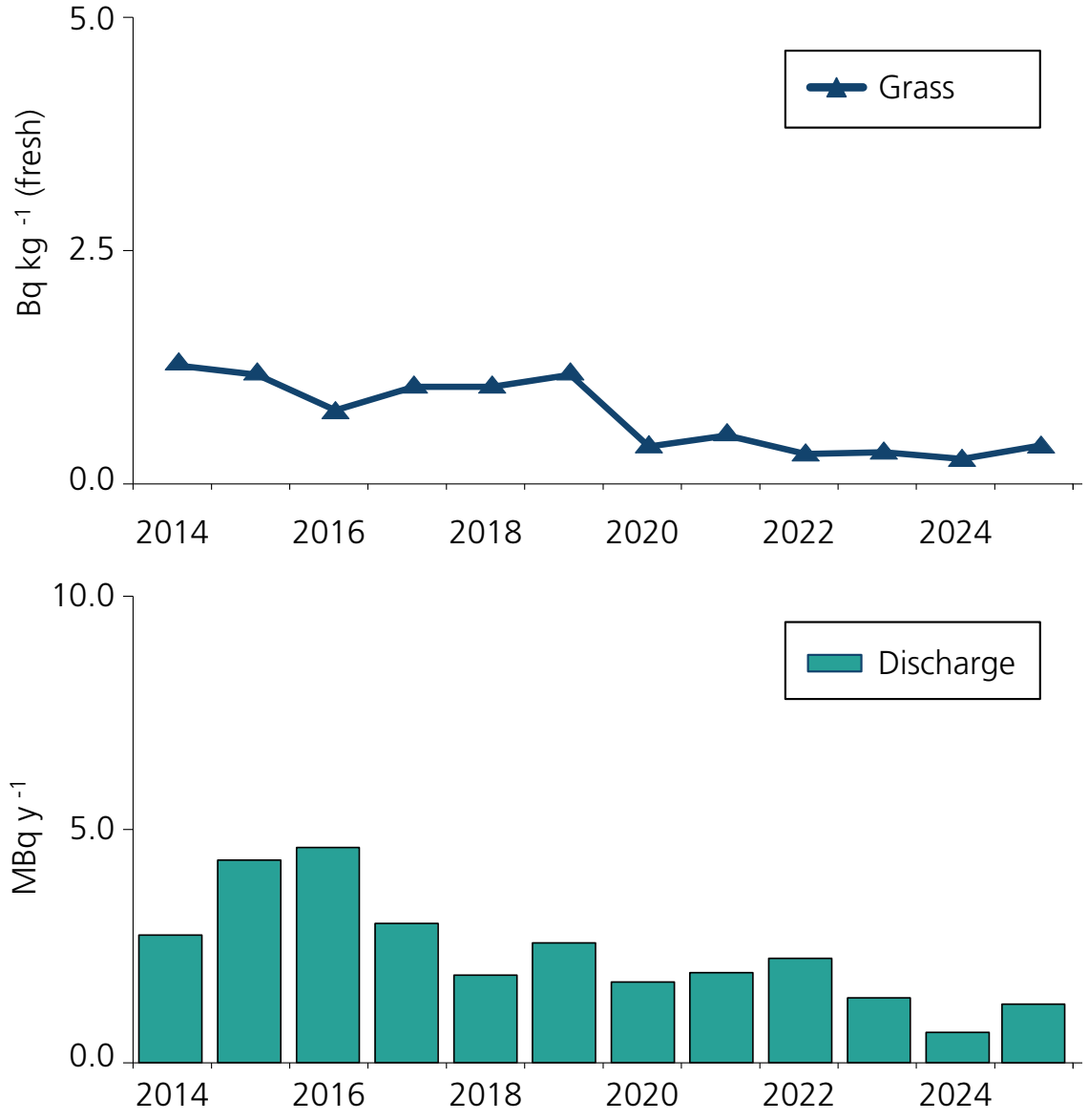


Source-specific assessments for high-rate consumers of locally grown foods, and for children playing in and around Rivacre Brook, give exposures that were less than the 'total dose' in 2025 (Table 3.1). The dose for children (10-year-old), who play in and around the brook and may inadvertently ingest water and sediment, was 0.009mSv in 2025 (up from 0.007mSv in 2024). The increase in dose was due to higher gamma dose rates measured over the riverbank at Rivacre Brook in 2025. The dose is estimated using cautious assumptions for occupancy of the bank of the brook, inadvertent ingestion rates of water and sediment, and gamma dose rates.

3.1.2 Gaseous discharges and terrestrial monitoring

Uranium is the main radioactive constituent of gaseous discharges from Capenhurst (Table A1.1), with small amounts of other radionuclides present in discharges by Urenco Nuclear Stewardship Limited. The focus for terrestrial sampling was the analyses of technetium-99 and uranium in food (including milk), grass and soil. Results for 2025 are given in Table 3.2(a). Concentrations of radionuclides in milk and food samples around the site were very low and generally similar to those in previous years. Isotopes of uranium in silage were lower by small amounts (most likely due to natural variation) in 2025. Figure 3.2(a) shows the trends over time (2014 to 2025) of low technetium-99 discharges and corresponding technetium-99 concentrations in grass. The overall trend reflects the reductions in discharges of technetium-99 from the enrichment of reprocessed uranium in the past. The most recently observed variability (from year to year) in the technetium-99 concentrations is based on data reported as 'less than values'. Discharges of uranium in 2025 are also given in Table A1.1 and were similar to those reported in 2024. Long term plots of uranium discharges are given in [127].

Figure 3.2 Technetium-99 concentrations in grass, Bq kg^{-1} (fresh), and annual discharge, in MBq y^{-1}, at Capenhurst, 2014 to 2025 (Note different scales used for discharges and activity concentrations).



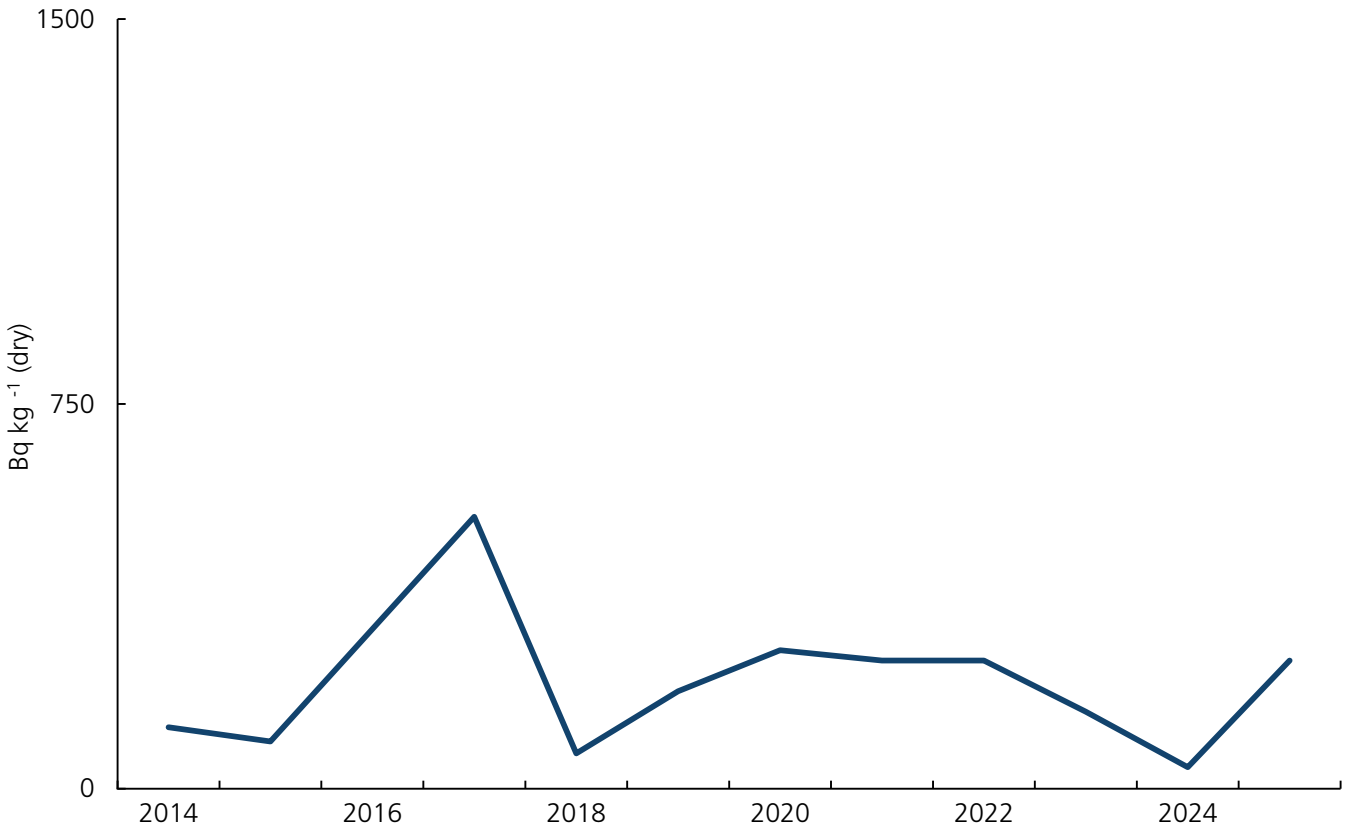
3.1.3 Liquid waste discharges and aquatic monitoring

The permit for the Urenco UK Limited Capenhurst site allows liquid waste discharges to the Rivacre Brook for uranium and uranium daughters, technetium-99 and non-uranium alpha (mainly neptunium-237) as shown in Table A1.2. Monitoring included the collection of samples of fish and shellfish from the local aquatic and downstream marine environment (for analysis of a range of radionuclides) and of freshwater and sediments for the analysis of tritium, technetium-99, gamma-emitting radionuclides, uranium, neptunium-237, and gross alpha and beta. Dose rate measurements were taken on the banks of the Rivacre Brook and surrounding area. Results for 2025 are given in Table 3.2(a) and Table 3.2(b). Concentrations of radionuclides in foods from the marine environment were very low and generally similar to those in previous years. The concentrations in fish and shellfish reflect the distant effects of discharges from Sellafield as observed in previous monitoring reports, such as the 'Radioactivity in surface and coastal waters of the British Isles' reports (published as part of the Fisheries Radiobiological Laboratory report and Aquatic Environment Monitoring Report series) and earlier RIFE reports.

As in previous years, sediment samples collected downstream from the Rivacre Brook contained very low but measurable concentrations of uranium (enhanced above natural concentrations) and technetium-99. As expected, enhanced concentrations of these radionuclides (and others) were measured close to the discharge point (Rivacre Brook). Technetium-99 and uranium radionuclide concentrations from this location were lower in 2025, compared to 2024, but similar to those in other recent years. Variations in concentrations in sediment from the brook are also to be expected due to differences in the size distribution of sedimentary particles. Concentrations of radionuclides in freshwaters at the discharge point (and at other freshwater locations) were very low in 2024. Measured gamma dose rates near to the discharge point were higher in 2025, compared to 2024 (where comparisons can be made for similar ground types and locations). Downstream of the discharge point (Rivacre Brook), at the location where children play, dose rates over grass were also higher in 2025.

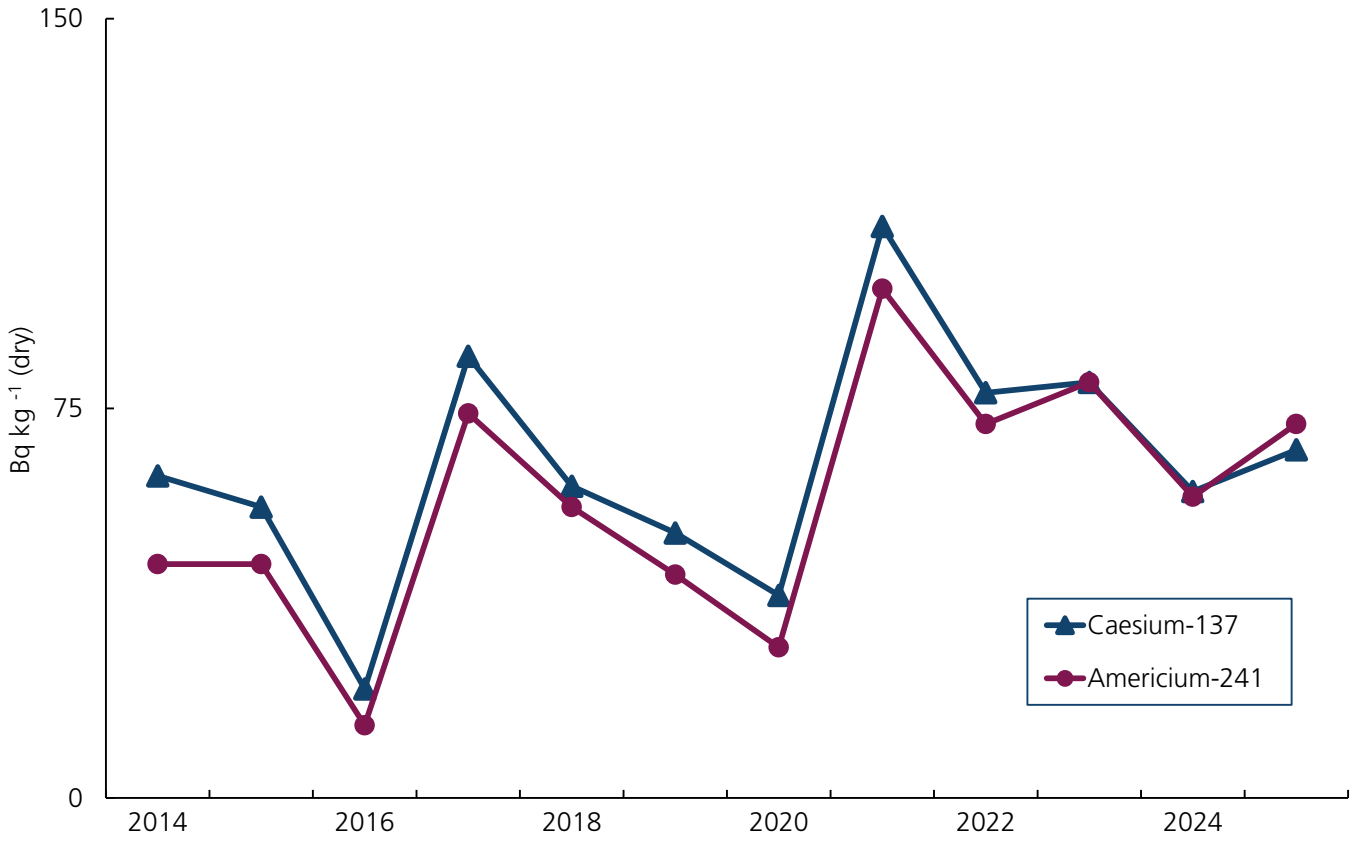
Concentrations of technetium-99 from liquid discharges were detectable in sediment from Rivacre Brook close to the discharge point in 2025. The trend of technetium-99 in sediment is given in Figure 3.3; concentrations in 2017 were higher than adjoining years as discussed in RIFE 23 [26].

Figure 3.3 Technetium-99 concentrations in sediment in Bq kg^{-1} (dry) at Rivacre Brook, Capenhurst, 2014 to 2025



Concentrations of caesium-137 and americium-241 in sediments at Rock Ferry (Figure 3.4) on the Irish Sea coast were from past discharges from Sellafield carried into the area by tides and currents. The concentrations were generally similar over most of the time period and any fluctuations were most likely due to the effects of normal dispersion in the environment. The lowest activity concentrations at Rock Ferry were reported in 2016.

Figure 3.4 Caesium-137 and americium-241 concentrations in sediment in Bq kg^{-1} (dry) at Rock Ferry, 2014 to 2025.



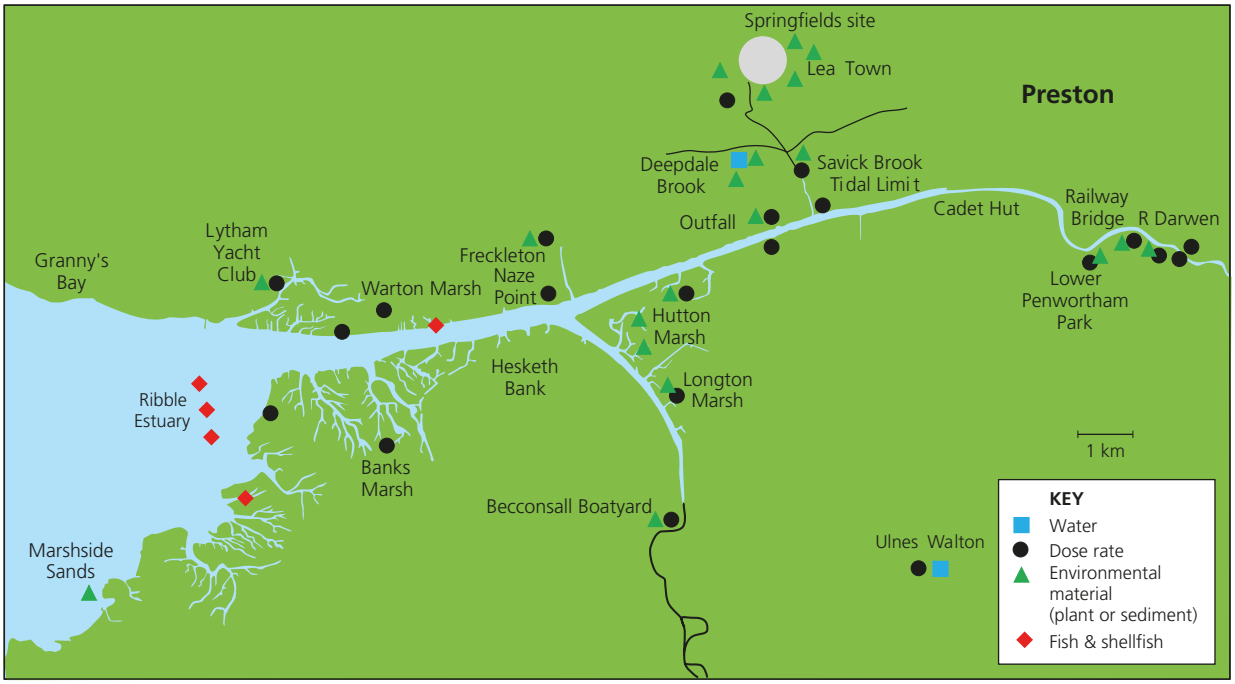
3.2 Springfields, Lancashire

The Springfields site near Preston is operated by Springfields Fuels Limited (SFL). The site is owned by the NDA and leased to Westinghouse Electric Company UK Limited, the parent company of Springfields Fuels Limited (SFL). The main commercial activity is the manufacture of fuel elements for nuclear reactors and the deconversion of uranium hexafluoride to produce powders and pellets for other fuel manufacturers. Other important activities include recovery of uranium from residues and decommissioning redundant plants and buildings, under contract to the NDA, who retain responsibility for the historical nuclear liabilities on the site.

Research and development, carried out by the UK National Nuclear Laboratory (UKNNL), produces small amounts of other gaseous radionuclides that are also discharged under the permit (see Appendix 1, Table A1.1).

Monitoring around the site is carried out to check not only for uranium concentrations, but also for other radionuclides discharged in the past (such as actinide decay products from past discharges when uranium ore concentrate (UOC) was the main feed material) and for radionuclides discharged from Sellafield. The monitoring locations (excluding farms) are shown in Figure 3.5. The corresponding sample types and locations are listed in the corresponding site tables.

Figure 3.5 Monitoring locations at Springfields, 2025 (not including farms).



The most recent habits survey was undertaken in 2022 [128]. Figures for consumption rates, together with occupancy and handling rates, are provided in Appendix 4 (Table A4.2).

3.2.1 Doses to the public

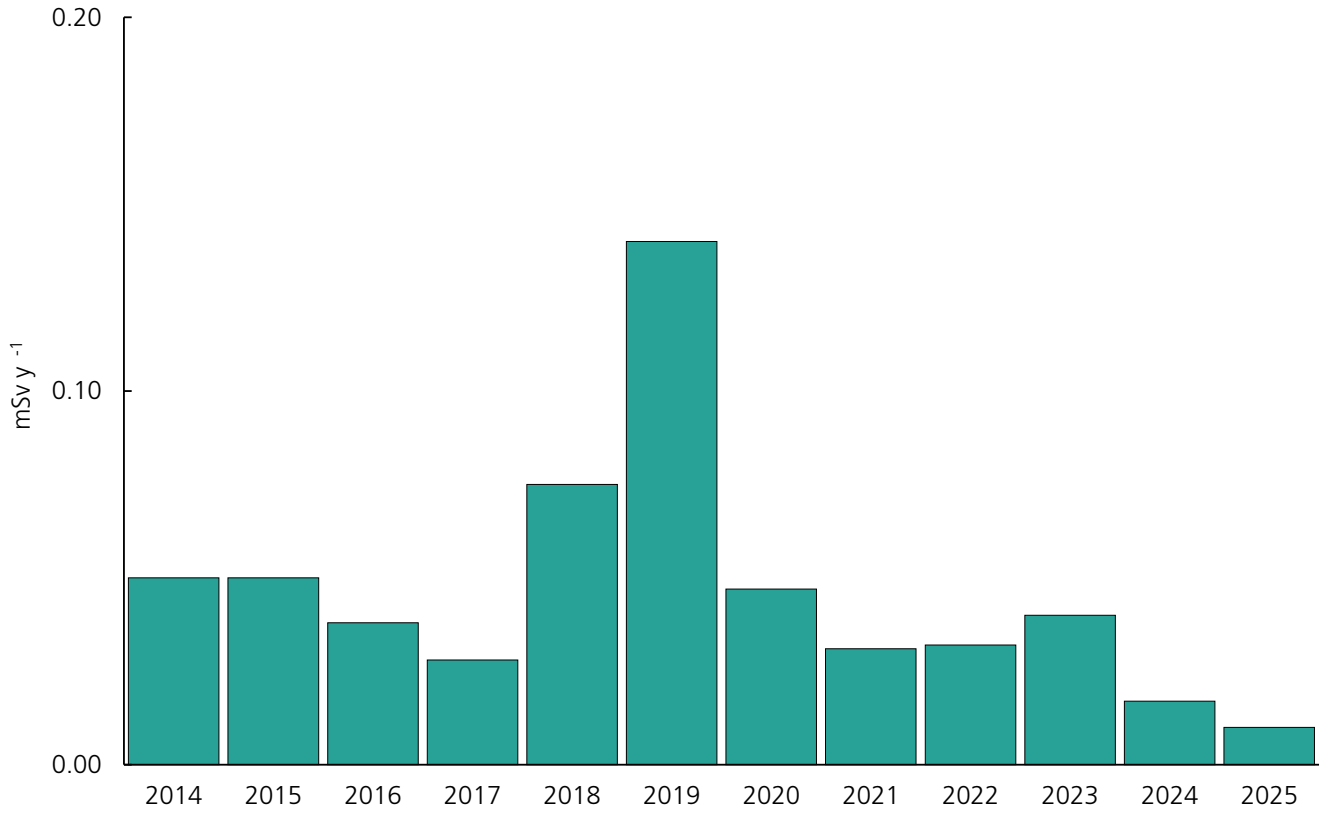
The 'total dose' from all pathways and sources of radiation was 0.010mSv in 2025 (Table 3.1), or 1% of the dose limit to members of the public. This is a decrease from 0.017mSv in 2024 and mainly attributed to a lower estimate of direct radiation from the site. In 2025, the representative person was an infant living near to the site and unchanged from 2024. Most of the dose to the representative person was from direct radiation. The trends of 'total dose' over the period 2014 to 2025 are given in Figure 3.6 and are generally low over this period, the increase observed in 2019 was due to a higher estimate of direct radiation caused by increased occupancy of some workers undertaking a specific responsibility (associated with the rail line) close to the site.

Source-specific assessments give exposures that were all less than the 'total dose' in 2025 (Table 3.1) for:

- consumers of locally grown food and of seafood (including wildfowl)
- farmers spending time on the banks of the estuary
- children playing on the banks of the estuary

Trends in source-specific doses for a high-rate houseboat dweller are presented in earlier RIFE reports.

Figure 3.6 'Total dose', in mSv y^{-1}, at Springfields (2014 to 2025).



The dose for high-rate consumers of seafood and wildfowl was 0.008mSv in 2025, with approximately 0.006mSv from external exposure (the remainder being from consumption of fish, crustaceans and wildfowl) and was similar to that in 2024 (0.009mSv). The most important radionuclide was caesium-137 from historical discharges from Sellafield.

A source-specific assessment for external exposure to farmers was less than 0.005mSv in 2025 (Table 3.1) and unchanged from 2024. The estimated doses to high-rate consumers of locally grown food, and to children playing on the banks of the estuary were all less than 0.005mSv in 2025.

It has been previously shown that assessed annual doses to the public from inhaling sediment from the Ribble Estuary, re-suspended into the air, were much less than 0.001mSv, and negligible in comparison with other exposure routes [129].

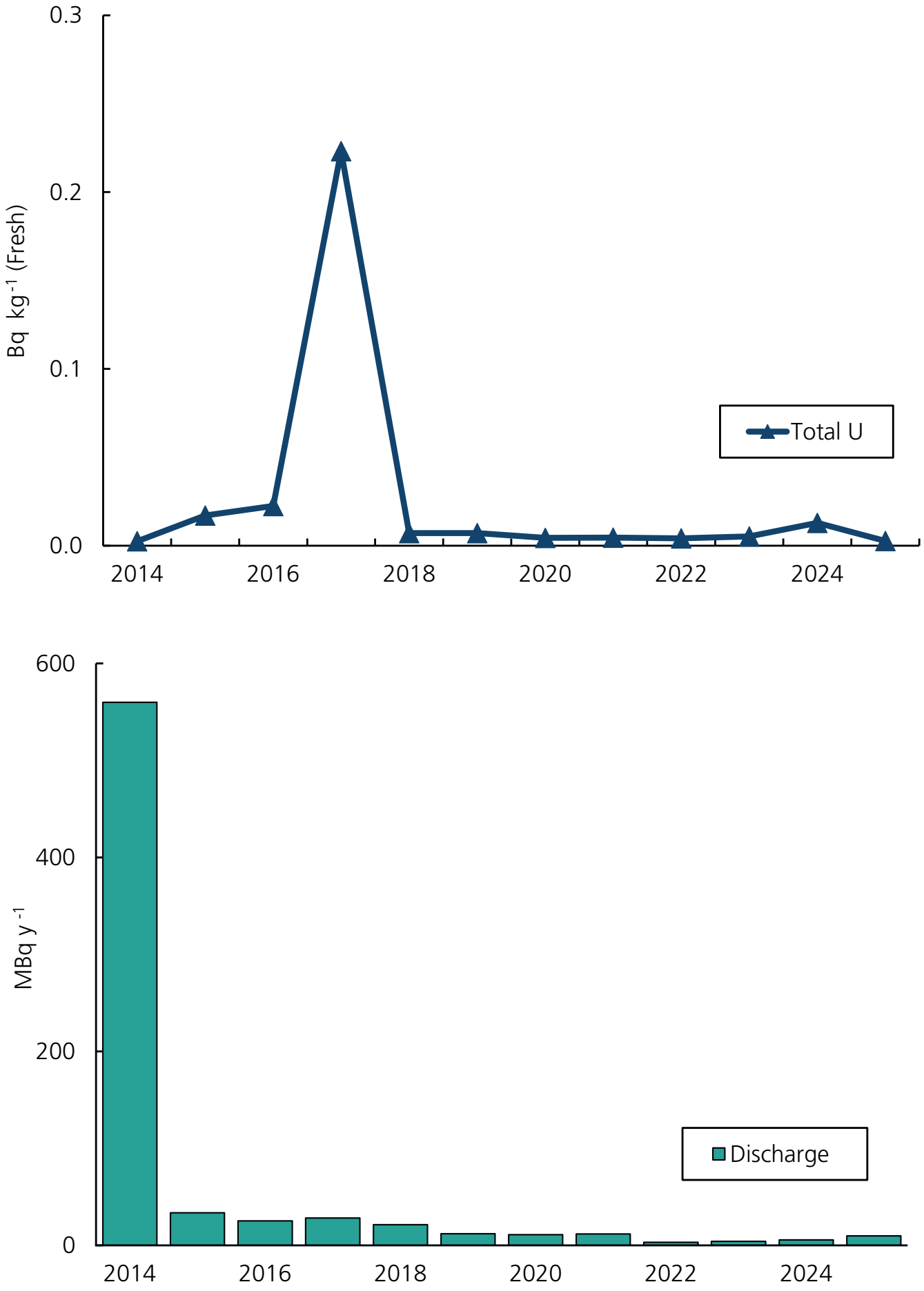
3.2.2 Gaseous discharges and terrestrial monitoring

Uranium is the main radioactive constituent of gaseous discharges, with small amounts of other radionuclides present in discharges from UK National Nuclear Laboratory research and development facilities (Table A1.1).

The focus of the terrestrial sampling was for the analyses of tritium, carbon-14, strontium-90, iodine-129, and isotopes of uranium, thorium, plutonium and americium in milk and vegetables. Grass, soil and freshwater samples were collected and analysed for isotopes of uranium. Data for 2025 are given in Table 3.3(a). Uranium isotope concentrations in beetroot in 2025 were similar to those in pumpkin in 2024 (no beetroot sample was available in 2024). Concentrations of thorium were also low in vegetable and grass samples. As in previous years, elevated concentrations of uranium isotopes were measured in soils around the site, but the isotopic ratio showed that they were most likely to be naturally occurring. Overall, results were broadly similar to those of previous years.

Figure 3.7 shows the trends over time (2014 to 2025) of gaseous uranium discharges and total uranium radionuclide concentrations in food (beetroot; 2014 to 2023; pumpkin 2024; beetroot 2025). Over the period, uranium discharges have declined, with the lowest value reported from this site in 2022. Total uranium was detected in beetroot and pumpkin samples during the period, as given in Figure 3.7, but the concentrations were very low. The apparent peak of uranium in beetroot in 2017 was also low and significantly less than that found in soil samples.

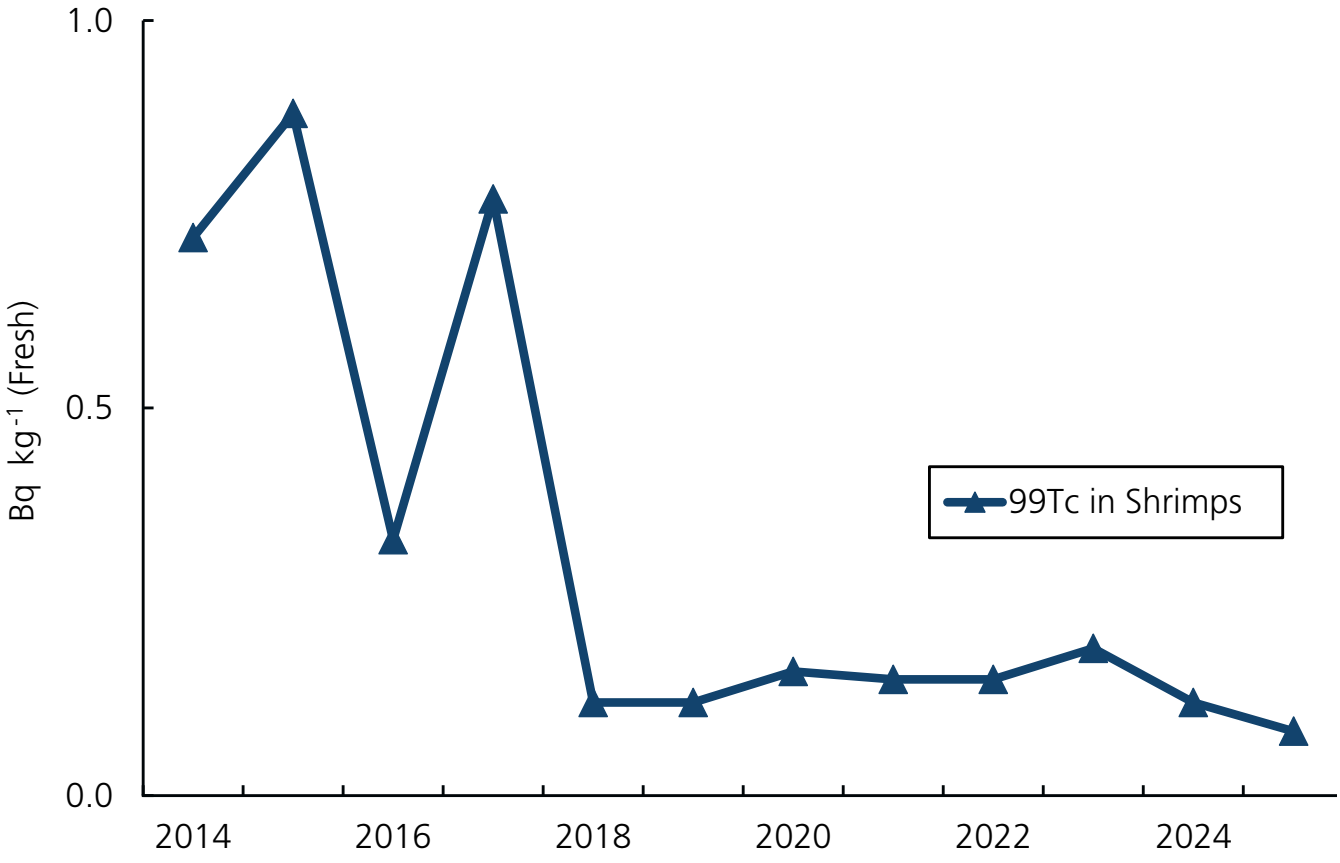
Figure 3.7 Concentrations of total uranium in terrestrial food, in Bq kg^{-1} (fresh) and annual discharges of uranium, in MBq y^{-1} at gaseous Springfields 2014 to 2025. (Note different scales used for discharges and activity concentrations).

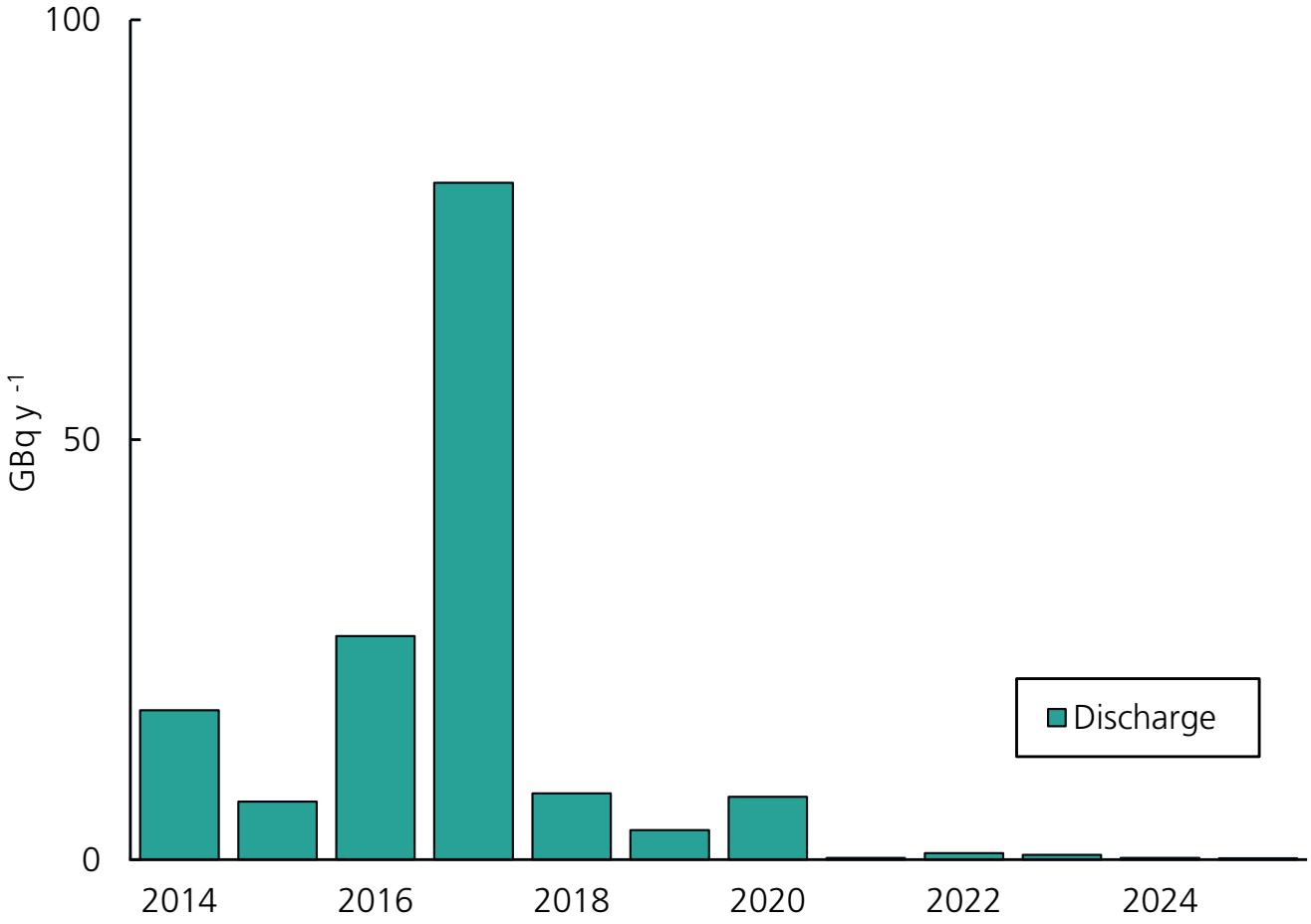


3.2.3 Liquid waste discharges and aquatic monitoring

Permitted discharges of liquid waste (including gross alpha and beta, technetium-99, thorium-230, thorium-232, neptunium-237, uranium and 'other transuranic radionuclides') are made from the Springfields site to the Ribble Estuary via 2 pipelines (Table A1.2). All discharges were generally similar in 2025, compared to 2024. Compared to previous years, discharges are now generally lower for beta-emitting radionuclides. This includes the short half-life beta-emitting radionuclides (mostly thorium-234) that have decreased following the end of the uranium ore concentrate purification process in 2006. Production of uranium hexafluoride ceased in 2014, and the associated plants mothballed. This has led to a corresponding reduction in discharges of uranium in recent years. Discharges of technetium-99 depend almost entirely on which legacy uranic residues are being processed. Since completion of one particular residue processing campaign (in 2012), technetium-99 discharges (Figure 3.8) have generally declined, with the lowest value (reported as <1% of the annual limit) from this site in 2024. The Ribble Estuary monitoring programme consisted of 'in situ' dose rate measurements, the collection and analysis of sediments for uranium and thorium isotopes and gamma-emitting radionuclides.

Figure 3.8 Concentrations of technetium-99 in shrimp, in Bq kg^{-1} (fresh) and annual discharges of technetium-99, in GBq y^{-1} at Springfields 2014 to 2025. (Note different scales used for discharges and activity concentrations).





Results for 2025 are shown in Table 3.3(a). As in previous years, radionuclides due to discharges from both Springfields and Sellafield were detected in sediment and biota in the Ribble Estuary. Radionuclides found in the Ribble Estuary originating from Sellafield were technetium-99, caesium-137 and americium-241. Isotopes of uranium and the short half-life radionuclide thorium-234 were also found from Springfields. Concentrations of the latter were closely linked to recent discharges from the Springfields site. In 2025, thorium-234 concentrations in sediments (over the range of sampling sites) were generally similar compared to those in 2024. Over a much longer timescale these concentrations have declined due to reductions in discharges as shown by the trend of sediment concentrations at the outfall (Figure 3.9), Lower Penwortham and Becconsall [26]. The most significant change in the discharge trends was the step reduction of short half-life beta-emitting radionuclides in liquid discharges, mostly thorium-234. The reduction was because the uranium ore concentrate purification process ended in 2006. In more recent years, thorium-234 concentrations have generally declined by small amounts in sediments at Lower Penwortham (Figure 3.10) and Becconsall (Figure 3.11), with the lowest values reported at Lower Penwortham and the outfall in 2023.

Figure 3.9 Concentrations of caesium-137, thorium-234 and americium-241 in sediment, in Bq kg^{-1} (dry), at the outfall, Springfields 2014 to 2025.

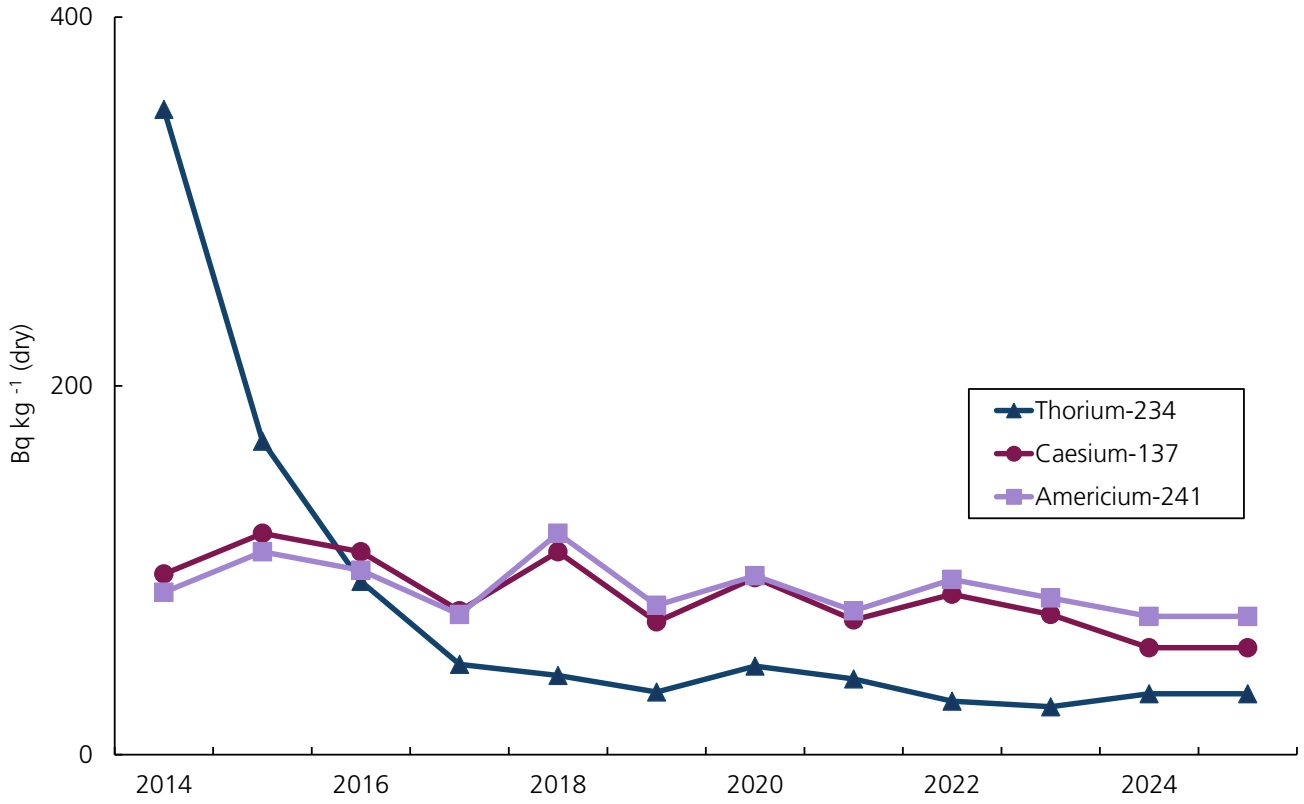


Figure 3.10 Concentrations of caesium-137, thorium-234 and americium-241 in sediment, in Bq kg^{-1} (dry), at Lower Penwortham Park, Springfields 2014 to 2025

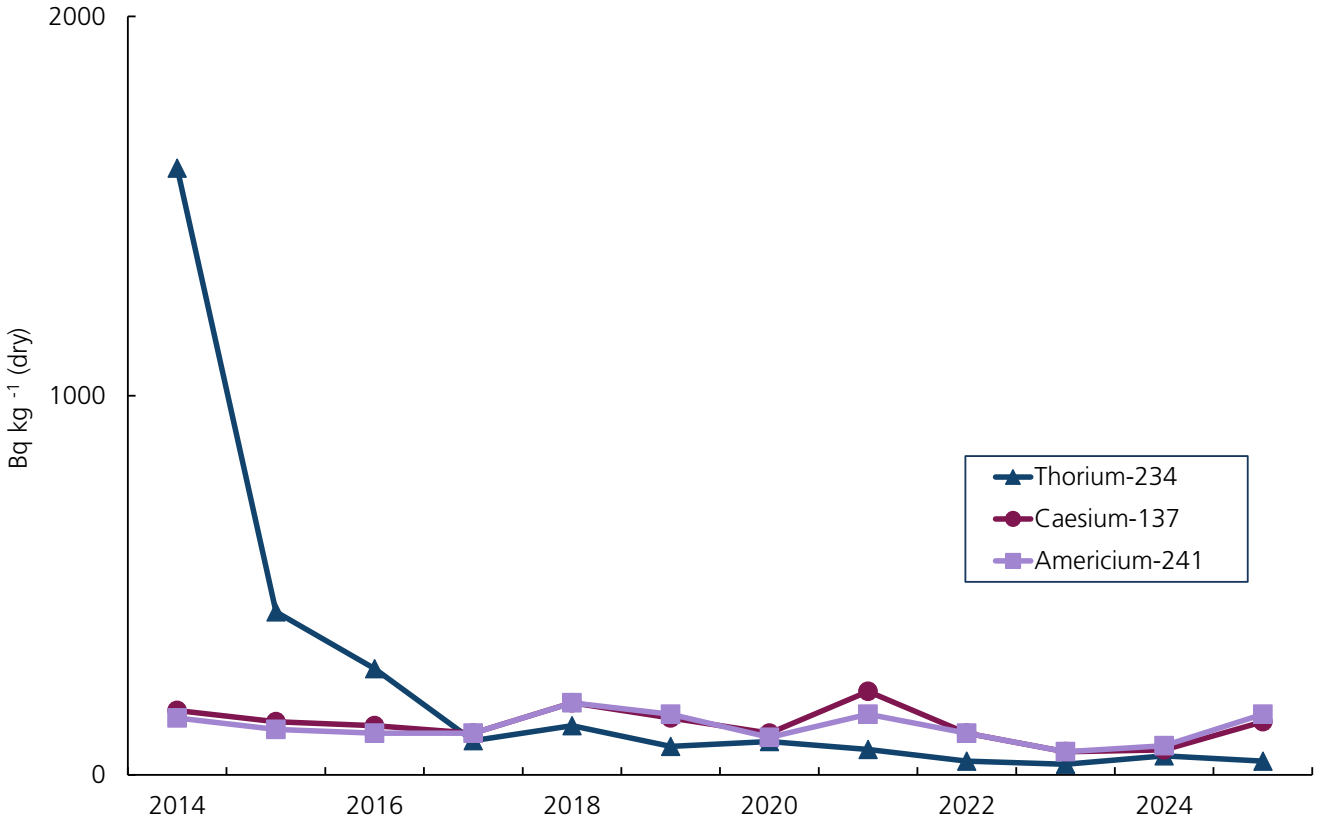
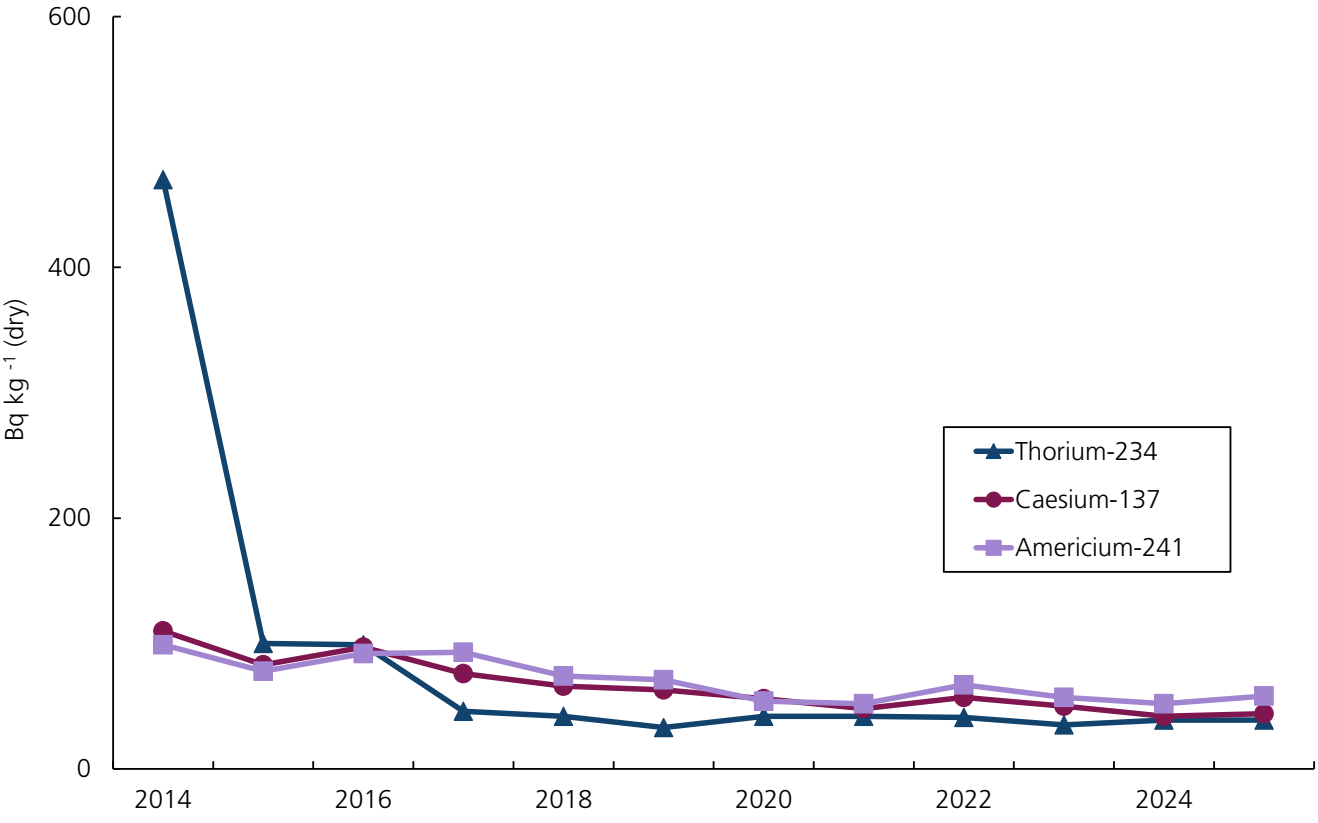


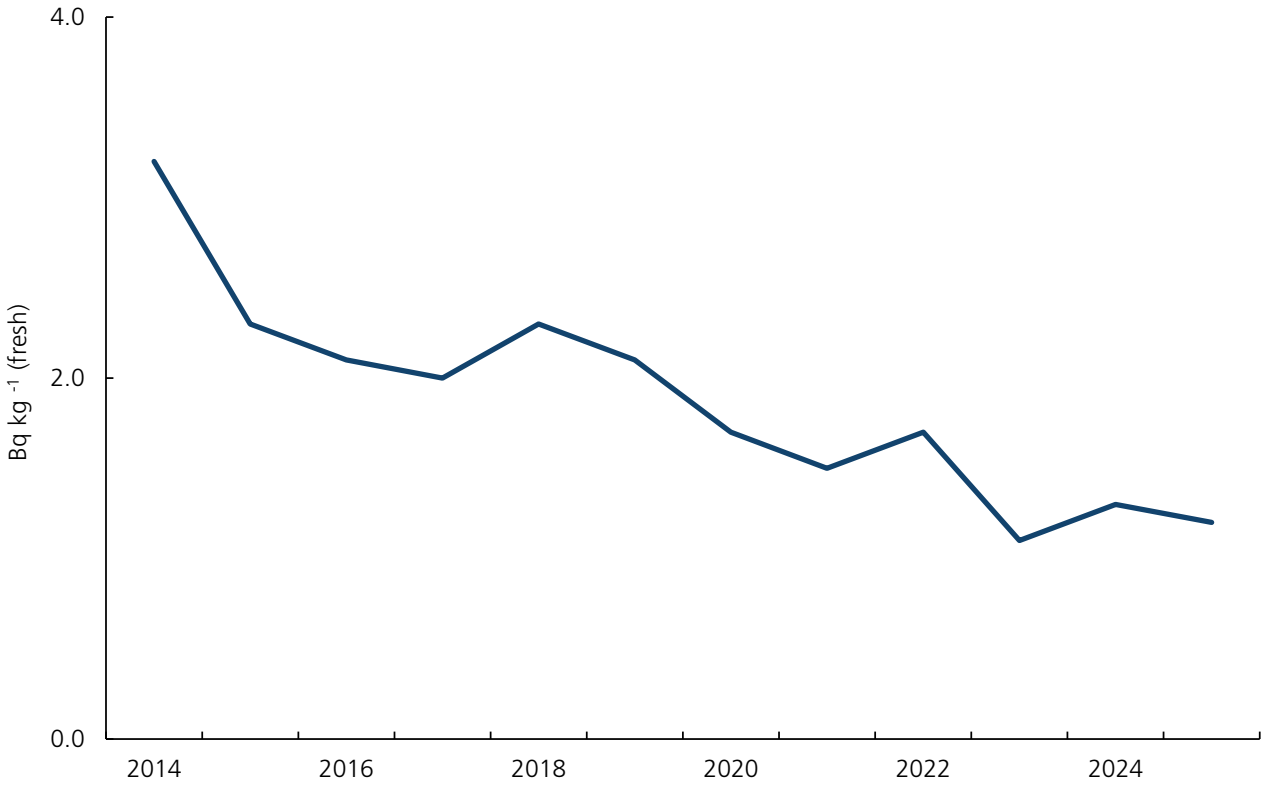
Figure 3.11 Concentrations of caesium-137, thorium-234 and americium-241 in sediment, in Bq kg^{-1} (dry), at Becconsall, Springfields 2014 to 2025.



Caesium-137 and americium-241 radionuclides were detected in biota and sediments from the Ribble Estuary in 2025, due to historical liquid discharges from Sellafield, carried from west Cumbria into the Ribble Estuary by sea currents and adsorbed on fine-grained muds. The concentrations observed were generally similar to those in recent years.

Figure 3.8 and Figure 3.12 also provide trend information over time (2014 to 2025) for several other permitted radionuclides and activity concentrations in food, flounder and shrimp. Liquid discharges of uranium radionuclides steadily decreased (and other discharges to a lesser extent) over the whole period, whilst technetium-99 discharges generally decreased overall (but peaked in 2012 and 2017). Caesium-137 concentrations in flounder showed variations between years and this was most likely due to natural changes in the environment, although there is evidence of decreasing concentrations overall [130]. Technetium-99 concentrations in shrimp showed variations between years and this was most likely due to natural changes in the environment, with lower concentrations observed as discharges have decreased in recent years.

Figure 3.12 Concentrations of caesium-137 in flounder, in Bq kg^{-1} (fresh) at Springfields 2014 to 2025.



Gamma dose rates (Table 3.3(b)) in the estuary were generally higher than expected natural background rates (see Section 2.12), due to discharges of gamma-emitting radionuclides (caesium-137 and americium-241) from Sellafield. In 2025, gamma dose rates in the estuary, were generally higher (by small amounts) to those in 2024, but with some small variations at some sites. Beta dose rates over salt marsh (where comparisons can be made) were similar to those in recent years.

3.3 Cumbrian coastal area including Sellafield, Cumbria

This section considers both historic and present activities in the Cumbrian coastal area that have led to discharges of radioactive waste, including Sellafield where a range of decommissioning and waste management activities are carried out.

The area is impacted by several sources of radioactivity, these are:

- Naturally occurring radionuclides from historical discharges from the former phosphate processing plant
- Artificial radionuclides from both historical and current discharges from Sellafield to both the marine and terrestrial environments
- Liquid discharges from LLWR
- Direct radiation from Sellafield
- Direct radiation from LLWR

The discharges impact upon the same area, therefore this section presents a dose to the Cumbrian Coastal Community from all sources. A separate assessment of doses from Sellafield only is also presented. Separate assessments for LLWR and the former phosphate processing plant are given in Sections 7.1 and 7.5 respectively.

The former phosphate processing plant which closed in 2004 was near Whitehaven in Cumbria. Although phosphoric acid production at the plant ceased in 1992, with a corresponding reduction in discharges to the Irish Sea [131], the effects of these past operations continue due to the ingrowth of decay products from the long-lived parent radionuclides discharges by the plant to the Irish Sea. Naturally occurring radionuclides from this historic industrial activity are monitored and assessed (see Section 7.5).

Sellafield Limited is responsible for the operation of the Sellafield site and is a wholly owned subsidiary of the NDA. In 2025, the main operations at Sellafield were:

- post-operational clean out at the Magnox reprocessing facility
- the decommissioning and clean-up of redundant nuclear facilities including Calder Hall nuclear power station, Windscale reactors and the Thermal Oxide Reprocessing Plant (THORP)
- waste treatment and storage of radioactive materials

Nuclear fuel reprocessing at THORP and the Magnox reprocessing facility ceased in 2018 and 2022 respectively, Resulting in reduced gaseous and liquid discharges in the intervening period. THORP will continue to serve the UK until the 2070/80s as a storage facility for spent Advanced Gas-cooled Reactor (AGR) fuel pending disposal to a new geological disposal facility. The Magnox Reprocessing facility has now entered the post-operational clean-out phase.

Monitoring of the environment and food in the Cumbrian Coastal area including around Sellafield reflects the historical and current activities the components of the programme are considered here in depth. The discussion is provided in 4 sub-sections, relating to the assessment of dose, the effects of gaseous discharges, the effects of liquid discharges and unusual pathways of exposure identified around the site.

A full habits survey is conducted every 5 years around the Cumbrian coastal area in the vicinity of the Sellafield site, which investigates the exposure pathways relating to current and historical liquid and gaseous discharges, and to direct radiation. Annual review surveys are also undertaken between the full habits surveys that investigate the pathways relating to liquid discharges, review high-rate fish and shellfish consumption by local people and review their intertidal occupancy rates. The most recent full Sellafield habits survey was conducted in 2023 [132]. A full survey around the LLWR was also performed in 2023 [133]. In 2025, some changes were found in the amounts (and mixes) of seafood species consumed and intertidal occupancy rates [134]. Revised figures for consumption rates, together with occupancy rates, are provided in Appendix 4 (Table A4.2). Further afield, the most recent habits surveys were conducted to determine the consumption and occupancy rates by members of the public on the Dumfries and Galloway coast in 2024 (available upon request from SEPA by emailing RSEnquiries@sepa.org.uk) and around Barrow and the south-west Cumbrian coast in 2025 [135]. The results of these surveys are used to determine the potential exposure pathways, related to liquid discharges from Sellafield.

Habits surveys to obtain data on activities undertaken on beaches relating to potential public exposure to radioactive particles in the vicinity of the Sellafield nuclear site were undertaken in 2007 and 2009 [136,137].

3.3.1 Doses to the Cumbrian coastal community

The doses calculated in this section cover a wide area and consider the inputs from several sources:

- naturally occurring radionuclides from the non-nuclear activity from the former phosphate processing plant in Whitehaven
- artificial radioactivity from both historical and current discharges from Sellafield to both the marine and terrestrial environments
- sources of direct radiation from Sellafield
- liquid discharges from the LLWR
- sources of direct radiation from the LLWR

Liquid discharges from Wylfa, Chapelcross, Barrow and Heysham also have a very small impact on doses but are not considered in this section.

3.3.1.1 'Total dose' from all pathways and sources to the Cumbrian coastal community

In 2025, the highest 'total dose' to the Cumbrian coastal community, near Sellafield, was assessed to have been 0.51mSv[14] (Table 3.16), or 51% of the dose limit to members of the public. The dose is broken down as follows:

- 0.49mSv from historical discharges of naturally occurring radionuclides from the former phosphate processing plant at Whitehaven, an increase from 0.18mSv in 2024
- 0.020mSv from discharges of artificial radionuclides (including external radiation) from Sellafield, a small increase from 0.018mSv in 2024. Approximately 0.003mSv of this was from sources of direct radiation from the LLWR

14. Values are rounded to 2 significant figures, or 3 decimal places, depending on their magnitude.

This is an increase from 0.20mSv in 2024, which is mostly attributed to higher polonium-210 concentrations in crabs (at Parton) and to a lesser extent an increase in the crustacean consumption rate. Polonium-210 (and lead-210) are important radionuclides as small changes in concentrations above the natural background of these radionuclides, significantly influence the dose contribution from these radionuclides (due to a relatively high dose coefficient used to convert an intake of radioactivity into a radiation dose) and therefore the value of the estimated dose. The assessment is cautious as the liquid discharges from all sites go into the same area.

The representative person was an adult consuming crustacean shellfish at high rates who also consumed significant quantities of other seafood (fish) and was unchanged from 2024. The annual 'total dose' from all pathways and sources of radiation is assessed using consumption and occupancy data from the full habits survey of 2023 [133] and the yearly review of shellfish and fish consumption, and intertidal occupancy in 2025 [134]. Calculations are performed for 4 age groups (adults, 10-year-old children, 1-year-old infants and prenatal children).

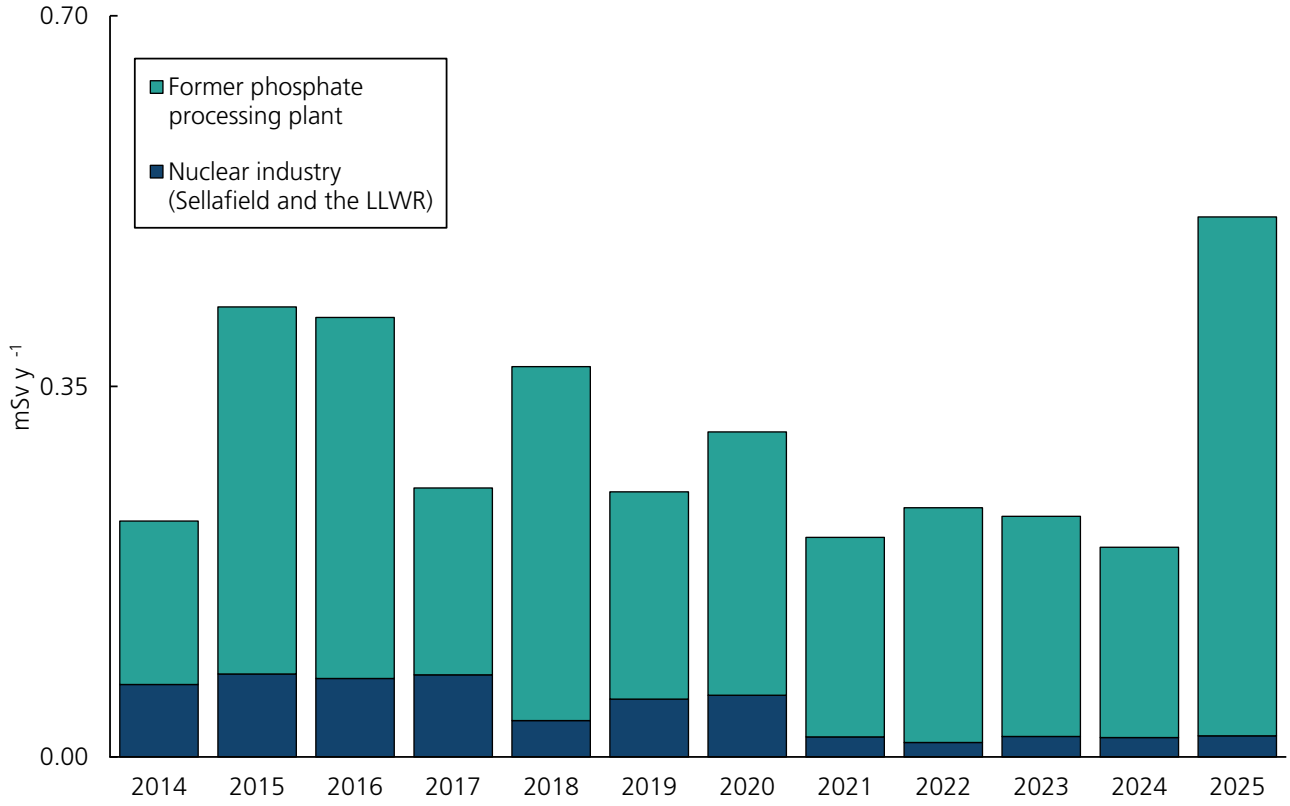
The most significant pathway contributions[15] to the 'total dose' in 2025 were from crustacean consumption (97%), fish consumption (1%), direct radiation (from the LLWR) (<1%) and external exposure over intertidal substrates (<1%) and other pathways (<1%). The listed food groups are consumption pathways; the other pathways include external exposure over sediment and saltmarsh. The most important radionuclide was polonium-210 (contributing 95% of the dose) with transuranic radionuclides (including plutonium-239+240 and americium-241) contributing less than 2% of the dose.

The contributions from artificial radionuclides from Sellafield (0.020msv in 2025) to the 'total dose' were mostly americium-241 (33%), iodine-129 (28%, based on concentrations reported at the limit of detection), and plutonium radionuclides (6%). External exposure contributed 27% of the 'total dose' from artificial radionuclides (48% in 2024).

Contributions to the highest annual 'total dose' each year (2013 to 2024), from all pathways and sources by industry, are given in Figure 3.6. Inter-annual variations were more complex and governed by both natural variability in seafood concentrations and real changes in the consumption and occupancy characteristics of the local population. Over a longer period, the trend is of generally declining dose [39]. In 2013, the highest dose was to people living on houseboats near Barrow (external exposure only), the reasons for dose in 2013 and the changes in dose between 2013 and 2014 are described in the relevant RIFE reports [41,95]. From 2014, the relative changes in dose were largely due to variations in polonium-210 concentrations in locally caught lobsters and crabs.

15. Contributions are rounded to the nearest percent.

Figure 3.13 Contributions from the nuclear industry (Sellafield and the LLWR) and the former phosphate processing plant to 'total dose' from all sources assessed along the Cumbrian Coast, 2014 to 2025.



The contributions from all pathways and sources to the highest annual 'total dose' from the nuclear industry (primarily Sellafield), from external exposure and ingestion or inhalation of radionuclides, and by radionuclide, are also given in Figure 3.14 (2014 to 2025) and Figure 3.15 (2014 to 2025), respectively. The overall trend from the nuclear industry is a generally declining dose (Figure 3.14), broadly reflecting a general reduction of concentrations of artificial radionuclides in seafood from the nuclear industry discharges and changes in habits information, over this period. The pathways of exposure contributing the highest dose were consumption of mollusc, crustacean and sea fish.

Figure 3.14 Contributions from nuclear industry (external exposure, and ingestion and inhalation doses), primarily from Sellafield, to 'total dose' from all sources assessed along the Cumbrian Coast, 2014 to 2025.

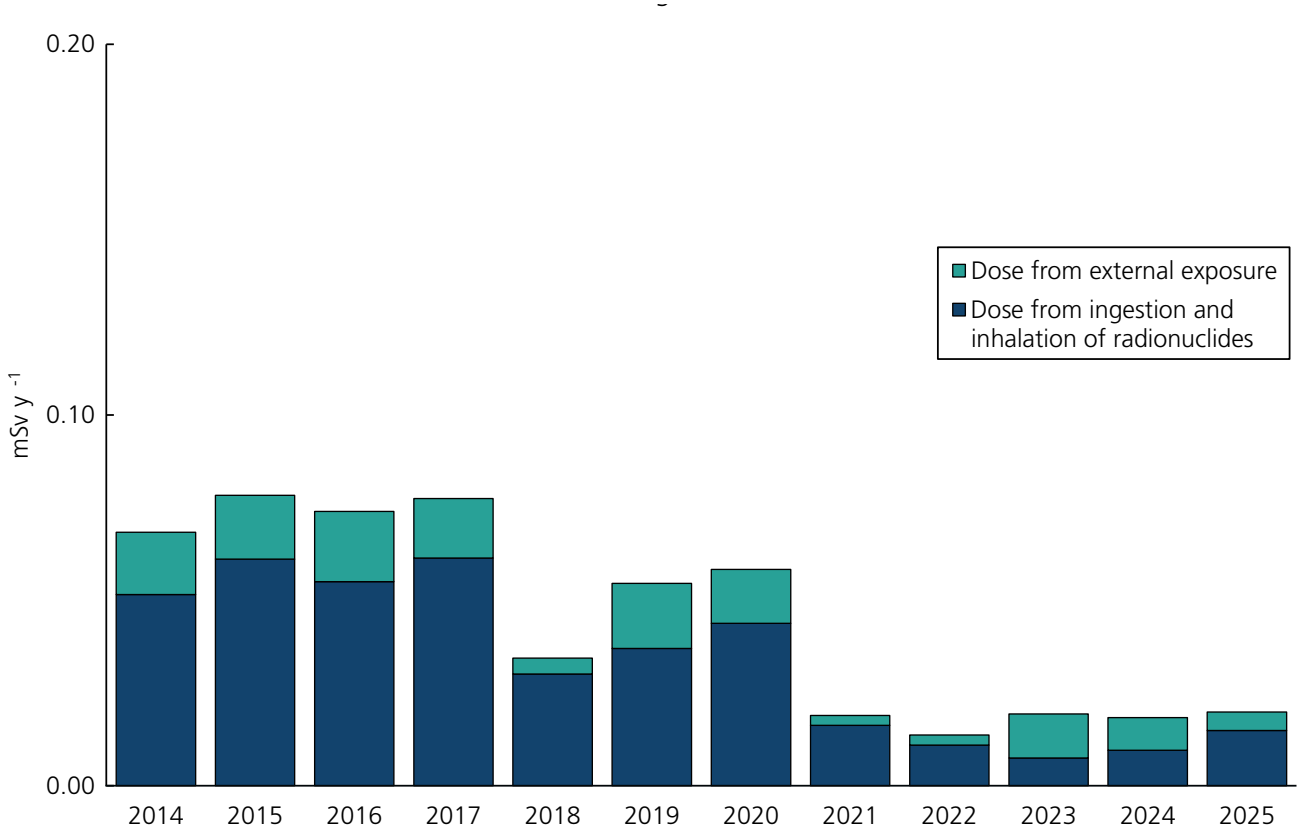
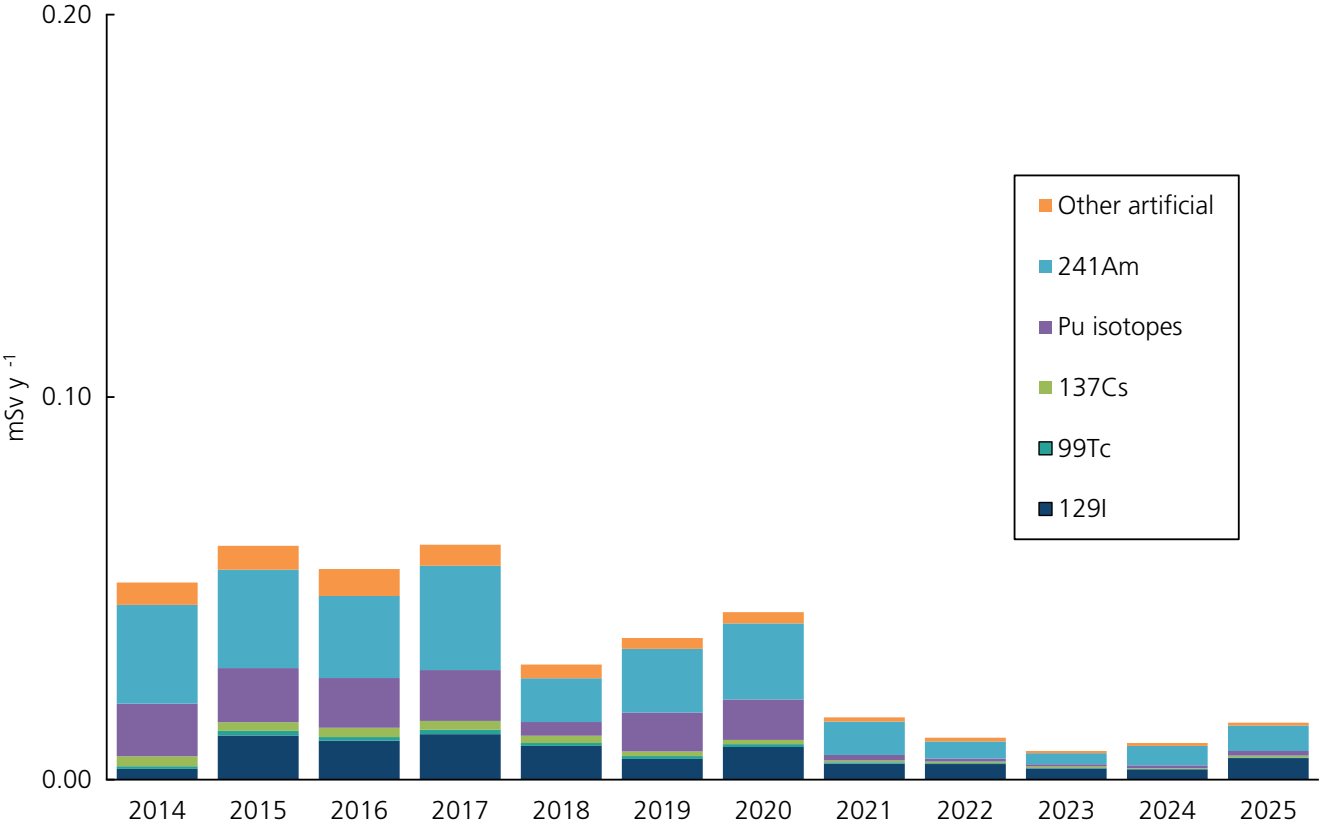


Figure 3.15 Radionuclide contributions from the ingestion and inhalation of radionuclides from nuclear industry to 'total dose' from all sources assessed along the Cumbrian Coast, 2014 to 2025



Other age groups in the Cumbrian Coastal Community received less exposure than the adults 'total dose' of 0.51mSv in 2025 (10-year-old children: 0.27mSv; 1-year-old infants: 0.18mSv; prenatal children: 0.063mSv). The contributors to the other age groups are similar to those for the overall 'total dose. The 'total dose' estimated for each age group may be compared with the average dose of approximately 2.2mSv to members of the UK population from exposure to natural radiation in the environment (https://www.ukhsa-protectionservices.org.uk/UKionisingradiation/) [1] and to the annual dose limit to members of the public of 1mSv.

3.3.1.2 'Total dose' from all pathways and sources in the vicinity of the Sellafield site

The annual 'total dose' from all pathways and sources of radiation is assessed using consumption and occupancy data from the full habits survey of 2023 [132] and the yearly review of shellfish and fish consumption, and intertidal occupancy in 2025 [134]. Calculations are performed for 4 age groups (adults, 10-year-old children, 1-year-old infants and prenatal children).

The highest total dose for a local high-rate seafood consumer was assessed to have been 0.51mSv in 2025, or approximately 51 per cent of the dose limit to members of the public (Table 3.16). This dose is broken down as follows:

- 0.49mSv from historical discharges of naturally occurring radionuclides from the former phosphate processing plant at Whitehaven, an increase from 0.18mSv in 2024
- 0.018mSv from discharges of artificial radionuclides (including external radiation) from Sellafield, an increase from 0.012mSv in 2024. 0.0003mSv of this was from sources of direct radiation from Sellafield (the 'representative person' only receives a portion of the annual direct radiation dose of 0.003mSv)

The representative person was an adult consuming crustacean shellfish at high rates who also consumed significant quantities of other seafood (fish). The increase from 0.19mSv in 2024, which was mostly attributed to higher polonium-210 concentrations in crabs (at Parton) and to a lesser extent an increase in the crustacean consumption rate.

The most significant contributions were from crustacean consumption (98%), fish consumption (1%) and other pathways (<1%). The listed food groups are consumption pathways the other pathways include external exposure over sediment. The most important radionuclide was polonium-210 from historical discharges of naturally occurring radionuclides from the former phosphate processing plant (96%) with transuranic radionuclides (including plutonium-239+240 and americium-241) contributing approximately 2% of the dose.

The dose in 2025 from artificial radionuclides discharged by Sellafield (including external radiation) and from historical discharges of naturally occurring radionuclides (from the former phosphate processing plant at Whitehaven) contributed 0.018mSv and 0.49mSv, respectively. Data for naturally occurring radionuclides in fish and shellfish, and their variation in recent years, are discussed in Section 7.5.

The contribution to the 'total dose' of 0.018mSv in 2025 from artificial radionuclides (including external radiation) was higher, in comparison to that in 2024 (0.012mSv). This was mostly attributed to update of habits information, in particular the increase in consumption rates of crustacean species. The contributing radionuclides to the dose from artificial radionuclides from Sellafield in 2025 were mostly americium-241 (37%), iodine-129 (31%, based on results at the

analytical limit of detection), other radionuclides (including carbon-14 and caesium-137) (8%) and plutonium radionuclides (7%). External exposure contributed 18% of the 'total dose' from artificial radionuclides (10% in 2024).

Other age groups received less exposure than the adults 'total dose' of 0.51mSv in 2025 (10-year-old children: 0.27mSv; 1-year-old infants: 0.18mSv; prenatal children: 0.12mSv). The contributors to the other age groups are similar to those for the overall 'total dose, except the 'total dose' to prenatal children, which is due to consumption of game meat, which has a high consumption rate of poultry. The 'total dose' estimated for each age group may be compared with the dose of approximately 2.2mSv to members of the UK population from exposure to natural radiation in the environment (https://www.ukhsa-protectionservices.org.uk/UKionisingradiation/) [1] and to the annual dose limit to members of the public of 1mSv.

3.3.1.3 'Total dose' from gaseous discharges and direct radiation in the vicinity of the Sellafield site

The annual 'total dose' from pathways related to gaseous discharges and sources of direct radiation is assessed by determining the highest dose to all combinations of these pathways. Once the representative person has been identified, the contributions from all other pathways are then included. Therefore, the representative person for the gaseous discharge pathway may also receive a dose contribution from consumption of seafood and intertidal occupancy.

The highest total dose from pathways related to gaseous discharges and sources of direct radiation in the vicinity of Sellafield was assessed to have been 0.30mSv in 2025, or approximately 30% of the dose limit to members of the public (Table 3.16). This is made up of:

- 0.26mSv from discharges of artificial radionuclides (including external radiation) from Sellafield, an increase from 0.036mSv in 2024
- 0.040mSv from historical discharges of naturally occurring radionuclides in seafood from the former phosphate processing plant, an increase from 0.009mSv in 2024

This is an increase from 0.046mSv in 2024. The most exposed profile and age group in 2025 was an adult who consumed game meat, who also consumed sea fish and spent time over intertidal substrates and a change from 2024 (adult freshwater fish consumer). The increase from 0.046mSv was attributed to high concentrations of caesium-137 in wild wood pigeon muscle. (~1600Bq kg^{-1}) observed in 2025, discussed in Section 3.3.3.12. The profile selection is based upon which individual (derived from habits surveys) receives the highest dose from pathways related to the gaseous discharges and direct radiation from the Sellafield site. In this case, the habits of the game consumers, had the highest consumption rate of poultry, which is the dominant pathway. After selection all pathways are re-included in the assessment, including aquatic pathways (see Section 1.6.1).

The pathway contributors in 2025 to the 'total dose' for adults were from consumption of poultry (85%), consumption of crustaceans (13%) and consumption of sea fish (1%)

3.3.1.4 'Total dose' from liquid discharges in the vicinity of the Sellafield site

The people receiving the highest 'total dose' from the pathways predominantly relating to liquid discharges are given in Table 3.16. Each 'total dose' is the same as that giving their maximum 'total dose' for all sources and pathways.

3.3.1.5 Source-specific doses

Doses from important routes of exposure resulting from radioactive waste discharges from Sellafield were estimated using source-specific assessments, and the results of these are given in Table 3.15 and Table 3.16. As in recent years, the sources of highest potential exposure were high-rate consumption of seafood, and external exposure from gamma rays over long periods. Other pathways were kept under review, particularly the potential for sea to land transfer at the Ravenglass Estuary to the south of the site, exposure from contact with beta-emitting radionuclides during handling of sediments and/or handling of fishing gear and from gaseous discharges, and the high-rate consumption of locally grown food.

Doses from terrestrial food consumption

In 2025, adults consuming poultry at high rates and exposed to external and inhalation pathways from gaseous discharges received the highest dose for all ages. The estimated dose was 0.64mSv in 2025 (Table 3.16), or 64% of the dose limit to members of the public and up from 0.010mSv in 2024. Other age groups were less exposed than the adults (10-year-old children: 0.25mSv; infants: 0.12mSv, prenatal children: 0.29mSv).

Doses from seafood consumption

Two sets of habits data are used in these dose assessments. One is based on the habits information seen in the area each year (2025 habits survey). The second is based on a 5-year rolling average using habits data gathered from 2021 to 2025. Some changes were found in the amounts (and mixes) of species consumed compared to those in the 2025 and the 2021 to 2025 rolling average. For crustaceans (crab and lobster, and other crustaceans), the total consumption rate increased in the 2025 habits survey and in the 2021 to 2025 rolling average data. For fish (cod, other fish), the total consumption rate increased in both the 2025 habits survey and in the 2021 to 2025 rolling average data. For molluscs (winkles and other molluscs), the total consumption rates remained the same in the 2024 habits and decreased in the 2021 to 2025 rolling average data. The occupancy rate over sediments increased in the 2024 habits information and decreased in the 2021 to 2025 rolling average. The revised habits data are given in Appendix 4 (Table A4.2).

Aquatic pathway habits are normally the most important in terms of dose near Sellafield and are surveyed every year (for example [134]). This allows generation of a unique yearly set of data and also rolling 5-year averages. The rolling averages are intended to smooth the effects of sudden changes in habits and provide an assessment of dose that follows more closely changes in radioactivity concentrations in food and the environment. These are used for the main assessment of doses from liquid discharges and follow the recommendations of the report of the consultative exercise on dose assessments [115].

Table 3.16 summarises source-specific doses to seafood consumers in 2025. The doses from artificial radionuclides to people who consume a large amount of seafood were 0.032mSv (0.030mSv in 2024) and 0.034mSv (0.040mSv in 2024) using the annual and 5-year rolling average habits data, respectively. These doses each include a contribution due to external radiation exposure over sediments.

The dose to a high-rate consumer of seafood, due to the naturally occurring radionuclides resulting from historical discharges from the former phosphate works (using maximising assumptions for the dose coefficients and the 5-year rolling average habits data), is estimated to have been 0.41mSv in 2025, and up from 0.27mSv in 2024. Most of this was due to polonium-210 (99%). For comparison (with the assessment using the 5-year rolling average habits data), the dose from the single-year assessment for the Cumbrian coastal community seafood consumer from naturally occurring radionuclides (based on consumption rates and habits survey data in 2025) was 0.56mSv (Table 3.16).

Taking artificial and enhanced natural radionuclides together, the source-specific doses were 0.59mSv and 0.44mSv for the annual and 5-year rolling average habits data, respectively. These estimates are slightly higher or similar than the estimate of 'total dose' from all sources of 0.51mSv. The main reason for this is a difference in the approach to selecting consumption rates for seafood for the representative person. The differences in dose are expected and are within the uncertainties in the assessments (see Section 2.13).

Exposures typical of the wider communities associated with fisheries in Whitehaven, Dumfries and Galloway, the Morecambe Bay area, Northern Ireland and North Wales have been kept under review in 2025 (Table 3.15). Those for fisheries in the Isle of Man and Fleetwood have been shown to be generally lower and dose data are available in earlier RIFE reports (for example [138]). Where appropriate, the dose from consumption of seafood is summed with a contribution from external exposure over intertidal areas. The doses received in the wider communities were significantly lower than for the Cumbrian coastal community because of the lower concentrations and dose rates further afield. There were generally small changes in the doses (and contribution to doses) in each area in 2025 (Table 3.15), in comparison to those in 2024. For example, in Morecambe Bay, the increase in dose, in 2025, to 0.023mSv (from 0.020mSv in 2024) was mostly due to higher gamma dose rates. All annual doses of the wider communities were well within the dose limit for members of the public of 1mSv.

The dose to a person, who typically consumes 15kg of fish per year from landings at Whitehaven is also given in Table 3.16. This dose was less than 0.005mSv in 2025. The consumption rate used represents an average for a typical consumer of seafood from the north-east Irish Sea.
used represents an average for a typical consumer of seafood from the north-east Irish Sea.

Doses from sediments

The main radiation exposure pathway associated with sediments is due to external dose from gamma-emitting radionuclides adsorbed on intertidal sediments in areas frequented by the public. This dose can make a significant contribution to the total exposure of members of the public in coastal communities of the north-east Irish Sea but particularly in Cumbria and Lancashire. Gamma dose rates currently observed in intertidal areas are mainly due to radiocaesium and naturally occurring radionuclides. For some people, the following pathways may also contribute to doses from sediments: exposure due to beta-emitting radionuclides during handling of sediments or fishing gear; inhalation of re-suspended beach sediments; and inadvertent ingestion of beach sediments. These pathways are considered later. In the main, they give rise to only minor doses compared with those due to external gamma-emitters.

Gamma radiation dose rates over areas of the Cumbrian coast and further afield in 2025 are given in Table 3.9. The results of the assessment of external exposure pathways are included in Table 3.16. The highest whole-body exposures due to external radiation resulting from Sellafield discharges, past and present, was received by a local houseboat dweller at Barrow, Cumbria. In 2025, the dose was 0.065mSv, or less than 7% of the dose limit, and up from 0.060mSv in 2024 (see Section 6.2). Other people received lower external doses in 2025. The dose to a person who spends a long time over the marsh in the Ravenglass Estuary was 0.008mSv in 2025, and a decrease from that in 2024 (0.016mSv). This decrease in dose was due to lower occupancy over salt marsh (Appendix 4, Table A4.2).

The doses to people in 2025 were also estimated for several other activities. Assessments were undertaken for a typical resident using local beaches for recreational purposes at 300 hours per year, and for a typical tourist visiting the coast of Cumbria with a beach occupancy of 30 hours per year. The exposure to residents was assessed for 2 different environments (at several locations) and at a distance from the Sellafield influence. The 2 different environments are 1) residents that visit and use beaches, and 2) residents that visit local muddy areas or salt marsh. Typical occupancy rates [136,137] are assumed and appropriate gamma dose rates have been used from Table 3.9. The activities for the typical tourist include consumption of local seafood and occupancy on beaches. Concentrations of radioactivity in fish and shellfish have been used from Table 3.5 to Table 3.7, and appropriate gamma dose rates used from Table 3.9. The consumption and occupancy rates for activities of a typical resident and tourist are provided in Appendix 4 (Table A4.2).

In 2025, the doses to people from recreational use of beaches varied from less than 0.005 to 0.008mSv (Table 3.16), with the higher doses being closer to the Sellafield source. The doses for recreational use of salt marsh and muddy areas had a similar variation, from less than 0.005 to 0.009mSv. The values for these activities were similar to those in recent years. The annual dose to a typical tourist visiting the coast of Cumbria, including a contribution from external exposure, was estimated to be less than 0.005mSv.

Doses from handling fishing gear and sediment

Exposures can also arise from contact with beta-emitting radionuclides during handling of sediments, or fishing gear on which fine particulates have become trapped. Habits surveys keep under review the amounts of time spent by fishers handling their fishing gear, and by bait diggers and shellfish collectors handling sediment. For those most exposed, the rates for handling nets and pots and for handling sediments are provided in Appendix 4 (Table A4.2). In 2025, the skin doses to a bait digger and shellfish collector from handling sediment was 0.087mSv (Table 3.16). This was less than 0.5% of the appropriate annual dose limit of 50mSv specifically for skin. The skin dose to a fisherman from handling fishing gear (including a component due to naturally occurring radiation), based on 2019 monitoring data was 0.14mSv. Therefore, both handling of fishing gear and sediments continued to be minor pathways of radiation exposure.

Doses from atmospheric sea to land transfer

At Ravenglass, the representative person was infants (1-year-old) from consuming terrestrial foods that were potentially affected by radionuclides transported to land by sea spray. In 2025, the dose (including contributions from Chernobyl and fallout from nuclear weapons testing) was estimated to be 0.013mSv, which was less than 2% of the dose limit for members of the public, and generally similar to that in 2024 (0.014mSv). The largest contribution to the dose was, from ruthenium-106 in milk. As in previous years, sea-to-land transfer was not of radiological importance in the Ravenglass area.

Doses from seaweed and sea-washed pasture

Estimated annual doses for a high-rate consumer of laverbread (brown seaweed), and a high-rate consumer of vegetables (assuming these foods were obtained from the monitored plots near Sellafield and seaweeds were used as fertilisers and/or soil conditioners), are available in earlier RIFE reports (for example [138]). Exposures of vegetable consumers using seaweed from further afield in Northern Ireland, Scotland and North Wales are expected to be much lower than near Sellafield.

Animals may also graze on seaweeds on beaches in coastal areas. However, there has been no evidence of this taking place significantly near Sellafield. A research study (relevant to the Scottish islands and coastal communities) conducted by UKHSA on behalf of the FSA and SEPA, investigated the potential transfer of radionuclides from seaweed to meat products and also to crops grown on land where seaweed had been applied as a soil conditioner [139]. The study concluded that the highest levels of dose to people using seaweed, as a soil conditioner or an animal feed, were in the range of a few microsieverts (μSv) and most of the doses are at least a factor of 100 lower. The report is available from SEPA by emailing RSEnquiries@sepa.org.uk.

3.3.2 Gaseous discharges and monitoring

Permitted discharges to atmosphere are made from a wide range of facilities at the site including the fuel storage ponds, the reprocessing plants and waste treatment plants, as well as from Calder Hall Power Station. Discharges to atmosphere, during 2025 are summarised in Appendix 1 (Table A1.1). The permit limits gaseous discharges for gross alpha and beta activities, and 8 specified radionuclides. In addition to overall site limits, plant notification levels have been set on discharges from the main contributing plants on site.

3.3.2.1 Monitoring around the site related to gaseous discharges

Monitoring of terrestrial foods in the vicinity of Sellafield is conducted by the FSA to reflect the scale and risk of discharges from the site. This monitoring is the most extensive of that for the nuclear sites in the UK. A range of foodstuffs was sampled in 2025 including milk, fruit, vegetables, meat and offal, game, and environmental materials (grass and soil). Environmental samples were obtained from different locations around the site to allow for variations due to the influence of meteorological conditions on the dispersal of gaseous discharges. The analyses conducted included gamma-ray spectrometry and specific measurements for tritium, carbon-14, strontium-90, technetium-99, iodine-129, uranium and transuranic radionuclides.

The results of monitoring in 2025 are given in Table 3.4. The activity concentrations of most radionuclides around the site were generally low. Activity concentrations in milk, fruit, vegetables, meat and offal, game, and environmental materials (grass and soil) were generally similar to those in recent years. Activity concentrations of radionuclides in meat and offal (cattle and sheep) were low, with many reported as below the limit of detection with only very limited evidence of the effects of Sellafield's gaseous discharges, detected in concentrations of carbon-14 in meat and offal samples. Concentrations of strontium-90, caesium-134, caesium-137 and transuranic radionuclides in wild wood pigeon were significantly higher than recorded over the last two decades (discussed in Section 3.3.3.12).

A range of foods (including fruit and vegetables) and terrestrial indicator materials was sampled in 2025, and the activity concentrations were generally similar to those found in previous years. In common with meat and offal samples, only limited evidence of the gaseous discharges from Sellafield was found in some of these foods. Strontium-90 was positively detected in a number of food samples (including milk) at low concentrations. As in 2024, the maximum iodine-129 and iodine-131 concentrations in milk were reported as below the limit of detection. Small enhancements (above the expected background) in concentrations of carbon-14 were found in some food samples (including milk), as in recent years. Concentrations of transuranic radionuclides, when detectable in these foods, were very low. Concentrations of radionuclides in milk (near Sellafield), and corresponding discharges of carbon-14, strontium-90 and caesium-137, for more than a decade are shown in Figure 3.16 to Figure 3.18, respectively. Over the whole period, concentrations of carbon-14 were relatively constant (with some variation between years and close to background), and caesium-137 concentrations (and strontium-90 to a lesser extent) were declining overall.

Figure 3.16 Concentrations of carbon-14 in milk, in Bq l^{-1}, near Sellafield and annual discharges of carbon-14, TBq y^{-1} from in Sellafield, 2014 to 2025.

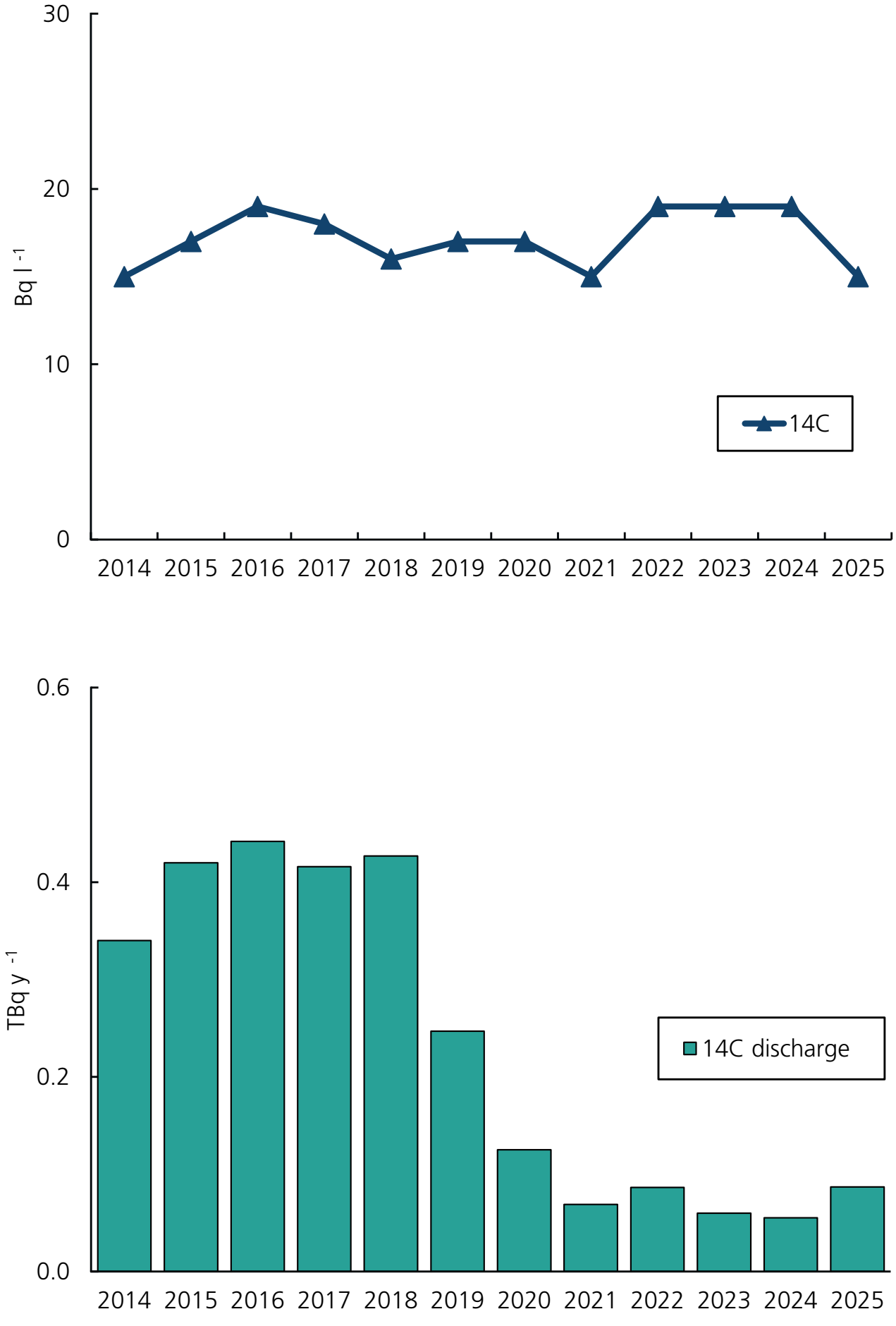
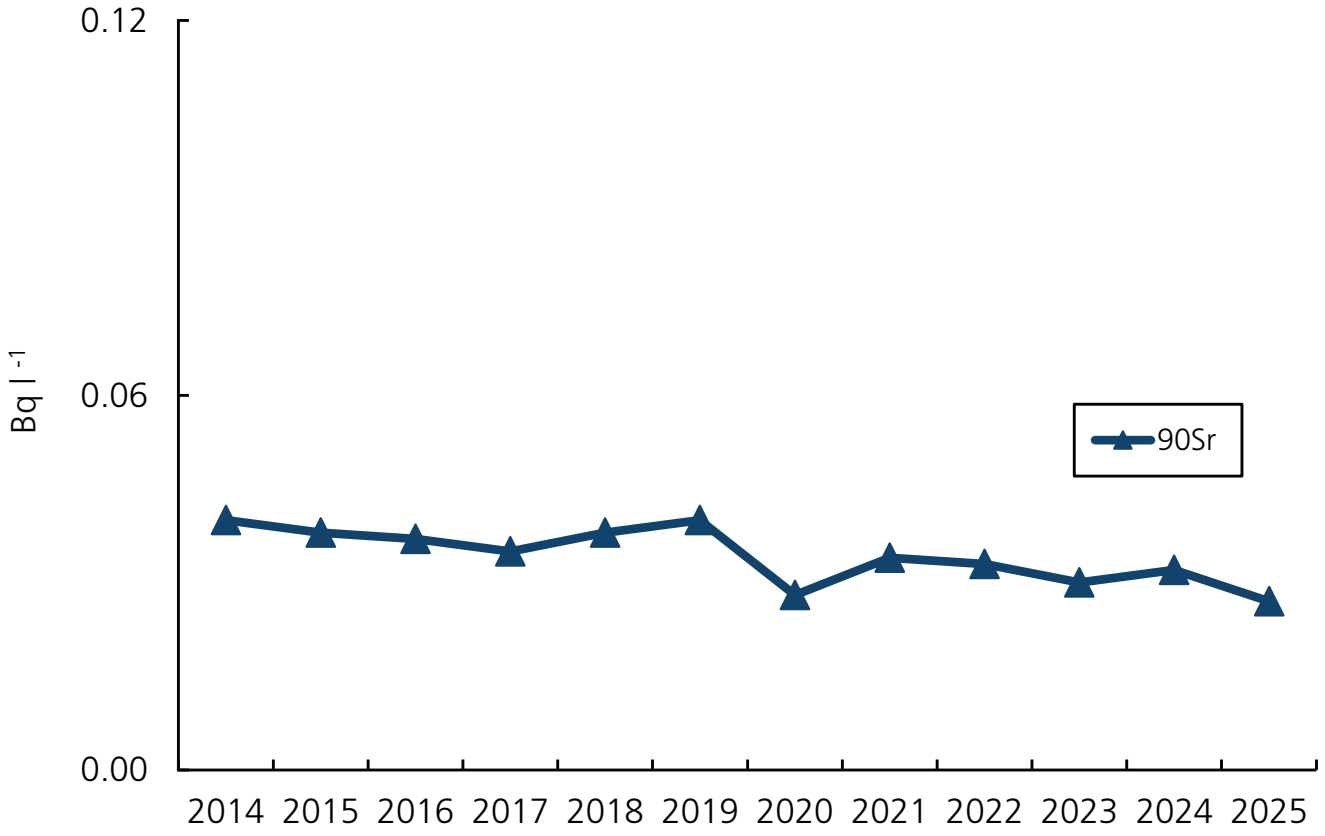


Figure 3.17 Concentrations of strontium-90 in milk, in Bq l^{-1}, near Sellafield and annual discharges of strontium-90, GBq y^{-1} from in Sellafield, 2014 to 2025.



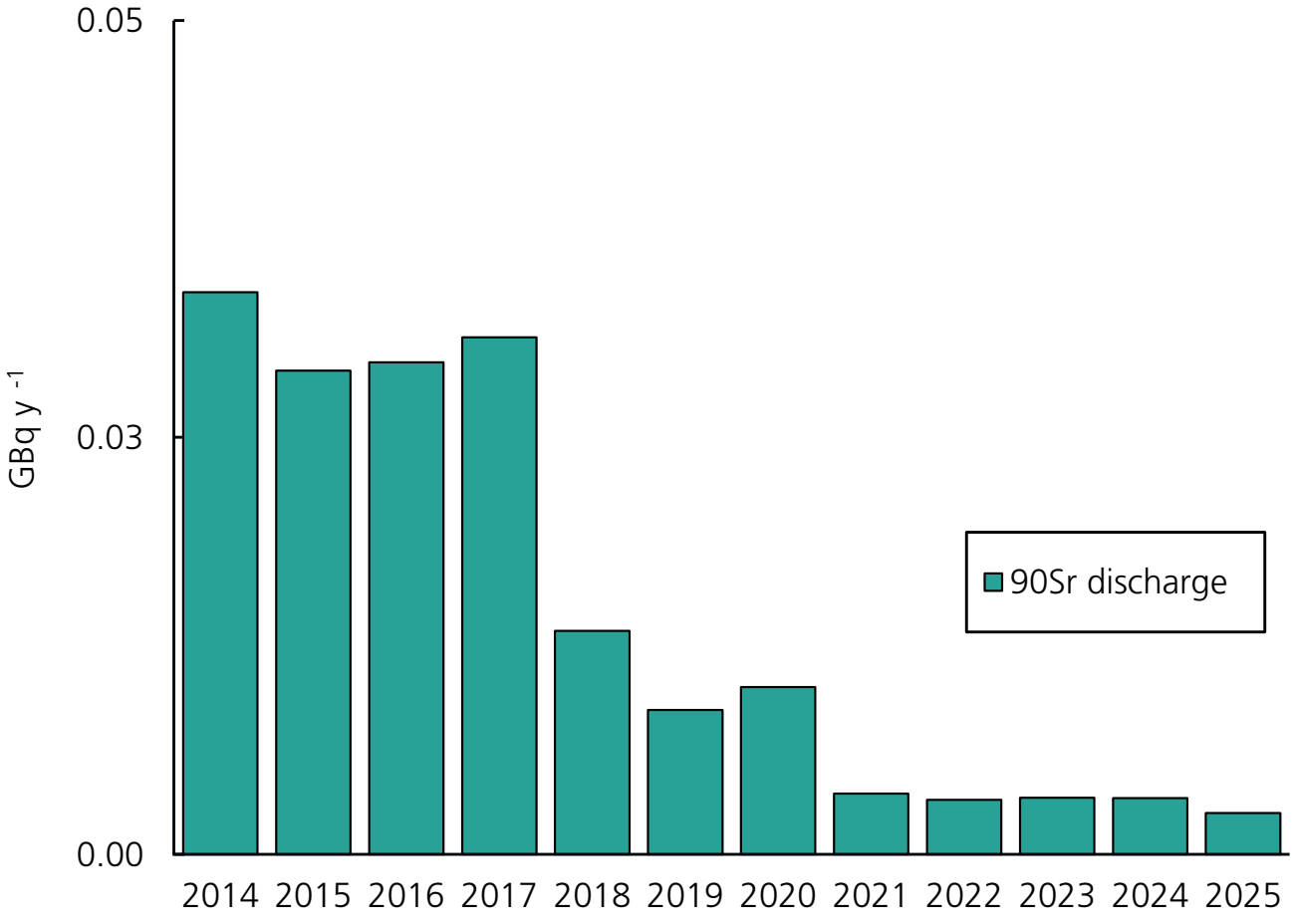
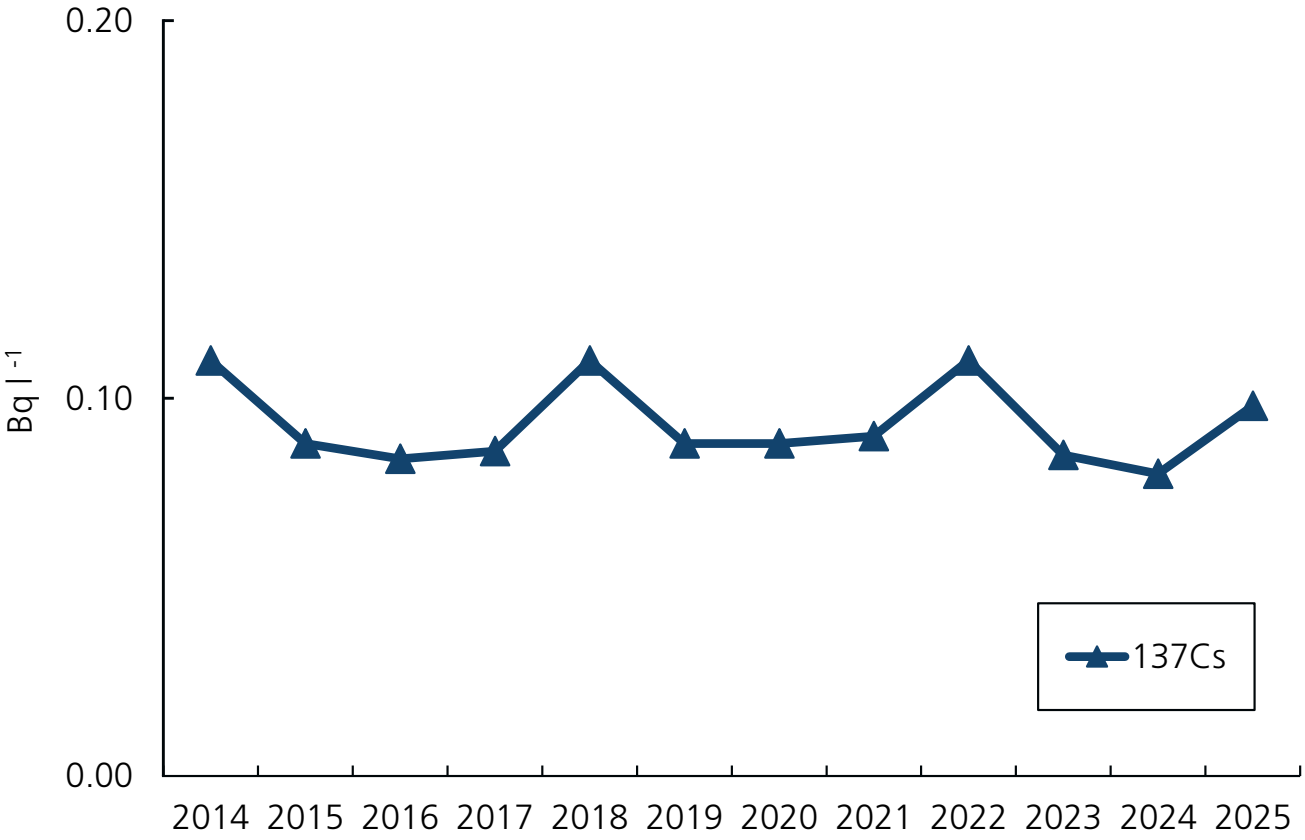
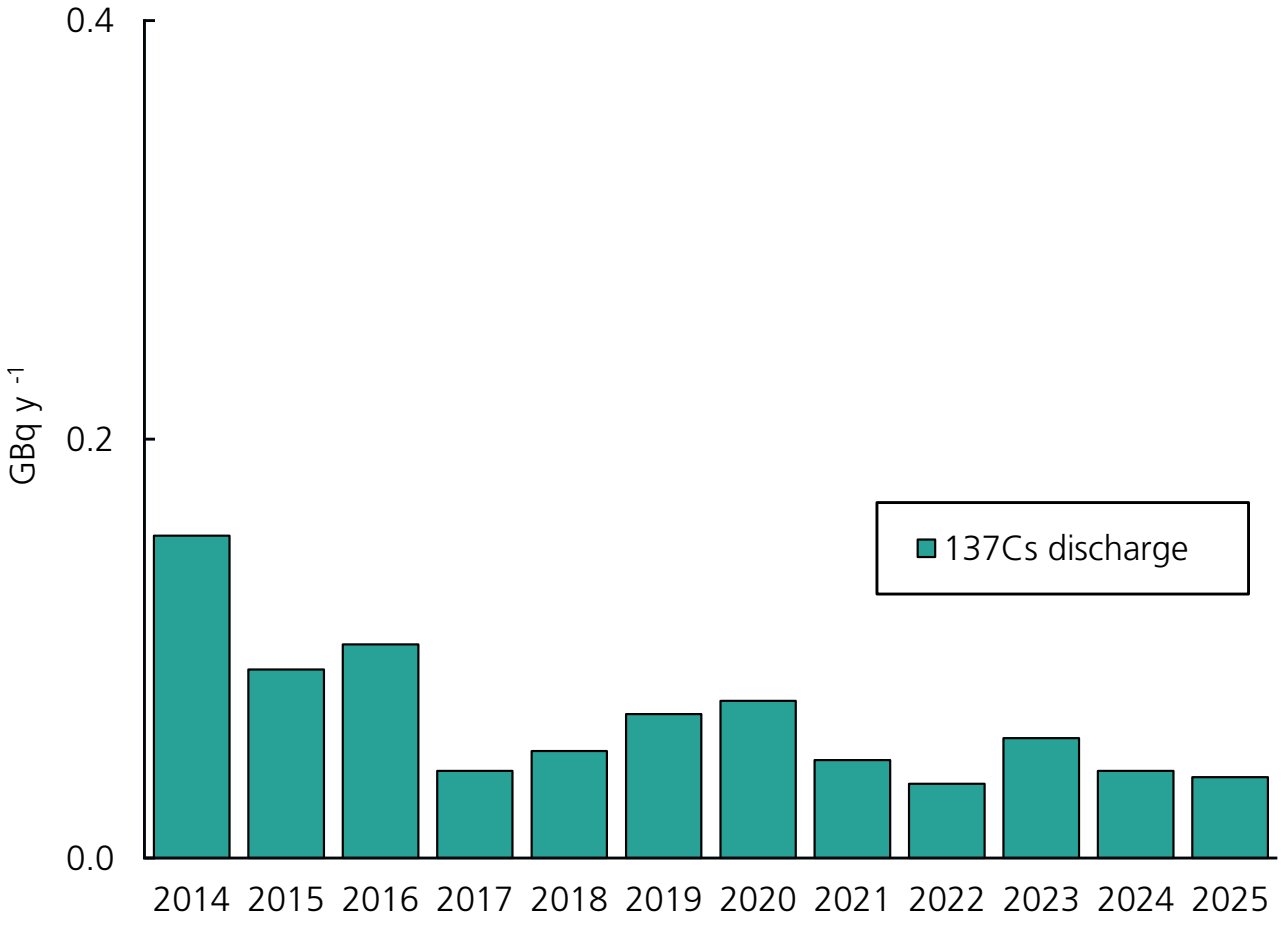


Figure 3.18 Concentrations of caesium-137 in milk, in Bq l^{-1}, near Sellafield and annual discharges of caesium-137, GBq y^{-1} from in Sellafield, 2014 to 2025.





3.3.3 Liquid discharges and monitoring

Permitted liquid discharges derive from a variety of sources at the site including the fuel storage ponds, the reprocessing plants, from the retrieval and treatment of legacy wastes, the laundry and general site drainage. Wastes from these sources are treated and then discharged to the Irish Sea via the sea pipelines that terminate 2.1km beyond low water mark. A small quantity of low activity liquid wastes (mostly rainfall runoff) is also discharged from the factory sewer to the River Ehen Estuary and (since 2015) some liquid wastes are also discharged via the Calder Interceptor Sewer [75]. Discharges from the Sellafield pipelines during 2025 are summarised in Appendix 1 (Table A1.2). The current permit sets limits on gross alpha and beta, and 12 individual radionuclides. In addition to overall site limits, plant notification levels have been set on discharges from the main contributing plants on site (Segregated Effluent Treatment Plant, Site Ion Exchange Effluent Plant (SIXEP), Enhanced Actinide Removal Plant and THORP).

All discharges of liquid wastes from Sellafield were less than the permit limits in 2025. Liquid discharges of most radionuclides decreased, in 2025, compared to releases in 2024.

The downward trend of technetium-99 discharges from Sellafield is given in Figure 3.19 (2014 to 2025) and Figure 3.20 (1996 to 2025). Technetium-99 trends in seaweed around the UK are shown in Figure 3.21 to Figure 3.28. Technetium-99 discharges have substantially reduced from the peak of 192TBq in 1995. Further information relating to past discharges of technetium-99 is available in earlier RIFE reports (for example [19]).

Figure 3.19 Technetium-99 in Sellafield seaweed ('Fucus vesiculosus'), in Bq kg^{-1} (fresh), and Sellafield discharges, in TBq y^{-1}.

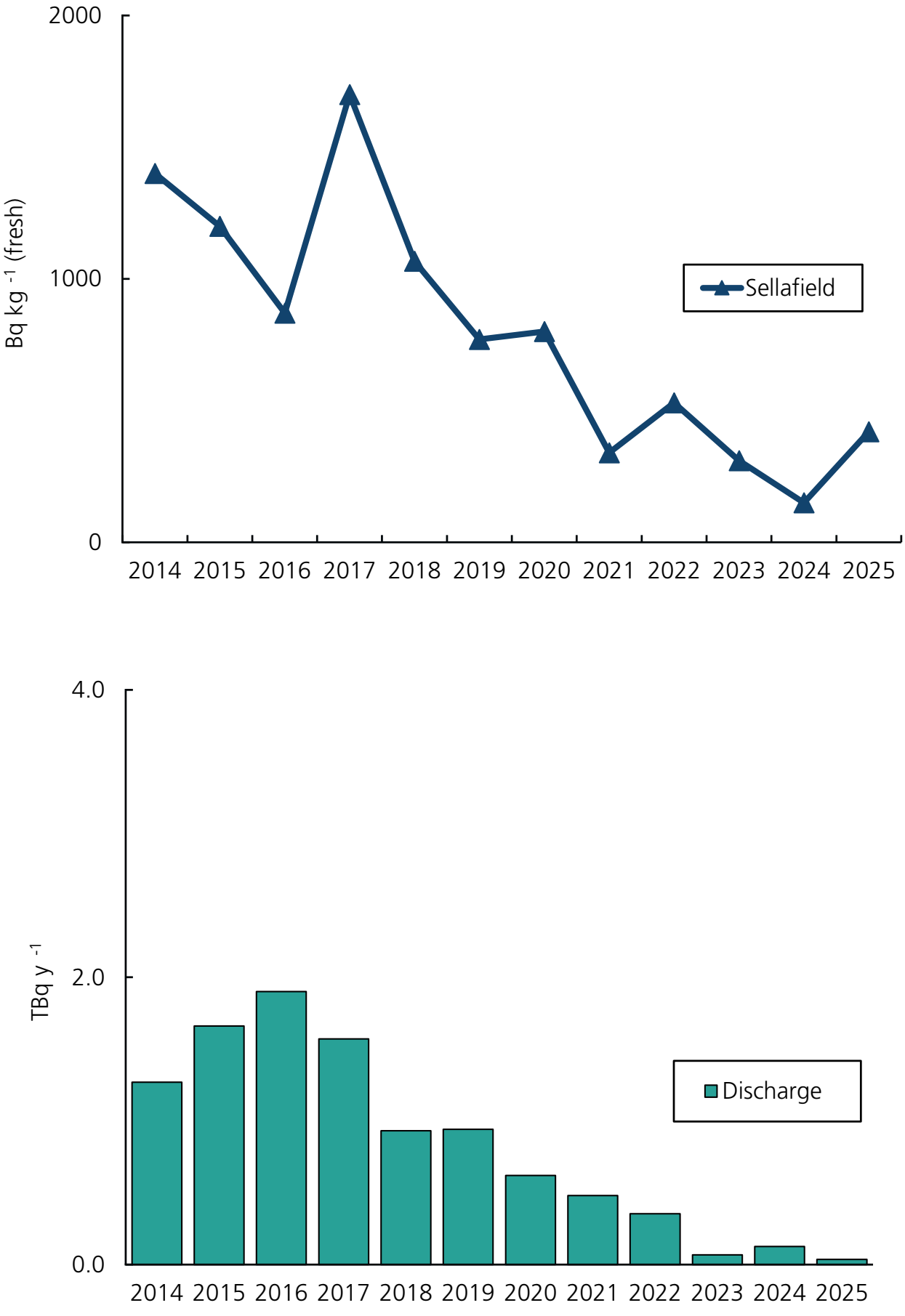


Figure 3.20 Technetium-99 in UK seaweed ('Fucus vesiculosus'), in Bq kg^{-1} (fresh), and Sellafield liquid discharges between, in TBq y^{-1}, 1996 to 2025.

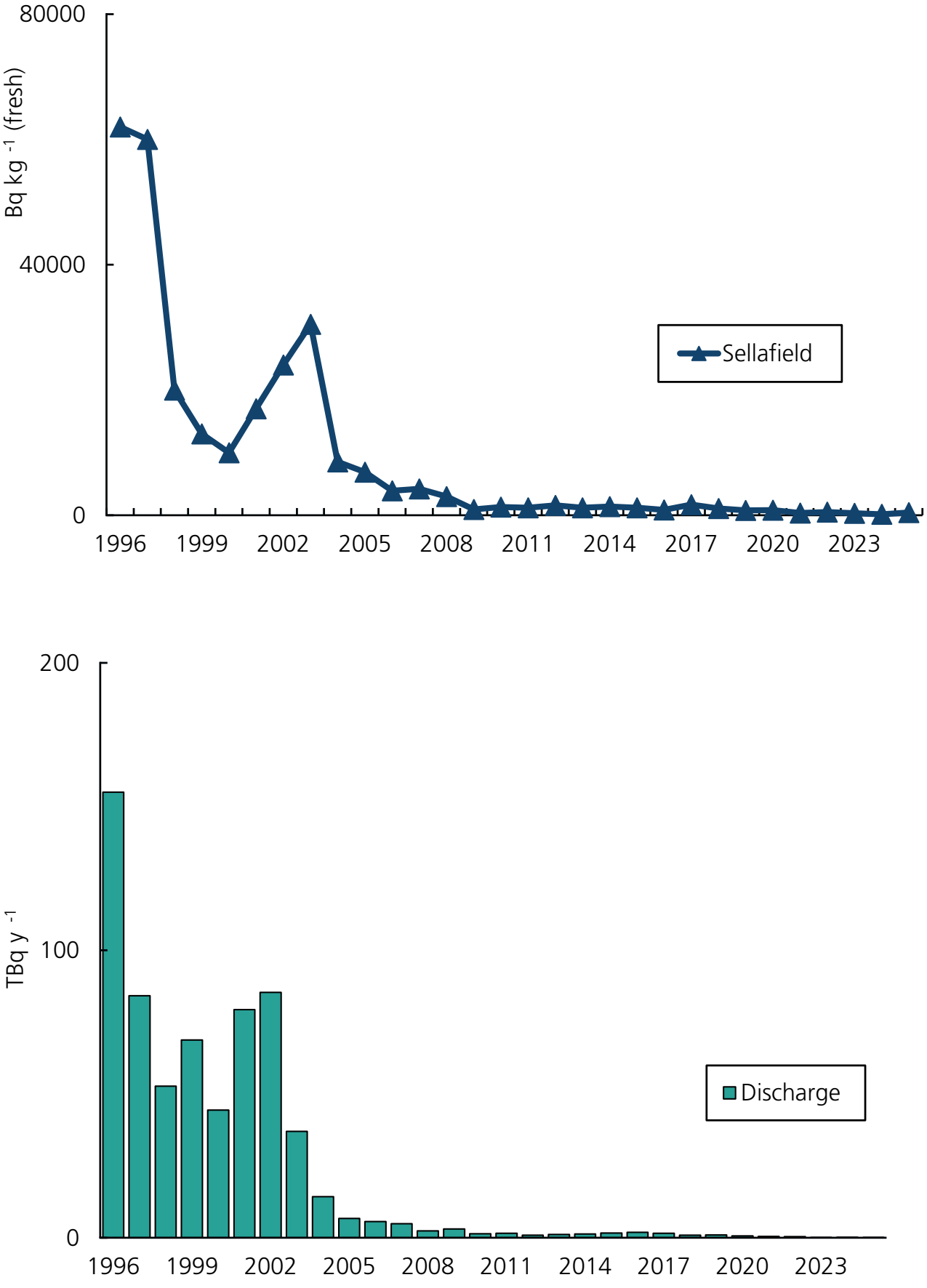


Figure 3.21 Technetium-99 in Dounreay seaweed ('Fucus vesiculosus'), in Bq kg^{-1} (fresh), 2014 to 2025

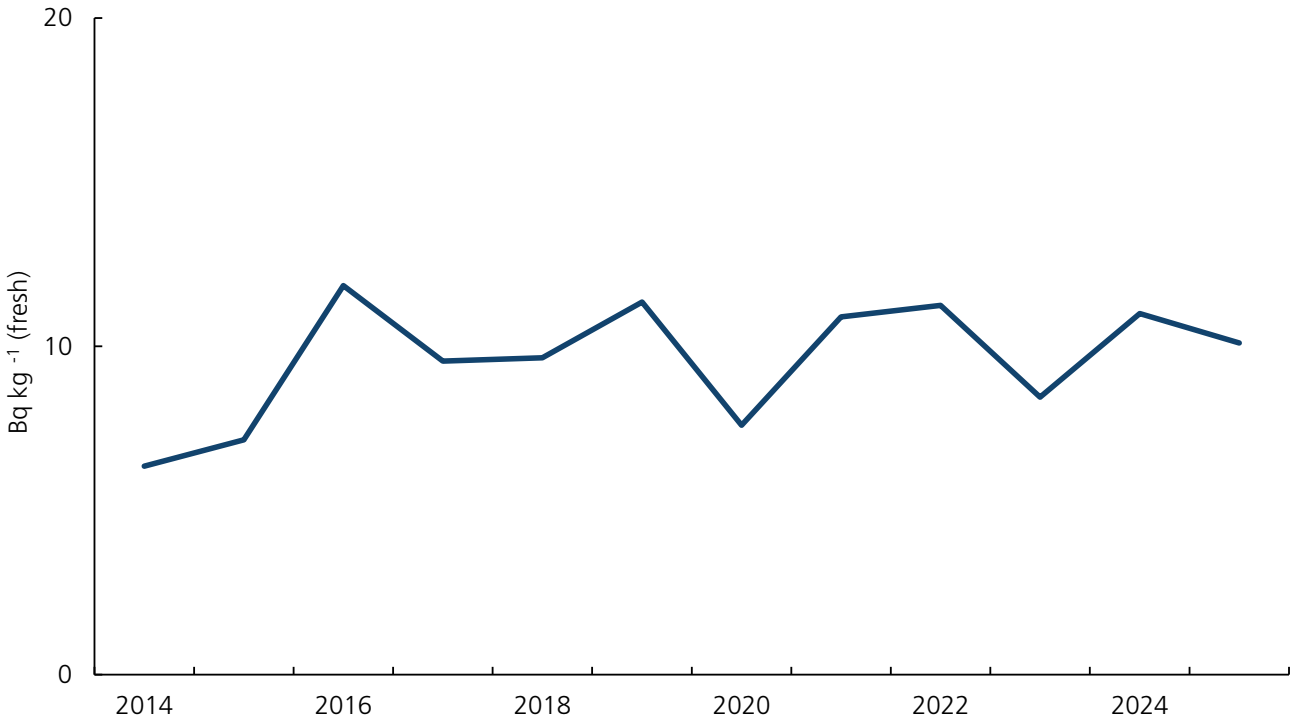


Figure 3.22 Technetium-99 in Hartlepool seaweed ('Fucus vesiculosus'), in Bq kg^{-1} (fresh), 2014 to 2025

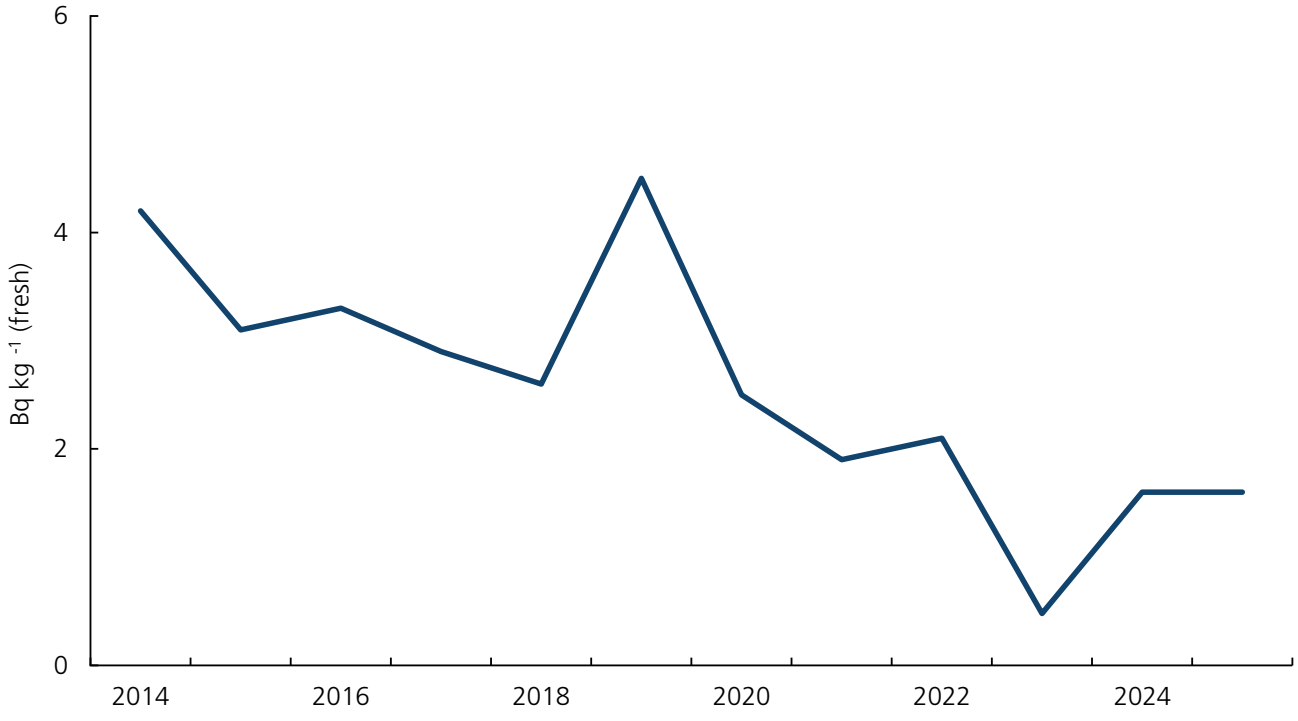


Figure 3.23 Technetium-99 in Bradwell seaweed ('Fucus vesiculosus'), in Bq kg^{-1} (fresh), 2014 to 2025

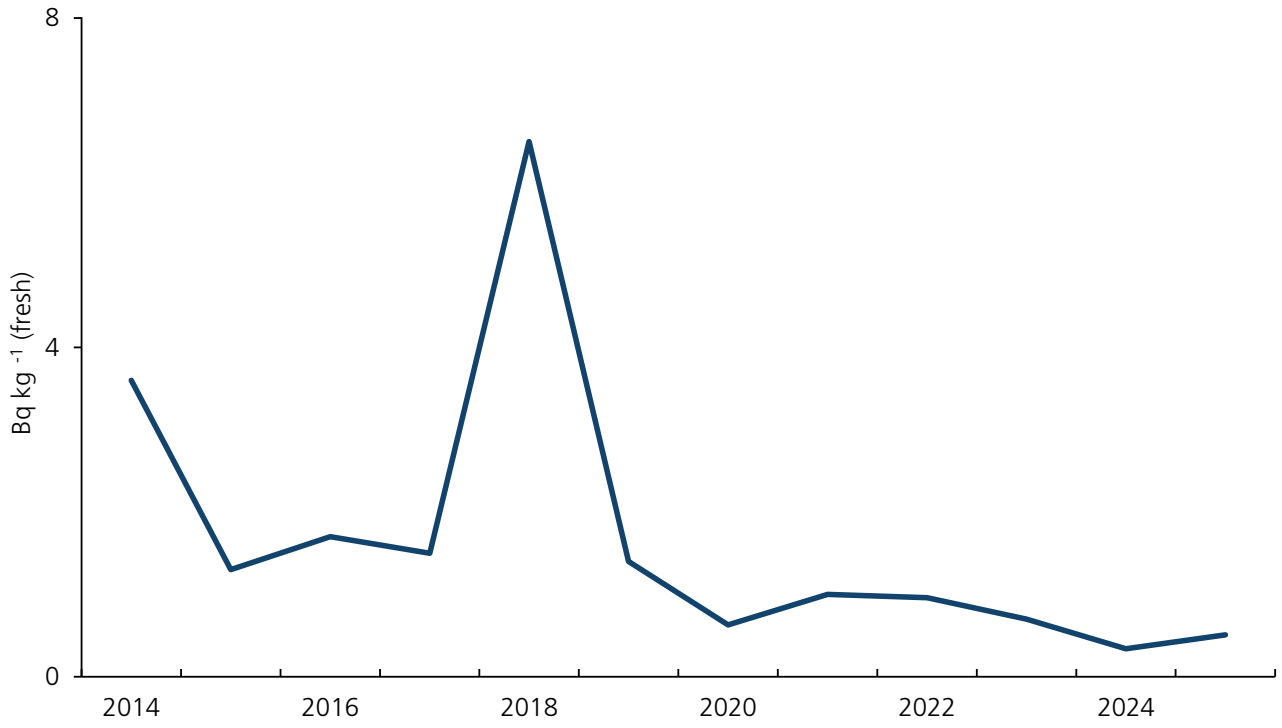


Figure 3.24 Technetium-99 in Dungeness seaweed ('Fucus vesiculosus'), in Bq kg^{-1} (fresh), 2014 to 2025

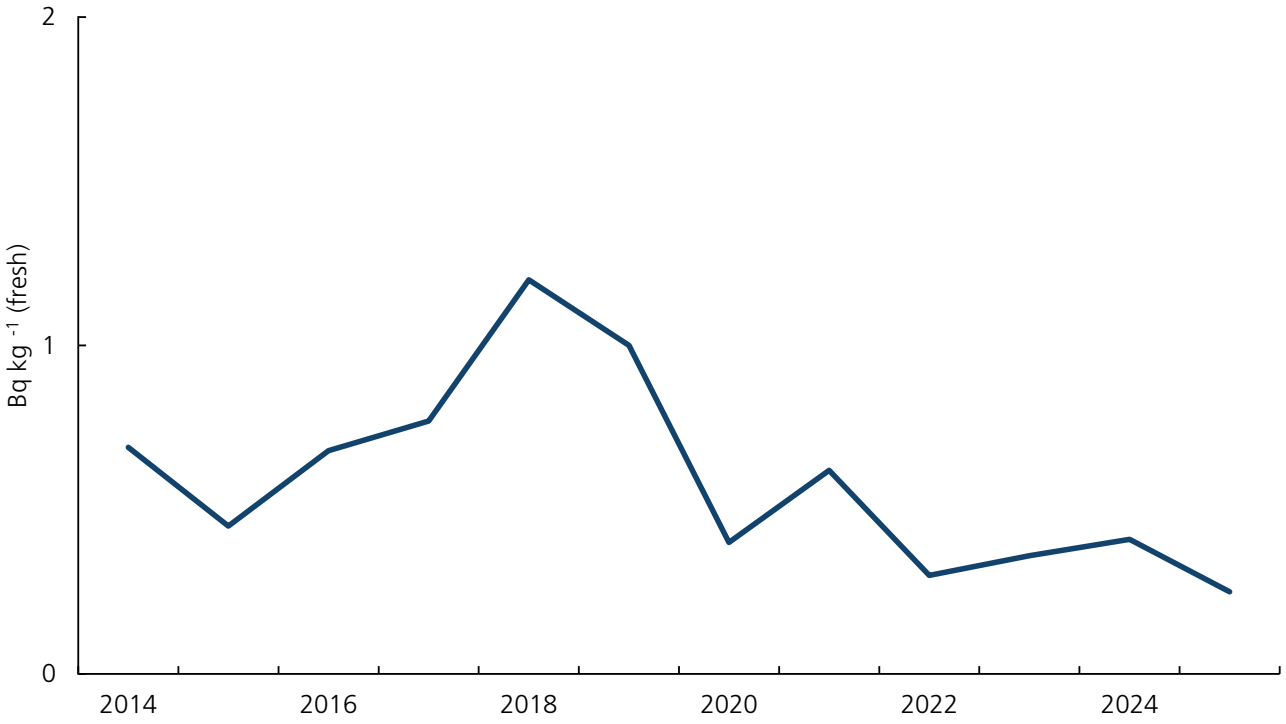


Figure 3.25 Technetium-99 in Isles of Scilly seaweed ('Fucus vesiculosus'), in Bq kg^{-1} (fresh), 2014 to 2025

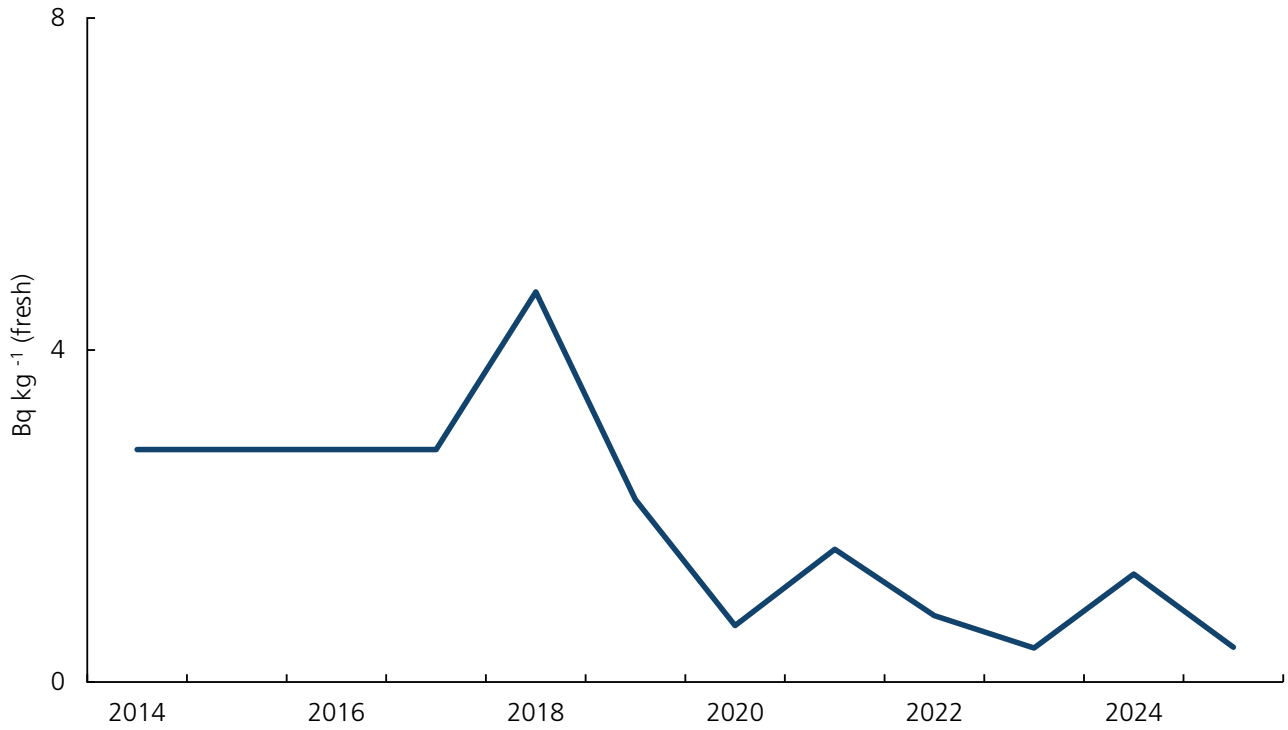


Figure 3.26 Technetium-99 in Fishguard seaweed ('Fucus vesiculosus'), in Bq kg^{-1} (fresh), 2014 to 2025

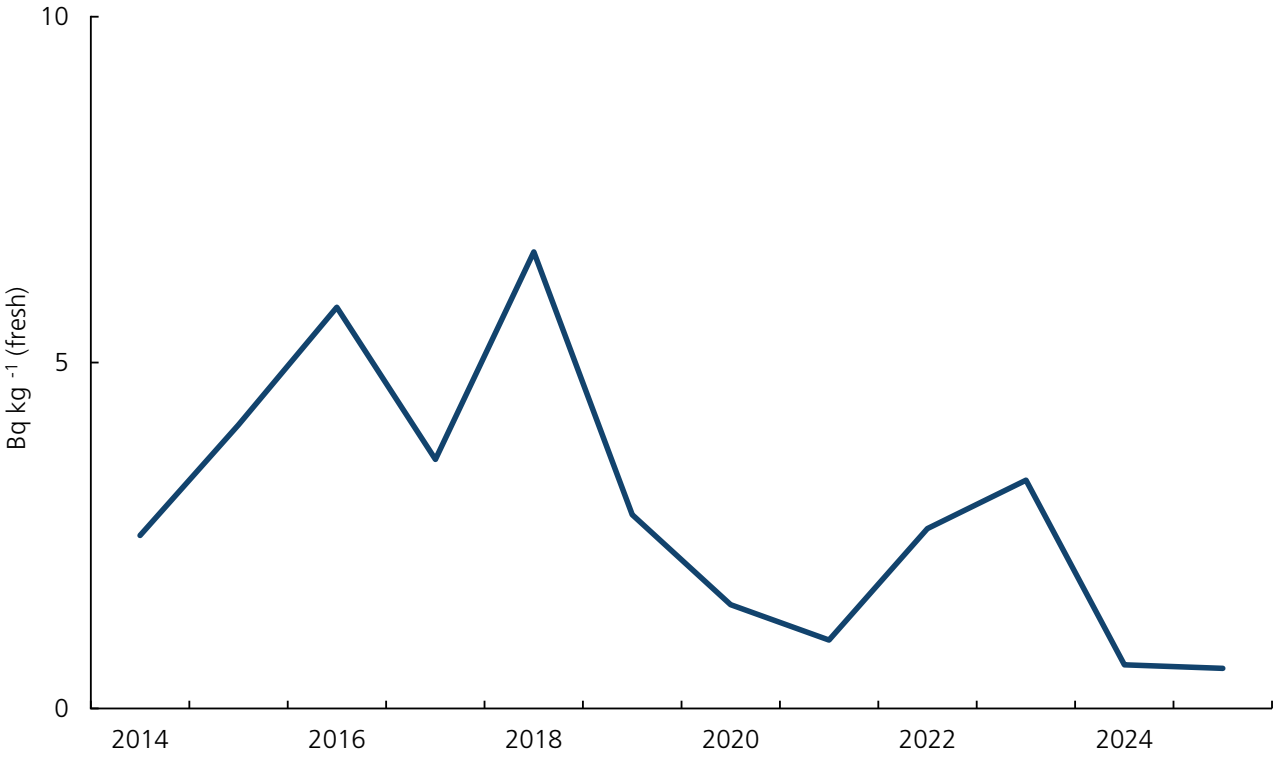


Figure 3.27 Technetium-99 in Ardglass seaweed ('Fucus vesiculosus'), in Bq kg^{-1} (fresh), 2014 to 2024

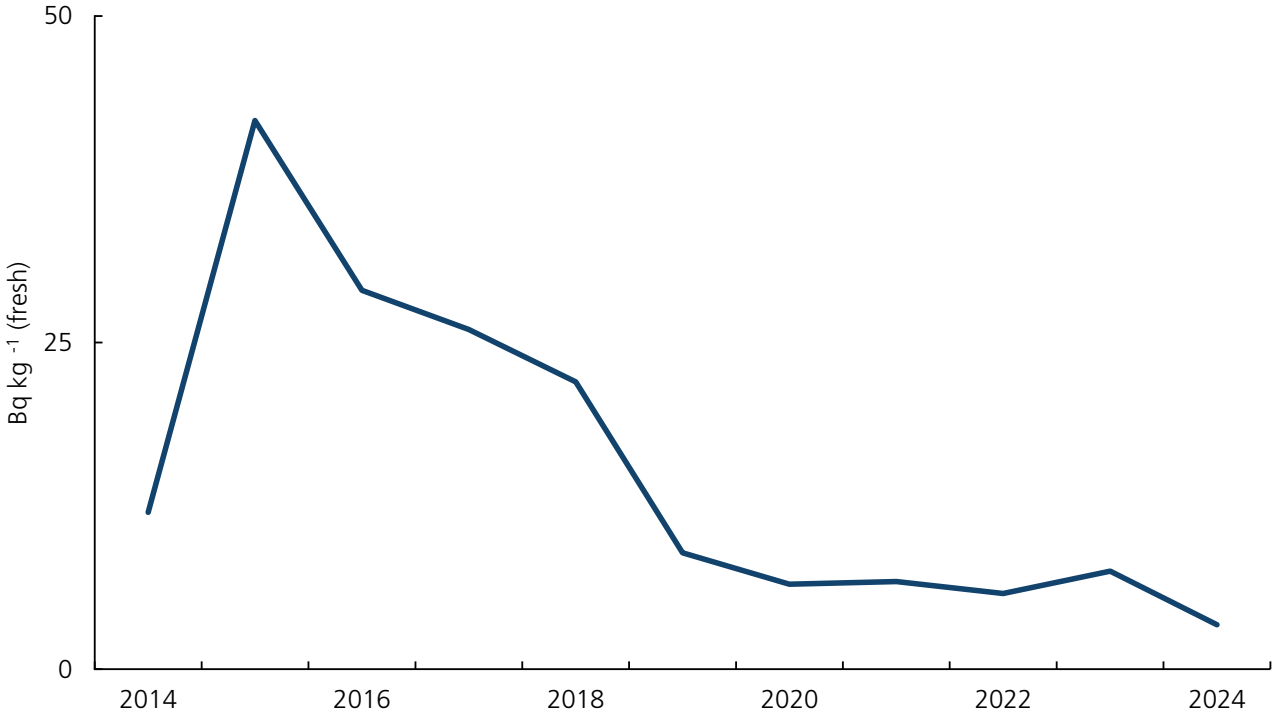
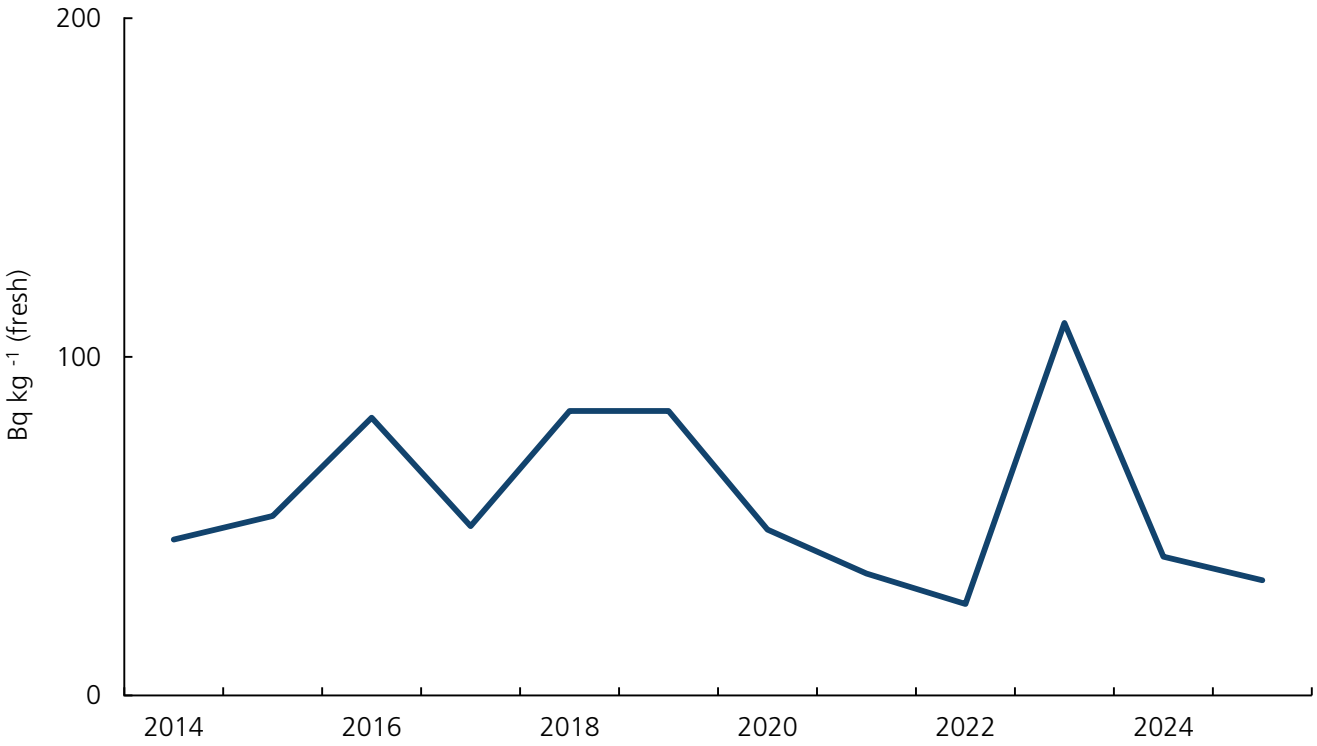


Figure 3.28 Technetium-99 in Port William seaweed ('Fucus vesiculosus'), in Bq kg^{-1} (fresh), 2014 to 2025



3.3.3.1 Monitoring of the marine environment

Regular monitoring of the marine environment near to Sellafield and further afield was conducted during 2025, by the Environment Agency and FSA (for England and Wales), NIEA (for Northern Ireland) and SEPA (for Scotland). In Scotland, SEPA and the FSS work closely together to maximise the value of every sample taken as it is fully funded by the Scottish Government. The monitoring locations for seafood, water, environmental materials and dose rates near the Sellafield site are shown in Figure 3.29 and Figure 3.30, the corresponding sample species, types and locations are listed in the corresponding site tables.

Figure 3.29 Monitoring locations in Cumbria, 2025 (not including farms).

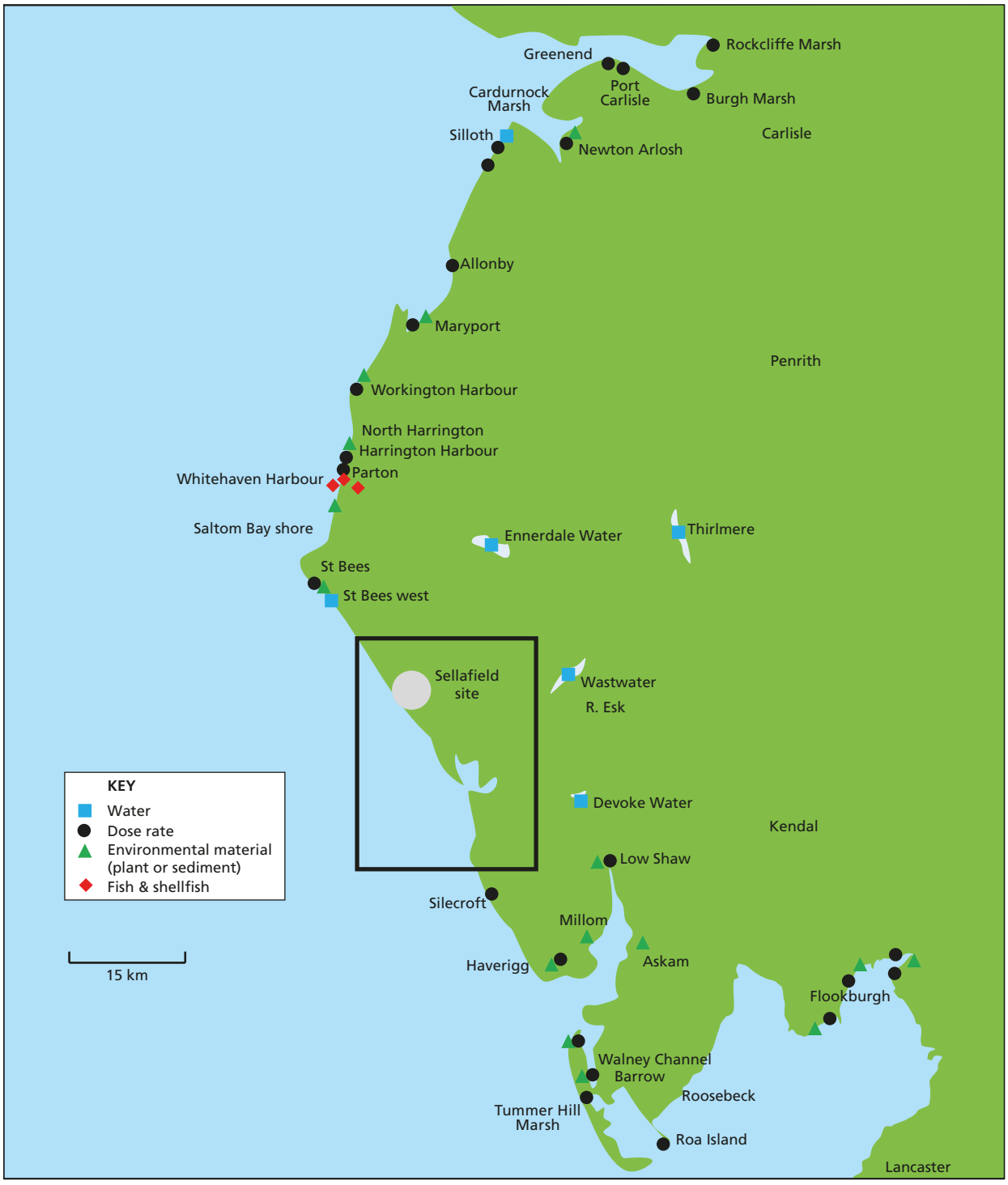


Figure 3.30 Monitoring locations at Sellafield, 2025 (not including farms).

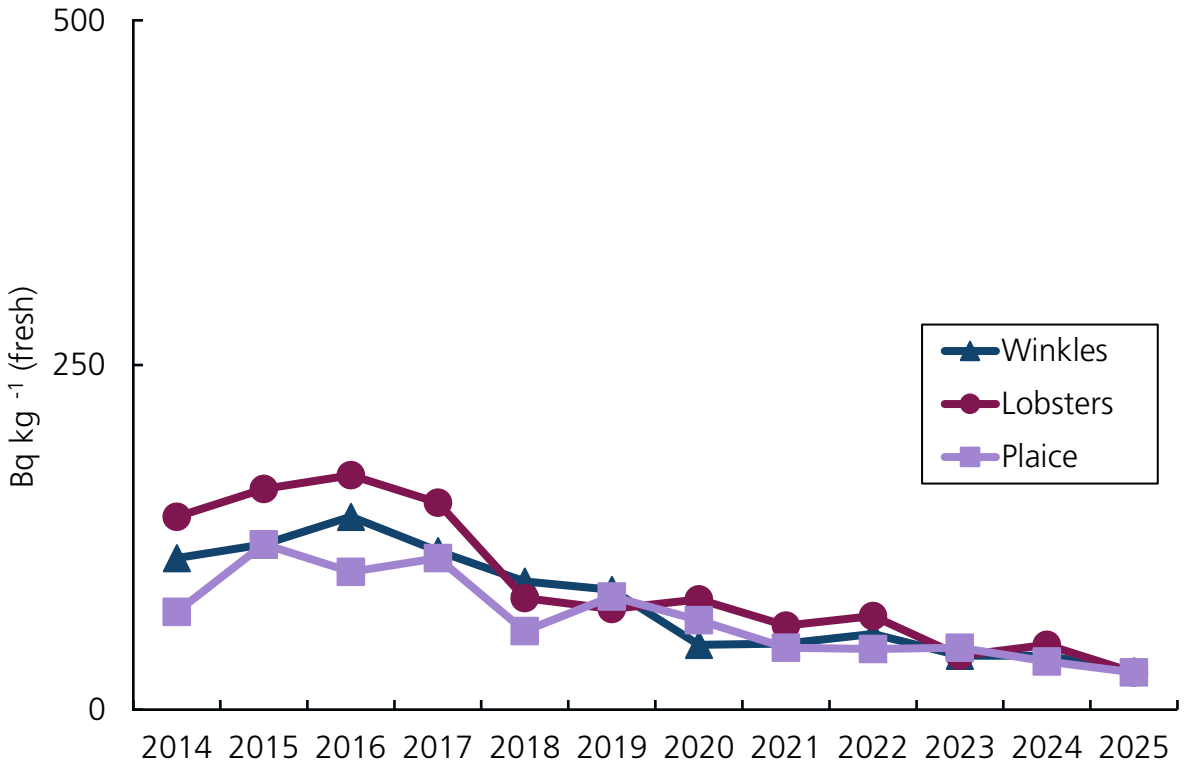


3.3.3.2 Monitoring of fish and shellfish

Concentrations of beta and gamma activity in fish from the Irish Sea and from further afield are given in Table 3.5. Data are listed by location of sampling or landing point, north to south in Cumbria, then in approximate order of increasing distance from Sellafield. Results are available for previous specific surveys in the 'Sellafield Coastal Area' (extending 15km to the north and to the south of Sellafield, from St Bees Head to Selker, and 11km offshore) and the smaller 'Sellafield Offshore Area' (consisting of a rectangle, 1.8km wide by 3.6km long, situated south of the pipelines) in earlier RIFE reports (for example, [138]). Concentrations of specific naturally occurring radionuclides in fish and shellfish in the Sellafield area are given in Section 7.

The concentrations of most radionuclides have decreased over the previous decades in response to decreases in discharges [140]. Concentrations generally continue to reflect changes in discharges over time periods, characteristic of radionuclide mobility and organism uptake. More recent trends in concentrations of radionuclides, and corresponding discharges, in seafood near Sellafield (over the last decade) are shown in Figure 3.31 to Figure 3.36. There was variability from year to year, particularly for the more mobile radionuclides. Over the period 2014 to 2025, discharges and the concentrations of carbon-14 in fish and shellfish have declined (Figure 3.31). Discharges of cobalt-60 have decreased over the period 2014 to 2025 (Figure 3.32). However, concentrations in fish and shellfish have shown some variation year on year, albeit at low concentrations. Liquid discharges of technetium-99 and concentrations of technetium-99 in fish and shellfish in 2025 (Figure 3.33) were similar, in comparison to their respective values in recent years. Over a longer timescale, technetium-99 concentrations in fish and shellfish have shown a continued reduction, from the relatively elevated values in the previous decade [140]. For the transuranic elements (Figure 3.35 and Figure 3.36), the trend of reductions in concentrations is not evident, unlike in earlier decades[140]. Over the last decade, discharges and concentrations of americium-241 and plutonium-239+240 in fish and shellfish have continued to show some variations from year to year (Figure 3.35 and Figure 3.36). Overall, these concentrations in shellfish have decreased over the period. The mean concentrations of carbon-14, cobalt-60, technetium-99, caesium-137, plutonium-239+240 and americium-241 in shellfish, were generally similar in 2025, compared to those in 2024.

Figure 3.31 Carbon-14 concentrations in plaice, lobsters and winkles from near Sellafield, in Bq kg^{-1} (fresh) and liquid discharge from Sellafield, in TBq y^{-1}, 2014 to 2025



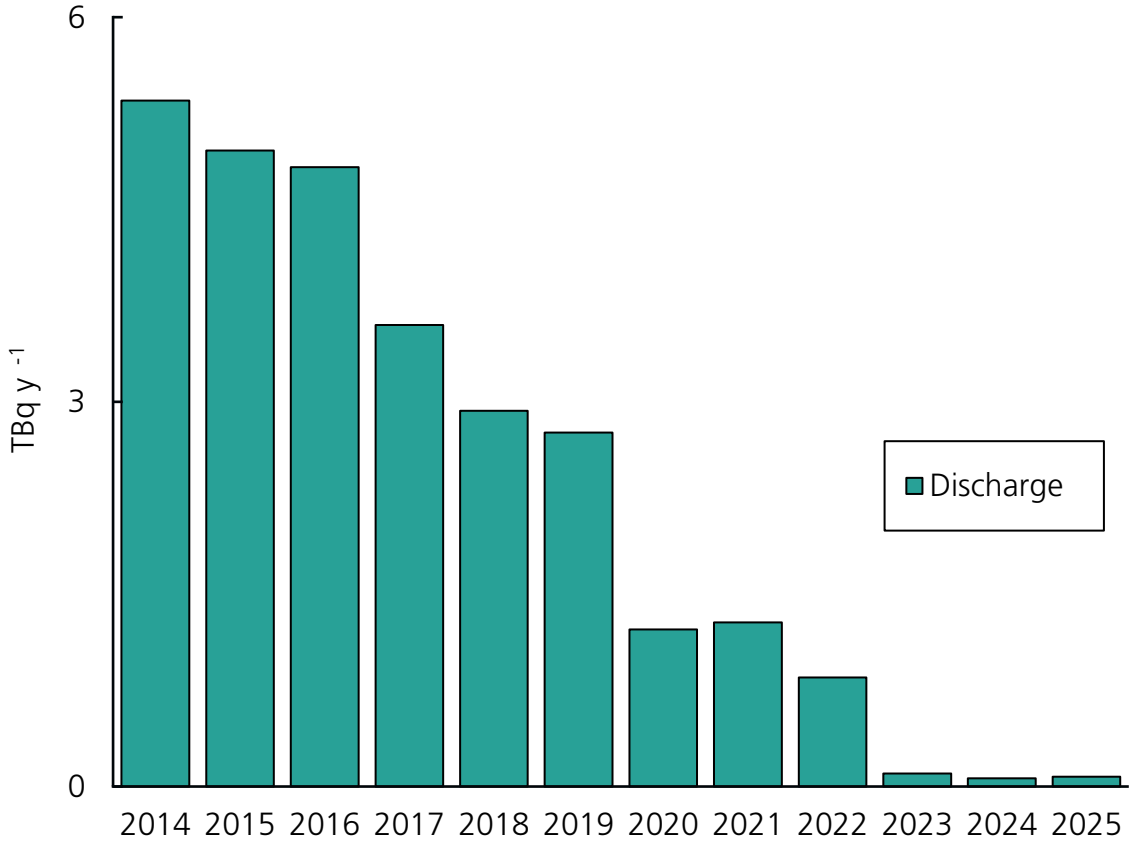


Figure 3.32 Cobalt-60 concentrations in plaice, lobsters and winkles from near Sellafield, in Bq kg^{-1} (fresh) and liquid discharge from Sellafield, in TBq y^{-1}, 2014 to 2025

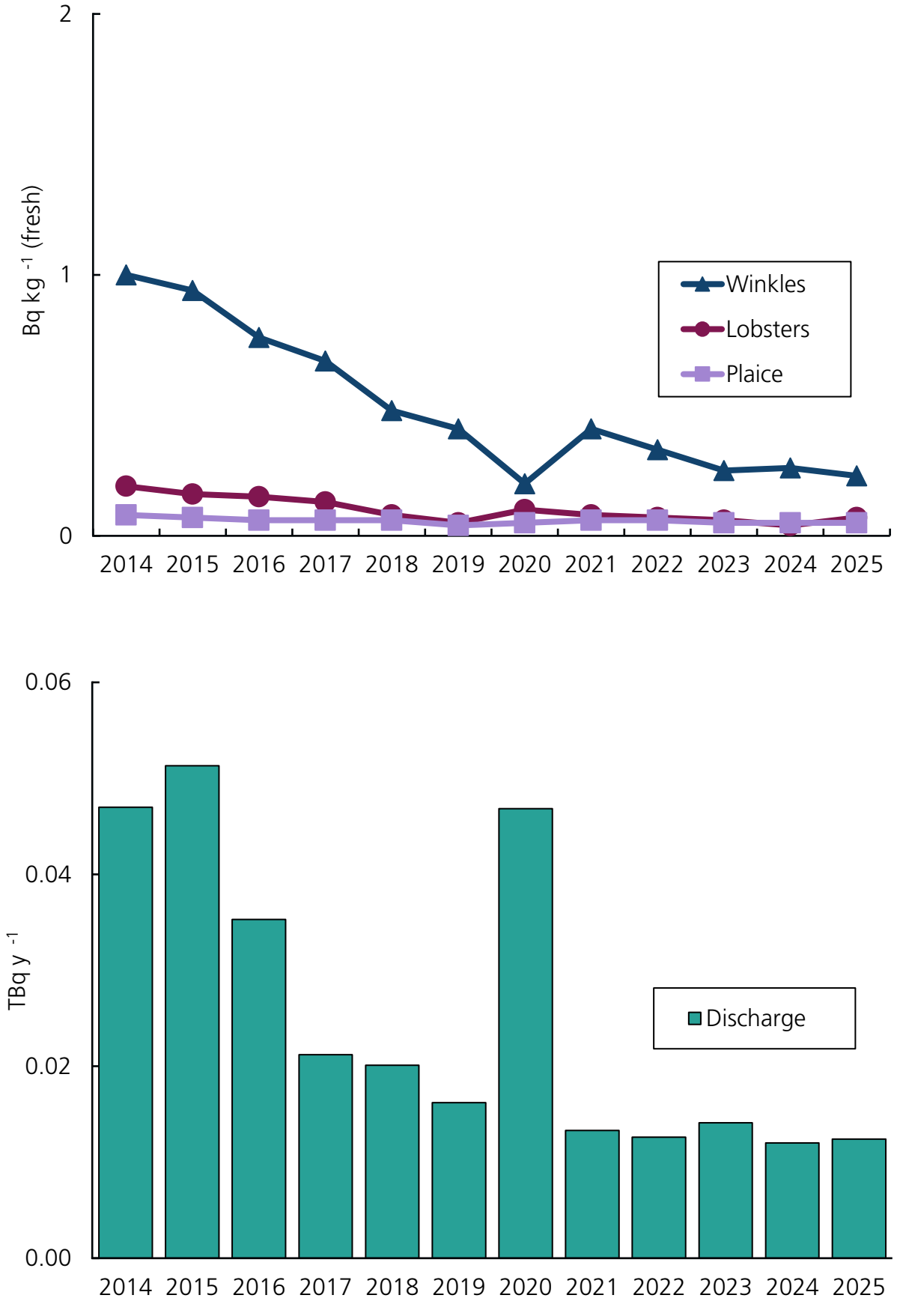


Figure 3.33 Technetium-99 concentrations in plaice, lobsters and winkles from near Sellafield, in Bq kg^{-1} (fresh) and liquid discharge from Sellafield, in TBq y^{-1}, 2014 to 2025

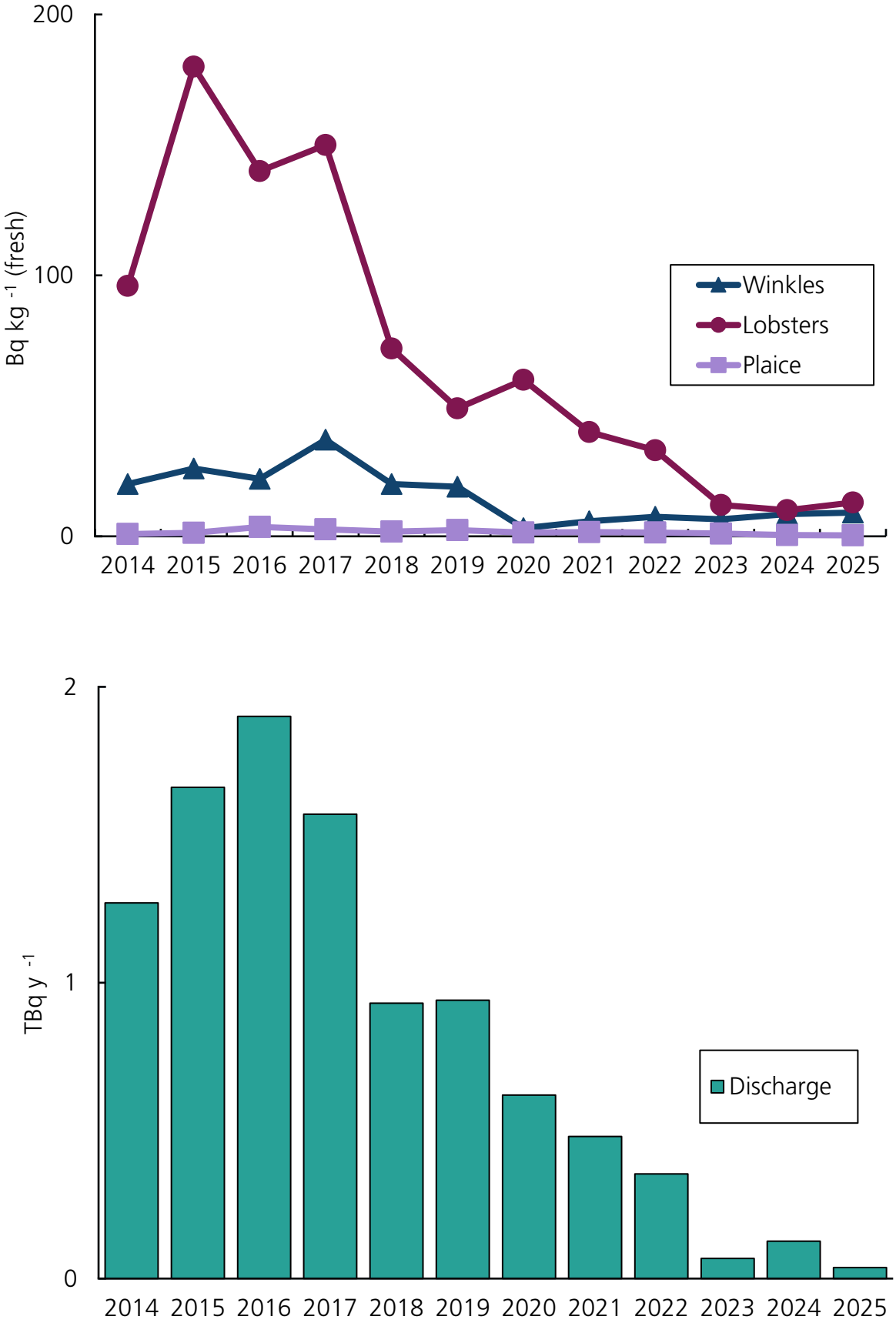
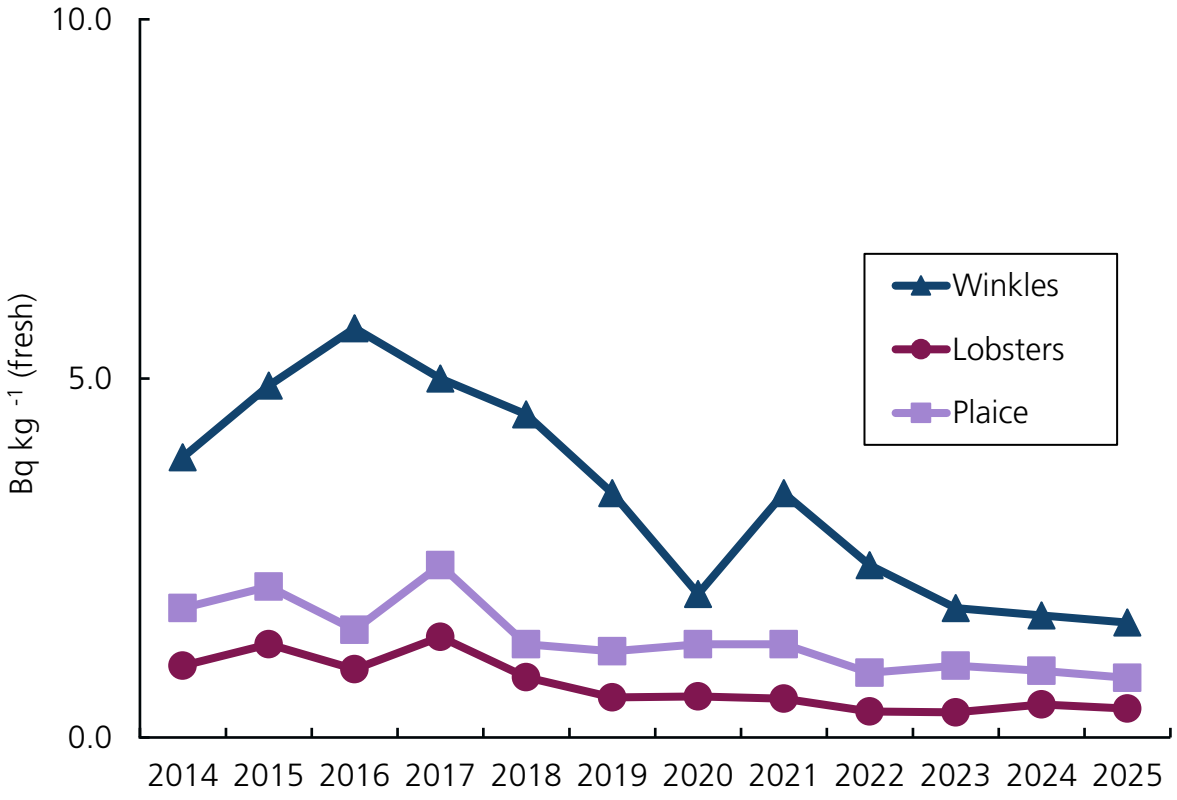


Figure 3.34 Caesium-137 concentrations in plaice, lobsters and winkles from near Sellafield, in Bq kg^{-1} (fresh) and liquid discharge from Sellafield, in TBq y^{-1}, 2014 to 2025



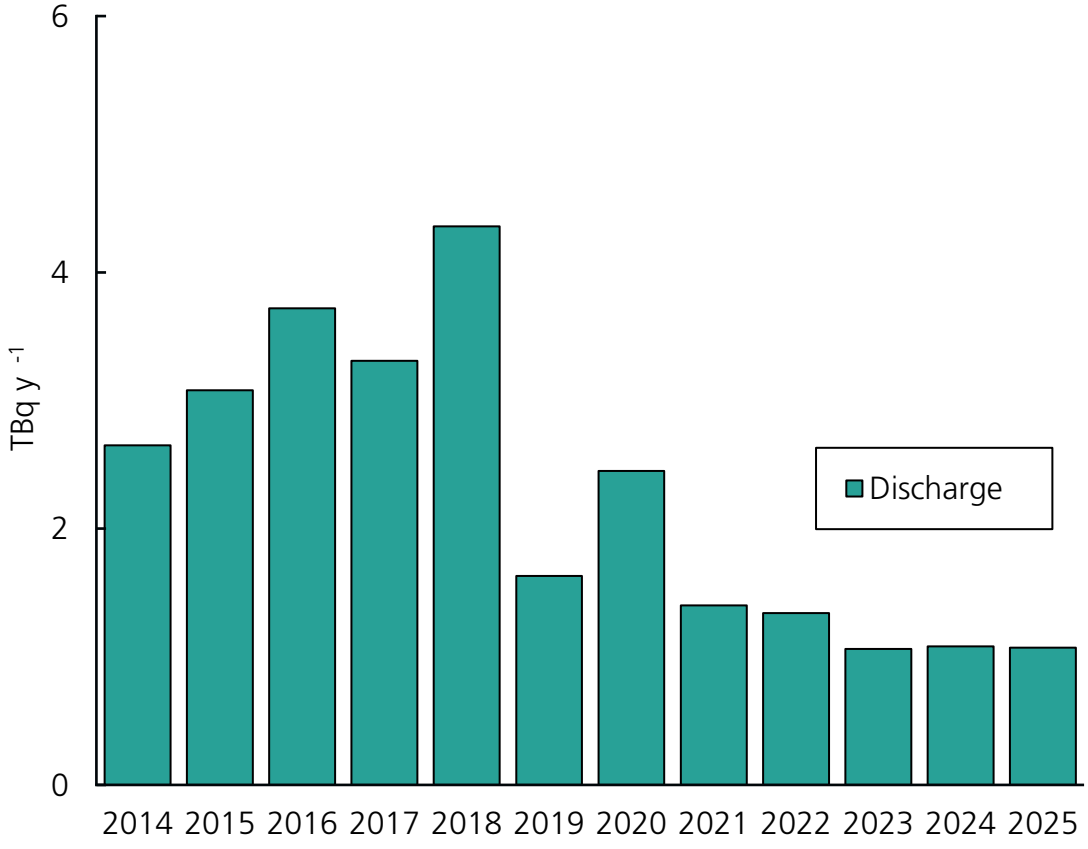


Figure 3.35 Plutonium-239+240 concentrations in plaice, lobsters and winkles from near Sellafield, in Bq kg^{-1} (fresh) and liquid discharge from Sellafield, in TBq y^{-1}, 2014 to 2025

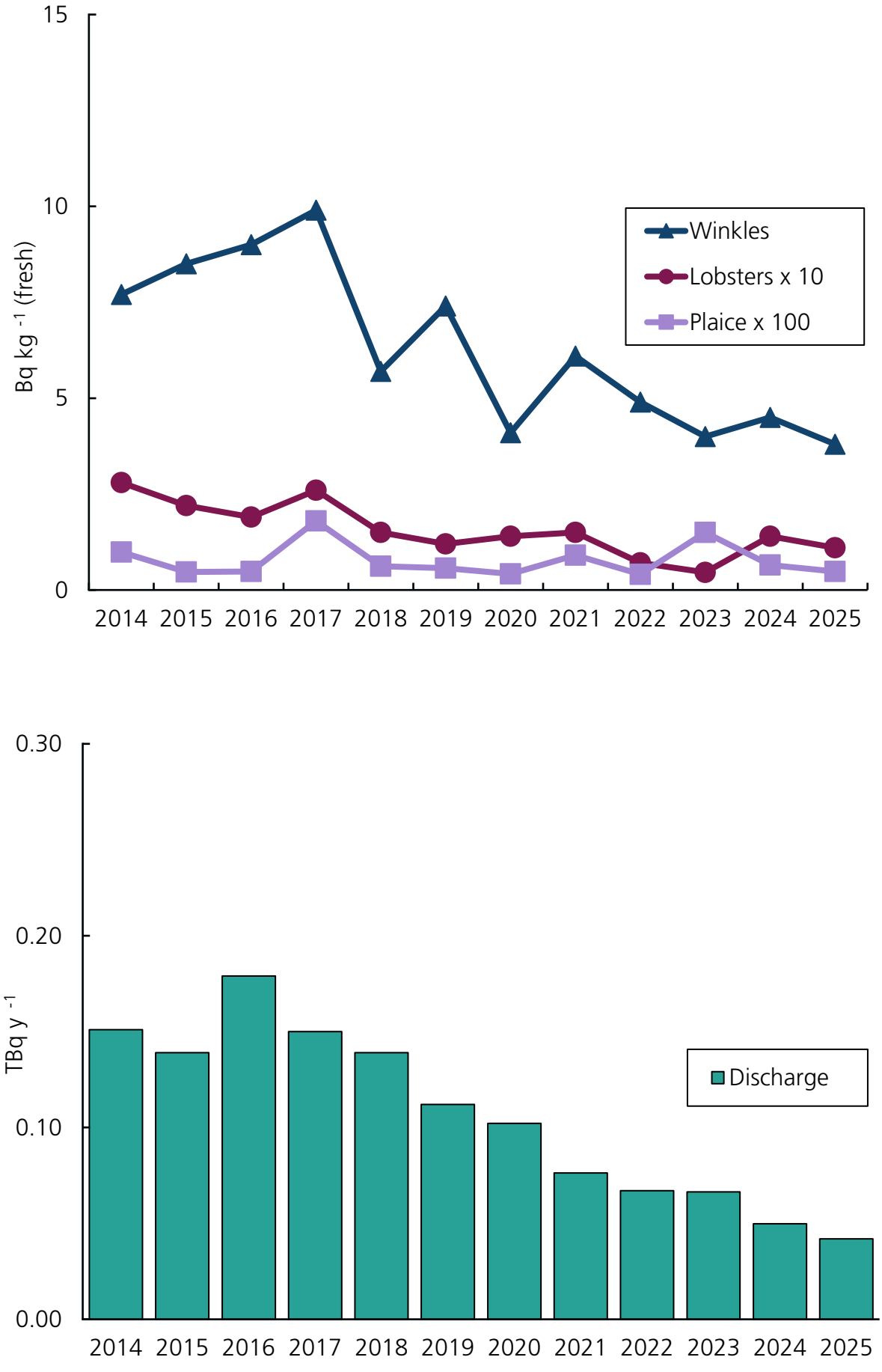
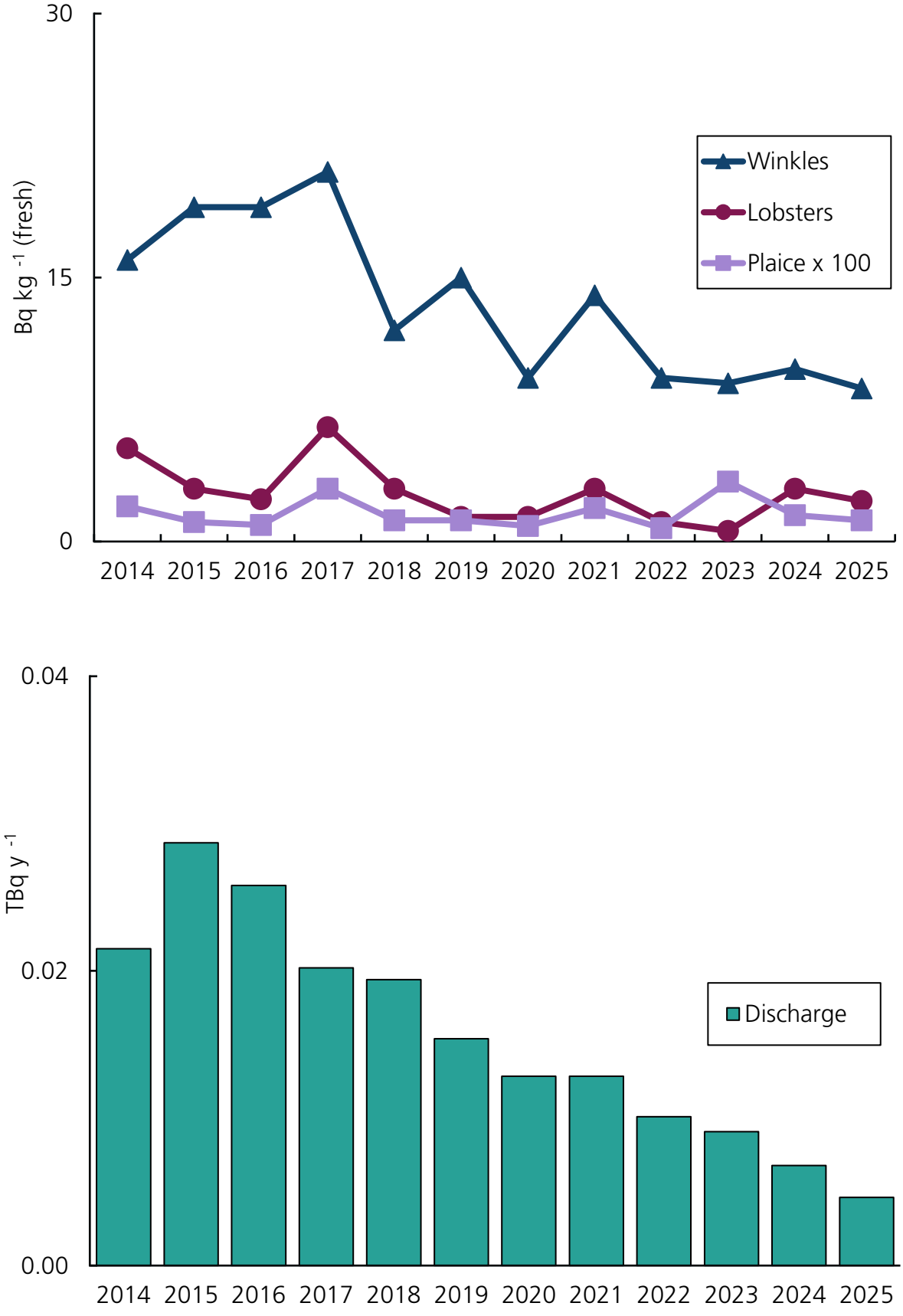


Figure 3.36 Americium-241concentrations in plaice, lobsters and winkles from near Sellafield, in Bq kg^{-1} (fresh) and liquid discharge from Sellafield, in TBq y^{-1}, 2014 to 2025



Beta- and gamma-emitting radionuclides detected in fish included tritium, carbon-14, technetium-99 and caesium-137 (Table 3.5). Overall, concentrations of caesium-137 in fish species, across a wide range of sampling locations, were generally similar in 2025, compared to those in 2024. Over longer time, activity concentrations in fish and shellfish appear to be generally declining (with minor variations) at a slow rate (Figure 3.34). Activity concentrations in fish (and shellfish) generally reflected progressive dilution with increasing distance from Sellafield. However, the rate of decline of caesium-137 concentrations with distance was not as marked as was the case when significant reductions in discharges were achieved in earlier decades.

Other artificial beta- and gamma-emitting radionuclides detected in fish included carbon-14 and tritium (Table 3.5). With an expected carbon-14 concentration from natural sources of about 19Bq kg^{-1} (see Appendix 6, Table A6.1), the data suggest a continued local enhancement of carbon-14 due to discharges from Sellafield. In 2025, carbon-14 is reported as the highest activity concentration in marine fish (plaice, 31Bq kg^{-1}) from Ravenglass. In 2025 most of both tritium and organically bound tritium (OBT) values, across all species and locations, were reported as below the limit of detection.

For shellfish, a wide range of radionuclides is detectable, owing to generally greater uptake of radioactivity by these organisms from sediments. Generally, molluscs tend to contain higher concentrations than crustaceans and both contain higher concentrations than fish. Concentrations of beta- and gamma-emitting radionuclides are shown in Table 3.6 (Table 3.7 for plutonium-241). There can be substantial variations between species; for example, lobsters tend to concentrate more technetium-99 than crabs (as shown in references, [141,142]). The highest concentrations in the marine environment from Sellafield discharges were carbon-14, tritium and technetium-99. Comparing 2024 and 2025 data across a wide range of sampling locations and shellfish species (where comparisons can be made), technetium-99 concentrations were similar (with minor variations) but reduced in comparison to those years prior to 2012 due to the progressive reductions in discharges of this radionuclide. Concentrations of other radionuclides (non-transuranic) in 2025 were also broadly similar (where comparisons can be made) to those in 2024.

Transuranic radionuclide data for fish and shellfish samples (chosen on the basis of potential radiological significance) in 2025 are given in Table 3.7. Transuranic elements are less mobile than other radionuclides in seawater and have a high affinity for sediments. This is reflected in higher concentrations of transuranic elements in shellfish compared with fish. Comparing 2025 and 2024 data across a wide range of sampling locations and shellfish species further afield from Sellafield, concentrations in shellfish were generally similar (where comparisons can be made). Those from the north-eastern Irish Sea were the highest transuranic concentrations found in foodstuffs in the UK. In 2025, the concentrations of plutonium and americium-241 in shellfish were generally lower (by small amounts) compared to those in 2024 at most of the north-eastern Irish Sea locations (for example, winkles from Parton). Americium-241 concentrations in mussels (near Sellafield) were also generally similar in 2025, compared to those in 2024. Overall, plutonium-239+240 and americium-241 concentrations in lobsters (near Sellafield) were generally similar (with minor variations) in 2025, compared to those in recent years. Variations of these observations in previous years were likely to have resulted from a combination of mechanisms including natural environmental variability and redistribution of sediments due to natural processes.

3.3.3.3 Monitoring of sediments

Radionuclides in Sellafield liquid discharges are taken up by sediments along the Cumbrian Coast, in particular in muddier (fine grained) areas such as estuaries. Some of these areas are used by the public. Concentrations of radionuclides are regularly monitored, both because of their relevance to exposure and to keep distributions of radioactivity under review. The results for 2025 are shown in Table 3.8. Radionuclides positively detected were cobalt-60, strontium-90, caesium-137, and transuranic elements. The highest concentrations found are close to the site and in fine particulate materials in estuaries and harbours, rather than the coarser grained sands on open beaches. In 2025, the concentrations of caesium-137 and plutonium-238, plutonium-239+240, plutonium-241 and americium-241 radionuclides were lower in the River Mite Estuary (an erosional area), compared to those in 2024. The concentrations of long-lived radionuclides, particularly caesium-137 and the transuranic elements, largely reflect past discharges from Sellafield, which were considerably higher than in recent years. Over the last 4 decades, discharges have fallen significantly as the site provided enhanced treatment to remove radionuclides prior to discharge. Overall, concentrations in sediments were generally similar in 2025, compared to those in 2024.

The trends over time (1996 to 2025) for activity concentrations in mud from Ravenglass and liquid discharges from Sellafield are shown in Figure 3.37 to Figure 3.40. The concentrations of most radionuclides have declined over the time period in response to decreases in discharges, with sustained reductions in discharges of caesium-137 and transuranic elements. Discharges of cobalt-60 have been variable in the earlier years but reduced over the last decade, as reflected in the sediment concentrations at Ravenglass, with some evidence of a time lag between discharge and sediment concentration (Figure 3.39). Over the last decade, caesium-137 and transuranic concentrations in sediments have remained relatively constant (Figure 3.37, Figure 3.38 and Figure 3.40). Since the mid-1990s, discharges of caesium-137, plutonium isotopes and americium-241 have remained low, but with some variability. There is a suggestion of small progressive increases in caesium-137 and transuranic elements activities in sediments (peaking in both 2006 and 2014). The likely explanation is that changes in these concentrations are due to remobilisation and subsequent accretion of fine-grained sediments containing higher activity concentrations. For americium-241, there is also a contribution due to radioactive in-growth from the parent plutonium-241 already present in the environment. The effect is less apparent in fish and shellfish (Figure 3.34 to Figure 3.36) and will continue to be monitored.

Figure 3.37 Caesium-137 concentration in mud at Ravenglass, in Bq kg^{-1} (dry), liquid discharge from Sellafield, in TBq y^{-1}, 1996 to 2025.

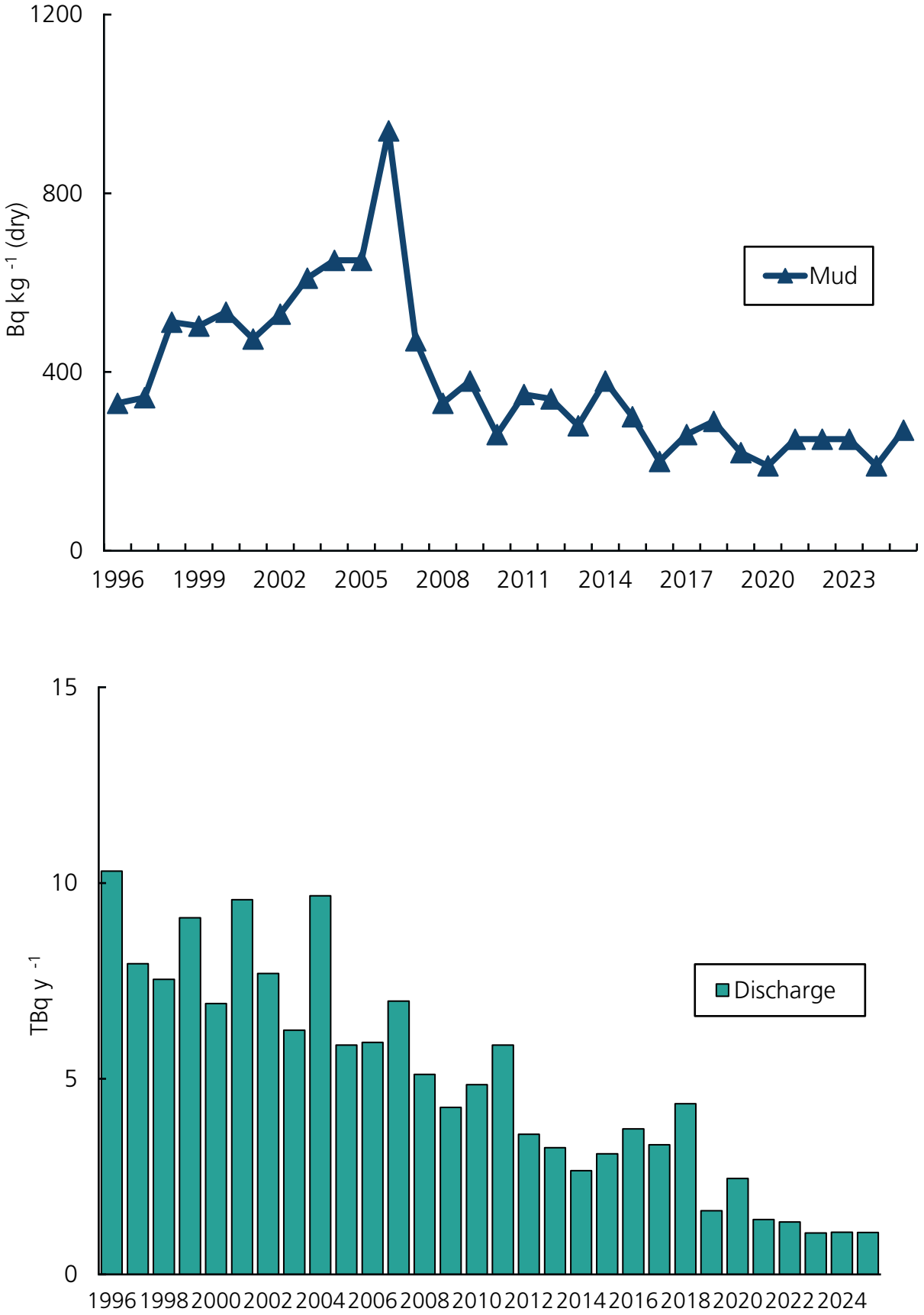
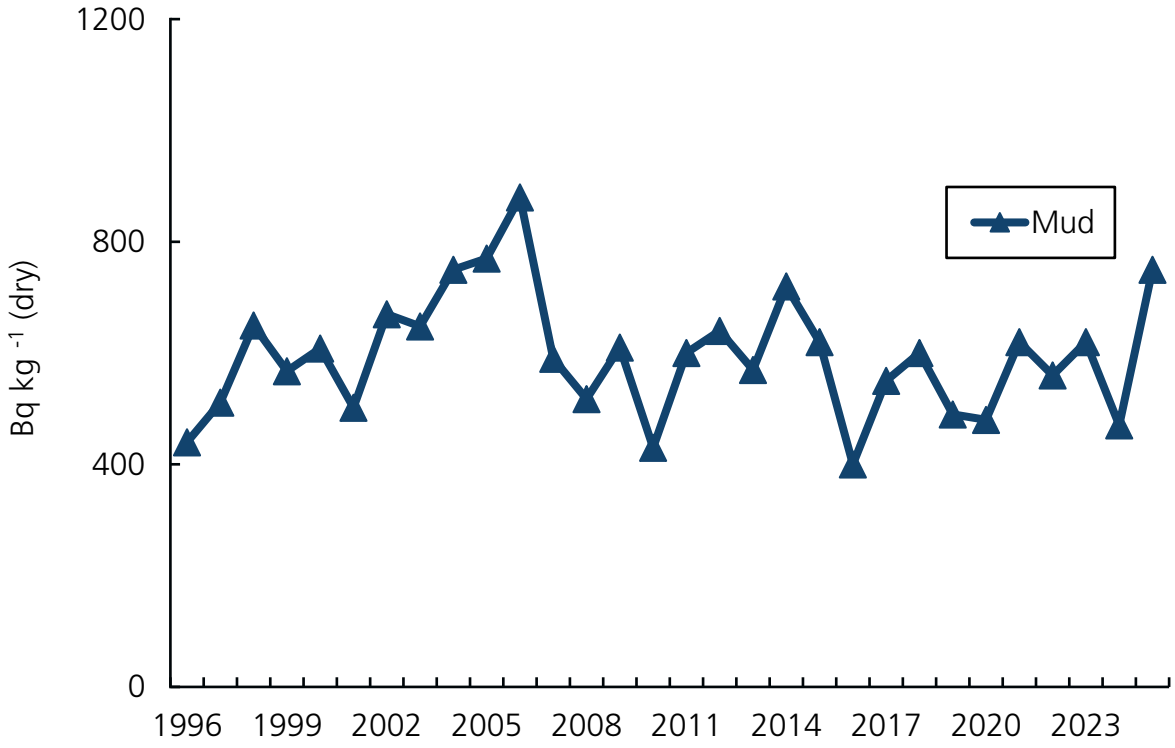


Figure 3.38 Plutonium-alpha concentration in mud at Ravenglass, in Bq kg^{-1} (dry), liquid discharge from Sellafield, in TBq y^{-1}, 1996 to 2025.



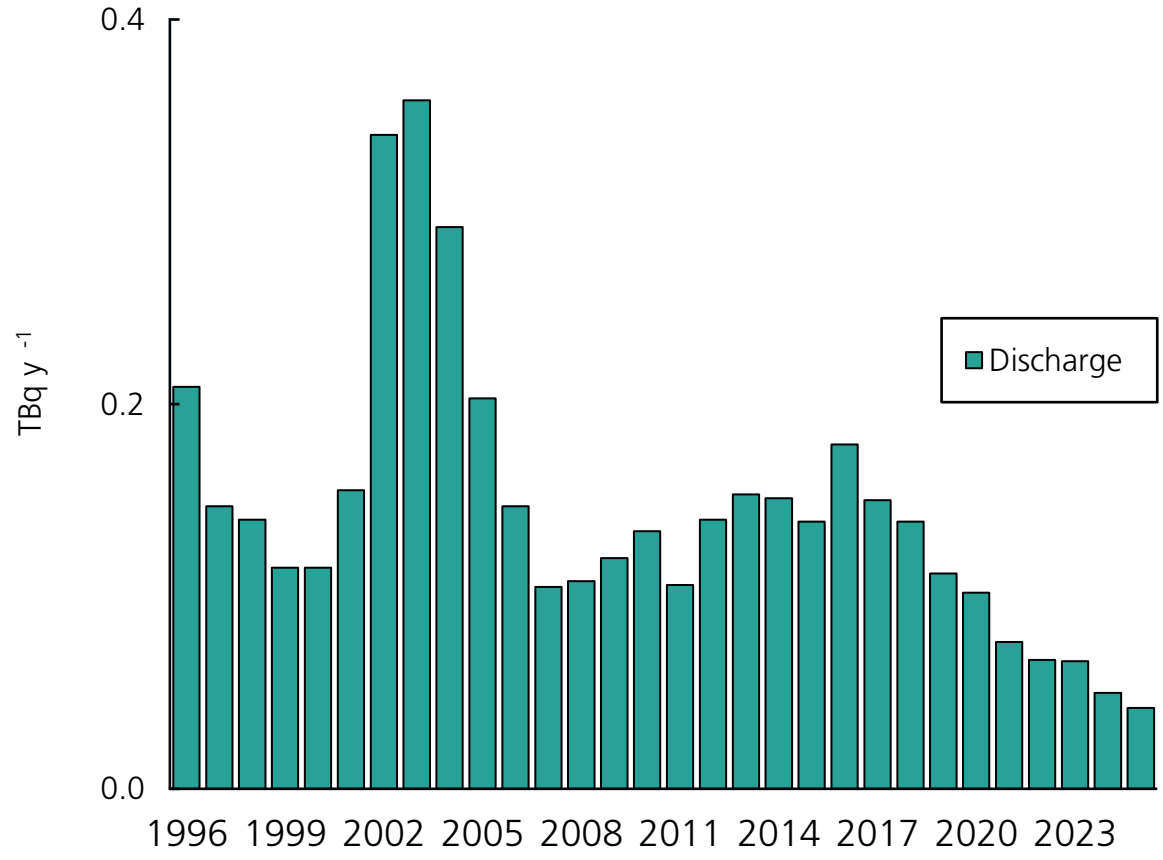


Figure 3.39 Cobalt-60 concentration in mud at Ravenglass, in Bq kg-1 (dry), liquid discharge from Sellafield, in TBq y-1, 1996 to 2025.

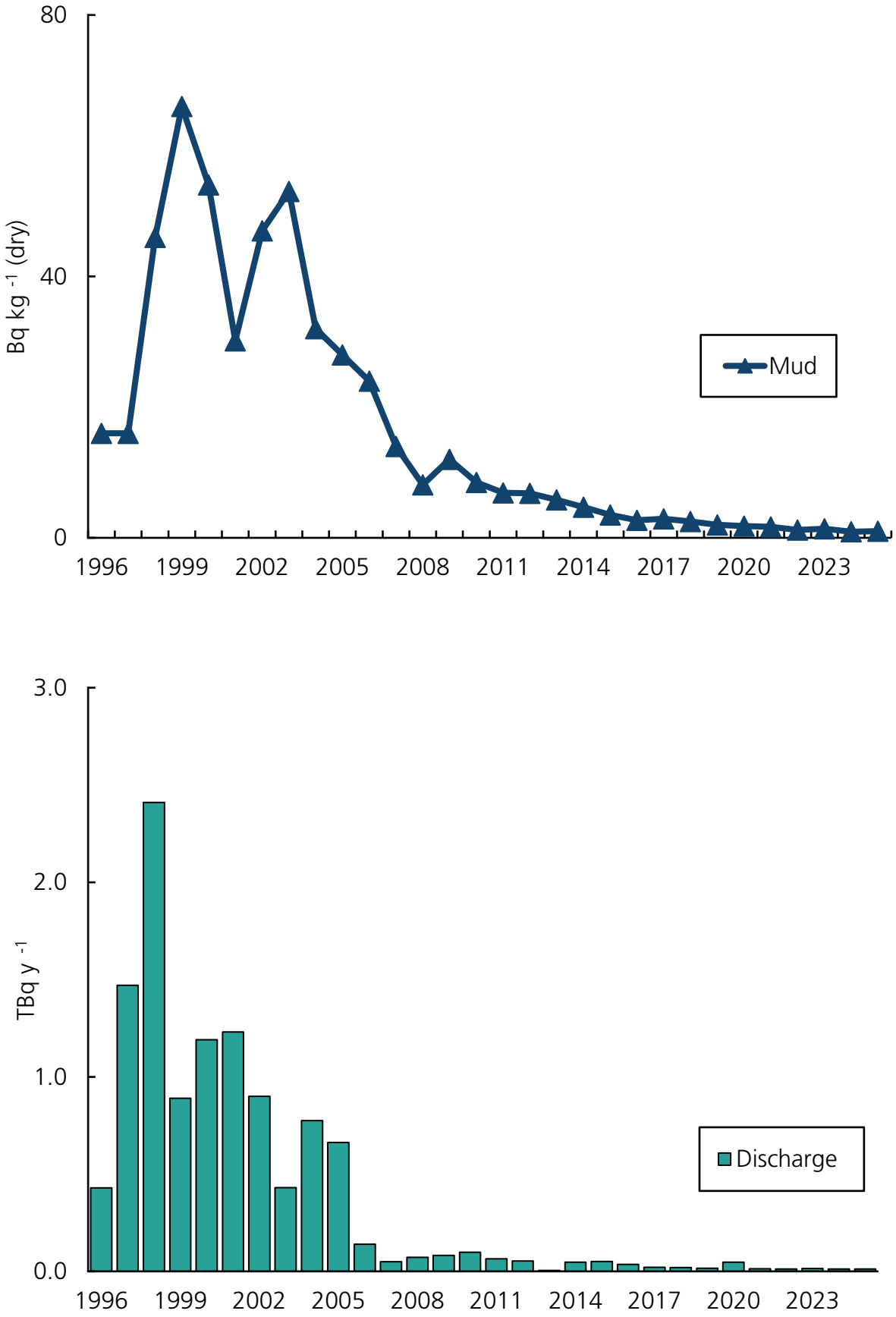
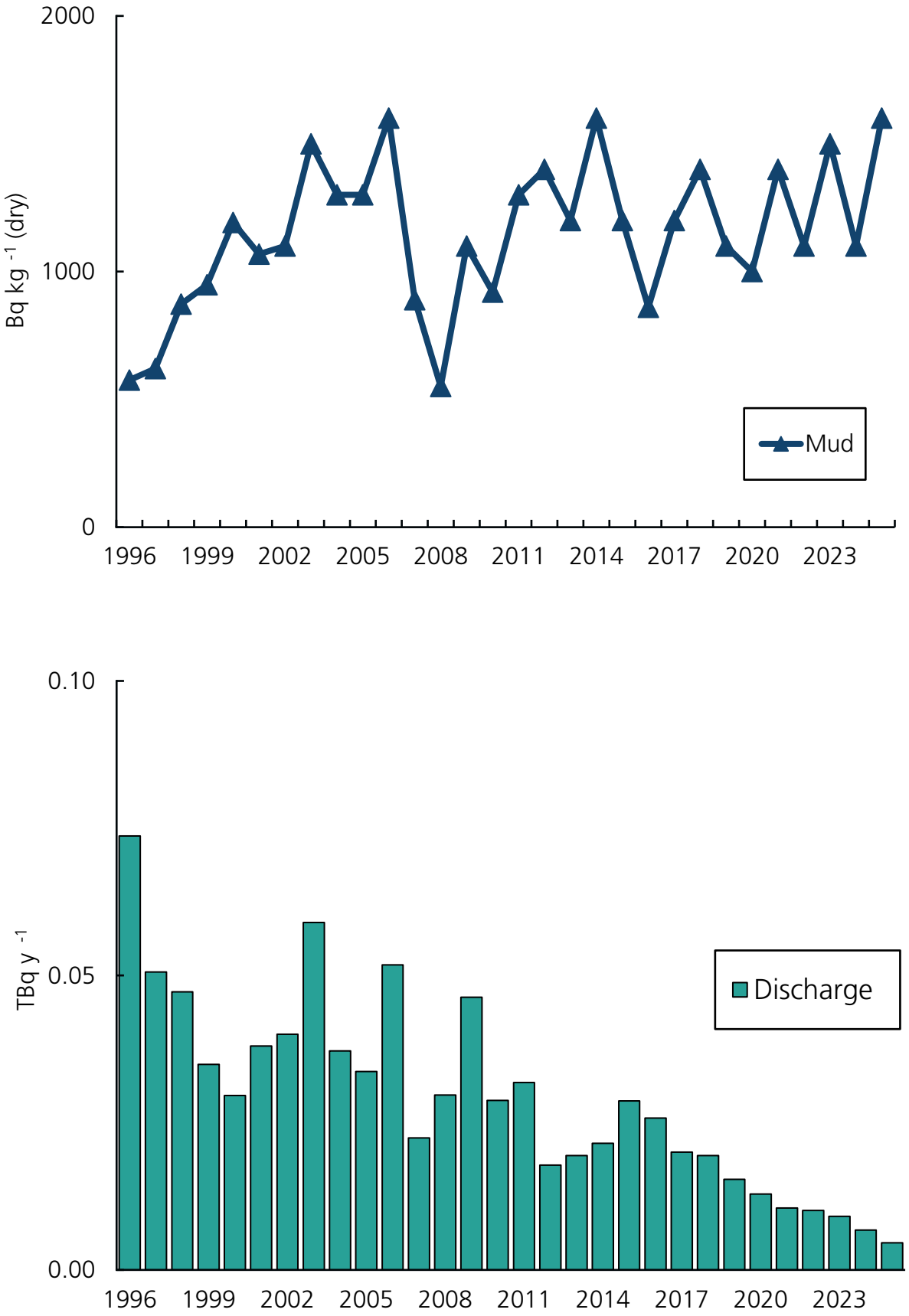


Figure 3.40 Americium-241 concentration in mud at Ravenglass, in Bq kg^{-1} (dry), liquid discharge from Sellafield, in TBq y^{-1}, 1996 to 2025.



Concentrations of caesium-137 and americium-241 in sediments from coastal locations of the north-east Irish Sea, including locations on the Dumfries and Galloway coast, Cumbrian coastline, Flookburgh, River Ribble estuary and North Wales coast, are also shown in Figure 3.41 to Figure 3.48. Concentrations of both radionuclides diminish with distance from Sellafield. Overall, concentrations in 2025 at a given location were generally similar to those in recent years, and any fluctuations were most likely due to the normal variability expected in the environment.

Figure 3.41 Concentrations of americium-241 and caesium-137 in coastal sediments, in Bq kg^{-1} (dry), at Innerwell between 1999 to 2025

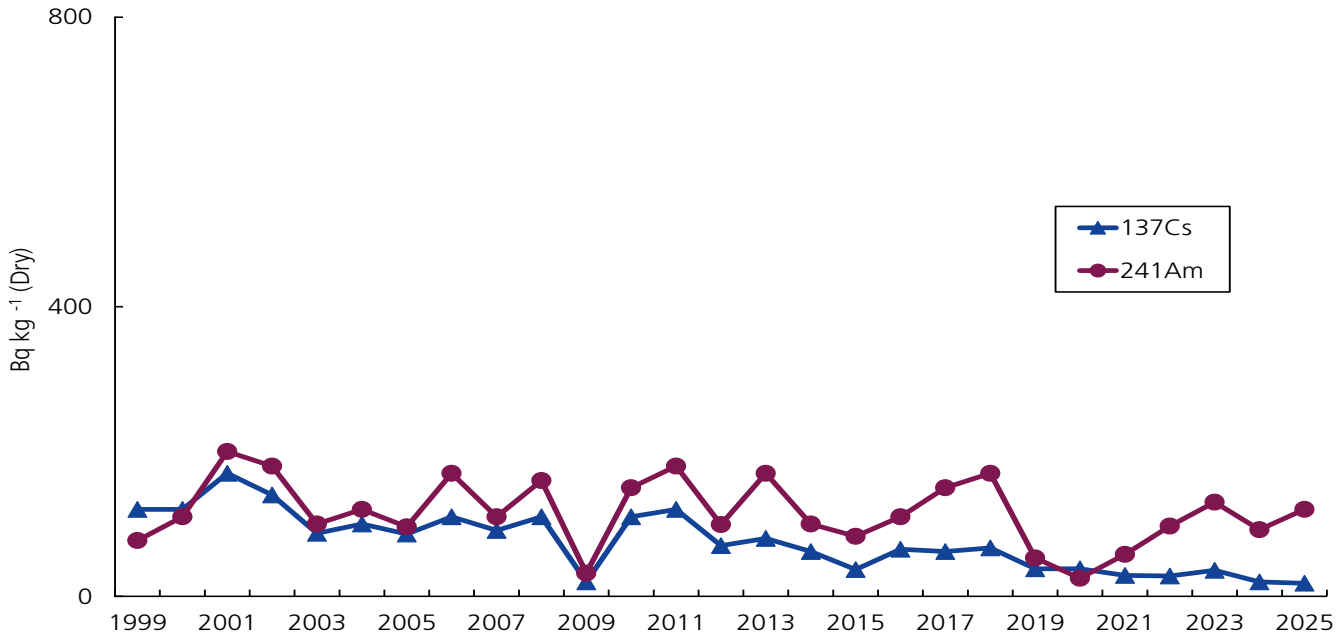


Figure 3.42 Concentrations of americium-241 and caesium-137 in coastal sediments, in Bq kg^{-1} (dry), at Carsluith between 1999 to 2025

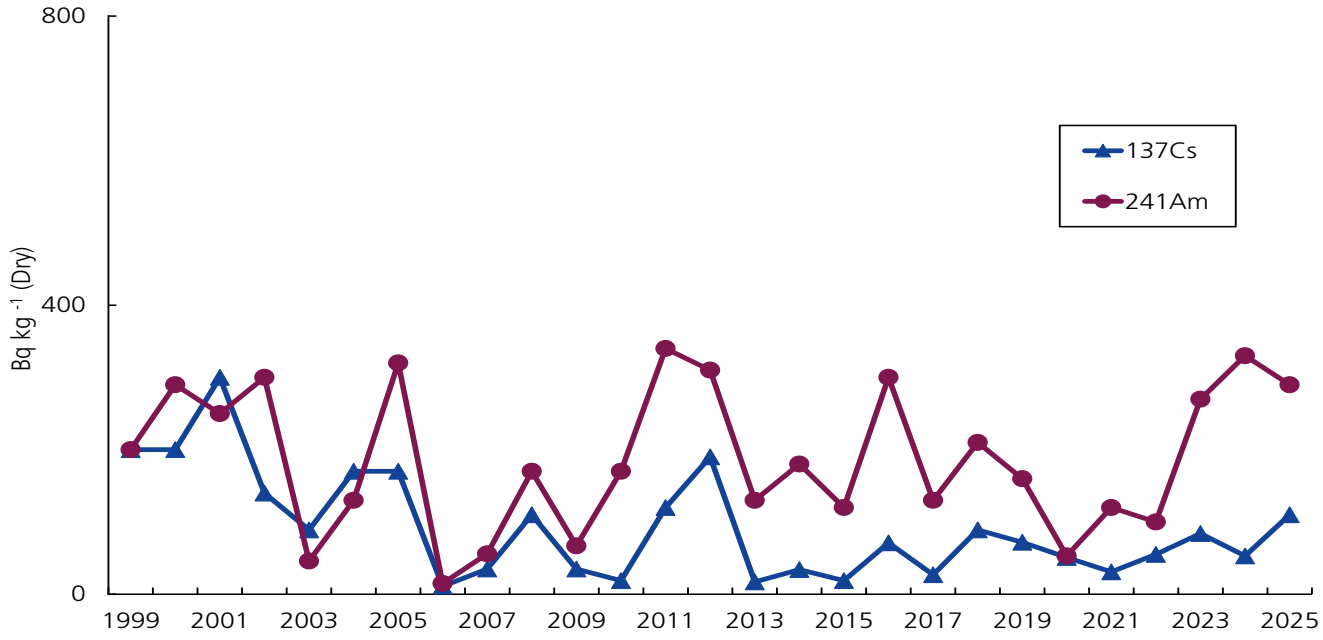


Figure 3.43 Concentrations of americium-241 and caesium-137 in coastal sediments, in Bq kg^{-1} (dry), at Newton between 1999 to 2025

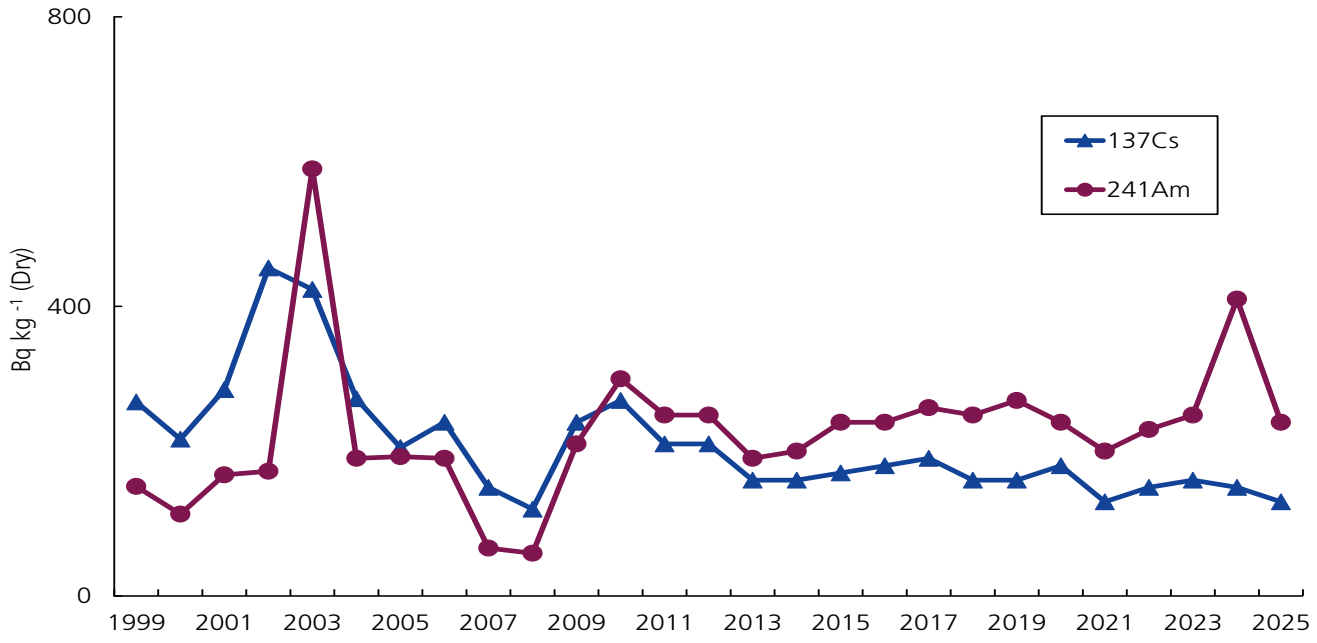


Figure 3.44 Concentrations of americium-241 and caesium-137 in coastal sediments, in Bq kg^{-1} (dry), at Carleton Marsh between 1999 to 2025

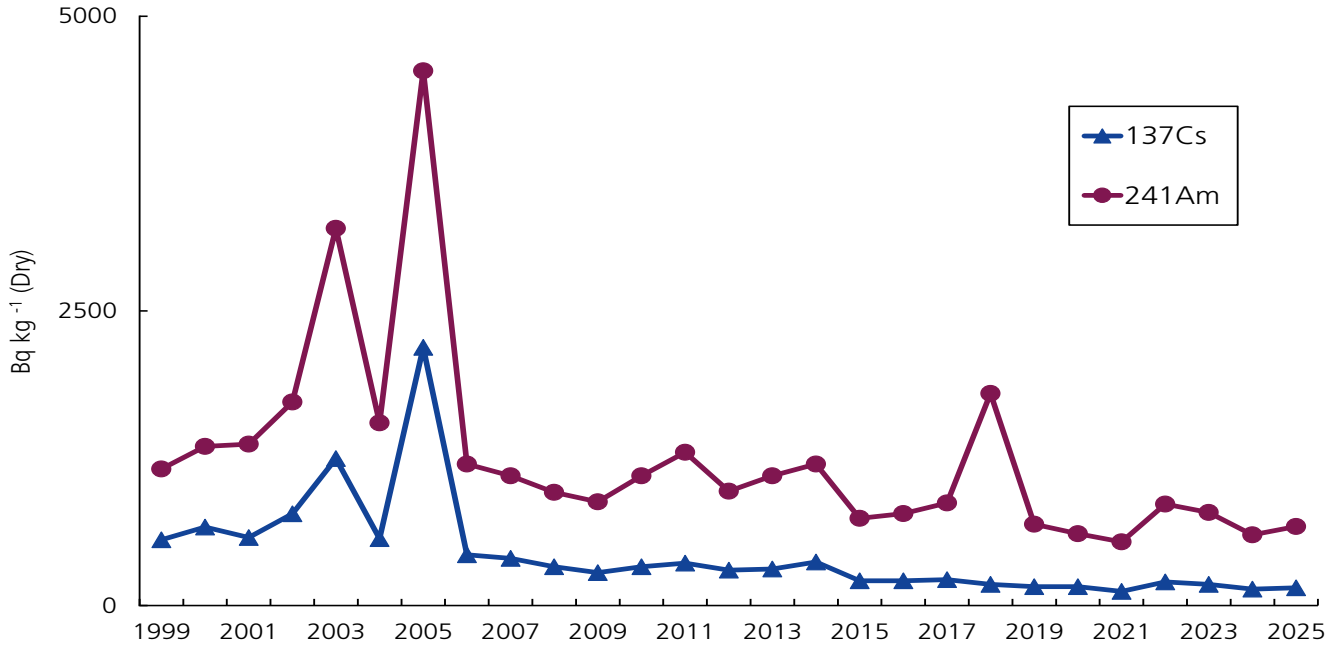


Figure 3.45 Concentrations of americium-241 and caesium-137 in coastal sediments, in Bq kg^{-1} (dry), at Newbiggins/Eskmeals between 1999 to 2025

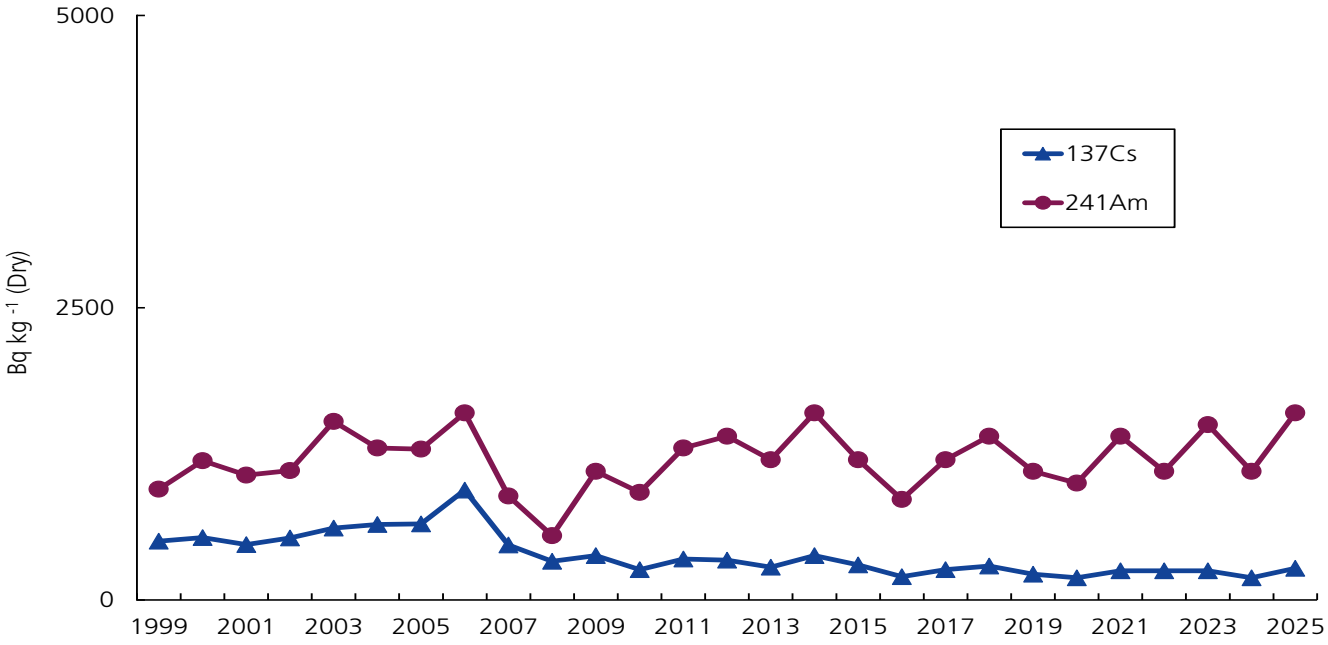


Figure 3.46 Concentrations of americium-241 and caesium-137 in coastal sediments, in Bq kg^{-1} (dry), at Flookburgh between 1999 to 2025

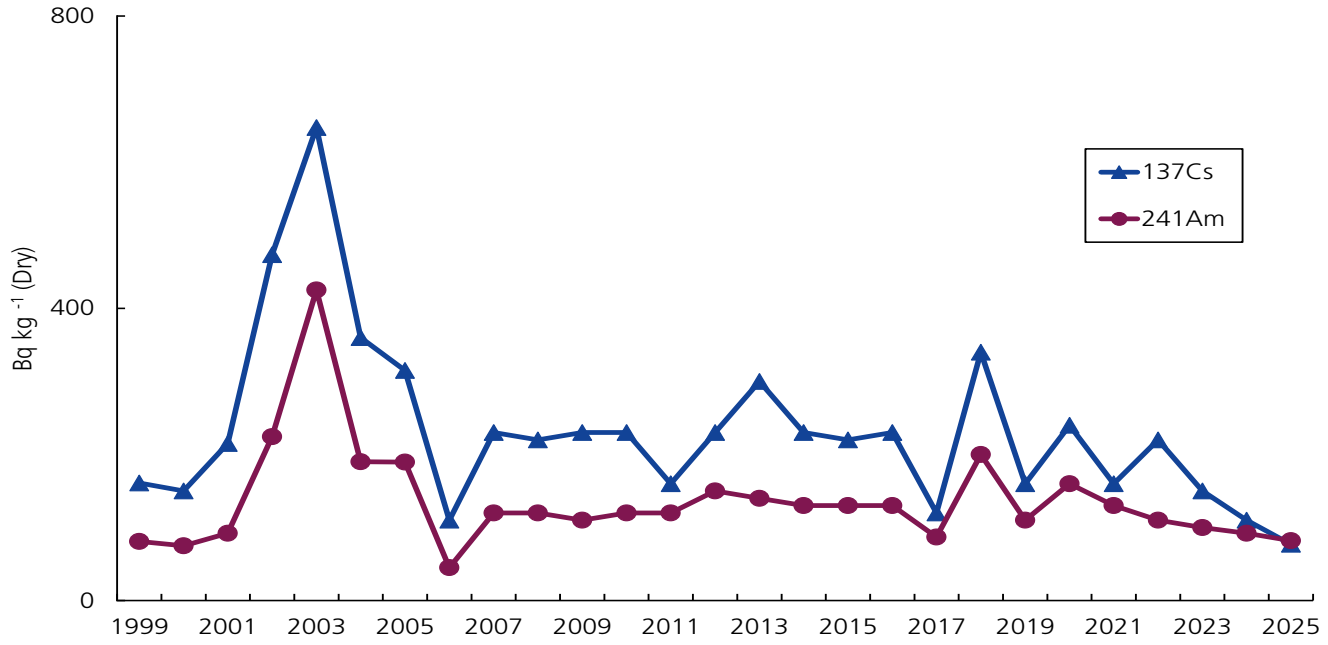


Figure 3.47 Concentrations of americium-241 and caesium-137 in coastal sediments, in Bq kg^{-1} (dry), at the River Ribble outfall between 1999 to 2025

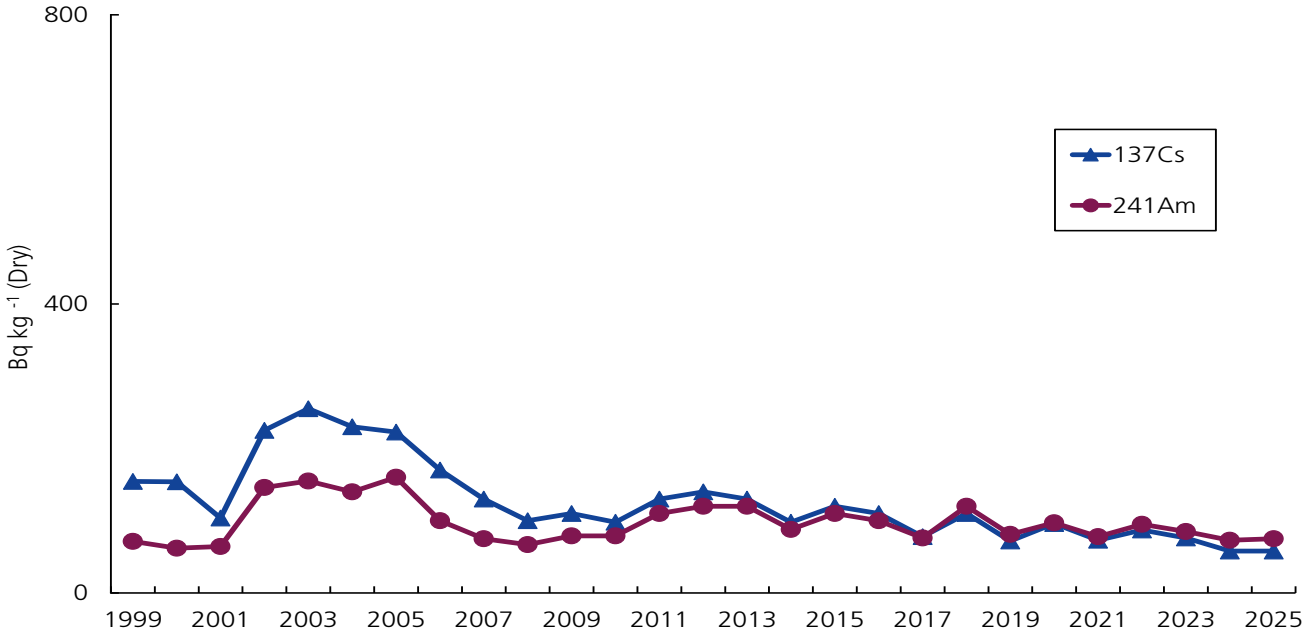
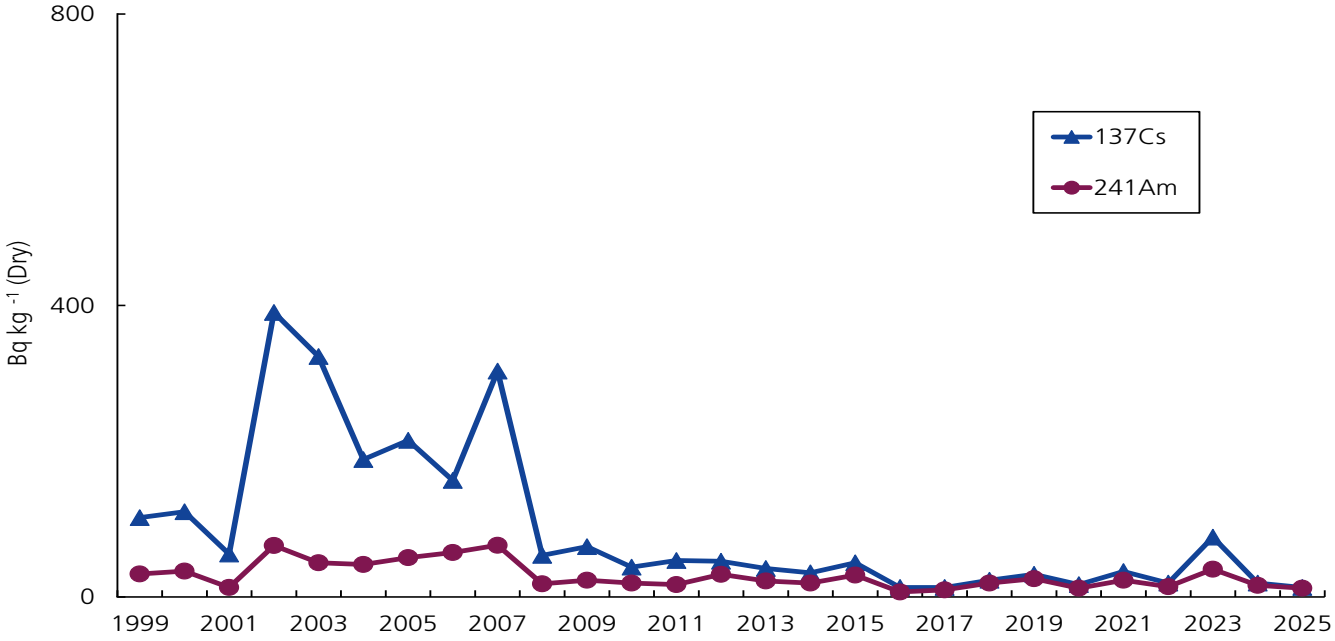


Figure 3.48 Concentrations of americium-241 and caesium-137 in coastal sediments, in Bq kg^{-1} (dry), at Caerhun between 1999 to 2025



3.3.3.4 Monitoring of dose rates

Dose rates are regularly monitored at many locations, both in the Sellafield vicinity and further afield, using environmental radiation dosimeters. Table 3.9 provides the locations monitored by the environment agencies and the gamma dose rates in air at 1 metre above ground. Where comparisons can be made from similar ground types and locations, dose rates over intertidal areas throughout the Irish Sea in 2025 were generally similar to those in recent years (with small variations compared to those in 2024). Any variations between years are likely to have been due to normal variability expected in the environment. As in previous years, gamma dose rates were measured on the banks of the River Calder, which flows through the Sellafield site. In 2025, gamma dose rates did not show a significant excess above natural background downstream of the site. Although these dose rates have been locally enhanced in previous years on the banks of the River Calder, occupancy by the public (mainly anglers) is low in this area, this is unlikely to be more than a few tens of hours per year. On this basis, the resulting doses (in previous years) were also much less than those at other intertidal areas as discussed earlier in this section.

Gamma dose rates above mud and salt marshes, from a range of coastal locations in the vicinity of Sellafield, are shown in Figure 3.49 to Figure 3.56 (2014 to 2025). Gamma dose rates at sandy locations are generally lower than those above mud or salt marshes. The general decrease in dose rates with increasing distance from Sellafield, which was apparent under conditions of higher discharges several decades ago, is no longer so prominent in recent years. Spatial variability of dose rates is expected, depending on ground type, with generally higher dose rates recorded over areas with finely grained sediments. For each location, there has been variation over time. Close to Sellafield (at Carleton Marsh and Newbiggin), there is some evidence to suggest that dose rates were slowly declining over time. Locations that are further afield from Sellafield show dose rate values that only marginally exceed average UK natural background rates.

Figure 3.49 Gamma dose rates, in microGy h^{-1}, above fine coastal sediments (mud and salt marshes) at Innerwell between 2014 to 2025.

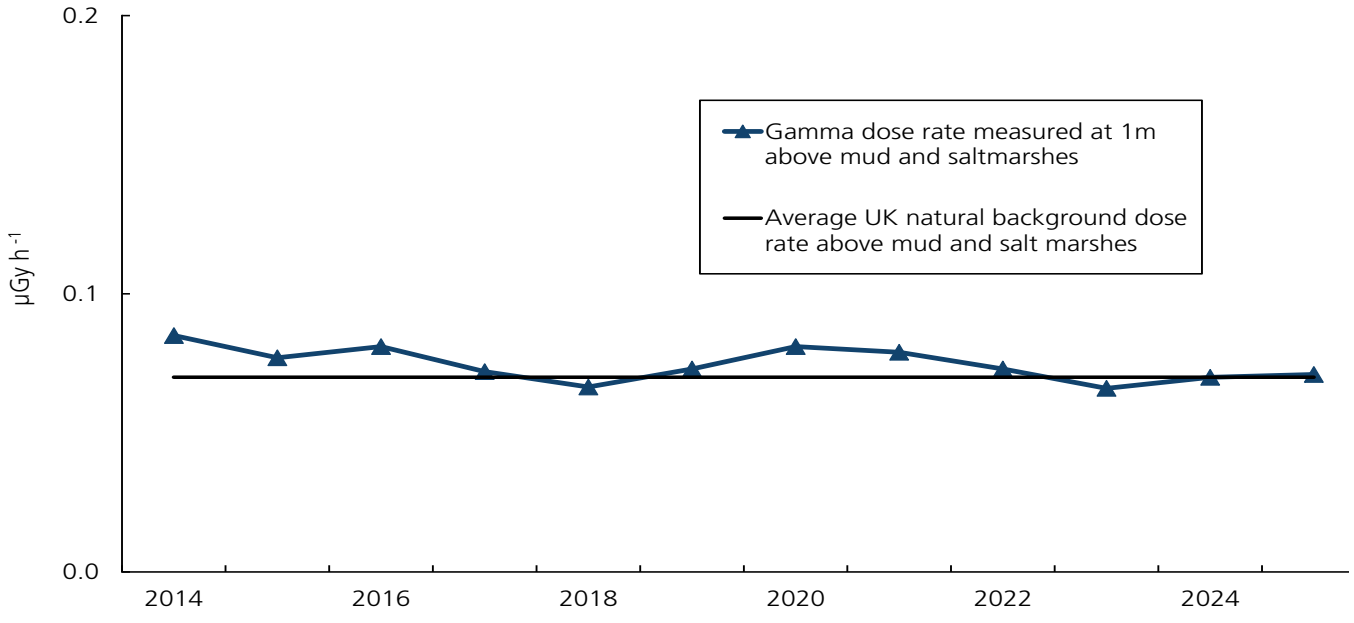


Figure 3.50 Gamma dose rates, in microGy h^{-1}, above fine coastal sediments (mud and salt marshes) at Carsluith between 2014 to 2025.

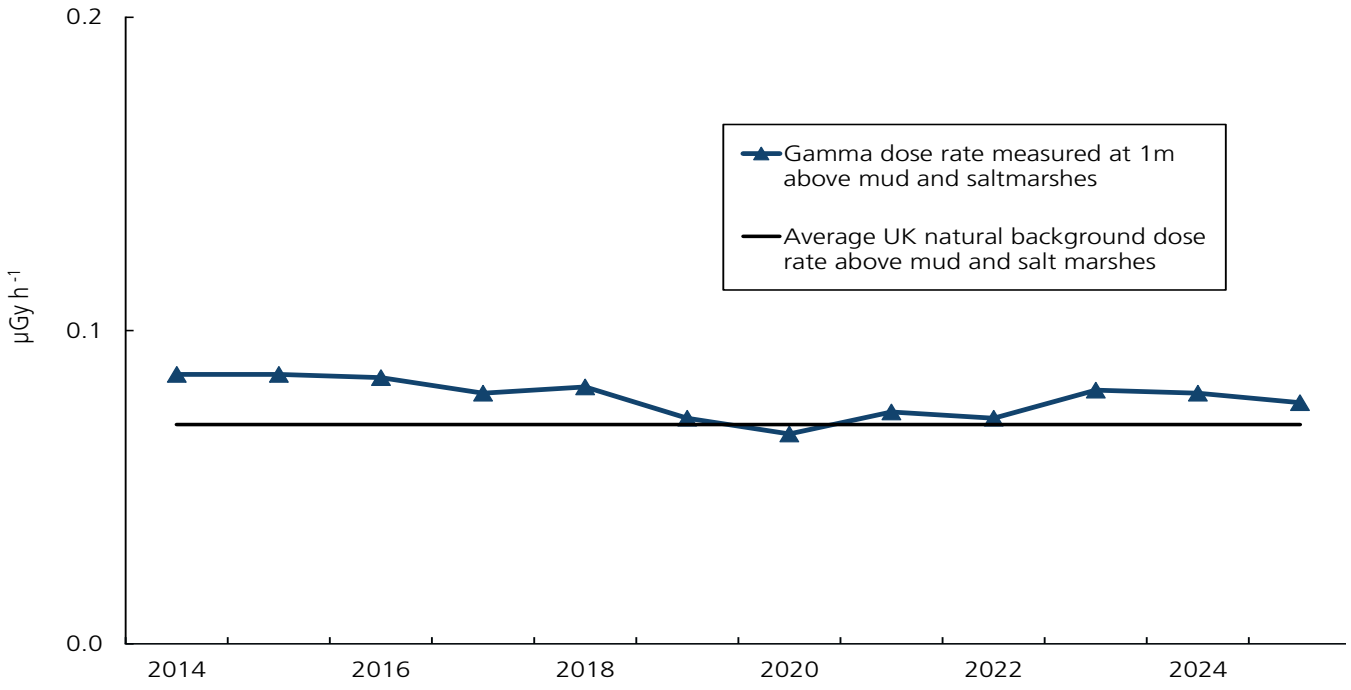


Figure 3.51 Gamma dose rates, in microGy h^{-1}, above fine coastal sediments (mud and salt marshes) at Newton Arlosh between 2014 to 2025.

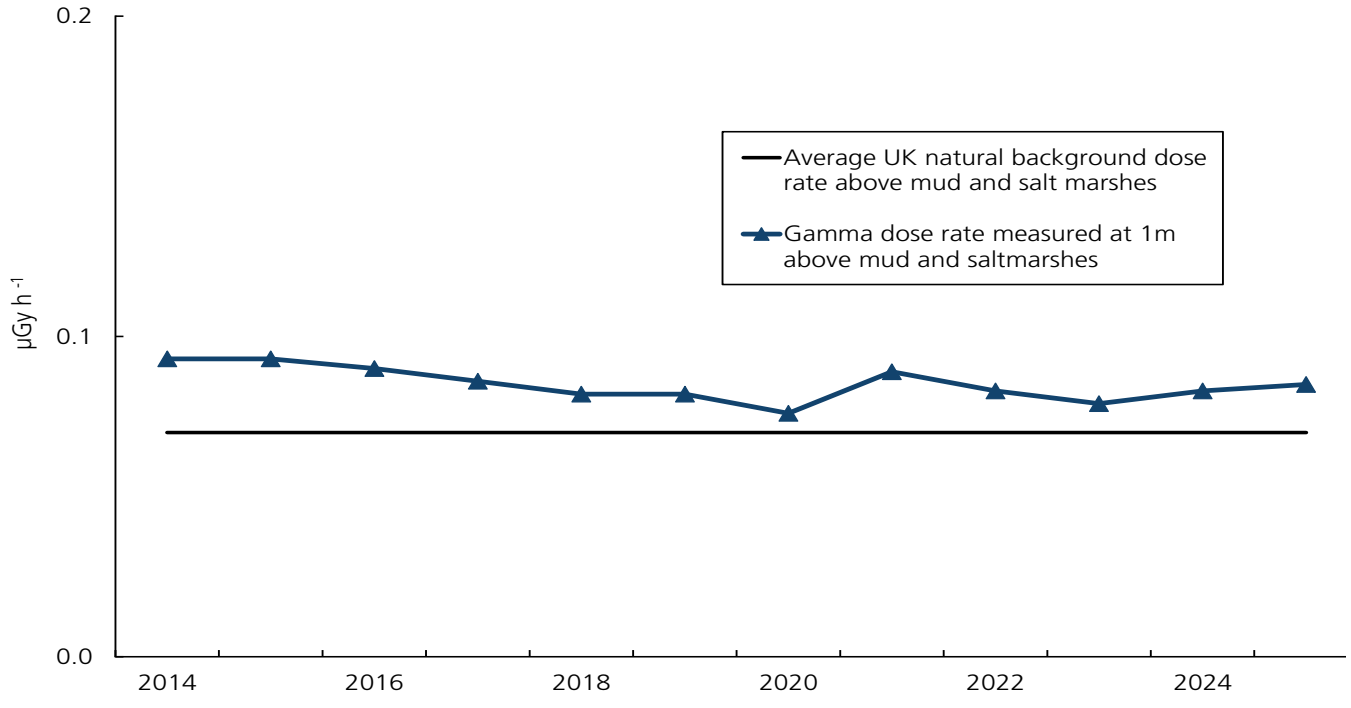


Figure 3.52 Gamma dose rates, in microGy h^{-1}, above fine coastal sediments (mud and salt marshes) at Carleton Marsh between 2014 to 2025.

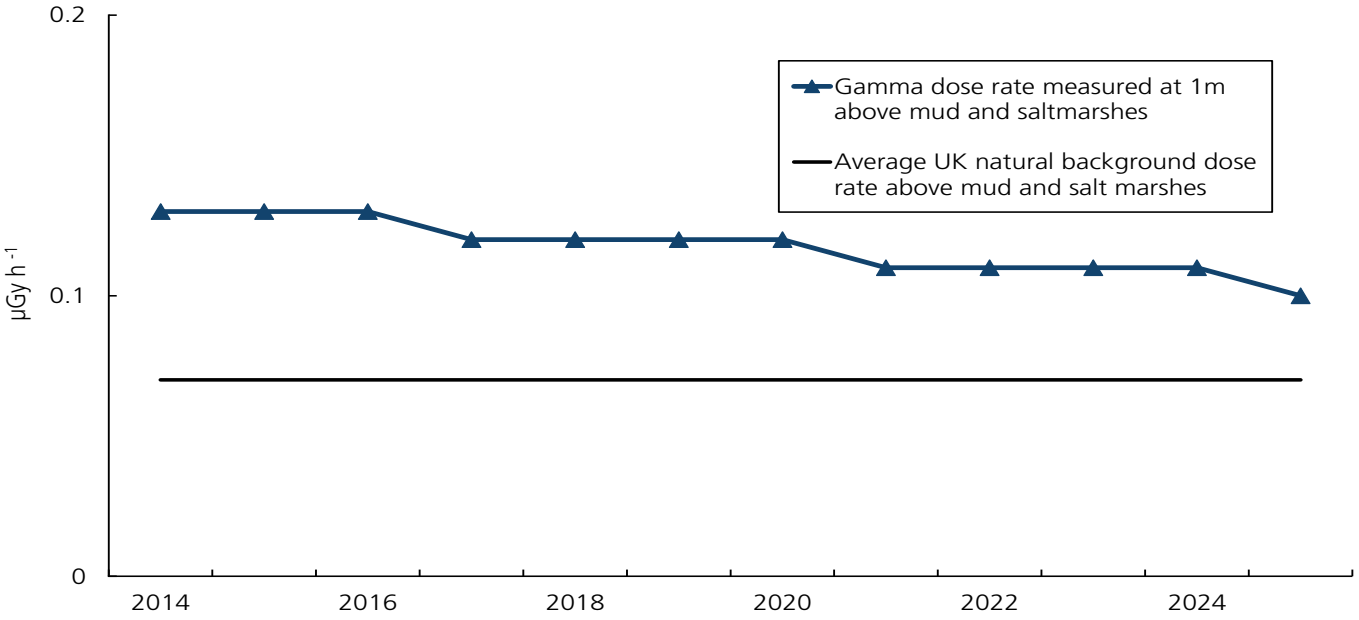


Figure 3.53 Gamma dose rates, in microGy h^{-1}, above fine coastal sediments (mud and salt marshes) at Newbiggin/Eskmeals between 2014 to 2025.

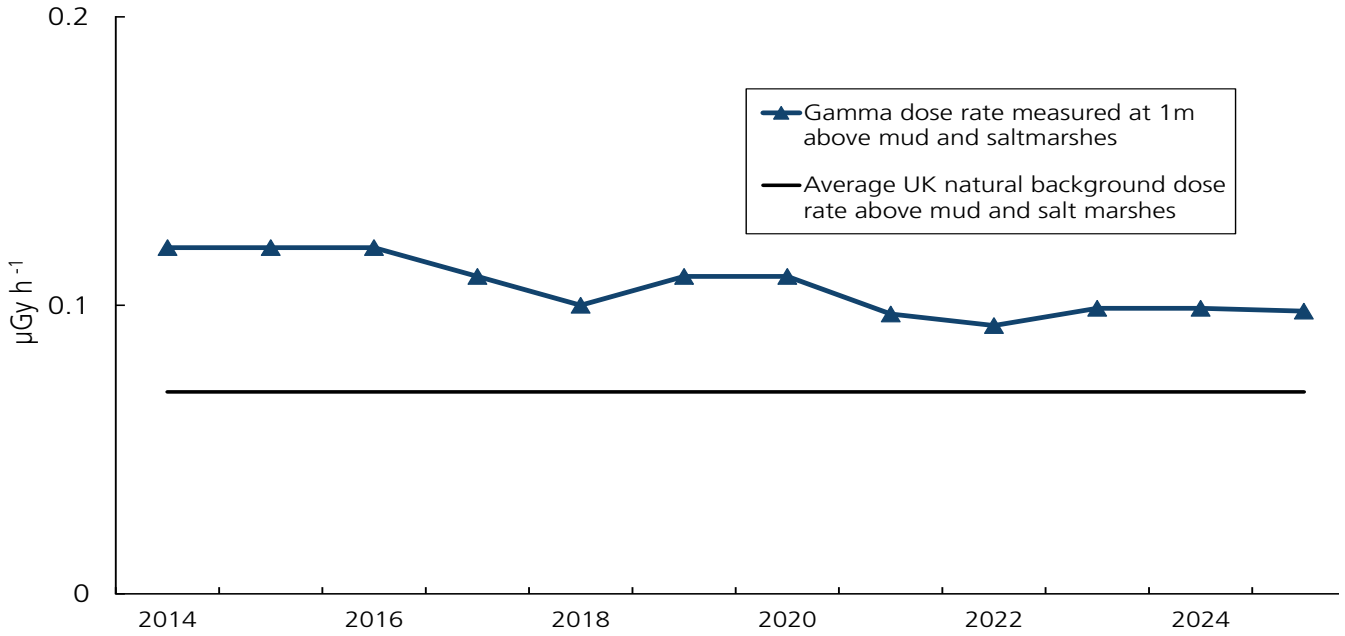


Figure 3.54 Gamma dose rates, in microGy h^{-1}, above fine coastal sediments (mud and salt marshes) at Flookburgh between 2014 to 2025.

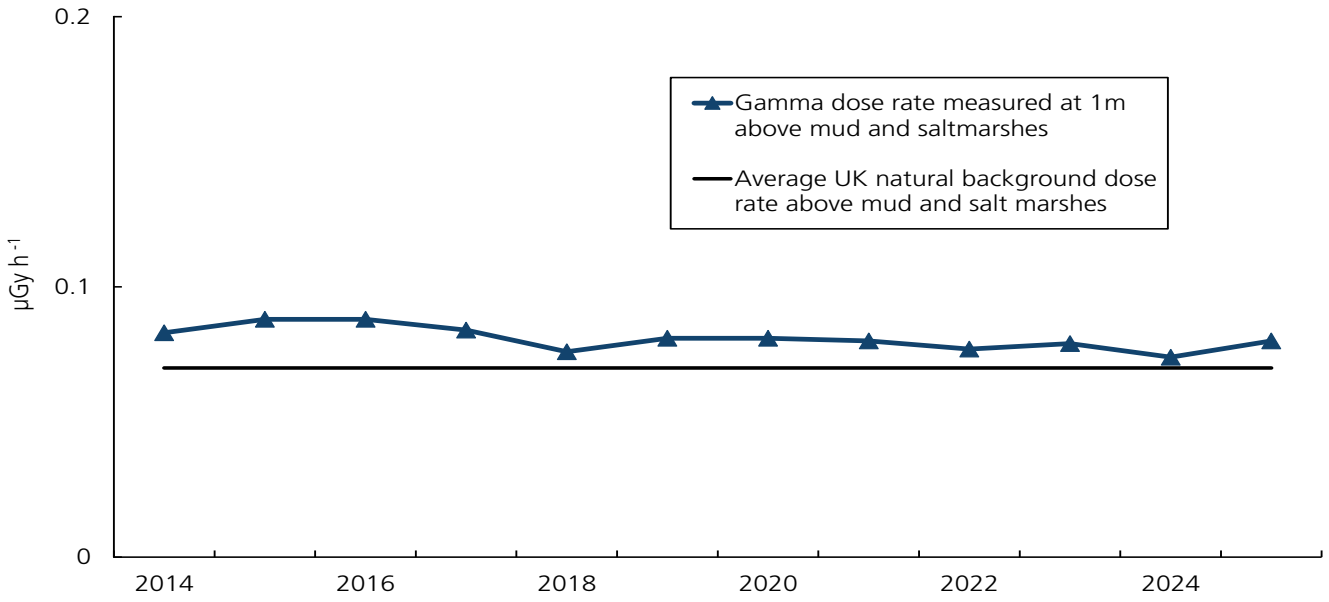


Figure 3.55 Gamma dose rates, in microGy h^{-1}, above fine coastal sediments (mud and salt marshes) at the River Ribble outfall between 2014 to 2025.

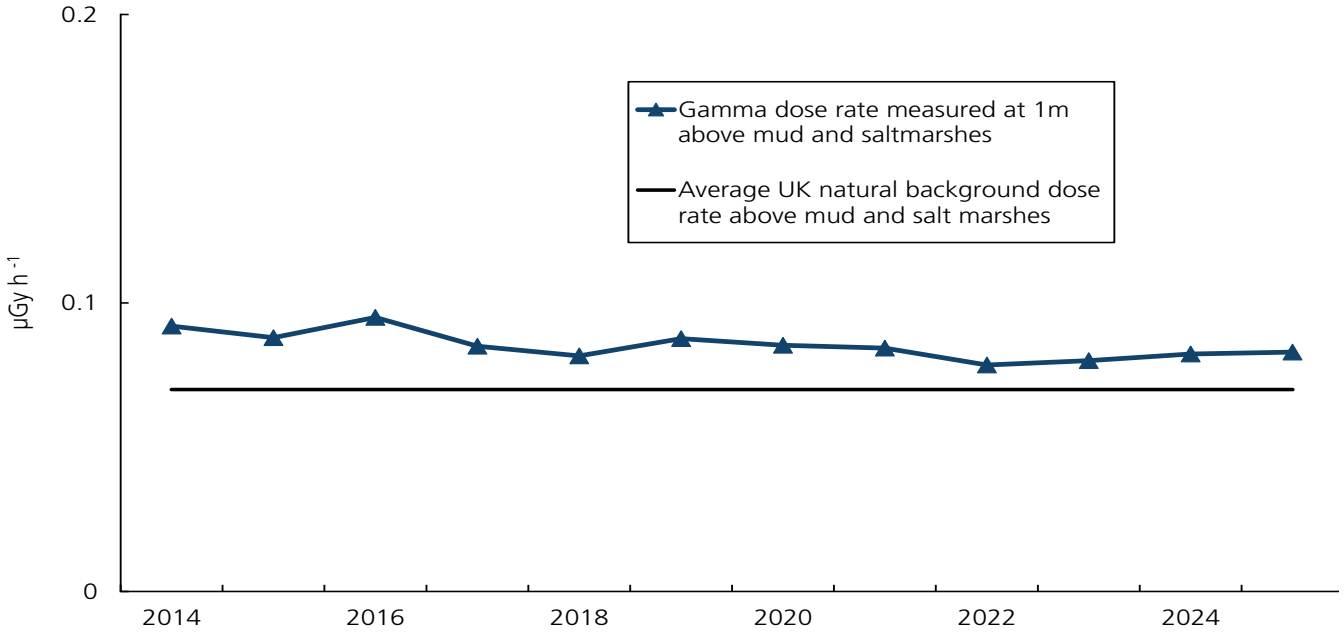
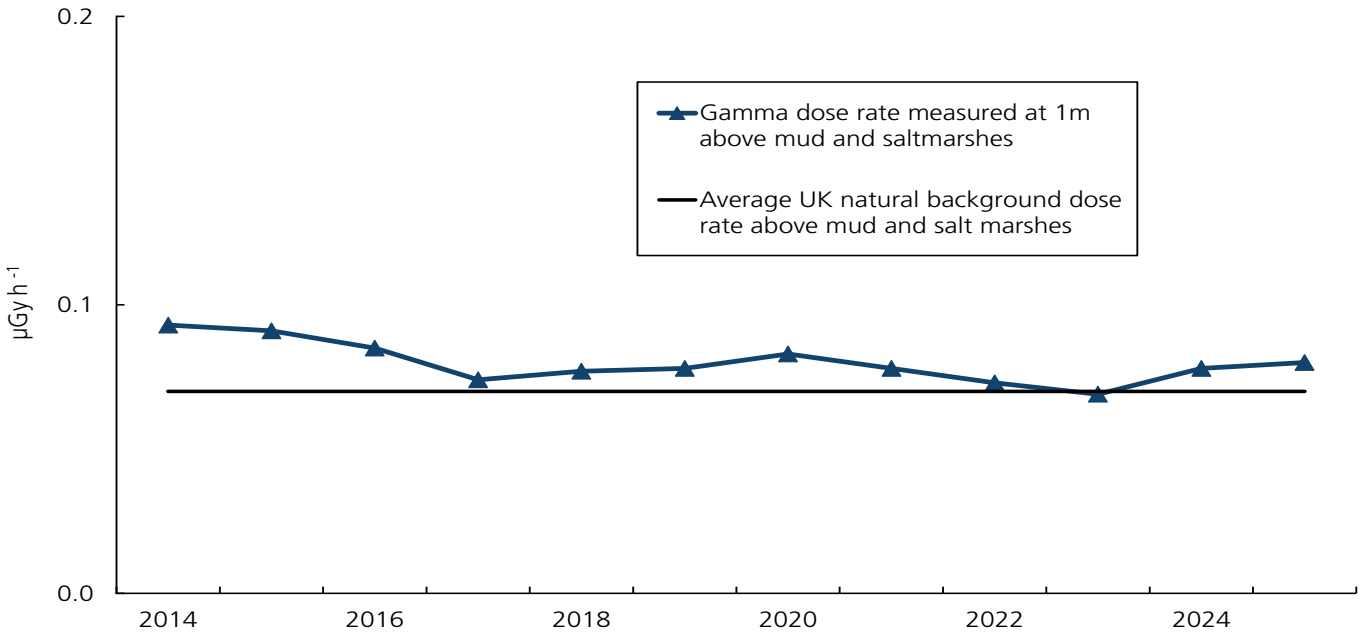


Figure 3.56 Gamma dose rates, in microGy h^{-1}, above fine coastal sediments (mud and salt marshes) at Caerhun between 2014 to 2025.



Over the last 4 decades, concentrations of radioactivity in the environment around Sellafield have declined as a result of reduced discharges. In more recent years, the values in the Esk Estuary have shown a less clear trend, with concentrations of some radionuclides fluctuating from year to year (for example, see Figure 3.38). This effect could be due to the dynamic nature of the sediment in the estuary, which is eroded and transported by tide and freshwater, periodically exposing older sediment (from depth) containing radioactivity from historical discharges. Due to annual variations and local concerns, the Environment Agency initiated a more detailed study of dose rates in the Esk Estuary in 2007. Further information providing more background information, and describing the objectives and results of this study, is available in earlier RIFE reports (for example [8]).

3.3.3.5 Monitoring of fishing gear

During immersion in seawater, fishing gear may trap particles of sediment on which radioactivity is adsorbed. Fishers handling this gear may be exposed to external radiation, mainly to skin from beta particles. Up to 2019, fishing gear was regularly monitored using surface contamination monitors. As in recent years, no monitoring of fishing gear was performed in 2025. Results up to 2019 are included in previous RIFE reports (for example, [9]).

3.3.3.6 Contact dose-rate monitoring of intertidal areas

Results from measurements of beta dose rates on shoreline sediments (using contamination monitors), to allow estimation of exposure of people who handle sediments regularly, are given in Table 3.10. Overall, positively detected dose rates in 2025 were generally similar to those in 2024 (where comparisons can be made from similar ground types and locations). Beta dose rates measured over sand in 2025 were similar at St Bees compared to those in 2024. However, reported beta dose rates are low, with no radiological significance.

In 2008, the Environment Agency published a formal programme of work for the assessment of contamination by radioactive particles and objects[16] on and around the west Cumbrian coastline. The assessment was focused on public protection from high activity discrete radioactive particles that have been released to the environment from activities at the Sellafield site [143].

Beach survey work using vehicle mounted detectors, by the Sellafield site operator's contractors, began in 2006. The current detection system in use is the Groundhog™ Synergy2 system, which was introduced in mid-2014 and was designed, and introduced, to further improve detection of americium-241 and strontium-90/yttrium-90. This replaced the Groundhog™ Synergy system, which was used from mid-2009 to mid-2014, which had a specific capability in relation to the detection of medium and high energy gamma-emitting radionuclides. The Groundhog™ Synergy system also provided improved detection capability for low energy gamma emissions (in comparison to the original system introduced in 2006), increasing the ability to detect particles containing americium-241.

Further beach monitoring for the 2025 calendar year was completed in line with the Environment Agency's specification [144]. During 2025, a total area of 117 hectares of the beaches along the Cumbrian coast were surveyed against a programme target of 105 hectares. A total of 49 particles and 3 larger objects were detected, recovered and analysed. The number of radioactive finds identified was 52 in 2025, of which approximately 94% were classified as particles (less than 2mm in size) and the remainder as larger objects. The number of finds were typical of those in recent years (for a summary of finds, see https://www.gov.uk/government/publications/monitoring-beaches-near-sellafield-for-radioactive-material/monitoring-beaches-near-sellafield-for-radioactive-material). All of the finds were recovered from beaches between Drigg point and St Bees. All have been removed from the beaches. In 2025, none of the finds detected exceeded the characterisation triggers set within the Environment Agency's intervention trigger levels: https://www.gov.uk/government/publications/sellafield-radioactive-objects-intervention-plan.

Monitoring along the Cumbrian coast will continue in 2026, with the current proposal being a further 105 hectares to be surveyed.

In 2012, UKHSA reported their review of the results and position on risk following the introduction of the improved monitoring (Groundhog™ Synergy system). The report concluded that the increase in particle finds following the introduction of this system was a result of its improved capability and also that advice previously given by UKHSA to the Environment Agency following a

16. Particles and objects' are terms used which encompass discrete radioactive items which can range in radioactivity concentration, size and origin. 'Particles' include radioactive scale, fragments of irradiated nuclear fuel and incinerated waste materials (less than 2mm in diameter). 'Objects' are larger radioactive artefacts and stones which have radioactive contamination on their surface and are larger than 2 mm in size.

detailed assessment of risks in 2010 remained valid [145,146]. The report restated the conclusion that, based on the currently available information, the overall health risks to beach users are very low and significantly lower than other risks people accept when using the beaches. As such, UKHSA advice remained that no special precautionary actions were required to limit access to or use of the beaches. A report by UKHSA describes the assessed health risks from the consumption of seafood (including those to commercial fishers) from radioactive particles in the vicinity of the Sellafield Site [147]. Based on currently available information, it is concluded that the overall health risks to both seafood consumers and commercial fishers are very low. More recently, UKHSA were requested by the Environment Agency to update their recommendations, if supported by available evidence. This is to account for the information from the beach monitoring programme and from the further analysis of finds that have been collected since 2012. A summary report of assessing the risk to people's health from radioactive objects on beaches around the Sellafield site was published by UKHSA in February 2020, concluding that the risk is very low [6]. Longer term trends on the number of finds and their characteristics have been published [148].

In relation to food safety (and following a previous assessment of the particles frequency and the activity concentrations), FSA's guidance to the Environment Agency supported UKHSA's advice. The Environment Agency will continue to work with relevant authorities to keep the situation under review.

In 2007, SEPA published a strategy document for the assessment of the potential impact of Sellafield radioactive particles on members of the public in south-west Scotland [149] and the beach monitoring programme was temporarily extended to include 2 locations on the north Solway coastline (Kirkcudbright Bay and Southerness). This was based on some limited modelling work on the movement of particles undertaken for the Environment Agency following a request by SEPA. No particles were detected at these locations. SEPA is maintaining a watching brief on the situation in as much as it may affect Scotland.

Further detail on enhanced beach monitoring data compiled so far can be obtained on the UK government website: https://www.gov.uk/government/publications/sellafield-radioactive-objects-notification-and-intervention-plan/sellafield-radioactive-objects-notification-and-intervention-plan#monitoring-beaches-near-sellafield.

3.3.3.7 Monitoring of seaweed

Seaweeds are useful indicator materials, in addition to their occasional use in foods and as fertilisers. Seaweeds have the capability to readily accumulate radionuclides and thereby assist in the detection of these radionuclides in the environment. Table 3.11 gives the results of measurements in 2025 of seaweeds from shorelines of the Cumbrian coast and further afield. When comparing between 2024 and 2025 data across a wide range of sampling locations, radionuclide concentrations were generally similar (where comparisons can be made) in seaweeds.

Fucus species of seaweeds are particularly useful indicators of most fission product radionuclides. In particular, samples of 'Fucus vesiculosus' are collected both in the Sellafield vicinity and further afield to show the extent of Sellafield contamination in north European waters. The effects of technetium-99 discharges from Sellafield on concentrations in seaweed are shown in Figure 3.19 (2014 to 2025) and Figure 3.20 (1996 to 2025). In the north-east Irish Sea, technetium-99

concentrations have been reasonably constant over the present decade, consistent with the relatively low discharges; the highest concentrations which were found near Sellafield were much less than those in the mid-1990s and the decade thereafter (in response to the progressive reduction in discharges). In general, there was also a large reduction in concentrations of technetium-99 in 'Fucus vesiculosus' with distance from Sellafield, as the effect of the discharges becomes diluted in moving further afield.

Technetium-99 concentrations in seaweed (Table 3.11) collected from sites in Cumbria were generally lower by small amounts in 2025, compared to those in 2024. Over the last 5 years, small variations have been found, year on year, but technetium-99 concentrations in seaweed in 2025 were still low (Figure 3.19). At one specific location (Auchencairn, Scotland), known to have had fluctuating concentrations in previous years, technetium-99 concentrations in seaweed (Fucus) were higher in 2025 than those in 2024. The reasons behind these variations have been described in previous RIFE reports (for example [19]).

3.3.3.8 Monitoring of tide-washed pasture

The potential transfer of technetium-99 to milk, meat and offal from animals grazing tide-washed pasture was considered using a modelling approach in the report for 1997 [150]. The maximum potential dose was calculated to be 0.009mSv per year, at that time. Follow-up sampling of tide-washed pastures at Newton Arlosh (Cumbria) and Hutton Marsh (Lancashire) in 2006 suggested that this dose estimate remains valid [92].

3.3.3.9 Monitoring of sea to land transfer

Terrestrial foodstuffs are monitored near Ravenglass to check on the extent of transfer of radionuclides from sea to land in this area. In 2025, samples of milk and livestock were collected and analysed, for radionuclides which were released in liquid effluent discharges from Sellafield. Results from surveys for activity concentrations in crops, fruit and environmental indicators are available in earlier RIFE reports (for example, [138]).

The results of measurements in 2025 are given in Table 3.12. Generally, the activity concentrations, where positively detected, show lower concentrations than were found in the immediate vicinity of Sellafield (Table 3.4). As in previous years, the evidence for sea to land transfer was very limited in 2025. Technetium-99 concentrations are reported as below (or close) to the limit of detection. Small concentrations of artificial nuclides were detected in some samples, but the concentrations were very low. As in recent years, where detectable, observed isotopic ratios of plutonium-238 to plutonium-239+240 concentrations were somewhat higher than 0.025, a ratio which might be expected if the source was entirely due to fallout from nuclear weapons testing. This may suggest a Sellafield influence.

3.3.3.10 Monitoring of fishmeal

A theoretical study has established that any indirect onward transmission of both naturally occurring and artificial radioactivity into the human diet from the fishmeal pathway (that is fed to farmed fish, poultry, pigs, cows and sheep) is unlikely to be of radiological significance [151]. A detailed survey was undertaken to confirm these findings [152]. Samples, obtained from 14 fish farms in Scotland and 3 in Northern Ireland, contained very low radionuclide concentrations, most being less than the limits of detection, and the few positively detected values were all less than 1Bq kg^{-1}. Annually reported RIFE results for activity concentrations in farmed salmon from the west of Scotland confirm the findings of the FSA study (for example, Tables 2.5 and 2.7 [138]).

3.3.3.11 Monitoring of waters

Evidence of the effects of liquid discharges from Sellafield on concentrations of radionuclides in seawater is determined by sampling from research vessels and the shore. The results of the seawater programme are given in Section 8.

Sampling of freshwater from rivers and lakes in west Cumbria is conducted as part of the regular environmental monitoring programme around Sellafield. However, other environmental materials are likely to be more indicative of direct site-related effects. Some of the sources monitored provide public drinking water. The results for 2025 are included in Table 3.13. Tritium, gross alpha and gross beta concentrations in public supplies were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51).

Small amounts of radioactivity are discharged from Sellafield under permit via the factory sewer outfall to the River Ehen Estuary, immediately prior to the confluence with the River Calder. In 2025, there was no evidence of tritium downstream or upstream of the outfall (Table 3.13). These are not drinkable waters, and any low concentrations observed previously are of no radiological significance. Table 3.13 also includes the results of monitoring from Ehen Spit beach (Figure 3.29) near Sellafield where water issues from the ground at low tide. This release is not due to permitted discharges of liquid wastes but to ground water migration from the Sellafield site. The water contains high levels of salt so it will not be used as a drinking water source and therefore the only consumption would be inadvertent (incidental). Enhanced gross beta and tritium concentrations were observed in 2025 with concentrations similar to those in recent years. The annual dose from inadvertent consumption of water from Ehen Spit has been shown to be insignificant [153].

3.3.3.12 Monitoring of unusual pathways

In 2025, concentrations of caesium-137 were significantly higher than recorded over the last two decades. This was due to elevated levels of caesium-137 found in the muscle of wild wood pigeon near Sellafield, with the concentration being reported as 1600Bq kg^{-1}. Results of the analysis of this wild wood pigeon sample collected in 2025 are included in Table 3.4.

In 1998, high caesium-137 concentrations (up to 110,000Bq kg^{-1}) were found in feral pigeons sampled in Seascale by the Ministry for Agriculture, Fisheries & Food [154]. MAFF issued precautionary advice not to eat feral pigeons in the vicinity of Sellafield and this advice has not subsequently been rescinded. Further background information, describing the consequences of this monitoring, and remedial measures taken by the site operator, is available in earlier RIFE reports (for example [8]).

Therefore, in 2025, while caesium-137 in pigeons was higher than in previous years, the levels remain orders of magnitude lower than in 1998. From a food safety perspective, there is minimal concern, due to the current advice in place not to eat wild wood pigeons and the supporting evidence from recent Habits surveys [132] which indicate that wood pigeons do not represent a significant dietary pathway for local populations, meaning the associated risk of radiological exposure is expected to be low. As there is no suggestion of any consumption of feral pigeons, no further controls have been needed to be proposed. However, as a precautionary measure in the unlikely event that feral pigeons are consumed, the wild wood pigeon data has been included in the terrestrial dose assessment in accordance with the National Dose Assessment Working Group (NDAWG) guidance and the "other foodstuffs" selection rules outlined in Section 2.8. The assessment demonstrated that, even when these results are taken into account, the resulting dose to members of the public remains within acceptable legal limits (see Table 1.4 and Table 3.16).

The cause of the elevated levels is under consideration and results of samples collected in 2026, will be reported in RIFE 32.

Following discovery of elevated concentrations in feral pigeons in 1998, the Environment Agency began to sample and analyse sediments from road drains (gully pots) in Seascale and Whitehaven in 1999. Gully pots in road drains collect sediments washed off road surfaces and provide good indicators of radiological contamination of urban environments. The results of analyses in 2025 are shown in Table 3.14. Overall, activity concentrations are generally similar to those in recent years, although caesium-137 concentrations decreased, by small amounts, in 2025. Further information of the previously elevated concentrations (of strontium-90, caesium-137, americium-241 and plutonium radionuclides) in road drain sediments is given in earlier RIFE reports (for example [19]).

Table 3.1 Individual doses (mSv y^{-1}) - Capenhurst and Springfields, 2025

Site	Representative person[a]	Exposure, mSv per year						
		All pathways	Seafood	Other local food	External radiation from intertidal areas, river banks or fishing gear[b]	Intakes of sediment and water	Gaseous plume related pathways	Direct radiation from site
Capenhurst								
'Total dose' all sources	**Local child inhabitants (0.5 - 1km)**	**0.18[c]**	**-**	**<0.005**	**<0.005**	**-**	**<0.005**	**0.18**
Source-specific doses	Infant inhabitants and consumers of locally grown food	<0.005[c]	-	<0.005	-	-	<0.005	-
	Children playing at Rivacre Brook	0.009[c]	-	-	0.009	<0.005	-	-
Springfields								
'Total dose' all sources	**Local infant inhabitants (0.25 - 0.5km)**	**0.010**	**-**	**<0.005**	**-**	**-**	**<0.005**	**0.010**
Source-specific doses	Seafood and wildfowl consumers	0.008[c]	<0.005	-	0.006	-	-	-
	Children playing at Lower Penwortham	<0.005[c]	-	-	<0.005	<0.005	-	-
	External in intertidal areas (farmers)	<0.005	-	-	<0.005	-	-	-
	Infant Inhabitants and consumers of locally grown food	<0.005[c]	-	<0.005	-	-	<0.005	-

a. The 'total dose' is the dose which accounts for all sources including gaseous and liquid discharges and direct radiation. The 'total dose' for the representative person with the highest dose is presented. Other dose values are presented for specific sources, either liquid discharges or gaseous discharges, and their associated pathways. They serve as a check on the validity of the 'total dose' assessment. The representative person is an adult unless otherwise stated. Data are presented to 2 significant figures or 3 decimal places. Data below 0.005 mSv are reported as <0.005 mSv

b. Doses ('total dose' and source-specific doses) only include estimates of anthropogenic inputs (by substracting background and cosmic sources from measured gamma dose rates)

c. Includes a component due to natural sources of radionuclides

Table 3.2(a) Concentrations of radionuclides in food and the environment near Capenhurst, 2025

Material	Location	No. of sampling observ-ations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}							
			^{3}H	^{99}Tc	^{137}Cs	^{234}Th	^{234}U	^{235}U	^{238}U	^{237}Np
Marine samples										
Dab	Liverpool Bay	1	<25		0.31					
Shrimp	Wirral	1	<25	0.070	0.35					
Mussels	Liverpool Bay	1	<25		0.24					
Cockles	Dee Estuary	1	<25	0.41	0.48					
Sediment	Rivacre Brook	1[E]		250	5.6	60	120	4.2	71	20
Sediment	Rivacre Brook (1.5 km downstream)	1[E]		33	0.97	28	28	<1.7	23	9.0
Sediment	Rossmore (3.1 km downstream)	2[E]		28	0.66	22	31	<1.7	23	<21
Sediment	Rivacre Brook (4.3 km downstream)	2[E]		15	<0.23	20	19	<1.0	16	<15
Freshwater	Rivacre Brook	2[E]	<3.5	<0.037			0.0092	<0.00041	0.0047	<0.040
Freshwater	Rivacre Brook (1.5 km downstream)	2[E]	<3.6	<0.035			0.0085	<0.00053	0.0049	<0.040
Freshwater	Rossmore (3.1 km downstream)	2[E]	<3.5	<0.034			0.0072	<0.00048	0.0049	<0.040
Freshwater	Rivacre Brook (4.3 km downstream)	2[E]	<3.5	<0.035			0.0054	<0.00035	0.0026	<0.040

Material	Location[b]	No. of sampling observ-ations[c]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Marine samples									
Dab	Liverpool Bay	1			<0.15				
Shrimp	Wirral	1	0.00037	0.0027	0.0053	*	*		
Mussels	Liverpool Bay	1			<0.58				
Cockles	Dee Estuary	1	0.045	0.34	1.2	*	*		
Sediment	Rivacre Brook	1[E]						810	1600
Sediment	Rivacre Brook (1.5 km downstream)	1[E]						320	750
Sediment	Rossmore (3.1 km downstream)	2[E]						310	730
Sediment	Rivacre Brook (4.3 km downstream)	2[E]						<240	710
Freshwater	Rivacre Brook	2[E]						0.022	0.26
Freshwater	Rivacre Brook (1.5 km downstream)	2[E]						<0.026	0.14
Freshwater	Rossmore (3.1 km downstream)	2[E]						0.039	0.22
Freshwater	Rivacre Brook (4.3 km downstream)	2[E]						<0.019	0.19

Table 3.2(a) continued

Table 3.2(b) Monitoring of radiation dose rates near Capenhurst, 2025

Location	Ground type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
East of railway station	Grass and herbage	1	0.077
Dunkirk Lane	Grass and mud	1	0.081
Near Lower Brook Farm	Grass and herbage	1	0.084
Rivacre Brook Plant outlet	Grass	1	0.086
Rivacre Brook Plant outlet	Grass and herbage	1	0.085
Rivacre Brook 1.5 km downstream	Grass	2	0.080
Rossmore Road West 3.1 km downstream	Grass and stones	1	0.083
Rossmore Road West 3.1 km downstream	Pebbles and sand	1	0.078
Rivacre Brook 4.3 km downstream	Pebbles and sand	2	0.083
North of Ledsham	Grass and herbage	1	0.081

Table 3.3(a) Concentrations of radionuclides in food and the environment near Springfields, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}								
			^{3}H	^{14}C	^{90}Sr	^{99}Tc	^{129}I	^{137}Cs	^{228}Th	^{230}Th	^{232}Th	^{234}Th
Marine samples												
European sea bass	Ribble Estuary	1						2.7				
Flounder	Ribble Estuary	1						1.2				
Shrimps[b]	Ribble Estuary	1		30		<0.083		0.62	0.0079	0.0046	0.0034	
Mussels[b]	Ribble Estuary	1						0.08	0.098	0.037	0.022	
Wildfowl	Ribble Estuary	1	<3.7	32	<0.045		<0.67	0.34		0.0073	0.0044	
Samphire	Marshside Sands	1				0.13		0.19				
Sediment	River Ribble outfall	4[E]						58	24	40	24	33
Sediment	Lea Gate	2[E]						85	29	55	31	51
Sediment	Lower Penwortham Park	3[E]						140	38	73	36	54
Sediment	River Angler Location 1	1[E]						6.4	18	9.3	14	24
Sediment	Penwortham road bridge - West bank	2[E]						80	26	39	27	55
Sediment	Becconsall	4[E]						44	24	34	24	39
Sediment	Freckleton	1[E]						130	33	77	33	51
Sediment	Hutton Marsh	1[E]						260	36	130	41	39
Sediment	Longton Marsh	1[E]						350	37	210	44	49
Soil	Hutton Marsh	1[E]				25						

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}								
			^{234}U	^{235}U	^{238}U	^{237}Np	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	Gross alpha	Gross beta
Marine samples											
European sea bass	Ribble Estuary	1							<0.03		
Flounder	Ribble Estuary	1							<0.03		
Shrimps[b]	Ribble Estuary	1				<0.000061	0.0014	0.0086	0.015		
Mussels[b]	Ribble Estuary	1					0.029	0.19	0.33		
Wildfowl	Ribble Estuary	1					0.0013	0.0080	0.016		
Samphire	Marshside Sands	1							0.25		
Sediment	River Ribble outfall	4[E]	18	<1.1	20				75	710	1000
Sediment	Lea Gate	2[E]	29	<1.5	28				97	880	1200
Sediment	Lower Penwortham Park	3[E]	28	<1.5	29				160	1100	1500
Sediment	River Angler Location 1	1[E]	14	0.56	14				6.6	390	680
Sediment	Penwortham road bridge - West bank	2[E]	24	<1.8	25				100	940	1200
Sediment	Becconsall	4[E]	20	<0.98	20				58	730	970
Sediment	Freckleton	1[E]	26	1.3	28				130	1100	1500
Sediment	Hutton Marsh	1[E]	26	1.4	27				220	1200	1800
Sediment	Longton Marsh	1[E]	35	1.5	35				270	1500	2000
Soil	Hutton Marsh	1[E]									

Table 3.3(a) continued

Material	Location[d]	No. of sampling observations[e]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}								
			^{3}H	^{14}C	^{90}Sr	^{129}I	^{137}Cs	Total Cs	^{230}Th	^{232}Th	^{234}Th
Terrestrial samples											
Milk		2									
Milk	Max										
Beetroot		1	<2.1	11	<0.048	<0.020	<0.05	<0.045	<0.00030	<0.00030	
Silage		1	<2.5	17	0.47	<0.012	<0.09	<0.087	0.026	0.027	
Grass and herbage	Opposite site entrance	1[E]									
Grass and herbage	Opposite windmill	1[E]									
Grass and herbage	Deepdale Brook	1[E]									
Grass and herbage	North of Lea Town	1[E]									
Sediment	Deepdale Brook	1[E]					0.69				79
Soil	Opposite site entrance	1[E]									
Soil	Opposite windmill	1[E]									
Soil	Deepdale Brook	1[E]									
Soil	North of Lea Town	1[E]									
Freshwater	Deepdale Brook	3[E]									
Freshwater[e]	Ulnes Walton	1[E]	<3.5				<0.25		0.0030	0.0012	

Material	Location[d]	No. of sampling observations[e]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}								
			^{234}U	^{235}U	^{238}U	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Pu	^{241}Am	Gross alpha	Gross beta
Terrestrial samples											
Milk		2	<0.0048	<0.0048	<0.0048						
Milk	Max		<0.0086	<0.0086	<0.0086						
Beetroot		1	0.0011	<0.00074	<0.00089	<0.000070	<0.000070	<0.31	0.000084		
Silage		1	0.034	0.0015	0.035	0.00027	0.0023	<0.26	0.0042		
Grass and herbage	Opposite site entrance	1[E]	0.53	<0.040	0.32						
Grass and herbage	Opposite windmill	1[E]	0.65	<0.040	0.64						
Grass and herbage	Deepdale Brook	1[E]	0.32	<0.039	0.26						
Grass and herbage	North of Lea Town	1[E]	0.24	<0.028	0.25						
Sediment	Deepdale Brook	1[E]		42	1.9	44				530	1000
Soil	Opposite site entrance	1[E]	80	3.4	72						
Soil	Opposite windmill	1[E]	83	3.6	75						
Soil	Deepdale Brook	1[E]	110	4.9	100						
Soil	North of Lea Town	1[E]	46	2.0	48						
Freshwater	Deepdale Brook	3[E]	0.51	0.024	0.51					0.95	0.87
Freshwater[e]	Ulnes Walton	1[E]	0.079	0.0027	0.071					0.12	0.70

a. Except for milk and freshwater where units are Bq l^{-1} and for sediment and soil where dry concentrations apply

b. The concentrations of ^{242}Cm and $^{243+244}$Cm were not detected by the method used

c. Data are arithmetic means unless stated as 'max'.' Max' data are selected to be maxima
If no 'max' value is given the mean value is the most appropriate for dose assessments

d. The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

e. The concentration of ^{228}Th was <0.0032 Bq l^{-1}

E. Measurements are made on behalf of the Food Standards Agency unless labelled "E".
In that case they are made on behalf of the Environment Agency

Table 3.3(b) Monitoring of radiation dose rates near Springfields, 2025

Location	Material or round type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Warton Salt Marsh	Salt marsh	2	0.086
Warton Salt Marsh	Salt marsh[a]	2	0.088
Freckleton	Salt marsh	1	0.086
Naze Point	Salt marsh	2	0.093
Banks Marsh (alternative)[b]	Salt marsh	2	0.11
Banks Marsh (alternative)[b]	Salt marsh[a]	2	0.11
Becconsall Boatyard	Salt marsh	4	0.078
Longton Marsh	Salt marsh	1	0.093
Hutton Marsh	Salt marsh	1	0.12
River Ribble outfall	Mud	1	0.083
River Ribble outfall	Mud and sand	2	0.083
River Ribble outfall	Salt marsh	1	0.083
River Ribble opposite outfall	Salt marsh	1	0.089
Savick Brook, confluence with Ribble	Salt marsh	2	0.082
Savick Brook, Lea Gate	Salt marsh	2	0.080
Penwortham road bridge	Mud	1	0.080
Penwortham road bridge	Mud and sand	1	0.083
Lower Penwortham Park	Grass	3	0.080
River Darwen	Grass	4	0.079
Riverbank Angler Location 1	Grass and herbage	1	0.075
Ulnes Walton, BNFL area survey	Grass	3	0.071
Mean beta dose rates			**µSv h^{-1}**
Lytham - Granny's Bay	Sand	1	0.069
Banks Marsh (alternative)[b]	Salt marsh	2	0.10
Warton Salt Marsh	Salt marsh	2	0.078

a. 15cm above substrate
b. As in 2023 and 2024, no monitoring was undertaken at Banks Marsh in 2025 (as reported in earlier RIFE reports)

Table 3.4 Concentrations of radionuclides in terrestrial food and the environment near Sellafield, 2025

Material	Location or selection[a]	No. of sampling observations[b]	Mean radioactivity concentration (fresh)[c], Bq kg^{-1}							
			Organic							
			^{3}H	^{3}H	^{14}C	^{54}Mn	^{60}Co	^{90}Sr	^{99}Tc	^{106}Ru
Milk		9	<2.2	<2.3	15	<0.06	<0.06	<0.027	0.011	<0.49
Milk	max		<2.3	<2.4	18	<0.07		0.038		<0.55
Apples		1	<1.8	<1.8	9.9	<0.06	<0.06	0.044	0.036	<0.51
Beef kidney		1	<3.4	<3.4	19	<0.08	<0.08	<0.087		<0.74
Beef liver		1	<2.9	<2.9	24	<0.06	<0.14	<0.054	<0.026	<0.53
Beef muscle		1	<3.8	<3.8	23	<0.07	<0.08	<0.042	<0.028	<0.60
Beetroot		1	<2.1	<2.1	12	<0.08	<0.05	0.15		<0.39
Cabbage		1	<1.6	<1.6	7.2	<0.06	<0.07	0.12		<0.53
Carrots		1	<2.1	<2.1	9.5	<0.04	<0.05	0.042	<0.022	<0.40
Eggs		1	<4.1	<4.1	21	<0.05	<0.04	0.036		<0.33
Mushrooms		1	<1.9	<1.9	15	<0.07	<0.08	<0.048		<0.59
Pheasant		1	<3.5	<3.5	24	<0.06	<0.07	<0.041	<0.025	<0.54
Potatoes		1	<1.9	<1.9	15	<0.04	<0.05	<0.043		<0.38
Rabbit		1	<3.0	<3.0	21	<0.04	<0.04	<0.044	<0.029	<0.35
Sheep muscle		2	<2.6	<2.6	12	<0.04	<0.06	<0.047	<0.023	<0.35
Sheep muscle	max		<2.7	<2.7	13			<0.048	<0.025	
Sheep offal		2	<3.3	<3.3	20	<0.08	<0.07	<0.037	<0.025	<0.50
Sheep offal	max				21	<0.11		<0.041	<0.026	<0.51
Wood pigeon muscle		2	<3.3	<3.3	25	<0.04	<0.05	4.4		<2.2
Wood pigeon muscle	max		<3.5	<3.5	28			5.9		
Barley		1	<7.3	<7.3	98	<0.08	<0.10	0.71		<0.68
Grass	Braystones	1[E]		<16	29			<0.13		<1.1
Grass	River Calder (upstream)	1[E]		<11	17			0.98		<0.79
Grass	River Calder (downstream)	1[E]		<11	30			<0.15		<0.94
Grass	WAMAC Access gate	1[E]		<9.7	4.9			3.1		<1.0
Soil		1	<1.1	<1.1	7.4	<0.25	<0.17	<2.1	<0.37	<1.3
Soil	Braystones	1[E]		<4.5	5.5			<0.65		<3.9
Soil	River Calder (upstream)	1[E]		15	8.4			<0.61		<2.0
Soil	WAMAC Access gate	1[E]		<5.2	5.7			3.5		<3.0

Table 3.4 continued

Material	Location or selection[a]	No. of sampling observations[b]	Mean radioactivity concentration (fresh), Bq[c] kg^{-1}							
			^{125}Sb	^{129}I	^{131}I	^{134}Cs	^{137}Cs	Total Cs	^{154}Eu	^{155}Eu
Milk		9	<0.12	<0.0056	<0.0018	<0.05	<0.09	<0.098	<0.18	<0.15
Milk	max		<0.13	<0.0096	<0.0022	<0.07	<0.13	0.14	<0.19	<0.16
Apples		1	<0.13	0.035		<0.05	0.18	0.18	<0.19	<0.12
Beef kidney		1	<0.19			<0.05	0.51	0.51	<0.24	<0.20
Beef liver		1	<0.13	<0.015		<0.08	0.68	0.68	<0.24	<0.12
Beef muscle		1	<0.15	<0.014		<0.10	1.1	1.1	<0.27	<0.14
Beetroot		1	<0.10	<0.012		<0.03	<0.04	<0.043	<0.16	<0.22
Cabbage		1	<0.13	<0.011		<0.08	<0.06	<0.061	<0.21	<0.16
Carrots		1	<0.11	<0.012		<0.04	<0.08	<0.082	<0.15	<0.23
Eggs		1	<0.08	<0.016		<0.03	<0.04	<0.037	<0.11	<0.18
Mushrooms		1	<0.15	<0.0090		<0.04	0.30	0.30	<0.27	<0.14
Pheasant		1	<0.13	<0.018		<0.06	0.17	0.17	<0.24	<0.13
Potatoes		1	<0.10	<0.023		<0.04	<0.04	<0.045	<0.18	<0.13
Rabbit		1	<0.09	<0.045		<0.04	0.37	0.37	<0.15	<0.13
Sheep muscle		2	<0.10	<0.019		<0.06	0.32	0.32	<0.15	<0.21
Sheep muscle	max			<0.020		<0.07	0.33	0.34	<0.16	
Sheep offal		2	<0.13	<0.020		<0.07	0.14	0.14	<0.23	<0.12
Sheep offal	max			<0.021		<0.09				
Wood pigeon muscle		2	<0.84	<0.015		1.2	1500	1600	<0.15	<1.3
Wood pigeon muscle	max		<0.90	<0.016		1.3	1600		<0.16	
Barley		1	<0.18	<0.026		<0.05	0.84	0.84	<0.32	<0.16
Grass	Braystones	1[E]	<0.63				0.39			
Grass	River Calder (upstream)	1[E]	<0.46				0.79			
Grass	River Calder (downstream)	1[E]	<0.54				1.5			
Grass	WAMAC Access gate	1[E]	<0.57				3.4			
Soil		1	<0.37	<0.021		<0.09	21	21	<0.58	1.8
Soil	Braystones	1[E]	<2.0				29			
Soil	River Calder (upstream)	1[E]	<0.99				57			
Soil	WAMAC Access gate	1[E]	<1.6				82			

Table 3.4 continued

Material	Location or selection[a]	No. of sampling observations[b]	Mean radioactivity concentration (fresh)[c], Bq kg^{-1}						
			^{234}U	^{235}U	^{238}U	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Pu	^{241}Am
Milk		9				<0.000043	<0.000038	<0.22	<0.000039
Milk	max					<0.000063	<0.000058	<0.31	<0.000086
Apples		1				0.000071	0.00039	<0.25	0.00076
Beef kidney		1	0.010	0.0012	0.0073	<0.00012	0.000012	<0.56	0.00027
Beef liver		1				0.000038	0.00034	<0.33	0.00047
Beef muscle		1				<0.000072	0.00012	<0.32	0.00040
Beetroot		1	0.0044	0.00056	0.0030				<0.52
Cabbage		1				<0.000053	0.000091	<0.26	0.00014
Carrots		1							<0.27
Eggs		1				0.00016	0.0016	<0.48	0.0018
Mushrooms		1				0.029	0.21	0.63	0.38
Pheasant		1				<0.000069	0.00012	<0.22	0.00025
Potatoes		1	0.0086	0.00043	0.0075	0.000022	0.00094	<0.26	0.0011
Rabbit		1				0.00015	0.0012	<0.26	0.0019
Sheep muscle		2				<0.000058	0.00012	<0.28	0.00030
Sheep muscle	max					<0.000066	0.00014	<0.32	0.00033
Sheep offal		2	0.0017	<0.00019	0.0013	0.00053	0.0042	<0.19	0.0038
Sheep offal	max		0.0019			0.00054	0.0046	<0.22	0.0045
Wood pigeon muscle		2				0.0039	0.020	<0.25	0.036
Wood pigeon muscle	max					0.0062	0.032	<0.29	0.061
Barley		1				0.00050	0.012	<0.27	0.0067
Grass	Braystones	1[E]				0.064	0.28	<2.3	<0.41
Grass	River Calder (upstream)	1[E]				<0.035	<0.050	<1.5	<0.29
Grass	River Calder (downstream)	1[E]				0.10	0.75	<3.0	<0.37
Grass	WAMAC Access gate	1[E]				<0.083	0.11	<2.1	<0.35
Soil		1				0.043	1.1	<14	0.28
Soil	Braystones	1[E]				0.29	3.2	<8.8	3.2
Soil	River Calder (upstream)	1[E]				2.0	35	<11	8.1
Soil	WAMAC Access gate	1[E]				1.3	19	<9.0	15

a. Data are arithmetic means unless stated as 'max'. 'Max' data are selected to be maxima
If no 'max' value is given the mean value is the most appropriate for dose assessments

b. The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

c. Except for milk where units are Bq l^{-1} and for soil, where dry concentrations apply

E. Measurements are made on behalf of the Food Standards Agency unless labelled "E".
In that case they are made on behalf of the Environment Agency

Table 3.5 Beta/gamma radioactivity in fish from the Irish Sea vicinity and further afield, 2025

Location	Material	No. of sampling observations	Mean radioactivity concentration (dry), Bq kg^{-1}					
			Organic					
			^{3}H	^{3}H	^{14}C	^{54}Mn	^{60}Co	^{90}Sr
Cumbria								
Parton	Coda	1			26	<0.05	<0.06	<0.055
Parton	Whiting[a]	1			22	<0.06	<0.05	
Whitehaven	Coda	2			22	<0.07	<0.05	<0.029
Whitehaven	Plaice[a,b]	2	<25	<25	27	<0.04	<0.05	<0.036
Ravenglass	Plaice[a,c]	2	<25	<25	31	<0.04	<0.04	<0.028
Lancashire and Merseyside								
Morecambe Bay (Morecambe)	Flounder	2	<25	<25	28	<0.06	<0.07	<0.028
Ribble Estuary	European Sea Bass	1				<0.04	<0.05	
Ribble Estuary	Flounder	1				<0.04	<0.05	
Liverpool Bay	Dab	1		<25		<0.04	<0.04	
Scotland								
The Minch	Herring	1[S]				<0.10	<0.10	
The Minch	Mackerel	1[S]				<0.10	<0.10	
Shetland	Fish meal (herring)	1[S]				<0.27	<0.31	
Shetland	Fish oil (herring)	1[S]				<0.20	<0.21	
Ardrossan South Bay	Mackerel	1[S]				<0.10	<0.10	
Ardrossan South Bay	Salmon	1[S]				<0.10	<0.10	
Annan	Salmon	1[S]		<5.0		<0.10	<0.10	
Inner Solway	Trout	1[S]		5.0		<0.10	<0.10	
Kirkcudbright	Plaice	2[S]			<15	<0.10	<0.10	
Northern Ireland								
North coast	Lesser spotted dogfish	2[N]				<0.06	<0.06	
Ardglass	Herring	2[N]				<0.07	<0.05	
Kilkeel	Cod	3[N]			32	<0.04	<0.04	
Kilkeel	Plaice	3[N]				<0.05	<0.04	
Kilkeel	Lesser spotted dogfish	3[N]				<0.06	<0.05	
Kilkeel	Haddock	2[N]				<0.05	<0.04	
Wales								
North Anglesey	Flounder	1	<25	<25	17	<0.04	<0.04	
Further afield								
Norwegian Sea	Haddock	2				<0.04	<0.07	

Table 3.5 continued

Location	Material	No. of sampling observations	Mean radioactivity concentration (dry), Bq kg^{-1}					
			^{95}Zr	^{95}Nb	^{99}Tc	^{106}Ru	^{125}Sb	^{134}Cs
Cumbria								
Parton	Coda	1	<0.12	<0.09	<0.075	<0.37	<0.10	<0.04
Parton	Whiting[a]	1	<0.11	<0.10		<0.30	<0.08	<0.03
Whitehaven	Coda	2	<0.11	<0.10	<0.070	<0.49	<0.06	<0.06
Whitehaven	Plaice[a,b]	2	<0.10	<0.08	0.37	<0.36	<0.10	<0.06
Ravenglass	Plaice[a,c]	2	<0.07	<0.05	0.63	<0.30	<0.07	<0.03
Lancashire and Merseyside								
Morecambe Bay (Morecambe)	Flounder	2	<0.16	<0.10	<0.063	<0.55	<0.15	<0.07
Ribble Estuary	European Sea Bass	1	<0.09	<0.08		<0.33	<0.08	<0.03
Ribble Estuary	Flounder	1	<0.09	<0.07		<0.30	<0.09	<0.03
Liverpool Bay	Dab	1	<0.10	<0.11		<0.35	<0.09	<0.03
Scotland								
The Minch	Herring	1^{S}	<0.23	<0.26		<0.55	<0.15	<0.10
The Minch	Mackerel	1^{S}	<0.29	<0.33		<0.73	<0.19	<0.10
Shetland	Fish meal (herring)	1^{S}	<0.49	<0.31		<2.4	<0.75	<0.30
Shetland	Fish oil (herring)	1^{S}	<0.36	<0.22		<1.8	<0.55	<0.20
Ardrossan South Bay	Mackerel	1^{S}	<0.35	<0.42		<0.84	<0.22	<0.10
Ardrossan South Bay	Salmon	1^{S}	<0.15	<0.16		<0.42	<0.12	<0.10
Annan	Salmon	1^{S}	<0.19	<0.17		<0.61	<0.17	<0.10
Inner Solway	Trout	1^{S}	<0.23	<0.22		<0.72	<0.21	<0.10
Kirkcudbright	Plaice	2^{S}	<0.19	<0.18	<0.20	<0.56	<0.15	<0.10
Northern Ireland								
North coast	Lesser spotted dogfish	2^{N}	<0.24	<0.32		<0.60	<0.15	<0.10
Ardglass	Herring	2^{N}	<0.55	<1.6		<0.53	<0.16	<0.05
Kilkeel	Cod	3^{N}	<0.20	<0.21		<0.41	<0.10	<0.06
Kilkeel	Plaice	3^{N}	<0.18	<0.26		<0.38	<0.10	<0.04
Kilkeel	Lesser spotted dogfish	3^{N}	<0.36	<0.84		<0.51	<0.13	<0.07
Kilkeel	Haddock	2^{N}	<0.17	<0.19		<0.43	<0.11	<0.06
Wales								
North Anglesey	Flounder	1	<0.08	<0.05		<0.39	<0.11	<0.05
Further afield								
Norwegian Sea	Haddock	2	<0.09	<0.06		<0.33	<0.09	<0.03

Table 3.5 continued

Location	Material	No. of sampling observations	Mean radioactivity concentration (dry), Bq kg^{-1}				
			^{137}Cs	^{144}Ce	^{154}Eu	^{155}Eu	Gross beta
Cumbria							
Parton	Coda	1	1.8	<0.14	<0.21	<0.06	
Parton	Whiting[a]	1	<0.13	<0.12	<0.16	<0.05	84
Whitehaven	Coda	2	1.5	<0.26	<9.0	<0.12	130
Whitehaven	Plaice[a,b]	2	0.83	<0.21	<0.16	<0.09	110
Ravenglass	Plaice[a,c]	2	0.81	<0.13	<0.11	<0.06	89
Lancashire and Merseyside							
Morecambe Bay (Morecambe)	Flounder	2	3.5	<0.31	<0.21	<0.13	
Ribble Estuary	European Sea Bass	1	2.7	<0.12	<0.18	<0.05	
Ribble Estuary	Flounder	1	1.2	<0.12	<0.17	<0.05	
Liverpool Bay	Dab	1	0.31	<0.42	<0.12	<0.11	
Scotland							
The Minch	Herring	1^{S}	0.11	<0.38	<0.10	<0.19	
The Minch	Mackerel	1^{S}	0.20	<0.47	<0.12	<0.23	
Shetland	Fish meal (herring)	1^{S}	<0.21	<1.3	<0.37	<0.61	
Shetland	Fish oil (herring)	1^{S}	0.18	<0.90	<0.24	<0.40	
Ardrossan South Bay	Mackerel	1^{S}	0.35	<0.52	<0.13	<0.24	
Ardrossan South Bay	Salmon	1^{S}	<0.10	<0.32	<0.10	<0.15	
Annan	Salmon	1^{S}	<0.10	<0.40	<0.10	<0.19	
Inner Solway	Trout	1^{S}	<0.10	<0.48	<0.13	<0.24	
Kirkcudbright	Plaice	2^{S}	<0.10	<0.36	<0.12	<0.18	
Northern Ireland							
North coast	Lesser spotted dogfish	2^{N}	0.44	<0.60	<0.18	<0.16	
Ardglass	Herring	2^{N}	<0.17	<0.45	<0.15	<0.14	
Kilkeel	Cod	3^{N}	0.23	<0.35	<0.14	<0.13	
Kilkeel	Plaice	3^{N}	<0.15	<0.29	<0.12	<0.11	
Kilkeel	Lesser spotted dogfish	3^{N}	0.38	<0.37	<0.15	<0.13	
Kilkeel	Haddock	2^{N}	0.17	<0.32	<0.14	<0.13	
Wales							
North Anglesey	Flounder	1	0.42	<0.29	<0.15	<0.13	
Further afield							
Norwegian Sea	Haddock	2	<0.09	<0.13	<0.19	<0.06	

a. Data for natural radionuclides for some of these samples may be available in Table 7.5
b. The concentrations of ^{129}I and ^{147}Pm were <0.92 Bq kg^{-1} and <0.034 Bq kg^{-1} respectively
c. The concentrations of ^{129}I and ^{147}Pm were <0.92 Bq kg^{-1} and <0.029 Bq kg^{-1} respectively
N. Measurements labelled "N" are made on behalf of the Northern Ireland Environment Agency
S. Measurements labelled "S" are made on behalf of the Scottish Environment Protection Agency

Table 3.6 Beta/gamma radioactivity in shellfish from the Irish Sea vicinity and further afield, 2025

Location	Material	No. of sampling observations	Mean radioactivity concentration (dry), Bq kg^{-1}					
			Organic ^{3}H	^{3}H	^{14}C	^{54}Mn	^{60}Co	^{90}Sr
Cumbria								
Parton	Crabs[a]	2			38	<0.06	<0.06	<0.075
Parton	Lobsters[a]	2			33	<0.05	<0.06	0.020
Parton	Winkles[a]	2			27	<0.04	0.12	0.15
Whitehaven	Nephrops[a, b]	2	<25	<25	21	<0.03	<0.04	<0.032
Whitehaven outer harbour	Mussels[a]	2			22	<0.08	<0.08	0.15
Nethertown	Winkles[a, c]	4	<25	<25	28	<0.05	0.23	0.48
Sellafield coastal area	Crabs[a,d]	2	<25	<25	37	<0.04	<0.11	<0.038
Sellafield coastal area	Lobsters[a]	2	<25	<25	27	<0.04	<0.07	<0.030
Ravenglass	Winkles[a]	2			28	<0.07	0.12	0.12
Seascale Area	Common prawns[a]	2	<25	<25	22	<0.06	<0.07	<0.053
Lancashire and Merseyside								
Morecambe Bay (Morecambe)	Shrimps	2	<25	28	29	<0.04	<0.05	<0.045
Morecambe Bay (Morecambe)	Mussels	2	<25	<25	30	<0.05	<0.04	0.081
Morecambe Bay (Middleton Sands)	Cockles	2	31	42	27	<0.06	<0.06	0.14
Ribble Estuary	Shrimps	1			30	<0.04	<0.08	
Ribble Estuary	Mussels	1				<0.04	<0.04	
Liverpool Bay	Mussels	1		<25		<0.08	<0.09	
Dee Estuary	Cockles	1		<25		<0.08	<0.08	
Wirral	Shrimps	1		<25		<0.04	<0.05	

Location	Material	No. of sampling observations	^{95}Zr	^{95}Nb	^{99}Tc	^{106}Ru	^{110m}Ag	^{134}Cs
Cumbria								
Parton	Crabs[a]	2	<0.12	<0.09	1.3	<0.48	<0.08	<0.05
Parton	Lobsters[a]	2	<0.12	<0.12	17	<0.43	<0.07	<0.04
Parton	Winkles[a]	2	<0.08	<0.04	9.2	<0.38	<0.05	<0.05
Whitehaven	Nephrops[a, b]	2	<0.09	<0.07	6.4	<0.28	<0.05	<0.04
Whitehaven outer harbour	Mussels[a]	2	<0.32	<0.52	4.2	<0.68	<0.10	<0.07
Nethertown	Winkles[a, c]	4	<0.10	<0.07	9.1	<0.38	<0.06	<0.07
Sellafield coastal area	Crabs[a,d]	2	<0.10	<0.09	1.1	<0.33	<0.05	<0.04
Sellafield coastal area	Lobsters[a]	2	<0.11	<0.06	13	<0.36	<0.06	<0.03
Ravenglass	Winkles[a]	2	<0.08	<0.07	4.8	<0.34	<0.05	<0.03
Seascale Area	Common prawns[a]	2	<0.20	<0.21	0.10	<0.60	<0.09	<0.11
Lancashire and Merseyside								
Morecambe Bay (Morecambe)	Shrimps	2	<0.09	<0.06	<0.15	<0.32	<0.06	<0.03
Morecambe Bay (Morecambe)	Mussels	2	<0.15	<0.07	15	<0.30	<0.05	<0.05
Morecambe Bay (Middleton Sands)	Cockles	2	<0.08	<0.10	1.0	<0.33	<0.05	<0.03
Ribble Estuary	Shrimps	1	<0.10	<0.06	<0.083	<0.33	<0.06	<0.04
Ribble Estuary	Mussels	1	<0.08	<0.06		<0.37	<0.05	<0.05
Liverpool Bay	Mussels	1	<0.16	<0.15		<0.80	<0.11	<0.09
Dee Estuary	Cockles	1	<0.25	<0.17	0.41	<0.71	<0.10	<0.12
Wirral	Shrimps	1	<0.08	<0.05	0.070	<0.41	<0.06	<0.05

Table 3.6 continued

Location	Material	No. of sampling observations	Mean radioactivity concentration (dry), Bq kg^{-1}					
			Organic					
			^{3}H	^{3}H	^{14}C	^{54}Mn	^{60}Co	^{90}Sr
Scotland								
Kinlochbervie	Crabs	2^{S}				<0.12	<0.12	
Islay	Crabs	1^{S}				<0.10	<0.10	
Islay	Scallops	1^{S}				<0.10	<0.10	
Kirkcudbright	Crabs[a]	2^{S}			27	<0.10	<0.10	<0.10
Kirkcudbright	Lobsters[a]	2^{S}			18	<0.10	<0.10	0.12
Kirkcudbright	Winkles	2^{S}				<0.14	<0.14	<0.10
Kirkcudbright	Scallops	2^{S}				<0.10	<0.10	
Kirkcudbright	Queens	2^{S}				<0.10	<0.10	
Cutters Pool	Limpets[a]	1^{S}				<0.10	<0.10	
Southerness	Winkles	2^{S}		<5.0		<0.20	<0.18	0.24
North Solway coast	Mussels	2^{S}		5.0	17	<0.13	<0.14	0.43
Inner Solway	Shrimps	2^{S}		5.0		<0.10	<0.10	<0.10

Table 3.6 continued

Location	Material	No. of sampling observations	Mean radioactivity concentration (dry), Bq kg^{-1}					
			Organic					
			^{3}H	^{3}H	^{14}C	^{54}Mn	^{60}Co	^{90}Sr
Wales								
North Anglesey	Crabs	1	<25	<25	36	<0.06	<0.06	
North Anglesey	Lobster	1	<25	<25	32	<0.05	<0.06	
Northern Ireland								
Ballycastle	Lobsters	2^{N}				<0.06	<0.04	
County Down	Scallops	2^{N}				<0.05	<0.04	
Kilkeel	Crabs	3^{N}				<0.05	<0.04	
Kilkeel	Lobsters	3^{N}				<0.06	<0.06	
Kilkeel	Nephrops	3^{N}				<0.24	<0.16	
Minerstown	Toothed winkles	1^{N}				<0.04	<0.04	
Minerstown	Winkles	3^{N}				<0.12	<0.09	
Carlingford Lough	Mussels	1^{N}				<0.10	<0.09	

Table 3.6 continued

Location	Material	No. of sampling observations	^{95}Zr	^{95}Nb	^{99}Tc	^{106}Ru	^{110m}Ag	^{134}Cs
Wales								
North Anglesey	Crabs	1	<0.14	<0.11		<0.56	<0.08	<0.11
North Anglesey	Lobster	1	<0.12	<0.09	14	<0.39	<0.07	<0.04
Northern Ireland								
Ballycastle	Lobsters	2[N]	<0.21	<0.29	3.7	<0.47	<0.07	<0.08
County Down	Scallops	2[N]	<0.15	<0.18		<0.40	<0.06	<0.06
Kilkeel	Crabs	3[N]	<0.33	<0.80		<0.41	<0.07	<0.06
Kilkeel	Lobsters	3[N]	<0.27	<0.39	4.9	<0.72	<0.09	<0.07
Kilkeel	Nephrops	3[N]	<0.71	<1.1	<0.91	<1.3	<0.21	<0.17
Minerstown	Toothed winkles	1[N]	<0.08	<0.08		<0.37	<0.05	<0.07
Minerstown	Winkles	3[N]	<0.48	<0.70		<0.85	<0.13	<0.07
Carlingford Lough	Mussels	1[N]	<0.53	<1.0	<0.067	<0.90	<0.20	<0.06
Further afield								
Cromer	Crabs	2	<0.11	<0.06		<0.41	<0.07	<0.05
Southern North Sea	Cockles	2	<0.10	<0.05		<0.30	<0.04	<0.04

Location	Material	No. of sampling observations	^{137}Cs	^{144}Ce	^{147}Pm	^{154}Eu	^{155}Eu	Gross beta
Wales								
North Anglesey	Crabs	1	0.23	<0.39		<0.18	<0.17	
North Anglesey	Lobster	1	0.29	<0.16		<0.21	<0.06	110
Northern Ireland								
Ballycastle	Lobsters	2[N]	0.08	<0.54		<0.15	<0.14	
County Down	Scallops	2[N]	0.12	<0.30		<0.13	<0.12	
Kilkeel	Crabs	3[N]	<0.11	<0.26		<0.13	<0.09	
Kilkeel	Lobsters	3[N]	<0.10	<0.68		<0.18	<0.16	
Kilkeel	Nephrops	3[N]	<0.22	<1.0		<0.40	<0.28	
Minerstown	Toothed winkles	1[N]	0.31	<0.28		<0.13	<0.13	
Minerstown	Winkles	3[N]	<0.10	<0.90		<0.25	<0.22	
Carlingford Lough	Mussels	1[N]	<0.08	<0.60		<0.24	<0.21	

Table 3.6 continued



Table 3.7 Concentrations of transuranic radionuclides in fish and shellfish from the Irish Sea vicinity and further afield, 2025

Location	Material	No. of sampling observations	Mean radioactivity concentration (fresh), Bq kg^{-1}						
			^{237}Np	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm
Cumbria									
Parton	Cod	1		0.00062	0.0035	<0.13	0.0076	*	0.000015
Parton	Whiting	1		0.000018	0.00016	<0.13	0.00018	0.000072	0.000027
Parton	Crabs	2		0.032	0.19	0.63	0.73	*	*
Parton	Lobsters	2		0.024	0.14	0.61	1.3	*	*
Parton	Winkles	2		0.42	2.7	9.4	5.7	*	*
Whitehaven	Cod	2		0.00069	0.0043	<0.18	0.0071	*	*
Whitehaven	Plaice	2	0.000045	0.00074	0.0048	<0.19	0.012	*	*
Whitehaven	Nephrops	2	0.00043	0.025	0.16	0.43	1.3	*	*
Whitehaven outer harbour	Mussels	2		0.41	2.5	8.9	5.6	*	*
Nethertown	Winkles	4	0.0098	0.68	3.8	14	8.7	*	*
Sellafield coastal area	Crabs	2	0.00092	0.023	0.15	<1.1	0.80	*	*
Sellafield coastal area	Lobsters	2		0.018	0.11	<0.52	2.3	*	*
Ravenglass	Plaice	2	<0.000090	0.00056	0.0042	<0.22	0.0095	*	*
Ravenglass	Winkles	2		0.32	2.1	7.8	4.6	*	*
Seascale	Common prawns	2		0.0054	0.033	<0.29	0.078	*	*
Lancashire and Merseyside									
Morecambe Bay (Morecambe)	Flounder	2		0.00036	0.0032		0.0064	*	*
Morecambe Bay (Morecambe)	Shrimps	2		0.0034	0.022		0.041	*	*
Morecambe Bay (Morecambe)	Mussels	2		0.24	1.5	5.3	3.0	*	*
Morecambe Bay (Middleton Sands)	Cockles	2		0.26	1.8	5.5	5.0	*	*
Ribble Estuary	Flounder	1					<0.03		
Ribble Estuary	European Sea Bass	1					<0.03		
Ribble Estuary	Shrimps	1	<0.000061	0.0014	0.0086		0.015	*	*
Ribble Estuary	Mussels	1		0.029	0.19		0.33	*	*
Liverpool Bay	Dab	1					<0.15		
Liverpool Bay	Mussels	1					<0.58		
Dee Estuary	Cockles	1		0.045	0.34		1.2	*	*
Wirral	Shrimps	1		0.00037	0.0027		0.0053	*	*

Table 3.7 continued

Location	Material	No. of sampling observations	Mean radioactivity concentration (fresh), Bq kg^{-1}					
			^{237}Np	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm
Scotland									
The Minch	Herring	1[S]		0.0012	0.0065		0.0067		
The Minch	Mackerel	1[S]		0.0024	0.0028		0.0057		
Shetland	Fish meal (herring)	1[S]		0.0091	0.0069		0.025		
Shetland	Fish oil (herring)	1[S]		0.0017	0.0022		0.013		
Kinlochbervie	Crabs	2[S]		0.025	0.029		0.059		
Islay	Crabs	1[S]					<0.24		
Islay	Scallops	1[S]					<0.20		
Ardrossan South Bay	Mackerel	1[S]		0.0022	0.0071		0.0084		
Ardrossan South Bay	Salmon	1[S]		0.0018	0.0025		0.0040		
Kirkcudbright	Plaice	2[S]		<0.00050	0.00028		0.00081		
Kirkcudbright	Crabs	2[S]		0.00027	0.00063	0.62	0.0014		
Kirkcudbright	Lobsters	2[S]		0.011	0.072	0.85	0.78		
Kirkcudbright	Winkles	2[S]		0.068	0.40		0.41		
Kirkcudbright	Scallops	2[S]		0.0063	0.045		0.0046		
Kirkcudbright	Queens	2[S]		0.00085	0.0087		0.0050		
Cutters Pool	Limpets	1[S]					8.3		
Southerness	Winkles	2[S]		0.20	1.3	28	1.0		
North Solway coast	Mussels	2[S]		0.20	1.3	4.3	2.7		
Annan	Salmon	1[S]					<0.10		
Inner Solway	Trout	1[S]					<0.26		
Inner Solway	Shrimps	2[S]		0.0025	0.0041		0.011		
Wales									
North Anglesey	Flounder	1					<0.17		
North Anglesey	Crabs	1					<0.23		
North Anglesey	Lobsters	1		0.0027	0.018	<0.19	0.14	*	*
Northern Ireland									
North coast	Lesser spotted dogfish	2[N]					<0.20		
Ballycastle	Lobsters	2[N]					<0.17		
County Down	Scallops	2[N]					<0.29		
Ardglass	Herring	2[N]					<0.18		
Kilkeel	Cod	3[N]					<0.16		
Kilkeel	Plaice	3[N]					<0.18		
Kilkeel	Lesser spotted dogfish	3[N]					<0.17		
Kilkeel	Haddock	2[N]					<0.17		
Kilkeel	Crabs	3[N]					<0.11		
Kilkeel	Lobsters	3[N]					<0.22		
Kilkeel	Nephrops	3[N]		0.0017	0.012		0.062	*	*
Minerstown	Toothed winkles	1[N]					0.38		
Minerstown	Winkles	3[N]		0.016	0.12		0.12	*	*
Carlingford Lough	Mussels	1[N]					<0.27		

Table 3.7 continued

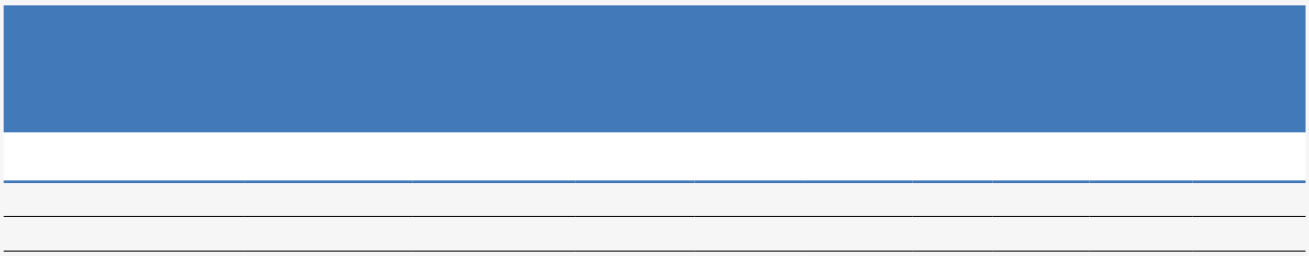


Table 3.8 Concentrations of radionuclides in sediment from the Cumbrian coast and further afield, 2025

Location	Material	No. of sampling observations	Mean radioactivity concentration (dry), Bq kg^{-1}								
			^{54}Mn	^{60}Co	^{90}Sr	^{95}Zr	^{95}Nb	^{106}Ru	^{110m}Ag	^{125}Sb	^{134}Cs	^{137}Cs
Cumbria												
Newton Arlosh	Sediment	2		<0.28		<0.57	<0.30	<2.3		<1.3	<0.28	130
Maryport Outer Harbour	Sediment	2		<0.30		<0.78	<0.26	<2.3		<1.2	<0.28	47
Workington Harbour	Sediment	2		<0.27		<0.54	<0.30	<2.1		<1.2	<0.26	73
Harrington Harbour	Sediment	2		<0.25		<0.58	<0.28	<2.0		<1.0	<0.24	50
Whitehaven Outer Harbour	Sediment	2		<0.22	<0.62	<0.64	<0.24	<1.8		<0.95	<0.22	33
St Bees beach	Sediment	4		<0.23		<0.46	<0.20	<1.6		<0.84	<0.19	34
Ehen spit	Sediment	4		<0.30		<0.71	<0.27	<2.3		<1.2	<0.26	48
Sellafield beach, S of former pipeline	Sediment	4		<0.25		<0.56	<0.22	<1.8		<0.92	<0.20	25
River Calder - downstream	Sediment	4		<0.28		<0.62	<0.26	<2.0		<1.1	<0.23	42
River Calder - upstream	Sediment	4		<0.35		<0.77	<0.34	<2.4		<1.3	<0.27	25
Seascale beach	Sediment	4		<0.25		<0.56	<0.20	<1.8		<0.91	<0.20	16
Ravenglass - Carleton Marsh	Sediment	4		<0.66	34	<1.0	<0.37	<3.2		<1.7	<0.37	150
River Mite Estuary (erosional)	Sediment	4		<0.64	30	<1.0	<0.46	<3.6		<1.9	<0.42	180
Ravenglass - Raven Villa	Sediment	4		<0.32		<0.71	<0.31	<2.4		<1.3	<0.28	74
Newbiggin (Eskmeals)	Sediment	4		1.0	41	<0.91	<0.36	<3.3		<1.7	<0.38	270
Haverigg	Sediment	2		<0.28		<0.53	<0.26	<2.0		<1.1	<0.22	20
Millom	Sediment	2		<0.33		<0.64	<0.33	<2.4		<1.3	<0.28	38
Askam Pier	Sediment	2		<0.29		<0.60	<0.24	<2.2		<1.2	<0.25	33
Low Shaw	Sediment	2		<0.26		<0.52	<0.21	<1.9		<1.0	<0.23	40
Walney Channel - N of discharge point	Sediment	2		<0.30		<0.59	<0.28	<2.2		<1.1	<0.26	36
Sand Gate Marsh	Sediment	1		<0.25		<0.47	<0.23	<1.8		<0.95	<0.21	46
Kents Bank	Sediment	1		<0.27		<0.51	<0.26	<2.1		<1.1	<0.23	77
Arnside	Sediment[a]	1		<0.38		<0.83	<0.39	<3.2		<1.7	<0.37	230

Table 3.8 continued

Location	Material	No. of sampling observations	Mean radioactivity concentration (dry), Bq kg^{-1}									
			^{54}Mn	^{60}Co	^{90}Sr	^{95}Zr	^{95}Nb	^{106}Ru	^{110m}Ag	^{125}Sb	^{134}Cs	^{137}Cs
Lancashire												
Morecambe	Sediment	2		<0.24								25
Half Moon Bay	Sediment	2		<0.32								52
Red Nab Point	Sediment	2		<0.24								31
Potts Corner	Sediment	2		<0.26								13
Shore adjacent to Northern Outfall	Sediment	1		<0.27								31
Sunderland Point	Sediment	1		<0.36		<0.89	<0.35	<2.9		<1.5	<0.35	53
Conder Green	Sediment	1		<0.39		<0.91	<0.41	<2.9		<1.5	<0.34	52
Hambleton	Sediment[b]	1		<0.40		<0.86	<0.40	<3.0		<1.6	<0.36	150
Skippool Creek	Sediment	1		<0.34		<0.78	<0.35	<2.7		<1.4	<0.31	130
Fleetwood	Sediment	1		<0.23		<0.50	<0.19	<1.6		<0.83	<0.18	3.7
Blackpool	Sediment	1		<0.20		<0.49	<0.17	<1.5		<0.78	<0.18	1.2
Crossens Marsh	Sediment	1		<0.38		<1.5	<0.43	<3.7		<1.9	<0.44	150
Ainsdale	Sediment	1		<0.21		<0.51	<0.17	<1.6		<0.79	<0.19	2.0
Rock Ferry	Sediment[c]	1		<0.34		<0.84	<0.37	<2.6		<1.4	<0.30	67
Scotland												
Nigg Bay	Sediment	1[S]	<0.10	<0.10		<0.12	<0.10	<0.58	<0.10	<0.18	<0.10	0.16
Campbeltown	Sediment	1[S]	<0.10	<0.10		<0.20	<0.17	<0.69	<0.13	<0.21	<0.10	4.2
Garlieston	Sediment	1[S]	<0.10	<0.10		<0.21	<0.11	<0.75	<0.14	<0.26	<0.11	21
Innerwell	Sediment	2[S]	<0.10	<0.10		<0.20	<0.15	<1.0	<0.18	<0.34	<0.15	18
Carsluith	Sediment	1[S]	<0.14	0.24		<0.48	<0.41	<1.4	<0.30	<0.73	<0.25	110
Skyreburn	Sediment	2[S]	<0.10	<0.12		<0.26	<0.19	<0.87	<0.17	<0.28	<0.13	26
Kirkcudbright	Sediment[d]	2[S]	<0.12	<0.13		<0.34	<0.24	<1.2	<0.23	<0.46	<0.20	55
Balcary Bay	Sediment[d]	1[S]	<0.10	0.15		<0.30	<0.23	<1.4	<0.22	<0.51	<0.19	50
Palnackie Harbour	Sediment	1[S]	<0.10	0.15		<0.15	<0.10	<0.88	<0.14	<0.35	<0.12	59
Gardenburn	Sediment	2[S]	<0.12	<0.28		<0.47	<0.29	<1.7	<0.26	<0.69	<0.21	140
Kippford Slipway	Sediment	2[S]	<0.12	0.13		<0.30	<0.22	<1.1	<0.19	<0.42	<0.14	63
Kippford Merse	Sediment	1[S]	<0.12	0.23		<0.40	<0.85	<2.2	<0.37	<0.82	<0.28	85
Kirkconnell Merse	Sediment	1[S]	<0.10	0.15		<0.36	<0.31	<1.6	<0.24	<0.65	<0.20	110
Southerness	Sediment	1[S]	<0.10	<0.11		<0.12	<0.14	<0.86	<0.15	<0.27	<0.13	5.1
Wales												
Rhyl	Sediment	1		<0.38		<1.5	<0.39	<2.9		<1.5	<0.32	28
Llandudno	Sediment	1		<0.35		<1.4	<0.36	<2.5		<1.3	<0.36	1.5
Llanfairfechan	Sediment	1		<0.19		<0.73	<0.20	<1.6		<0.78	<0.18	13
Northern Ireland												
Ballykelly	Sand	2[N]	<0.29	<0.17		<1.9	<3.2	<1.5	<0.24	<0.38	<0.17	1.1
Portrush	Sand	2[N]	<0.32	<0.13		<1.6	<6.9	<1.5	<0.24	<0.36	<0.17	0.30
Oldmill Bay	Mud	1[N]	<0.42	<0.15		<2.3	<1.7	<1.8	<0.26	<0.44	<0.16	6.2
Oldmill Bay	Sand	1[N]	<0.29	<0.13		<0.65	<0.88	<1.5	<0.20	<0.36	<0.09	4.7
Ballymacormick	Mud	2[N]	<0.28	<0.14		<2.2	<2.7	<1.7	<0.25	<0.41	<0.14	8.4
Strangford Lough - Nicky's Point	Mud	2[N]	<0.27	<0.13		<1.8	<2.6	<1.5	<0.23	<0.38	<0.12	3.6
Dundrum Bay	Mud	1[N]	<0.39	<0.17		<2.3	<2.6	<1.9	<0.30	<0.47	<0.19	2.6
Dundrum Bay	Sandy mud	1[N]	<0.35	<0.16		<2.1	<3.7	<1.8	<0.29	<0.47	<0.12	2.9
Carlingford Lough	Mud	2[N]	<0.49	<0.25		<3.0	<3.9	<2.8	<0.43	<0.73	<0.37	27

Table 3.8 continued

Location	Material	No. of sampling observations	Mean radioactivity concentration (dry), Bq kg^{-1}									
			^{144}Ce	^{154}Eu	^{155}Eu	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Cumbria													
Newton Arlosh	Sediment	2	<1.6	<0.93	<0.74				240			1600	1200
Maryport Outer Harbour	Sediment	2	<1.4	<0.97	<0.62				140			790	700
Workington Harbour	Sediment	2	<1.7	<0.91	<0.78				260			1300	1200
Harrington Harbour	Sediment	2	<1.6	<0.79	<0.73				68			690	990
Whitehaven Outer Harbour	Sediment	2	<1.4	<0.69	<0.61	6.0	38	110	52			650	780
St Bees beach	Sediment	4	<0.89	<0.68	<0.41				120			480	540
Ehen spit	Sediment	4	<1.4	<0.97	<0.61				97			660	1000
Sellafield beach, S of former pipeline	Sediment	4	<0.99	<0.82	<0.46				95			510	630
River Calder - downstream	Sediment	4	<1.2	<0.88	<0.50				76			470	800
River Calder - upstream	Sediment	4	<1.4	<1.2	<0.66							770	1700
Seascale beach	Sediment	4	<0.97	<0.81	<0.43				90			460	590
Ravenglass - Carleton Marsh	Sediment	4	<1.9	<1.2	<0.83	52	330	1100	670			2300	1400
River Mite Estuary (erosional)	Sediment	4	<2.1	<1.4	<0.86	59	380	1200	780			2100	1600
Ravenglass - Raven Villa	Sediment	4	<1.4	<1.0	<0.64				360			1400	1100
Newbiggin (Eskmeals)	Sediment	4	<2.0	<2.0	<0.99	120	750	2300	1600			5000	1700
Haverigg	Sediment	2	<1.1	<0.88	<0.50				81			450	690
Millom	Sediment	2	<1.3	<1.0	<0.61				130			500	870
Askam Pier	Sediment	2	<1.2	<0.96	<0.56				110			580	810
Low Shaw	Sediment	2	<1.2	<0.88	<0.52				89			520	780
Walney Channel - N of discharge point	Sediment	2	<1.3	<0.99	<0.57				97			690	830
Sand Gate Marsh	Sediment	1	<1.1	<0.83	<0.48				67			470	780
Kents Bank	Sediment	1	<1.2	<0.90	<0.54				82			700	900
Arnside	Sediment[a]	1	<1.5	<1.2	<0.65				160			1200	1300
Lancashire													
Morecambe	Sediment	2							43				
Half Moon Bay	Sediment	2				8.1	49		91				
Red Nab Point	Sediment	2							62				
Potts Corner	Sediment	2							23				
Shore adjacent to Northern Outfall	Sediment	1							64				
Sunderland Point	Sediment	1	<1.8	<1.2	<0.78				80			890	970
Conder Green	Sediment	1	<1.8	<1.3	<0.78				68			840	1000
Hambleton	Sediment[b]	1	<1.4	<1.3	<0.61				200			970	1500
Skippool Creek	Sediment	1	<1.3	<1.1	<0.58				180			750	1500
Fleetwood	Sediment	1	<0.77	<0.73	<0.33				5.7			<130	400
Blackpool	Sediment	1	<0.89	<0.62	<0.41				3.7			140	210
Crossens Marsh	Sediment	1	<2.4	<1.2	<0.93				130			860	1500
Ainsdale	Sediment	1	<0.87	<0.64	<0.40				2.8			<150	360
Rock Ferry	Sediment[c]	1	<1.3	<1.2	<0.55				72			760	1400

Table 3.8 continued

Location	Material	No. of sampling observations	Mean radioactivity concentration (dry), Bq kg^{-1}										
			^{144}Ce	^{154}Eu	^{155}Eu	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Scotland													
Nigg Bay	Sediment	1[S]	<0.56	<0.16	<0.25				<0.33				
Campbeltown	Sediment	1[S]	<0.68	<0.19	<0.27				0.86				
Garlieston	Sediment	1[S]	<0.76	<0.20	<0.30	3.9	28		53				
Innerwell	Sediment	2[S]	<0.99	<0.22	<0.46	8.1	47		120				
Carsluith	Sediment	1[S]	<1.4	<0.29	<0.46	20	130		290			250	2400
Skyreburn	Sediment	2[S]	<0.80	<0.21	<0.35	4.6	29		58				
Kirkcudbright	Sediment[d]	2[S]	<1.2	<0.32	<0.44				130				
Balcary Bay	Sediment[d]	1[S]	<1.4	<0.41	<0.55				130				
Palnackie Harbour	Sediment	1[S]	<0.89	<0.20	<0.34	12	79		120				
Gardenburn	Sediment	2[S]	<1.8	<0.39	<0.71	26	170		340				
Kippford Slipway	Sediment	2[S]	<1.2	<0.28	<0.48	10	69		140				
Kippford Merse	Sediment	1[S]	<2.2	<0.54	<0.62	21	140		250				
Kirkconnell Merse	Sediment	1[S]	<1.7	<0.46	<0.74	18	110		220			270	2100
Southerness	Sediment	1[S]	<0.83	<0.24	<0.36	1.6	14		27				
Wales													
Rhyl	Sediment	1	<1.5	<1.3	<0.60				30			660	1200
Llandudno	Sediment	1	<1.7	<1.2	<0.64				1.4			330	740
Llanfairfechan	Sediment	1	<1.3	<0.57	<0.56				12			280	910
Northern Ireland													
Ballykelly	Sand	2[N]	<2.0	<0.45	<0.63	0.027	0.17		0.50	*	*		
Portrush	Sand	2[N]	<1.5	<0.39	<0.55				<1.7				
Oldmill Bay	Mud	1[N]	<2.5	<0.48	<0.69				7.8				
Oldmill Bay	Sand	1[N]	<1.4	<0.40	<0.59				5.1				
Ballymacormick	Mud	2[N]	<1.6	<0.46	<1.2				10				
Strangford Lough - Nicky's Point	Mud	2[N]	<2.0	<0.42	<1.2				3.2				
Dundrum Bay	Mud	1[N]	<3.4	<0.55	<0.80				2.3				
Dundrum Bay	Sandy mud	1[N]	<3.8	<0.54	<1.6				2.2				
Carlingford Lough	Mud	2[N]	<4.6	<0.80	<0.54	1.6	11		7.3	*	*		

* Not detected by the method used
[a] The concentration of ^{125}I was 2.2 Bq kg^{-1}
[b] The concentration of ^{125}I was 1.8 Bq kg^{-1}
[c] The concentration of ^{125}I was 2.3 Bq kg^{-1}
[d] Data for natural radionuclides for some of these samples may be available in Table 7.5
[S] Measurements labelled "S" are made on behalf of the Scottish Environment Protection Agency
[N] Measurements labelled "N" are made on behalf of the Northern Ireland Environment Agency
All other measurements are made on behalf of the Environment Agency

Table 3.9 Gamma radiation dose rates over areas of the Cumbrian coast and further afield, 2025

Location	Ground type	No. of sampling observations	Mean gamma dose rate in air at 1m, µGy h^{-1}
Cumbria, Rockcliffe-Harrington			
Rockcliffe Marsh	Salt marsh	2	0.075
Burgh Marsh	Salt marsh	2	0.071
Port Carlisle 1	Mud and sand	2	0.078
Port Carlisle 1	Grass	1	0.078
Port Carlisle 2	Salt marsh	1	0.081
Newton Arlosh	Salt marsh	2	0.085
Silloth harbour	Sand	1	0.086
Allonby	Sand	1	0.074
Allonby	Sand and stones	1	0.087
Maryport harbour	Sand	1	0.077
Maryport harbour	Sand and stones	1	0.090
Workington harbour	Foundry slag and shingle	1	0.098
Workington harbour	Shingle	1	0.10
Harrington harbour	Sand	1	0.098
Harrington harbour	Sand and stones	1	0.090
Cumbria, Whitehaven-Drigg			
Whitehaven - outer harbour	Sand and stones	2	0.088
St Bees	Sand	4	0.071
Nethertown beach	Shingle	4	0.12
Ehen spit	Sand	1	0.087
Ehen spit	Sand and shingle	1	0.11
Ehen spit	Shingle	2	0.10
Braystones	Grass	1	0.084
Braystones beach	Shingle	4	0.11
WAMAC Access gate	Grass	1	0.092
Sellafield dunes	Grass	4	0.086
North of former pipeline on foreshore	Sand	4	0.080
South of former pipeline on foreshore	Sand	4	0.081
River Calder downstream of site	Grass	2	0.082
River Calder downstream of site	Grass and herbage	1	0.087
River Calder downstream of site	Grass and sand	1	0.087
River Calder upstream of site	Grass	1	0.090
Seascale beach	Pebbles and sand	1	0.074
Seascale beach	Sand	2	0.073
Seascale beach	Sand and stones	1	0.088
Cumbria, Ravenglass-Askam			
Ravenglass - Carleton Marsh	Salt marsh	4	0.10
Ravenglass - River Mite estuary (erosional)	Salt marsh	4	0.10
Ravenglass - Raven Villa	Salt marsh	4	0.10
Ravenglass - boat area	Sand and stones	3	0.099
Ravenglass - boat area	Stones	1	0.098
Ravenglass - ford	Sand	3	0.087
Ravenglass - ford	Sand and stones	1	0.087
Muncaster Bridge	Grass	3	0.092
Muncaster Bridge	Salt marsh	1	0.094
Ravenglass - salmon garth	Mud and sand	1	0.088
Ravenglass - salmon garth	Pebbles and sand	1	0.097
Ravenglass - salmon garth	Sand	1	0.098
Ravenglass - salmon garth	Sand and stones	1	0.099
Ravenglass - Eskmeals Nature Reserve	Salt marsh	3	0.091

Table 3.9 continued

Location	Ground type	No. of sampling observations	Mean gamma dose rate in air at 1m, μGy h^{-1}
Cumbria, Ravenglass-Askam			
Newbiggin/Eskmeals Bridge	Salt marsh	4	0.098
Newbiggin/Eskmeals viaduct	Salt marsh	4	0.098
Tarn Bay	Sand	4	0.071
Silecroft	Shingle	2	0.11
Haverigg	Rock and sand	1	0.075
Haverigg	Sand and shingle	1	0.085
Millom	Mud and sand	1	0.088
Millom	Sand and stones	1	0.090
Low Shaw	Salt marsh	2	0.070
Askam	Mud and sand	1	0.063
Askam	Sand	3	0.066
Askam Pier	Mud and sand	3	0.073
Askam Pier	Sand	1	0.076
Cumbria, Walney-Arnside			
Walney Channel, N of discharge point	Mud and sand	2	0.076
Walney Channel, N of discharge point	Sand	2	0.080
Tummer Hill Marsh	Salt marsh	2	0.090
Roa Island	Sand	2	0.085
Sand Gate Marsh	Salt marsh	2	0.079
Kents Bank 2	Salt marsh	2	0.077
Arnside 2	Salt marsh	2	0.080
Lancashire and Merseyside			
Morecambe Central beach	Sand	2	0.072
Half Moon Bay	Rock and sand	1	0.076
Half Moon Bay	Sand	1	0.078
Pipeline (Heysham)	Sand and stones	1	0.069
Red Nab Point	Sand	1	0.078
Red Nab Point	Sand and stones	1	0.079
Middleton Sands	Sand	2	0.072
Sunderland Point	Mud and sand	1	0.090
Sunderland Point	Salt marsh and sand	1	0.080
Colloway Marsh	Salt marsh	2	0.094
Lancaster	Grass and herbage	1	0.074
Lancaster	Salt marsh	1	0.076
Aldcliffe Marsh	Salt marsh	2	0.082
Conder Green	Salt marsh	2	0.080
Pilling Marsh	Salt marsh	2	0.087
Knott End	Sand	2	0.079
Height o' th' hill - River Wyre	Salt marsh	2	0.088
Hambleton	Salt marsh	2	0.091
Skippool Creek	Salt marsh	2	0.092
Skippool Creek (mud)	Salt marsh	2	0.092
Fleetwood shore 1	Sand	2	0.074
Fleetwood shore 2	Salt marsh	2	0.097
Blackpool	Sand	2	0.061
Crossens Marsh	Salt marsh	2	0.082
Ainsdale	Sand	2	0.059
Rock Ferry	Mud and sand	2	0.083
West Kirby	Sand	2	0.068

Table 3.9 continued

Location	Ground type	No. of sampling observations	Mean gamma dose rate in air at 1m, μGy h^{-1}
Scotland			
Piltanton Burn	Sediment	2[S]	0.063
Garlieston	Sediment	2[S]	0.060
Innerwell	Sediment	2[S]	0.071
Bladnoch	Sediment	2[S]	0.064
Carsluith	Sediment	2[S]	0.077
Skyreburn Bay (Water of Fleet)	Sediment	2[S]	0.068
Kirkcudbright Merse	Salt marsh	2[S]	0.064
Cutters Pool	Sediment	4[S]	0.080
Balcary Bay	Sediment	2[S]	0.082
Gardenburn	Sediment	2[S]	0.075
Palnackie Harbour	Sediment	1[S]	0.072
Kippford - Slipway	Sediment	2[S]	0.084
Kippford - Merse	Salt marsh	2[S]	0.080
Kirkconnell Merse	Sediment	2[S]	0.064
Southerness	Sediment	2[S]	0.054
Wales			
Flint 1	Mud	2	0.085
Flint 2	Salt marsh	2	0.085
Rhyl	Salt marsh	2	0.079
Llandudno	Sand and shingle	1	0.091
Llandudno	Shingle	1	0.088
Caerhun	Salt marsh	1	0.080
Llanfairfechan	Sand and shells	2	0.076
Northern Ireland			
Lisahally	Mud	1[N]	0.055
Donnybrewer	Shingle	1[N]	0.052
Ballykelly	Mud	1[N]	0.064
Bellerena	Mud	1[N]	0.056
Benone	Sand	1[N]	0.073
Castlerock	Sand	1[N]	0.064
Portstewart	Sand	1[N]	0.059
Portrush, Blue Pool	Sand	1[N]	0.060
Portrush, White Rocks	Sand	1[N]	0.058
Portballintrae	Sand	1[N]	0.052
Giant`s Causeway	Sand	1[N]	0.049
Ballycastle	Sand	1[N]	0.057
Cushendun	Sand	1[N]	0.062
Cushendall	Sand and stones	1[N]	0.062
Red Bay	Sand	1[N]	0.063
Carnlough	Sand	1[N]	0.057

Table 3.9 continued

Location	Ground type	No. of sampling observations	Mean gamma dose rate in air at 1m, μGy h^{-1}
Northern Ireland			
Glenarm	Sand	1[N]	0.054
Half Way House	Sand	1[N]	0.052
Ballygally	Sand	1[N]	0.054
Drains Bay	Sand	1[N]	0.053
Larne	Sand	1[N]	0.055
Whitehead	Sand	1[N]	0.059
Carrickfergus	Sand	1[N]	0.058
Jordanstown	Sand	1[N]	0.054
Helen`s Bay	Sand	1[N]	0.055
Groomsport	Sand	1[N]	0.062
Millisle	Sand	1[N]	0.063
Ballywalter	Sand	1[N]	0.061
Ballyhalbert	Sand	1[N]	0.063
Cloghy	Sand	1[N]	0.063
Portaferry	Shingle and stones	1[N]	0.082
Kircubbin	Sand	1[N]	0.074
Greyabbey	Sand	1[N]	0.083
Ards Maltings	Mud	1[N]	0.070
Island Hill	Mud	1[N]	0.075
Nicky`s Point	Mud	1[N]	0.083
Strangford	Shingle and stones	1[N]	0.10
Kilclief	Sand	1[N]	0.074
Ardglass	Mud	1[N]	0.092
Killough	Mud	1[N]	0.082
Ringmore Point	Sand	1[N]	0.074
Tyrella	Sand	1[N]	0.071
Dundrum	Sand	1[N]	0.079
Newcastle	Sand	1[N]	0.093
Annalong	Sand	1[N]	0.11
Cranfield Bay	Sand	1[N]	0.078
Mill Bay	Sand	1[N]	0.096
Greencastle	Sand	1[N]	0.083
Rostrevor	Sand	1[N]	0.11
Narrow Water	Mud	1[N]	0.095

[S.] Measurements labelled "S" are made on behalf of the Scottish Environment Protection Agency
[N.] Measurements labelled "N" are made on behalf of the Northern Ireland Environment Agency
All other measurements are made on behalf of the Environment Agency

Table 3.10 Beta radiation dose rates over intertidal areas of the Cumbrian coast, 2025

Location	Ground type	No. of sampling observations	Mean beta dose rate in tissue μSv h^{-1}
Whitehaven - outer harbour	Sand and stones	2	0.30
St Bees	Sand	4	0.11
Sellafield beach, N of discharge point	Sand	4	0.10
Ravenglass - Raven Villa	Salt marsh	4	0.23
Tarn Bay	Sand	4	0.064

Table 3.11 Concentrations of radionuclides in aquatic plants from the Cumbrian coast and further afield, 2025

Location	Material	No. of sampling observations	Mean radioactivity concentration (fresh), Bq kg^{-1}								
			^{54}Mn	^{60}Co	^{65}Zn	^{90}Sr	^{95}Zr	^{95}Nb	^{99}Tc	^{106}Ru	^{129}I
Cumbria											
Silloth	Seaweed	1		<0.25			<0.41	<0.20	18	<1.8	
Harrington Harbour	Seaweed	2		<0.18			<0.29	<0.15	22	<1.2	
St Bees[a]	Seaweed	2		<0.23		<0.082	<0.33	<0.17	57	<1.6	<0.28
Sellafield[b]	Seaweed	2		<0.26		<0.19	<0.40	<0.20	420	<1.8	<0.33
Ravenglass	Samphire	1[F]	<0.06	<0.06	<0.20		<0.27	<0.11	0.62	<0.58	
Ravenglass[c]	Seaweed	2		<0.30		0.99	<0.45	<0.24	29	<2.0	<0.26
Lancashire											
Half Moon Bay[d]	Seaweed	2		<0.28			<0.38	<0.20	43	<1.7	
Marshside Sands	Samphire	1[F]	<0.02	<0.02	<0.04		<0.04	<0.03	0.13	<0.20	

Location	Material	No. of sampling observations	Mean radioactivity concentration (fresh), Bq kg							
			^{134}Cs	^{137}Cs	^{144}Ce	^{154}Eu	^{155}Eu	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am
Cumbria										
Silloth	Seaweed	1	<0.21	2.2	<0.80					1.1
Harrington Harbour	Seaweed	2	<0.15	0.66	<0.58					1.0
St Bees[a]	Seaweed	2	<0.21	1.1	<0.78			0.84	4.8	3.0
Sellafield[b]	Seaweed	2	<0.24	2.2	<0.87			1.2	6.9	4.9
Ravenglass	Samphire	1[F]	<0.05	1.2	<0.37	<0.19	<0.16			5.6
Ravenglass[c]	Seaweed	2	<0.25	3.5	<0.78			1.5	9.5	13
Lancashire										
Half Moon Bay[d]	Seaweed	2	<0.21	2.1	<0.69					2.0
Marshside Sands	Samphire	1[F]	<0.03	0.19	<0.25	<0.07	<0.07			0.25

Table 3.11 continued

Location	Material	No. of sampling observations	Mean radioactivity concentration (fresh), Bq kg^{-1}							
			^{54}Mn	^{60}Co	^{65}Zn	^{90}Sr	^{95}Zr	^{95}Nb	^{99}Tc	^{106}Ru	^{129}I
Scotland											
Lerwick	Fucus vesiculosus	1[S]	<0.10	<0.10	<0.23		<0.18	<0.16	3.9	<0.62	
Kinlochbervie	Fucus vesiculosus	2[S]	<0.10	<0.10	<0.22		<0.22	<0.25	24	<0.59	
Lewis	Fucus vesiculosus	1[S]	<0.10	<0.10	<0.17		<0.15	<0.14	14	<0.44	
Islay	Fucus vesiculosus	1[S]	<0.10	<0.10	<0.22		<0.28	<0.39	20	<0.59	
Campbeltown	Fucus vesiculosus	1[S]	<0.10	<0.10	<0.17		<0.12	<0.10	9.7	<0.47	
Nigg Bay Aberdeen	Fucus vesiculosus	1[S]	<0.10	<0.10	<0.18		<0.13	<0.10	4.5	<0.45	
Port William	Fucus vesiculosus	4[S]	<0.10	<0.10	<0.20		<0.16	<0.16	34	<0.53	
Garlieston	Fucus vesiculosus	4[S]	<0.10	<0.10	<0.20		<0.15	<0.16	21	<0.52	
Auchencairn	Fucus vesiculosus	4[S]	<0.10	<0.10	<0.18		<0.14	<0.16	140	<0.49	
Wales											
Cemaes Bay	Seaweed	2		<0.17			<0.25	<0.13	7.9	<1.0	
Porthmadog	Seaweed	2		<0.22			<0.37	<0.18	0.55	<1.6	
Lavernock Point	Seaweed	2		<0.29			<0.33	<0.32	0.52	<2.0	
Fishguard	Seaweed	2		<0.13			<0.20	<0.11	0.58	<0.94	

Location	Material	No. of sampling observations	Mean radioactivity concentration (fresh), Bq kg^{-}							
			^{134}Cs	^{137}Cs	^{144}Ce	^{154}Eu	^{155}Eu	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am
Scotland										
Lerwick	Fucus vesiculosus	1[S]	<0.10	<0.10	<0.48	<0.14	<0.27			<0.14
Kinlochbervie	Fucus vesiculosus	2[S]	<0.10	<0.13	<0.44	<0.11	<0.18			<0.22
Lewis	Fucus vesiculosus	1[S]	<0.10	0.12	<0.31	<0.10	<0.16			<0.18
Islay	Fucus vesiculosus	1[S]	<0.10	<0.10	<0.48	<0.12	<0.24			<0.25
Campbeltown	Fucus vesiculosus	1[S]	<0.10	0.18	<0.28	<0.10	<0.10			<0.10
Nigg Bay Aberdeen	Fucus vesiculosus	1[S]	<0.10	<0.10	<0.33	<0.10	<0.18			<0.10
Port William	Fucus vesiculosus	4[S]	<0.10	0.26	<0.41	<0.12	<0.20			<0.47
Garlieston	Fucus vesiculosus	4[S]	<0.10	2.0	<0.41	<0.12	<0.22			6.5
Auchencairn	Fucus vesiculosus	4[S]	<0.10	1.1	<0.38	<0.12	<0.19			1.7
Wales										
Cemaes Bay	Seaweed	2	<0.13	<0.19	<0.46					<0.20
Porthmadog	Seaweed	2	<0.19	<0.26	<0.75					<0.23
Lavernock Point	Seaweed	2	<0.26	<0.24	<1.1	<0.92	<0.48			<0.36
Fishguard	Seaweed	2	<0.11	<0.11	<0.39					<0.12

Table 3.11 continued

Location	Material	No. of sampling observations	Mean radioactivity concentration (fresh), Bq kg^{-}							
			^{134}Cs	^{137}Cs	^{144}Ce	^{154}Eu	^{155}Eu	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am
Northern Ireland										
Portrush	Fucus serratus	4^{N}	<0.04	<0.05	<0.22	<0.13	<0.07			<0.15
Strangford Lough (Island Hill)[e]	Rhodymenia species	4^{N}	<0.12	0.87	<0.57	<0.30	<0.23	0.14	0.88	1.6
Ardglass	Fucus spiralis	1^{N}	<0.05	0.17	<0.66	<0.17	<0.15			<0.39
Ardglass	Ascophyllum nodosum	3^{N}	<0.07	0.20	<0.38	<0.23	<0.15			<0.22
Carlingford Lough	Fucus vesiculosus	4^{N}	<0.07	0.21	<0.41	<0.14	<0.21			<0.21
Isles of Scilly										
	Seaweed	1	<0.27	<0.26	<1.1	<0.90	<0.50			<0.41

a The concentration of ^{14}C was 18 Bq kg^{-1}
b The concentration of ^{14}C was 36 Bq kg^{-1}
c The concentration of ^{14}C was 12 Bq kg^{-1}
d The concentration of ^{35}S was <0.68 Bq kg^{-1}
e The concentration of ^{242}Cm and $^{243+244}$Cm were not detected by the method used
F Measurements labelled "F" are made on behalf of the Food Standards Agency
N Measurements labelled "N" are made on behalf of the Northern Ireland Environment Agency
S Measurements labelled "S" are made on behalf of the Scottish Environment Protection Agency
All other measurements are made on behalf of the Environment Agency

Table 3.12 Concentrations of radionuclides in terrestrial food and the environment near Ravenglass, 2025

Material and selection[a]	No. of sampling observations[b]	Mean radioactivity concentration (fresh)[c], Bq kg^{-1}											
		Organic											
		^{3}H	^{3}H	^{14}C	^{60}Co	^{90}Sr	^{95}Zr	^{95}Nb	^{99}Tc	^{106}Ru	^{125}Sb	^{129}I	^{134}Cs
Milk	3		<2.4	17	<0.06	<0.033	<0.25	<0.58	<0.0059	<0.50	<0.12	<0.0038	<0.05
Milk	max					0.042	<0.28	<0.81		<0.53		<0.0045	<0.06
Beef kidney	1		<3.4	20	<0.11	<0.052	<0.19	<0.13	<0.028	<0.72	<0.21		<0.11
Beef liver	1		<3.5	30	<0.07	<0.037	<0.08	<0.05	<0.037	<0.37	<0.10	<0.033	<0.06
Beef muscle	1		<3.0	25	<0.05	<0.048	<0.14	<0.08	<0.033	<0.34	<0.09	<0.017	<0.04
Plums	1	<1.8	<1.8	4.9	<0.07	0.035	<0.13	<0.09		<0.50	<0.13	<0.017	<0.05
Sheep muscle	2		<3.3	17	<0.05	<0.046	<0.07	<0.05	<0.059	<0.35	<0.09	<0.017	<0.04
Sheep muscle	max		<3.6	23			<0.08		0.076				<0.06
Sheep offal	2		<3.4	22	<0.04	<0.036	<0.07	<0.04	<0.033	<0.32	<0.08	<0.025	<0.03
Sheep offal	max		<3.6	23				<0.05	<0.034	<0.33	<0.09	0.035	

Material and selection[a]	No. of sampling observations[b]	Mean radioactivity concentration (fresh)[c], Bq kg^{-1}										
		Total								^{239}Pu +		
		^{137}Cs	Cs	^{144}Ce	^{154}Eu	^{155}Eu	^{234}U	^{235}U	^{238}U	^{238}Pu	^{240}Pu	^{241}Pu	^{241}Am
Milk	3	<0.06		<0.32	<0.18	<0.15				<0.000037	<0.000030	<0.18	<0.000038
Milk	max			<0.34	<0.19								
Beef kidney	1	0.29	0.29	<0.30	<0.31	<0.13	0.0073	0.00026	0.0060	0.000025	0.00044	<0.38	0.0014
Beef liver	1	0.13	0.13	<0.25	<0.15	<0.13				0.00066	0.0043	<0.17	0.0058
Beef muscle	1	0.29	0.29	<0.23	<0.16	<0.12				0.0000047	0.00011	<0.22	0.00015
Plums	1	<0.06	<0.061	<0.26	<0.21	<0.12				0.000023	0.00015	<0.28	0.00025
Sheep muscle	2	0.26	0.26	<0.28	<0.16	<0.17				0.000045	0.00041	<0.26	0.00078
Sheep muscle	max	0.35	0.35	<0.32		<0.20				0.000048	0.00044	<0.32	0.00082
Sheep offal	2	0.14	0.14	<0.26	<0.12	<0.15				0.000089	0.00070	<0.20	0.0012
Sheep offal	max	0.15	0.15	<0.31	<0.13	<0.19				0.00010	0.00078		0.0014

[a] Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima. If no 'max' value is given the mean value is the most appropriate for dose assessments

[b] The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

[c] Except for milk where units are Bq l^{-1}

Table 3.13 Concentrations of radionuclides in surface waters from West Cumbria, 2025

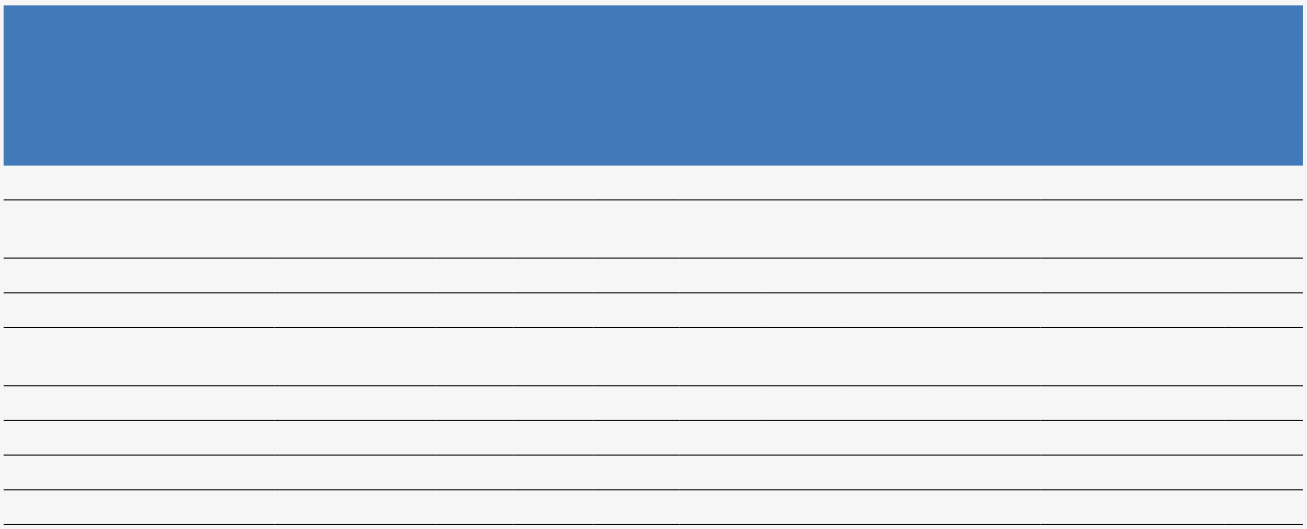


Table 3.14 Concentrations of radionuclides in road drain sediments from Whitehaven and Seascale, 2025

Location	No. of sampling observations	Mean radioactivity concentration (dry), Bq kg^{-1}						
		^{60}Co	^{90}Sr	^{134}Cs	^{137}Cs	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am
Seascale SS 204	1	<0.43	<0.60	<0.52	54	2.8	20	10
Seascale SS 233	1	<0.46	<0.59	<0.46	42	1.3	8.3	18
Seascale SS 209	1	<0.30	1.1	<0.24	8.9	0.67	5.0	5.1
Seascale SS 231	1	<0.35	<0.61	<0.35	18	2.1	12	11
Whitehaven SS 201	1	<0.44	<0.41	<0.55	13	0.50	1.9	5.7

Table 3.15 Doses, in mSv y^{-1}, from artificial radionuclides in the Irish Sea, 2009 to 2025

Group	Exposure, mSv per year																
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Northern Ireland	0.012	0.010	0.010	0.011	0.010	0.009	0.009	0.011	0.010	0.011	0.010	0.009	0.008	0.007	0.007	0.007	0.007
Dumfries and Galloway	0.047	0.040	0.040	0.046	0.044	0.045	0.038	0.044	0.035	0.029	0.031	0.027	0.056	0.024	0.021	0.014	0.014
Whitehaven	0.011	0.010	0.010	0.013	0.010	0.012	0.017	0.016	0.017	0.018	0.014	0.013	0.012	0.010	0.012	0.011	0.010
Sellafield (5 year average consumption)	0.20	0.18	0.15	0.14	0.12	0.089	0.084	0.083	0.085	0.072	0.064	0.062	0.058	0.045	0.039	0.040	0.028
Morecambe Bay	0.041	0.046	0.034	0.034	0.036	0.032	0.031	0.024	0.026	0.015	0.024	0.015	0.019	0.022	0.021	0.020	0.023
North Wales	0.015	0.013	0.014	0.014	0.013	0.018	0.014	0.015	0.014	0.014	0.012	0.010	0.010	0.018	0.012	0.011	0.012

Table 3.16 Individual radiation exposures (mSv y^{-1}) , Cumbrian Coastal community, 2025

Representative person[a]	Exposure, mSv per year							
	Total	Seafood (nuclear industry discharges)[b]	Seafood (other discharges)[c]	Other local food	External radiation from intertidal areas, river banks or fishing gear[d]	Intakes of sediment and water	Gaseous plume related pathways	Direct radiation from site
'Total dose' - maximum effect of all sources								
Adult crustacean consumers	**0.51[e]**	**0.015**	**0.49**	**<0.005**	**<0.005**	**-**	**-**	**-**
'Total dose' - maximum effect of all sources – maximum effect of all sources to people in the vicinity of the Sellafield site								
Adult crustacean consumers	**0.51[f]**	**0.015**	**0.49**	**<0.005**	**<0.005**	**-**	**<0.005**	**<0.005**
'Total dose' - maximum effect of gaseous release and direct radiation sources								
Adult game meat consumers	**0.30[b]**	**<0.005**	**0.040**	**0.25**	**<0.005**	**-**	**-**	**-**
'Total dose' - maximum effect of liquid release source								
Adult crustacean consumers	**0.51[f]**	**0.015**	**0.49**	**<0.005**	**<0.005**	**-**	**<0.005**	**<0.005**
Source-specific doses Seafood consumers								
Local seafood consumers (habits averaged 2021-25)	0.44[g]	0.013	0.41	-	0.021	-	-	-
Local seafood consumers (habits for 2025)	0.59[h]	0.014	0.56	-	0.019	-	-	-
Whitehaven seafood consumers	0.010	0.010	-	-	-	-	-	-
Dumfries and Galloway seafood and wildfowl consumers	0.014	0.008	-	-	0.007	-	-	-
Morecambe Bay seafood consumers	0.023	0.007	-	-	0.016	-	-	-
Northern Ireland seafood consumers	0.007	0.006	-	-	<0.005	-	-	-
North Wales seafood consumers	0.012	0.007	-	-	0.005	-	-	-
Other groups								
Ravenglass Estuary, marsh users	0.008	-	-	-	0.006	<0.005	-	-
Bait diggers and shellfish collectors[i]	0.087	-	-	-	0.087	-	-	-
Barrow Houseboats[j]	0.065	-	-	-	0.065	-	-	-
Local infant consumers of locally grown food at Ravenglass	0.013[k]	-	-	0.013	-	-	-	-
Local infant consumers of locally grown food at the LLWR	<0.005[k]	-	-	<0.005	-	-	-	-
Inhabitants and onsumers of locally grown food	0.64[k]	-	-	0.64	-	-	<0.005	-

Table 3.16 continued

Representative person[a]	Exposure, mSv per year							
	Total	Seafood (nuclear industry discharges)[b]	Seafood (other discharges)[c]	Other local food	External radiation from intertidal areas, river banks or fishing gear[d]	Intakes of sediment and water	Gaseous plume related pathways	Direct radiation from site
Groups with average consumption or exposure								
Average seafood consumer in Cumbria	<0.005	<0.005	-	-	-	-	-	-
Average consumer of locally grown food[l]	0.22	-	-	0.22	-	-	-	-
Typical visitor to Cumbria	<0.005	<0.005	<0.005	-	<0.005	-	-	-
Recreational user of beaches								
Dumfries and Galloway	<0.005	-	-	-	<0.005	-	-	-
North Cumbria	0.008	-	-	-	0.008	-	-	-
Sellafield	0.007	-	-	-	0.007	-	-	-
Lancashire	<0.005	-	-	-	<0.005	-	-	-
North Wales	<0.005	-	-	-	<0.005	-	-	-
Recreational user of mud/saltmarsh areas								
Dumfries and Galloway	<0.005	-	-	-	<0.005	-	-	-
North Cumbria	<0.005	-	-	-	<0.005	-	-	-
Sellafield	0.007	-	-	-	0.007	-	-	-
Lancashire	0.006	-	-	-	0.006	-	-	-
North Wales	0.009	-	-	-	0.009	-	-	-

a. The 'total dose' is the dose which accounts for all sources including gaseous and liquid discharges and direct radiation.
The 'total dose' for the representative person with the highest dose is presented.
Other dose values are presented for specific sources, either liquid discharges or gaseous discharges, and their associated pathways.
They serve as a check on the validity of the total dose assessment.
The representative person is an adult unless otherwise stated
Data are presented to 2 significant figures or 3 decimal places. Data below 0.005 mSv are reported as <0.005 mSv

b. May include a small contribution from the LLWR

c. Enhanced naturally occuring radionuclides from Whitehaven

d. Doses ('total dose' and source-specific doses) only include estimates of anthropogenic inputs (by substracting background and cosmic sources from measured gamma dose rates)

e. The dose due to nuclear industry discharges was 0.020 mSv and includes a contribution from sources of direct radiation from the LLWR site (0.003 mSv)

f. The dose due to nuclear industry discharges was 0.018 mSv

g. The dose due to nuclear industry discharges was 0.034 mSv

h. The dose due to nuclear industry discharges was 0.032 mSv

i. Exposure to skin for comparison with the 50 mSv dose limit

j. Exposures at Barrow are largely due to discharges from the Sellafield site

k. Includes a component due to natural sources of radionuclides

l. Only the adult age group is considered for this assessment

4 Nuclear power stations

Highlights

- 'total dose' for the representative person was less than 2% of the dose limit for all sites assessed

England

Berkeley, Gloucestershire and Oldbury, South Gloucestershire

- 'total dose' for the representative person was less than 0.005mSv in 2025 and was unchanged from 2024

Bradwell, Essex

- 'total dose' for the representative person was less than 0.005mSv in 2025 and was unchanged from 2024

Dungeness, Kent

- 'total dose' for the representative person was 0.010mSv in 2025 and was unchanged from 2024

Hartlepool, County Durham

- 'total dose' for the representative person was 0.007mSv in 2025 and was unchanged from 2024

Heysham, Lancashire

- 'total dose' for the representative person was 0.017mSv and increased slightly in 2025 compared to 2024

Hinkley Point, Somerset

- 'total dose' for the representative person was 0.011mSv and decreased in 2025 compared to 2024

Sizewell, Suffolk

- 'total dose' for the representative person was 0.010mSv and decreased in 2025 compared to 2024

Scotland

Chapelcross, Dumfries and Galloway

- 'total dose' for the representative person was 0.007mSv in 2025 and was unchanged from 2024

Hunterston, North Ayrshire

- 'total dose' for the representative person was 0.007mSv and increased slightly in 2025 compared to 2024

Torness, East Lothian

- 'total dose' for the representative person was 0.010mSv and decreased slightly in 2025 compared to 2024

Wales

Trawsfynydd, Gwynedd

- 'total dose' for the representative person was 0.015mSv and increased in 2025 compared to 2024

Wylfa, Isle of Anglesey

- 'total dose' for the representative person was 0.006mSv in 2025 and decreased compared to 2024

This section considers the results of environment and food monitoring, under the responsibility of the Environment Agency, FSA, FSS, NRW and SEPA, undertaken near nuclear power stations (both operating stations and stations being decommissioned). There is a total of 18 nuclear power stations (which may contain more than 1 reactor and more than 1 reactor type) at 13 locations in the UK as listed in the highlights section above.

Ten of the 18 nuclear power stations are older, first-generation nuclear power stations (Magnox reactors), owned by the NDA. The NDA was set up under the Energy Act 2004 and is a non-departmental public body (sponsored and funded by DESNZ). Its remit is to secure the decommissioning and clean-up of the UK's civil nuclear power sites. All first-generation nuclear power stations are now in the process of decommissioning, including Calder Hall which is operated by Sellafield Limited (see Section 3). The remaining first-generation nuclear power stations are operated by NRS Limited (formerly Magnox Limited).

All first-generation nuclear reactors have now been completely defuelled. In March 2026, the NDA published its annual business plan (April 2026 to March 2029) and a new strategy. The plan summarises the programme of work at each of the sites [30].

Six AGR power stations and one Pressurised Water Reactor power station are owned and operated by EDF Energy Nuclear Generation Limited. These are Dungeness B, Hartlepool, Heysham 1 and 2, Hinkley Point B, Sizewell B Power Stations in England, and Torness Power Station in Scotland. In 2021, EDF decided to move Dungeness B into defuelling phase following an extended outage in the previous years. In 2021, the UK government and EDF signed an agreement to transfer control of the AGR power stations to the NDA after cessation of generation and defuelling of the reactors. Hinkley Point B stopped generating electricity in 2022, became officially fuel free in January 2026. Ownership is now expected to be transferred to NRS in late 2026. Hunterston B stopped generating electricity in 2022 and defuelling was completed in 2025. In April 2026, Hunterston B nuclear power station ownership was transferred to Nuclear Restoration Services (NRS).

Gaseous and liquid discharges from each of the power stations are regulated by the Environment Agency and NRW in England and Wales, respectively and by SEPA in Scotland. In 2025, gaseous and liquid discharges were below regulated limits for each of the power stations (see Appendix 1, Table A1.1 and Table A1.2). Solid waste transfers in 2025 from nuclear establishments in Scotland (Chapelcross, Hunterston A, Hunterston B and Torness) are also given in Appendix 1 (Table A1.4). Independent monitoring of food and the environment around each of the power stations is conducted by the FSA and the Environment Agency in England and Wales, and by SEPA in Scotland. The Environment Agency undertakes the monitoring in Wales on behalf of NRW and the Welsh Government.

4.1 England

4.1.1 Berkeley, Gloucestershire and Oldbury, South Gloucestershire

Berkeley and Oldbury are both first-generation nuclear power stations. Berkeley Power Station is situated on the eastern bank of the River Severn and was powered by 2 Magnox reactors. Berkeley was the first commercial power station in the UK to enter decommissioning. Electricity generation started in 1962 and ceased in 1989. Defuelling was completed in 1992. Decommissioning is still in progress and small amounts of radioactive wastes are still generated by these operations. In 2021, a modular encapsulation plant went into service to treat intermediate level waste (ILW) and to make it suitable for longer term storage and eventual disposal.

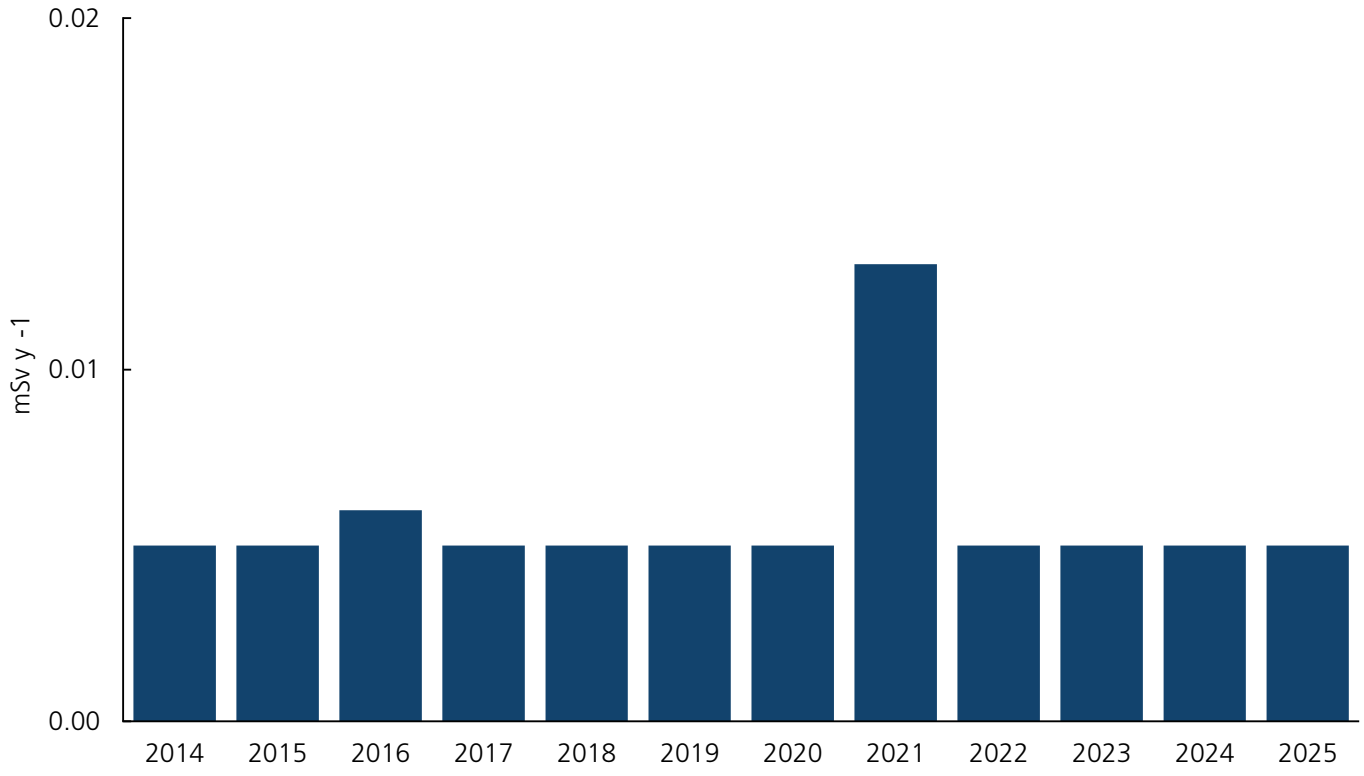
Oldbury Power Station is located on the south bank of the River Severn close to the village of Oldbury-on-Severn and has 2 Magnox reactors. Electricity generation started in 1967 and ceased in 2012. Defuelling was completed in 2016, and the site is now prioritising the retrieval, treatment, and storage of intermediate level waste.

Berkeley and Oldbury sites are considered together for the purposes of environmental monitoring because the discharge effects from both sites impact on the same area. The most recent habits survey was undertaken in 2014 [155]. A new habits survey was conducted during the summer of 2026; the results are which are expected to be published in early 2027.

4.1.1.1 Doses to the public

In 2025, the ‘total dose’ from all pathways and sources of radiation was less than 0.005mSv (Table 4.1), or less than 0.5% of the dose limit to members of the public. This is unchanged from recent years. The representative person in 2025 was an infant consuming milk and a change from 2024 (adult spending time over sediments). The trend in the ‘total dose’ over the period 2014 to 2025 is given in Figure 4.1. Any longer-term variations in ‘total dose’ over time are attributable to changes in the contribution from direct radiation.

Figure 4.1 'Total dose', in mSv y^{-1}, at Berkeley and Oldbury nuclear power stations, 2014 to 2025. (Small doses less than or equal to 0.005mSv are recorded as being 0.005mSv).



As in recent years, the source-specific assessments for a high-rate consumer of fish and shellfish, in the vicinity of the Berkeley and Oldbury sites, gave exposures that were less than 0.005mSv in 2025 (Table 4.1). The dose to a consumer of fish and shellfish includes external gamma radiation and a component due to the tritium historically discharged from the Maynard Centre, the former GE Healthcare Limited plant at Cardiff[17]. As in recent years, the estimated dose for a high-rate consumer (infant) of locally grown foods gave an exposure of less than 0.005mSv in 2025.

The estimated dose for houseboat dwellers was 0.028mSv in 2025. This is similar to that reported in 2024 (0.027mSv). The estimate is determined as a cautious value (and therefore not included in the 'total dose' assessment), because gamma dose rate measurements used were not necessarily representative of the categories of ground type and houseboat location (as identified in the habits survey [155]).

17. GE Healthcare ceased manufacturing tritium and carbon-14 radiolabelled compounds at its premises, the Maynard Centre, in Cardiff in 2009 and 2010, respectively. Its custom radiolabelling division was acquired by Quotient Bioresearch (Radiochemicals) Ltd in 2010, and subsequently by Pharmaron UK Ltd in 2017. This operation is located at a new premises in Cardiff under a non-nuclear permit, albeit at lower levels compared to the historic discharges from the Maynard Centre.

4.1.1.2 Gaseous discharges and terrestrial monitoring

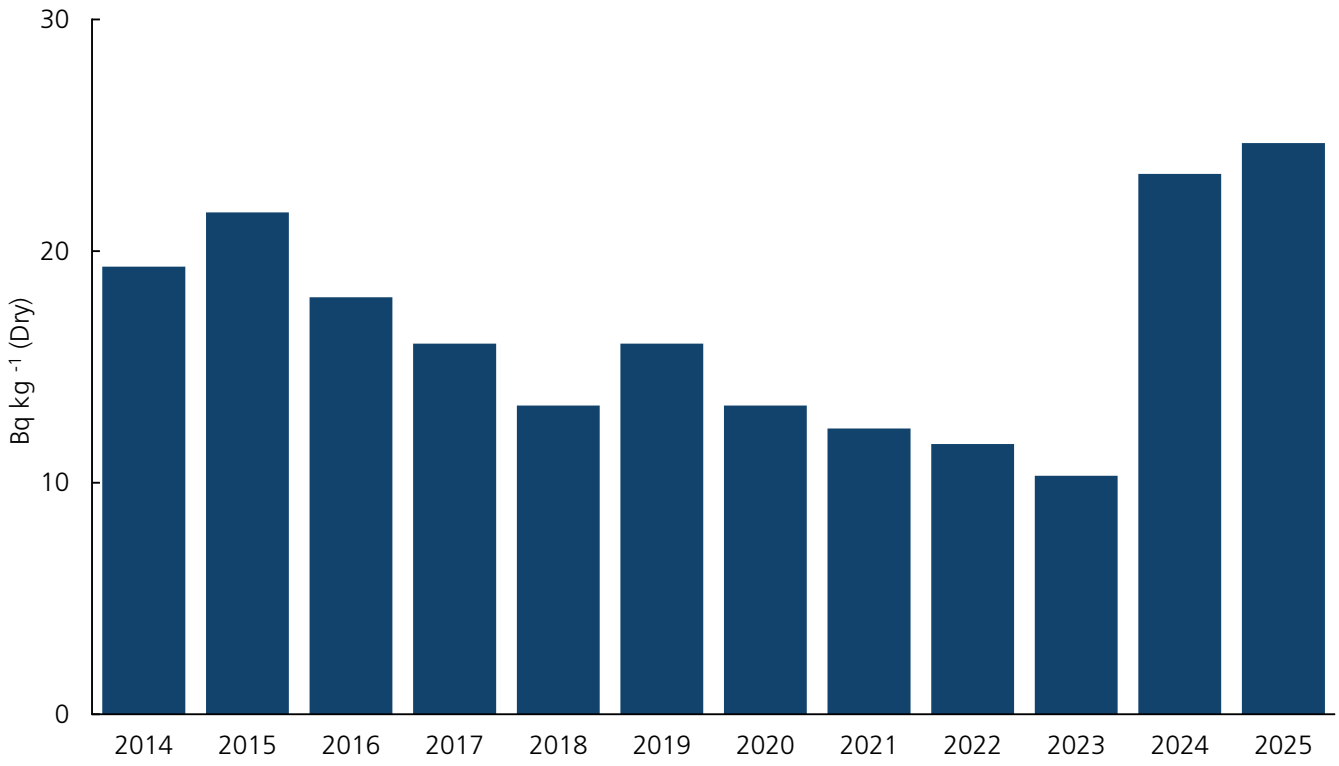
The Berkeley and Oldbury sites discharge gaseous radioactive wastes via separate stacks to the atmosphere. The gaseous discharge of carbon-14 from the Berkeley site decreased in 2025, compared to 2024. The focus of the terrestrial sampling was for the analyses of tritium, carbon-14 and sulphur-35 in milk and crops. Local freshwater samples were also analysed. Data for 2025 are given in Table 4.2(a). Unlike in 2024, sulphur-35 was not positively detected in barley in 2025. Carbon-14 concentrations in milk were above the default value used to represent background (see Appendix 5) and were slightly higher than those observed in 2024. Tritium, gross alpha and gross beta concentrations in surface water were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51).

4.1.1.3 Liquid waste discharges and aquatic monitoring

Liquid radioactive wastes are discharged to the Severn Estuary.

Analyses of seafood and marine indicator materials as well as measurements of external radiation were conducted over muddy intertidal areas. Data for 2025 are given in Table 4.2(a) and Table 4.2(b). Most of the artificial radioactivity detected was due to caesium-137, representing the combined effect of discharges from the sites, other nuclear establishments discharging into the Bristol Channel, fallout from nuclear weapons testing, and possibly a small Sellafield-derived component. In 2025, caesium-137 concentrations in sediment were similar to those observed in 2024 (Figure 4.2). Very small concentrations of other radionuclides were detected but taken together, were of low radiological significance. Gamma dose rates were generally similar to those observed in recent years.

Figure 4.2 Caesium-137 concentration, in Bq kg^{-1} (dry), in marine sediments near Berkeley and Oldbury nuclear power stations between 2014 and 2025.



4.1.2 Bradwell, Essex

The Bradwell site is located on the south side of the Blackwater Estuary. This Magnox power station ceased electricity production in 2002 after 40 years of operation, and defuelling was completed in 2006. In 2018, Bradwell became the UK's first Magnox site to reach the interim end-state of passive Care and Maintenance, following an accelerated decommissioning programme.

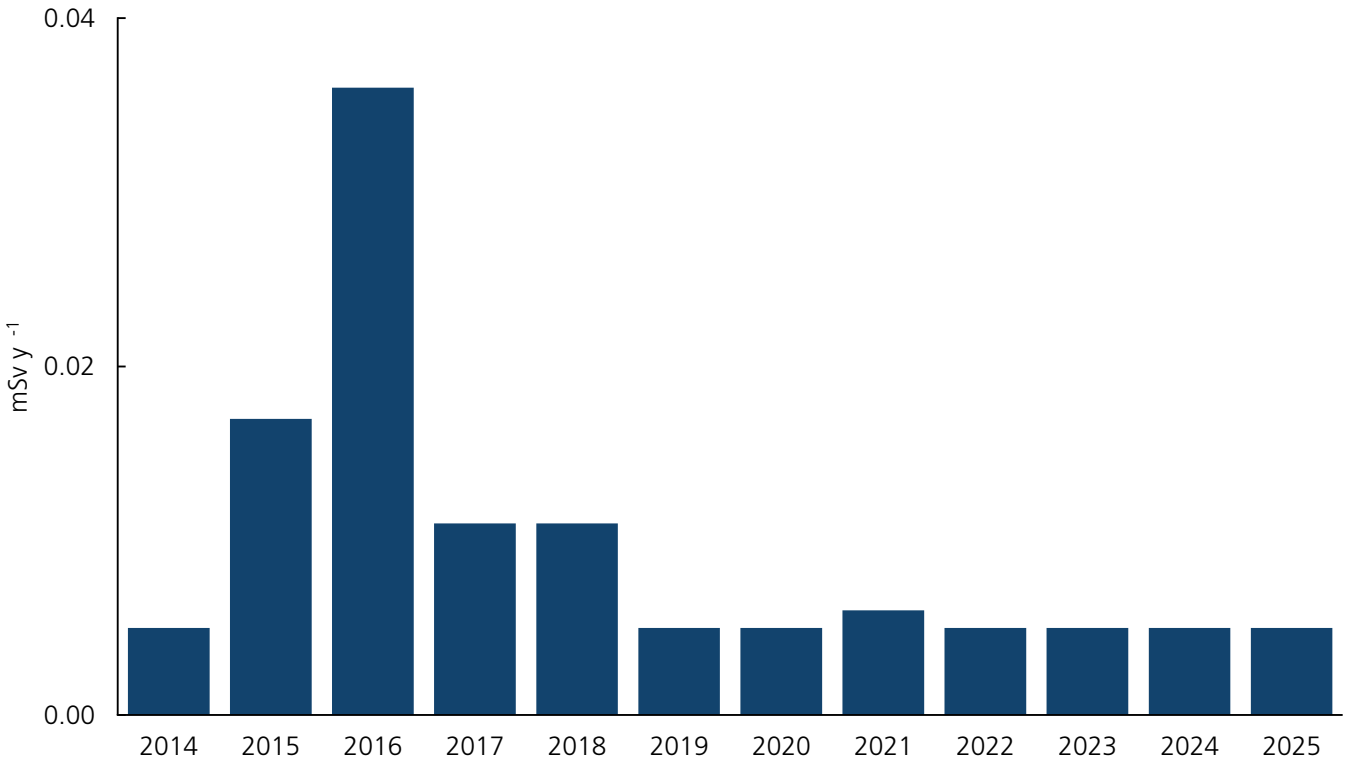
Following the cessation of intermediate level waste processing in 2018, environmental monitoring was reverted to baseline monitoring programme.

The most recent habits survey was undertaken in 2015 [156].

4.1.2.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was less than 0.005mSv in 2025 (Table 4.1), or 0.5% of the dose limit for members of the public and unchanged from 2024. The representative person in 2025 was an adult living on a houseboat and was unchanged from recent years. The trend in 'total dose' over the period 2014 to 2025 is given in Figure 4.3. Any significant variations in 'total dose' over time were attributed to changes in the estimate of direct radiation.

Figure 4.3 'Total dose', in mSv y^{-1}, at Bradwell nuclear power station, 2014 to 2025. (Small doses less than or equal to 0.005mSv are recorded as being 0.005mSv).



As in recent years, the doses to a high-rate consumer of fish and shellfish and a high-rate consumer of locally grown foods from source-specific assessment were less than 0.005mSv in 2025.

4.1.2.2 Gaseous discharges and terrestrial monitoring

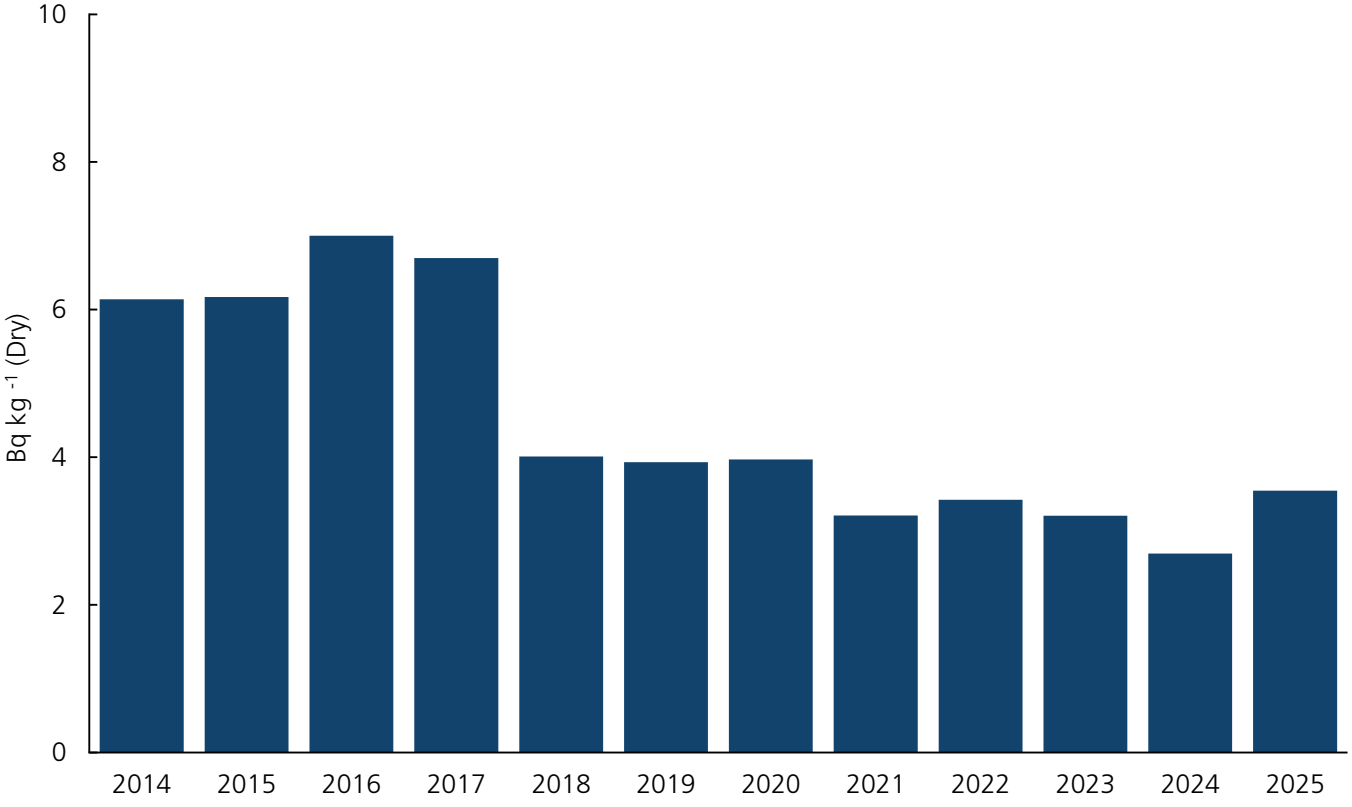
The power station is permitted to discharge gaseous wastes to the local environment via stacks to the atmosphere. Terrestrial sampling is similar to that for other power stations including analyses of milk and crop samples. Samples of freshwater are also taken from a coastal ditch. Data for 2025 are given in Table 4.3(a). Activity concentrations were low in terrestrial samples. As in recent years, carbon-14 was detected in locally produced milk at concentrations close to the expected background concentration. Unlike in 2024, strontium-90 was not positively detected in any coastal ditch freshwater samples in 2025. As in past years, the gross beta activities in water samples collected from the coastal ditch in 2025 were above the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51). However, the water in the ditches is not known to be used as a source of drinking water.

4.1.2.3 Liquid waste discharges and aquatic monitoring

Liquid wastes are discharged into the River Blackwater estuary. The main source of this effluent is rainwater runoff which is discharged to the estuary via the main drains pit at Bradwell site. The main drains pit is sampled at quarterly intervals. The site is also permitted to discharge non-radioactive effluent from the turbine hall voids to the main drains pit, and from there to the estuary. However, no effluent from this source was discharged in 2025. Effluent was last discharged to the estuary via Bradwell site's active effluent system in 2017. This route has since been decommissioned and was removed from the environmental permit in 2019.

Aquatic sampling was directed at the consumption of locally caught fish and shellfish and external exposure over intertidal sediments. Seaweeds were also analysed as an environmental indicator material. Data for 2025 are given in Table 4.3(a) and Table 4.3(b). Low concentrations of artificial radionuclides were detected in marine samples as a result of discharges from the station, discharges from Sellafield and fallout from nuclear weapons testing. Due to the low concentrations detected, it is difficult to attribute these results to a particular source without any complementary forensic investigations. There has been an overall decline in caesium-137 concentrations in sediments over the last decade (Figure 4.4). The caesium-137 concentrations observed in sediment samples collected in 2025 were slightly higher than those reported in 2024. Gamma dose rates on beaches were difficult to distinguish from natural background and were generally similar to those observed in recent years.

Figure 4.4 Caesium-137 concentration, in Bq kg^{-1} (dry), in marine sediments near Bradwell nuclear power station between 2014 and 2025.



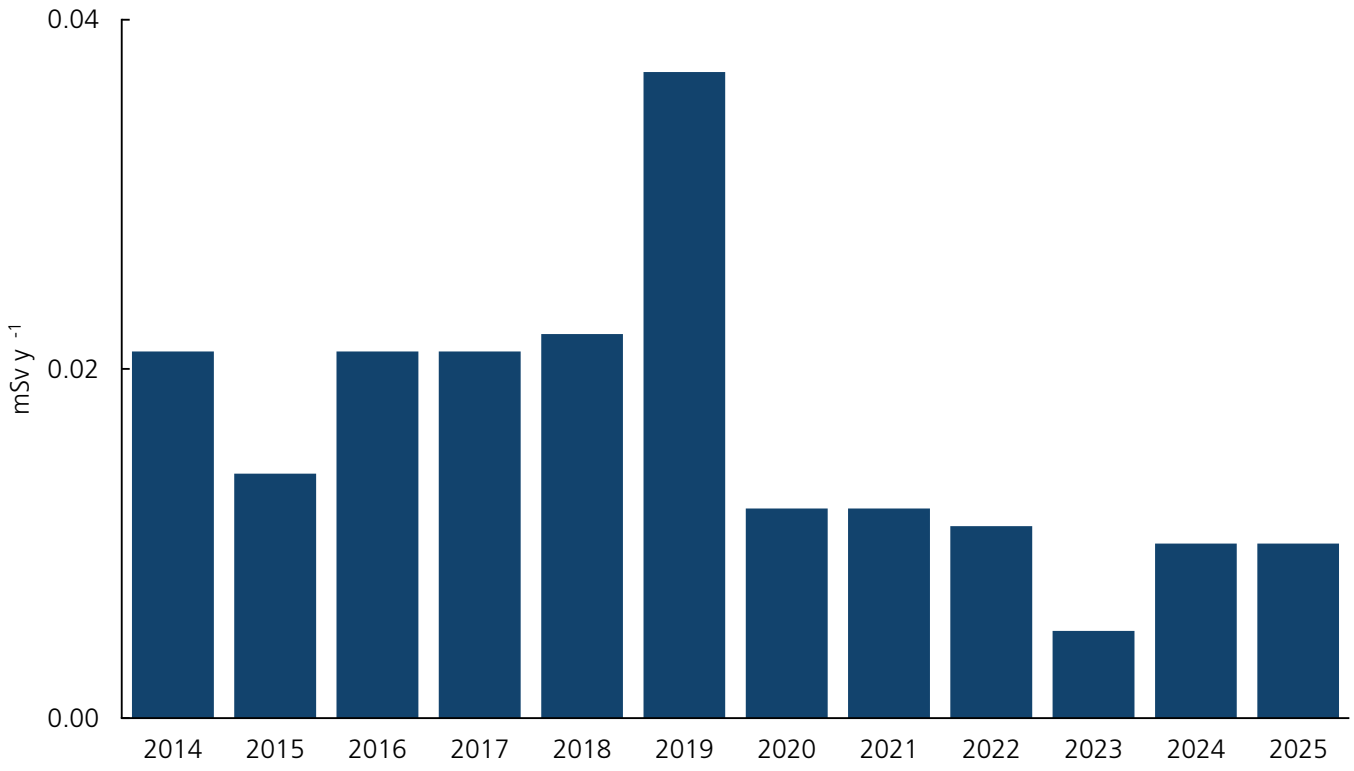
4.1.3 Dungeness, Kent

The Dungeness power stations are located on the south Kent coast, between Folkestone and Rye. There are 2 separate A and B nuclear power stations on neighbouring sites: Dungeness A was powered by 2 Magnox reactors and Dungeness B has twin AGRs. Discharges are made via separate and adjacent outfalls and stacks, but for the purposes of environmental monitoring these are considered together. Dungeness A ceased generating electricity in 2006. Defuelling of both Magnox reactors was completed in 2012, and the site is currently undergoing decommissioning. In 2021, Dungeness B nuclear power station was moved into the defuelling phase following over 2 years of outage. A consultation led by EDF on proposals for the decommissioning of Dungeness B nuclear power station was run between March and April 2026. The most recent habits survey was conducted in 2019 [157].

4.1.3.1 Doses to the public

In 2025, the 'total dose' from all pathways and sources of radiation was 0.010mSv (Table 4.1), which was 1% of the dose limit to members of the public and was unchanged from 2024. As in 2024, the representative person was an adult spending extensive time over intertidal substrates in 2025. The trend in 'total dose' over the period 2014 to 2025 is given in Figure 4.5. The annual 'total dose' ranged between less than 0.005 and 0.037mSv over this period and were dominated by direct radiation. Over a longer time-series, this dose has declined more significantly from the peak value of 0.63mSv, following the shutdown of the Magnox reactors in 2006 [26].

Figure 4.5 'Total dose', in mSv y^{-1}, at Dungeness nuclear power stations, 2014 to 2025. (Small doses less than or equal to 0.005mSv are recorded as being 0.005mSv).



As in recent years, the dose to a high-rate consumer of locally grown foods was estimated to be less than 0.005mSv and was unchanged from recent years (Table 4.1). The dose to a local seafood consumer was estimated to be 0.010mSv in 2025, similar to that in 2024 (0.011mSv).

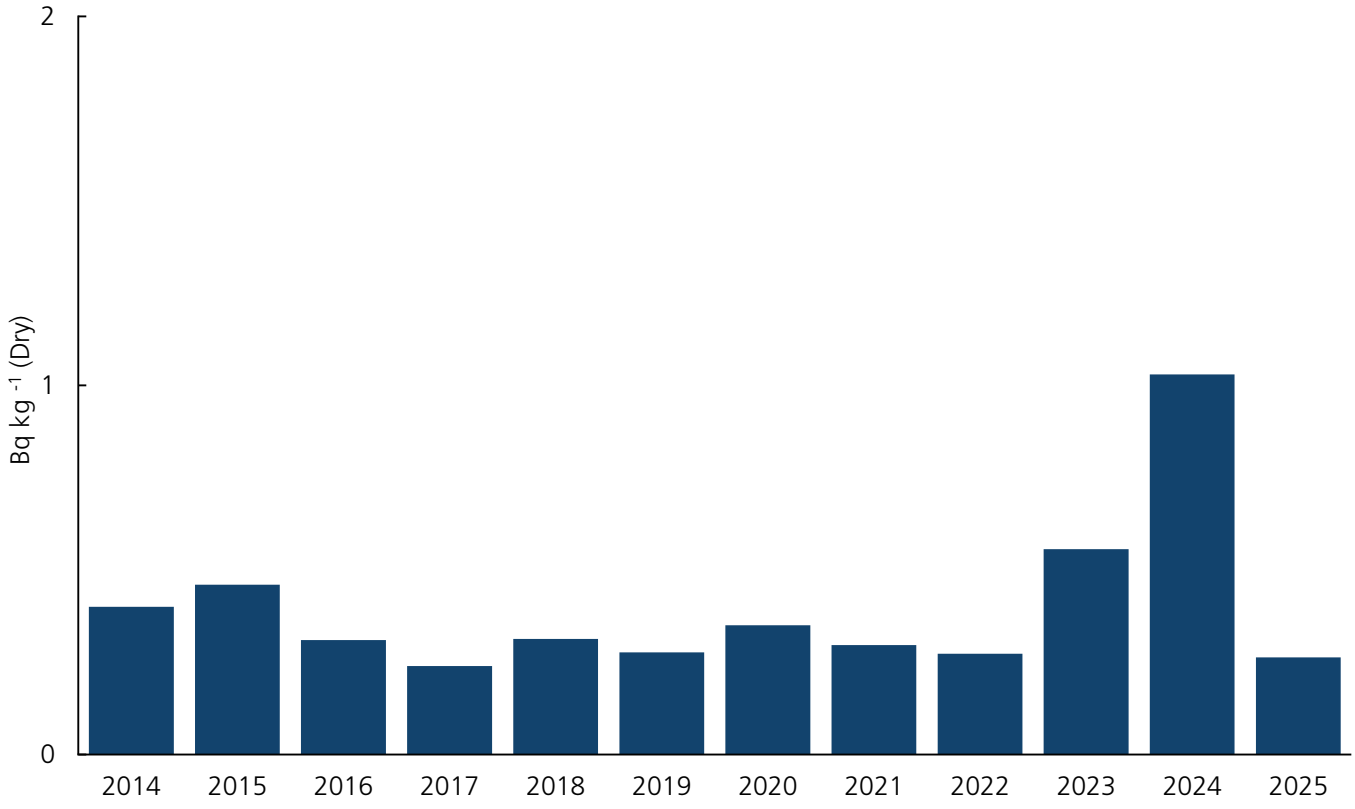
4.1.3.2 Gaseous discharges and terrestrial monitoring

Gaseous wastes are discharged via separate stacks to the local environment. The focus of the terrestrial sampling was the analyses of tritium, carbon-14 and sulphur-35 in milk and crops. The results of monitoring for 2025 are given in Table 4.4(a). Activity concentrations in many terrestrial foods are reported as 'less than values' (or close to the 'less than value'). As in recent years, sulphur-35 was positively detected in grass. As was the case in 2024, tritium was not positively detected in food (potato) in 2025. As in recent years, carbon-14 was positively detected in locally produced milk at concentrations slightly above background in 2025. Tritium, gross alpha and gross beta concentrations in freshwater were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51) in 2025.

4.1.3.3 Liquid waste discharges and aquatic monitoring

Permitted discharges of radioactive liquid effluent from both power stations are made via separate outfalls to the English Channel. The draining of fuel ponds at Dungeness A was completed in 2019 and this removed the main source of aqueous waste discharges on site. As in 2024, the liquid discharge of sulphur-35 was reported as nil in 2025, as its presence in treated aqueous effluent has now fallen below detectable limits following cessation of electricity generation. Marine monitoring included gamma dose rate measurements, and analysis of seafood, seaweed, sediments and seawater. The results of monitoring for 2025 are given in Table 4.4(a) and Table 4.4(b). The caesium-137 concentrations in seafood are attributable to discharges from the stations, fallout from nuclear weapons testing and a long-distance contribution from Sellafield and La Hague nuclear fuel reprocessing facility in France. Due to the low concentrations detected in foods and marine materials, it is generally difficult to attribute the results to a particular source without any complementary forensic investigations. The low concentrations of transuranic nuclides in molluscs (scallop sample collected in 2025) were typical of values expected at sites remote from Sellafield. As in recent years, the 2025 tritium concentrations in seafood were all reported as 'less than values'. Caesium-137 concentrations in sediment have remained low over the last decade (Figure 4.6). Unlike in recent years, caesium-137 was not positively detected in any sediments collected in 2025.

Figure 4.6 Caesium-137 concentration, in Bq kg^{-1} (dry), in marine sediments near Dungeness nuclear power stations between 2014 and 2025.



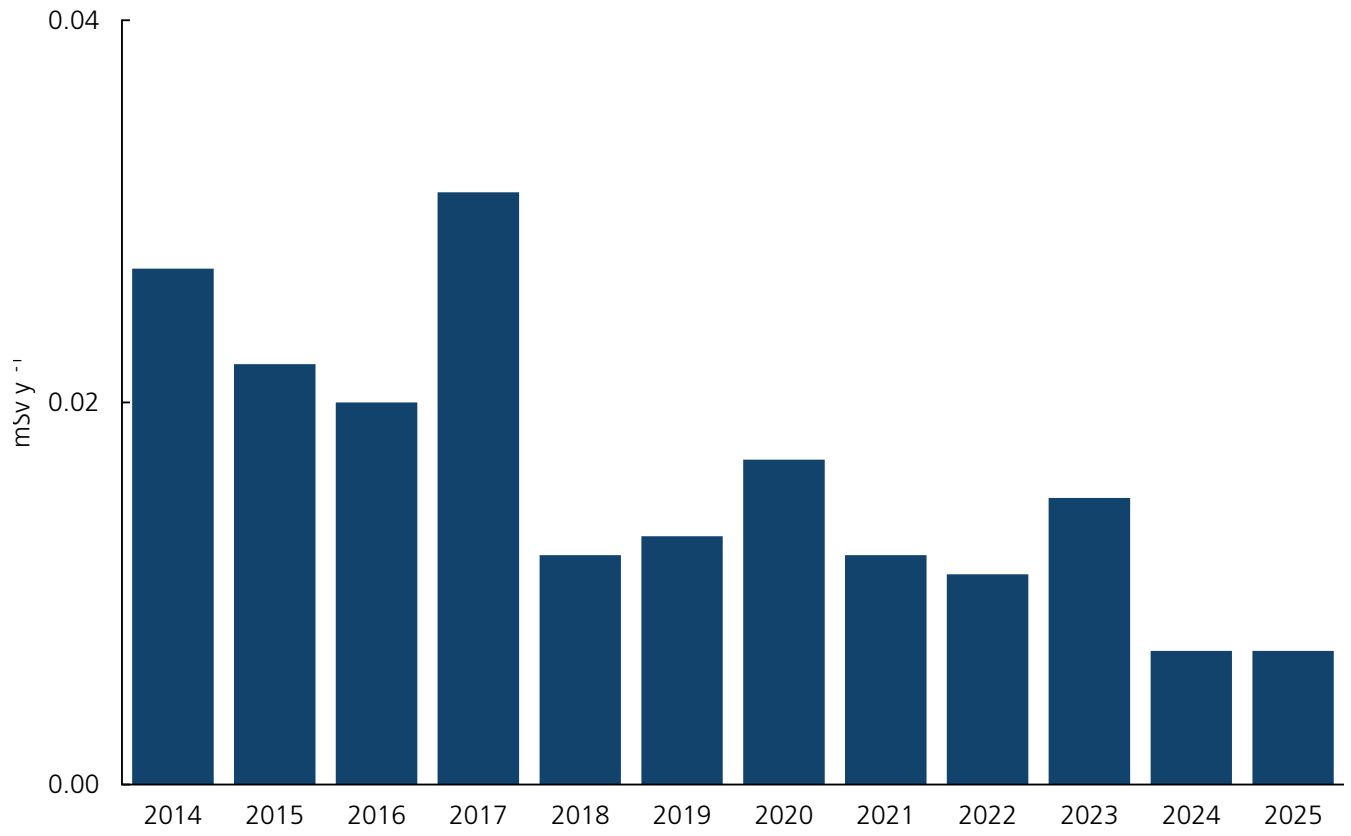
4.1.4 Hartlepool, County Durham

Hartlepool Power Station is situated on the mouth of the Tees Estuary, on the north-east coast of England. This station, which is powered by twin AGRs, began operation in 1983. The power station in Hartlepool is expected to end power production in 2030. The most recent habits survey was undertaken in 2024 [158].

4.1.4.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was 0.007mSv in 2025 (Table 4.1), which was less than 1% of the dose limit to members of the public and was unchanged from 2024. As in 2024, the representative person was an adult living near the site. The trend in 'total dose' over the period 2014 to 2025 is given in Figure 4.7. The 'total doses' in 2024 and 2025 were the lowest estimated in the last ten years.

Figure 4.7 'Total dose', in mSv y^{-1}, at Hartlepool nuclear power station, 2014 to 2025.



A source-specific assessment for high-rate consumers of locally grown foodstuffs gave an exposure that was less than the 'total dose' in 2025 (Table 4.1). The estimated dose was less than 0.005mSv and down from 0.005mSv in 2024. The decrease in dose was mainly due to a lower concentration of carbon-14 in milk. The dose to a local fish and shellfish consumer (including external radiation but excluding naturally occurring radionuclides) was 0.007mSv in 2025 and was unchanged from 2024.

As in previous years, a source-specific assessment was not undertaken to determine the exposure from naturally occurring radionuclides in 2025 as discussed in previous RIFE reports [159].

4.1.4.2 Gaseous discharges and terrestrial monitoring

Gaseous radioactive waste is discharged via stacks to the local environment. Gaseous discharges of carbon-14 decreased in 2025, compared to 2024 as a result of planned and unplanned outages. Analyses of tritium, carbon-14, sulphur-35 and gamma-emitting radionuclides were carried out in milk and crop samples. Samples of freshwater were also taken from boreholes. Data for 2025 are given in Table 4.5(a). Carbon-14 was detected in locally produced milk at concentrations slightly above the default value used to represent background. Tritium, and gross beta concentrations in freshwater were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51).

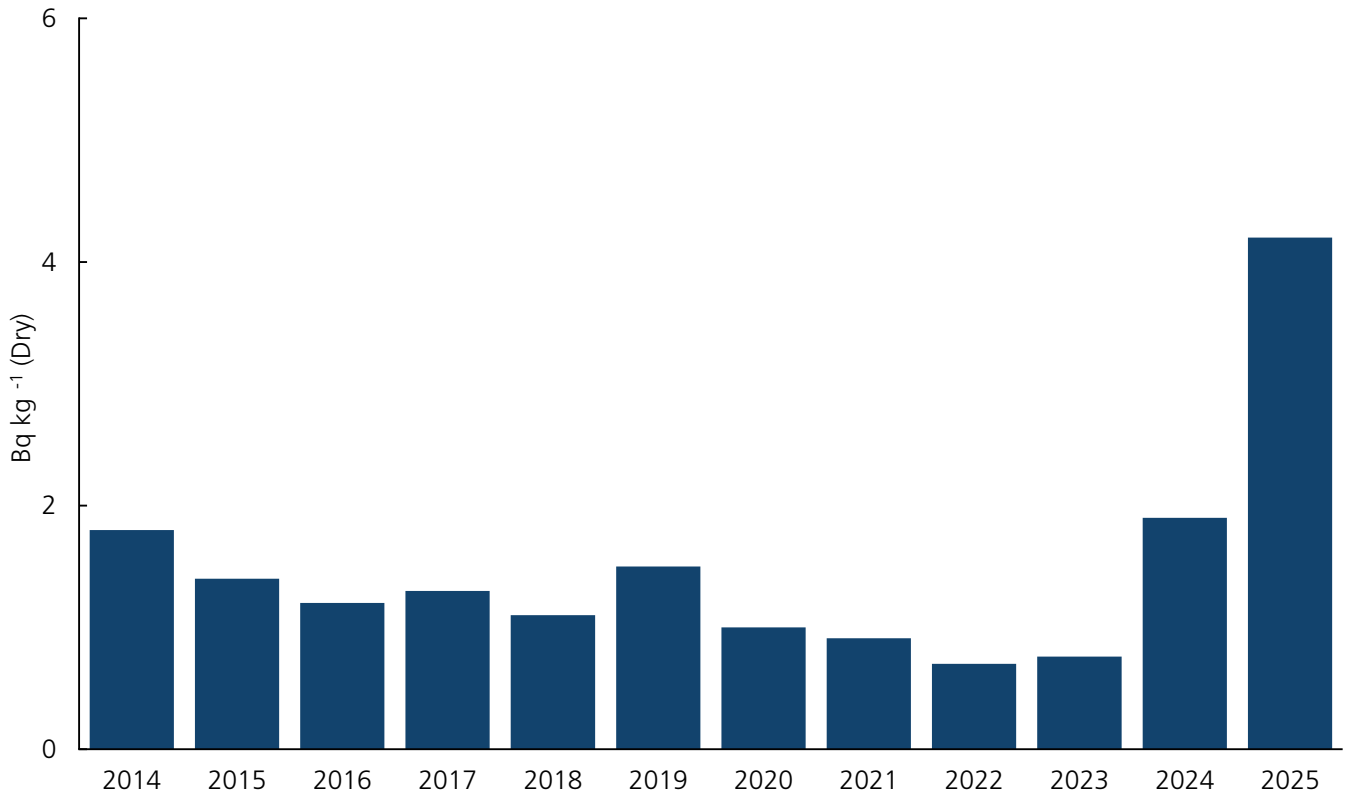
4.1.4.3 Liquid waste discharges and aquatic monitoring

Permitted discharges of radioactive liquid effluent are made to Tees Bay with non-radioactive trade effluents being discharged directly to the River Tees. Liquid discharges of tritium and sulphur-35 decreased in 2025 compared to 2024 due to planned and unplanned outages. Tritium discharges are directly related to power output and the reduction in liquid tritium discharges can be attributed to the increased time that the Hartlepool reactors were off-line undergoing maintenance or refuelling during outages.

Results of the aquatic monitoring programme conducted in 2025 are shown in Table 4.5(a) and Table 4.5(b). As in 2024, the carbon-14 concentrations measured in the mollusc samples (winkles) were found to be slightly above the expected background (Table A6.2). Carbon-14 concentrations in fish and crustaceans were generally higher in 2025, compared to those in 2024.

The analysis of technetium-99 in seaweed is used as a specific indication of the far-field effects of disposals to sea from Sellafield. As in previous years, technetium-99 was positively detected in seaweed, but was very low and significantly less than the peak concentration observed in 2008 [19]. Technetium-99 concentrations in seaweed are less than 1% of the equivalent concentrations near Sellafield. As in previous years, iodine-131 was positively detected in seaweed samples collected around the mouth of the River Tees Estuary in 2025. The detected values, as in previous years, are believed to originate from the therapeutic use of this radionuclide in local hospitals. Detectable concentrations of caesium-137 were mainly due to disposals from Sellafield and fallout from nuclear weapons testing. However, caesium-137 concentrations in sediment have remained low for several years (Figure 4.8). Overall, gamma dose rates over intertidal sediment in 2025 were similar (where comparisons can be made from similar ground types and locations), to those observed in recent years.

Figure 4.8 Caesium-137 concentrations, in Bq kg^{-1} (dry), in marine sediments near Hartlepool nuclear power station between 2014 and 2025.



In 2025, the reported polonium-210 and lead-210 concentrations in winkles from South Gare were consistent with values expected due to naturally occurring sources (given in Appendix 6, Table A6.1). As in previous years, a winkle sample could not be collected from the estuary entrance near Paddy's Hole in 2025.

4.1.5 Heysham, Lancashire

Heysham Power Station is situated on the Lancashire coast, to the south of Morecambe and near the port of Heysham. This establishment comprises of 2 separate nuclear power stations, Heysham 1 and Heysham 2, each powered by twin AGRs. Heysham 1 commenced operation in 1983 and Heysham 2 began operating in 1988. It is estimated that Heysham 1 and 2 will continue to generate electricity until 2030. Disposals of radioactive waste from both stations are permitted via separate and adjacent outfalls to Morecambe Bay and via stacks. However, in RIFE, both stations are considered together for purposes of environmental monitoring, because the discharges from both sites impact on the same area.

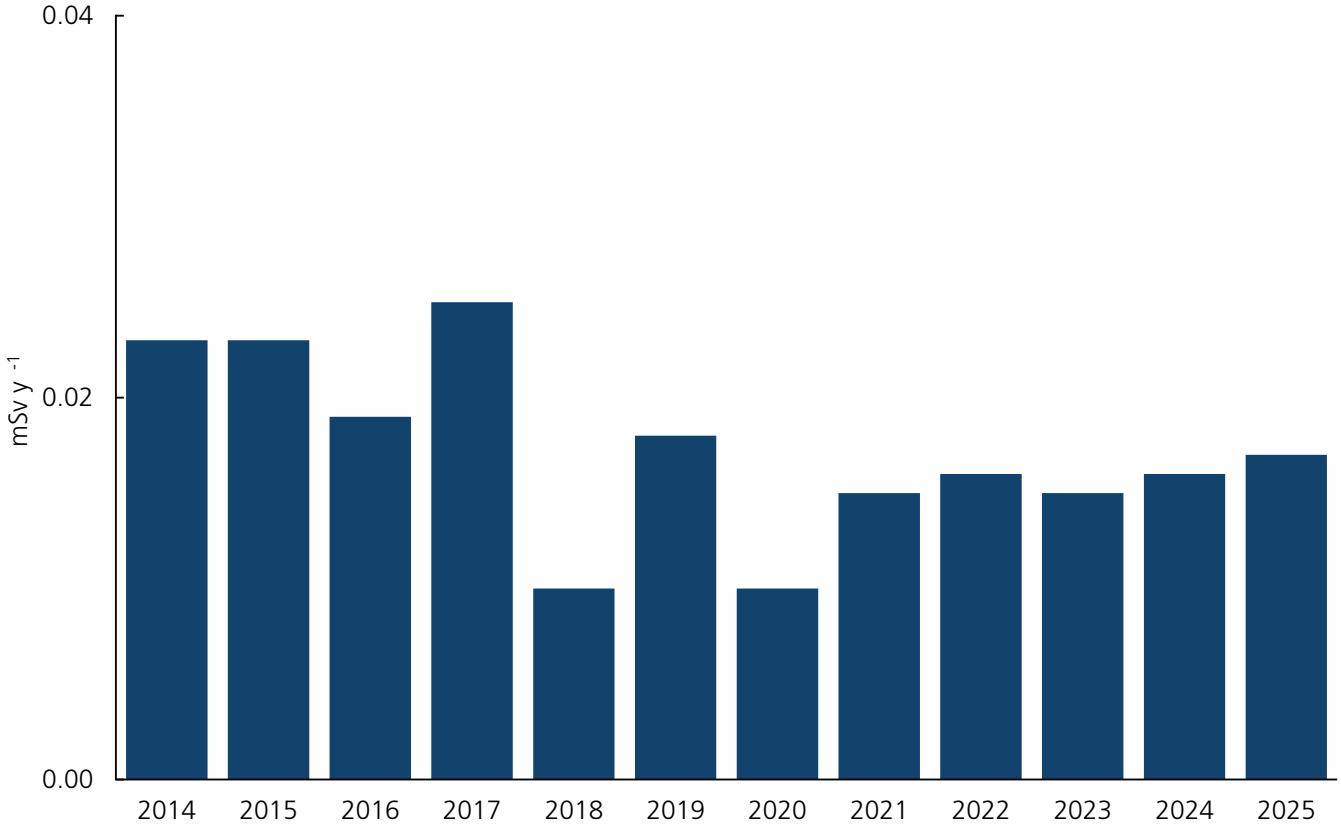
The most recent habits survey was conducted in 2016 [160], a new habits survey was conducted during the summer of 2026, the results are which are expected to be published in early 2027.

4.1.5.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was 0.017mSv in 2025 (Table 4.1) or less than 2% of the dose limit for members of the public, similar to 2024 (0.016mSv). As in recent years, the representative person was an adult spending time over sediments. The small increase in 'total dose' in 2025 was mostly due to higher gamma dose rates measured over sand compared to those in 2024.

The trend in 'total dose' over the period 2014 to 2025 is given in Figure 4.9. The annual 'total dose' ranged between 0.010 and 0.025mSv and were below the dose limit.

Figure 4.9 'Total dose', in mSv y^{-1}, at Heysham nuclear power stations, 2014 to 2025.



As in 2024, source-specific assessments for high-rate terrestrial food consumption, and from external exposure for turf cutting over salt marsh, give exposures that were less than the 'total dose' in 2025 (Table 4.1). The estimated dose for terrestrial food consumption was less than 0.005mSv in 2025 and unchanged from 2024. The estimated dose to the turf cutters was less than 0.005mSv in 2025 and unchanged from recent years. The dose to a local fisherman, who was considered to consume a large amount of seafood and was exposed to external radiation over intertidal areas, was 0.023mSv in 2025, which was approximately 2% of the dose limit for members of the public an increase from 0.020mSv in 2024 (Table 4.1). The main reason for the increase in dose was the same as that contributing to the 'total dose'.

4.1.5.2 Gaseous discharges and terrestrial monitoring

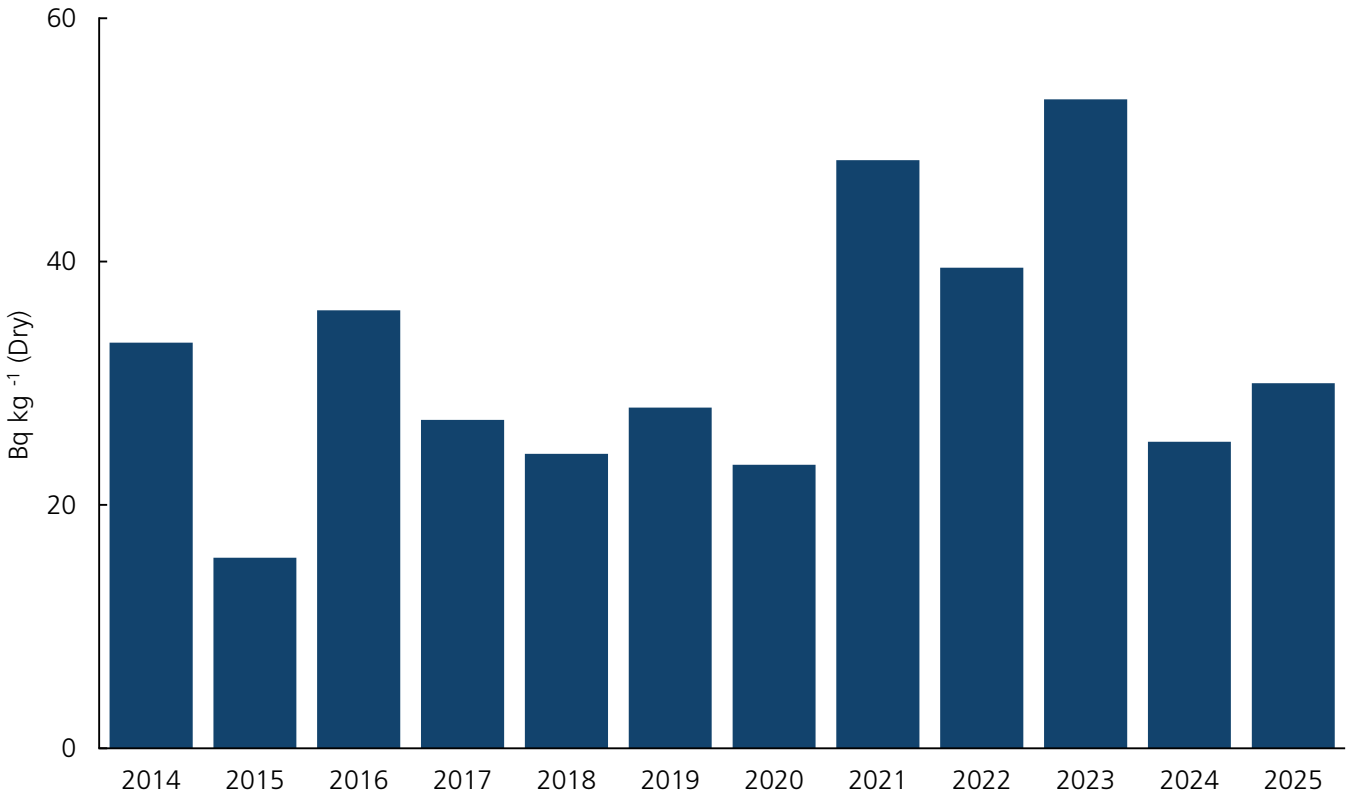
Both stations discharge gaseous radioactive waste via stacks to the atmosphere. Gaseous discharges of carbon-14 from Heysham 2 decreased in 2025, compared to 2024. This was due to reduced power output from one of the reactors and reactor shut down as part of a graphite inspection. The monitoring programme for determining the effects of gaseous disposals was similar to that for other power stations. Data for 2025 are given in Table 4.6 (a). As in recent years, sulphur-35 was positively detected in silage in 2025. As in 2024, the carbon-14 concentrations in milk were above the default value used to represent background in 2025 but were lower than those observed in 2024. Tritium, gross alpha and gross beta concentrations in freshwater were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51).

4.1.5.3 Liquid waste discharges and aquatic monitoring

Permitted discharges of radioactive liquid effluent are made via outfalls into Morecambe Bay. Liquid discharges from Heysham 1 and 2, in 2025 were broadly similar in comparison with recent years.

The monitoring programme for the effects of liquid disposals included sampling of fish, shellfish, sediment, seawater and measurements of gamma dose rates. For completeness, the data considered in this section include all of those for Morecambe Bay. A substantial part of the programme is in place to monitor the effects of Sellafield disposals. The results for 2025 are given in Table 4.6(a) and Table 4.6(b). In general, activity concentrations in 2025 were similar (in comparison to those in recent years) and the effect of liquid disposals from Heysham was difficult to detect above the Sellafield background, based upon the greater historical discharges from Sellafield and monitoring data prior to operation of Heysham 1 and 2. Plutonium radionuclides and americium-241 concentrations in mussels and concentrations of technetium-99 in marine samples originating from Sellafield discharges were similar to those observed in recent years. As in recent years, strontium-90 was detected at low concentrations (reported as just above, or close to, the ‘less than value’) in food samples collected in 2025. Gamma dose rates measured over sand were slightly higher in 2025 (in comparison with 2024). Concentrations of caesium-137 in sediment samples near the Heysham nuclear power stations is given in Figure 4.10 over the period 2014 to 2025. There has been variability from year to year, with a large Sellafield influence.

Figure 4.10 Caesium-137 concentration, in Bq kg^{-1} (dry), in marine sediments near Heysham nuclear power stations between 2014 and 2025.



4.1.6 Hinkley Point, Somerset

The Hinkley Point Power Station sites are situated on the Somerset coast, west of the River Parrett estuary. There are 2 separate stations, A and B, that include 2 Magnox reactors and 2 AGRs, respectively. Hinkley Point A started electricity generation in 1965 and ceased in 1999. This station completed defuelling in 2004 and is undergoing decommissioning. Hinkley Point B ended power generation and entered its defuelling phase in 2022. The defuelling phase was completed in 2025, and the site was granted Fuel Free Verification status by ONR, allowing formal decommissioning to begin. The permit limits for gaseous discharges of sulphur-35, argon-41, iodine-131 and liquid discharges of sulphur-35 from Hinkley Point B were revised in December 2025. A single environmental monitoring programme covers the effects of the 2 power stations, because the discharge effects from both sites impact on the same area. The most recent habits survey was conducted in 2024 [161].

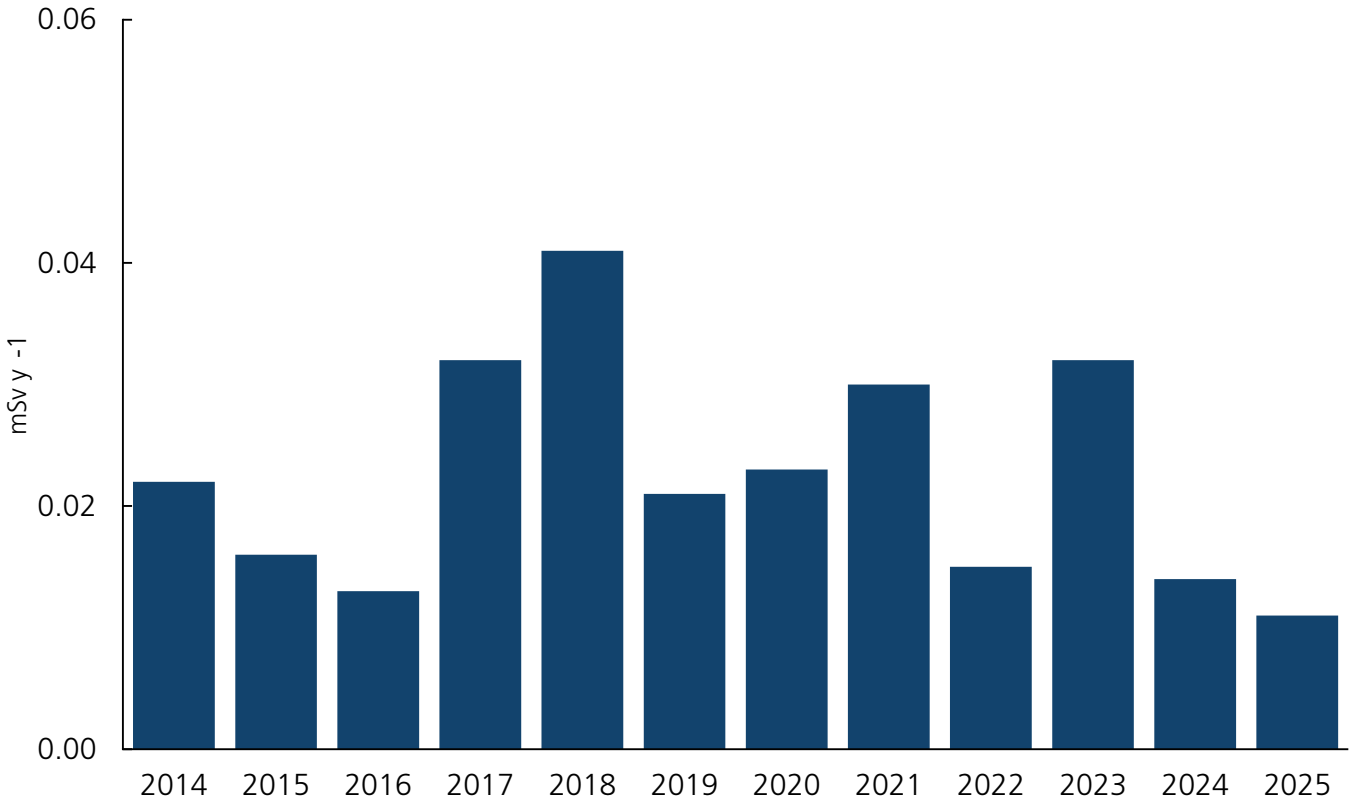
The construction of the 2 new generation EPR™ reactors continues at Hinkley Point C. Summary details of earlier environmental permits issued (by the Environment Agency), the pre-construction safety case (approved by the ONR), the planning consents granted, and other approvals, are available in earlier RIFE reports (for example [19]) and from https://www.gov.uk/government/publications/hinkley-point-decisions-on-environmental-permit-applications-for-a-proposed-new-nuclear-power-station. The reactor pressure vessels were installed at Hinkley Point C in 2024 and 2026 with operation of the first reactor expected in 2030. The latest information on the project can be found at: https://www.gov.uk/government/collections/hinkley-point.

4.1.6.1 Doses to the public

In 2025, the 'total dose' from all pathways and sources of radiation was 0.011mSv (Table 4.1), or approximately 1% of the dose limit to members of the public. This is a decrease from 0.014mSv in 2024. The representative person was an adult spending time over sediments (unchanged from recent years). The decrease in 'total dose' was primarily due to gamma dose rates being measured over different substrates at Stolford.

The trend in 'total dose' over the period 2014 to 2025 is given in Figure 4.11. The annual 'total dose' ranged between 0.011 and 0.041mSv and were below the dose limit.

Figure 4.11 'Total dose', in mSv y^{-1}, at Hinkley Point nuclear power stations, 2014 to 2025.



As in 2024, the source-specific assessment for a high-rate consumer of locally grown food gave an exposure that was less than the 'total dose' in 2025 (Table 4.1). The dose to this consumer of locally grown food was less than 0.005mSv in 2025 (unchanged from 2024). A source-specific assessment for local people who consume high rates of seafood and are exposed to external radiation over intertidal area gave an exposure of 0.013mSv, similar to that in 2024 (0.014mSv). This dose estimate also includes the effects of (historical) discharges of tritium from the Maynard Centre, the former GE Healthcare Limited plant at Cardiff[18] and uses an increased dose coefficient (see Appendix 5).

18. GE Healthcare ceased manufacturing tritium and carbon-14 radiolabelled compounds at its premises, the Maynard Centre, in Cardiff in 2009 and 2010, respectively. Its custom radiolabelling division was acquired by Quotient Bioresearch (Radiochemicals) Ltd in 2010, and subsequently by Pharmaron UK Ltd in 2017. This operation is located at a new premises in Cardiff under a non-nuclear permit, albeit at lower levels compared to the historic discharges from the Maynard Centre.

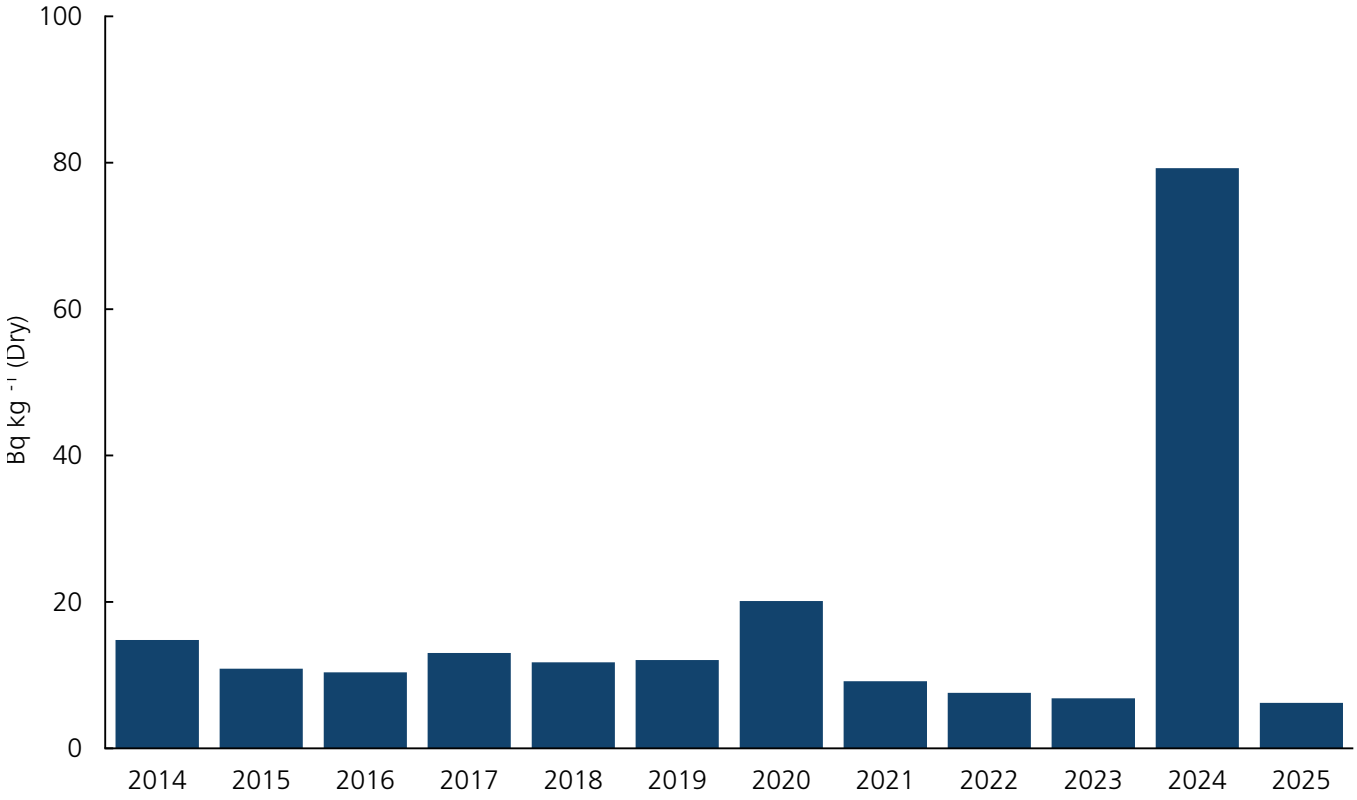
4.1.6.2 Gaseous discharges and terrestrial monitoring

Gaseous radioactive waste is discharged via separate stacks to the local environment. Gaseous discharges in 2025 were similar in comparison with 2024. Analyses of milk, fruit, honey and crops were undertaken to measure activity concentrations of tritium, carbon-14, sulphur-35 and cobalt-60. Local reservoir water samples were also analysed. Data for 2025 are given in Table 4.7(a). In 2025, tritium was positively detected in the blackberry sample. Activity concentrations of cobalt-60 in all terrestrial materials were reported as 'less than values'. As in recent years, sulphur-35 was positively detected in food samples (honey and barley) in 2025. The carbon-14 concentrations in locally produced milk were higher than values observed in 2024. Tritium, gross alpha and gross beta concentrations in reservoir water were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51).

4.1.6.3 Liquid waste discharges and aquatic monitoring

Permitted discharges of radioactive liquid effluent from both power stations are made via separate outfalls into the Bristol Channel. Analyses of seafood and marine indicator materials and measurements of external radiation were conducted over intertidal areas. The environmental results for 2025 are given in Table 4.7(a) and Table 4.7(b). Overall, activity concentrations observed in seafood collected from the Bristol Channel were generally similar to those in previous years. Unlike in 2024, tritium was not positively detected in seafood in 2025. Concentrations of other radionuclides in the aquatic environment represent the combined effect of releases from these stations, plus other establishments that discharge into the Bristol Channel. Other contributors to the aquatic environment are Sellafield, and fallout from Chernobyl and nuclear weapons testing. The concentrations of transuranic nuclides in seafoods were of negligible radiological significance. Trends of caesium-137 concentrations in sediment are shown in Figure 4.12. The high concentrations of strontium-90 and caesium-137 observed in 2024 prompted an extensive investigation of the full process from sampling to data reporting. Although the main cause could not be confirmed, the impact on the 'total dose' and external dose was found to be limited [130].

Figure 4.12 Caesium-137 concentration, in Bq kg^{-1} (dry), in marine sediments near Hinkley Point nuclear power stations between 2014 and 2025.



4.1.7 Sizewell, Suffolk

The 2 Sizewell Power Stations are located on the Suffolk coast, near Leiston. Sizewell A has 2 Magnox reactors that ceased electricity generation in 2006. Defuelling commenced in 2007 and was completed in 2014. Sizewell B, powered by one reactor, is the only commercial Pressurised Water Reactor power station in the UK. The Sizewell B power station began operation in 1995, and the end of power generation is now scheduled for 2055, as a 20-year operational extension was announced in July 2026 [162]. The most recent habits survey was conducted in 2025 [163]. One of the findings from the survey was that no houseboat occupancy was identified, therefore the source-specific assessment for this pathway calculated in previous years was discontinued.

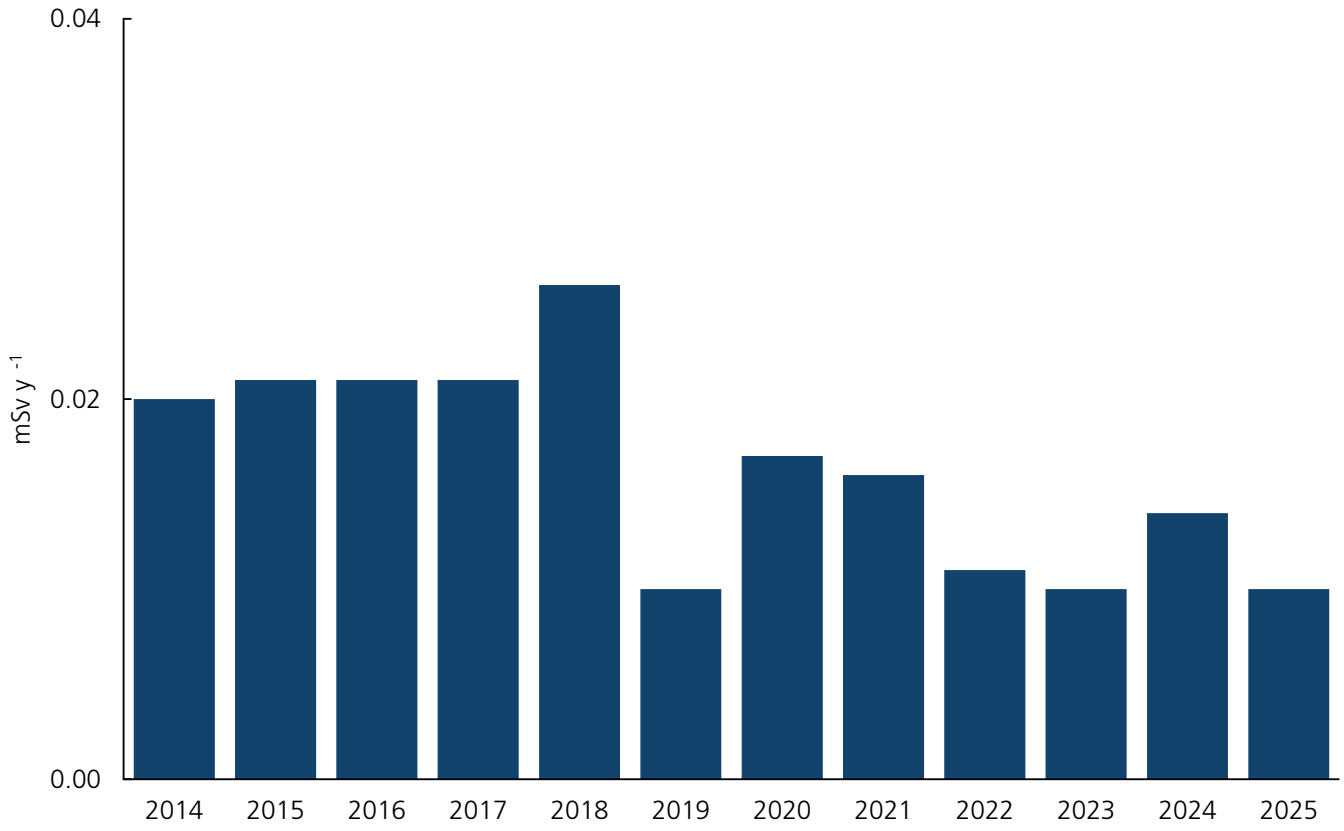
Sizewell C Limited intends to construct 2 EPR™ reactors at a site north of the existing Sizewell B site. In 2022, the Secretary of State for the Department of Business, Energy and Industrial Strategy announced that the Sizewell C project had been granted its Development Consent Order. In 2023, the Environment Agency granted the permit for discharging and disposing of radioactive waste in the environment. In 2024, ONR granted its nuclear site license. Further information can be found at: https://www.gov.uk/guidance/sizewell-nuclear-regulation. In July 2025, the UK Government confirmed a final investment decision for the project.

Gaseous and liquid discharges of radioactivity from Sizewell C are not expected to begin until active commissioning of the station in the mid-2030s.

4.1.7.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was 0.010mSv in 2025 (Table 4.1) or 1% of the dose limit to members of the public. This is a decrease from 0.014mSv in 2024. The representative person in 2025 was an adult living close to the site, unchanged from recent years. The decrease in 'total dose' was mostly attributed to a lower estimate of direct radiation in 2025. The trend in 'total dose' over the period 2014 to 2025 is given in Figure 4.13. Any variation in 'total dose' from year to year was largely due to a change in the contribution from direct radiation from the site, which has been low in recent years. The 'total dose' has declined (reduced by a factor of 5 or 6), following the closure of the Magnox reactors at Sizewell A in 2006 [26].

Figure 4.13 Total dose', in mSv y^{-1}, at Sizewell nuclear power stations, 2014 to 2025.



As in recent years, source-specific assessments for both a high-rate consumer of locally grown foodstuffs, and of fish and shellfish gave exposures that were lower than the 'total dose' in 2025 (less than or equal to 0.005mSv (Table 4.1)).

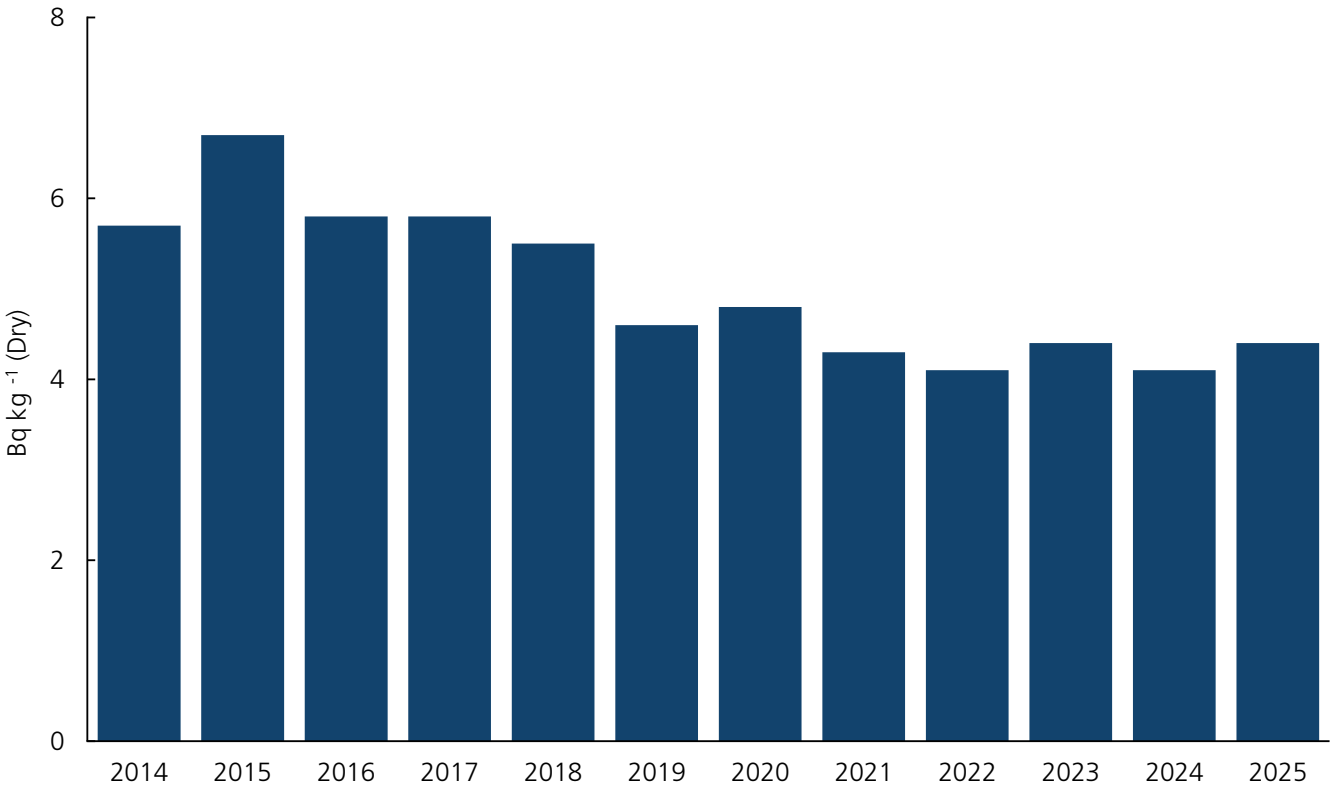
4.1.7.2 Gaseous discharges and terrestrial monitoring

Gaseous discharges in 2025 were very similar to those reported in 2024.
The results of the terrestrial monitoring in 2025 are shown in Table 4.8(a). As in recent years, gamma-ray spectrometry and radiochemical analysis of tritium and sulphur-35 in milk and crops generally showed very low concentrations of artificial radionuclides near the power stations in 2025. In 2025, carbon-14 concentrations in produced milk were found to be above the estimated background level and slightly higher than those in 2024. As in recent years, sulphur-35 was positively detected at a very low concentration in a grass sample collected in 2025. Sulphur-35 was also positively detected in a potato sample in 2025, unlike in 2024. As in recent years, tritium concentrations in local freshwater were reported as 'less than values' in 2025. Tritium, gross alpha and gross beta concentrations in surface water were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51).

4.1.7.3 Liquid waste discharges and aquatic monitoring

Permitted discharges of radioactive liquid effluent are made via outfalls to the North Sea. Liquid discharges of tritium from Sizewell B decreased in 2025, in comparison with those in 2024. These discharges follow a cyclical profile which follow the 18-month outage cycle, with tritium discharges peaking just before the outage (as part of the outage enabling works). The project to drain the fuel storage pond at Sizewell A was completed in 2019. This has resulted in a significant reduction in liquid effluent generation at Sizewell A. As part of the aquatic programme, analysis of seafood, sediment, and seawater, and measurements of gamma dose rates were conducted in intertidal areas. Data for 2025 are given in Table 4.8(a) and Table 4.8(b). As in 2024, tritium was not positively detected in seafood in 2025. As in recent years, concentrations of strontium-90 observed in sediment samples were all reported as 'less than values' and concentrations of caesium-137 were very low. Caesium-137 concentrations in sediment have remained low over the last decade and are generally decreasing over time (Figure 4.14). Overall, gamma radiation dose rates over intertidal areas were difficult to distinguish from the natural background and were similar to those reported in recent years.

Figure 4.14 Caesium-137 concentration, in Bq kg^{-1} (dry), in marine sediments near Sizewell nuclear power stations between 2014 and 2025.



4.2 Scotland

4.2.1 Chapelcross, Dumfries and Galloway

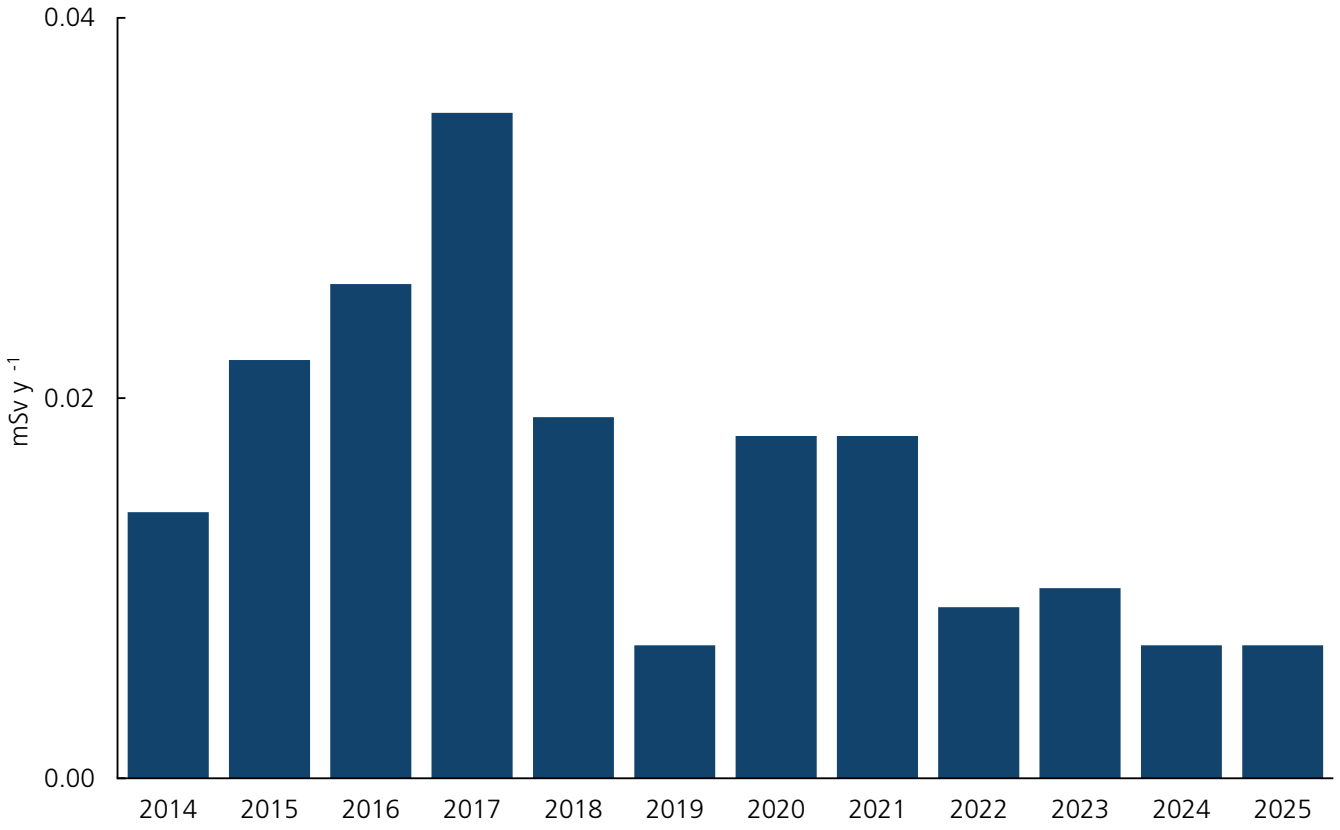
Chapelcross was Scotland's first commercial nuclear power station. It has 4 Magnox reactors and is located near the town of Annan in Dumfries and Galloway. After 45 years of continuous operation, electricity generation ceased in 2004, and the station has since been undergoing decommissioning. Defuelling of the reactors began in 2008 and was completed during 2013. The major hazards remaining on the site are being addressed during the decommissioning phase. Habits surveys have been undertaken to investigate aquatic and terrestrial exposure pathways. The most recent habits survey for Chapelcross was conducted in 2022. In 2024, a separate habits survey was also conducted to determine the consumption and occupancy rates by members of the public on the Dumfries and Galloway coast. Copies of the most recent habits surveys are available from SEPA by emailing RSEnquiries@sepa.org.uk. The results of this survey are used to determine the potential exposure pathways relating to permitted liquid discharges from the Sellafield nuclear site in Cumbria (see Section 3.3.1).

In 2025, the site applied for a variation to their EASR permit. The application was for increasing the gaseous discharge limits for tritium associated with the site's Intermediate Waste Storage Facility (ISF), to support ongoing decommissioning activities.

4.2.1.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was 0.007mSv in 2025 (Table 4.1), or less than 1% of the dose limit to members of the public. This is unchanged from 2024. As in recent years, the representative person was an infant consuming locally produced milk at high rates. The trend in 'total dose' over the period 2014 to 2025 is given in Figure 4.15, doses are generally low, with a small peak observed in 2017 (still less than 5% of the dose limit to members of the public).

Figure 4.15 'Total dose', in mSv y^{-1}, at Chapelcross nuclear power station, 2014 to 2025.



As in recent years, source-specific assessments for a high-rate consumer of locally grown food, and for a seafood (salmon) and wildfowl consumer, gave exposures that were less than the 'total dose' in 2025 (Table 4.1). The dose for the terrestrial food consumer was estimated to be 0.006mSv in 2025 and unchanged from 2024. The dose for the seafood and wildfowl consumer was 0.006mSv in 2025 and up from 2024 (less than 0.005mSv). The increase in dose in 2025 was mostly due to the use of an indirect method for estimating an average gamma dose rate via sediment analysis (instead of the use of direct dose rate measurements over salt marsh in 2024). Crustacean consumption was not identified in the recent habits survey.

Doses from the presence of artificial radionuclides in marine materials in the Chapelcross vicinity are mostly due to the effects of Sellafield discharges and are consistent with values expected at this distance from Sellafield.

4.2.1.2 Gaseous discharges and terrestrial monitoring

Gaseous radioactive waste is discharged via stacks to the local environment.

Terrestrial monitoring consisted of the analysis of a variety of foods, including milk, fruit, crops as well as grass, soil and freshwater samples, for a range of radionuclides. Air samples at 3 locations were also monitored to investigate the inhalation pathway. The results of terrestrial food and air monitoring in 2025 are given in Table 4.9(a) and Table 4.9(c). Carbon-14 concentrations in milk were similar to those observed in 2024. As in recent years, americium-241 concentrations 'in all terrestrial food, and grass samples were all reported as 'less than values'.

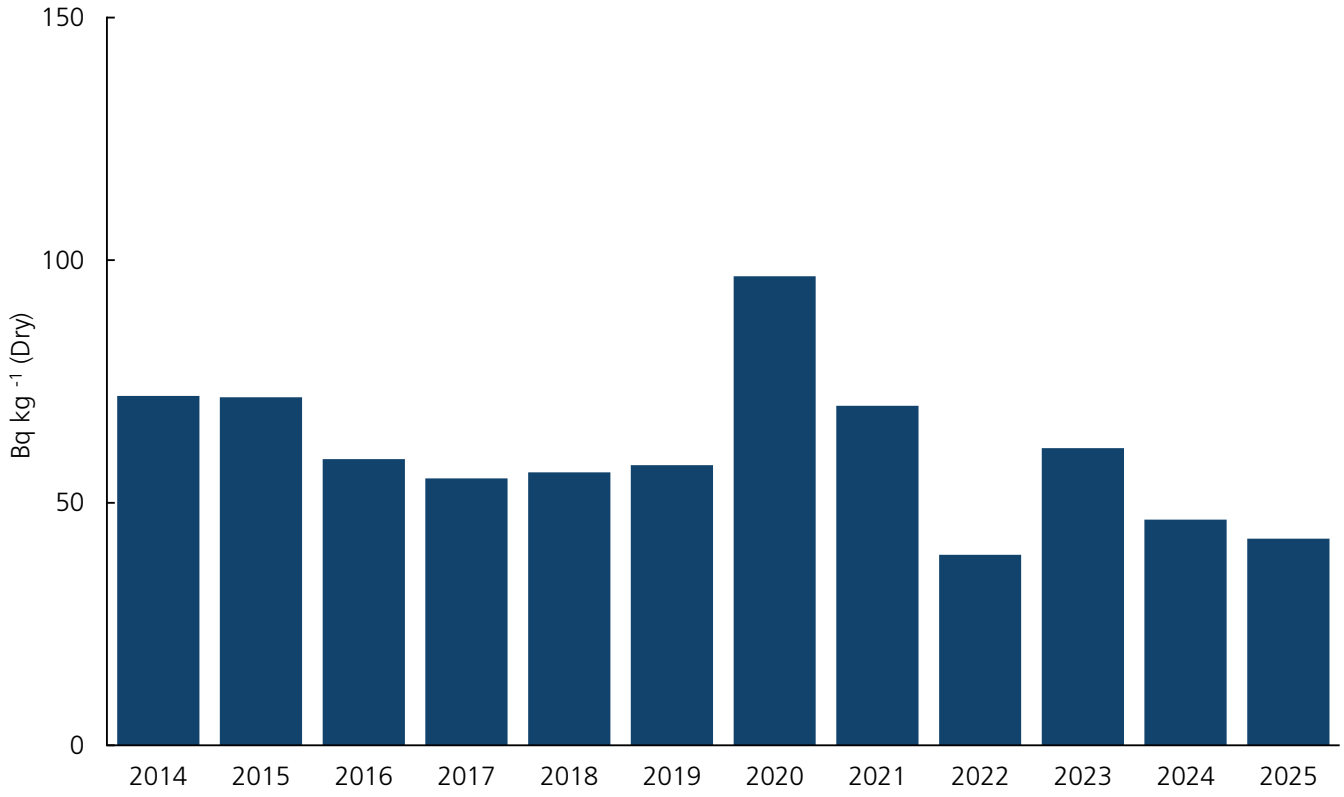
As in recent years, tritium was positively detected in the freshwater sample collected at Gullielands Burn. However, tritium, gross alpha and gross beta concentrations in all freshwater samples were well below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51). Activity concentrations in air samples at locations near to the site (Table 4.9(c)) were reported as 'less than values' (or close to the 'less than value'). Solid waste transfers in 2025 are also given in Appendix 1 (Table A1.4).

4.2.1.3 Liquid waste discharges and aquatic monitoring

Radioactive liquid effluents are discharged to the Solway Firth. As in 2024, radioactive effluent was discharged from the site on a number of occasions in support of ongoing decommissioning activities in 2025. Samples of seawater and seaweed ('Fucus vesiculosus'), used as environmental indicators, were collected in addition to shrimps, mussels, fish (salmon and trout), sediments and measurements of gamma dose rates. Data for 2025 are given in Table 4.9(a) and Table 4.9(b). Concentrations of artificial radionuclides in marine materials in the Chapelcross vicinity are mostly due to the effects of Sellafield discharges and are consistent with values expected at this distance from Sellafield. Concentrations of most radionuclides remained similar to those detected in recent years. Unlike in previous years, europium-155 was not positively detected in sediment samples collected in 2025.

As in previous years, concentrations of caesium-137, plutonium radionuclides and americium-241 were enhanced in sediment samples taken close to the pipeline in 2025. The average concentration of caesium-137 in sediments analysed in 2025 was higher than in 2024 and is known to be largely due to Sellafield discharges (Figure 4.16). In 2025, gamma dose rates over intertidal sediment were generally lower to those in 2024 (where comparisons can be made). As in previous years, measurements of the contact beta dose rate on sediments were reported as 'less than values' in 2025.

Figure 4.16 Caesium-137 concentrations, in Bq kg^{-1} (dry), in marine sediments near Chapelcross nuclear power stations between 2014 and 2025



Between 1992 and 2009, several particles were found at the end of the discharge outfall consisting of limescale originating from deposits within the pipeline. The site operator continues to monitor this area frequently and no particles were found during 2024 (as for the previous years). The relining of the pipeline and grouting at strategic points, which was undertaken between 2009 and 2010, has reduced the potential for particles to be released.

4.2.2 Hunterston, North Ayrshire

Hunterston Power Station is located on the Ayrshire coast near West Kilbride and consists of 2 separate nuclear power stations - Hunterston A and Hunterston B.

Hunterston A was powered by 2 Magnox reactors until it ceased electricity production in 1990 and is now being decommissioned by NRS. Defuelling was completed in 1995. Decommissioning activities continue to focus on 2 major areas: the ongoing decommissioning of the cartridge (nuclear fuel) cooling pond; and making progress towards ensuring that all higher activity waste is stored in a passively safe manner.

Most of the radioactivity in liquid effluent discharged from the Hunterston A site over the last few years has arisen from the cartridge cooling pond. The draining of the cartridge cooling pond is now largely complete. However, there is still a need to manage the remaining radioactive sludges from several areas associated with the pond.

In 2023, SEPA received an application from NRS to vary the permit, made under the Environmental Authorisations (Scotland) Regulations 2018 (EASR), for the Hunterston A site. The variation application includes the addition of the Solid Intermediate Level Waste Encapsulation plant (SILWE) facility discharge stack to the site permit, and an increase to the site gaseous discharge limits. The permit variation application went to public consultation in late October 2024.

In 2024, SEPA received another application from NRS to amend its EASR permit. The requested changes include removing the minimum flow requirement during aqueous discharges (7m3 s^{-1}) and eliminating the tidal window restriction (one hour after high tide to one hour before low tide). The discharge point will remain unchanged, and no other limits will be altered.
In terms of safe management of legacy higher activity waste at Hunterston A, NRS are in the process of commissioning the SILWE. The Wet Intermediate Level Waste Retrieval and Encapsulation Plant (WILWREP) has finalised modifications for processing radioactively contaminated acid wastes and is currently going through active commissioning. Processing of the legacy higher activity waste, present at the Hunterston A site will be processed through either SILWE or WILWREP, with the current plans being to make safe by encapsulating it in a grout mixture. The encapsulated waste will then be transferred to the Intermediate Level Waste Store (ILWS) for storage.

Hunterston B was powered by a pair of AGRs, referenced as Reactors 3 and 4. Electricity production was ceased in 2022, and defuelling operations were undertaken by EDF Energy Nuclear Generation Limited. Both reactors are now defuelled, and the site has been declared as fuel free. The past year has been spent transitioning to a decommissioning structure as well as preparing to transfer to the NDA Estate and to be decommissioned by NRS. Both gaseous and liquid discharges are much lower following defuelling than during the operational phase.

Hunterston B has also applied to vary its permit for radioactive substances activities to remove the minimum flow during aqueous discharges (7m3 s^{-1}) as well as the tidal window (one hour after high tide to one hour before low tide). The discharge point will remain unchanged, and no other limits will be altered.

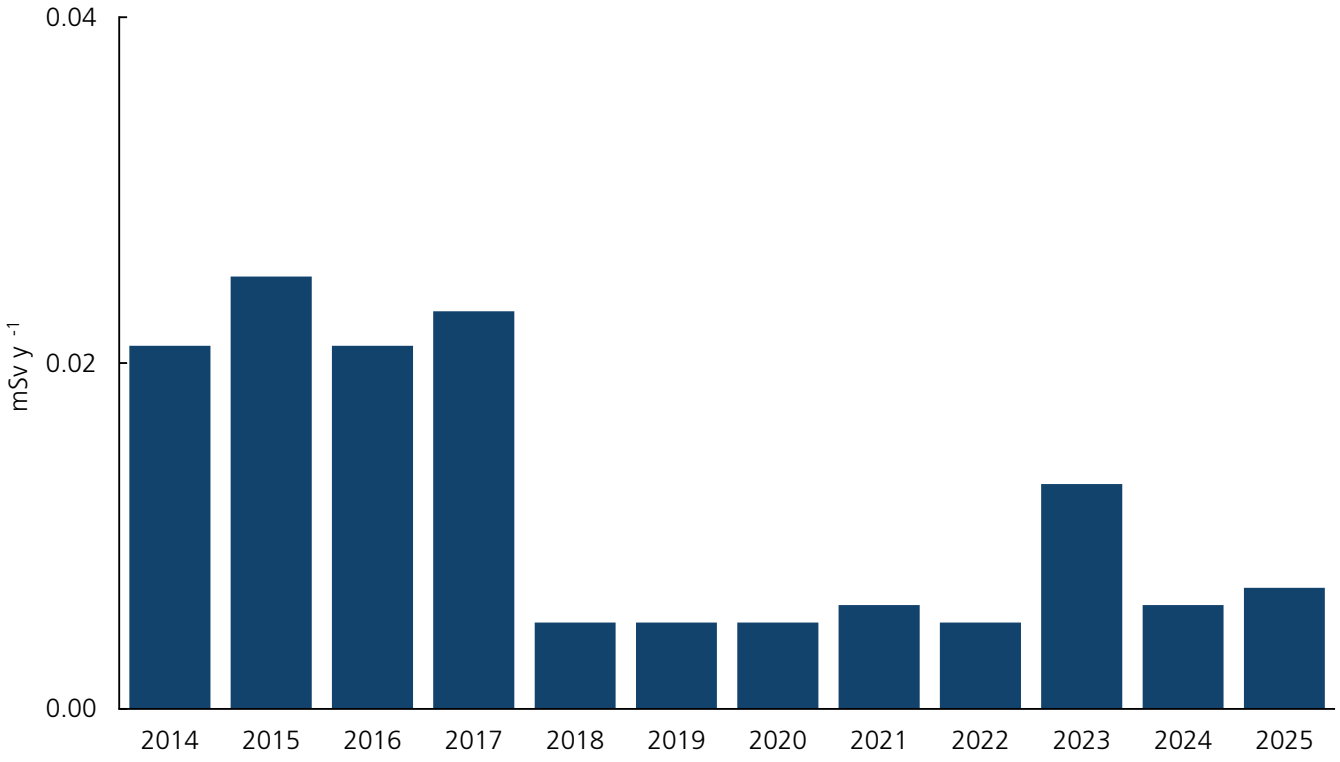
In terms of safe management of legacy higher activity waste at Hunterston B, the preferred option is to use the Intermediate Level Waste Store on Hunterston A. The station continues to develop the optimal solution for the Operational Waste Processing Facility (OWPF), which will manage the higher activity wastes arising from the station's operational life. The Decommissioning Waste Processing Facility will be refurbished and used to manage the lower activity waste arising from the decommissioning phase, however, Reinforced Autoclaved Aerated Concrete (RAAC) has been found in part of the roof which will require a management strategy in order to progress the refurbishment of the Decommissioning Waste Processing Facility.

Environmental monitoring in the area considers the effects of both Hunterston A and Hunterston B sites together. The most recent habits survey was conducted in 2024 and is available on https://beta.sepa.scot/topics/radioactive-substances/guidance-and-supporting-documents/ or by emailing RSEnquiries@sepa.org.uk.

4.2.2.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was 0.007mSv in 2025 or less than 1% of the dose limit (Table 4.1) to members of the public. This is similar to the dose in 2024 (0.006mSv). The representative person was prenatal children of an adult living near the site unchanged from 2024. The trend in 'total dose' over the period 2014 to 2025 is given in Figure 4.17, doses have generally decreased since 2018, with some variability observed over this period.

Figure 4.17 'Total dose', in mSv y^{-1}, at Hunterston nuclear power stations, 2014 to 2025 (Small doses less than or equal to 0.005mSv are recorded as being 0.005mSv).



The estimated dose for seafood consumption was 0.008mSv in 2025 which was less than 1% of the dose limit for members of the public of 1mSv and unchanged from 2025.

The estimated dose for a terrestrial food consumer was 0.025mSv in 2025, which was less than 3% of the dose limit for members of the public of 1mSv and up compared to that in 2024 (0.009mSv). The reason for the increase in dose was mainly due to a significantly higher caesium-137 concentration in the pheasant sample selected in 2025 (54Bq kg^{-1}).

4.2.2.2 Gaseous discharges and terrestrial monitoring

Gaseous discharges are made via separate discharge points from the Hunterston A and Hunterston B stations. Gaseous radioactive waste discharges from the site remain low in comparison to current site limits which are recognised as being low in comparison to other NRS sites.

There is a substantial terrestrial monitoring programme which includes the analyses of a comprehensive range of wild and locally produced foods. In addition, air, freshwater, grass and soil are sampled to provide background information. The results of terrestrial food and air monitoring in 2025 are given in Table 4.10(a) and Table 4.10(c). The concentrations of radionuclides in air, milk, crops and fruit were generally low and similar to those in previous years (where comparisons can be made). The concentration of ceasium-137 in pheasant was significantly higher in 2025 in comparison to that in 2024. As in recent years, sulphur-35 was positively detected in grass in 2025. Tritium, gross alpha and gross beta concentrations in freshwater were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51).

All activity concentrations in air at locations near to the site (Table 4.10(c)) were reported as 'less than values' (or close to the 'less than value'). Solid waste transfers in 2025 are also given in Appendix 1 (Table A1.4).

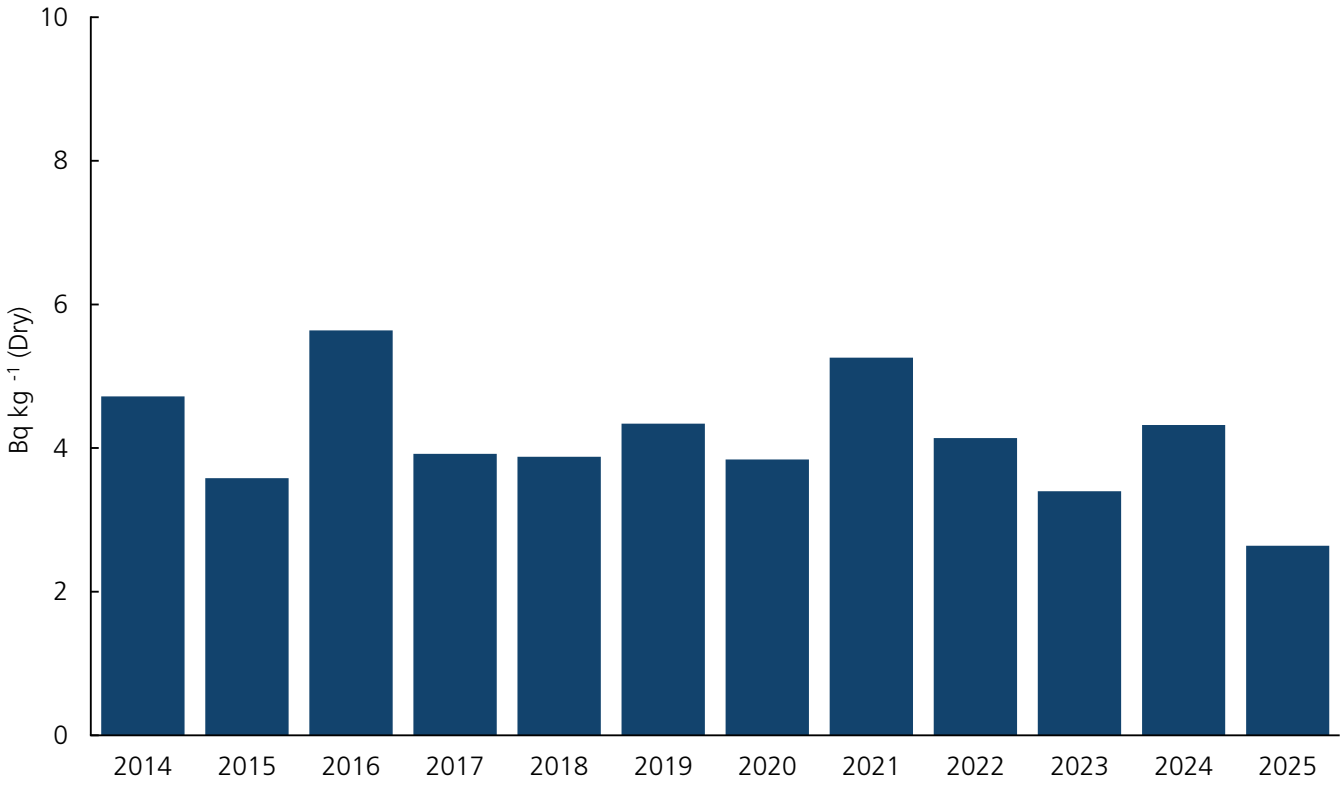
4.2.2.3 Liquid waste discharges and aquatic monitoring

Authorised liquid discharges from both Hunterston stations are made to the Firth of Clyde via the Hunterston B station's cooling water outfall. The primary source of liquid discharges from Hunterston A, is the cartridge cooling pond, draining of which is nearly complete (reducing the radiological hazards on site), which is supported by nil discharges of alpha emitting radionuclides and plutonium-241.

The main part of the aquatic monitoring programme consists of sampling of fish and shellfish and the measurement of gamma and beta dose rates on the foreshore. Samples of sediment, seawater and seaweed are analysed as environmental indicator materials.

The results of aquatic monitoring in 2025 are shown in Table 4.10(a) and Table 4.10(b). The concentrations of artificial radionuclides in the marine environment are predominantly due to Sellafield discharges, the general values being consistent with those to be expected at this distance from Sellafield. As in recent years, the concentrations of Sellafield derived technetium-99 in crabs and lobsters around Hunterston were low. All cobalt-60 concentrations in sediments were reported as 'less than value' in 2025. In 2025, plutonium and americium-241 concentrations in seafood were generally similar to those observed in recent years. Gamma dose rates were generally similar in 2025, in comparison to those observed in recent years. Measurements of the beta dose rates over sediments and rocks were all reported as 'less than values' in 2025. Caesium-137 concentrations in sediment have remained low over the last decade (Figure 4.18).

Figure 4.18 Caesium-137 concentration, in Bq kg^{-1} (dry), in marine sediments near Hunterston nuclear power stations between 2014 and 2025.



4.2.3 Torness, East Lothian

Torness Power Station is located near Dunbar on the east coast of Scotland. The station is powered by twin AGRs and began operation at the end of 1987. The current anticipated date for end of generation is 2030, however, EDF keeps operational dates under constant review.

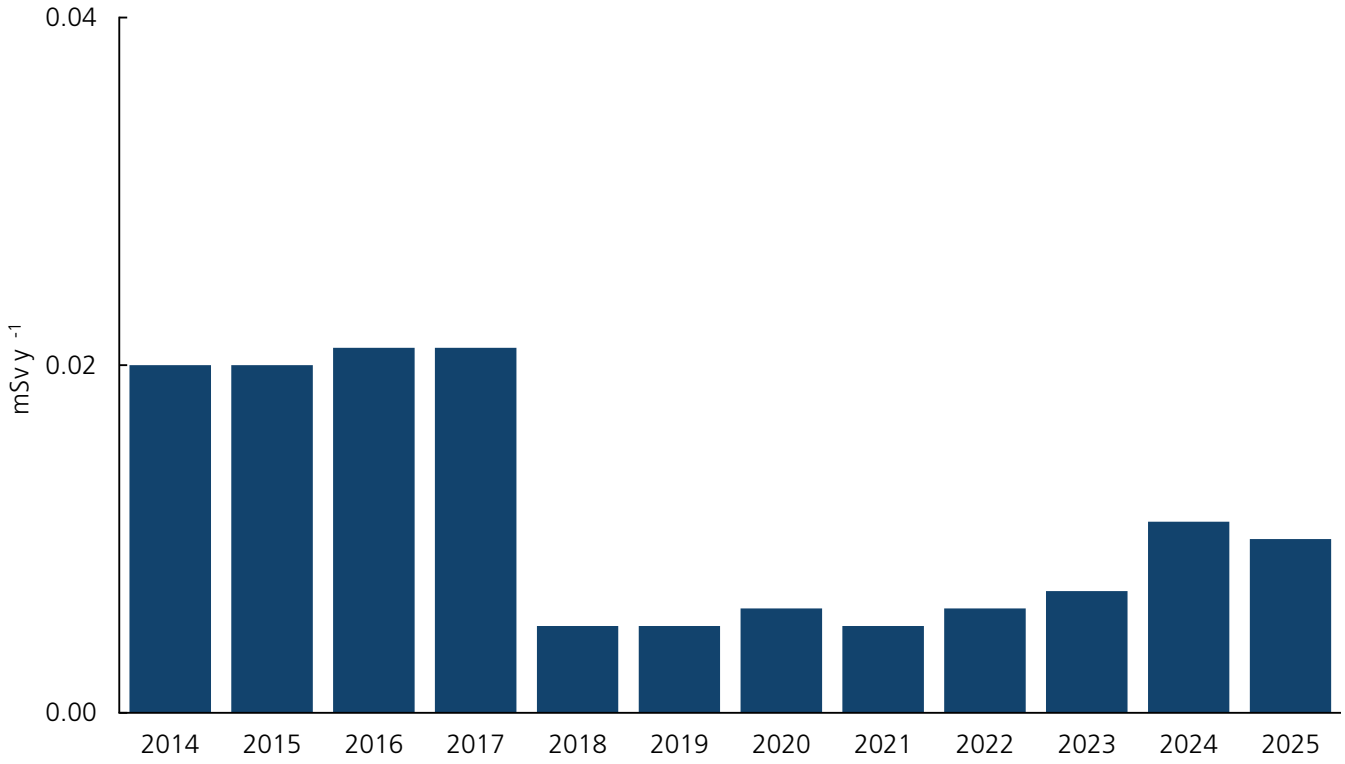
The gaseous and liquid discharges from the site are given in Appendix 1.

The most recent habits survey, to determine the consumption and occupancy rates by members of the public was published in 2025 and is available on SEPA's website https://beta.sepa.scot/topics/radioactive-substances/guidance-and-supporting-documents/radiological-habits-surveys/. Copies can also be requested from SEPA by emailing RSEnquiries@sepa.org.uk.

4.2.3.1 Doses to the public

In 2025, the 'total dose' from all pathways and sources of radiation was 0.010mSv (Table 4.1), or 1% of the dose limit to members of the public. This is similar to the dose in 2024 (0.011mSv). In 2025, the representative person was a prenatal child of a local inhabitant consuming domestic fruits and unchanged from recent years. The trend in 'total dose' over the period 2014 to 2025 is given in Figure 4.19. The decrease in 'total dose' from 2018 reflected a downward trend in the reported direct radiation, thereafter 'total dose' has remained broadly similar, from year to year, and were low.

Figure 4.19 'Total dose', in mSv y^{-1}, at Torness nuclear power station, 2014 to 2025. (Small doses less than or equal to 0.005mSv are recorded as being 0.005mSv).



The source-specific assessment for a high-rate consumer (infant) of terrestrial food gave an exposure that was 0.006mSv in 2025 (Table 4.1) and similar to that in 2024 (0.007mSv). The estimated dose to a high consumer of local fish and shellfish was less than 0.005mSv in 2025, or less than 0.5% of the dose limit for members of the public of 1mSv, and unchanged from that in recent years.

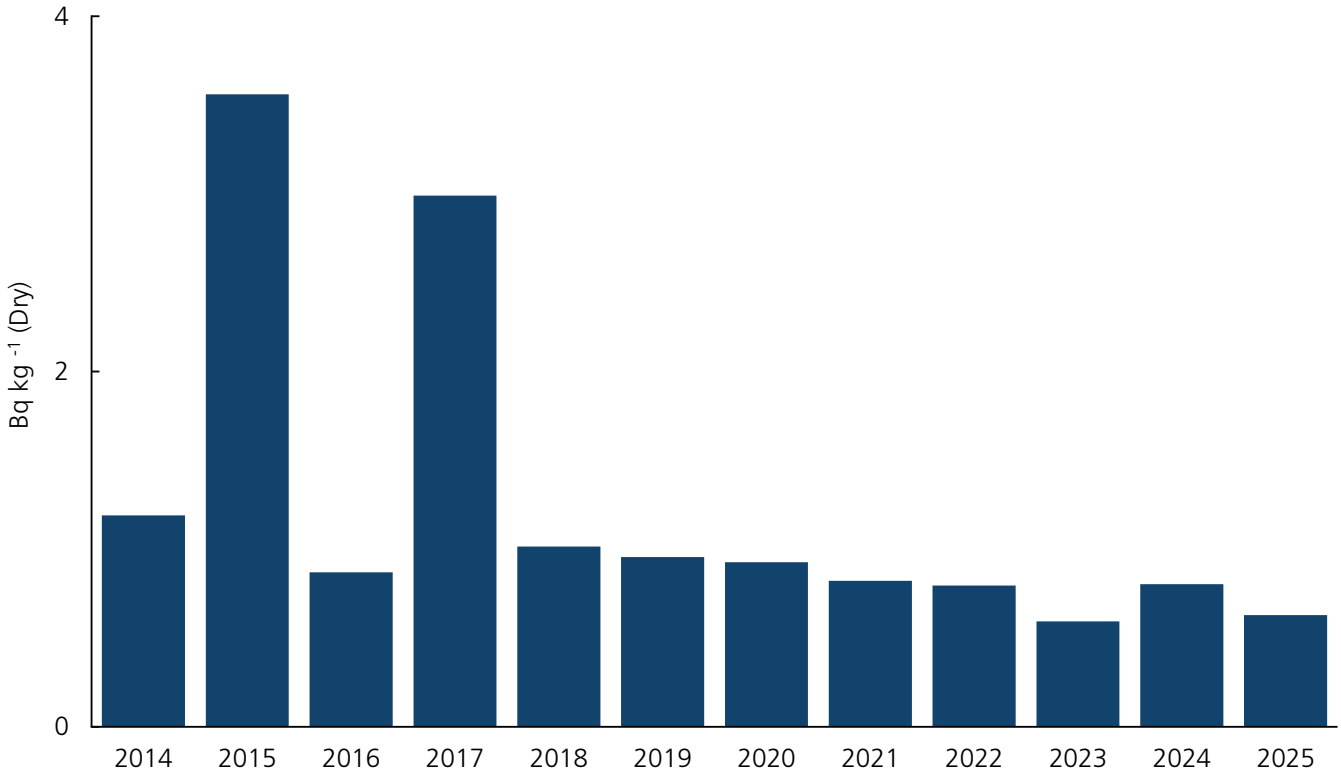
4.2.3.2 Gaseous discharges and terrestrial monitoring

A variety of foods, including milk, crops, fruit, and game as well as grass, soil and freshwater samples, were measured for a range of radionuclides. Air sampling at 3 locations was undertaken to investigate the inhalation pathway. The results of terrestrial food and air monitoring in 2025 are given in Table 4.11(a) and Table 4.11(c). Activity concentrations in many terrestrial foods are reported as 'less than values' (or close to the 'less than value'). The carbon-14 concentrations in locally produced milk were close to the default value used to represent background. Caesium-137 was positively detected in soil, but at low concentrations. As in recent years, americium-241 concentrations in all terrestrial food and soil samples (measured by gamma–ray spectrometry) were reported as 'less than values' in 2025. The tritium, gross alpha and gross beta concentrations in freshwater were well below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51). Measured concentrations of radioactivity in air, at locations near to the site, were all reported as 'less than values' or close to the 'less than values' in 2025 (Table 4.11(c)). Solid waste transfers in 2025 are also given in Appendix 1 (Table A1.4).

4.2.3.3 Liquid waste discharges and aquatic monitoring

Discharges of authorised liquid radioactive wastes are made to the Firth of Forth. Seafood, seaweed, sediment, and seawater samples were collected in 2025. Measurements were also made of gamma dose rates over intertidal areas, supported by analyses of sediment, and beta dose rate measurements on fishing gear. The results of the aquatic monitoring in 2025 are shown in Table 4.11(a) and Table 4.11(b). Concentrations of artificial radionuclides were mainly due to the distant effects of Sellafield discharges, and fallout from Chernobyl and nuclear weapons testing. Cobalt-60 was only detected positively in winkles and seaweeds collected near the main discharge pipeline and at Thorntonloch in 2025. This activation product was likely to have originated from the station. Technetium-99 concentrations in marine samples were similar to those in recent years. Overall, caesium-137 concentrations in sediments have remained low over the last decade (Figure 4.20). Gamma dose rates over intertidal areas were generally indistinguishable from natural background and were similar to those measured in recent years. Measurements of the contact beta dose rate on fisher's pots were reported as 'less than values' in 2025.

Figure 4.20 Caesium-137 concentration, in Bq kg^{-1} (dry), in marine sediments near Torness nuclear power station between 2014 to 2025.



4.3 Wales

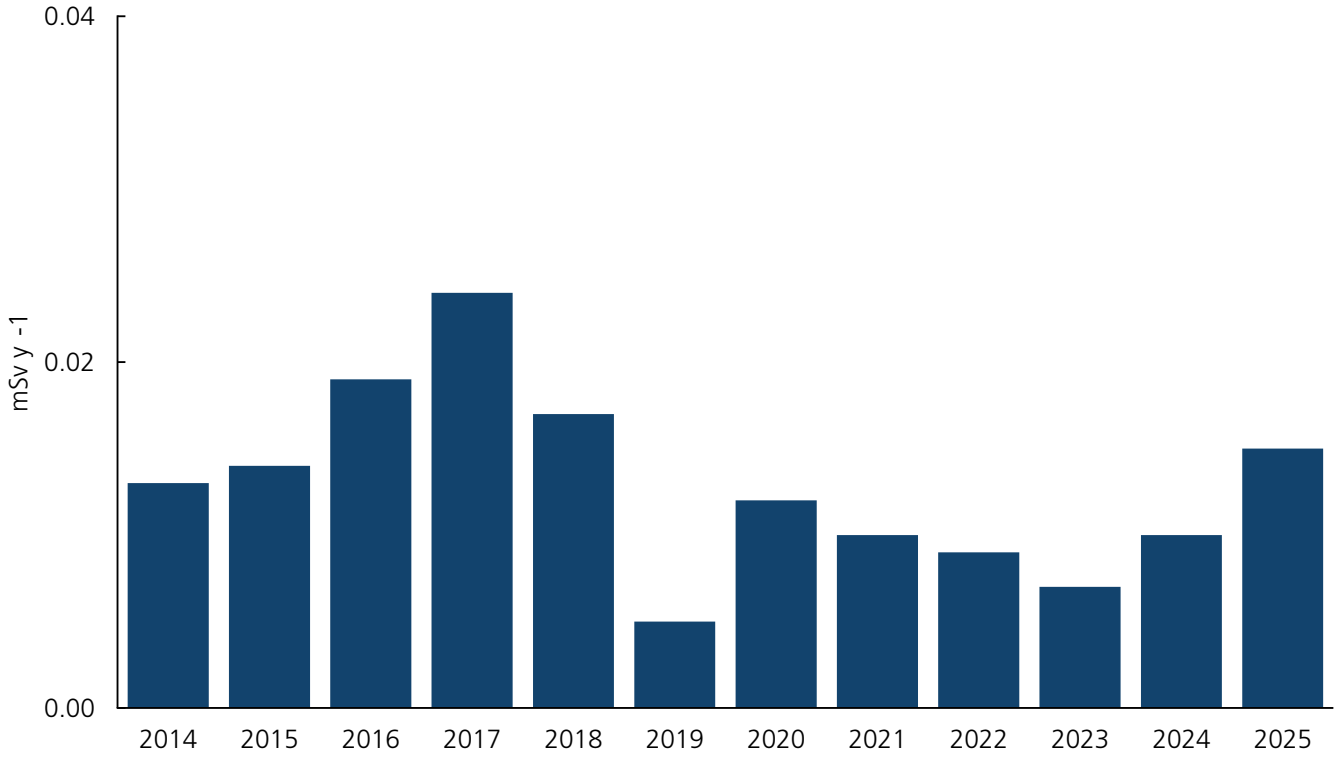
4.3.1 Trawsfynydd, Gwynedd

Trawsfynydd Power Station is located inland on the northern bank of Llyn Trawsfynydd in Eryri (Snowdonia) National Park, North Wales and was powered by 2 Magnox reactors. Trawsfynydd stopped generating electricity in 1991. Defuelling of the reactors was completed in 1995, and the station is being decommissioned. As part of NDA's site-specific approach to decommissioning, Trawsfynydd was selected as the lead location, where the reactors will be dismantled without a long period of care and maintenance [164]. The most recent habits survey was undertaken in 2018 [165].

4.3.1.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was 0.015mSv in 2025 (Table 4.1), which was less than 2% of the dose limit to members of the public. This is an increase from 0.010mSv in 2024. The representative person in 2025 was an adult exposed to external radiation over lake sediments and was unchanged from recent years. The increase in 'total dose' was mostly attributed to a higher mean caesium-137 concentration in sediments collected from the lake shore near a café and near the main discharge pipeline (and hence calculated gamma dose rate over lacustrine sediments) in 2025. The trend in 'total dose' over the period 2014 to 2025 is given in Figure 4.21, with variations in recent years due to estimates of gamma dose rate over lacustrine sediments.

Figure 4.21 'Total dose', in mSv y^{-1}, at Trawsfynydd nuclear power station, 2014 to 2025. (Small doses less than or equal to 0.005mSv are recorded as being 0.005mSv).



The dose to an angler (who consumes large quantities of fish and spends long periods of time in the location being assessed) was 0.012mSv in 2025 (Table 4.1), which was approximately 1% of the dose limit for members of the public of 1mSv and an increase from 2024 (0.007mSv). The main reason for the increase in dose was the same as for the 'total dose'. The activity concentrations observed in lake sediments are used to calculate an external dose rate due to the difficulty in establishing the increase in measured dose rates above natural background rates. The dose to infants (1-year-old) consuming terrestrial food was 0.021mSv, or approximately 2% of the dose limit. This was lower than in 2024 (0.038mSv) because of a lower limit of detection for americium-241 in milk samples collected in 2025.

4.3.1.2 Gaseous discharges and terrestrial monitoring

The results of the terrestrial programme, for local food (including milk) and grass samples in 2025, are shown in Table 4.12(a). Concentrations of activity in all terrestrial samples were low. As in 2024, tritium concentrations in all milk samples were reported as 'less than values' in 2025. As in recent years, carbon-14 concentrations in milk were reported just above the background concentration. Measured activities for caesium-137 in all terrestrial samples were reported as 'less than values' (or close to the 'less than value') in 2025. The most likely source of small amounts of caesium-137 is fallout from Chernobyl and nuclear weapons testing, though it is conceivable that a small contribution may be made by re-suspension of lake activity. In recognition of this potential mechanism, monitoring of transuranic radionuclides, which are also associated with liquid discharges from the site [166], was also conducted on an apple sample. In 2025, detected activities of transuranic radionuclides in apples were low and generally similar to observations in other areas of England and Wales, where activity was attributable to fallout from nuclear weapons testing. Therefore, there was no direct evidence of re-suspension of activity in sediment from the lake shore contributing to increased exposure from transuranic radionuclides in 2025.

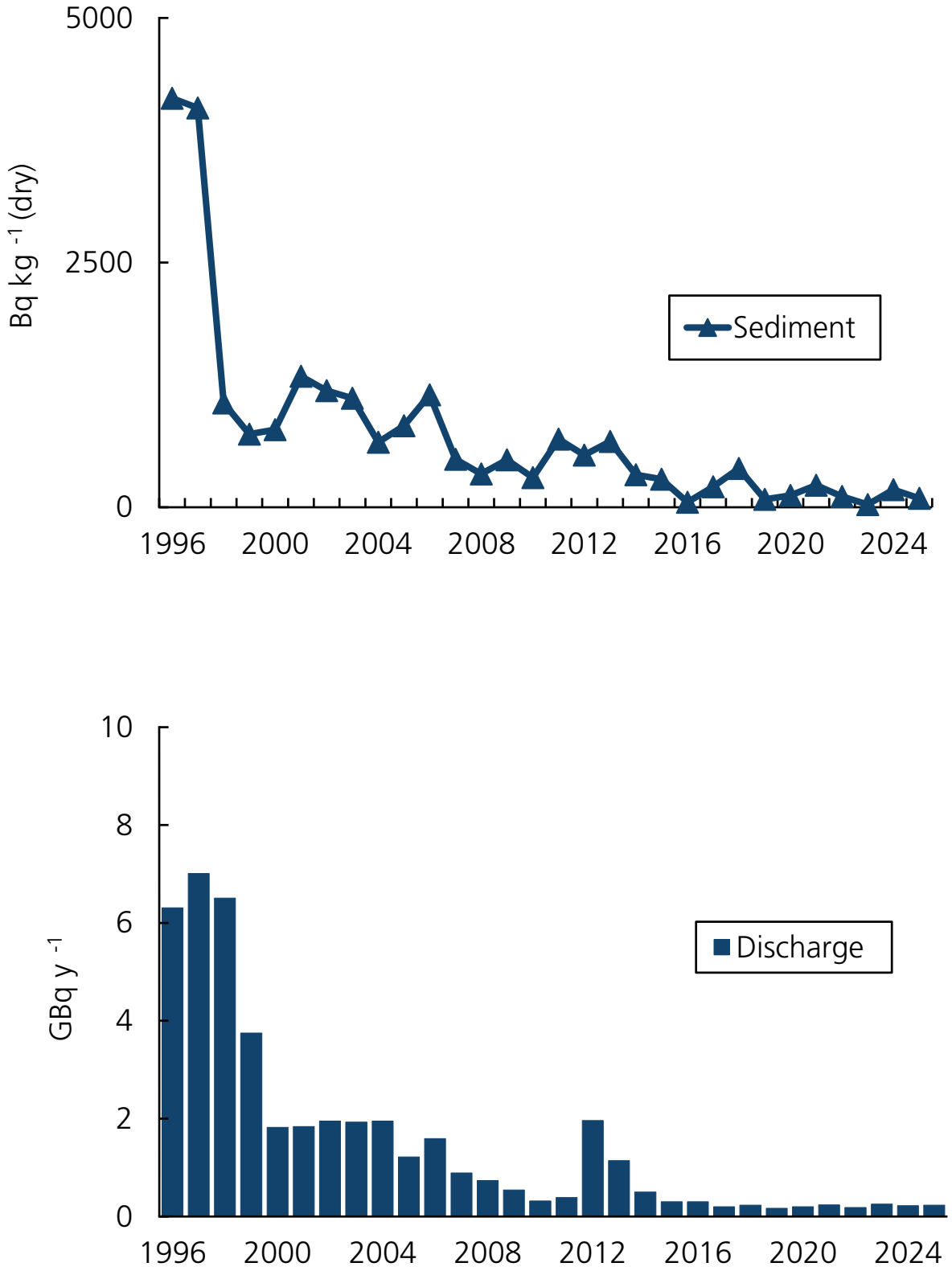
4.3.1.3 Liquid waste discharges and aquatic monitoring

Discharges of liquid radioactive waste are made to a freshwater lake, making the power station unique in UK terms. The aquatic monitoring programme was directed at consumers of freshwater fish caught in the lake and external exposure over the lake shoreline; the important radionuclides being caesium-137 and, to a lesser extent, strontium-90. Freshwater and sediment samples were also analysed in 2025. Brown and rainbow trout were found to be the species regularly consumed in past habits surveys. Most brown trout are indigenous to the lake, but rainbow trout are introduced from a hatchery. Due to the limited period that they spend in the lake, introduced fish generally exhibit lower caesium-137 concentrations than indigenous fish.

Data for 2025 are given in Table 4.12(a) and Table 4.12(b). Most activity concentrations in fish and sediments result from historical discharges, due to inefficient dispersion and binding to sediments [166]. As in recent years, due to sample availability, only rainbow trout samples were collected in 2025. The most recent brown trout sample to be collected was in 2015 and the concentration of caesium-137 was the lowest reported value for fish indigenous to the lake [75]. As in previous years, caesium-137 concentrations in water samples are reported as 'less than values' in 2025. Concentrations in the water column are predominantly maintained by processes that release activity (such as remobilisation) from near surface sediments. Caesium-137 concentrations in lake sediments were slightly lower to those observed in 2024 at all sampling locations apart from the sediment collected near the main discharge pipeline, which exhibited a caesium-137 concentration of 350Bq kg^{-1} (compared to a maximum of 320Bq kg-1 observed in a sediment sample collected in 2024 on the lake shore near a café). Americium-241 was also positively detected in the sediment sample collected near the main discharge pipeline (5.3Bq kg^{-1}). In previous years' monitoring programmes, it has been demonstrated that these concentrations increase with depth beneath the sediment surface. The concentrations of strontium-90 in all sediment samples collected in 2025 were reported as 'less than values'. Unlike in 2024, plutonium-238 was positively detected in sediment sample (collected near the main discharge pipeline). As in recent years, plutonium-239+240 was also positively detected in a sediment sample (collected on the lake shore near a café and near the main discharge pipeline). Strontium-90 and transuranic concentrations in fish continued to be very low in 2025 and it is the effects of caesium-137 that dominate the external radiation pathways.

In the lake itself, there remains clear evidence of the effects of liquid discharges from the power station (activity concentrations of caesium-137, and other radionuclides, in sediments). However, gamma dose rates measured on the shoreline (where anglers fish) were difficult to distinguish from background dose rates in 2025 and were generally similar (where comparison could be made) to those in 2024. The predominant radionuclide in the dose assessment was caesium-137. The time trends of concentrations of caesium-137 in sediments and discharges are shown in Figure 4.22. A substantial decline in concentrations was observed in the mid to late 1990s in line with reducing discharges. Since 2000, the discharges of caesium-137 have generally decreased, but with some variability. Concentrations have since decreased broadly, with fluctuations due to environmental variability and short periods of increased discharges, particularly in 2012 and 2013.

Figure 4.22 Caesium-137 liquid discharge, in GBq y^{-1}, from Trawsfynydd and concentration in sediment, in Bq kg^{-1} (dry), in Trawsfynydd Lake, 1996 to 2025.



4.3.2 Wylfa, Isle of Anglesey

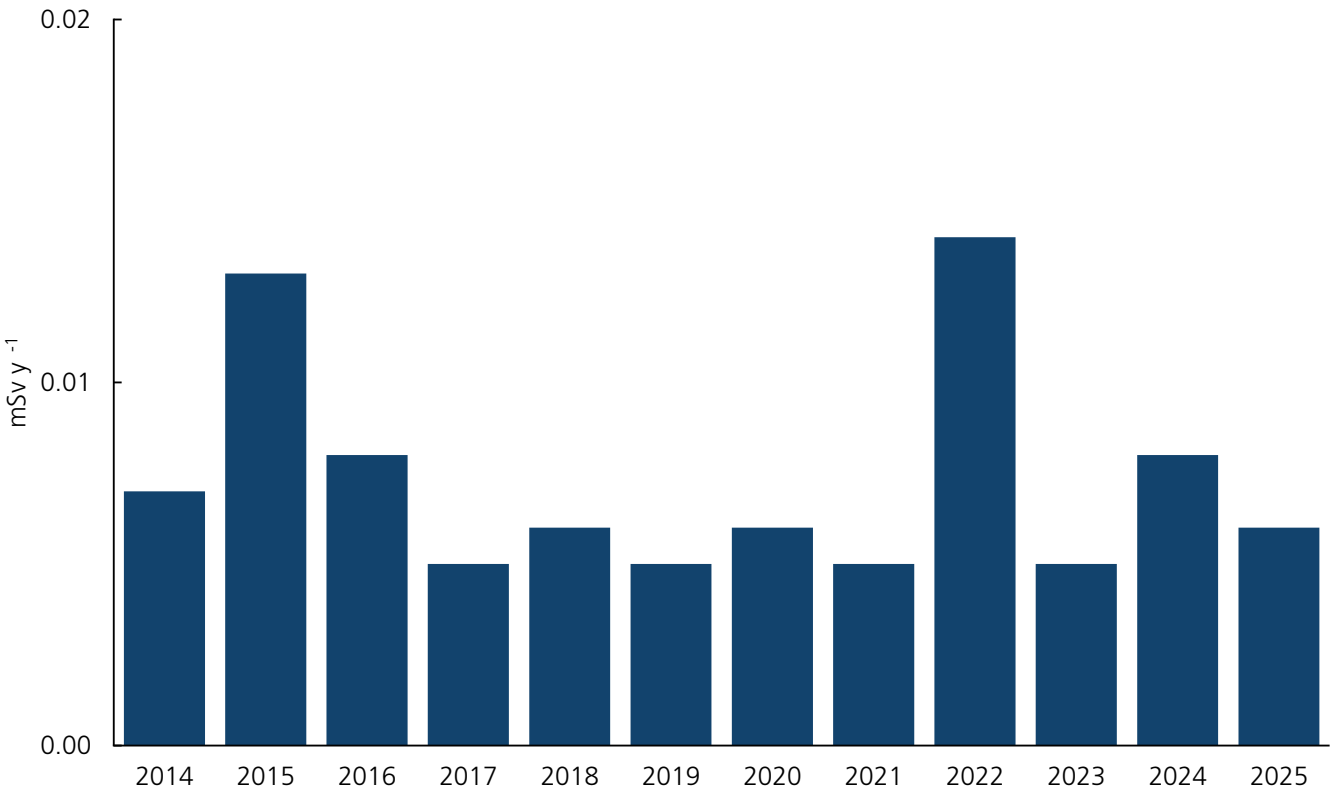
Wylfa Power Station is located on the north coast of Anglesey and has 2 Magnox reactors. It was the last and largest power station of its type to be built in the UK and commenced electricity generation in 1971 and ceased in 2015. Defuelling operations were completed in 2019 [167]. This milestone marked the end of defuelling operations at all the UK's first-generation nuclear reactors. In 2025, the UK Government announced the site will host a new power station to contain the UK's first fleet of small modular reactors. In April 2026, Rolls-Royce SMR Ltd was contracted by Great British Energy – Nuclear (GBE-N) to design and deliver initially three SMR units, this project is named Gwyndod.

The most recent habits survey was undertaken in 2023 [168].

4.3.2.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was 0.006mSv in 2025 (Table 4.1), which was less than 1% of the dose limit to members of the public. This is a decrease from 0.008mSv in 2024 because of a lower estimate of direct radiation compared with 2024. The representative person in 2025 was an adult eating marine plants and algae and was unchanged from 2024. The trend in 'total dose' over the period 2014 to 2025 is given in Figure 4.23. The annual 'total dose' has remained broadly similar, from year to year, and were generally very low.

Figure 4.23 'Total dose', in mSv y^{-1}, at Wylfa nuclear power station, 2014 to 2025. (Small doses less than or equal to 0.005mSv are recorded as being 0.005mSv).



As in recent years, source-specific assessments for a high-rate consumer of locally grown foods, and for a high-rate consumer of fish and shellfish (including external radiation) gave exposure levels that were lower than the 'total dose' (Table 4.1). The dose to a high-rate consumer of fish and shellfish (including external radiation) was less than 0.005mSv in 2025 and unchanged from recent years. The dose to a high-rate consumer of locally grown foods was also less than 0.005mSv in 2025 and unchanged from recent years.

4.3.2.2 Gaseous discharges and terrestrial monitoring

The focus of the terrestrial sampling was for the analyses of tritium, carbon-14 and sulphur-35 in milk and crops. Data for 2025 are given in Table 4.13(a). As in recent years, sulphur-35 was not positively detected in milk, but was detected in grass and carbon-14 concentrations measured in locally produced milk were just above background levels in 2025.

4.3.2.3 Liquid waste discharges and aquatic monitoring

The aquatic monitoring programme consists of sampling of fish and shellfish, and the measurement of gamma dose rates. Samples of sediment, seawater and seaweed are analysed as environmental indicator materials. The results of the programme in 2025 are given in Table 4.13(a) and Table 4.13(b). The data for artificial radionuclides related to the Irish Sea continue to reflect the distant effects of Sellafield discharges. The activity concentrations in 2025 were similar to those in previous years. The reported concentration of technetium-99 in seaweed in 2025 (due to the distant effects of discharges to sea from Sellafield) was slightly higher than the level observed in 2024. Caesium-137 concentrations in sediment have remained low over the last decade (Figure 4.24). Overall, gamma dose rates in 2025 were generally similar to those measured in recent years.

Figure 4.24 Caesium-137 concentrations, in Bq kg^{-1} (dry), in marine sediments near Wylfa nuclear power stations between 2014 and 2025

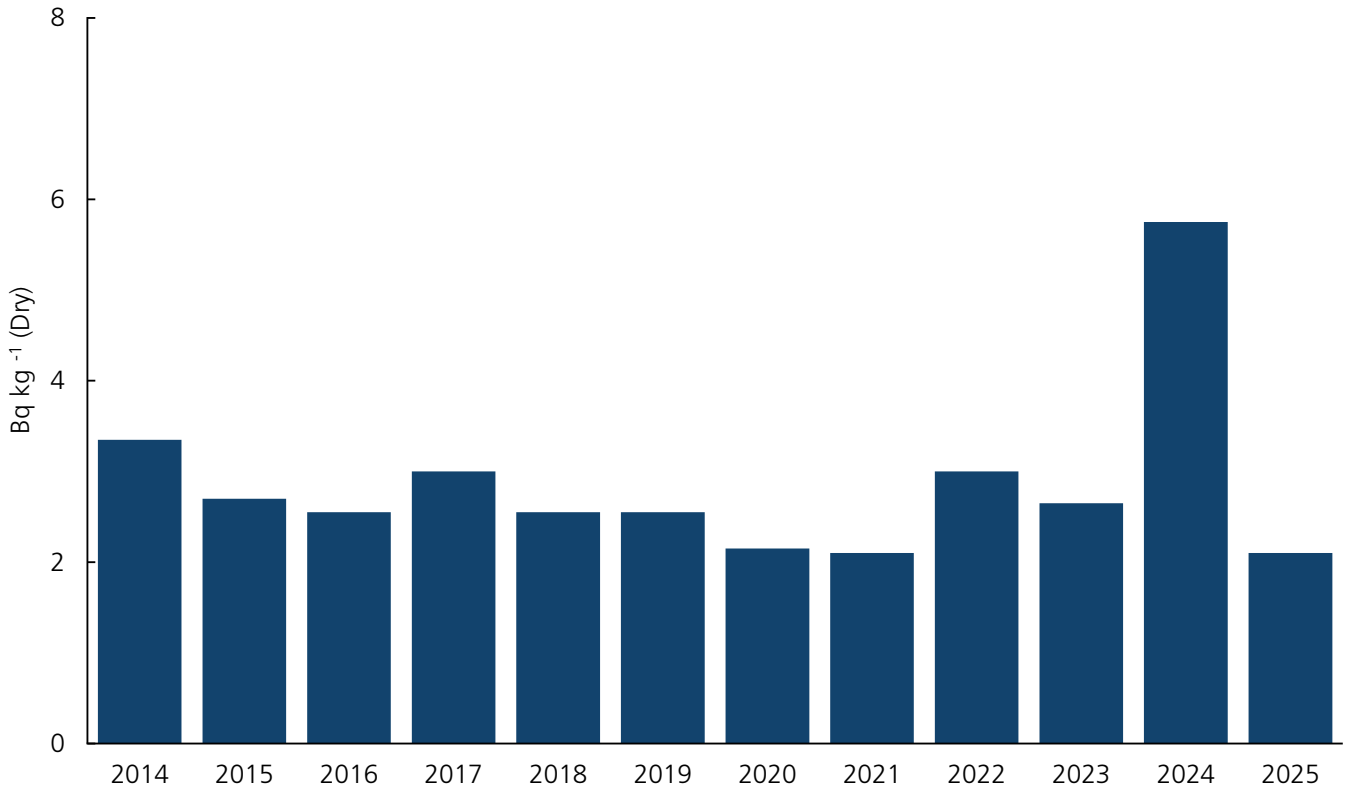


Table 4.1 Individual doses (mSv y^{-1}) - nuclear power stations, 2025

Operating sites	Representative person[a]	Exposure, mSv per year					
		Total	Fish and shellfish	Other local food	External radiation from intertidal areas or shoreline[b]	Gaseous plume related pathways	Direct radiation from site
England							
Berkeley and Oldbury							
'Total dose' - all sources	**Infant milk consumers**	**<0.005**	**-**	**<0.005**	**-**	**-**	**-**
Source-specific doses	Seafood consumers	<0.005	<0.005	-	<0.005	-	-
	Houseboat occupants	0.028	-	-	0.028	-	-
	Infant inhabitants and consumers of locally grown food	<0.005	-	<0.005	-	<0.005	-
Bradwell							
'Total dose' - all sources	**Adult houseboat occupants**	**<0.005**	**<0.005**	**<0.005**	**<0.005**	**-**	**-**
Source-specific doses	Seafood consumers	<0.005	<0.005	-	<0.005	-	-
	Infant inhabitants and consumers of locally grown food	<0.005	-	<0.005	-	<0.005	-
Dungeness							
'Total dose' - all sources	**Adult occupants over sediment**	**0.010**	**<0.005**	**-**	**0.009**	**<0.005**	**<0.005**
Source-specific doses	Seafood consumers	0.010	<0.005	-	0.009	-	-
	Infant inhabitants and consumers of locally grown food	<0.005	-	<0.005	-	<0.005	-
Hartlepool							
'Total dose' - all sources	**Local adult inhabitants (0 - 0.25km)**	**0.007**	**-**	**-**	**<0.005**	**<0.005**	**0.005**
Source-specific doses	Seafood consumers[c]	0.007	<0.005	-	<0.005	-	-
	Infant inhabitants and consumers of locally grown food	<0.005	-	<0.005	-	<0.005	-
Heysham							
'Total dose' - all sources	**Adult occupants over sediment**	**0.017**	**<0.005**	**<0.005**	**0.017**	**<0.005**	**<0.005**
Source-specific doses	Seafood consumers	0.023	0.007	-	0.016	-	-
	Turf cutters	<0.005	-	-	<0.005	-	-
	Infant inhabitants and consumers of locally grown food	<0.005	-	<0.005	-	<0.005	-
Hinkley Point							
'Total dose' - all sources	**Adult occupants over sediment**	**0.011**	**<0.005**	**-**	**0.011**	**-**	**-**
Source-specific doses	Seafood consumers	0.013	<0.005	-	0.011	-	-
	Infant inhabitants and consumers of locally grown food	<0.005	-	<0.005	-	<0.005	-
Sizewell							
'Total dose' - all sources	**Local adult inhabitants (0 - 0.25km)**	**0.010**	**<0.005**	**-**	**<0.005**	**<0.005**	**0.009**
Source-specific doses	Seafood consumers	<0.005	<0.005	-	<0.005	-	-
	Infant inhabitants and consumers of locally grown food	0.005	-	0.005	-	<0.005	-

Table 4.1 continued

Operating sites	Representative person[a]	Exposure, mSv per year					
		Total	Fish and shellfish	Other local food	External radiation from intertidal areas or shoreline[b]	Gaseous plume related pathways	Direct radiation from site
Scotland							
Chapelcross							
'Total dose' - all sources	**Infant milk consumers**	**0.007**	**-**	**0.007**	**-**	**-**	**-**
Source-specific doses	Fish and wildfowl consumers	0.006	<0.005	-	<0.005	-	-
	Infant inhabitants and consumers of locally grown food	0.006	-	0.006	-	<0.005	-
Hunterston							
'Total dose' - all sources	**Prenatal children of local inhabitants (0.5 - 1km)**	**0.007**	**-**	**<0.005**	**<0.005**	**<0.005**	**0.007**
Source-specific doses	Seafood consumers	0.008	0.008	-	<0.005	-	-
	Inhabitants and consumers of locally grown food	0.025	-	0.025	-	<0.005	-
Torness							
'Total dose' - all sources	**Prenatal children of domestic fruit consumers**	**0.010**	**<0.005**	**<0.005**	**<0.005**	**<0.005**	**0.007**
Source-specific doses	Seafood consumers	<0.005	<0.005	-	<0.005	-	-
	Infant inhabitants and consumers of locally grown food	0.006	-	0.006	-	<0.005	-
Wales							
Trawsfynydd							
'Total dose' - all sources	**Adult occupants over sediment**	**0.015**	**<0.005**	**-**	**0.010**	**<0.005**	**<0.005**
Source-specific doses	Anglers	0.012	<0.005	-	0.010	-	-
	Infant inhabitants and consumers of locally grown food	0.021	-	0.021	-	<0.005	-
Wylfa							
'Total dose' - all sources	**Adult consumers of marine plants and algae**	**0.006**	**-**	**-**	**0.005**	**<0.005**	**<0.005**
Source-specific doses	Seafood consumers	<0.005	<0.005	-	<0.005	-	-
	Infant inhabitants and consumers of locally grown food	<0.005	-	<0.005	-	<0.005	-

a. The 'total dose' is the dose which accounts for all sources including gaseous and liquid discharges and direct radiation
The 'total dose' for the representative person with the highest dose is presented
Other dose values are presented for specific sources, either liquid discharges or gaseous discharges, and their associated pathways
They serve as a check on the validity of the 'total dose' assessment
The representative person is an adult unless otherwise stated
Data are presented to 2 significant figures or 3 decimal places. Data below 0.005 mSv are reported as <0.005 mSv

b. Doses ('total dose' and source-specific doses) only include estimates of anthropogenic inputs (by substracting background and cosmic sources from measured gamma dose rates)

c. Excluding possible enhancement of naturally occurring radionuclides. See Section 4

Table 4.2 (a). Concentrations of radionuclides in food and the environment near Berkeley and Oldbury nuclear power stations, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}										
			^{3}H	^{99}Tc	^{125}I	^{137}Cs	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Marine samples													
Shrimps	Guscar	2	<25			<0.10	0.00034	0.0014	0.0026	*	*		
Seaweed	2km south west of Berkeley	2[E]		<0.36	0.41	<0.24				<0.34			
Sediment	0.5km south of Oldbury	2[E]				35				<0.52			
Sediment	2km south west of Berkeley	2[E]				27				<0.72			
Sediment	Sharpness	2[E]				12				<0.60			
Sediment	Ledges	2[E]				11				<0.65			
Seawater	2km south west of Berkeley	2[E]	<3.9			<0.26				<0.37		<2.7	9.7

Material	Location or selection[b]	No. of sampling observations[c]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			^{3}H	^{14}C	^{35}S	^{137}Cs	Gross alpha	Gross beta
Terrestrial samples								
Milk		4	<2.3	19	<0.16	<0.05		
Milk	max			22	<0.20	<0.06		
Potatoes		1	<2.6	21	<0.10	<0.04		
Barley		1	<8.9	76	<0.20	<0.05		
Freshwater	Gloucester and Sharpness Canal	2[E]	<3.6		<0.11	<0.26	<0.045	0.22

* Not detected by the method used

[a] Except for milk and water where units are Bq l^{-1}, and for sediment where dry concentrations apply

[b] Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima
If no 'max' value is given the mean value is the most appropriate for dose assessments

[c] The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

[E] Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 4.2(b) Monitoring of radiation dose rates near Berkeley and Oldbury nuclear power stations, 2025

Location	Ground type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
0.5 km south of Oldbury	Mud	1	0.082
0.5 km south of Oldbury	Mud and salt marsh	1	0.078
2 km south west of Berkeley	Grass and mud	1	0.079
2 km south west of Berkeley	Mud	1	0.080
Guscar Rocks	Mud and salt marsh	1	0.078
Lydney Rocks	Mud	2	0.10
Sharpness	Mud	1	0.077
Sharpness	Mud and salt marsh	1	0.081
Ledges	Mud	1	0.079
Ledges	Mud and salt marsh	1	0.075

Table 4.3(a) Concentrations of radionuclides in food and the environment near Bradwell nuclear power station, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}				
			^{3}H	^{99}Tc	^{137}Cs	^{238}Pu	^{239}Pu+ ^{240}Pu
Marine samples							
Smooth hound	Pipeline	1			0.17		
Lobsters	West Mersea	1			<0.04		
Oysters	Blackwater Estuary	1			<0.07	0.00037	0.0023
Samphire	Tollesbury	1		<0.036	0.07		
Seaweed	Waterside	2[E]		<0.51	<0.31		
Seaweed	West Mersea	1[E]		<0.15	<0.08		
Sediment	Pipeline	2[E]			<0.52		
Sediment	Waterside	2[E]			6.2		
Sediment	N side Blackwater Estuary	2[E]			4.0		
Sediment	Maldon Harbour	2[E]			6.6		
Sediment	West Mersea Beach Huts	2[E]			0.87		
Sediment	West Mersea Boatyard	2[E]			3.1		
Seawater	Pipeline	2[E]	<3.6		<0.27		

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}				
			^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Marine samples							
Smooth hound	Pipeline	1	<0.16				
Lobsters	West Mersea	1	<0.04				
Oysters	Blackwater Estuary	1	0.0011	*	*		
Samphire	Tollesbury	1	<0.08				
Seaweed	Waterside	2[E]	<0.34				
Seaweed	West Mersea	1[E]	<0.09				
Sediment	Pipeline	2[E]	<0.27				
Sediment	Waterside	2[E]	<0.70				
Sediment	N side Blackwater Estuary	2[E]	<0.60				
Sediment	Maldon Harbour	2[E]	<0.59				
Sediment	West Mersea Beach Huts	2[E]	<0.30				
Sediment	West Mersea Boatyard	2[E]	<0.56				
Seawater	Pipeline	2[E]	<0.35			<3.7	15

Table 4.3(a) continued

Material	Location or selection[f]	No. of sampling observations[g]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			^{3}H	^{14}C	^{90}Sr	^{137}Cs	Gross alpha	Gross beta
Terrestrial samples								
Milk		2	<2.3	22		<0.05		
Milk	max		<2.4					
Cabbage		1	<1.8	8.5		<0.04		
Wheat		1	<9.4	93		<0.05		
Freshwater	Coastal ditch, between power station and shore	1[E]	<3.7		<0.041	<0.30	<1.1	4.3
Freshwater	Coastal ditch, east face of sector building	1[E]	<3.7			<0.27	<0.46	3.6
Freshwater	Coastal ditch, east face of turbine hall	1[E]	<3.9		<0.025	<0.31	<0.44	4.3
Freshwater	Coastal ditch, drain pit overflow	1[E]	<3.6			<0.30	0.35	4.7

* Not detected by the method used

a. Except for milk and water where units are Bq l^{-1}, and for sediment where dry concentrations apply

b. Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima
If no 'max' value is given the mean value is the most appropriate for dose assessments

c. The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

E Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 4.3(b) Monitoring of radiation dose rates near Bradwell nuclear power station, 2025

Location	Ground type	No. of sampling observations	μGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Bradwell Beach	Sand and shingle	2	0.057
Bradwell Beach opposite power station N side of estuary	Grass and mud	2	0.074
Waterside	Mud	1	0.063
Waterside	Mud and shingle	1	0.067
Maldon Harbour	Grass and mud	2	0.067
West Mersea Beach Huts	Mud	1	0.070
West Mersea Beach Huts	Sand and shingle	1	0.066
SE of West Mersea boatyard	Mud and shingle	1	0.065
SE of West Mersea boatyard	Sand and shingle	1	0.060

Table 4.4(a) Concentrations of radionuclides in food and the environment near Dungeness nuclear power stations, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}							
			^{3}H	^{3}H	^{14}C	^{60}Co	^{90}Sr	^{99}Tc	^{137}Cs	^{238}Pu
Marine samples										
Cod	Pipeline	1	<25	<25		<0.05			0.10	
Dover sole	Pipeline	1	<25	<25		<0.05			0.11	
Spiny spider crabs	Pipeline	1	<25	<25		<0.12			<0.09	
Scallops	Pipeline	1	<25	<25	19	<0.05	<0.027		<0.04	0.00021
Sea kale	Dungeness Beach	1				<0.05			<0.07	
Seaweed	Folkestone Harbour	2[E]				<0.27		<0.25	<0.21	
Sediment	Rye Harbour	3[E]				<0.25			<0.36	<0.32
Sediment	Camber Sands	2[E]				<0.20			<0.18	
Sediment	Pilot Sands	2[E]				<0.15			<0.25	
Seawater	Dungeness South	2[E]		<3.4		<0.28			<0.24	

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			^{239}Pu+ ^{240}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Marine samples								
Cod	Pipeline	1		<0.03				
Dover sole	Pipeline	1		<0.05				
Spiny spider crabs	Pipeline	1		<0.11				
Scallops	Pipeline	1	0.0015	0.00046	*	*		
Sea kale	Dungeness Beach	1		<0.06				
Seaweed	Folkestone Harbour	2[E]		<0.20				
Sediment	Rye Harbour	3[E]	<0.31	<0.61				720
Sediment	Camber Sands	2[E]		<0.46				
Sediment	Pilot Sands	2[E]		<0.43				
Seawater	Dungeness South	2[E]		<0.43			<4.6	13

Table 4.4(a) continued

Material	Location or selection[b]	No. of sampling observations[c]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{3}H	^{14}C	^{35}S	^{60}Co	^{137}Cs	Gross alpha	Gross beta
Terrestrial samples									
Milk		2	<2.3	18	<0.18	<0.06	<0.05		
Milk	max		<2.4	19		<0.07	<0.06		
Potatoes		1	<2.3	20	<0.10	<0.05	<0.04		
Grass		1	<2.3	18	1.2	<0.09	<0.10		
Grass	Lydd	2[E]	<13	30		<0.29	<0.23		
Grass	Denge Marsh	2[E]	<13	33		<0.31	<0.28		
Freshwater	Long Pits	2[E]	<3.5		<0.15	<0.33	<0.26	<0.021	0.11
Freshwater	Pumping station Well number 2	1[E]	<3.5		<0.15	<0.26	<0.24	<0.016	0.14
Freshwater	Reservoir	1[E]	<3.6		<0.14	<0.24	<0.26	<0.019	0.13

* Not detected by the method used

a. Except for milk and water where units are Bq l^{-1} and for sediment where dry concentrations apply

b. Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima. If no 'max' value is given the mean value is the most appropriate for dose assessments

c. The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

E Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 4.4(b) Monitoring of radiation dose rates near Dungeness nuclear power stations, 2025

Location	Ground type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Littlestone on Sea	Sand and shingle	1	0.059
Littlestone on Sea	Shingle	1	0.053
Greatstone on Sea	Mud	1	0.062
Greatstone on Sea	Mud and sand	1	0.059
Pilot Sands	Sand	1	0.059
Pilot Sands	Sand and shingle	1	0.052
Dungeness West	Shingle	2	0.053
Jury's Gap	Sand	2	0.061
Rye Bay	Sand	2	0.064

Table 4.5(a) Concentrations of radionuclides in food and the environment near Hartlepool nuclear power stations, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1} Organic							
			^{3}H	^{3}H	^{14}C	^{60}Co	^{99}Tc	^{131}I	^{137}Cs	^{210}Pb
Marine samples										
Plaice	Pipeline	1	<25	42	26	<0.05		<0.86	0.08	
Crabs	Pipeline	1	<25	<25	35	<0.06		<0.50	<0.04	
Winkles	South Gare	2	<25	<26	33	<0.07		<0.05	<0.14	1.5
Seaweed	Pilot Station	2[E]				<0.16	1.6	21	<0.13	
Sediment	Old Town Basin	2[E]				<0.24			0.82	
Sediment	Seaton Carew	2[E]				<0.18			<0.16	
Sediment	Paddy's Hole	2[E]				<0.31			4.2	
Sediment	North Gare	2[E]				<0.19			<0.16	
Sediment	Greatham Creek	2[E]			16	<0.33			2.8	
Sediment	Redcar Sands	2[E]				<0.20			<0.19	
Sea coal	Old Town Basin	2[E]				<0.30			<0.28	
Sea coal	Carr House Sands	2[E]				<0.26			0.63	
Seawater[b]	North Gare	2[E]		<3.6		<0.25			<0.19	

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}							
			^{210}Po	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Marine samples										
Plaice	Pipeline	1				<0.03				
Crabs	Pipeline	1				<0.09				
Winkles	South Gare	2	20	0.0042	0.036	0.019	*	*		
Seaweed	Pilot Station	2[E]				<0.23				
Sediment	Old Town Basin	2[E]				<0.39				
Sediment	Seaton Carew	2[E]				<0.30				
Sediment	Paddy's Hole	2[E]				<0.72				
Sediment	North Gare	2[E]				<0.29				
Sediment	Greatham Creek	2[E]				<0.69				
Sediment	Redcar Sands	2[E]				<0.34				
Sea coal	Old Town Basin	2[E]				<0.41				
Sea coal	Carr House Sands	2[E]				<0.47				
Seawater[b]	North Gare	2[E]				<0.56			<3.6	16

Table 4.5(a) continued

Material	Location[b]	No. of sampling observations[c]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{3}H	^{14}C	^{35}S	^{60}Co	^{137}Cs	Gross alpha	Gross beta
Terrestrial Samples									
Milk		2	<2.4	18	<0.19	<0.05	<0.05		
Milk	max			19	<0.20	<0.06			
Potatoes		1	<2.4	19	0.60	<0.06	<0.05		
Wheat		1	<8.9	84	0.60	<0.09	<0.08		
Grass	0.8km NW of site	2[E]	<13	39	<0.68	<0.26	<0.20		
Grass	0.6km NE of site	2[E]	<18	35	<0.75	<0.30	<0.25		
Freshwater	Boreholes, Dalton Piercy	2[E]	<3.6		<0.098	<0.22	<0.20	<0.068	0.13

* Not detected by the method used

a. Except for milk and water where units are Bq l^{-1} and for sediment and sea coal where dry concentrations apply

b. The concentration of ^{35}S was <0.090 Bq l^{-1}

c. Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima
If no 'max' value is given the mean value is the most appropriate for dose assessments

d. The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

E Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 4.5(b) Monitoring of radiation dose rates near Hartlepool nuclear power station, 2025

Location	Ground type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Fish Sands	Sand and stones	2	0.064
Old Town Basin	Sand and sea coal	2	0.069
Carr House	Sand	1	0.058
Carr House	Sand and sea coal	1	0.064
Seaton Carew	Sand	2	0.056
North Gare	Sand	2	0.067
Paddy's Hole	Mud and stones	1	0.17
Paddy's Hole	Sand and stones	1	0.16
Greatham Creek nature reserve	Mud and sand	2	0.083
Redcar Sands	Pebbles and sand	1	0.059
Redcar Sands	Sand	1	0.065

Table 4.6(a) Concentrations of radionuclides in food and the environment near Heysham nuclear power stations, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}							
			Organic							
			^{3}H	^{3}H	^{14}C	^{60}Co	^{90}Sr	^{99}Tc	^{137}Cs	^{238}Pu
Marine samples										
Flounder	Morecambe	2	<25	<25	28	<0.07	<0.028	<0.063	3.5	0.00036
Shrimps	Morecambe	2	<25	28	29	<0.05	<0.045	<0.15	2.5	0.0034
Cockles[b]	Middleton Sands	2	31	42	27	<0.06	0.14	1.0	1.5	0.26
Mussels[c]	Morecambe	2	<25	<25	30	<0.04	0.081	15	0.72	0.24
Wildfowl	Morecambe	1				<0.05			0.22	
Seaweed[d]	Half Moon Bay	2[E]				<0.28		43	2.1	
Sediment	Half Moon Bay	2[E]				<0.32			52	8.1
Sediment	Potts' Corner	2[E]				<0.26			13	
Sediment	Morecambe central beach	2[E]				<0.24			25	
Sediment	Red Nab Point	2[E]				<0.24			31	
Sediment	Shore adjacent to Northern Outfall	1[E]				<0.27			31	
Seawater[e]	Shore adjacent to Northern Outfall	2[E]		<100		<0.18			<0.18	

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{239}Pu+ ^{240}Pu	^{241}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Marine samples									
Flounder	Morecambe	2	0.0032		0.0064	*	*		
Shrimps	Morecambe	2	0.022		0.041	*	*		
Cockles[b]	Middleton Sands	2	1.8	5.5	5.0	*	*		60
Mussels[c]	Morecambe	2	1.5	5.3	3.0	*	*		37
Wildfowl	Morecambe	1			<0.02				
Seaweed[d]	Half Moon Bay	2[E]			2.0				
Sediment	Half Moon Bay	2[E]	49		91				
Sediment	Potts' Corner	2[E]			23				
Sediment	Morecambe central beach	2[E]			43				
Sediment	Red Nab Point	2[E]			62				
Sediment	Shore adjacent to Northern Outfall	1[E]			64				
Seawater[e]	Shore adjacent to Northern Outfall	2[E]			<0.42			<2.9	13

Table 4.6(a) continued

Material	Location or selection[f]	No. of sampling observations[g]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{3}H	^{14}C	^{35}S	^{60}Co	^{137}Cs	Gross alpha	Gross beta
Terrestrial samples									
Milk		2	<2.3	18	<0.15	<0.06	<0.06		
Milk	max			19			<0.08		
Beetroot		1	<2.1	18	<0.10	<0.08	<0.07		
Silage		1	<2.5	18	2.9	<0.06	<0.05		
Grass	Half Moon Bay, recreation ground	2[E]	<11	34	<1.7	<0.24	<0.22		
Grass	Overton	2[E]	<11	31	<1.6	<0.25	<0.22		
Freshwater	Damas Gill reservoir	2[E]	<3.7	<2.8	<0.24	<0.19	<0.17	<0.021	0.073
Freshwater	Lower Halton Weir	2[E]	<3.7	<2.4	<0.25	<0.19	<0.17	0.030	0.055

* Not detected by the method used

[a] Except for milk and water where units are Bq l^{-1}, and for sediment where dry concentrations apply

[b] The concentration of ^{210}Po was 20 Bq kg^{-1}

[c] The concentration of ^{210}Po was 38 Bq kg^{-1}

[d] The concentration of ^{35}S was <1.5 Bq kg^{-1}

[e] The concentration of ^{35}S was <0.66 Bq kg^{-1}

[f] Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima
If no 'max' value is given the mean value is the most appropriate for dose assessments

[g] The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

[E] Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 4.6(b) Monitoring of radiation dose rates near Heysham nuclear power stations, 2025

Location	Ground type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Sand Gate Marsh	Salt marsh	2	0.079
Arnside 2	Salt marsh	2	0.080
Morecambe central beach	Sand	2	0.072
Half Moon Bay	Rock and sand	1	0.076
Half Moon Bay	Sand	1	0.078
Pipeline	Sand and stones	1	0.069
Red Nab point	Sand	1	0.078
Red Nab point	Sand and stones	1	0.079
Middleton Sands	Sand	2	0.072
Sunderland Point	Mud and sand	1	0.090
Sunderland Point	Salt marsh and sand	1	0.080
Colloway Marsh	Salt marsh	2	0.094
Lancaster	Grass and herbage	1	0.074
Lancaster	Salt marsh	1	0.076
Aldcliffe Marsh	Salt marsh	2	0.082
Conder Green	Salt marsh	2	0.080

Table 4.7(a) Concentrations of radionuclides in food and the environment near Hinkley Point nuclear power stations, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1} Organic						
			^{3}H	^{3}H	^{14}C	^{60}Co	^{90}Sr	^{99}Tc	^{137}Cs
Marine samples									
Grey mullet	Stolford	1	<25	<25	35	<0.06			<0.10
Shrimps	Stolford	1	<25	<25	26	<0.06			<0.04
Limpets	Stolford	1	<25	<25	17	<0.08			<0.14
European oysters	Stolford	1	<25	<25	14	<0.06			<0.05
Seaweed	Pipeline	2[E]				<0.16		<0.28	<0.13
Seaweed	Hinkley Point A Outfall	2[E]				<0.18		<0.31	<0.14
Sediment	Pipeline	2[E]				<0.32	<0.70		4.2
Sediment	Stolford	2[E]				<0.40	<0.66		4.8
Sediment	Steart Flats	2[E]				<0.28	<0.61		4.9
Sediment	River Parrett	2[E]				<0.42	<0.65		11
Sediment	River Parrett Central 2	2[E]				<0.36	<1.0		7.0
Sediment	Weston-Super-Mare	2[E]				<0.22	<0.90		0.59
Sediment	Burnham-On-Sea	2[E]				<0.18	<0.89		0.54
Sediment	Kilve	2[E]				<0.28	<0.63		<0.38
Sediment	Helwell Bay	2[E]				<0.24	<0.68		0.89
Sediment	Blue Anchor Bay	2[E]				<0.30	<1.4		2.3
Seawater	Pipeline	1[E]		<3.9		<0.15	<0.024		<0.13

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Marine samples									
Grey mullet	Stolford	1			<0.23				
Shrimps	Stolford	1	0.00015	0.00078	0.0013	*	*		
Limpets	Stolford	1			<0.06				
European oysters	Stolford	1			<0.04				
Seaweed	Pipeline	2[E]			<0.17				
Seaweed	Hinkley Point A Outfall	2[E]			<0.20				
Sediment	Pipeline	2[E]			<0.61				
Sediment	Stolford	2[E]			<0.70				
Sediment	Steart Flats	2[E]			<0.83				
Sediment	River Parrett	2[E]			<0.66				
Sediment	River Parrett Central 2	2[E]			<0.63				
Sediment	Weston-Super-Mare	2[E]			<0.37				
Sediment	Burnham-On-Sea	2[E]			<0.37				
Sediment	Kilve	2[E]			<0.51				
Sediment	Helwell Bay	2[E]			<0.75				
Sediment	Blue Anchor Bay	2[E]			<0.58				
Seawater	Pipeline	1[E]			<0.48			<3.3	17

Table 4.7(a) continued

Material	Location or selection[b]	No. of sampling observations[c]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{3}H	^{14}C	^{35}S	^{60}Co	^{137}Cs	Gross alpha	Gross beta
Terrestrial Samples									
Milk		2	<2.3	19	<0.23	<0.06	<0.05		
Milk	max			20	<0.25		<0.06		
Blackberries		1	8.0	6.6	<0.10	<0.08	<0.06		
Honey		1	<6.6	75	0.30	<0.05	<0.05		
Barley		1	<8.5	79	0.50	<0.09	<0.07		
Grass	Gunter's Grove	2[E]	<16	49		<0.50	<0.41		
Grass	Wall Common	2[E]	<11	36		<0.66	<0.56		
Freshwater	Durleigh Reservoir	2[E]	<3.9			<0.20	<0.19	<0.027	0.13
Freshwater	Ashford Reservoir	2[E]	<3.7			<0.21	<0.18	<0.025	0.078

* Not detected by the method used

a. Except for milk and water where units are Bq l^{-1} and for sediment where dry concentrations apply

b. Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima. If no 'max' value is given the mean value is the most appropriate for dose assessments

c. The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

E Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 4.7(b) Monitoring of radiation dose rates near Hinkley Point nuclear power stations, 2025

Location	Ground type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Weston-super-Mare	Mud and sand	1	0.082
Weston-super-Mare	Sand	1	0.064
Burnham-on-Sea	Sand	2	0.063
River Parrett	Mud and salt marsh	1	0.079
River Parrett	Salt marsh	1	0.082
River Parrett Bridgwater Central 2	Mud	2	0.087
Steart Flats	Mud	2	0.078
Stolford	Mud	2	0.097
Pipeline	Mud	1	0.088
Pipeline	Rock and sand	1	0.092
Kilve	Rock and sand	1	0.10
Kilve	Sand	1	0.094
Helwell Bay	Mud and rock	1	0.10
Helwell Bay	Sand	1	0.093
Blue Anchor Bay	Mud and sand	1	0.075
Blue Anchor Bay	Sand	1	0.080

Table 4.8(a) Concentrations of radionuclides in food and the environment near Sizewell nuclear power stations, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			Organic ^{3}H	^{3}H	^{14}C	^{90}Sr	^{137}Cs	^{238}Pu
Marine samples								
Thornback ray	Sizewell	1	<25	<25			<0.14	
Lobsters	Sizewell	1	<25	<25			<0.07	
Oysters	Butley Creek	1	<25	<25	14		<0.03	0.00017
Sediment	Aldeburgh	2[E]				<0.83	<0.32	
Sediment	Southwold harbour	2[E]				<0.86	4.4	
Sediment	Minsmere river outfall	2[E]				<0.83	3.8	
Seawater	Sizewell beach	2[E]		<3.8	<2.7		<0.27	

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			^{239}Pu+ ^{240}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Marine samples								
Thornback ray	Sizewell	1		<0.05				
Lobsters	Sizewell	1		<0.04				
Oysters	Butley Creek	1	0.0014	0.00073	*	*		
Sediment	Aldeburgh	2[E]		<0.26				
Sediment	Southwold harbour	2[E]		<0.80				1400
Sediment	Minsmere river outfall	2[E]		<0.50				
Seawater	Sizewell beach	2[E]		<0.37			<3.2	17

Table 4.8(a) continued

Material	Location or selection[b]	No. of sampling observations[c]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			^{3}H	^{14}C	^{35}S	^{137}Cs	Gross alpha	Gross beta
Terrestrial Samples								
Milk		2	<2.3	21	<0.23	<0.05		
Milk	max			23	<0.28			
Potatoes		1	<2.2	23	0.70	<0.08		
Grass		1	7.8	19	1.9	<0.11		
Grass	Sizewell belts	1[E]	<11	27		<0.37		
Grass	Sizewell common	2[E]	<13	31		<0.26		
Freshwater	Minsmere nature reserve	2[E]	<3.8		<0.15	<0.24	<0.044	0.29
Freshwater	The Meare	2[E]	<3.7		<0.17	<0.24	<0.031	0.35
Freshwater	Leisure Park	2[E]	<3.7		<0.16	<0.26	<0.049	0.41
Freshwater	Farm Reservoir	2[E]	<3.8		<0.17	<0.26	<0.033	0.16

* Not Detected by the method used

b. Except for milk and water where units are Bq l^{-1}, and for sediment where dry concentrations apply

c. Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima. If no 'max' value is given the mean value is the most appropriate for dose assessments

d. The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

E Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 4.8(b) Monitoring of radiation dose rates near Sizewell nuclear power stations, 2025

Location	Ground type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Sizewell Beach	Sand and shingle	2	0.060
Dunwich	Shingle	2	0.057
Aldeburgh	Sand and shingle	1	0.054
Aldeburgh	Shingle	1	0.054
Southwold Harbour	Mud	2	0.070

Table 4.9(a) Concentrations of radionuclides in food and the environment near Chapelcross nuclear power station, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{3}H	^{14}C	^{60}Co	^{90}Sr	^{99}Tc	^{125}Sb	^{137}Cs
Marine samples									
Shrimps	Annan	2	5.0		<0.10	<0.10	<0.57	<0.17	<0.10
Salmon	Annan	1	<5.0		<0.10			<0.17	<0.10
Trout	Annan	1	5.0		<0.10			<0.21	<0.10
Mussels[b]	North Solway	2	5.0	17	<0.14	0.43	10	<0.35	1.1
Fucus vesiculosus	Pipeline	4			<0.10		21	<0.17	7.2
Fucus vesiculosus	Browhouses	2			<0.10		14	<0.17	4.7
Fucus vesiculosus	Dornoch Brow	2			<0.10		33	<0.22	7.9
Sediment	Priestside Bank	1			<0.10			<0.29	73
Sediment	Pipeline	4	<5.0		0.17			<0.49	100
Sediment	Dornoch Brow	1			<0.10			<0.30	49
Sediment	Powfoot Merse	1			<0.10			<0.26	12
Sediment	Redkirk	1			<0.10			<0.26	9.3
Sediment	Stormont	1			<0.10			<0.21	28
Seawater	Pipeline	2	<1.0		<0.10			<0.18	<0.10

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{154}Eu	^{155}Eu	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	Gross alpha	Gross beta
Marine samples									
Shrimps	Annan	2	<0.11	<0.19	0.0025	0.0041	0.011		
Salmon	Annan	1	<0.10	<0.19			<0.10		
Trout	Annan	1	<0.13	<0.24			<0.26		
Mussels[b]	North Solway	2	<0.17	<0.26	0.20	1.3	2.7		
Fucus vesiculosus	Pipeline	4	<0.12	<0.17	0.71	4.8	8.7	35	970
Fucus vesiculosus	Browhouses	2	<0.12	<0.14	0.47	2.8	6.1	8.0	350
Fucus vesiculosus	Dornoch Brow	2	<0.15	<0.21	0.69	5.5	9.1	13	600
Sediment	Priestside Bank	1	<0.21	<0.28	3.4	21	38		
Sediment	Pipeline	4	<0.26	<0.49	14	87	160		
Sediment	Dornoch Brow	1	<0.18	<0.34	6.9	43	85		
Sediment	Powfoot Merse	1	<0.20	<0.24	1.5	3.3	4.7		
Sediment	Redkirk	1	<0.25	<0.38	1.1	6.2	9.8		
Sediment	Stormont	1	<0.15	<0.23	2.9	24	49		
Seawater	Pipeline	2	<0.11	<0.14			<0.10		

Table 4.9(a) continued

Material	Location or selection[c]	No. of sampling observations[d]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}										
			^{3}H	^{14}C	^{35}S	^{60}Co	^{90}Sr	^{95}Nb	^{137}Cs	^{155}Eu	^{241}Am	Gross alpha	Gross beta
Terrestrial samples													
Milk		9	<5.0	<15	<0.50	<0.05	<0.10	<0.13	<0.05		<0.05		
Milk	max		<5.3	16				<0.16			<0.06		
Apples		2	<5.0	<15	<0.50	<0.05	<0.10	<0.08	<0.05		<0.11		
Apples	max							<0.10			<0.13		
Beef		1	<5.0	35	<0.50	<0.05	<0.10	<0.15	0.05		<0.13		
Beetroot		1	<5.0	<15	<0.50	<0.05	0.14	<0.07	<0.05		<0.13		
Cabbage		1	<5.0	<15	<0.50	<0.05	0.10	<0.08	<0.05		<0.05		
Carrots		1	<5.0	<15	<0.50	<0.05	0.16	<0.13	<0.05		<0.05		
Eggs		1	<5.0	21	<0.50	<0.05	<0.10	<0.06	<0.05		<0.12		
Honey		1	<5.0	56	<0.85	<0.16	<0.10	<0.17	0.19		<0.19		
Lamb		1	<5.0	34	<0.50	<0.05	<0.10	<0.10	0.13		<0.13		
Leeks		1	<5.0	<15	<0.50	<0.05	<0.10	<0.12	<0.05		<0.12		
Pork		1	<5.0	37	<0.50	<0.05	<0.10	<0.09	<0.05		<0.05		
Potatoes		1	<5.0	20	<0.50	<0.05	<0.10	<0.05	<0.05		<0.05		
Rosehips		1	<5.0	17	<0.50	<0.05	0.12	<0.09	0.33		<0.14		
Turnip		1	<5.0	<15	<0.50	<0.05	0.17	<0.11	<0.05		<0.14		
Grass		5	<9.8	<15	<0.60	<0.05	<0.21	<0.09	<0.05	<0.10	<0.09	0.63	400
Grass	max		18	16	<1.0		0.32	<0.16	<0.06	<0.14	<0.13	0.87	440
Soil		4	<6.4	31	<1.7	<0.09	1.2	<0.22	8.3	<0.35	<0.44	160	1600
Soil	max		11	77	<3.0	<0.11	1.7	<0.32	10	<0.38	<0.55	180	1800
Freshwater	Winterhope	1	<1.0			<0.01		<0.01	<0.01		<0.01	<0.010	0.056
Freshwater	Castle Loch	1	<1.0			<0.01		<0.01	<0.01		<0.01	0.011	0.15
Freshwater	Black Esk	1	<1.0			<0.01		<0.01	<0.01		<0.01	0.013	0.016
Freshwater	Gullielands Burn	1	9.2			<0.01		<0.01	<0.01		<0.01	0.030	0.24

[a] Except for milk and water where units are Bq l^{-1}, and for sediment and soil where dry concentrations apply
[b] The concentration of ^{241}Pu was 4.3 Bq kg^{-1}
[c] Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima. If no 'max' value is given the mean value is the most appropriate for dose assessments
[d] The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

Table 4.9(b) Monitoring of radiation dose rates near Chapelcross nuclear power station, 2025

Location	Material or ground type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Glencaple Harbour	Sediment	2	0.063
Priestside Bank	Sediment	2	0.062
Powfoot Merse	Salt marsh	1	0.067
Powfoot Merse	Sediment	1	0.061
Gullielands	Grass	1	0.053
Seafield	Sediment	2	0.067
Woodhead	Grass	1	0.059
East Bretton	Grass	1	0.055
Pipeline	Salt marsh	2	0.066
Pipeline	Sediment	2	0.080
Dumbretton	Grass	1	0.060
Battlehill	Sediment	2	0.069
Dornoch Brow	Sediment	2	0.074
Dornoch Brow Merse	Salt marsh	2	0.068
Browhouses	Sediment	2	0.075
Redkirk	Sediment	2	0.060
Stormont	Sediment	2	0.067

Location	Material or ground type	No. of sampling observations	µSv h^{-1}
Mean beta dose rates			
Pipeline	Sediment	3	<1.0
500m east of pipeline	Sediment	1	<1.0
500m west of pipeline	Sediment	1	<1.0

Table 4.9(c) Radioactivity in air near Chapelcross nuclear power station, 2025

Location	No. of sampling observations	Mean radioactivity concentration, mBq m^{-3}			
		^{131}I	^{137}Cs	Gross alpha	Gross beta
Mean beta dose rates					
Eastriggs	11	<0.010	<0.010	0.033	<0.37
Kirtlebridge	12	<0.010	<0.010	0.033	<0.35
Brydekirk	12	<0.011	<0.010	<0.038	<0.40

Table 4.10(a) Concentrations of radionuclides in food and the environment near Hunterston nuclear power stations, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}				
			^{3}H	^{35}S	^{60}Co	^{99}Tc	^{110m}Ag
Marine samples							
Cod	Millport	2			<0.10		<0.12
Hake	Millport	2			<0.10		<0.14
Crabs	Millport	2			<0.10	<0.28	<0.10
Lobsters	Largs	1			<0.10	7.3	<0.11
Squat lobsters	Largs	2			<0.10	<0.40	<0.10
Scallops	Largs	2			<0.10		<0.10
Oysters	Hunterston	1			<0.10		<0.10
Winkles	Hunterston	2			<0.12		<0.16
Fucus vesiculosus	N of pipeline	2			<0.10		<0.11
Fucus vesiculosus	S of pipeline	2			<0.10		<0.10
Sediment	Largs	1			<0.10		<0.14
Sediment	Millport	1			<0.10		<0.12
Sediment	Gull's Walk	1			<0.10		<0.18
Sediment	Ardneil Bay	1			<0.10		<0.14
Sediment	Fairlie	1			<0.10		<0.14
Sediment	Pipeline	1			<0.10		<0.15
Sediment	Ardrossan North Bay	1			<0.10		<0.16
Sediment	Ardrossan South Bay	1			<0.10		<0.12
Seawater	Pipeline	2	<1.0	<0.50	<0.10		<0.10

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}				
			^{137}Cs	^{155}Eu	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am
Marine samples							
Cod	Millport	2	0.60	<0.21			<0.14
Hake	Millport	2	0.71	<0.23			<0.23
Crabs	Millport	2	<0.11	<0.18	0.010	0.048	0.039
Lobsters	Largs	1	<0.10	<0.23			<0.10
Squat lobsters	Largs	2	<0.16	<0.14	0.0048	0.024	0.026
Scallops	Largs	2	<0.10	<0.21	0.014	0.052	0.044
Oysters	Hunterston	1	<0.10	<0.10			<0.11
Winkles	Hunterston	2	<0.12	<0.22	0.012	0.071	0.079
Fucus vesiculosus	N of pipeline	2	0.73	<0.21			<0.27
Fucus vesiculosus	S of pipeline	2	0.16	<0.13			<0.16
Sediment	Largs	1	1.8	<0.41			<0.44
Sediment	Millport	1	1.6	<0.35			0.26
Sediment	Gull's Walk	1	7.4	<0.43			1.2
Sediment	Ardneil Bay	1	1.6	<0.27			<0.32
Sediment	Fairlie	1	1.2	<0.40			0.30
Sediment	Pipeline	1	1.4	<0.22			0.25
Sediment	Ardrossan North Bay	1	2.3	<0.41			0.39
Sediment	Ardrossan South Bay	1	2.1	<0.34			0.68
Seawater	Pipeline	2	<0.10	<0.17			<0.10

Table 4.10(a) continued

Material	Location or selection[b]	No. of sampling observations[c]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			^{3}H	^{14}C	^{35}S	^{60}Co	^{90}Sr	^{95}Nb
Terrestrial Samples								
Milk		2	<5.0	<15	<0.50	<0.05	<0.10	<0.15
Milk	max							
Apples		1	<5.0	<15	<0.50	<0.05	<0.10	<0.08
Beef		1	<5.0	18	<0.50	<0.05	<0.10	<0.08
Cabbage		1	<5.0	<15	<0.50	<0.05	<0.10	<0.08
Carrots		1	<5.0	<15	<0.50	<0.05	0.17	<0.09
Cauliflower		1	<5.0	<15	<0.50	<0.10	<0.10	<0.15
Leeks		1	<5.0	<15	<0.50	<0.05	<0.10	<0.15
Onions		1	<5.0	<15	<0.50	<0.05	<0.10	<0.07
Pheasant		1	<5.0	25	<0.50	<0.09	<0.10	<0.33
Potatoes		1	<5.0	<15	<0.50	<0.05	<0.10	<0.08
Rosehips		1	<5.0	20	<0.50	<0.12	0.64	<0.14
Turnips		1	<5.0	<15	0.53	<0.05	0.12	<0.12
Venison		2	<5.0	<16	<0.71	<0.05	<0.10	<0.09
Venison	max				0.92			<0.12
Wild Blackberries		1	<5.0	<15	<0.50	<0.05	0.15	<0.06
Grass		6	<5.0	<16	<0.50	<0.05	<0.18	<0.15
Grass	max			<17		<0.06	0.24	<0.38
Soil		3	<5.0	15	<2.9	<0.08	0.67	<0.32
Soil	max		5.0		5.9	<0.11	1.2	<0.74
Freshwater	Busbie Muir	1	<1.0			<0.01		<0.01
Freshwater	Loch Ascog	1	<1.0			<0.01		<0.01
Freshwater	Camphill	1	<1.0			<0.01		<0.01
Freshwater	Knockendon Reservoir	1	<1.0			<0.01		<0.01
Freshwater	Outerwards	1	<1.0			<0.01		<0.01

Table 4.10(a) continued

Material	Location or selection[b]	No. of sampling observations[c]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			^{110m}Ag	^{137}Cs	^{155}Eu	^{241}Am	Gross alpha	Gross beta
Terrestrial Samples								
Milk		2	<0.05	<0.05		<0.05		
Milk	max		<0.05	<0.05		<0.05		
Apples		1	<0.05	<0.05		<0.14		
Beef		1	<0.05	0.14		<0.14		
Cabbage		1	<0.05	<0.05		<0.14		
Carrots		1	<0.05	<0.05		<0.16		
Cauliflower		1	<0.10	<0.07		<0.11		
Leeks		1	<0.06	<0.05		<0.09		
Onions		1	<0.05	<0.05		<0.11		
Pheasant		1	<0.15	54		<0.14		
Potatoes		1	<0.05	<0.05		<0.10		
Rosehips		1	<0.12	<0.08		<0.14		
Turnips		1	<0.05	<0.05		<0.11		
Venison		2	<0.07	6.3		<0.09		
Venison	max		<0.08	12		<0.13		
Wild Blackberries		1	<0.05	<0.05		<0.15		
Grass		6	<0.06	<0.08	<0.11	<0.10	<0.51	240
Grass	max		<0.08	0.14	<0.13	<0.13	0.77	290
Soil		3	<0.14	9.0	<0.33	<0.32	150	1500
Soil	max		<0.20	9.6	<0.42	<0.52	170	2100
Freshwater	Busbie Muir	1	<0.01	<0.01		<0.01	<0.010	0.083
Freshwater	Loch Ascog	1	<0.01	<0.01		<0.01	<0.010	0.086
Freshwater	Camphill	1	<0.01	<0.01		<0.01	<0.010	0.039
Freshwater	Knockendon Reservoir	1	<0.01	<0.01		<0.01	<0.010	0.035
Freshwater	Outerwards	1	<0.01	<0.01		<0.01	<0.010	0.023

a. Except for milk and water where units are Bq l^{-1}, and for sediment and soil where dry concentrations apply

b. Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima
If no 'max' value is given the mean value is the most appropriate for dose assessments

c. The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

Table 4.10(b) Monitoring of radiation dose rates near Hunterston nuclear power stations, 2025

Location	Material or ground type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Meigle Bay	Sediment	2	<0.050
Largs Bay	Rocks	2	0.060
Millport	Sediment	2	<0.047
Kilchattan Bay	Sediment	2	<0.047
Gull's Walk	Sediment	2	0.052
Hunterston	Sediment	2	<0.047
0.5 km north of pipeline	Sediment	2	<0.049
0.5 km south of pipeline	Sediment	2	0.060
Ardneil Bay	Sediment	2	<0.049
Ardrossan North Bay	Sediment	2	<0.049
Ardrossan South Bay	Sediment	2	<0.049
Milstonford	Grass	1	0.049
Biglies	Grass	1	0.072
Carlung House	Grass	1	0.055
Mean beta dose rates			**µSv h^{-1}**
Millport	Sediment	1	<1.0
0.5km north of pipeline	Sediment	1	<1.0
0.5 km south of pipeline	Rocks	1	<1.5

Table 4.10(c) Radioactivity in air near Hunterston nuclear power stations, 2025

Location	No. of sampling observations	Mean radioactivity concentration, mBq m^{-3}			
		^{131}I	^{137}Cs	Gross alpha	Gross beta
Fairlie	12	<0.010	<0.010	<0.019	<0.25
West Kilbride	12	<0.010	<0.010	<0.022	<0.29
Low Ballees	12	<0.010	<0.010	0.032	<0.32

Table 4.11(a). Concentrations of radionuclides in food and the environment near Torness nuclear power station, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}							
			^{14}C	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{99}Tc	^{110m}Ag	^{125}Sb
Marine samples										
Cod	White Sands	2		<0.10	<0.33	<0.11	<0.10		<0.10	<0.18
Mackerel	Pipeline	2		<0.10	<0.43	<0.12	<0.10		<0.10	<0.15
Crabs	Torness	1	19	<0.10	<0.30	<0.10	<0.10	<0.19	<0.10	<0.14
Lobsters	Torness	1	20	<0.10	<0.35	<0.10	<0.10	1.1	<0.10	<0.16
Nephrops	Dunbar	2		<0.10	<0.59	<0.17	<0.10		<0.11	<0.22
Winkles	Pipeline	2		<0.27	<1.0	<0.28	0.39		2.7	<0.54
Fucus vesiculosus	Pipeline	2		3.1	<0.52	<0.11	0.96		0.51	<0.19
Fucus vesiculosus	Thorntonloch	2		0.62	<0.45	<0.12	0.22	4.4	<0.10	<0.17
Fucus vesiculosus	White Sands	2		<0.10	<0.39	<0.12	<0.10		<0.10	<0.13
Fucus vesiculosus	Coldingham Bay	2		<0.10	<0.28	<0.10	<0.10		<0.10	<0.16
Fucus vesiculosus	Pease Bay	2		<0.10	<0.25	<0.10	<0.10		<0.10	<0.13
Sediment	Dunbar	1		<0.10	<0.46	<0.15	<0.10		<0.14	<0.25
Sediment	Barns Ness	1		<0.10	<0.16	<0.10	<0.10		<0.10	<0.16
Sediment	Thorntonloch	1		<0.10	<0.25	<0.10	<0.10		<0.12	<0.23
Sediment	Heckies Hole	1		<0.10	<0.34	<0.12	<0.10		<0.13	<0.27
Sediment	Belhaven Bay	1		<0.10	<0.32	<0.12	<0.10		<0.12	<0.26
Sediment	Coldingham Bay	1		<0.10	<0.24	<0.10	<0.10		<0.13	<0.27
Sediment	Pease Bay	1		<0.10	<0.23	<0.10	<0.10		<0.14	<0.26
Seawater[b]	Pipeline	2		<0.10	<0.14	<0.10	<0.10		<0.10	<0.13

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{137}Cs	^{155}Eu	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	Gross alpha	Gross beta
Marine samples									
Cod	White Sands	2	0.17	<0.20			<0.10		
Mackerel	Pipeline	2	<0.10	<0.18			<0.19		
Crabs	Torness	1	<0.10	<0.17			<0.20		
Lobsters	Torness	1	<0.10	<0.13			<0.10		
Nephrops	Dunbar	2	<0.10	<0.23	0.00038	0.0055	0.0070		
Winkles	Pipeline	2	0.16	<0.38			<0.18	1.6	200
Fucus vesiculosus	Pipeline	2	0.13	<0.22			<0.19		
Fucus vesiculosus	Thorntonloch	2	<0.10	<0.23			<0.24		
Fucus vesiculosus	White Sands	2	<0.11	<0.19			<0.15		
Fucus vesiculosus	Coldingham Bay	2	<0.10	<0.21			<0.17		
Fucus vesiculosus	Pease Bay	2	<0.10	<0.17			<0.18		
Sediment	Dunbar	1	0.98	<0.35			<0.47		
Sediment	Barns Ness	1	0.79	<0.17			<0.26		
Sediment	Thorntonloch	1	0.61	<0.41			0.30		
Sediment	Heckies Hole	1	0.58	<0.40			<0.47		
Sediment	Belhaven Bay	1	0.22	<0.28			<0.38		
Sediment	Coldingham Bay	1	0.59	<0.42			<0.10		
Sediment	Pease Bay	1	1.0	<0.41			<0.46		
Seawater[b]	Pipeline	2	<0.10	<0.12			<0.10		

Table 4.11(a) continued

Material	Location or selection[c]	No. of sampling observations[d]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}										
			^{3}H	^{14}C	^{35}S	^{60}Co	^{90}Sr	^{110m}Ag	^{137}Cs	^{155}Eu	^{241}Am	Gross alpha	Gross beta
Terrestrial Samples													
Milk		2	<5.0	<15	<0.50	<0.05	<0.10	<0.05	<0.05		<0.05		
Milk	max			<16									
Apples		1	<5.0	<15	<0.50	<0.05	<0.10	<0.05	<0.05		<0.14		
Beetroot		1	<5.0	19	<0.50	<0.05	0.28	<0.05	<0.05		<0.12		
Cabbage		1	<5.0	<15	<0.50	<0.05	<0.10	<0.05	<0.05		<0.09		
Goose		1	<5.0	17	0.56	<0.05	<0.10	<0.05	<0.05		<0.10		
Honey		1	<5.0	67	<0.78	<0.05	<0.10	<0.06	0.64		<0.15		
Lamb		1	<5.0	<15	<0.50	<0.05	<0.10	<0.05	0.06		<0.10		
Mushrooms		1	<5.0	<15	<0.50	<0.05	<0.10	<0.05	<0.05		<0.12		
Partridge		1	<5.0	20	<0.52	<0.05	<0.10	<0.05	<0.05		<0.13		
Pheasant		1	<5.0	18	<0.50	<0.05	0.13	<0.05	<0.05		<0.08		
Plums		1	<5.0	<15	<0.50	<0.05	<0.10	<0.05	<0.05		<0.06		
Pork		1	<5.0	20	<0.50	<0.05	<0.10	<0.05	<0.05		<0.13		
Red Gooseberries		1	<5.0	<15	<0.50	<0.05	<0.10	<0.05	<0.05		<0.06		
Rhubarb		1	<5.0	<15	<0.50	<0.05	<0.10	<0.05	<0.05		<0.05		
Rosehips		1	<5.0	22	<0.50	<0.05	0.29	<0.05	<0.05		<0.14		
Grass		6	<5.0	<25	<0.63	<0.06	<0.26	<0.06	<0.05	<0.16	<0.15	1.0	400
Grass	max			31	0.97		0.60	<0.07	<0.08	<0.18	<0.19	1.6	560
Soil		3	<5.0	15	<2.3	<0.10	0.47	<0.17	4.3	<0.38	<0.34	190	1500
Soil	max		5.0		<2.9	<0.11	0.56	<0.20	5.9	<0.41	<0.55	230	
Freshwater	Hopes Reservoir	1	<1.0			<0.01		<0.01	<0.01		<0.01	<0.010	0.030
Freshwater	Thorter's Reservoir	1	<1.0			<0.01		<0.01	<0.01			<0.010	0.070
Freshwater	Whiteadder	1	<1.0			<0.01		<0.01	<0.01		<0.01	<0.010	0.035
Freshwater	Thornton Loch Burn	1	<1.0			<0.01		<0.01	<0.01		<0.01	0.029	0.16

[a] Except for milk and water where units are Bq l^{-1}, and for sediment and soil where dry concentrations apply
[b] The concentrations of ^{3}H and ^{35}S were <3.2Bq l^{-1} and <0.50 Bq l^{-1} respectively
[c] Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima. If no 'max' value is given the mean value is the most appropriate for dose assessments
[d] The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

Table 4.11(b) Monitoring of radiation dose rates near Torness nuclear power station, 2025

Location	Ground type	No. of sampling observations	μGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Heckies Hole	Sediment	2	0.070
Dunbar Inner Harbour	Sediment	2	0.091
Belhaven Bay Saltmarsh	Sediment	2	0.052
Barns Ness	Sediment	2	0.049
Skateraw	Sediment	2	<0.047
Thorntonloch	Grass	1	0.068
Thorntonloch beach	Sediment	2	<0.047
Ferneylea	Grass	1	0.063
Pease Bay	Sediment	2	<0.05
St Abbs Head	Rock	1	0.075
St Abbs Head	Sediment	1	0.089
Coldingham Bay	Sediment	2	<0.047
West Meikle Pinkerton	Grass	1	0.063
Mean beta dose rates on fishing gear			**μSv h^{-1}**
Torness	Lobster Pots	1	<1.0
Torness	Pots	1	<2.0

Table 4.11(c) Radioactivity in air near Torness nuclear power station, 2025

Location	No. of sampling observations	Mean radioactivity concentration, mBq m^{-3}				
		^{60}Co	^{131}I	^{137}Cs	Gross alpha	Gross beta
Innerwick	12	<0.010	<0.010	<0.010	0.053	0.38
Cockburnspath	12	<0.010	<0.010	<0.010	0.037	<0.32
Dunbar	12	<0.010	<0.010	<0.010	0.040	<0.34

Table 4.12(a) Concentrations of radionuclides in food and the environment near Trawsfynydd nuclear power station, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			^{3}H	^{14}C	^{90}Sr	^{137}Cs	^{238}Pu	^{239}Pu+ ^{240}Pu
Freshwater samples								
Rainbow trout	Trawsfynydd Lake	2		37	0.017	1.3	<0.000029	0.0000029
Sediment	Lake shore near café	2[E]			<0.71	250	<0.13	0.56
Sediment	1.5km SE of power station	1[E]			<0.72	34	<0.078	<0.27
Sediment	Pipeline	1[E]			<1.0	330	0.38	2.9
Sediment	SE of footbridge	1[E]			<1.1	56	<0.081	<0.28
Sediment	Cae Adda	2[E]			<0.91	24	<0.15	<0.52
Freshwater	Pipeline	2[E]	<3.6			<0.17		
Freshwater	Gwylan Stream	2[E]	<3.5			<0.21		
Freshwater	Afon Prysor	2[E]	<3.5			<0.19		
Freshwater	1.5km SE of power station	2[E]	<3.5			<0.06		
Freshwater	Afon Tafarn-helyg	2[E]	<3.7			<0.18		

Material	Selection[b]	No. of sampling observations[c]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}							
			^{3}H	^{14}C	^{90}Sr	^{137}Cs	Total Cs	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am
Terrestrial samples										
Milk		2	<2.4	17	0.035	<0.06	<0.057			<0.15
Milk	max		<2.5	18	0.039		<0.060			
Apples		1	5.5	9.8		<0.07		<0.000082	0.000026	0.00012
Silage		1	<2.4	18		0.95		0.000057	0.0015	0.00071

* Not detected by the method used

[a] Except for milk and water where units are Bq l^{-1}, and for sediment where dry concentrations apply

[b] Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima. If no 'max' value is given the mean value is the most appropriate for dose assessments

[c] The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

[E] Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 4.12(b) Monitoring of radiation dose rates near Trawsfynydd nuclear power station, 2025

Table 4.13(a) Concentrations of radionuclides in food and the environment near Wylfa nuclear power station, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
				Organic					
			^{3}H	^{3}H	^{14}C	^{99}Tc	^{137}Cs	^{238}Pu	^{239}Pu+ ^{240}Pu
Marine samples									
Flounder	Pipeline	1	<25	<25	17		0.42		
Crabs	Pipeline	1	<25	<25	36		0.23		
Lobsters	Pipeline	1	<25	<25	32	14	0.29	0.0027	0.018
Winkles	Cemaes Bay	1	<25	<25	23	2.2	0.15	0.017	0.12
Seaweed	Cemaes Bay	2[E]				7.9	<0.19		
Sediment	Cemaes Bay	2[E]					2.3		
Sediment	Cemlyn Bay West	2[E]					1.9		
Seawater	Cemaes Bay	2[E]		<3.4			<0.20		

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			^{241}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Marine samples								
Flounder	Pipeline	1		<0.17				
Crabs	Pipeline	1		<0.23				
Lobsters	Pipeline	1	<0.19	0.14	*	*		110
Winkles	Cemaes Bay	1	<0.26	0.19	*	*		48
Seaweed	Cemaes Bay	2[E]		<0.20				
Sediment	Cemaes Bay	2[E]		0.95				
Sediment	Cemlyn Bay West	2[E]		<0.50				
Seawater	Cemaes Bay	2[E]		<0.42			<1.8	10

Table 4.13(a) Continued

Material	Location or selection[b]	No. of sampling observations[c]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}				
			^{3}H	^{14}C	^{35}S	^{137}Cs	^{241}Am
Terrestrial samples							
Milk		2	<2.3	16	<0.15	<0.06	<0.12
Milk	max		<2.4	17		<0.07	
Potatoes		1	<2.2	17	<0.10	<0.05	<0.28
Grass		1	<2.4	22	0.40	<0.15	<0.24
Grass	Foel Fawr	2[E]	<16	19		<0.18	
Grass	Wylfa Head Nature Reserve	2[E]	<15	19		<0.18	

* Not detected by the method used
[a] Except for milk and water where units are Bq l^{-1}, and sediment where dry concentrations apply
[b] Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima
If no 'max' value is given the mean value is the most appropriate for dose assessments
[c] The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime
[E] Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 4.13(b) Monitoring of radiation dose rates near Wylfa nuclear power station, 2025

Location	Ground type	No. of sampling observations	μGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Cemaes Bay	Pebbles and sand	1	0.066
Cemaes Bay	Sand	1	0.064
Cemlyn Bay West	Pebbles and sand	1	0.067
Cemlyn Bay West	Sand and shingle	1	0.067
Porth Yr Ogof	Sand and stones	1	0.067
Porth Yr Ogof	Shingle	1	0.068

5 Research and radiochemical production establishments

Highlights

- For research establishments assessed in 2025 the 'total dose' for the representative person was 1% (or less) of the annual dose limit
- For the radiochemical production establishment assessed in 2025 the 'total dose' for the representative person was 8% of the annual dose limit

Dounreay, Highland

- 'total dose' for the representative person was 0.008mSv and decreased in 2025 compared to 2024

Grove Centre, Amersham, Buckinghamshire

- 'total dose' for the representative person was 0.083mSv and decreased in 2025 compared to 2024

Harwell, Oxfordshire

- 'total dose' for the representative person was 0.007mSv and decreased in 2025 compared to 2024

Winfrith, Dorset

- 'total dose' for the representative person was less than 0.005mSv and decreased in 2025 compared to 2024

This section considers the results of monitoring near research establishments (Dounreay, Harwell, Winfrith and the former fusion energy research site at Culham) and 1 radiochemical production establishment (Grove Centre, Amersham).

In 2025, gaseous and liquid discharges were below regulated limits for each of the establishments (see Appendix 1, Table A1.1 and Table A1.2). Solid waste transfers in 2025 from NRS Dounreay are given in Appendix 1 (Table A1.4).

5.1 Dounreay, Highland

The Dounreay site was opened in 1955 to develop research reactors. Three reactors were built on the site: the Prototype Fast Reactor, the Dounreay Fast Reactor, and the Dounreay Materials Test Reactor. All 3 reactors are now shut down and undergoing decommissioning.

The existing radioactive waste disposal authorisations were transferred to Dounreay Site Restoration Limited (DSRL), a new site licence company who took over the site management contract. DSRL became wholly owned by the NDA on 1 April 2021.

In 2025, radioactive waste discharges from the Dounreay site were made by NRS under an EASR radioactive substances authorisation granted by SEPA.

The quantities of both gaseous and liquid discharges were generally similar to those released in recent years (Appendix 1, Table A1.1 and Table A1.2). Solid waste transfers from Dounreay in 2025 are also given in Appendix 1 (Table A1.4).

The most recent habits survey was conducted in 2025. This habits survey did not identify any occupancy in the area of Oigin's Geo (see Figure 5.2) that would form an external exposure pathway. The most recent habits survey is available on SEPA's website: https://beta.sepa.scot/topics/radioactive-substances/guidance-and-supporting-documents/radiological-habits-surveys/#anchor-dounreay or can be requested by emailing RSEnquiries@sepa.org.uk.

In 2013, SEPA granted an authorisation to DSRL for the Low-Level Radioactive Waste Disposal Facility (LLWF) that is located adjacent to the main Dounreay site. The first phase of the disposal site comprised the construction and operation of 2 concrete vaults that began accepting low level radioactive waste and demolition low level waste from the Dounreay site in 2015. The safety case and planning permission allow for the construction of an additional 24 vaults at the site. Further phases of construction will be dependent on the progress with the decommissioning of the Dounreay site.

There are no authorised routes for liquid or gaseous discharges from the Dounreay LLWF. The facility is designed to contain the radioactive waste over a long time, allowing radioactive decay to occur while the waste remains isolated from the environment.

In June 2024, NRS notified SEPA of possible loss of radioactively contaminated water to the ground from the Carbon Bed Filter structure located within the Fuel Cycle Area. NRS's investigation concluded that there was a small leak from the Carbon Bed Filter. NRS has subsequently removed water from the structure and installed level monitoring instrumentation. In July 2025, SEPA issued a regulatory notice requiring NRS to:

- undertake a review of existing groundwater monitoring arrangements
- assess compliance with the requirement to dispose of radioactive waste via an authorised route
- undertake characterisation to establish the extent of the radioactive contamination and develop a programme for undertaking the appropriate remediation

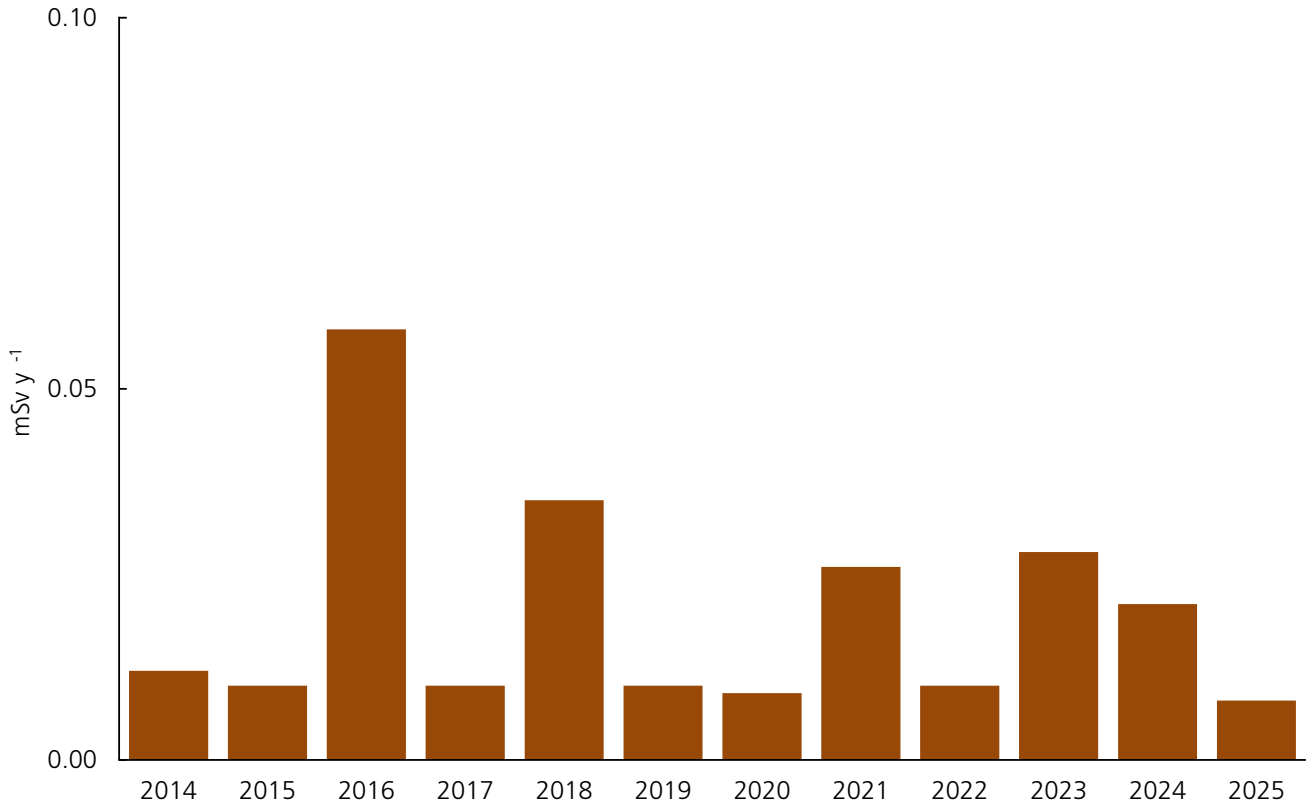
In August 2024, NRS notified SEPA that very low levels of radioactivity had been identified in samples taken from a sump collecting water ingress within a non-radioactive facility on the Dounreay site. The arrangements in place at the time involved the water being pumped from the sump and discharged to the marine environment via the non-active drainage system, which is not an authorised route for the disposal of liquid radioactive waste. Dounreay subsequently rerouted the discharge from the sump to the Low Active Drain shortly thereafter. SEPA's investigation concluded that NRS had contravened conditions of its EASR radioactive substances authorisation. In October 2025, SEPA issued a Regulatory Notice requiring NRS to undertake a review of the management arrangements in place for the disposal of aqueous liquid waste.

5.1.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was 0.008mSv in 2025 (Table 5.1), or less than 1% of the dose limit to members of the public. This is a decrease from 0.021mSv in 2024. The representative person was an adult living near the site and represents a change from 2024 (adult consuming game meat at high rates in 2024). The decrease in 'total dose' was mostly due to the change of habits (no game meat consumption) in 2025.

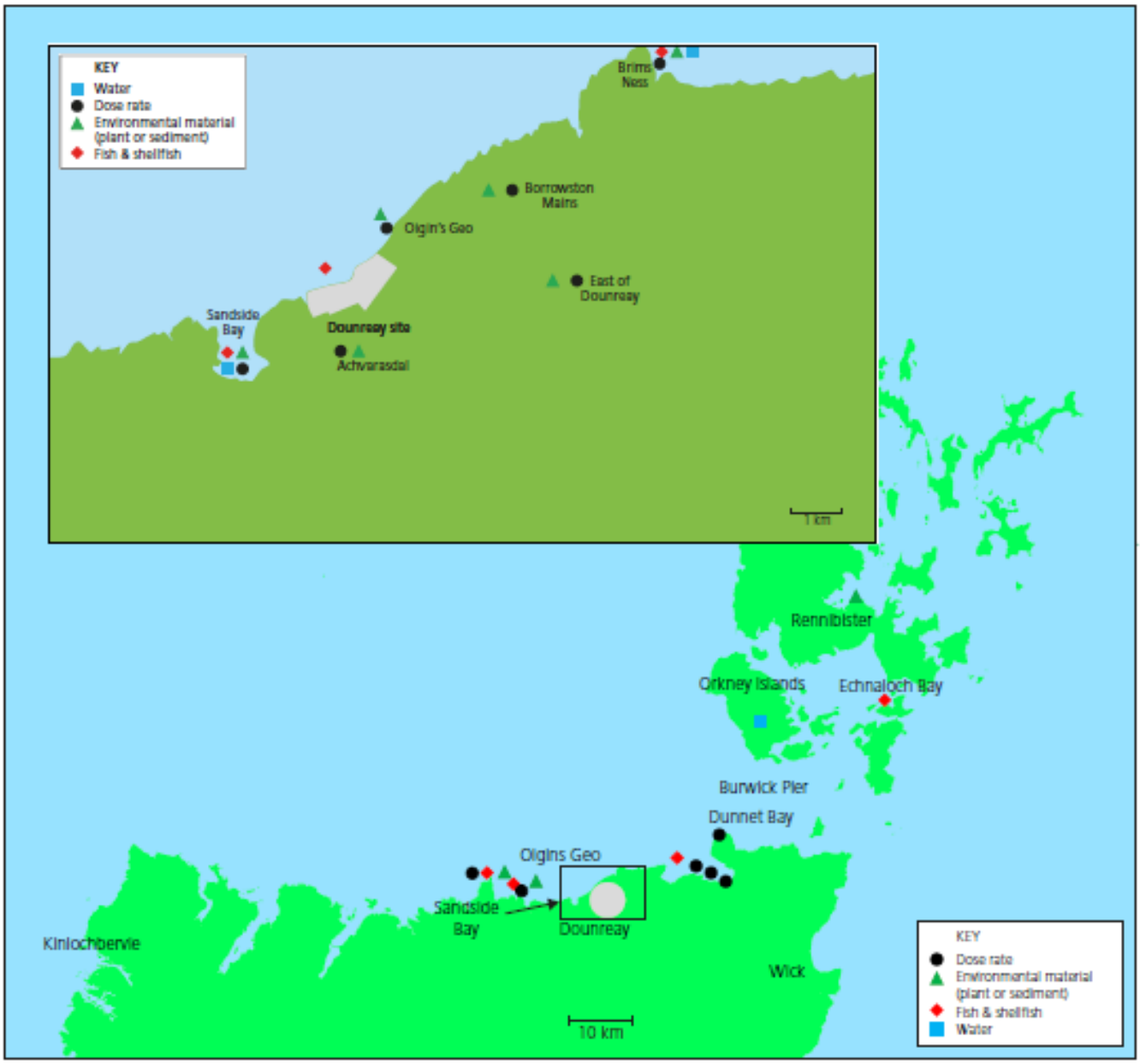
The trend in the annual 'total dose' over the period 2014 to 2025 is given in Figure 5.1. Between 2014 to 2015, the change in annual 'total dose' was mostly due to the contribution of goats' milk not being included in the assessment (which had been assessed prior to 2013), as milk samples have not been available in more recent years. In 2016, 2018, 2021, 2023 and 2024, the most significant contributor that influenced the dose was the concentration of caesium-137 found in venison (game).

Figure 5.1 'Total dose', in mSv y^{-1}, at Dounreay, 2014 to 2025.



The annual dose to a consumer of terrestrial foodstuffs was 0.013mSv in 2025, or approximately 1% of the dose limit for members of the public of 1mSv, and down from 0.015mSv in 2024. As in previous years, adults were identified as the most exposed age group with reason for the decrease in dose was the reduction of caesium-137 in venison (24Bq kg^{-1} in 2024 to 18Bq kg^{-1} in 2025). The annual dose to a consumer of fish and shellfish, including external exposure from occupancy over local beaches, was lower than the 'total dose' in 2025 (0.008mSv) and was unchanged from 2024. As in recent years, the dose (external pathways only) to members of the public visiting Oigin's Geo, based on previously collected habits data [169] and 2019 monitoring data, was less than 0.005mSv in 2025. The sample species, type and locations are listed in the respective site tables.

Figure 5.2 Monitoring locations at Dounreay, 2025 (not including farms or air sampling locations). The rectangle around the Dounreay site is presented inset.



5.1.2 Gaseous discharges and terrestrial monitoring

In 2025, NRS was authorised by SEPA to discharge radioactive gaseous wastes to the local environment via stacks to the atmosphere. The discharges also include a minor contribution from the adjoining reactor site (Vulcan Naval Reactor Test Establishment (NRTE)), which is operated by the MOD's Submarine Delivery Agency. Monitoring conducted in 2025 included the sampling of air, freshwater, grass, soil and locally grown terrestrial foods including meat and vegetables as well as wild foods. As there are no dairy cattle herds in the Dounreay area, no milk samples were collected from cattle. As in recent years, goats' milk samples were not sampled, as no milk sample was available in 2025.

The sampling locations for the terrestrial (and marine) monitoring programmes shown in Figure 5.2. Figure 5.3 to Figure 5.7 provides time trends of radionuclide discharges (gaseous and liquid), which are generally decreasing over the period 2014 to 2025. The sample species, type and locations are listed in the respective site tables. The results for terrestrial samples and radioactivity in air are given in Table 5.2(a) and Table 5.2(c).

Figure 5.3 Discharges of gaseous iodine-129, in MBq y^{-1}, 2014 to 2025.

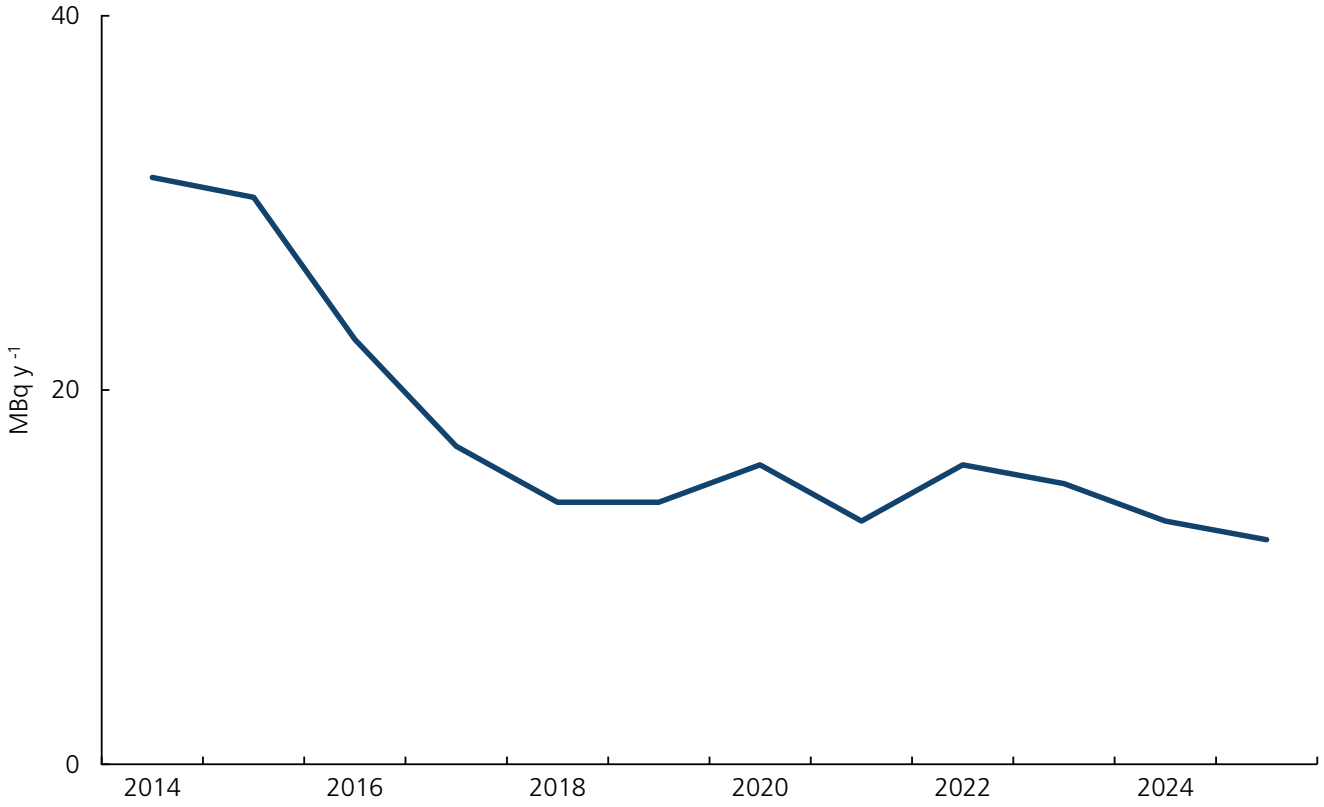


Figure 5.4 Discharges of gaseous alpha, in MBq y^{-1}, 2014 to 2025.

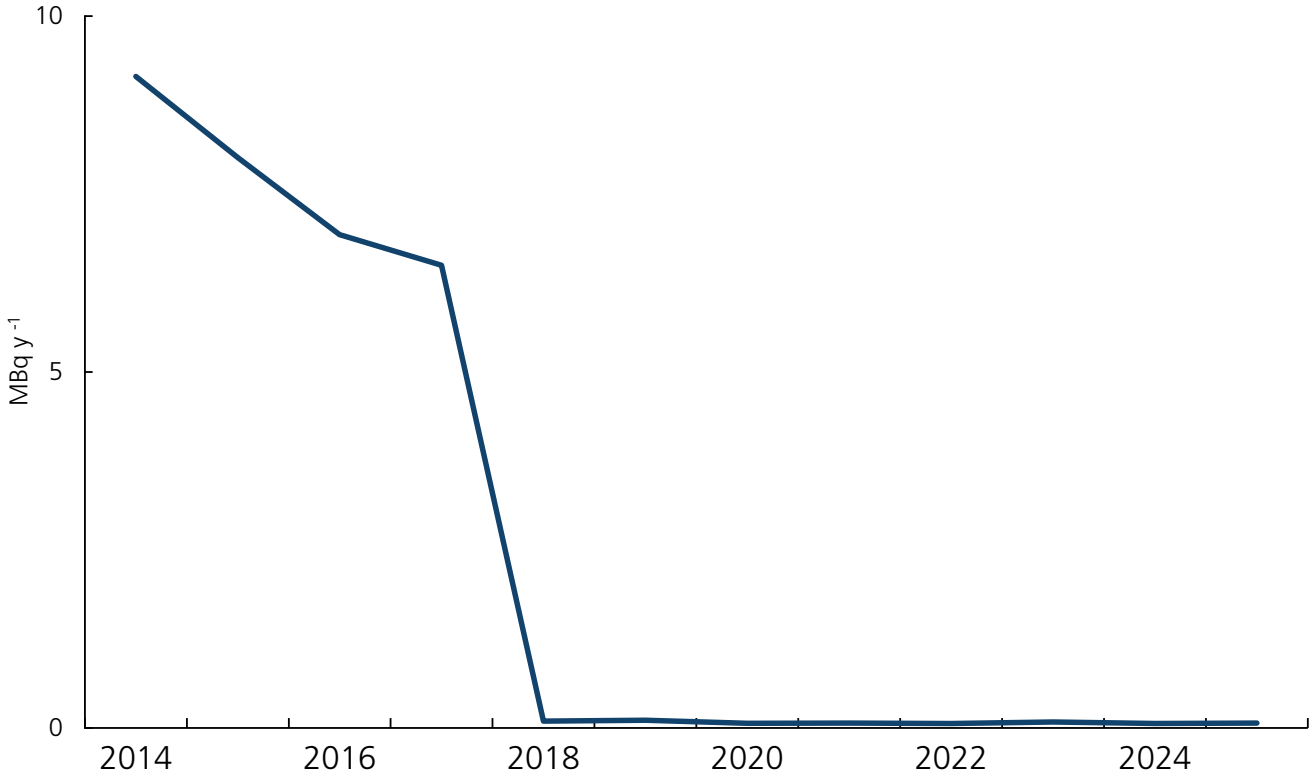


Figure 5.5 Liquid discharges of strontium-90, in GBq y^{-1}, 2014 to 2025.

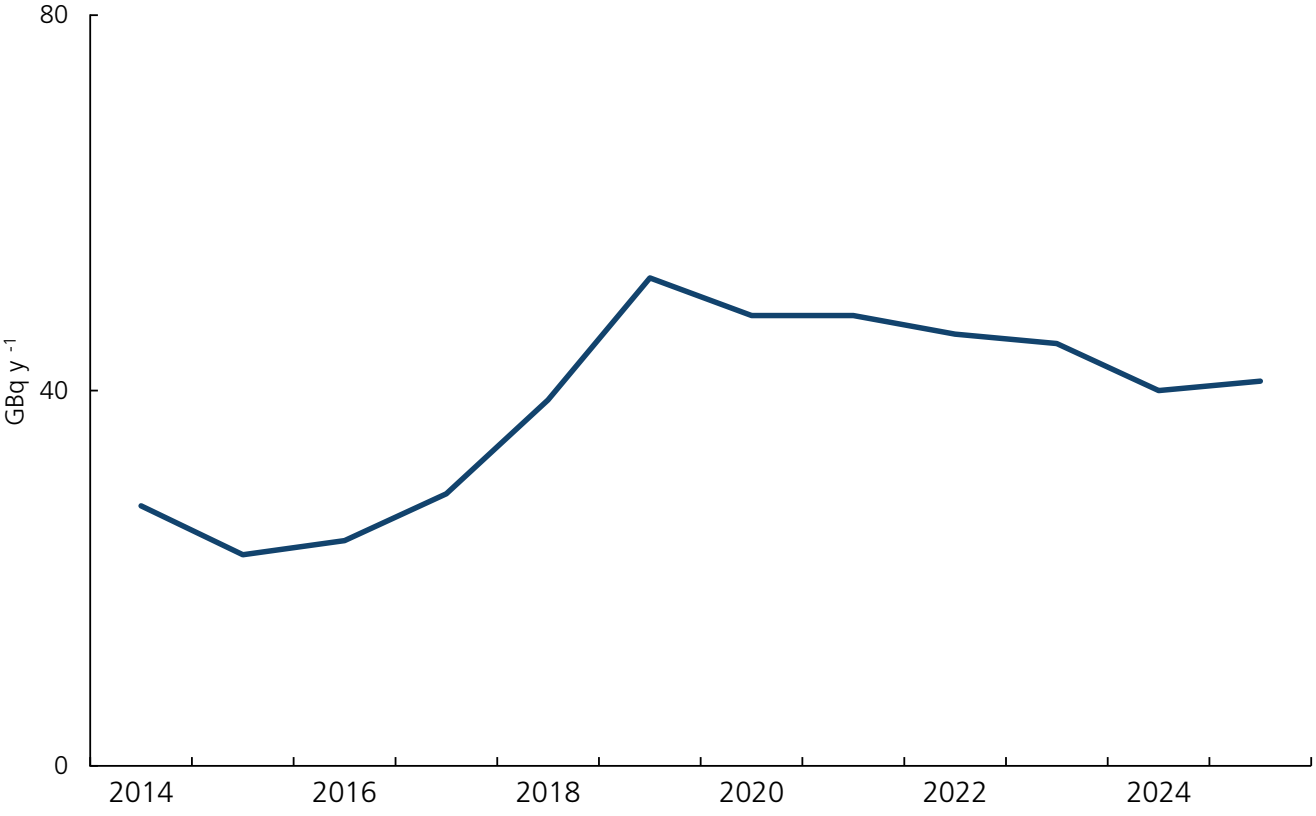


Figure 5.6 Liquid discharges of caesium-137, in GBq y^{-1}, 2014 to 2025.

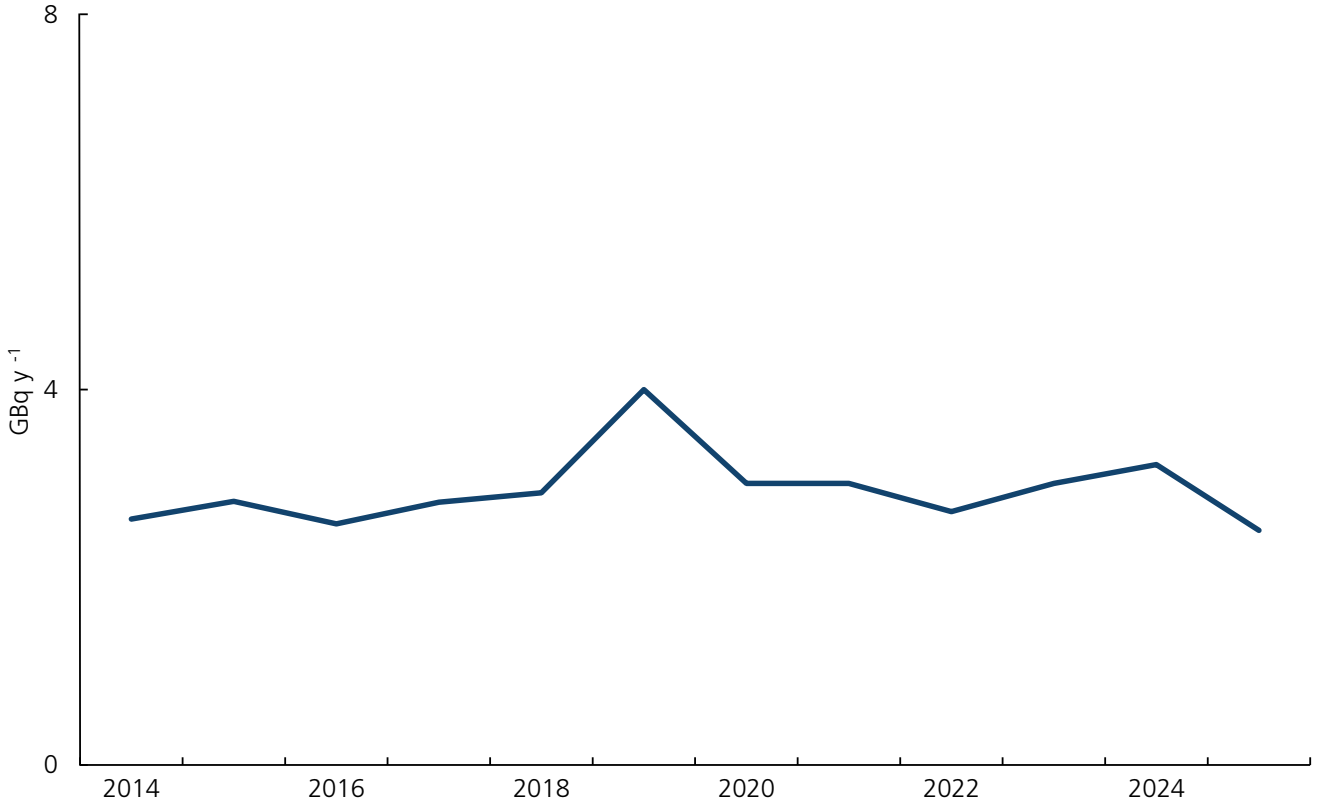


Figure 5.7 Liquid discharges of alpha, in GBq y^{-1}, 2014 to 2025.

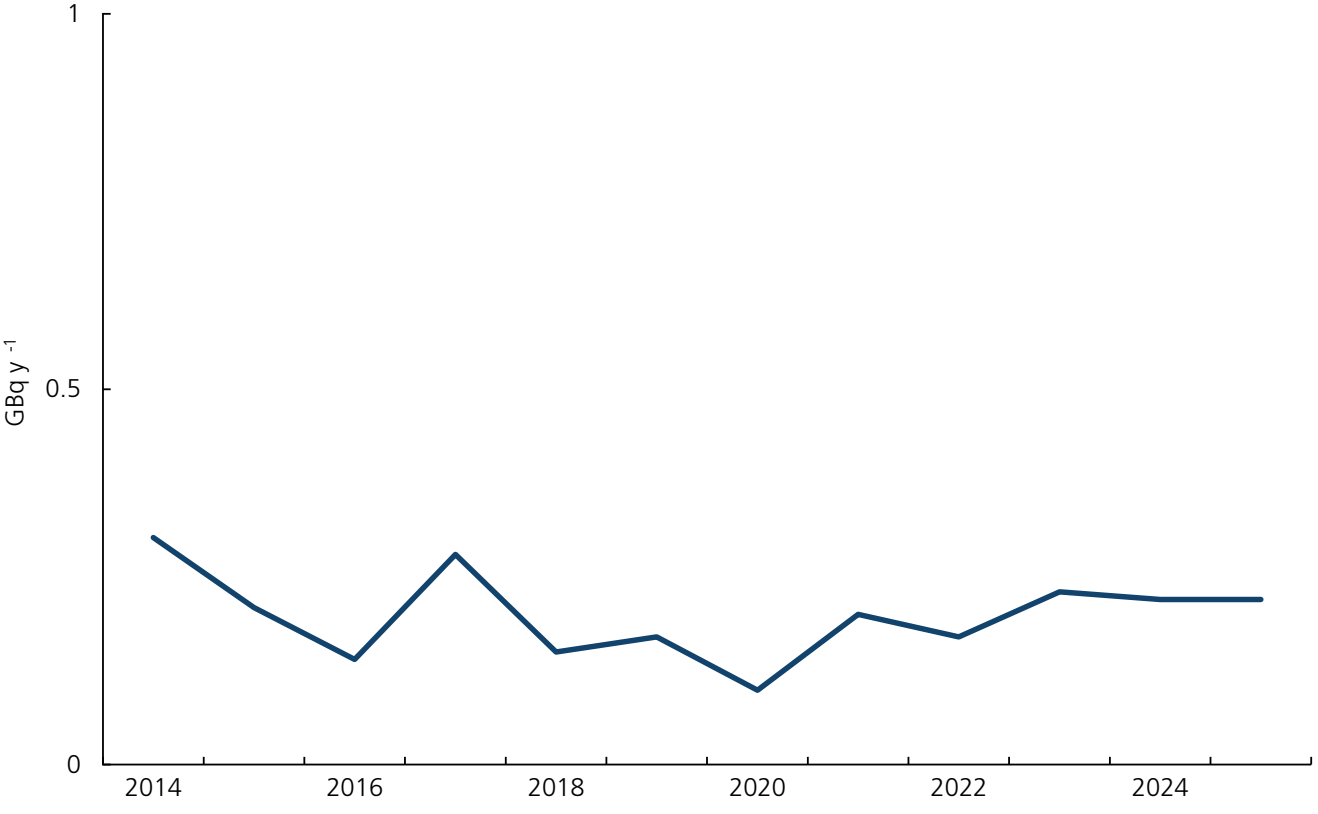


Figure 5.8 Concentrations of technetium-99 in seaweed at Sandside Bay and Burwick Pier, Bq kg^{-1} (fresh), 2014 to 2025.

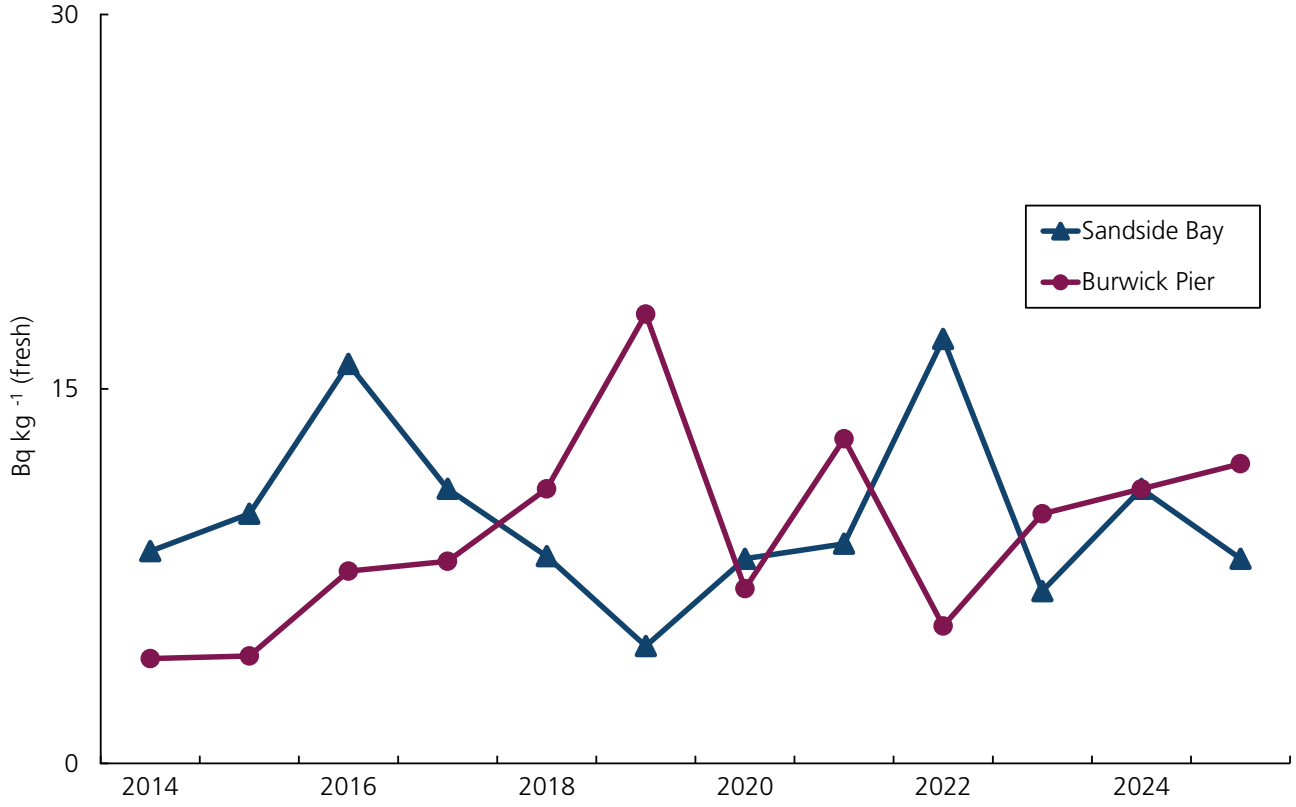
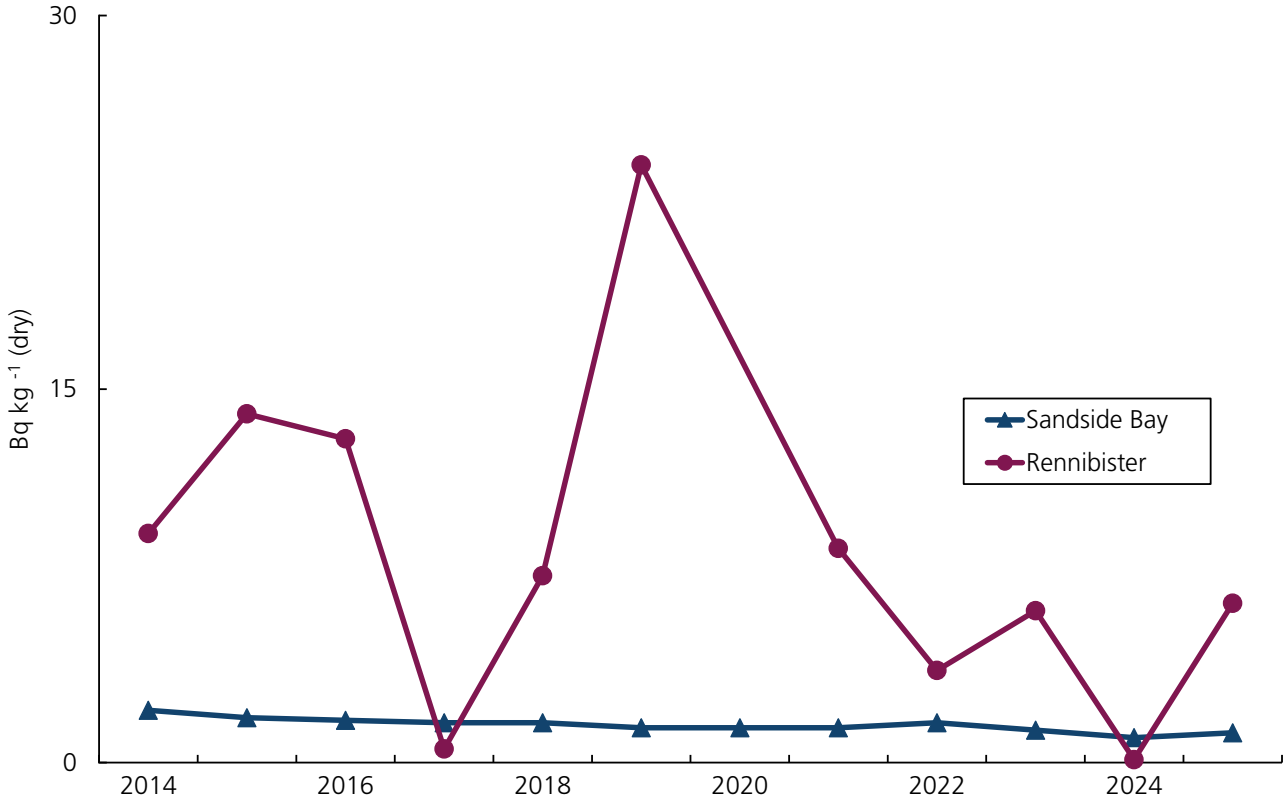


Figure 5.9 Concentrations of caesium-137 in sediments at Sandside Bay and Rennibister, Bq kg^{-1} (dry), 2014 to 2025.



The concentrations of radionuclides at Dounreay were generally low and relatively similar to those observed in previous years. As in recent years, strontium-90 was positively detected in a few food samples, and iodine-129 concentrations were all reported as 'less than values' in 2025. Activity concentrations in air samples at locations near to the site (Table 5.2(c)) were reported as 'less than values', apart from gross alpha (just above the Limit of Detection) from all three sampling locations.

Caesium-137 is likely to be present in terrestrial samples from the Dounreay area due to fallout from weapons testing in the 1960s and from the Chernobyl reactor accident in 1986. As in recent years, caesium-137 was positively detected in the venison sample collected in 2025 (18Bq kg^{-1}) and was slightly lower than that observed in 2024 (24Bq kg^{-1}). Unlike 2024, a honey sample was not available in 2025. Earlier RIFE reports have provided results and interpretation of honey monitoring (for example [26]).

5.1.3 Liquid waste discharges and aquatic monitoring

Low level liquid waste is routed via a Low-Level Liquid Effluent Treatment Plant (LLLETP). The effluent is discharged to sea (Pentland Firth) via a pipeline terminating 600 metres offshore at a depth of about 24 metres. The discharges also include groundwater pumped from the Dounreay shaft, surface water runoff, leachate from the on-site low level solid waste disposal facility (which operated from 1958 to 2005), and a minor contribution from the adjoining reactor site (Vulcan NRTE).

Routine marine monitoring included sampling of seafood and the measurement of beta and gamma dose rates. A Food and Environment Protection Act (FEPA) Order[19] exists which prevents the collection of seafood within a defined area around the long sea outfall. Samples can be collected under consent granted in 1997 by the Scottish Office and revised in 2011 by the FSS (then FSA in Scotland).

Cod, crab, mussel and winkle samples were collected from areas along the Caithness coastline. Additionally, sediment, seawater and seaweed were sampled in 2025 as indicator materials. The results for marine samples, and gamma and beta dose rates, are given in Table 5.2(a) and Table 5.2(b). Activity concentrations were generally low in 2025 and similar to those in recent years. Technetium-99 concentrations in seaweed remained at the levels expected for this distance from Sellafield and were lower to those reported in previous years (Figure 3.21). Figure 5.8 also gives time trend information for technetium-99 concentrations (from Sellafield) in seaweed at Sandside Bay (location shown in Figure 5.2), and Burwick. Data indicate a general decline in concentrations over the period at both locations. Caesium-137 concentrations in sediment (Figure 5.9) at Sandside Bay and Rennibister (both 2014 to 2025), have generally decreased albeit with fluctuations due to environmental variability. Overall, gamma dose rates in 2025 were slightly higher than those observed in recent years. As in recent years, beta dose rate measurements were all reported as 'less than values' (Table 5.2(b)) in 2025.

19. The FEPA Order was made in 1997 following the discovery of fragments of irradiated nuclear fuel on the seabed near Dounreay, by United Kingdom atomic energy authority (UKAEA), and prohibits the collection of seafoods within a 2km radius of the discharge pipeline.

During 2025, NRS continued monitoring of local public beaches, using vehicle mounted detectors, for radioactive fragments in compliance with the requirements of the authorisation granted by SEPA. In 2025, 4 fragments were recovered from Sandside Bay, and 3 fragments were recovered from the Dounreay foreshore. The caesium-137 activity measured in the fragments recovered from Sandside Bay ranged from 9.2kBq to 120kBq. Fragments recovered from the Dounreay foreshore ranged from 29kBq to 1400kBq.

Dounreay particle updates are posted on Radioactive particles in the environment around Dounreay - GOV.UK (www.gov.uk)(https://www.gov.uk/government/publications/onshore-monitoring-of-radioactive-particles) and pre-2023, particle find updates can be found here (https://www.gov.uk/government/publications/radioactive-particles-in-the-environment-around-dounreay.

The previously conducted offshore survey work provided data on repopulation rates of particles (fragments) to areas of the seabed previously cleared of particles. This work has improved the understanding of particle movements in the marine environment. The Dounreay Particles Advisory Group (DPAG) completed its work following the production of its Fourth Report [170]. Since the work of Dounreay Particles Advisory Group† was concluded, Particles Retrieval Advisory Group (Dounreay) (PRAG(D)) has published reports in 2010, 2011, 2016 and 2026 [171–174]. In 2026, the Particles Retrieval Advisory Group (Dounreay) (PRAG(D)) published its 2025 report. This publication provides an overview of the health risks from fragments generated at Dounreay; consideration of movement of fragments in the offshore environment; reviewing the numbers of fragments found through the beach monitoring programme and outlines potential numbers of fragments remaining in the environment. Additionally, the report outlines support to maintain the Food and Environment Protection Act Order, ongoing monitoring and sets out concerns in relation to plans to install high-voltage cables in the Dounreay offshore environment [174].

The Particles Retrieval Advisory Group (Dounreay) (PRAG(D)) have published a report in September 2026.

In 2007, the FSA reviewed the Dounreay FEPA Order. A risk assessment, that was peer-reviewed by UKHSA, indicated that the food chain risk was very small [175]. The FEPA Order was reviewed with regard to ongoing work to remove radioactive particles from the seabed and the food chain risk. In 2009, the FSA in Scotland (now FSS) announced that the FEPA Order would remain in place and be reviewed again upon completion of the (now completed) seabed remediation work. Following a recommendation in the 2016 PRAG(D) report, FSS agreed that the FEPA Order would remain in place and be reviewed following re-evaluation of particle arrival rates. The 2025 PRAG(D) report (https://beta.sepa.scot/media/edwkousf/prag-dounreay-report-2025.docx) reviewed the impact of offshore retrievals on particle arrival rates at local beaches. The report recommended that the current monitoring programme should continue and that the offshore FEPA area should not be disturbed.

The FEPA Order prevents disturbance of the area in relation to seafood harvesting; however, it cannot prevent any sediment movement by natural processes or by high voltage power cables being placed in the area to transfer energy to the National Grid. SEPA is aware of a number of propositions in the Dounreay offshore area to lay energy cables that could result in the disturbance of sediment. SEPA is engaging with those involved in offshore cable laying to assess the potential impacts on the offshore environment.

†Dounreay Particles Advisory Group was set up in 2000, and PRAG(D) thereafter, to provide independent advice to SEPA and United Kingdom atomic energy authority (UKAEA) on issues relating to the Dounreay fragments.

5.2 Grove Centre, Amersham, Buckinghamshire

The Grove Centre is operated by GE Healthcare Limited, it consists of a range of plants previously used for manufacturing diagnostic imaging products for use in medicine and research, which are now closed and being decommissioned. In April 2026, the ONR relicensed GE Healthcare Limited's nuclear licensed site after the site footprint was reduced by a half as part of major remediation activities.

The monitoring programme consists of analysis of fish, crops, water, soil and other environmental materials, and measurements of gamma dose rates. The monitoring locations are shown in Figure 5.10. The sample species, type and locations are listed in the respective site tables. The most recent habits survey was undertaken in 2016 [176].

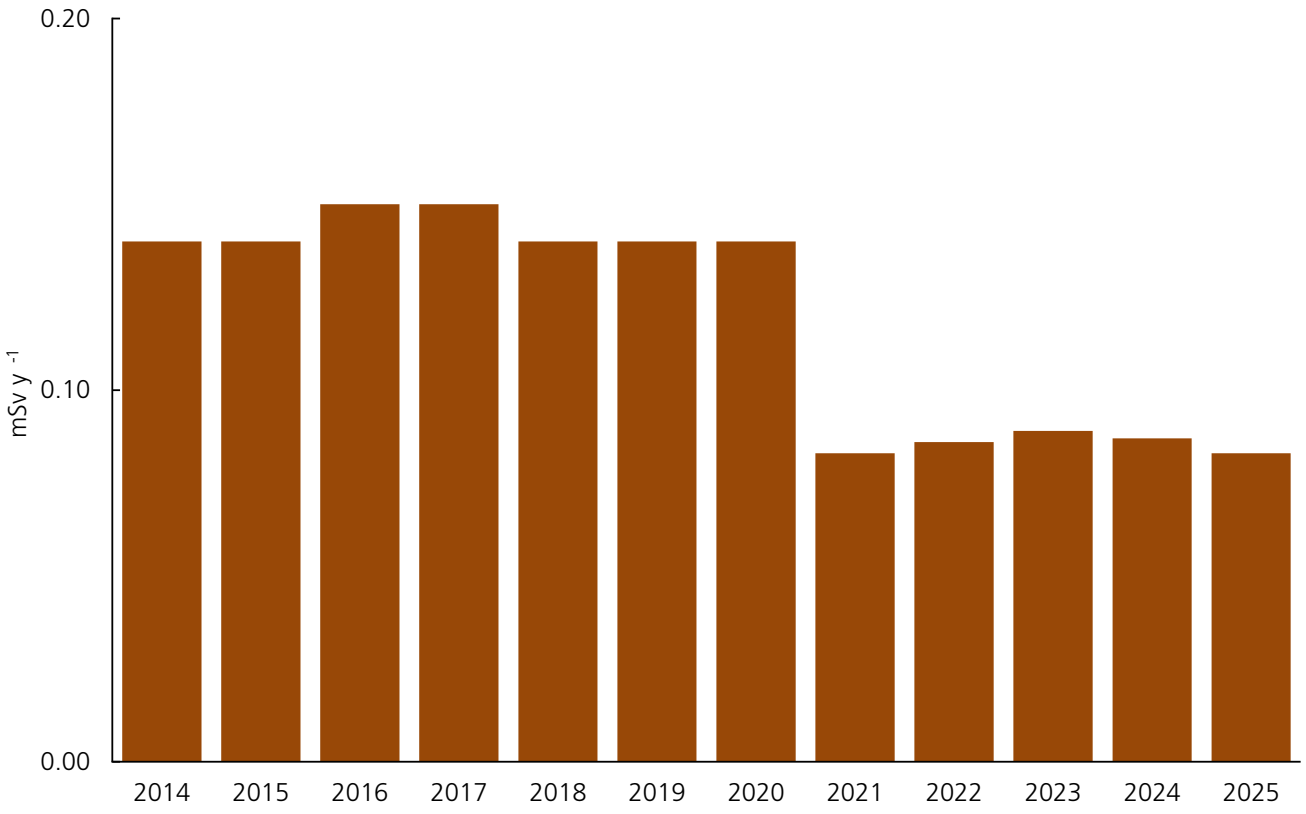
Figure 5.10 Monitoring locations near the River Thames, 2025 (not including farms).



5.2.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was estimated to be 0.083mSv in 2025 (Table 5.1) or less than 9% of the dose limit to members of the public. This was a decrease from 2024 (0.087mSv). As in recent years, the dominant contribution to 'total dose' was from direct radiation from stored radioactive waste. The representative person was a prenatal child of an adult living in the vicinity of the site in 2025 (unchanged from 2024). Exposure from direct radiation varies around the boundary of the Grove Centre and therefore the 'total dose' is estimated as a cautious upper value. The trend in annual 'total dose' over the period 2014 to 2025 is given in Figure 5.11. The lower values are due to all distribution activities ceasing in 2019. Dose from the site has since been dominated by radiation from the waste store. The 'total dose' is expected to be no more than the conservative estimated value of 0.083mSv. The trends in 'total dose' is given in Figure 5.11. The doses are dominated by direct radiation, estimates of which have remained relatively constant in the recent years.

Figure 5.11 'Total dose', in mSv y^{-1}, at the Grove Centre, Amersham, 2014 to 2025.



As in recent years, source-specific assessments for a high-rate consumer of locally grown foods, for an angler and for a worker at Maple Lodge Sewage Treatment Works (STW), which serves the sewers to which permitted discharges are made, gave exposures that were less than the 'total dose' in 2025 (Table 5.1). The dose for a high-rate consumer of locally grown foods was less than 0.005mSv in 2025 and down from 2024 (0.010mSv). This decrease in dose was mostly due to a lower contribution from the gaseous discharges of radon-222 in 2025. It should be noted that the current assessment methodology uses a conservative dose factor based on this nuclide being in equilibrium with its decay products. In 2025 the dose to a local angler was 0.005mSv and slightly up from recent years (reported as less than 0.005mSv in 2024 and 2023).

The 2016 habits survey at Amersham did not directly identify any consumers of fish, shellfish or freshwater plants. As in previous surveys, however, there were reports of occasional coarse fish and signal crayfish consumption (but no actual consumption rates). To allow for this, a consumption rate of 1kg per year for fish and signal crayfish has been included in the dose assessment for an angler.

The Grove Centre discharges liquid waste to Maple Lodge STW, and the proximity to raw sewage and sludge experienced by sewage treatment workers is a likely exposure pathway [177]. The dose received by one of these workers was modelled using the methods described in Appendix 3. The dose from a combination of external exposure to contaminated raw sewage and sludge, inadvertent ingestion and inhalation of re-suspended radionuclides was less than 0.005mSv in 2025 and unchanged from recent years.

5.2.2 Gaseous discharges and terrestrial monitoring

The Grove Centre is permitted to discharge gaseous radioactive wastes via stacks on the site. Gaseous discharges of radon-222 decreased in 2025, in comparison with those in 2024. The radon-222 discharges are associated with retrieval and repackaging of legacy radium waste. These retrievals are now nearly complete, resulting in a much-reduced radon-222 discharges since April 2025. The results for the terrestrial monitoring for 2025 are given in Table 5.3(a) and Table 5.3(b). As in recent years, caesium-137 deposited from atmospheric fallout was detected in soil near the site in 2025.

5.2.3 Liquid waste discharges and aquatic monitoring

Radioactive liquid wastes are discharged to sewers serving the Maple Lodge STW; treated effluent subsequently enters the Grand Union Canal and the River Colne. The results of the aquatic monitoring programme for 2025 are given in Table 5.3(a). As in recent years, activity concentrations of tritium, iodine-131 (believed to originate from the therapeutic use of this radionuclide in local hospitals) and caesium-137 in freshwater were all reported as 'less than values' in 2025. Samples of effluent and sludge from Maple Lodge STW were also collected in 2025. The concentration levels observed in these samples were similar to the latest results observed in recent years and iodine-131 (likely from therapeutic use in hospitals) was positively detected in the crude effluent and the digested sludge collected in 2025.Tritium, gross alpha and gross beta concentrations observed in freshwater were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51). Gamma dose rates over grass were generally indistinguishable from natural background in 2025 (Table 5.3(b)) and were broadly similar to those measured in recent years.

5.3 Harwell, Oxfordshire

The Harwell site was established in 1946 as the UK's first Atomic Energy Research Establishment and is situated approximately 5km southwest of the town of Didcot. Since 2015, the Harwell site has been operated by NRS on behalf of the NDA. The Harwell nuclear site forms part of Harwell Campus, a science, innovation and business campus. The site accommodated 5 research reactors of various types. Harwell also had a number of other nuclear research facilities, together with plutonium handling facilities, radioactive laboratories, nuclear waste treatment and storage facilities. Decommissioning at Harwell is well underway. Two research reactors have been completely removed, and the fuel has been removed from the remaining 3 which are now in decommissioning. Several facilities have now been removed from the site and others are being decommissioned. Historic wastes are being retrieved from their existing storage locations and repackaged for longer-term storage and eventual disposal.

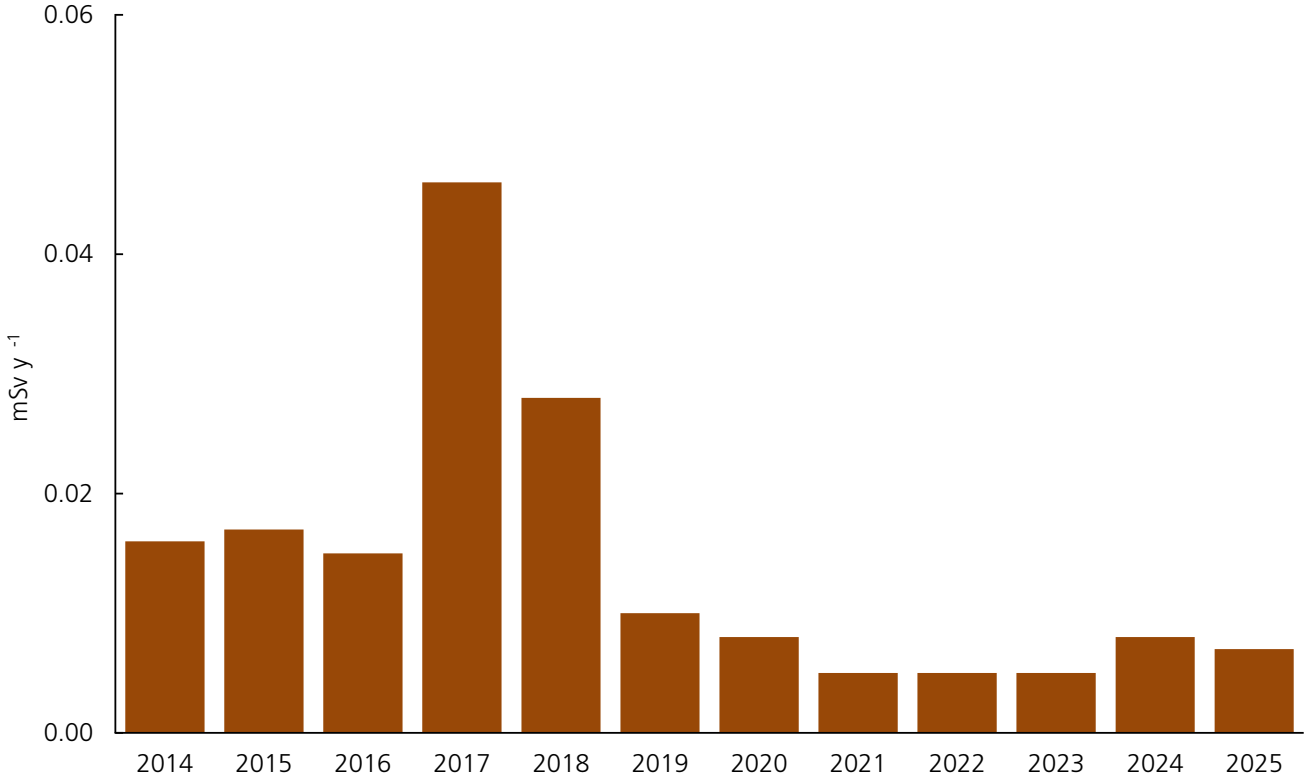
In 2022, the final remediation work was completed for the decommissioned Liquid Effluent Treatment Plant. Radiological sampling to support the environmental permit surrender and delicensing of this area is now complete. Once the area is released from radioactive substances regulation, this land will be handed back to the Harwell Science Park for future development.

The most recent habits survey was conducted in 2015 [178].

5.3.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was 0.007mSv in 2025 (Table 5.1), which was less than 1% of the dose limit to members of the public and similar to that in 2024 (0.008mSv). The decrease in dose was mainly related to the exclusion of the direct radiation from the site, which could not be distinguished from elevated levels unrelated to the site (Table 1.1). The representative person was an adult spending time over sediments. This is a change from 2024 (adult living near the site). The trend in annual 'total dose' over the period 2014 to 2025 is given in Figure 5.12. The 'total dose' was broadly similar, between 2014 and 2016, and was low. The increase in 'total dose' in 2017, and then decrease in 2018, were attributed to changes in the estimate of direct radiation from the site.

Figure 5.12 'Total dose', in mSv y^{-1}, at Harwell, 2014 to 2025. (Small doses less than or equal to 0.005mSv are recorded as being 0.005mSv).



As in recent years, the source-specific assessment for a high-rate consumer of terrestrial foods gave an exposure that was less than 0.005mSv in 2025 (Table 5.1). The source-specific assessment for an angler gave an exposure of 0.007mSv in 2025 and increased from less than 0.005mSv in 2024. The increase in dose was mostly attributed to a higher gamma dose rate measured over grass at Sutton Courtney.

5.3.2 Gaseous discharges and terrestrial monitoring

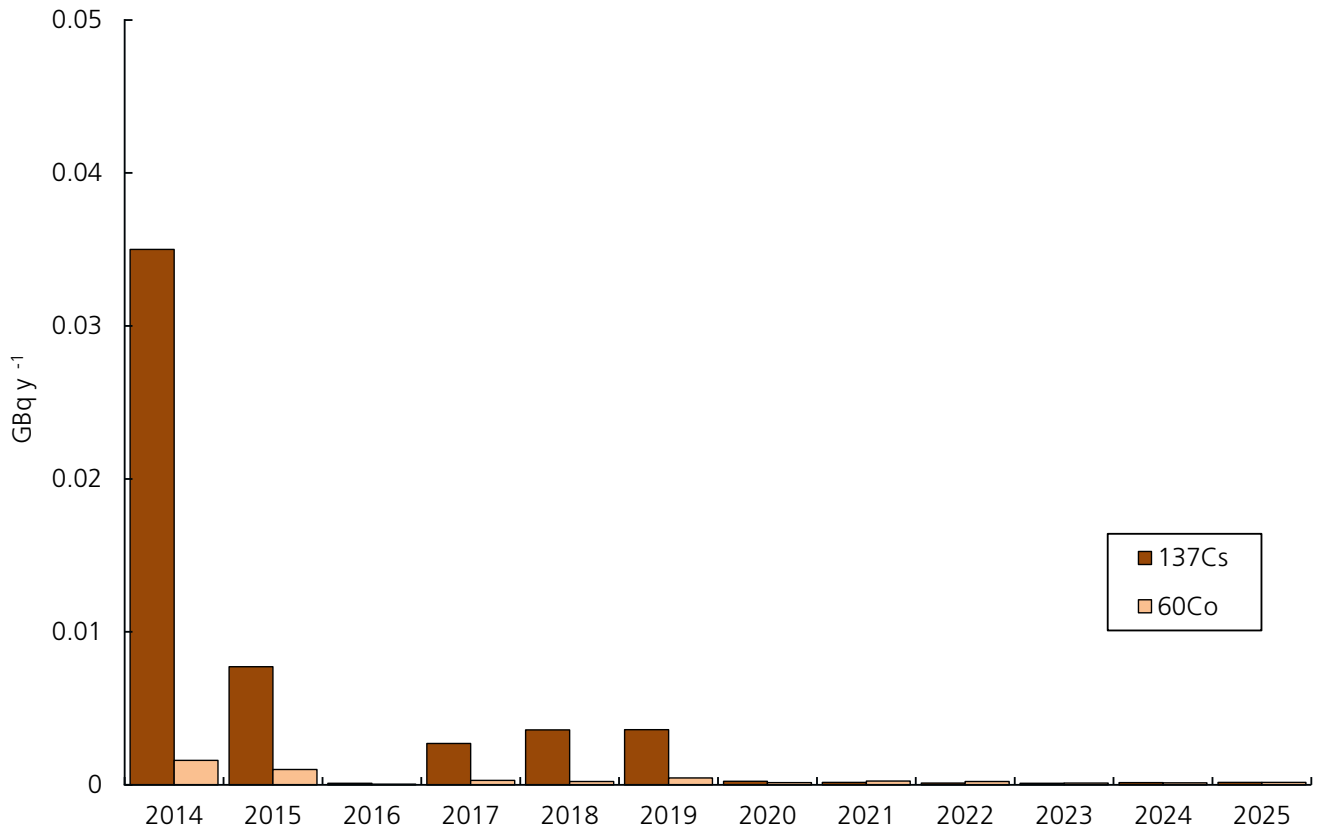
Gaseous wastes are discharged via stacks to the local environment. As in previous years, discharges of radioactive wastes continued at very low rates. The terrestrial monitoring programme sampled milk, fruit and cereal. The results of the terrestrial monitoring programme in 2025 are shown in Table 5.4. As in recent years, tritium concentrations in terrestrial samples were all reported as 'less than values' in 2025.

5.3.3 Liquid waste discharges and aquatic monitoring

Permitted liquid discharges from Harwell are discharged to sewers serving the Didcot STW; treated effluent subsequently enters the River Thames at Long Wittenham.

Permitted discharges of surface water drainage from the Harwell site are made via the Lydebank Brook. As in recent years, discharges to Lydebank Brook were very low. The liquid discharges of alpha-emitting radionuclides and tritium decreased in 2025, in comparison to those in 2024, due to lower volume of effluents via this route due to lower rainfall. Figure 5.13 shows trends of discharges over time (2014 to 2025) for cobalt-60 and caesium-137 to sewer. There was an overall reduction in the discharges over the whole period and very low discharges in most recent years.

Figure 5.13 Trends in liquid discharges, to sewer, of caesium-137 and cobalt-60, in GBq y^{-1}, from Harwell, Oxfordshire 2014 to 2025.



The aquatic monitoring programme is directed at consumers of fish and occupancy (sediment and freshwater samples) close to the liquid discharge point. Due to on-going access issues at Day's Lock, the Environment Agency have replaced this sampling location with River Thames above Shillingford. The results of the aquatic monitoring programme in 2025 are shown in Table 5.4. As in recent years, concentrations of tritium, cobalt-60 and caesium-137 in freshwater were reported as 'less than values' in 2025. The caesium-137 concentration in sediment continued to be slightly enhanced above background levels in 2025. As in 2024, plutonium-239+240 were positively detected at low levels in the sediment collected near Sutton Courtenay in 2025.

5.4 Winfrith, Dorset

The Winfrith site is located near Winfrith Newburgh, Dorset. It was established in 1957 as an experimental reactor research and development site. Since 2015, the Winfrith site has been operated by NRS on behalf of the NDA. At various times, there have been 9 research and development reactors. The last operational reactor at Winfrith closed in 1995. Seven of the reactors have been decommissioned. The final 2; the Steam Generating Heavy Water and 'Dragon' (high temperature gas-cooled) reactors and supporting site facilities, are in the process of being decommissioned. It is the end state intention of NRS to return most of the land to a brownfield heathland site with public access.

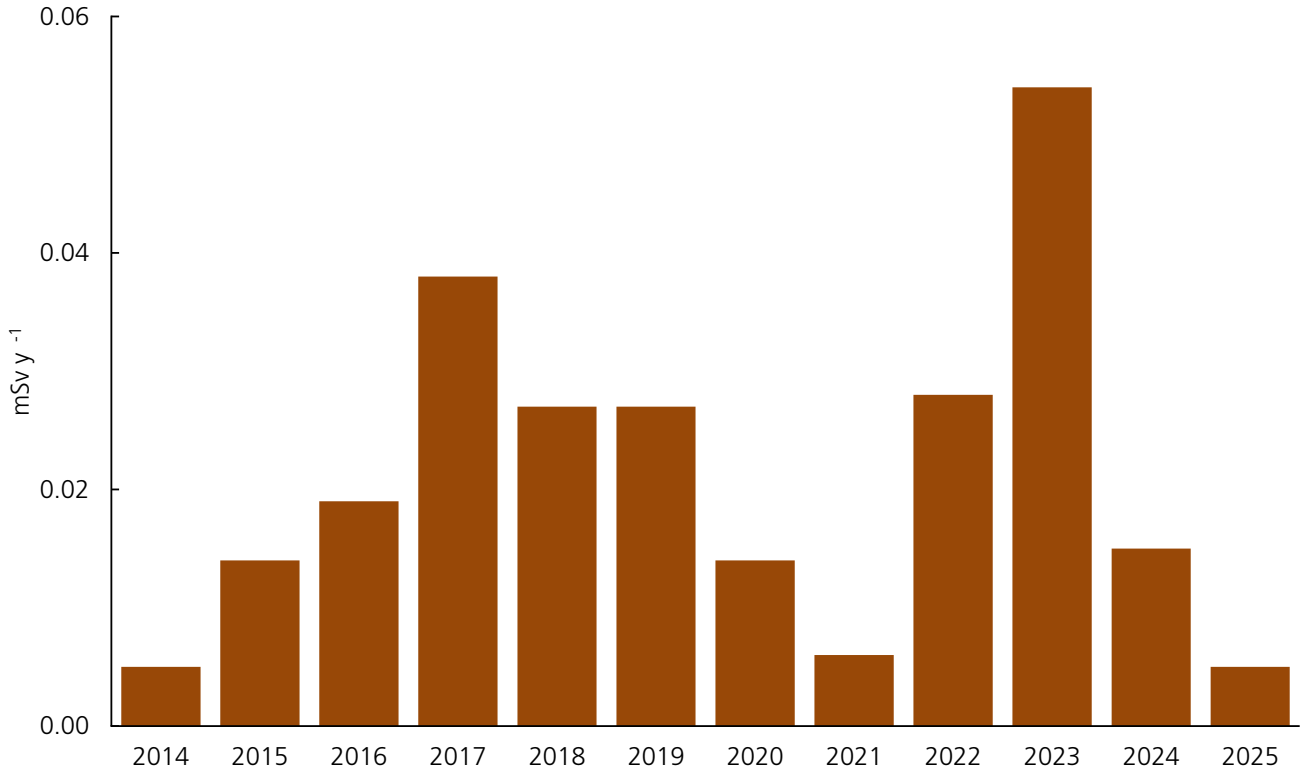
NRS Winfrith is located adjacent to the Tradebe-Inutec site. Tradebe-Inutec is an independent nuclear operator (see section 7.3). NRS Winfrith and Tradebe-Inutec undertake separate site environmental monitoring programmes as required by their respective environmental permits. However, in this report, NRS Winfrith and Tradebe-Inutec are considered together for the purposes of environmental monitoring because, with the exclusion of their liquid discharges (which discharge to different geographic areas), their operational activities and gaseous discharges impact on the same local area.

The most recent habits survey (covering both the NRS and Tradebe-Inutec sites) was conducted in 2019 [179].

5.4.1 Doses to the public

In 2025, the 'total dose' from all pathways and sources of radiation was less than 0.005mSv (Table 5.1), or less than 0.5% of the dose limit to members of the public. This is a decrease from 0.015mSv in 2024. The decrease in dose was mainly related to the exclusion of the direct radiation from the site, as the dose rates measured were found to originate from other sources or measurement errors and were not attributable to the site (Table 1.1). The representative person was an adult spending time over sediments. This is a change from 2024 (adult living near the site). Trends in annual 'total dose' over the period between 2014 and 2025 are shown in Figure 5.14. In 2014, 'total dose' was very low. The variations observed since 2015 are mainly due to changes in the estimates of direct radiation from the site. The fluctuations in estimates of total dose at NRS Winfrith has been attributed to the extent of the decommissioning work undertaken at the site in the recent years, including removal, temporary storage, and transfer of legacy wastes for off-site disposal. The specific waste transfer activities that occurred in recent years, were time limited in nature, and form part of the routine operational work required to secure the safe decommissioning of the site. Estimates of 'total dose' will fluctuate with operational decommissioning work demands as the site proceeds through to the final stage of decommissioning and all radioactive waste management activities cease.

Figure 5.14 'Total dose', in mSv y^{-1}, at Winfrith, 2014 to 2025. (Small doses less than or equal to 0.005mSv are recorded as being 0.005mSv).



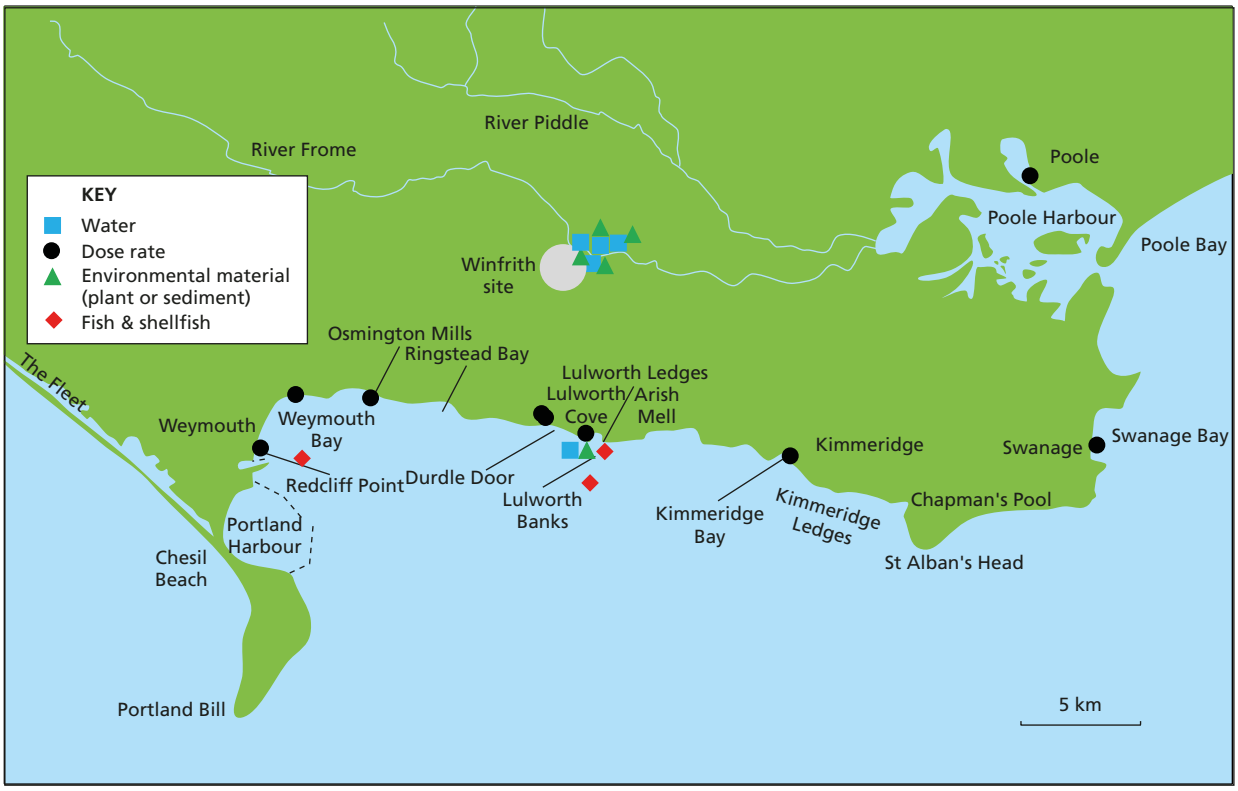
As in 2024, the doses to a high-rate consumer of locally grown food and of fish and shellfish, were less than 0.005mSv in 2025.

5.4.2 Gaseous discharges and terrestrial monitoring

At NRS Winfrith, gaseous radioactive waste is discharged via various stacks to the local environment. As in previous years, discharges were very low in 2025. In this report, gaseous discharges from NRS Winfrith and Tradebe-Inutec are considered together for the purposes of environmental monitoring because their operational activities and gaseous discharges impact on the same local area.

The focus of the terrestrial sampling was the analyses of tritium and carbon-14 in milk and crops. Local freshwater, grass and sediment samples were also analysed. Sampling locations at Winfrith are shown in Figure 5.15. The sample species, type and locations are listed in the respective site tables. Data for 2025 are given in Table 5.5(a). Results from terrestrial samples provide little indication of an effect due to gaseous discharges. As in recent years, the carbon-14 concentrations in locally produced milk were above values used to represent background concentrations. Unlike in 2024, tritium was positively detected in surface waters in 2025 (North of site and River Win east of site). Tritium, gross alpha, and gross beta concentrations in freshwater were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51).

Figure 5.15 Monitoring locations at Winfrith, 2025 (not including farms).

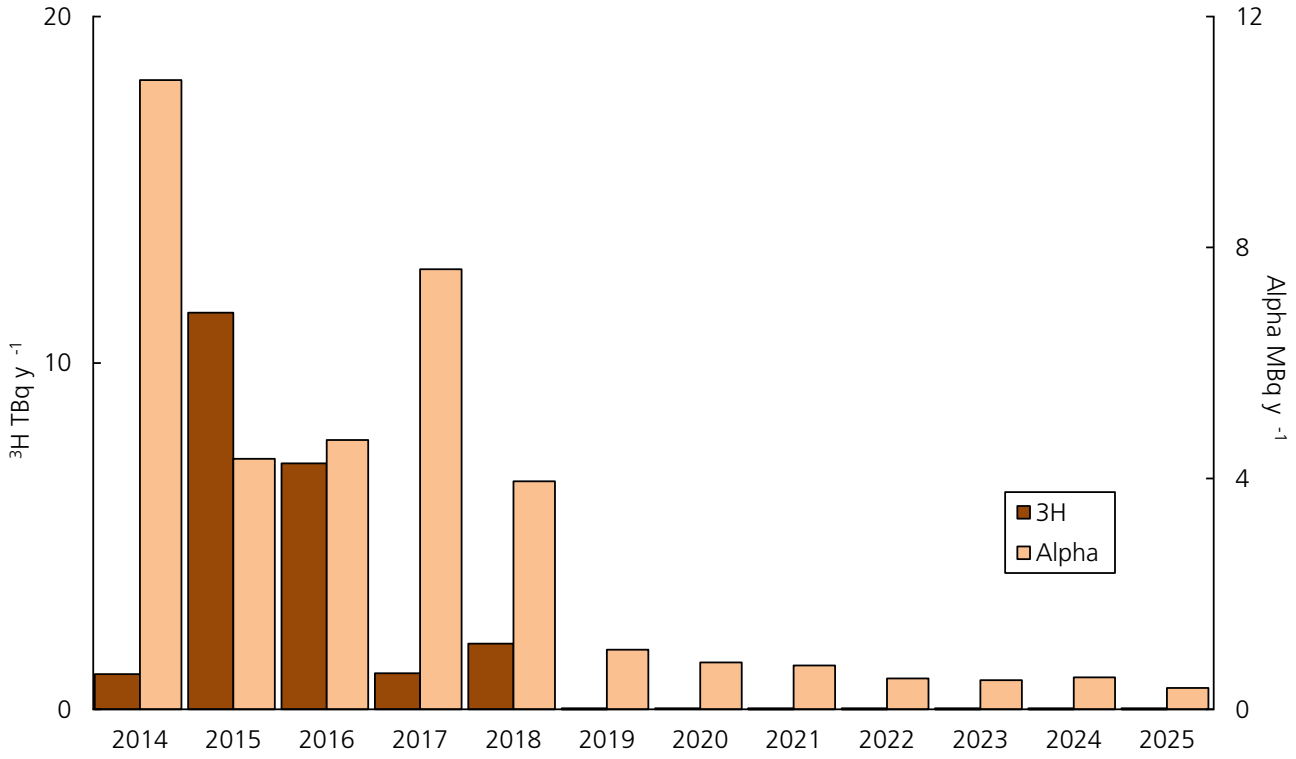


5.4.3 Liquid waste discharges and aquatic monitoring

Liquid wastes, from the NRS Winfrith site, are disposed via a pipeline to deep water in Weymouth Bay. As in previous years, discharges continued at very low rates in 2025 (all reported as <1% of the annual limit).

Figure 5.16 shows trends of liquid discharges over time (2014 to 2025) for tritium and alpha-emitting radionuclides. In recent years, discharges of alpha-emitting radionuclides have remained very low. In comparison, tritium discharges have varied more between years, with periodic peaks in releases, due to operations at Tradebe-Inutec, but have also generally declined since 2015 and ceased in 2019.

Figure 5.16 Trends in liquid discharges of tritium, in TBq y^{-1}, and alpha emitting radionuclides, in MBq y^{-1}, from NRS Winfrith, 2014 to 2025.



Analyses of seafood and marine indicator materials and measurements of external radiation over muddy intertidal areas were conducted in 2025. These are primarily to determine the effects of liquid discharges from the NRS Winfrith site and, to a lesser extent, historical (pre-2019) liquid discharges from Tradebe-Inutec. The results of the aquatic monitoring programme and measurements of external radiation in 2025 are shown in Table 5.5(a) and Table 5.5 (b) respectively. Concentrations of radionuclides in the marine environment were low and similar to those in previous years. Unlike in 2024, technetium-99 was positively detected in seaweed samples collected at Bognor Rocks, but caesium-137 was not positively detected in the fish sample collected from Weymouth Bay (skates and rays). Gamma dose rates in 2025 were generally similar to those measured in 2024 (where comparison could be made).

5.5 Culham, Oxfordshire

Culham Centre for Fusion Energy, operated by the United Kingdom Atomic Energy Authority (UKAEA), is the UK's national laboratory for fusion research. The Culham Centre for Fusion Energy hosts and is responsible for the operation of 2 experimental fusion reactors: the Joint European Torus and the Mega Amp Spherical Tokamak (MAST) Upgrade. The Joint European Torus concluded its operation in 2023.

The Culham site also operates several other facilities to support fusion energy and related technologies and should host commercial fusion developers to become a fusion cluster hub in the future.

A site-specific 'total dose' has not determined at this site in this report because an integrated habits survey has not been undertaken. As in recent years, the source-specific dose (including tritium and caesium-137), from using the River Thames directly as a source of drinking water, downstream of the discharge point at Culham, was estimated to be less than 0.005mSv in 2025 (Table 5.1).

Monitoring of soil and grass around Culham and of sediment and water from the River Thames was undertaken in 2025. Locations and data are shown in Figure 5.10 and Table 5.6, respectively. Historically, the main effect of the site's operation was the increased tritium concentrations found in grass collected near the site perimeter. As in recent years, concentrations of tritium in all samples were reported as 'less than values'. The reported caesium-137 concentration in the downstream sediment collected in 2025 was 11Bq kg^{-1} and was slightly lower in comparison with 2024 was lower 14Bq kg^{-1}). Caesium-137 concentrations in the River Thames sediment are not attributable to Culham but were most likely due to past discharges from Harwell and fallout from Chernobyl and nuclear weapons testing.

Table 5.1 Individual doses, in mSv y^{-1}, Research and radiochemical production sites, 2025

Site	Representative person[a]	Exposure, mSv per year						
		Total	Fish and shellfish	Other local food	External radiation from intertidal areas or river banks[b]	Intakes of sediment and water[c]	Gaseous plume related pathways	Direct radiation from site
Dounreay								
'Total dose' - all sources	**Local adult inhabitants (0.5-1km)**	**0.008[d]**	**<0.005**	**<0.005**	**<0.005**	**-**	**<0.005**	**0.006**
Source-specific doses	Seafood consumers	0.008	<0.005	-	0.007	-	-	-
	Inhabitants and consumers of locally grown food	0.013[d]	-	0.013	-	-	<0.005	-
Grove Centre, Amersham								
'Total dose' - all sources	**Prenatal children of local inhabitants (0 - 0.25km)**	**0.083[d]**	**-**	**<0.005**	**<0.005**	**-**	**<0.005**	**0.080**
Source-specific doses	Anglers	<0.005	<0.005	-	<0.005	-	-	-
	Infant inhabitants and consumers of locally grown food	<0.005[d]	-	<0.005	-	-	<0.005	-
	Workers at Maple Lodge STW	<0.005	-	-	<0.005[e]	<0.005[f]	-	-
Harwell								
'Total dose' - all sources	**Adult occupants over sediment**	**0.007**	**<0.005**	**-**	**0.007**	**-**	**-**	**-**
Source-specific doses	Anglers	0.007	<0.005	-	0.007	-	-	-
	Infant inhabitants and consumers of locally grown food	<0.005[d]	-	<0.005	-	-	<0.005	-
Winfrith								
'Total dose' - all sources	**Adult occupants over sediment**	**<0.005**	**<0.005**	**-**	**<0.005**	**-**	**-**	**-**
Source-specific doses	Seafood consumers	<0.005	<0.005	-	<0.005	-	-	-
	Infant inhabitants and consumers of locally grown food	<0.005	-	<0.005	-	-	<0.005	-
Culham								
Source-specific dose	Drinkers of river water	<0.005	-	-	-	<0.005	-	-

a. The 'total dose' is the dose which accounts for all sources including gaseous and liquid discharges and direct radiation. The 'total dose' for the representative person with the highest dose is presented. Other dose values are presented for specific sources, either liquid discharges or gaseous discharges, and their associated pathways. They serve as a check on the validity of the 'total dose' assessment. The representative person is an adult unless otherwise stated Data are presented to 2 significant figures or 3 decimal places. Data below 0.005 mSv are reported as <0.005 mSv

b. Doses ('total dose' and source-specific doses) only include estimates of anthropogenic inputs (by substracting background and cosmic sources from measured gamma dose rates)

c. Water is from rivers and streams and not tap water

d. Includes a component due to natural sources of radionuclides

e. External radiation from raw sewage and sludge

f. Intakes of resuspended raw sewage and sludge

Table 5.2(a) Concentrations of radionuclides in food and the environment near Dounreay, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{3}H	^{60}Co	^{65}Zn	^{90}Sr	^{99}Tc	^{134}Cs	^{137}Cs
Marine samples									
Cod	Scrabster	2		<0.10	<0.23			<0.10	0.22
Crabs	Dounreay Coastline	2		<0.10	<0.24	<0.10	<0.28	<0.10	<0.10
Crabs	Strathy	2		<0.10	<0.23			<0.10	<0.10
Crabs	Melvich Bay	2		<0.11	<0.23		<0.33	<0.10	<0.10
Mussels	Echnaloch Bay	2		<0.17	<0.41		<0.61	<0.18	<0.15
Winkles	Brims Ness	3		<0.27	<0.67	<0.10		<0.27	<0.22
Winkles	Sandside Bay	4		<0.16	<0.39	<0.10	<0.35	<0.16	<0.12
Fucus vesiculosus	Brims Ness	3		<0.10	<0.20			<0.10	<0.10
Fucus vesiculosus	Sandside Bay	4		<0.10	<0.17		8.2	<0.10	<0.11
Fucus vesiculosus	Burwick Pier	4		<0.10	<0.19		12	<0.10	<0.10
Sediment	Brims Ness	1		<0.10	<0.29			<0.12	0.44
Sediment	Strathy	1		<0.10	<0.26			<0.11	0.65
Sediment	Melvich Bay	1		<0.10	<0.24			<0.10	1.1
Sediment	Sandside Bay	1		<0.10	<0.25			<0.10	1.2
Sediment	Rennibister	1		<0.13	0.39			<0.16	6.4
Seawater	Brims Ness	2	<1.0	<0.10	<0.13			<0.10	<0.10
Seawater	Sandside Bay	2	<1.0	<0.10	<0.13			<0.10	<0.10

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{154}Eu	^{155}Eu	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	Gross alpha	Gross beta
Marine samples									
Cod	Scrabster	2	<0.11	<0.21	<0.00070	0.00070	0.00093		
Crabs	Dounreay Coastline	2	<0.12	<0.19	0.016	0.026	0.039	<1.1	170
Crabs	Strathy	2	<0.11	<0.17	0.0013	0.011	0.0048		
Crabs	Melvich Bay	2	<0.13	<0.20	0.0025	0.014	0.017		
Mussels	Echnaloch Bay	2	<0.20	<0.32	0.0080	0.055	0.030		
Winkles	Brims Ness	3	<0.30	<0.44	0.038	0.16	0.31		
Winkles	Sandside Bay	4	<0.17	<0.28	0.011	0.043	0.080		
Fucus vesiculosus	Brims Ness	3	<0.10	<0.17			<0.16	<2.7	620
Fucus vesiculosus	Sandside Bay	4	<0.11	<0.16			0.31	<2.6	640
Fucus vesiculosus	Burwick Pier	4	<0.10	<0.16			<0.17		
Sediment	Brims Ness	1	<0.12	<0.43	1.5	9.2	9.9		
Sediment	Strathy	1	<0.20	<0.38	0.53	0.74	0.94		
Sediment	Melvich Bay	1	<0.17	<0.32	0.23	0.86	0.88		
Sediment	Sandside Bay	1	<0.18	<0.34	1.4	8.3	9.0		
Sediment	Rennibister	1	<0.27	<0.41	0.14	0.51	2.1		
Seawater	Brims Ness	2	<0.10	<0.12			<0.10		
Seawater	Sandside Bay	2	<0.10	<0.12			<0.10		

Table 5.2(a) continued

Material	Location or selection[c]	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}								
			^{3}H	^{60}Co	^{90}Sr	^{95}Nb	^{129}I	^{134}Cs	^{137}Cs	^{144}Ce	^{155}Eu
Terrestrial samples - Annual											
Beef muscle		1	<5.0	<0.05	<0.10	<0.07	<0.050	<0.05	0.07	<0.18	<0.09
Beef offal		1	<5.0	<0.05	<0.10	<0.08	<0.057	<0.05	<0.05	<0.24	<0.12
Cabbage		1	<5.0	<0.05	<0.10	<0.07	<0.050	<0.05	0.12	<0.21	<0.05
Carrots		1	<5.0	<0.08	<0.10	<0.13	<0.050	<0.08	<0.08	<0.41	<0.17
Cauliflower		1	<5.0	<0.05	0.22	<0.09	<0.050	<0.05	0.08	<0.25	<0.13
Eggs		1	<5.0	<0.05	0.12	<0.16	<0.050	<0.05	<0.05	<0.25	<0.12
Lamb muscle		1	<5.0	<0.05	<0.10	<0.09	<0.050	<0.05	0.34	<0.27	<0.13
Leeks		1	<5.0	<0.05	<0.10	<0.10	<0.050	<0.05	<0.05	<0.25	<0.13
Mushrooms		1	<5.0	<0.05	0.17	<0.12	<0.050	<0.05	0.41	<0.24	<0.12
Parsnip		1	<5.0	<0.05	<0.10	<0.09	<0.050	<0.05	<0.05	<0.24	<0.12
Pork		1	<5.0	<0.05	<0.10	<0.10	<0.050	<0.05	<0.05	<0.19	<0.09
Potatoes		1	<5.0	<0.05	<0.10	<0.08	<0.050	<0.05	0.05	<0.19	<0.10
Swede		1	<5.0	<0.05	0.16	<0.06	<0.050	<0.05	0.06	<0.13	<0.07
Venison		1	<5.0	<0.05	<0.10	<0.13	<0.050	<0.05	18	<0.28	<0.13
Grass		3	<5.0	<0.06	0.30	<0.17	<0.053	<0.06	<0.10	<0.34	<0.16
Grass	max			<0.08	0.34	<0.19	<0.059		0.16	<0.44	<0.21
Soil		3	<5.0	<0.12	0.79	<0.26	<0.050	<0.15	12	<1.0	<0.38
Soil	max			<0.14	1.0	<0.29		<0.17	13	<1.1	<0.41
Freshwater	Loch Calder	1	<1.0	<0.01		<0.02		<0.01	<0.01	<0.03	
Freshwater	Loch Shurrery	1	<1.0	<0.01		<0.01		<0.01	<0.01	<0.03	
Freshwater	Loch Baligill	1	<1.0	<0.01		<0.01		<0.01	<0.01	<0.03	
Freshwater	Heldale Water	1	<1.0	<0.01		<0.01		<0.01	<0.01	<0.01	

Material	Location or selection[c]	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}							
			^{234}U	^{235}U	^{238}U	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	Gross alpha	Gross beta
Terrestrial samples - Annual										
Beef muscle		1	<0.050	<0.050	<0.050	<0.050	<0.050	0.050		
Beef offal		1	<0.050	<0.050	<0.050	<0.050	<0.050	0.050		
Cabbage		1				<0.050	<0.050	0.050		
Carrots		1				<0.050	<0.050	<0.050		
Cauliflower		1				<0.050	<0.050	0.050		
Eggs		1				<0.050	<0.050	0.050		
Lamb muscle		1	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050		
Leeks		1				<0.050	<0.050	0.050		
Mushrooms		1				<0.050	<0.050	0.061		
Parsnip		1				<0.050	<0.050	<0.050		
Pork		1				<0.050	<0.050	0.050		
Potatoes		1				<0.050	<0.050	0.050		
Swede		1				<0.050	<0.050	0.050		
Venison		1				<0.050	<0.050	0.050		
Grass		3	<0.13	<0.050	<0.13	<0.050	<0.050	<0.050		
Grass	max		0.19		0.20					
Soil		3	31	1.4	29	<0.050	0.30	0.16		
Soil	max		37	1.6	34		0.34	0.18		

Table 5.2(a) continued

Material	Location or selection[c]	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}							
			^{234}U	^{235}U	^{238}U	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	Gross alpha	Gross beta
Terrestrial samples - Annual										
Freshwater	Loch Calder	1						<0.01	<0.010	0.054
Freshwater	Loch Shurrery	1						<0.01	<0.010	0.050
Freshwater	Loch Baligill	1						<0.01	<0.010	0.067
Freshwater	Heldale Water	1						<0.01	0.010	0.053

a. Except for seawater and freshwater where units are Bq l^{-1}, and for soil and sediment where dry concentrations apply

b. Data are arithmetic means unless stated as 'Max' in this column. 'Max' data are selected to be maxima. If no 'max' value is given the mean value is the most appropriate for dose assessments

Table 5.2(b) Monitoring of radiation dose rates near Dounreay, 2025

Location	Material or ground type	No. of sampling observations	μGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Sandside Bay	Sediment	2	0.059
Sandside Bay	Winkle Bed	2	0.12
Brims Ness	Sediment	2	0.095
Melvich	Salt marsh	2	0.056
Melvich Sands	Sediment	2	0.052
Strathy Sands	Sediment	2	<0.053
Thurso riverbank	Salt marsh	1	0.077
Thurso riverbank	Sediment	1	0.097
Achvarasdal	Grass	2	0.072
Thurso Park	Grass	2	0.082
Borrowston Mains	Grass	2	0.078
Castletown Harbour	Sediment	2	0.069
Dunnet Bay	Sediment	2	<0.047
Hallam	Grass	2	0.070
Mean beta dose rates			**μSv h^{-1}**
Sandside Bay	Sediment	2	<1.0
Thurso riverbank	Sediment	2	<1.0
Castletown Harbour	Sediment	2	<1.0

Table 5.2(c) Radioactivity in air near Dounreay, 2025

Table 5.3(a) Concentrations of radionuclides in food and the environment near the Grove Centre, Amersham, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}				
			^{3}H	^{131}I	^{137}Cs	Gross alpha	Gross beta
Freshwater samples							
Flounder	Woolwich Reach	1	<25	<4.2	<0.03		
Sediment	Upstream of outfall (Grand Union Canal)	2[E]		<0.31	14	<150	<280
Sediment	Downstream of outfall (Grand Union Canal)	2[E]		<0.53	19	<320	<270
Freshwater	Downstream of outfall (Grand Union Canal)	1[E]	<4.0	<0.21	<0.21	<0.068	0.76
Freshwater	River Chess	1[E]	<3.8	<0.24	<0.21	<0.034	0.046
Freshwater	River Misbourne - downstream	1[E]	<3.4	<0.22	<0.23	0.037	0.062
Crude effluent[b]	Maple Lodge Sewage Treatment Works	2[E]	<11	15	<0.16	<4.2	5.5
Digested sludge[c]	Maple Lodge Sewage Treatment Works	2[E]	<11	1.0	<0.20	<1.4	3.3
Final effluent[d]	Maple Lodge Sewage Treatment Works	2[E]	<10		<0.20	<0.054	0.61

Material	Location or selection	No. of sampling observations[e]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			^{3}H	^{35}S	^{131}I	^{137}Cs	Gross alpha	Gross beta
Terrestrial samples								
Milk		1	<2.3	<0.18	<0.0020	<0.06		
Potatoes		1	<1.8	0.60		<0.04		
Wheat		1	<8.2	1.3		<0.05		
Grass and herbage	Orchard next to site	1[E]			<0.12	<0.11	2.9	170
Grass and herbage	Water Meadows (River Chess)	1[E]			<0.18	<0.21	7.0	310
Soil	Orchard next to site	1[E]			<0.24	6.1	550	680
Soil	Water Meadows (River Chess)	1[E]			<0.25	7.8	340	510

a. Except for milk, water and effluent where units are Bq l^{-1} and for sediment and soil where dry concentrations apply
b. The concentration of ^{3}H as tritiated water was <3.6Bq l^{-1}
c. The concentration of ^{3}H as tritiated water was <4.2Bq l^{-1}
d. The concentration of ^{3}H as tritiated water was <3.6Bq l^{-1}
e. The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime
E Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 5.3(b) Monitoring of radiation dose rates near the Grove Centre, Amersham, 2025

Location	Material or ground type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Bank of Grand Union Canal (downstream)	Grass	2	0.073
Downstream of outfall (Grand Union Canal)	Grass	2	0.069
Upstream of outfall (Grand Union Canal)	Grass	2	0.069
Water Meadows (River Chess)	Grass	1	0.072
Orchard next to site	Grass	1	0.082

Table 5.4 Concentrations of radionuclides in food and the environment near Harwell, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[b], Bq kg^{-1}								
			^{3}H	^{60}Co	^{131}I	^{137}Cs	^{238}Pu	$^{239}Pu+$ ^{240}Pu	^{241}Am	Gross alpha	Gross beta
Freshwater samples											
Flounder	Woolwich Reach	1	<25	<0.03	<4.2	<0.03			<0.12		
Sediment	River Thames (Sutton Courtenay)	1[E]		<0.26		19	<0.060	0.32	<0.43	710	670
Sediment	River Thames (Shillingford)	2[E]		<0.33	1.3	2.2	<0.34	<0.31	<0.46	750	860
Freshwater	River Thames (Long Wittenham)	4[E]	<3.5	<0.21		<0.19				<0.048	0.35
Freshwater	River Thames (Shillingford)	4[E]	<3.5	<0.22		<0.18				<0.040	0.29

Material	Location or selection[c]	No. of sampling observations[d]	Mean radioactivity concentration (fresh)[b], Bq kg^{-1}		
			Organic		
			^{3}H	^{3}H	^{137}Cs
Terrestrial samples					
Milk		2	<2.3	<2.3	<0.05
Milk	max				
Strawberries		1	<2.0	<2.0	0.14
Barley		1	<7.7	<7.7	<0.07

[a] The gamma dose rate in air at 1m over grass at Sutton Courtney was 0.076 µGy h^{-1}

[b] Except for milk and freshwater where units are Bq l^{-1}, and for sediment where dry concentrations apply

[c] Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima
If no 'max' value is given the mean value is the most appropriate for dose assessments

[d] The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

[E] Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 5.5(a) Concentrations of radionuclides in food and the environment near Winfrith, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}									
			^{14}C	^{99}Tc	^{137}Cs	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Marinel samples												
Skates / rays	Weymouth Bay	1			<0.15			<0.09				
Crabs	Lulworth Banks	1	29		<0.04			<0.04				
Scallops	Lulworth Ledges	1			<0.08	0.00051	0.0061	0.00063	0.000060	0.000024		
Seaweed	Bognor Rocks	2[E]		0.43	<0.13			<0.20				
Seaweed	Lulworth Cove	1[E]		<0.64	<0.20			<0.25				
Seawater	Lulworth Cove	1[E]			<0.27			<0.47			<2.5	15

Material	Location or selection[b]	No. of sampling observations[c]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			Organic					
			^{3}H	^{3}H	^{14}C	^{137}Cs	Gross alpha	Gross beta
Terrestrial samples - Annual								
Milk		2	<2.3	<2.3	19	<0.06		
Milk	max		<2.4	<2.4	22	<0.07		
Potatoes		1	<1.9	9.1	21	0.12		
Barley		1	<8.8	<8.8	93	<0.05		
Grass	Near Newburgh Farm Cottages	2[E]		<16	26	<0.23	<3.4	220
Grass	Adjacent to railway	2[E]		<17	25	<0.31	<3.4	130
Sediment	North of site	1[E]				0.78	<160	<110
Sediment	River Frome (upstream)	1[E]				0.58	130	<75
Sediment	River Frome (downstream)	1[E]				4.8	390	250
Sediment	River Win, east of site	1[E]				1.6	570	270
Freshwater	North of site	2[E]		7.5		<0.20	0.051	0.099
Freshwater	River Frome (upstream)	2[E]		<3.5		<0.21	<0.032	0.10
Freshwater	River Frome (downstream)	2[E]		<3.6		<0.20	<0.029	0.16
Freshwater	River Win, east of site	2[E]		57		<0.20	<0.031	0.34

* Not detected by the method used

a. Except for milk and water where units are Bq l^{-1}, and for sediment where dry concentrations apply

b. Data are arithmetic means unless stated as 'max' in this column. 'Max' data are selected to be maxima
If no 'max' value is given the mean value is the most appropriate for dose assessments

c. The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

E Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 5.5(b) Monitoring of radiation dose rates near Winfrith, 2025

Location	Material or ground type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Weymouth Bay	Shingle	1	0.063
Osmington Mills	Pebbles and rock	1	0.067
Durdle Door	Shingle	1	0.082
Lulworth Cove	Shingle	1	0.074
Kimmeridge Bay	Pebbles and shingle	1	0.092
Swanage Bay	Sand and shingle	1	0.068
Poole Harbour	Sand and shingle	1	0.063

Table 5.6 Concentrations of radionuclides in the environment near Culham, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}					
			^{3}H	^{14}C	^{131}I	^{137}Cs	Gross alpha	Gross beta
Grass and herbage	0.6km east of site perimeter	2	<13	23		<0.16		290
Freshwater	River Thames (upstream)	2	<3.5			<0.19	<0.043	0.30
Freshwater	River Thames (downstream)	2	<3.6			<0.21	<0.044	0.36
Sediment	River Thames (upstream)	2			1.4	<4.5		
Sediment	River Thames (downstream)	2			2.0	11		
Soil	0.6km east of site perimeter	1	<9.3	<1.5		0.54		570

a. Except for freshwater where units are Bq l^{-1}, and for sediment and soil where dry concentrations apply

6 Defence establishments

Highlights

- For the defence establishments assessed in 2025 the 'total dose' for the representative person was 10% of the annual dose limit

Aldermaston and Burghfield, Berkshire

- 'total dose' for the representative person was 0.10mSv and increased in 2025 compared to 2024

Barrow, Cumbria

- 'total dose' for the representative person was 0.066mSv and increased in 2025 compared to 2024

Derby, Derbyshire

- 'total dose' for the representative person was 0.006mSv and was similar in 2025 to 2024

Devonport, Devon

- 'total dose' for the representative person was less than 0.005mSv and unchanged in 2025 compared to 2024

Faslane and Coulport, Argyll and Bute

- 'total dose' for the representative person was 0.007mSv and increased in 2025 compared to 2024

Rosyth, Fife

- 'total dose' for the representative person was 0.007mSv and decreased in 2025 compared to 2024

This section considers the results of monitoring undertaken by the Environment Agency, FSA, FSS and SEPA, near 8 defence-related establishments in the UK. In addition, the MOD undertakes monitoring at other defence sites where radiological contamination may occur.

In 2025, gaseous and liquid discharges were below regulated limits for each of the defence establishments, see Appendix 1, Table A1.1 and Table A1.2. Solid waste transfers in 2025 from nuclear establishments in Scotland (Coulport, Faslane, Rosyth and Vulcan) are also given in Appendix 1 (Table A1.4).

6.1 Aldermaston and Burghfield

TThe Atomic Weapons Establishment (AWE) has 2 sites located in Berkshire: AWE Aldermaston and AWE Burghfield. AWE Aldermaston provides and maintains the fundamental components of the UK's nuclear deterrent, including component manufacture and radioactive waste management activities. The day-to-day operations and the maintenance of the UK's nuclear stockpile are managed, on behalf of the MOD, by AWE plc (which is a non-departmental public body, wholly owned by the MOD). AWE Burghfield is responsible for the final assembly and maintenance of warheads whilst in service, as well as their decommissioning. Gaseous and liquid discharges of radioactive waste to the environment are regulated by the Environment Agency, permitting discharges of low concentrations of radioactive waste.

The most recent habits survey to determine the consumption and occupancy rates by members of the public in the vicinity of the sites was undertaken in 2022 [180].

6.1.1 Doses to the public

In 2025, the 'total dose' from all pathways and sources of radiation was 0.10mSv (Table 6.1), or 10% of the dose limit to members of the public. This is an increase from 0.010mSv in 2024. This increase in the 'total dose' was primarily a result of a higher estimate of direct radiation from Aldermaston in 2025, which was driven by abnormally low background radiation measurements in the vicinity of the site rather than measurable increases in direct radiation from the site. This can arise from the inherent variability and measurement uncertainties associated with establishing background dose rates. As in recent years, the representative person was an adult consuming game meat at high rates.

Source-specific assessments for high-rate consumers of locally grown foods, for sewage workers, and for anglers gave exposures that were less than 0.005mSv in 2025 (Table 6.1), and these were consistent with the corresponding assessment results of recent years. Estimates of activity concentrations in fish, used for the dose determination, have been based on shellfish samples from the aquatic monitoring programme. A low consumption rate of 1kg per year for fish has been included in the dose assessment for anglers.

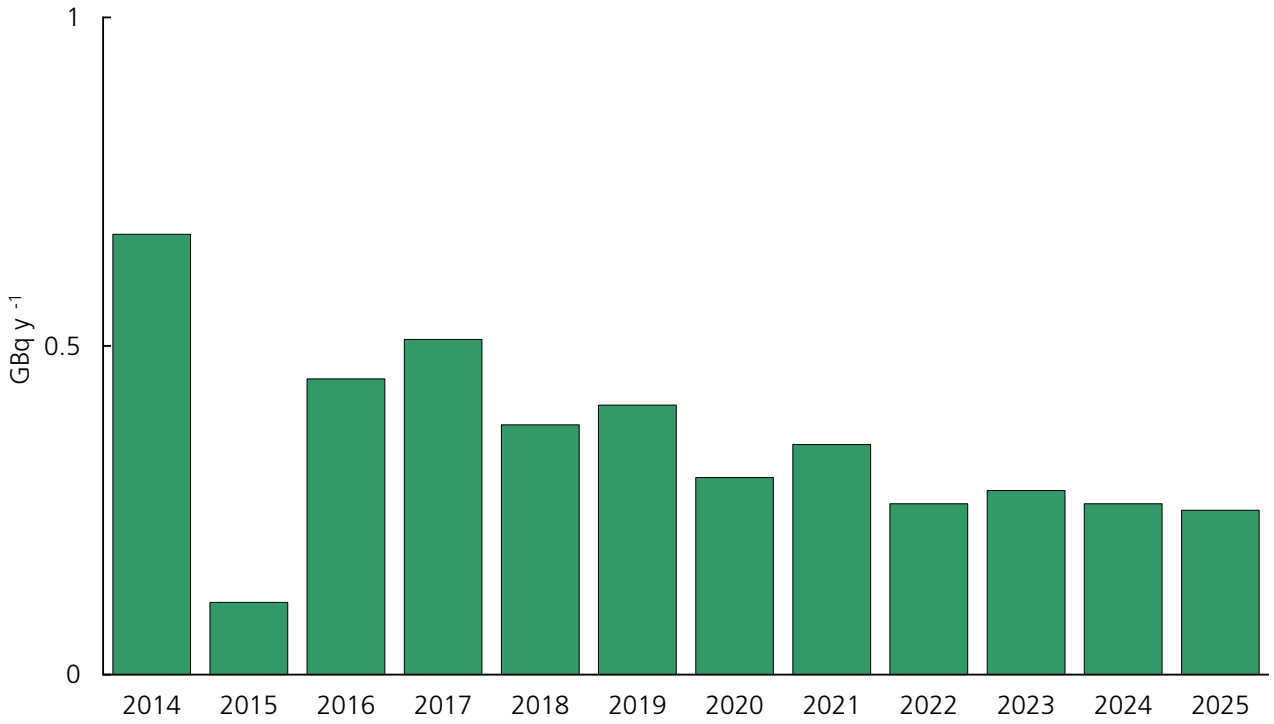
6.1.2 Gaseous discharges and terrestrial monitoring

Permitted discharges of gaseous radioactive waste are made via stacks from facilities at AWE Aldermaston and AWE Burghfield. Samples of milk, terrestrial foodstuffs, grass and soil were taken from locations close to the sites (Figure 5.10), and the results of the terrestrial monitoring in 2025 are given in Table 6.2(a). In 2025, tritium concentrations and other radionuclides in foodstuffs, including milk, were very low or reported as 'less than values'. Caesium-137 concentrations were positively detected in soil samples and were generally similar to those measured in previous years. For all food samples, caesium-137 concentrations were reported as 'less than values' in 2025. Caesium-137 was positively detected in one of the four grass samples in 2025. Uranium isotopes in milk were not positively detected in 2025 as was the also case in 2024.

6.1.3 Liquid waste discharges and aquatic monitoring

Permitted discharges of radioactive liquid effluent are made to the sewage treatment works at Silchester (Figure 5.10), and to the Aldermaston Stream from AWE Aldermaston. A time-series trend of generally decreasing tritium discharges from AWE Aldermaston, over the period 2014 to 2025, is shown in Figure 6.1. Tritium discharges have declined more significantly, over a longer period in comparison to the last decade [26]. The longer-term decline in discharges is partly due to the reduction of historical groundwater contamination by radioactive decay and dilution by natural processes. Discharges of radioactive liquid effluent from AWE Burghfield are made to a sewage treatment works located on the site. Environmental monitoring of the River Thames, at Pangbourne and Mapledurham, has continued to assess the effect of historical discharges.

Figure 6.1 Trends in liquid discharges of tritium, in GBq y^{-1}, from Aldermaston, Berkshire 2014 to 2025 (including discharges to Silchester sewer and Aldermaston Stream).



Activity concentrations for freshwater, fish, sediment samples, including gully pot sediments from road drains, and measurements of gamma dose rates, are given in Table 6.2(a) and Table 6.2(b). The concentrations of artificial radioactivity detected in the Thames catchment were very low in 2025 and similar to those in recent years. Activity concentrations of artificial radionuclides in shellfish were very low in 2024 and similar to those reported in recent years. The results from analyses of caesium-137 and uranium activity concentrations in River Kennet sediments were broadly consistent with those observed in recent years. As in 2024, tritium concentrations in freshwater samples were all reported as less than values, and caesium-137 concentrations in gully pot sediments were broadly similar to those measured in 2024. Gross alpha and beta activities in freshwater samples were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (based upon the European Directive 2013/51). Gamma dose rates were below or close to natural background.

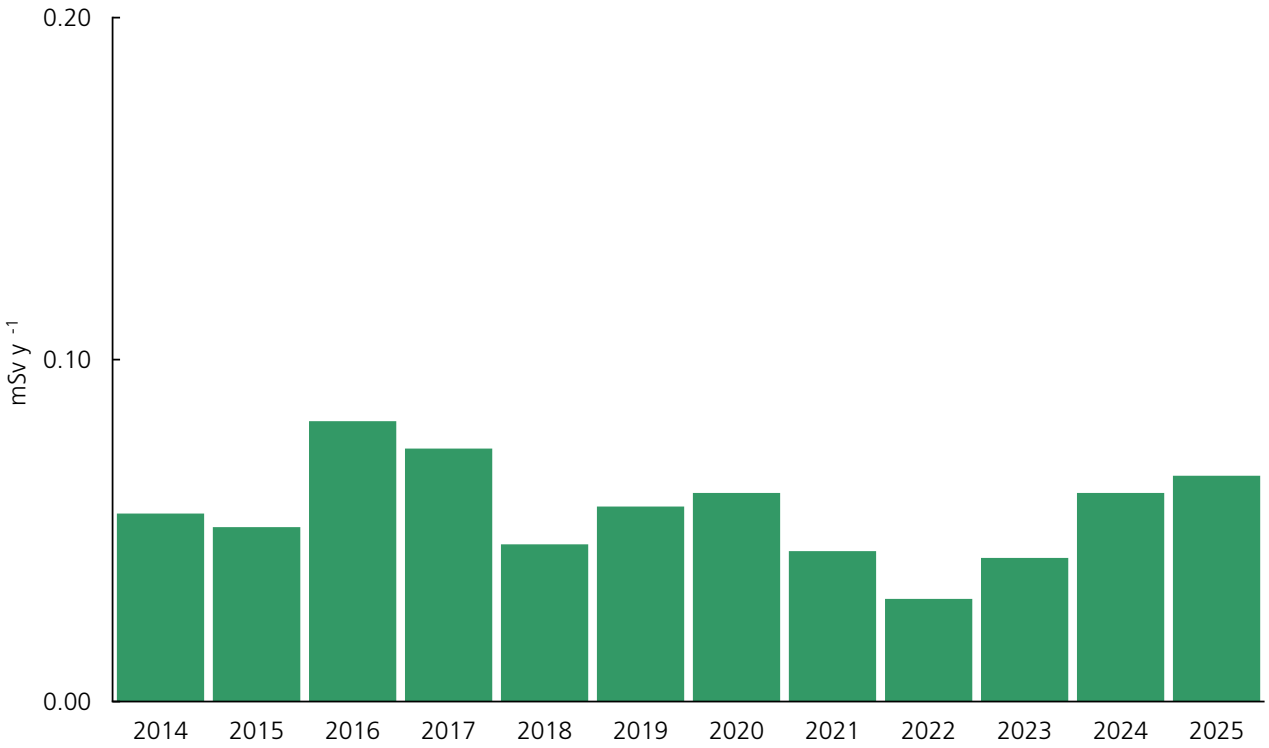
6.2 Barrow, Cumbria

At Barrow, BAE Systems Marine Limited builds, tests and commissions new nuclear-powered submarines. Gaseous discharges were reported as nil, and liquid discharges of tritium, carbon-14 and cobalt-60 to sewer were all below 1% of the annual limit in 2025. The most recent habits survey was undertaken in 2025 [135].

The 'total dose' from all pathways and sources of radiation was 0.066mSv (Table 6.1) in 2025, or less than 7% of the dose limit to members of the public. This is an increase from 0.061mSv in 2024. Most of this dose was due to the effects of Sellafield discharges. As in recent years, the representative person was an adult living on a local houseboat. The increase in 'total dose' was primarily due to an increase in the rate of houseboat occupancy. A secondary factor for the 'total dose' was a change in habits information: the most recent habits survey [135] noted that there was only a houseboat at Askam Pier. As the gamma dose rates at Askam Pier are typically lower

than that at Roa Island, this negated some of the increase in 'total dose' that arose from the increase in houseboat occupancy rates. The trend in 'total dose' over the period 2014 to 2025 is given in Figure 6.2, ranging from 0.030 to 0.082mSv.

Figure 6.2 'Total dose', in mSv y^{-1}, at Barrow (2014 to 2025). Doses are largely due to Sellafield discharges



As in 2024, source-specific assessments for a person living on a local houseboat gave exposures that were slightly lower than the 'total dose' in 2025 (Table 6.1). The assessment for a high-rate consumer of locally grown food (<0.005mSv) was unchanged from the 2024 value. No assessment of seafood consumption was undertaken in 2025 due to the absence of relevant monitoring data. However, the dose from seafood consumption is less important than that from external exposure on a houseboat [138].

The FSA's terrestrial monitoring at Barrow is limited to vegetable and grass (or silage) sampling. The Environment Agency monitors gamma dose rates and radioactivity concentrations in sediment samples from local intertidal areas and is directed primarily at the far-field effects of Sellafield discharges. The results are given in Table 6.3(a) and Table 6.3(b). No effects of discharges from Barrow were apparent in the concentrations of radioactivity in vegetables and grass, with most results reported at or below the limit of detection. The reported gross beta concentration, due to the far-field effects of Sellafield discharges, in Walney Channel sediment in 2025 was generally consistent with values measured in recent years. The gamma dose rates in intertidal areas near Barrow in 2025 are given in Table 6.3(b) and Table 3.9. Gamma dose rates measured in 2025 were also generally consistent with measurements from recent years. Gamma dose rates for the area are higher than the expected background levels, and this enhancement is most likely due to the far-field effects of historical discharges from Sellafield.

6.3 Derby, Derbyshire

Rolls-Royce Submarines Limited (RRSL) a subsidiary of Rolls-Royce plc, carries out design, development, testing and manufacture of reactor cores for nuclear-powered submarines at its 2 adjacent sites in Raynesway in Derby. Small discharges of liquid effluent are made via the Megaloughton Lane STW to the River Derwent and very low concentrations of alpha activity are present in releases to the atmosphere. Other wastes are disposed of by transfer to other sites, for example, at a permitted solid waste disposal site or by incineration. The most recent habits survey was undertaken in 2021 [181].

6.3.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was 0.006mSv in 2025 (Table 6.1), which is less than 1% of the dose limit to members of the public. This is similar to the value reported in 2024 (0.007mSv). The representative person was a child living near the site in 2025 and was unchanged from 2024. Source-specific assessment for consumption of fish, crustaceans and drinking river water at high-rates, and for spending time over river-washed areas gave an exposure that was less than 0.005mSv in 2025. Similarly, a source-specific assessment for inhabitants of the area consuming locally grown vegetables gave an exposure estimate that was less than 0.005mSv in 2025 (Table 6.1).

Results of the routine monitoring programme at Derby are given in Table 6.3(a). Concentrations of uranium in samples taken around the site in 2025 were generally similar to those observed in previous years. More detailed analysis in previous years has shown the activity as being consistent with natural sources. The gross alpha and beta activities in water samples from the River Derwent were less than the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (based upon the European Directive 2013/51). Caesium-137 detected in sediments from local water courses was most likely from historic fallout associated with overseas sources, such as nuclear weapons testing.

Table 6.3(a) also includes analytical results for a water sample taken from Fritchley Brook, downstream of Hilts Quarry, near Crich in Derbyshire. Rolls-Royce Submarines Limited formerly used the quarry for the controlled burial of solid low level radioactive waste. Concentrations of uranium isotopes detected in the sample in 2025 were broadly similar to those reported elsewhere in Derbyshire (Table 8.7).

6.4 Devonport, Devon

The Devonport Royal Dockyard consists of 2 parts and is operated by His Majesty's Naval Base (HMNB) (owned and operated by the MOD) and Devonport Royal Dockyard Limited (owned by Babcock International Group plc). Devonport Royal Dockyard refits, defuels, refuels, repairs and maintains the Royal Navy's nuclear-powered submarine fleet. Gaseous and liquid discharges of radioactive waste to the environment are regulated by the Environment Agency.

The most recent habits survey to determine the consumption and occupancy rates by members of the public was undertaken in 2017 [182]. The routine monitoring programme in 2025 consisted of measurements of gamma dose rate and analysis of grass, vegetables, fish, shellfish and other environmental indicator materials (Table 6.3(a) and Table 6.3(b)).

6.4.1 Doses to the public

The 'total dose' from all pathways and sources of radiation was less than 0.005mSv in 2025 (Table 6.1), which was less than 0.5% of the dose limit, and unchanged from 2024. The representative person was an adult consuming locally collected marine plants at high rates, who also consumed fish (which largely determined the exposure) and spent time on intertidal areas. The trend in annual 'total dose' at Devonport is for exposures that are consistently less than 0.005mSv (Table 1.3)

As in recent years, source-specific assessments for a high-rate consumer of locally grown food (including doses from external and inhalation from gaseous discharges), for fish and shellfish consumers, and for an occupant of a houseboat, gave exposures that were less than 0.005mSv in 2025 (Table 6.1).

6.4.2 Gaseous discharges and terrestrial monitoring

Permitted discharges of gaseous radioactive waste at Devonport are made to the atmosphere.

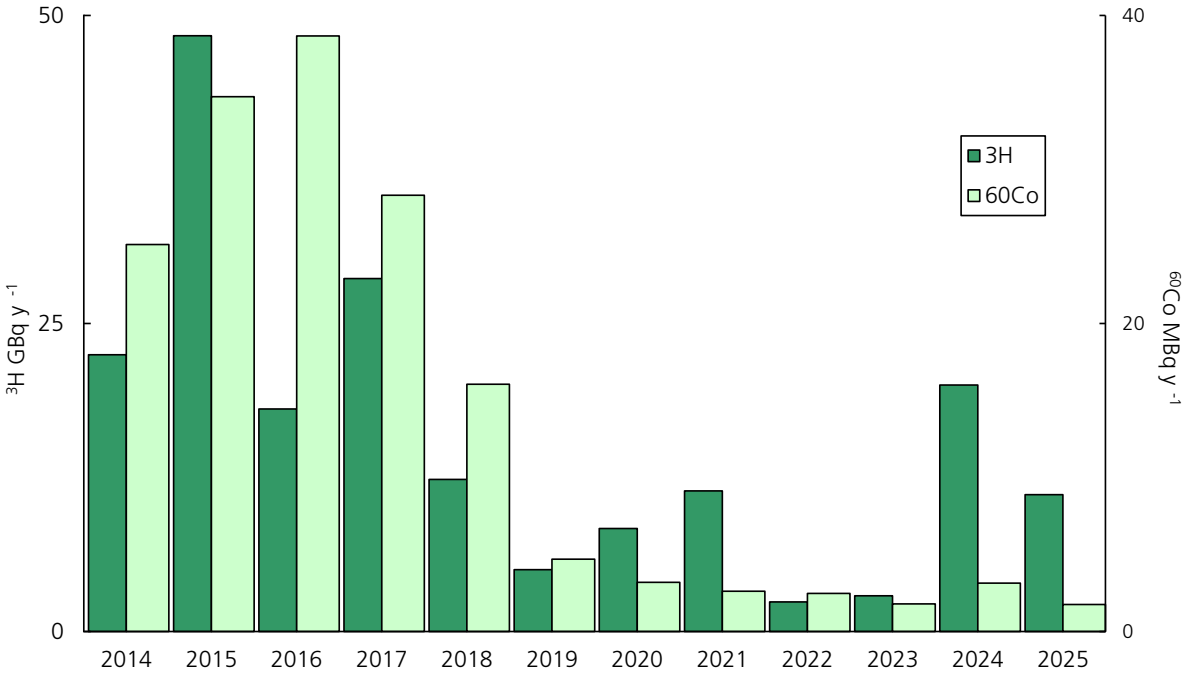
In 2025, gaseous discharges of argon-41 increased in comparison to those reported in 2024. Terrestrial samples (grass and potatoes) were analysed for several radionuclides (Table 6.3(a)). Activity concentrations in terrestrial samples were reported as 'less than values' in 2025.

6.4.3 Liquid waste discharges and aquatic monitoring

Permitted discharges of liquid radioactive waste are made to the Hamoaze, which is part of the Tamar estuary and to the local sewer.

The trends of tritium and cobalt-60 discharges over time (2014 to 2025) are given in Figure 6.3. The main contributor to the variations in tritium discharges over time has been the re-fitting of Vanguard class submarines. These submarines have a high tritium inventory as they do not routinely discharge primary circuit coolant until they undergo refuelling at Devonport. Cobalt-60 discharges have declined more substantially than tritium discharges since the early 2000s [26]. This reduction is largely attributable to improvements in submarine reactor design, which have decreased the production of cobalt-60 during operation and, consequently, reduced releases during submarine maintenance activities

Figure 6.3 Trends in liquid discharges of tritium, in GBq y^{-1}, and cobalt-60, in MBq y^{-1}, from Devonport, Devon 2014 to 2025.



Concentrations of tritium and cobalt-60 in marine samples were reported as 'less than values' in 2025 as they were in 2024. Low caesium-137 concentrations, likely to originate from other sources (such as nuclear weapons testing), were measured in sediment samples. Carbon-14 concentrations in seafood species were generally similar to those in previous years. The seaweed samples obtained in 2025 contained concentrations of iodine-131, this was most likely to have originated from the therapeutic use of this radionuclide in local hospitals, as iodine-131 is not discharged by the site. Gamma dose rates in the vicinity of Devonport in 2025 were similar to those in recent years and reflect the local effects of enhanced background radiation from natural sources. The results are given in Table 6.3(a) and Table 6.3(b).

6.5 Faslane and Coulport, Argyll and Bute

The His Majesty's Naval Base Clyde establishment consists of the naval base at Faslane and the armaments depot at Coulport. Babcock Marine, a subsidiary of Babcock International Group plc, operates His Majesty's Naval Base Clyde, Faslane in partnership with the MOD. However, the MOD remains in control of the undertaking, through the Naval Base Commander, Clyde (NBC Clyde) in relation to radioactive waste disposal. MOD through NBC Clyde also remains in control of the undertaking at Coulport although many of the activities undertaken at Coulport have been outsourced to an industrial alliance comprising of AWE plc, Babcock and Lockheed Martin UK (known as ABL).

From the 1st of January 2025 discharges of liquid and gaseous radioactive waste were made under a single Letter of Approval (LoA) which covers both the Faslane and Coulport sites. The single LoA is a new approach and combines the previous four Letters of Agreement that had been in place for many years. The new LoA is generally more restrictive than the previous LoA's with the limits on existing discharges being significantly reduced and some disposal pathways limited for the first time. See Appendix 1 (Tables A1.1 and A1.2) for a summary of the discharge limits for all sites, including Faslane and Coulport.

Construction of the Nuclear Support Hub (NSH) facility at Faslane was completed in 2023, and commissioning of the NSH will continue in 2026.

Gaseous tritium discharges from Coulport were broadly similar in 2025 to those in recent years. Gaseous discharges from Faslane consisted of tritium and a small amount of waste from other radionuclides in 2025, and liquid discharges were limited solely to tritium in general effluents (see Appendix 1, Table A1.1 and Table A1.2, respectively).

Solid waste transfers in 2025 are given in Appendix 1 (Table A1.4).

The most recent habits survey to determine the consumption and occupancy rates by members of the public was undertaken in 2023. The report is available on SEPA's website (https://beta.sepa.scot/topics/radioactive-substances/guidance-and-supporting-documents/radiological-habits-surveys/#anchor-hmnbclyde), and copies can also be requested from SEPA by emailing RSEnquiries@sepa.org.uk.

The 'total dose' from all pathways and sources of radiation was 0.007mSv in 2025 (Table 6.1), which was less than 1% of the dose limit to members of the public. This is similar to the value of 0.005mSv for 2024. The representative person was an adult consuming fish at high rates and was unchanged from 2024. Activity concentrations in fish (not collected in recent years) were estimated using reported environmental fish data in 2025, sampled outside the aquatic habits survey area of this site, but within the Firth of Clyde. The assessment of this 'total dose' was therefore highly conservative, due to the assumption of fish concentration data. In 2025, the source-specific assessment for a high-rate consumer of shellfish, which is based on limited data, gave an exposure of 0.008mSv, which was also similar to the 2024 value (0.006mSv). The dose to a consumer of locally grown food, was less than 0.005mSv and unchanged from 2024.

The routine marine monitoring programme consisted of the analysis of seawater, seaweed and sediment samples, and gamma dose rate measurements. Terrestrial monitoring included meat, honey, water, grass and soil sampling. The results in 2025 are given in Table 6.3(a) and Table 6.3(b) and were generally similar to those in recent years. Caesium-137 was positively detected at a low concentration in honey (as in recent years). Caesium-137 was also positively detected in sediment and soil. The measured concentrations are consistent with the distant effects of discharges from Sellafield, fallout from Chernobyl and nuclear weapons testing. Other radionuclide concentrations were generally reported as 'less than values' in 2025. Concentrations of tritium, gross alpha and gross beta were much lower than the investigation levels in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51).

Gamma dose rates measured in the surrounding area were difficult to distinguish from natural background (Table 6.3(b)).

6.6 Rosyth, Fife

The Rosyth naval dockyard is located on the north bank of the River Forth in Fife, 3km west of the Forth Road Bridge and some 50km from the mouth of the Firth of Forth. It is sited on reclaimed land, with reclamation completed in 1916. From 1916, the site was known as HM Dockyard Rosyth and activities conducted there included refitting and maintaining warships.

In 1997, Rosyth Royal Dockyard Limited (RRDL), a wholly owned subsidiary of Babcock International Group Marine Division, was set up to be responsible for the decommissioning of the dockyard site and the management of radioactive waste that had arisen from the re-fitting of nuclear submarines which ended in 2003. Site decommissioning started in 2006 and has mainly been completed, except for some small areas of the site where facilities are required to continue managing radioactive wastes.

The MOD sold the site to Babcock International Group Marine Division who now manage and operate the site. However, radioactive waste that was generated by the site, to support the nuclear submarine fleet, is owned by the MOD. Therefore, the MOD has entered into a contract with RRDL to manage all radioactive waste on the dockyard site. As the radioactive waste owner, the MOD maintains an overview of procedures to ensure RRDL fully complies with the terms and conditions of its contract.

In 2016, SEPA granted RRDL an authorisation (under Radioactive Substances Act 1993) to dispose of radioactive waste arising on the Rosyth dockyard site. This allows RRDL to dispose of LLW that arises from the decommissioning of the Rosyth premises, from former submarine re-fitting operations and from waste transferred from the MOD from the dismantling of the 7 redundant nuclear submarines currently stored afloat at the dockyard site. The authorisation was transitioned to a permit under the Environmental Authorisations (Scotland) Regulations 2018 (EASR) with a new permit being issued in March 2019. In 2023, RRDL applied for a permit variation to allow the management of intermediate level waste from the dismantling of the 7 submarines stored at the dockyard. A Letter of Approval (LoA) (effective from 2016) to the MOD allows the transfer of LLW from the 7 nuclear submarines berthed at the Rosyth dockyard site to RRDL. Granting of the LoA and new authorisation to RRDL has permitted the start of the MOD submarine dismantling programme at Rosyth. Work to dismantle and remove radioactive and conventional wastes from each submarine and subsequently clean up the Rosyth site is expected to take up to 15 years to complete. A new LoA was issued to the MOD in April 2025 in line with the Memorandum of Understanding between SEPA and the MOD. The LoA has been applied to the submarines whilst afloat in the main basin at Rosyth and under the control of MOD Clyde. The submarine in dry dock number 2 and under RRDL control is being dismantled under the permit granted to RRDL.

The most recent habits survey was undertaken in 2022, and copies of the report are available from SEPA by emailing RSEnquiries@sepa.org.uk.

The ‘total dose’ from all pathways and sources of radiation was 0.007mSv in 2025 (Table 6.1), which is less than 1% of the dose limit to members of the public. In 2025, the representative person was an adult consuming crustacean shellfish at high rates, and this was unchanged from 2024.

The decrease in 'total dose' was mainly attributed to a decrease in the gamma dose rate measured over sediments in 2025. The source-specific assessment for marine pathways (fishers and beach users) was estimated to be 0.005mSv in 2025 (a decrease from 0.008mSv in 2024). The reason for the decrease in dose was the same as that contributing to the maximum 'total dose'.

The gaseous and liquid discharges from Rosyth in 2025 are given in Appendix 1 (Table A1.1 and Table A1.2, respectively), and solid waste transfers in Table A1.4. Liquid wastes are discharged via a dedicated pipeline to the Firth of Forth.

The direct radiation from the site was less than 0.001mSv in 2025 (Table 1.1). This was unchanged from 2024. This value of direct radiation is based upon actual measurements and is a more representative background radiation measurement location.

SEPA's routine monitoring programme included analysis of shellfish, environmental indicator materials and measurements of gamma dose rates in intertidal areas. Results are shown in Table 6.3(a) and Table 6.3(b). The radioactivity concentrations measured in freshwater samples were low in 2025 and similar to those observed in recent years, and in most part due to the combined effects of Sellafield, weapon testing and Chernobyl. Gamma dose rates were slightly higher in 2025 than in 2024 but, as in previous years, were difficult to distinguish from natural background at all measurement locations.

6.7 Vulcan NRTE, Highland

The Vulcan Naval Reactor Test Establishment (NRTE) is operated by the Submarine Delivery Agency, part of the MOD, and its purpose was to prototype submarine nuclear reactors. It is located adjacent to the Dounreay site, and the impact of its discharges is considered along with those from Dounreay (in Section 5). The transfer of solid and aqueous waste to NRS Dounreay and the disposal of gaseous waste are made under a LoA between SEPA and the MOD. It is intended to transition the LoA to replicate an EASR permit in line with the current Memorandum of Understanding between SEPA and the MOD.

Ownership of the site will be transferred from MOD to the NDA for decommissioning once operations have been completed (and subject to regulatory approval).

Gaseous discharges, and solid waste transfers, from Vulcan NRTE in 2025 are given in Appendix 1 (Table A1.1 and Table A1.4, respectively).

Table 6.1 Individual doses - defence sites, 2025

Site	Representative person[a]	Exposure mSv, per year						
		Total	Fish and shell-fish	Other local food	External radiation from inter-tidal areas or river banks[b]	Intakes of sediment or water[c]	Gaseous plume related path-ways	Direct radiation from site
Aldermaston and Burghfield								
'Total dose' - all sources	**Adult game meat consumers**	**0.10[d]**	**-**	**<0.005**	**-**	**-**	**<0.005**	**0.10**
Source-specific doses	Anglers	<0.005[d]	<0.005	-	<0.005	-	-	-
	Infant inhabitants and consumers of locally grown food	<0.005[d]	-	<0.005	-	-	<0.005	-
	Workers at Silchester STW	<0.005	-	-	<0.005[e]	<0.005[f]	-	-
Barrow								
'Total dose' - all sources	**Adult occupants on houseboats[g]**	**0.066**	**-**	**-**	**0.066**	**-**	**-**	**-**
Source-specific doses	Houseboat occupants[g]	0.065	-	-	0.065	-	-	-
	Consumers of locally grown food	<0.005	-	<0.005	-	-	-	-
Derby								
'Total dose' - all sources	**Local child inhabitants (0.25 - 0.5km)**	**0.006**	**-**	**<0.005**	**-**	**-**	**<0.005**	**0.006**
Source-specific doses	Anglers consuming fish, shellfish and drinking water	<0.005	<0.005	-	<0.005	<0.005	-	-
	Children Inhabitants and consumers of locally grown food	<0.005	-	<0.005	-	-	<0.005	-
Devonport								
'Total dose' - all sources	**Adult consumers of marine plants and algae**	**<0.005**	**<0.005**	**-**	**<0.005**	**-**	**-**	**-**
Source-specific doses	Seafood consumers	<0.005	<0.005	-	<0.005	-	-	-
	Houseboat occupants	<0.005	-	-	<0.005	-	-	-
	Prenatal children of Inhabitants and consumers of locally grown food	<0.005	-	<0.005	-	-	<0.005	-
Faslane								
'Total dose' - all sources	**Adult sea fish consumers**	**0.007**	**0.007**	**<0.005**	**<0.005**	**-**	**-**	**-**
Source-specific doses	Seafood consumers	0.008	0.007	-	<0.005	-	-	-
	Consumers of locally grown food	<0.005	-	<0.005	-	-	-	-
Rosyth								
'Total dose' - all sources	**Adult crustacean consumers**	**0.007**	**<0.005**	**-**	**0.006**	**-**	**-**	**-**
Source-specific doses	Fishermen and beach users	0.005	<0.005	-	<0.005	-	-	-

a. The 'total dose' is the dose which accounts for all sources including gaseous and liquid discharges and direct radiation.
The 'total dose' for the representative person with the highest dose is presented.
Other dose values are presented for specific sources, either liquid discharges or gaseous discharges, and their associated pathways.
They serve as a check on the validity of the 'total dose' assessment
The representative person is an adult unless otherwise specified
Data are presented to 2 significant figures or 3 decimal places. Data below 0.005 mSv are reported as <0.005 mSv

b. Doses ('total dose' and source-specific doses) only include estimates of anthropogenic inputs (by substracting background and cosmic sources from measured gamma dose rates)

c. Water is from rivers and streams and not tap water

d. Includes a component due to natural sources of radionuclides

e. External radiation from raw sewage and sludge

f. Intakes of resuspended raw sewage and sludge

g. Exposures at Barrow are largely due to discharges from the Sellafield site

Table 6.2(a) Concentrations of radionuclides in food and the environment near Aldermaston and Burghfield, 2025

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[b], Bq kg^{-1}						
			Organic ^{3}H	^{3}H	^{131}I	^{137}Cs	^{234}U	^{235}U	^{238}U
Freshwater samples									
Flounder	Woolwich Reach	1		<25	<4.2	<0.03			
Signal crayfish	Ufton Bridge - Theale	1	<25	<25	<0.06	<0.02	0.035	0.0010	0.024
Sediment	Pangbourne	2[E]				<0.73	16	0.79	18
Sediment	Mapledurham	2[E]				8.9	11	<0.42	11
Sediment	Aldermaston	4[E]				2.7	19	<0.95	18
Sediment	Spring Lane	4[E]				<0.46	14	<0.89	14
Sediment	Stream draining south	4[E]				1.4	11	<0.73	11
Sediment	Near Chamber 39 of PPL	4[E]				<1.0	13	<1.0	15
Sediment	Oval pond near Chamber 14	4[E]				1.3	15	<0.93	15
Sediment	River Kennet	4[E]				1.9	16	<0.82	15
Sediment	Hosehill Lake	3[E]				<0.90	21	<0.90	20
Gully pot sediment	Aldermaston Gate	1[E]		<9.2		0.61	18	0.80	18
Gully pot sediment	Falcon Gate	1[E]		<18		5.4	17	0.72	17
Gully pot sediment	Tadley Entrance	1[E]		<21		2.2	18	0.68	19
Freshwater	Pangbourne	2[E]		<3.5		<0.15	0.0060	<0.00070	0.0052
Freshwater	Mapledurham	2[E]		<3.5		<0.20	0.0089	<0.00066	0.0065
Freshwater	Aldermaston	4[E]		<3.5		<0.19	0.0064	<0.00077	0.0045
Freshwater	Spring Lane	4[E]		<3.5		<0.13	0.0031	<0.0013	0.0022
Freshwater	Stream draining south	4[E]		<3.7		<0.17	0.0049	<0.00089	<0.0036
Freshwater	Near Chamber 39 of PPL	4[E]		<3.6		<0.21	0.0061	<0.00066	0.0048
Freshwater	Oval pond near Chamber 14	4[E]		<3.6		<0.20	<0.0013	<0.0010	<0.0011
Freshwater	River Kennet	4[E]		<3.5		<0.19	0.0063	<0.00071	0.0046
Freshwater	Hosehill Lake	4[E]		<3.5		<0.18	0.0048	<0.00098	0.0033
Crude effluent	Silchester treatment works	2[E]		<3.7		<0.23	0.038	<0.0010	0.028
Final effluent	Silchester treatment works	2[E]		<3.4		<0.23	0.027	<0.0024	0.019
Sewage sludge	Silchester treatment works	2[E]		<12	28	<0.23	0.21	<0.0085	0.20

Table 6.2(a) continued

Material	Location	No. of sampling observations	Mean radioactivity concentration (fresh)[b], Bq kg^{-1}						
			^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross alpha	Gross beta
Freshwater samples									
Flounder	Woolwich Reach	1			<0.12				
Signal Crayfish	Ufton Bridge - Theale	1	<0.000068	0.000036	0.000029	*	*		
Sediment	Pangbourne	2[E]	<0.21	<0.85	<0.71			640	620
Sediment	Mapledurham	2[E]	<0.20	<0.58	<0.50			290	<240
Sediment	Aldermaston	4[E]	<0.16	1.7	<0.46			580	750
Sediment	Spring Lane	4[E]	<0.18	<0.56	<0.48			190	<170
Sediment	Stream draining south	4[E]	<0.11	<0.77	<0.68			<260	<200
Sediment	Near Chamber 39 of PPL	4[E]	<0.094	<0.29	<0.52			270	480
Sediment	Oval pond near Chamber 14	4[E]	<0.096	<0.28	<0.58			280	480
Sediment	River Kennet	4[E]	<0.12	<0.41	<0.52			320	360
Sediment	Hosehill Lake	3[E]	<0.14	<0.38	<0.58			490	710
Gully pot sediment	Aldermaston Gate	1[E]	<0.058	<0.36	<0.42			620	700
Gully pot sediment	Falcon Gate	1[E]	<0.060	0.56	<0.47			620	980
Gully pot sediment	Tadley Entrance	1[E]	<0.11	1.8	<0.45			490	790
Freshwater	Pangbourne	2[E]	<0.0013	<0.0032	<0.0053			<0.065	0.30
Freshwater	Mapledurham	4[E]	<0.00054	<0.0030	<0.0025			<0.057	0.24
Freshwater	Aldermaston	4[E]	<0.00076	<0.0020	<0.0027			<0.025	0.20
Freshwater	Spring Lane	4[E]	<0.00075	<0.0020	<0.0027			<0.031	0.15
Freshwater	Stream draining south	4[E]	<0.00086	<0.0021	<0.0025			<0.029	0.21
Freshwater	Near Chamber 39 of PPL	4[E]	<0.0012	<0.0023	<0.0024			<0.047	0.11
Freshwater	Oval pond near Chamber 14	4[E]	<0.00093	<0.0021	<0.0027			<0.023	0.062
Freshwater	River Kennet	4[E]	<0.00077	<0.0020	<0.0025			<0.035	0.099
Freshwater	Hosehill Lake	2[E]	<0.00071	<0.0021	<0.0032			<0.023	0.32
Crude effluent	Silchester treatment works	2[E]	<0.0012	<0.0032	<0.44			<0.080	0.84
Final effluent	Silchester treatment works	2[E]	<0.0015	<0.0035	<0.34			<0.067	0.69
Sewage sludge	Silchester treatment works	2[E]	<0.0088	<0.010	<0.42			24	27

Table 6.2(a) continued

Material	Location or selection[b]	No. of sampling observ-ations[c]	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}									
			^{3}H	^{137}Cs	^{234}U	^{235}U	^{238}U	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	Gross alpha	Gross beta
Terrestrial samples												
Milk		2	<2.3	<0.05	<0.0021	<0.0021	<0.0026	<0.000026	<0.000019	<0.000033		
Milk	max						<0.0030	<0.000028		0.000034		
Potatoes		1	<1.9	<0.07	0.0048	0.00030	0.0049	0.000018	0.00023	0.00033		
Wheat		1	<7.8	<0.20	0.0022	<0.00081	<0.00081	0.000034	0.000080	0.000083		
Grass and herbage	0.25km east of Main gate	1[E]	<16	<0.20	0.16	<0.033	0.11	<0.013	<0.057		8.1	310
Grass and herbage	Opposite Gate 36	1[E]	<15	<0.21	0.11	<0.027	0.097	<0.013	<0.061		11	320
Grass and herbage	Opposite Gate 26A	1[E]	<11	<0.27	0.28	<0.011	0.21	<0.016	<0.088		7.8	260
Grass and herbage	Tadley, Perimeter fence	1[E]	<11	1.5	2.2	0.10	2.2	<0.021	<0.093		52	250
Soil	0.25km east of Main gate	1[E]	<6.6	1.9	13	<0.85	14	<0.066	<0.27		280	540
Soil	Opposite Gate 36	1[E]	<7.0	12	10	0.81	11	<0.055	0.30		270	420
Soil	Opposite Gate 26A	1[E]	<4.7	6.1	13	0.47	13	<0.067	<0.37		230	360
Soil	Tadley, Perimeter fence	1[E]	<7.6	6.4	24	1.0	24	<0.067	<0.37		630	720

* Not detected by the method used

a. Except for milk, sewage effluent and water where units are Bq l^{-1}, and for sediment and soil where dry concentrations apply

b. Data are arithmetic means unless stated as 'max'. 'Max' data are selected to be maxima. If no 'max' value is given the mean value is the most appropriate for dose assessments

c. The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

E Measurements labelled "E" are made on behalf of the Environment Agency, all other measurements are made on behalf of the Food Standards Agency

Table 6.2(b) Monitoring of radiation dose rates near Aldermaston and Burghfield, 2025

Location	Ground type	No. of sampling observations	µGy h^{-1}
Mean gamma dose rates at 1m over substrate			
Pangbourne, riverbank	Grass	2	0.067
Mapledurham, riverbank	Grass	2	0.073

Table 6.3(a) Concentrations of radionuclides in food and the environment near defence establishments, 2025

Material	Location or selection	No. of sampling observ-ations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}							
			Organic ^{3}H	^{3}H	^{14}C	^{60}Co	^{125}Sb	^{131}I	^{137}Cs	^{154}Eu
Barrow										
Beetroot	Barrow	1[F]		<2.1		<0.08	<0.14	<0.12	<0.06	<0.26
Grass	Barrow	1[F]		<2.2		<0.05	<0.11	<0.24	0.40	<0.15
Sediment	Walney Channel - N of discharge point	2				<0.30	<1.1		36	<0.99
Derby										
Potatoes	Derby	1[F]				<0.06	<0.10	<0.06	<0.04	<0.18
Barley	Derby	1[F]				<0.09	<0.17	<1.3	<0.06	<0.29
Sediment	River Derwent, upstream	1				<0.20			0.95	
Sediment	Fritchley Brook	1				<0.25			0.63	
Sediment	River Derwent, downstream	4				<0.27		2.3	1.3	
Freshwater	River Derwent, upstream	1				<0.20				
Freshwater[b]	Fritchley Brook	1		<3.7		<0.19			<0.15	
Freshwater	River Derwent, downstream	4				<0.19				
Devonport										
Ballan wrasse	Plymouth Sound	1[F]	<25	<25	28	<0.04	<0.11	*	0.12	<0.13
Crabs	Plymouth Sound	1[F]			13	<0.05	<0.12	<0.31	<0.05	<0.17
Shrimps	River Lynher	1[F]			23	<0.18	<0.21	*	<0.16	<0.28
European Oysters	River Lynher	1[F]	<25	<25	8.0	<0.05	<0.12	<0.83	<0.08	<0.16
Seaweed[c]	Beach near Royal Albert Bridge	2				<0.24		2.6		
Sediment[d]	Beach near Royal Albert Bridge	2		<4.0		<0.33			1.8	
Sediment	Torpoint South	2		<5.8		<0.39			5.0	
Sediment	Lopwell	2		<17		<0.18			6.0	
Seawater	Torpoint South	1		<3.6	<2.4	<0.32				
Seawater	Millbrook Lake	1		<3.9	<2.6	<0.26				
Potatoes	Devonport	1[F]		<2.1		<0.05	<0.10	<0.06	<0.07	<0.17
Grass	Devonport	1[F]		<2.3		<0.04	<0.09	<0.08	<0.04	<0.14
Faslane										
Fucus vesiculosus	Garelochhead	1				<0.10	<0.12		0.22	<0.10
Fucus vesiculosus	Carnban	1				<0.10	<0.12		0.24	<0.10
Fucus vesiculosus	Rhu	1				<0.10	<0.10	1.3	0.41	<0.10
Fucus vesiculosus	Cairndhu Point	1				<0.10	<0.14		0.32	<0.11
Fucus vesiculosus	Helensburgh	1				<0.10	<0.16		0.42	<0.10
Sediment	Garelochhead	1				<0.10	<0.28		1.7	<0.21
Sediment	Carnban	1				<0.10	<0.17		1.9	<0.15
Sediment	Rhu	1				<0.10	<0.16		3.6	<0.15
Seawater	Garelochhead	2		<1.0		<0.10	<0.11		<0.10	<0.10
Seawater	Carnban	2		<1.0		<0.10	<0.11		<0.10	<0.10
Seawater	Rosneath Bay	2		<1.0		<0.10	<0.12		<0.10	<0.10
Seawater	Cove	2		<1.1		<0.10	<0.10		<0.10	<0.10
Seawater	Coulport	2		<1.0		<0.10	<0.15		<0.10	<0.10

Table 6.3(a) continued

Material	Location or selection	No. of sampling observ-ations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}							
			Organic							
			^{3}H	^{3}H	^{14}C	^{60}Co	^{125}Sb	^{131}I	^{137}Cs	^{154}Eu
Faslane										
Beef muscle	Faslane	1				<0.05			0.08	
Honey	Faslane	1				<0.13			1.3	
Grass	Auchengaich Reservoir	1		<5.0		<0.06			0.48	
Grass	Lochan Ghlas Laoigh	1		<5.0		<0.06			0.45	
Soil	Auchengaich	1		5.0		<0.15			17	
Soil	Faslane	1				<0.09			3.3	
Soil	Lochan Ghlas Laoigh	1		5.0		<0.11			6.4	
Freshwater	Helensburgh Reservoir	1		<1.0		<0.01			<0.01	
Freshwater	Loch Finlas	1		<1.0		<0.01			<0.01	
Freshwater	Auchengaich Reservoir	1		<1.0		<0.01			<0.01	
Freshwater	Lochan Ghlas Laoigh	1		<1.0		<0.01			<0.01	
Freshwater	Loch Eck	1		<1.0		<0.01			<0.01	
Freshwater	Loch Lomond	1		<1.0		<0.01			<0.01	
Rosyth										
Winkles	St David's Bay	1				<0.16	<0.37		<0.10	<0.14
Fucus vesiculosus	East of dockyard	1				<0.10	<0.14		0.11	<0.10
Sediment	East of dockyard	1				<0.10	<0.26		7.9	<0.21
Sediment	Port Edgar	1				<0.10	<0.26		8.0	<0.22
Sediment	West of dockyard	1				<0.10	<0.27		0.30	<0.23
Sediment	East Ness Pier	1				<0.10	<0.17		12	<0.13
Sediment	Blackness Castle	1				<0.10	<0.26		1.5	<0.24
Sediment	Charlestown Pier	1				<0.19	<0.70		13	<0.39
Seawater	East of dockyard	2		<1.0		<0.10	<0.15		<0.10	<0.10
Freshwater	Castlehill Reservoir	1		<1.0		<0.01			<0.01	
Freshwater	Holl Reservoir	1		<1.0		<0.01			<0.01	
Freshwater	Gartmorn Dam	1		<1.0		<0.01			<0.01	
Freshwater	Morton No. 2 Reservoir	1		<1.0		<0.01			<0.01	

Table 6.3(a) continued

Material	Location or selection	No. of sampling observ-ations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{155}Eu	^{234}U	^{235}U	^{238}U	^{241}Am	Gross alpha	Gross beta
Barrow									
Beetroot	Barrow	1[F]	<0.13				<0.17		
Grass	Barrow	1[F]	<0.25				<0.53		
Sediment	Walney Channel - N of discharge point	2	<0.57				97	690	830
Derby									
Potatoes	Derby	1[F]	<0.14	0.011	<0.0011	0.0095	<0.17		
Barley	Derby	1[F]	<0.15	0.0023	<0.0027	0.0021	<0.14		
Sediment	River Derwent, upstream	1		19	<0.13	20		390	470
Sediment	Fritchley Brook	1		22	0.95	22		550	820
Sediment	River Derwent, downstream	4		22	1.3	22		560	640
Freshwater	River Derwent, upstream	1						0.050	0.19
Freshwater[b]	Fritchley Brook	1		0.0024	<0.00025	0.0024		<0.019	0.16
Freshwater	River Derwent, downstream	4						<0.040	0.18
Devonport									
Ballan wrasse	Plymouth Sound	1[F]	<0.13				<0.15		
Crabs	Plymouth Sound	1[F]	<0.13				<0.35		
Shrimp	River Lynher	1[F]	<0.17				<0.14		
European Oyster	River Lynher	1[F]	<0.13				<0.18		
Seaweed[c]	Beach near Royal Albert Bridge	2							
Sediment[d]	Beach near Royal Albert Bridge	2					<0.51		
Sediment	Torpoint South	2							
Sediment	Lopwell	2							
Seawater	Torpoint South	1							
Seawater	Millbrook Lake	1							
Potatoes	Devonport	1[F]	<0.21				<0.15		
Grass	Devonport	1[F]	<0.12				<0.14		
Faslane									
Fucus vesiculosus	Garelochhead	1	<0.14				<0.10		
Fucus vesiculosus	Carnban	1	<0.17				<0.20		
Fucus vesiculosus	Rhu	1	<0.10				<0.10		
Fucus vesiculosus	Cairndhu Point	1	<0.17				<0.12		
Fucus vesiculosus	Helensburgh	1	<0.17				<0.20		
Sediment	Garelochhead	1	<0.31				<0.41		
Sediment	Carnban	1	<0.23				<0.31		
Sediment	Rhu	1	<0.21				0.51		
Seawater	Garelochhead	2	<0.10				<0.10		
Seawater	Carnban	2	<0.10				<0.10		
Seawater	Rosneath Bay	2	<0.11				<0.10		
Seawater	Cove	2	<0.10				<0.10		
Seawater	Coulport	2	<0.13				<0.10		

Table 6.3(a) continued

Material	Location or selection	No. of sampling observ-ations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{155}Eu	^{234}U	^{235}U	^{238}U	^{241}Am	Gross alpha	Gross beta
Faslane									
Beef muscle	Faslane	1					<0.05		
Honey	Faslane	1					<0.17		
Grass	Auchengaich Reservoir	1	<0.18				<0.19		
Grass	Lochan Ghlas Laoigh	1	<0.15				<0.05		
Soil	Auchengaich	1	<0.46				<0.69		
Soil	Faslane	1	<0.31				<0.19		
Soil	Lochan Ghlas Laoigh	1	<0.39				<0.58		
Freshwater	Helensburgh Reservoir	1					<0.01	<0.010	0.057
Freshwater	Loch Finlas	1					<0.01	<0.010	0.023
Freshwater	Auchengaich Reservoir	1					<0.01	0.011	0.041
Freshwater	Lochan Ghlas Laoigh	1					<0.01	<0.010	0.028
Freshwater	Loch Eck	1					<0.01	<0.010	0.026
Freshwater	Loch Lomond	1					<0.01	0.010	0.045
Rosyth									
Winkles	St David's Bay	1	<0.24				<0.15		
Fucus vesiculosus	East of dockyard	1	<0.20				<0.23		
Sediment	East of dockyard	1	<0.31				0.91		
Sediment	Port Edgar	1	<0.32				1.7		
Sediment	West of dockyard	1	<0.33				<0.10		
Sediment	East Ness Pier	1	0.17				<0.20		
Sediment	Blackness Castle	1	<0.46				<0.20		
Sediment	Charlestown Pier	1	<0.54				2.2		
Seawater	East of dockyard	2	<0.10				<0.10		
Freshwater	Castlehill Reservoir	1					<0.01	<0.010	0.027
Freshwater	Holl Reservoir	1					<0.01	<0.010	0.028
Freshwater	Gartmorn Dam	1					<0.01	<0.010	0.12
Freshwater	Morton No. 2 Reservoir	1					<0.01	<0.010	0.025

* Not detected by the method used

a. Except for sediment and sewage pellets where dry concentrations apply, and for water where units are Bq l^{-1}

b. The concentrations of ^{228}Th, ^{230}Th and ^{232}Th were 0.0028, 0.0027 and <0.00073 Bq l^{-1} respectively

c. The concentration of ^{99}Tc was <0.25 Bq kg^{-1}

d. The concentrations of ^{238}Pu and $^{239+240}$Pu were <0.073 and <0.27 Bq kg^{-1}

F Measurements labelled "F" are made on behalf of the Food Standards Agency, all other measurements are made on behalf of the environment agencies

Table 6.3(b) Monitoring of radiation dose rates near defence establishments, 2025

Establishment	Location	Ground type	No. of sampling observations	μGy h^{-1}
Mean gamma dose rates at 1m over substrate				
Barrow	Askam Pier	Mud and sand	3	0.073
Barrow	Askam Pier	Sand	1	0.076
Barrow	Walney Channel, N of discharge point	Mud and sand	2	0.076
Barrow	Walney Channel, N of discharge point	Sand	2	0.080
Barrow	Roa Island	Sand	2	0.085
Devonport	Torpoint South	Mud and shingle	2	0.10
Devonport	Beach near Royal Albert Bridge	Mud and shingle	1	0.083
Devonport	Beach near Royal Albert Bridge	Rock and shingle	1	0.093
Devonport	Lopwell	Mud	1	0.083
Devonport	Lopwell	Mud and shingle	1	0.077
Faslane	Garelochhead	Sediment	2	0.049
Faslane	Gulley Bridge Pier	Sediment	2	0.058
Faslane	Rhu	Sediment	2	0.053
Faslane	Helensburgh	Sediment	2	0.054
Faslane	Carnban	Sediment	2	0.064
Faslane	Rahane	Rock	2	0.062
Faslane	Rosneath Bay	Sediment	2	<0.049
Faslane	Auchengaich	Grass	1	0.056
Faslane	Lochan Ghlas	Grass	1	0.056
Rosyth	Blackness Castle	Sediment	2	0.055
Rosyth	Charlestown Pier	Sediment	2	<0.055
Rosyth	East Ness Pier	Sediment	2	0.054
Rosyth	East of Dockyard	Sediment	2	0.058
Rosyth	Port Edgar	Sediment	2	0.059
Rosyth	West of Dockyard	Sediment	2	0.049

7 Industrial, solid waste disposal, legacy and other non-nuclear sites

Highlights

- doses (dominated by the effects of legacy discharges from other sources) increased at the Low Level Waste Repository in 2025
- doses at solid waste disposal sites were less than 0.5% of the dose limit in 2025
- doses (dominated by the effects of naturally occurring radionuclides from legacy discharges) increased at Whitehaven in 2025 compared to 2024

This section considers the results of monitoring by the Environment Agency, FSA, FSS, NRW and SEPA for industrial, solid waste disposal, legacy and other non-nuclear sites that may have introduced radioactivity into the environment such as:

1. the main disposal site for solid radioactive wastes in the UK, at the LLWR in Cumbria, as well as a recycling facility and other solid waste disposal sites that received small quantities of solid wastes
2. one legacy site in England, near Whitehaven, Cumbria, which was used to manufacture phosphoric acid from imported phosphate ore
3. two legacy sites in Scotland, at Dalgety Bay, Fife, and Kinloss, Moray
4. other non-nuclear sites

7.1 Low Level Waste Repository, Cumbria

The LLWR is the UK's national facility for the disposal of lower activity waste and is located on the west Cumbrian coast, southeast of Sellafield. The main function of the LLWR is to receive low-activity solid and non-aqueous liquid radioactive wastes from all UK nuclear sites (except Dounreay, where the adjacent disposal facility began accepting waste in 2015) and many non-nuclear sites. Where possible, the waste is compacted before transfer to the site and then most waste is grouted on site within containers before disposal. Wastes are currently disposed of in engineered concrete vaults on land, whereas prior to the early 1990s waste was disposed of in open clay lined trenches.

The site is owned by the NDA and operated on their behalf by Nuclear Waste Services (NWS). In 2018, the NDA awarded the incumbent Parent Body Organisation, UK Nuclear Waste Management Limited, a third (and final) contract for the management of LLWR Limited. In January 2022, NWS was launched. This brought together the operator of the LLWR, Geological Disposal Facility developer Radioactive Waste Management Limited and the NDA group's integrated waste management programmes into a single organisation.

NWS published a major review of their Environmental Safety Case in May 2026. This consists of a suite of documents including an optimisation and site development plan, which sets out plans for the long-term future of the site through to final closure, expected around 2135 [183].

The disposal permit allows for the discharge of leachate from the site through a marine pipeline. These discharges are small compared with those discharged from the nearby Sellafield site (Appendix 1). Monitoring of the marine environment close to the LLWR is therefore subsumed

within the Sellafield programme, described in Section 3.3. The contribution to exposures due to LLWR discharges is negligible compared with that attributable to Sellafield and any effects of LLWR discharges in the marine environment could not, in 2025, be distinguished from those due to Sellafield.

The current permit allows for continued solid radioactive waste disposal at the site, including permission to dispose of further radioactive waste beyond Vaults 8 and 9, and limits disposals against a lifetime capacity for the site. In 2019, Revised Joint Waste Management Plans were published for the NDA's radioactive waste-producing site licence companies (LLWR Limited (now NWS), Magnox Limited (now NRS Limited) and Sellafield Limited), covering the financial years, 2019/20 to 2024/25. More information can be found at the UK government's website: https://www.gov.uk/government/collections/joint-waste-management-plans-jwmp.

Waste received at the site will have a final disposal location allocated to it at the appropriate time. Table A1.3 records, for the financial year 2025/26, both solid radioactive wastes already disposed in Vault 8 and the solid radioactive wastes accepted for disposal by the site currently located within Vault 9, pending placement in its final disposal position. A total of 239m^3 of waste was received by the site with the intention of disposal in financial year 2025/26, bringing the cumulative total to 235,000m^3. The data given in Table A1.3 are recorded by financial year, instead of calendar year. All activities in terms of waste accepted for disposal have been within the lifetime capacity for the site.

Although the permit for routine disposal to the Drigg Stream was revoked in 2006, reassurance monitoring has continued for samples of water and sediment. The results are given in Table 7.2. The tritium, gross alpha and gross beta concentrations in the stream were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from European Directive 2013/51). Although the stream is not known to be used as a source of drinking water, it is possible that occasional use could occur, for example by campers. If the stream was used as a drinking water supply for 3 weeks, the annual dose would be less than 0.005mSv. Concentrations of positively detected radionuclides (plutonium-238 and plutonium-239+240) in sediment from the Drigg stream were very low and similar to those in previous years. They reflect the legacy of direct discharges of leachate from the disposal site into the stream which stopped in 1991 [184].

In the past, groundwater from some of the trenches on the LLWR site migrated eastwards towards a railway drain that runs along the perimeter of the site. Radioactivity from the LLWR was detected in the drain water. The previous operators of the site, British Nuclear Fuels plc (BNFL), took steps in the early 1990s to reduce migration of water from the trenches by building a 'cut-off wall' to reduce lateral migration of leachate. The results of monitoring in 2025 show that the activity concentrations have continued to be very low in the railway drain (Table 7.2) and have reduced significantly since the construction of the cut-off wall. Tritium, gross alpha and gross beta concentrations in the drain were also below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from European Directive 2013/51).

The monitoring programme of terrestrial foodstuffs at the site was primarily directed at the potential migration of radionuclides from the waste burial site via groundwater, since gaseous wastes releases are very small. Results for 2025 are given in Table 7.2 and do not indicate that

radioactivity in leachate from the LLWR might be transferring to foods. Concentrations of radionuclides were generally similar to (or lower than) those measured near Sellafield (Section 3.3). The latest habits survey for the LLWR was undertaken in 2023 and the results have been included in the dose assessments for the site [133].

The 'total dose' from all pathways and sources of radiation was 0.51mSv in 2025, or 51% of the dose limit for members of the public of 1mSv (Table 1.2 and Table 7.1) and includes a component due to the fallout from Chernobyl and nuclear weapons testing. This dose was dominated by the effects of naturally occurring radionuclides discharged to sea from the former phosphate works at Whitehaven, with smaller contributions from legacy discharges into the sea from Sellafield and sources of direct radiation on site. If these effects were to be excluded, and only the sources of exposure from the LLWR are considered, the 'total dose' from gaseous releases and direct radiation was 0.029mSv in 2025 (Table 1.2). The representative person was an adult living near the site and unchanged from 2024. The decrease in 'total dose' (from 0.030mSv in 2024) was mostly due to a lower estimate of direct radiation. A source-specific assessment of exposure for consumers of locally grown terrestrial food (animals fed on oats), using 2025 modelled activity concentrations in animal products, gives an exposure that was less than 0.005mSv in 2025, and lower to that in recent years.

7.2 Metals Recycling Facility, Lillyhall, Cumbria

The Metals Recycling Facility (MRF), operated by Cyclife UK Limited, is located at the Lillyhall Industrial Estate near Workington in Cumbria. The MRF predominantly receives metallic waste items contaminated with low quantities of radiological contamination from clients within the UK nuclear industry which are processed in batches. Techniques used include size reduction using conventional hot and cold cutting methods, with subsequent decontamination using industrial grit blasting equipment.

The permit for the MRF site allows discharges of low-activity gaseous waste to the environment via a main stack and of aqueous waste to the sewer. All discharges in 2025 were within permitted limits (Appendix 1, Table A1.1 and Table A1.2). As in recent years, direct radiation from the site was less than 0.001mSv in 2025 (Table 1.1) and the radiological impact was low.

A habits survey, focusing on direct radiation pathways, was undertaken in 2018 [185]. This was the first habits survey to be carried out at the MRF, and it was undertaken to ensure consistency with other nuclear sites in the UK. The qualitative survey focussed on the area adjacent to the waste container park that had resulted in elevated dose rates being recorded in 2016. Quantitative habits data were not obtained as the time spent by members of the public undertaking activities in the area was minimal.

7.3 Tradebe-Inutec, Winfrith, Dorset

The Tradebe-Inutec site is a radiological waste processing facility, for the wider nuclear industry, located adjacent to the NRS Winfrith site. In 2019, Tradebe-Inutec acquired buildings and land at Winfrith from the NDA and the ONR and Environment Agency granted a new nuclear site licence and environmental permit transfer (respectively) to Inutec Limited, who trade as Tradebe-Inutec. Prior to this, Tradebe-Inutec had been operating as a tenant of Magnox Limited, now NRS. The impact of its site operations and gaseous discharges is considered along with those from the NRS Winfrith site (in Section 5.4).

Gaseous discharges from Tradebe-Inutec are also made via stacks to the local environment and are given in Appendix 1 (Table A1.1). As in recent years, discharges of alpha, carbon-14 and other radioelements were less than 1% of the discharge limits. The discharge of tritium increased in 2025 in comparison to 2024. These discharges were associated with a campaign of treating tritiated solid waste, with higher activity items being processed between February and December 2025. As in 2024, the dose from direct radiation from the Tradebe-Inutec site was low and reported as <0.001mSv (Table 1.1).

Liquid waste from Tradebe-Inutec is transferred off site for disposal into Southampton Water under a non-nuclear permit (included in Table 7.7) and therefore these impacts are not considered in the RIFE report.

7.4 Other solid waste disposal sites

SEPA, the Environment Agency and NRW grant permits to dispose of solid waste containing low levels of radioactivity at approved landfill sites. In Northern Ireland, this type of waste is transferred to Great Britain for incineration. Waste with very low quantities of radioactivity can also be disposed of in general refuse.

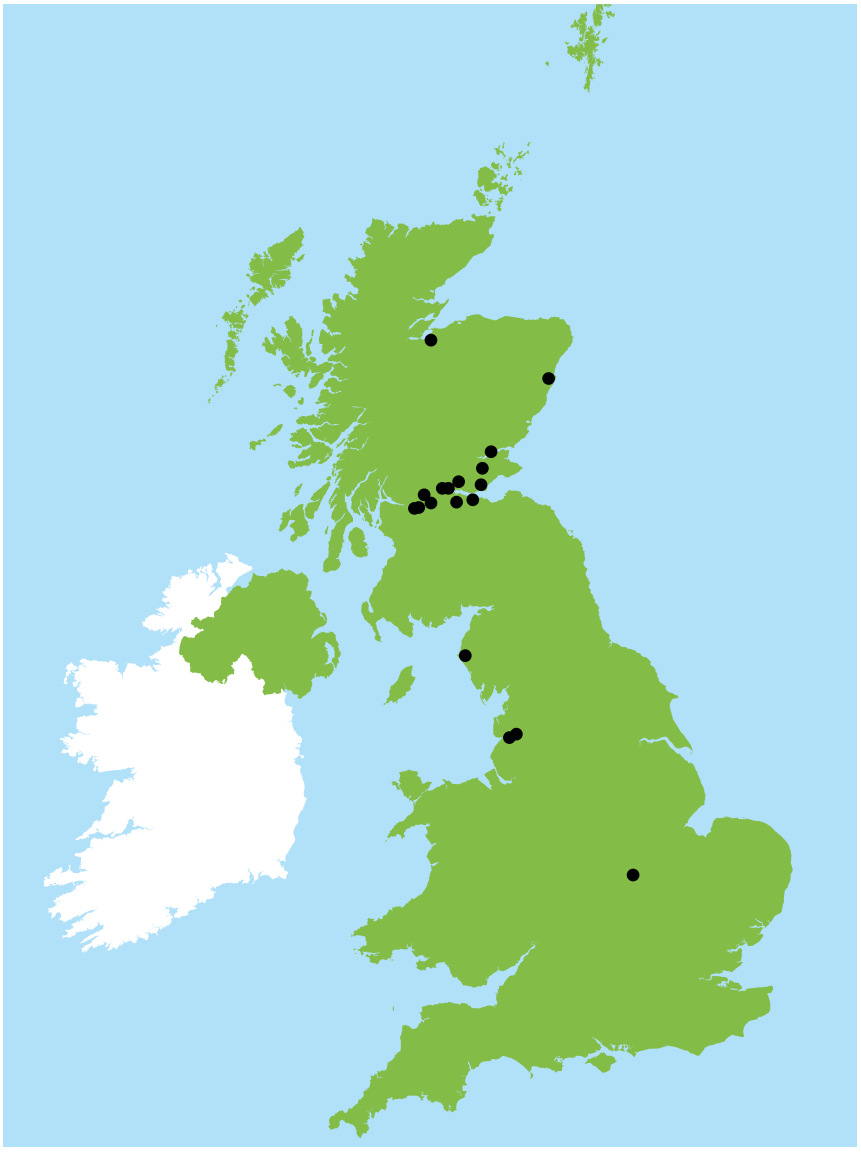
The UK government introduced a more flexible framework in 2024 for the disposal of certain categories of LLW to landfill. Further details and information are provided on the website: (https://assets.publishing.service.gov.uk/media/6632371769098ded31fca7c1/managing-radioactive-substances-and-nuclear-decommissioning-uk-policy-framework.pdf).

In England and Wales, disposal of LLW at landfill sites requires both landfill companies and nuclear operators to hold permits to dispose of LLW and very low-level waste (VLLW). The 2007 government policy led to applications from landfill operators for permits to dispose of LLW at their sites. The landfill sites were:

- Waste Recycling Group Limited (part of FCC Environmental) at the Lillyhall Landfill Site in Cumbria. Their revised permit, issued in 2021, allows disposal of very low-level waste
- Augean at the East Northants Resource Management Facility (ENRMF), near Kings Cliffe, Northamptonshire. Their permit, issued in 2016, allows the disposal of low activity LLW and very low-level waste. The Environment Agency undertook a baseline survey as described in previous RIFE reports (for example [8,138])
- Suez Recycling and Recovery UK Limited (formerly SITA UK) at Clifton Marsh in Lancashire. A permit to dispose of LLW was issued by the Environment Agency in 2012

Radioactivity in wastes can migrate into leachate and in some cases can enter the groundwater. SEPA and the Environment Agency carry out monitoring of leachates and off-site watercourses. The locations of landfill sites considered in 2025 are shown in Figure 7.1 and the results are presented in Table 7.3 and Table 7.4, alongside the respective regions and locations.

Figure 7.1 Solid waste disposal sites monitored in 2025.



The results, in common with previous years, showed evidence for migration of tritium from some of the disposal sites. The reported tritium concentrations vary from year to year. The variation is thought to be related to changes in rainfall quantity and resulting leachate production and the use of different boreholes for sampling. A possible source of the tritium is thought to be due to disposal of Gaseous Tritium Light Devices [186]. As in recent years, inadvertent ingestion of leachate (2.5 litres per year) from the Cathkin landfill (City of Glasgow) site (with the highest observed concentration of tritium) would result in a dose of less than 0.005mSv in 2025 (Table 7.1), or less than 0.5% of the dose limit for members of the public of 1mSv. Similarly, the annual doses from ingestion of uranium isotopes in leachate from Clifton Marsh and inadvertent ingestion of borehole or surface water close to the East Northants Resource Management Facility were also less than 0.005mSv in 2025. The latter assessment excludes potassium-40 because its presence is homeostatically controlled in the body.

Gross beta concentrations in off-site watercourses were below the investigation levels for drinking water in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from the European Directive 2013/51).

SEPA's monitoring programme at the Stoneyhill Landfill Site in Aberdeenshire, authorised to dispose of conditioned NORM waste, ceased in 2016. Results up to 2015 are included in earlier RIFE reports and show no significant radiological impact (for example [75]).

NORM is found within oil and gas reserves and is consequently extracted along with the oil and gas. The NORM can precipitate onto oil and gas industry equipment, creating an insoluble scale (NORM scale). The presence of this scale reduces the efficiency of the equipment and must be removed. Suez Recycling and Recovery UK Limited, the operators of the Stoneyhill Landfill site, has constructed a descaling facility adjacent to the landfill in partnership with Nuvia Limited. This facility descales oil and gas industry equipment, such as pipes, using pressurised water. The solid scale removed from the equipment is then grouted into drums and can be consigned to Stoneyhill Landfill site in accordance with the authorisation granted in 2012.

7.5 Former phosphate processing plant, Whitehaven, Cumbria

An important historical anthropogenic source of naturally occurring radionuclides in the marine environment was the former phosphate processing plant, which used to manufacture phosphoric acid (for use in detergents) from imported phosphate ore [131]. Processing of ore resulted in a liquid waste slurry (phosphogypsum) containing most of the thorium, uranium and radioactive decay products (including polonium-210 and lead-210) originally present in the ore, and this was discharged by pipeline to Saltom Bay.

The slurry is regarded as NORM from industrial activity. Historical discharges continue to have an impact through the production of the radioactive products. This impact is due to the decay of long-lived parent radionuclides previously discharged to sea. Both polonium-210 and lead-210 are important radionuclides in that small changes in activity concentrations above background significantly influence the dose contribution from these radionuclides. This is due to their relatively high dose coefficients used to convert an intake of radioactivity into a radiation dose.

Processing of phosphoric acid at the plant ceased at the end of 2001. The plant was subsequently decommissioned and the authorisation to discharge radioactive wastes was revoked by the Environment Agency. The results of routine monitoring for naturally occurring radioactivity near the site in 2025 are shown in Table 7.5. Routine analytical effort is focused on polonium-210 and lead-210, which concentrate in marine species and are the important radionuclides in terms of potential dose to the public. As in previous years, polonium-210 and other naturally occurring radionuclides were slightly enhanced near Whitehaven but reduced to background values further away. Figure 7.2 to Figure 7.4 show how concentrations of polonium-210 in winkles, crabs and lobsters have generally decreased since 1998, with larger concentration variations in lobsters since 2014. Concentrations in the early 1990s were more than 100Bq kg^{-1} (fresh weight), when discharges were taking place, prior to a change in site operations (in 1992) and later plant closure in 1997. There were some variations in concentrations of polonium-210 in local samples in 2025 (where comparisons can be made), in comparison with those in 2024. Polonium-210 concentrations in Parton crab were higher in 2025 than those in 2024. Polonium-210 concentrations in lobsters were similar to those reported in 2024. As in recent years, these concentrations continued to be within or close to the expected range due to natural sources. For crustacean and other seafood samples, it is now difficult to distinguish between the measured radionuclide concentrations and the range of concentrations normally expected from naturally sourced radioactivity. The latter are shown in Figure 7.2 to Figure 7.4 and in Appendix 6 (minimum, median and maximum concentrations of polonium-210 in each species, as reported in [187,188]). There were small enhancements for some samples at other locations above the expected natural background median values for marine species, however, the majority were within the ranges observed in the undisturbed marine environment. It is considered prudent to continue to estimate doses at Whitehaven whilst there remains an indication that concentrations are higher than natural background. Further analysis has confirmed that this approach is unlikely to underestimate doses [189].

Figure 7.2 Polonium-210 concentration, in Bq kg^{-1} (fresh), in winkles at Parton, 1996 to 2025.

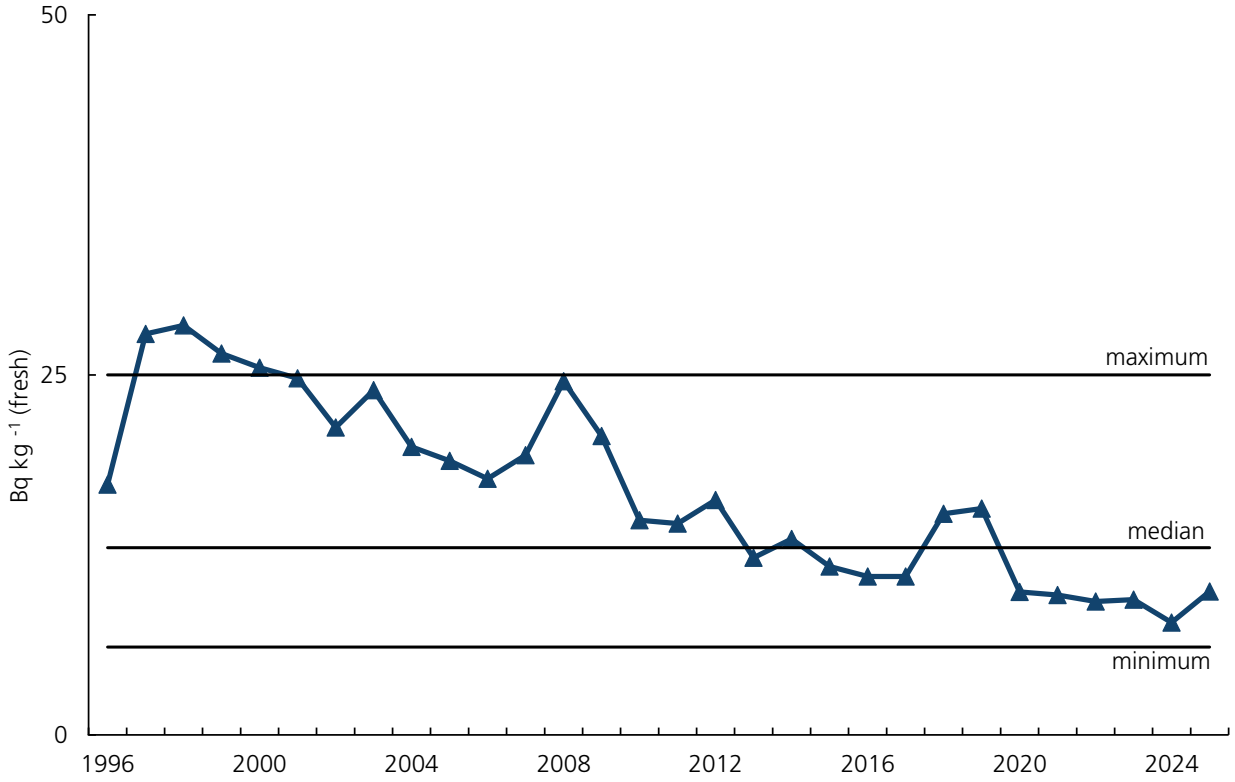


Figure 7.3 Polonium-210 concentration, in Bq kg^{-1} (fresh), in crabs at Parton, 1996 to 2025.

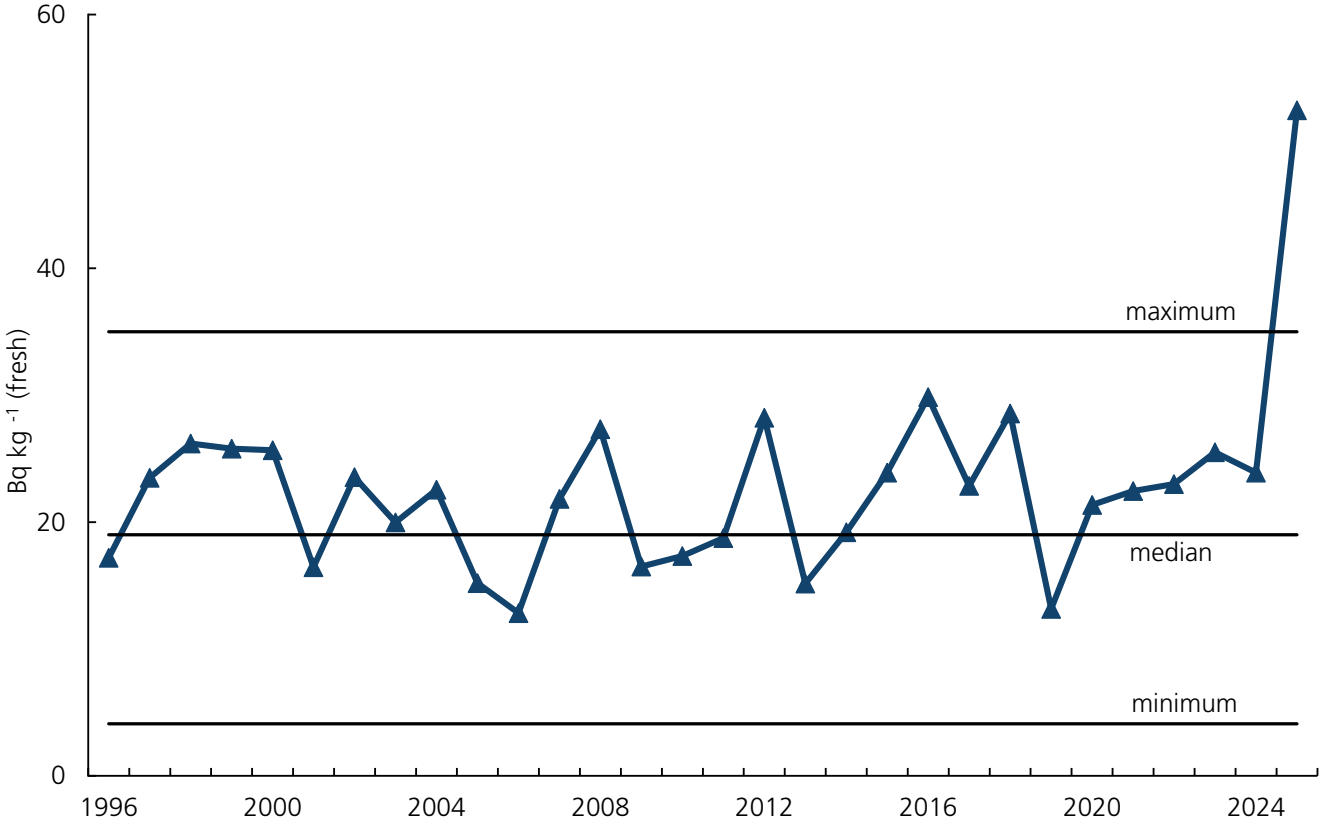
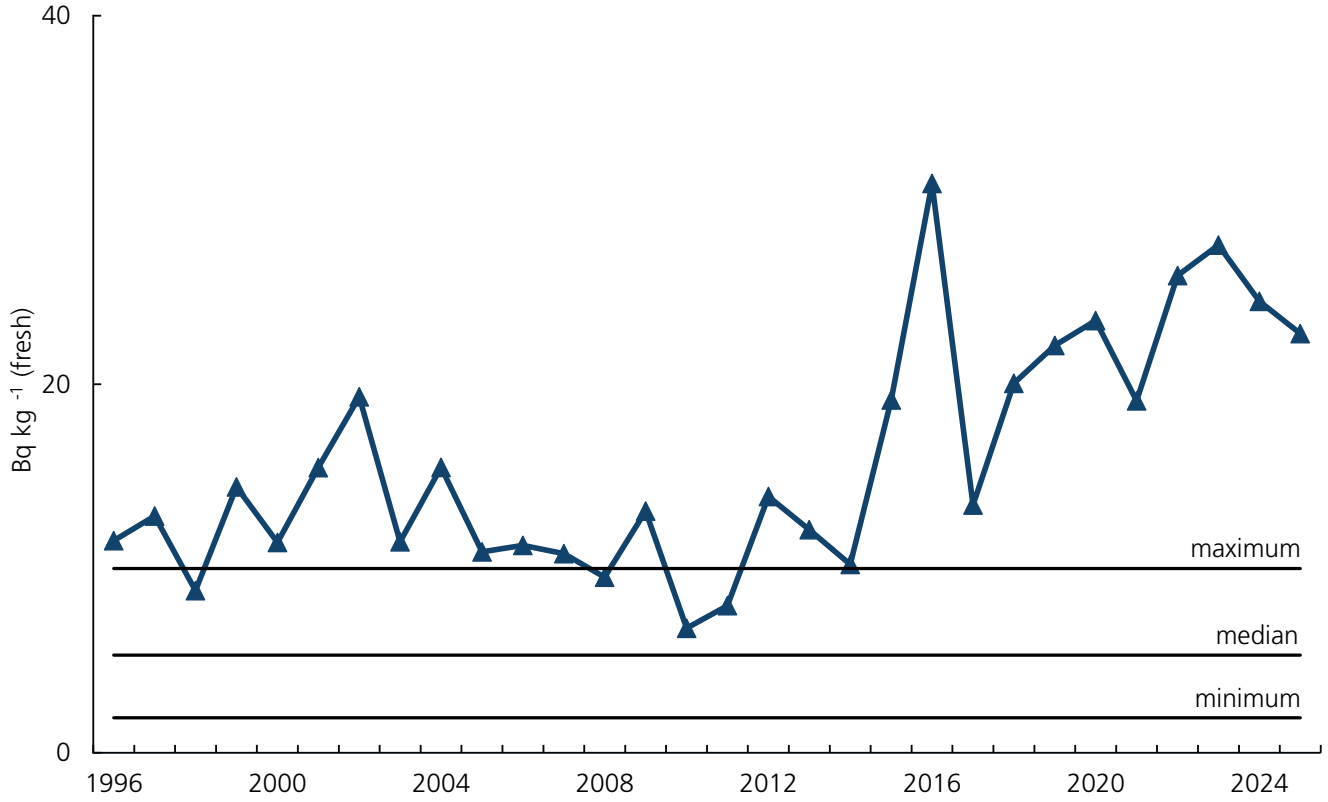


Figure 7.4 Polonium-210 concentration, in Bq kg^{-1} (fresh), in lobsters at Parton, 1996 to 2025.



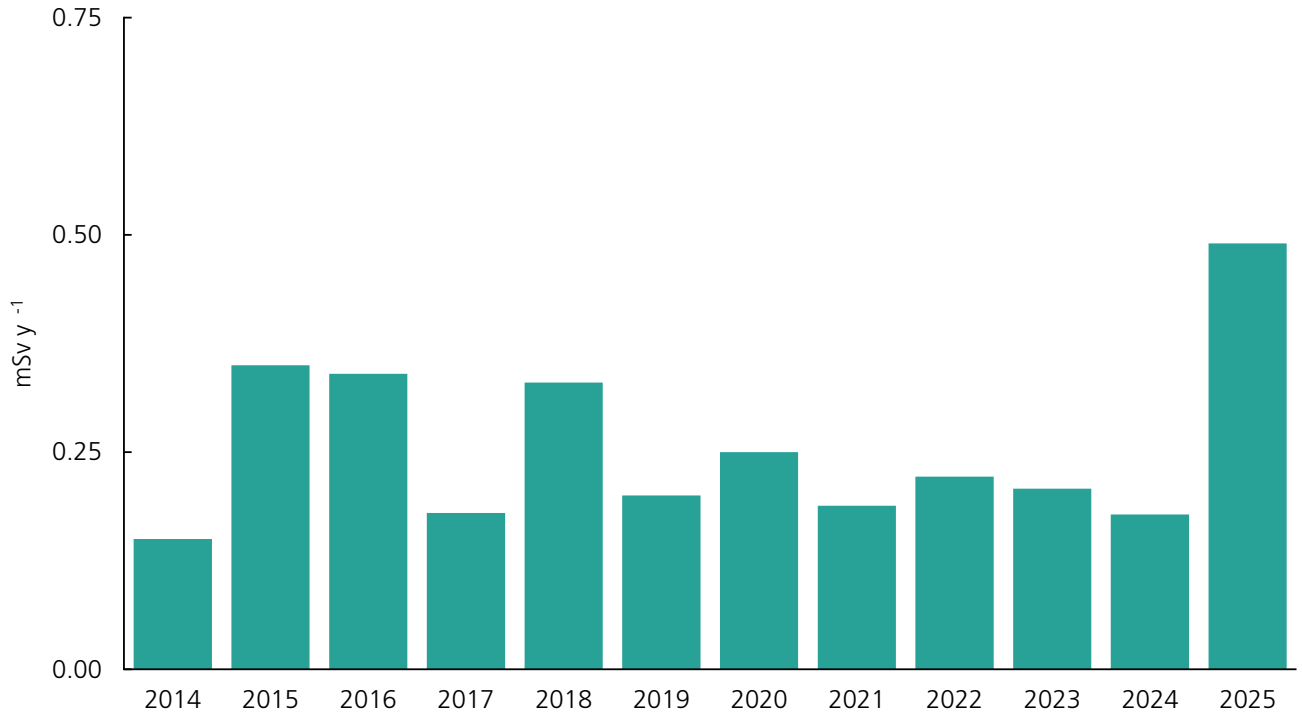
In 2018, the Environment Agency, with the support of the FSA, NIEA and SEPA, performed additional polonium-210 analyses in shellfish samples to obtain baseline data, providing naturally sourced polonium-210 concentrations that are unlikely to be influenced by NORM in the Irish Sea. Further details are presented in RIFE 24 [19].

The exposure pathway considered for the assessment at Whitehaven was internal irradiation, due to the ingestion of naturally occurring radioactivity in local fish and shellfish. The representative person was a Cumbrian coastal community consumer who, centred on the Sellafield site to the south of Whitehaven, obtained their sources of seafood from locations such as Whitehaven, Nethertown and Parton. This consumer is also considered in the assessment of the marine impacts of the Sellafield and LLWR sites (Sections 3.3 and 7.1). The estimated contribution due to background median concentrations of naturally occurring radionuclides is subtracted from the measured activity concentration. Consumption rates for people who eat seafood at high rates were reviewed and revised in 2025 [134]. Revised figures for consumption rates, together with occupancy rates, are provided in Appendix 4 (Table A4.2). The dose coefficient for polonium-210 is based on a value of the gut transfer factor of 0.5 for all foods.

The 'total dose' to a local high-rate consumer of seafood was 0.51mSv in 2025 (Table 7.1), or 51% of the dose limit to members of the public. This is an increase from 0.20mSv in 2024. The dose includes the effects of all sources near the site as explained in Section 3. The contribution to the 'total dose' from enhanced natural radionuclides was 0.49mSv and was higher in 2025, compared to that in 2024 (0.18mSv). The increase in 'total dose' in 2025 was mostly attributed to higher concentrations of polonium-210 in crab (at Parton) and to a lesser extent the revision of crustacean consumption rate. The largest contribution to dose to a Cumbrian coastal community seafood consumer near Whitehaven and Sellafield continues to be from historical discharges near Whitehaven. A source-specific dose assessment targeted directly at local consumers of seafood (at high rates), gives an exposure of 0.44mSv in 2025 (Table 7.1).

The longer-term trend in annual 'total dose' over the period 2014 to 2025 is shown in Figure 7.5. The variations in 'total dose' over the period 2014 to 2025 reflect changes in polonium-210 concentrations, consumption rates and the range of seafood species consumed by individuals at high-rates, including that of crustaceans. Over a longer period, the trend is of generally declining dose [26].

Figure 7.5 Trend in 'total dose', in mSv y^{-1}, to seafood consumers from naturally- occurring radionuclides near Whitehaven, 2014 to 2025.



7.6 Holy Loch, Argyll and Bute

A small programme of monitoring at Holy Loch continued during 2025 to determine the effects of past discharges from the US submarine support facilities which closed in 1992. Radionuclide concentrations in the sediment sample collected in 2025 were low (Table 7.11(a)). Gamma dose rate measurements over intertidal areas (Table 7.11(b)) were similar to those values reported in recent years. As reported in previous RIFE reports [23], no dose assessment is being undertaken for the site as there are no radioactive discharges to the loch and monitoring provides confidence that there is no realistic risk to the public using the area.

Should results from future monitoring indicate that a dose assessment is needed, this will be undertaken.

7.7 Former military airbase, Dalgety Bay, Fife

Radioactive items containing radium-226 and associated decay products have been detected at Dalgety Bay in Fife since at least 1990. The contamination is associated with historical disposals of waste from past military operations at the Royal Naval Air Station (RNAS) Donibristle, which closed in 1959 and upon which large areas of the town of Dalgety Bay have been built. The air station played a role as an aircraft repair, refitting and salvage yard. It is believed that waste was incinerated, and the resultant ash and clinker was disposed of by reclaiming land from the sea. Following years of erosion at the site, the contamination was being exposed on and adjacent to the foreshore. Some of the incinerated material contained items such as dials and levers which had been painted with luminous paint containing radium-226.

In 1990, environmental monitoring showed elevated activity concentrations in the Dalgety Bay area. The monitoring was undertaken as part of the routine environmental monitoring programme for Rosyth Royal Dockyard Limited conducted in accordance with the dockyard's authorisation to dispose of liquid radioactive effluent to the Firth of Forth. Some material was removed for analysis, which indicated the presence of radium-226. Further investigation confirmed that the contamination could not have originated from the dockyard and was most likely to be associated with past practices related to the nearby former Royal Naval Air Station Donibristle or HMS Merlin military airfield. Since this initial discovery, there have been several monitoring exercises to determine the extent of this contamination. In 2017, SEPA issued guidance on monitoring for heterogeneous radium-226 sources resulting from historic luminising activities or waste disposal sites [190].

Additional public protection measures were established following the increased number of particles and the discovery of some high activity particles in 2011. A monthly beach monitoring and particle recovery programme was adopted in 2012 by a contractor working on behalf of the MOD. The information signs advising the public of the contamination and precautions to be taken remain in place. In addition, the FEPA Order issued by FSS (then FSA in Scotland) prohibiting the collection of seafood from the Dalgety Bay area remains in force. SEPA undertook a one-year programme of shellfish monitoring from February 2012, during which no particles were detected in the shellfish. All shellfish samples collected were analysed for the presence of radium-226 and all were reported as 'less than values'. During routine monitoring of mussel beds in 2015 a particle was detected in this area (for the first time since 2011) and retrieved, indicating that the continuation of these protection measures is reducing the risks to members of the public whilst further work continues to address the contamination.

The Committee on Medical Aspects of Radiation in the Environment (COMARE) recommended that effective remediation of the affected area be undertaken as soon as possible. This recommendation followed the publication of the Risk Assessment in 2013, which was considered alongside the Appropriate Person Report. This Appropriate Person Report included a comprehensive study of the land ownership and history at Dalgety Bay. The Committee on Medical Aspects of Radiation in the Environment recommendation, amongst others, was subsequently published in 2014 in Committee on Medical Aspects of Radiation in the Environment 's 15th report. Copies of these reports are available on the UK government website: https://www.gov.uk/government/groups/committee-on-medical-aspects-of-radiation-in-the-environment-comare.

The MOD progressed with addressing the contamination by initially publishing its Outline Management Options Appraisal Report in 2014, followed by a further publication in 2014 of its broad management strategy and timescale for implementation of its preferred management option.

The environmental impact assessment in support of the planning application for the remediation works was submitted to Fife Council for consideration. In 2017, the planning application for the remediation works was submitted to Fife Council and subsequently approved.

The remediation contract was awarded by the MOD in February 2020 and an EASR permit to undertake the required work was granted by SEPA in May 2021. Remediation work took place between 2021 and 2023. The works involved extraction of beach material which was then transferred to a compound where the material was screened for asbestos and then radioactive contamination on a conveyor system.

Asbestos material and oversized material were monitored for radioactive contamination separately by hand.

Screened material was then replaced onto the beach. This was covered with a geotextile membrane on top of which graded rock armour was fixed in place.

It is estimated that a total of over 13,000 items have been removed from the beach as a result of both the remediation works and previous monitoring undertaken since 1990.

Monthly monitoring of the foreshore, where possible, continued during the remediation by MOD contractors.

Monthly verification monitoring has been undertaken by MOD contractors following completion of the works. This will progress in 2026 and into 2027 on a less frequent basis due to the substantial reduction in items found on the foreshore since the remediation work was undertaken. By analysing the activity range and depth of particles recovered from the area, SEPA will determine if the remediation objective has been met. Following this, the site will then be regularly monitored by SEPA (radiological monitoring) and Fife Council (rock armour assessment).

Further details on the work at Dalgety Bay can requested by emailing RSEnquiries@sepa.org.uk.

7.8 Former military airbase, Kinloss Barracks, Moray

Radioactive items containing radium-226 and associated decay products have been detected on an area of land which used to form part of the former RAF Kinloss, now Kinloss Barracks. The contamination is associated with historical disposals of waste from past military operations at the site resulting from the dismantling of aircraft no longer required by the RAF following World War II. During the late 1940s, the aircraft were stripped for their scrap metal, with the remains being burnt and/or buried at the site. The source of the radium-226 and associated decay products are the various pieces of aircraft instrumentation which were luminised with radium paint.

SEPA has undertaken monitoring surveys at the site which positively identified the presence of radium-226 and has published an assessment of the risks posed to the public [191]. Currently, the site is largely undeveloped open land covered in gorse with several wind turbines and access tracks. The area has a few informal paths crossing the land that is used by visitors and dog walkers. The contamination detected at the site is all currently buried at depth. Current uses of the site do not involve intrusion into the ground to any significant depth; thus, there is no current pathway for exposure via skin contact, ingestion or inhalation. Exposure via external gamma irradiation is possible but is significantly below the relevant dose criteria detailed in the Radioactive Contaminated Land Statutory Guidance [192,193].

The risk assessment of the series of monitoring surveys concluded that, under its current use, there are no viable or credible exposure pathways for the public to be exposed to the contamination and that this site does not currently meet the definition of radioactive contaminated land [191]. However, SEPA will keep this site under review as a change in land use on the site may alter the potential exposure pathways. To access the full risk assessment report, please email RSenquires@sepa.org.uk.

7.9 Other non-nuclear sites

Small quantities of gaseous and liquid radioactive wastes are routinely discharged from a wide range of other non-nuclear sites in the UK on land (including to the atmosphere from industrial stacks and incinerators), and from offshore oil and gas installations.

A summary of the most recent data for the quantities discharged under regulation for England and Northern Ireland in 2025 is given in Table 7.6 and Table 7.7. Data for Scotland are presented in Table 7.8 and Table 7.9 in terms of OSPAR regions (Region II represents the Greater North Sea and Region III the Celtic Sea). This change in format allows easier trend analysis to be performed for OSPAR. Data for Wales are presented in Table 7.10. The data are grouped according to the main industries giving rise to such wastes in the UK and exclude information for other industries considered in other sections of this report, principally the nuclear sector. The main industries are:

- oil and gas, both off and onshore
- education, including universities and colleges
- hospitals
- other, which includes research, manufacturing and public sector

Discharges may also occur without an authorisation or permit when the quantities are below the need for specific regulatory control. For example, discharges of natural radionuclides are made from coal-fired power stations because of the presence of trace quantities of uranium and thorium and their decay products in coal [194].

As indicated in Section 1, general monitoring of the British Isles as reported elsewhere in this report has not detected any gross effects from non-nuclear sources. Occasionally, routine programmes directed at nuclear site operations detect the effects of discharges from the non-nuclear sector and, when this occurs, a comment is made in the relevant nuclear site text. The radiological impact of the radioactivity from the non-nuclear sector detected inadvertently in this way is very low.

Monitoring of the effect of the non-nuclear sector is limited because of the relatively low impact of the discharges. However, programmes are carried out to confirm that impacts are low and, when these occur, they are described in this report.

The Pharmaron UK radiolabelling facility in Cardiff, discharges tritium and carbon-14 to the atmosphere and to the marine environment, via the Cardiff sewage treatment works outfall. This site began operation after Quotient Bioresearch (Radiochemicals) Ltd in 2010 (later becoming Pharmaron UK in 2017) acquired GE Healthcare's custom radiolabelling division which previously operated at the Maynard Centre in Cardiff (previously reported in RIFE [77]). These operations were then moved to new premises in Cardiff, under a non-nuclear permit with lower discharge limits. Discharges from the Pharmaron UK facility are included in the discharges reported in Table 7.10. The radiological impacts of these discharges are low.

In 2025, SEPA continued to undertake a small-scale survey (as part of the annual programme) of the effects of discharges from non-nuclear operators by analysing mussel samples and other materials from the River Clyde, the Firth of Forth and sludge pellets from a sewage treatment works (at Daldowie). The results are given in Table 7.12. The results in 2025 were generally similar to those in 2024. Activity concentrations were typical of the expected effects from Sellafield discharges at this distance and the presence of iodine-131 in sludge pellets (probably from a hospital source). An assessment was undertaken to determine the dose to the representative high-rate mollusc consumer. The dose was estimated to be less than 0.005mSv in 2025, or approximately 0.5% of the dose limit for members of the public, and unchanged from 2024.

Scotoil, in Aberdeen City, operates a cleaning facility for equipment from the oil and gas industry contaminated with enhanced concentrations of radionuclides of natural origin. The facility is authorised to discharge liquid effluent to the marine environment within the limitations and conditions of the authorisation, which includes limits for radium-226, radium-228, lead-210 and polonium-210 discharges. The authorisation includes conditions requiring Scotoil to undertake environmental monitoring. Prior to their operations, a fertiliser manufacturing process was operated on the site and made discharges to sea. Monitoring of seaweed ('Fucus vesiculosus') from Nigg Bay, near Aberdeen Harbour was carried out in 2025 and are reported in Table 3.11. In 2025, the dose rate on sediment was 0.078μGy h^{-1} and similar to background.

Table 7.1 Individual doses - industrial and solid waste disposal sites, 2025

Site	Representative person[a]	Exposure, mSv per year							
		Total	Seafood (nuclear industry discharges)	Seafood (other discharges)	Other local food	External radiation from intertidal areas[b]	Intakes of sediment and water[c]	Gaseous plume related pathways	Direct radiation from site
'Total dose' - all sources									
Whitehaven and the Low Level Waste Repository	**Adult crustacean consumers**	**0.51[d]**	**0.015**	**0.49**	**<0.005**	**<0.005**	**-**	**-**	**<0.005**
Source-specific doses									
Low Level Waste Repository	Infant consumers of locally grown food	<0.005	-	-	<0.005	-	-	-	-
	Consumers of water from Drigg stream	<0.005[e]	-	-	-	-	<0.005	-	-
Landfill sites for low-level radioactive wastes	Inadvertent leachate consumers (infants)	<0.005	-	-	-	-	<0.005	-	-
Whitehaven (habits averaged 2021-2025)	Seafood consumers	0.44[d]	0.013	0.41	-	0.021	-	-	-

a. The 'total dose' is the dose which accounts for all sources including gaseous and liquid discharges and direct radiation.
The 'total dose' for the representative person with the highest dose is presented.
Other dose values are presented for specific sources, either liquid discharges or gaseous discharges, and their associated pathways. They serve as a check on the validity of the 'total dose' assessment.
The representative person is an adult unless otherwise stated
'Data are presented to 2 significant figures or 3 decimal places. Data below 0.005 mSv are reported as <0.005 mSv

b. Doses ('total dose' and source-specific doses) only include estimates of anthropogenic inputs (by substracting background and cosmic sources from measured gamma dose rates)

c. Water is from rivers and streams and not tap water

d. Includes the effects of discharges from the adjacent Sellafield site

e. Includes a component due to natural sources of radionuclides

Table 7.2 Concentrations of radionuclides in terrestrial food and the environment near the LLWR, 2025

Material	Location or selection	No. of sampling observ-ations[a]	Mean radioactivity concentration (fresh)[b], Bq kg^{-1}											
			^{3}H	^{14}C	^{60}Co	^{90}Sr	^{95}Zr	^{95}Nb	^{99}Tc	^{106}Ru	^{125}Sb	^{129}I	^{134}Cs	^{137}Cs	Total Cs
Milk		1	<2.3	14	<0.05	<0.026	<0.17	<0.25	<0.0056	<0.46	<0.11	<0.0040	<0.05	<0.10	
Deer		1	<4.0	26	<0.07	<0.049	<0.13	<0.08	<0.026	<0.54	<0.14	<0.0090	<0.04	0.47	0.47
Eggs		1	<3.4	20	<0.04	0.044	<0.06	<0.04		<0.34	<0.09	<0.017	<0.05	0.10	0.096
Potatoes		1	<2.5	11	<0.08	<0.043	<0.14	<0.09	<0.023	<0.62	<0.17	<0.013	<0.04	0.18	0.18
Sheep muscle		1	<2.7	11	<0.05	0.036	<0.08	<0.13	<0.027	<0.36	<0.09	<0.011	<0.02	1.9	1.9
Sheep offal		1	<3.8	29	<0.07	<0.038	<0.16	<0.13	<0.028	<0.55	<0.14	<0.015	<0.08	0.83	0.84
Oats		1	<8.7	100	<0.16	0.32	<0.39	<0.19	<0.059	<1.5	<0.41	<0.031	<0.20	<0.17	
Sediment	Drigg Stream	4[E]			<0.26	<0.88	<0.75	<0.26		<2.0	<1.1		<0.23	33	
Freshwater	Drigg Stream	4[E]	<3.8		<0.20	<0.014							<0.17	<0.15	
Freshwater	Railway drain	1[E]	<3.9		<0.34	<0.016							<0.28	<0.26	

Material	Location or selection	No. of sampling observ-ations[a]	Mean radioactivity concentration (fresh)[b], Bq kg^{-1}									
			^{144}Ce	^{210}Po	^{228}Th	^{230}Th	^{232}Th	^{234}U	^{235}U	^{238}U	^{238}Pu	^{239}Pu+ ^{240}Pu
Milk		1	<0.32								<0.000051	<0.000042
Deer		1	<0.28								<0.000058	<0.000082
Eggs		1	<0.34								<0.00016	0.000025
Potatoes		1	<0.32								0.000075	0.00096
Sheep muscle		1	<0.35								0.000090	0.00081
Sheep offal		1	<0.29								0.011	0.071
Oats		1	<1.1								0.00034	0.0029
Sediment	Drigg Stream	4[E]	<1.2	11	10	8.7	8.1	15	<0.74	15	1.8	14
Freshwater	Drigg Stream	4[E]		<0.0014	<0.0020	<0.0017	<0.00090	0.013	<0.00077	0.0094	<0.00093	<0.0021
Freshwater	Railway drain	1[E]		0.0010	<0.0016	0.00070	<0.00074	0.0046	<0.00016	0.0038	<0.00034	<0.0027

Material	Location or selection[e]	No. of sampling observations[a]	Mean radioactivity concentration (fresh)[b], Bq kg^{-1}			
			^{241}Pu	^{241}Am	Gross alpha	Gross beta
Milk		1	<0.24	<0.000037		
Deer		1	<0.28	0.00024		
Eggs		1	<0.57	0.000060		
Potatoes		1	<0.29	0.0012		
Sheep muscle		1	<0.26	0.0019		
Sheep offal		1	<0.18	0.088		
Oats		1	<0.31	0.0064		
Sediment	Drigg Stream	4[E]	<27	20	330	600
Freshwater	Drigg Stream	4[E]	<0.083	<0.0045	0.041	0.41
Freshwater	Railway drain	1[E]	<0.037	<0.00055	0.032	0.33

a. The number of farms from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

b. Except for milk and freshwater where units are Bq l^{-1}, and for sediment where dry concentrations apply

E Measurements are made on behalf of the Food Standards Agency unless labelled 'E'. In that case they are made on behalf of the Environment Agency

Table 7.3 Concentrations of radionuclides in surface water leachate from solid waste disposal sites in Scotland, 2025

Area	Location	No. of sampling observations	Mean radioactivity concentration, Bq l^{-1}			
			^{3}H	^{14}C	^{137}Cs	^{241}Am
Aberdeen City	Ness landfill	1	<5.0	<15	<0.05	<0.05
City of Glasgow	Summerston landfill	1	55	<15	<0.05	<0.05
City of Glasgow	Cathkin	1	210	<15	<0.05	<0.05
Clackmannanshire	Black Devon	1	<5.0	<15	<0.05	<0.05
Dunbartonshire	Birdston	1	<5.0	<15	<0.05	<0.05
Dundee City	Riverside	1	5.0	<15	<0.05	<0.05
Edinburgh	Braehead	1	<5.0	<15	<0.05	<0.05
Fife	Balbarton	1	31	<15	<0.05	<0.05
Fife	Melville Wood	1	170	<15	<0.05	<0.05
Highland	Longman landfill	1	<5.0	<15	<0.05	<0.05
North Lanarkshire	Dalmacoulter	1	110	<15	<0.05	<0.05
North Lanarkshire	Kilgarth	1	<5.0	<15	<0.05	<0.05
Stirling	Lower Polmaise	1	<5.0	<15	<0.05	<0.05

Table 7.4 Concentrations of radionuclides in water from solid waste disposal sites in England and Wales, 2025

Location	Sample source	No. of sampling observ-ations	Mean radioactivity concentration Bq^{-1}						
			^{3}H	^{40}K	^{60}Co	^{137}Cs	^{226}Ra	^{228}Th	^{230}Th
Cumbria									
Lillyhall	Borehole WMBH02	1	<3.0	<6.4	<0.39	<0.36		0.0033	0.020
Lillyhall	Borehole WMBH12	1	<10	<5.6	<0.37	<0.34		0.0023	0.0093
	Distington Beck	1		6.7	<0.40	<0.36			
Lancashire									
Clifton Marsh	Borehole 6	2	<3.4	<3.9	<0.20	<0.17		<0.0095	<0.0023
Clifton Marsh	Borehole 19	2	<3.5	<5.4	<0.17	<0.16		<0.0040	<0.0047
Clifton Marsh	Borehole 40	2	<3.5	<3.9	<0.20	<0.17		<0.0042	0.0035
Clifton Marsh	Borehole 59	1	<3.7	<4.4	<0.21	<0.16		<0.0057	<0.0046
Northamptionshire									
Kings Cliffe	K13A Groundwater borehole	1	<3.8	<5.5		<0.23	0.012	0.0034	0.0036
Kings Cliffe	K15A Groundwater borehole	1	<3.7	<5.5		<0.24	0.013	0.0037	0.0035
Kings Cliffe	K17 Northern perimeter Groundwater borehole	1	<3.7	<6.2		<0.27	0.092	0.015	0.0039
	Horse Water spring	1		<5.8		<0.25			
	Willow brook	1		<6.3		<0.25			

Table 7.4 continued

Location	Sample source	No. of sampling observ-ations	Mean radioactivity concentration Bq^{-1}					
			^{232}Th	^{234}U	^{235}U	^{238}U	Gross alpha[a]	Gross beta
Cumbria								
Lillyhall	Borehole WMBH02	1	0.0018	0.00010	0.0015	<0.0052	<0.10	<0.12
Lillyhall	Borehole WMBH12	1	<0.0025	0.0036	0.00010	<0.0027	<0.10	<0.12
	Distington Beck	1					<0.10	<0.16
Lancashire								
Clifton Marsh	Borehole 6	2	<0.0012	0.034	0.0015	0.029	<0.24	0.97
Clifton Marsh	Borehole 19	2	<0.0015	0.048	0.0021	0.040	<1.4	6.8
Clifton Marsh	Borehole 40	2	<0.0016	0.0037	<0.00018	0.0035	<0.13	1.1
Clifton Marsh	Borehole 59	1	<0.0022	0.0014	<0.00041	0.0010	<0.090	1.3
Northamptionshire								
Kings Cliffe	K13A Groundwater borehole	1	<0.0010	0.026	0.0014	0.024	<0.19	0.56
Kings Cliffe	K15A Groundwater borehole	1	0.0017	0.017	0.00070	0.017	<0.12	0.20
Kings Cliffe	K17 Northern perimeter Groundwater borehole	1	0.0015	0.030	0.00080	0.028	0.88	3.0
	Horse Water spring	1					<0.070	0.49
	Willow brook	1					<0.039	0.25

a. Lillyhall using ^{239}Pu standard, otherwise using ^{242}Pu standard

Table 7.5 Concentrations of naturally occurring radionuclides in the environment near Whitehaven and further afield, 2025[a]

Material	Location	No. of sampling observ-ations[a]	Mean radioactivity concentration (fresh)[b], Bq kg^{-1}							
			^{210}Pb	^{210}Po	^{228}Th	^{230}Th	^{232}Th	^{234}U	^{235}U	^{238}U
Phosphate processing, Whitehaven										
Winkles	Parton	2	0.93	10						
Winkles	Nethertown	4	1.1	11	0.53	0.38	0.33	0.67	0.021	0.61
Winkles	Ravenglass	2	2.0	18						
Mussels	Whitehaven	2	1.1	41						
Common prawns	Seascale	2	0.012	4.6						
Crabs	Parton	2	0.079	52						
Crabs	Sellafield coast-al area	2	0.10	15	0.087	0.0039	0.0037	0.074	0.0023	0.061
Lobsters	Parton	2	0.23	23						
Lobsters	Sellafield coast-al area	2	0.054	14						
Nephrops	Whitehaven	2	0.059	2.3	0.023	0.012	0.0094	0.022	0.00082	0.020
Cod	Parton	1	0.028	0.62						
Whiting	Parton	1	0.016	0.39						
Cod	Whitehaven	2	0.061	0.68						
Plaice	Whitehaven	2	0.22	1.9	0.063	<0.000073	0.00040	0.021	0.0012	0.020
Plaice	Drigg	2	0.19	2.1	0.053	<0.00017	0.00058	0.027	0.00095	0.023
Annual samples (Non-Whitehaven)										
Winkles	South Gare (Hartlepool)	2	1.5	20						
Cockles	Middleton Sands	2		20						
Mussels	Morecambe	2		38						
Mussels	Ribble Estuary	1			0.098	0.037	0.022			
Limpets	Kirkcudbright	1[S]		4.5						
Crabs	Kirkcudbright	2[S]		2.6						
Lobsters	Kirkcudbright	2[S]		2.3						
Winkles	Kirkcudbright	2[S]		4.7						
Shrimps	Ribble Estuary	1			0.0079	0.0046	0.0034			
Wildfowl	Ribble Estuary	1				0.0073	0.0044			
Sediment	Kirkcudbright	2[S]						14	0.54	13
Sediment	Balcary Bay	1[S]						6.2	0.26	5.8

a. Data for artificial nuclides for some of these samples may be available in the relevant sections for nuclear sites

b. Except for sediment where dry concentrations apply

[S] Measurements are made on behalf of the Scottish Environment Protection Agency

All other measurements are made on behalf of the Food Standards Agency

Table 7.6 Discharges of gaseous radioactive wastes from non-nuclear establishments in England and Northern Ireland, 2025[a]

	Discharges during 2025, Bq					
	Education (Universities and Colleges)		Hospitals		Other (Research, manufacturing and public sector)	
	England	Northern Ireland	England	Northern Ireland	England	Northern Ireland
^{3}H					4.1E+11	
^{14}C	5.2E+08				1.9E+12	2.1E+08
^{18}F	1.8E+11				8.1E+11	
^{35}S					1.1E+08	
^{60}Co					1.5E+07	
^{85}Kr					5.8E+10	
^{90}Sr					1.5E+08	
^{99m}Tc			5.5E+07		8.1E+05	
^{125}I			1.0E+07		8.5E+07	
^{129}I					9.0E+04	
^{131}I			1.4E+08		1.6E+08	
^{137}Cs					1.9E+08	
Uranium Alpha					1.0E+00	
241Pu					9.6E+02	
Plutonium Alpha					1.6E+06	
241Am					4.2E+02	
^{242}Cm					1.0E+00	
Other Alpha Particulate			1.1E+07		5.9E+10	
Other Beta/Gamma Particulate	3.4E+11		6.1E+09		6.1E+12	

a. Excludes nuclear power, defence and radiochemical manufacturing (Amersham) industries. Excludes discharges which are exempt from reporting. England discharge data refers to 2024

Table 7.7 Discharges of liquid radioactive waste from non-nuclear establishments in England and Northern Ireland, 2025[a]

	Discharges during 2025, Bq						
	Education (Universities and Colleges)		Hospitals		Other (Research, manufacturing and public sector)		Oil and gas (off-shore)
	England	Northern Ireland	England	Northern Ireland	England	Northern Ireland	United Kingdom
^{3}H	3.2E+09		6.3E+07		4.6E+13		
^{14}C	1.9E+09				6.9E+10	2.8E+07	
^{18}F	5.5E+11		5.4E+12	3.1E+11	7.2E+12		
^{32}P	6.0E+08		1.1E+08		6.5E+07		
^{33}P	4.1E+07		5.4E+07				
^{35}S	2.6E+09				7.2E+08		
^{51}Cr	1.8E+08		1.6E+07				
^{57}Co			5.3E+07				
^{60}Co	1.3E+06				6.6E+01		
^{67}Ga	3.0E+08		2.0E+09				
^{75}Se	2.7E+07		6.5E+09	2.1E+08	2.2E+08		
^{90}Sr	2.2E+03				1.3E+03		
^{90}Y			3.2E+10	1.4E+09	2.3E+09		
^{99}Tc	1.9E+06				8.6E+04		
^{99m}Tc	5.3E+10		4.4E+13	1.3E+12	1.3E+12		
^{111}In	2.8E+08		5.9E+10	2.3E+10			
^{123}I	1.8E+09		1.3E+12	7.9E+10	2.9E+10		
^{125}I	1.5E+09	6.6E+07	7.9E+08	5.6E+09	7.3E+09		
^{129}I					1.8E+03		
^{131}I			8.8E+12	3.4E+11	4.0E+11		
^{137}Cs	2.2E+07				7.3E+09		
^{177}Lu	2.9E+07		1.1E+13	4.4E+11	1.6E+12		
^{201}Tl			1.3E+10				
^{223}Ra		1.1E+05	1.1E+10	4.1E+08	1.9E+07		
^{230}Th					4.7E+08		
^{232}Th					4.2E+08		
^{237}Np					1.0E+00		
Uranium Alpha					5.0E+08		
^{241}Pu					8.7E+03		
Plutonium Alpha					2.8E+04		
^{241}Am					3.8E+03		
^{242}Cm					5.0E+00		
^{243}Cm					2.1E+01		
^{244}Cm					1.0E+00		
Total Alpha	7.4E+04		1.0E+10		5.9E+10		2.9E+10
Total Beta/Gamma (Excl Tritium)	5.9E+11		6.3E+13		9.2E+12		2.1E+10
Other Alpha Particulate			1.5E+08		1.6E+07		
Other Beta/Gamma[b]	3.3E+10		3.1E+11		1.0E+11		
Other Beta/Gamma Particulate					2.2E+08		

a. Excludes nuclear power, defence and radiochemical manufacturing (Amersham) industries. Excludes discharges which are exempt from reporting. England discharge data refers to 2024

b. Excluding specific radionuclides

Table 7.8 Discharges of gaseous radioactive wastes from non-nuclear establishments in Scotland by OSPAR region, 2025[a]

Area	Discharges during 2025, Bq					
	OSPAR Region II - Greater North Sea			OSPAR Region III - Celtic Seas		
	Education (Universities and Colleges)	Hospitals	Other (Research, manufacturing and public sector)	Education (Universities and Colleges)	Hospitals	Other (Research, manufacturing and public sector)
^{3}H	Nil	Nil	3.5E+08	Nil	Nil	Nil
^{14}C	Nil	Nil	1.4E+10	Nil	Nil	Nil
^{18}F	Nil	Nil	Nil	Nil	Nil	Nil
^{85}Kr	Nil	Nil	Nil	Nil	Nil	Nil
^{125}I	Nil	Nil	Nil	Nil	Nil	Nil
^{131}I	Nil	Nil	Nil	Nil	Nil	Nil
^{133}Xe	Nil	Nil	Nil	Nil	Nil	Nil
^{137}Cs	Nil	Nil	Nil	Nil	Nil	Nil
Group of Two or More Specified Radionuclides	Nil	5.6E+10	Nil	Nil	Nil	5.6E+06
Other Alpha	Nil	Nil	Nil	Nil	Nil	1.2E+01
Other Beta/Gamma	Nil	1.1E+11	Nil	Nil	Nil	6.5E+04
Other Radionuclides Not Listed	Nil	Nil	2.2E+04	Nil	1.4E+10	Nil

a. Excludes nuclear power and defence industries. Excludes discharges which are exempt from reporting.

Table 7.9 Discharges of liquid radioactive wastes from non-nuclear establishments in Scotland by OSPAR region, 2025[a]

Area	Discharges during 2025, Bq						
	OSPAR Region II - Greater North Sea				OSPAR Region III - Celtic Seas		
	Education (Universities and Colleges)	Hospitals	Other (Research, manufacturing and public sector)	Oil and gas (on-shore)	Education (Universities and Colleges)	Hospitals	Other (Research, manufacturing and public sector)
^{3}H	4.1E+07	3.8E+05	5.0E+07	Nil	8.0E+07	Nil	4.2E+06
^{14}C	1.9E+07	Nil	2.2E+09	Nil	3.7E+06	3.7E+06	7.5E+06
^{18}F	Nil	1.8E+11	Nil	Nil	Nil	3.4E+11	Nil
^{22}Na	Nil	Nil	Nil	Nil	Nil	Nil	Nil
^{32}P	1.4E+07	1.1E+05	Nil	Nil	7.9E+07	Nil	9.3E+08
^{33}P	2.8E+09	Nil	Nil	Nil	Nil	Nil	Nil
^{35}S	Nil	Nil	Nil	Nil	6.0E+08	Nil	Nil
^{51}Cr	Nil	Nil	Nil	Nil	Nil	Nil	Nil
^{57}Co	Nil	Nil	Nil	Nil	Nil	Nil	Nil
^{60}Co	Nil	Nil	Nil	Nil	Nil	Nil	Nil
^{67}Ga	Nil	Nil	Nil	Nil	Nil	4.8E+07	Nil
^{75}Se	Nil	9.0E+07	Nil	Nil	Nil	8.0E+07	Nil
^{89}Sr	Nil	Nil	Nil	Nil	Nil	Nil	Nil
^{90}Sr	Nil	Nil	Nil	Nil	Nil	Nil	Nil
^{90}Y	Nil	4.1E+08	Nil	Nil	Nil	7.8E+08	Nil
^{99m}Tc	2.8E+07	2.8E+12	Nil	Nil	Nil	2.1E+12	2.5E+08
^{111}In	Nil	9.3E+07	Nil	Nil	Nil	7.4E+08	Nil
^{123}I	Nil	5.7E+10	Nil	Nil	Nil	6.1E+10	Nil
^{125}I	Nil	7.2E+06	Nil	Nil	Nil	Nil	Nil
^{131}I	9.6E+07	2.9E+11	Nil	Nil	Nil	2.5E+11	Nil
^{134}Cs	Nil	Nil	Nil	Nil	Nil	Nil	Nil
^{137}Cs	Nil	Nil	Nil	Nil	Nil	Nil	Nil
^{153}Sm	Nil	Nil	Nil	Nil	Nil	Nil	Nil
^{169}Er	Nil	Nil	Nil	Nil	Nil	Nil	Nil
^{201}Tl	Nil	Nil	Nil	Nil	Nil	1.4E+08	Nil
^{210}Pb	Nil	Nil	1.4E+07	1.4E+08	Nil	Nil	Nil
^{210}Po	Nil	Nil	2.1E+06	1.4E+08	Nil	Nil	Nil
^{226}Ra	Nil	Nil	3.3E+06	1.2E+09	Nil	Nil	Nil
^{228}Ra	Nil	Nil	9.8E+05	9.9E+08	Nil	Nil	Nil
^{232}Th	Nil	Nil	Nil	Nil	Nil	Nil	6.6E+05
Uranium Alpha	Nil	Nil	2.1E+03	Nil	1.0E+03	Nil	Nil
^{237}Np	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Plutonium Alpha	Nil	Nil	Nil	Nil	Nil	Nil	Nil
^{241}Am	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Group of Two or More Specified Radionuclides	Nil	Nil	Nil	Nil	Nil	Nil	4.6E+06
Other Alpha	3.0E+03	1.1E+08	Nil	Nil	Nil	Nil	2.2E+05
Other Beta/ Gamma[b]	1.4E+05	1.5E+11	Nil	Nil	Nil	9.2E+11	1.3E+07
Other Radionuclide Not Listed	Nil	2.0E+08	Nil	Nil	Nil	2.3E+08	2.9E+05

a. Excludes nuclear power and defence industries. Excludes discharges which are exempt from reporting.

b. Excluding specific radionuclides

Table 7.10 Discharges of gaseous and liquid radioactive wastes from non-nuclear establishments in Wales, 2025[a]

	Discharges during 2025, Bq		
	Education (Universities and Colleges)	Hospitals	Other (Research, manufacturing and public sector)
Gaseous Discharges			
^{3}H			1.4E+13
^{14}C			1.5E+12
Liquid Discharges			
^{3}H	1.8E+08		3.9E+10
^{14}C	6.3E+04		2.0E+09
^{32}P	2.7E+06		
^{35}S			1.7E+07
^{125}I	1.3E+10		5.4E+07
^{131}I		2.7E+11	

a. Excludes nuclear power industries. Excludes discharges which are exempt from reporting.

Table 7.11 Monitoring near Holy Loch, 2025

Material	Location	No. of sampling observations	^{60}Co	^{125}Sb	^{137}Cs	^{155}Eu	^{241}Am
Sediment	Mid-loch	1	<0.10	<0.30	2.4	<0.39	<0.56

Location	Ground type	No. of sampling observations	Mean gamma dose rate in air at 1m, μGy h^{-1}
Kilmun Pier	Sediment	1	0.051
Mid-Loch	Sediment	1	<0.047
Robertsons Yard	Sediment	1	0.053

Table 7.12 Monitoring in the Firth of Forth, River Clyde and near Glasgow, 2025[a]

Location	Material and selection[b]	No. of sampling observ-ations[a]	Mean radioactivity concentration (fresh)[b], Bq kg^{-1}						
			^{3}H	^{14}C	^{54}Mn	^{90}Sr	^{95}Nb	^{99}Tc	^{125}Sb
Between Finlaystone and Woodhall	Mussels	1		<15	<0.10		<0.14	0.29	<0.27
Between Finlaystone and Woodhall	Fucus vesiculosus	1		20	<0.10		<0.10	11	<0.11
Dalmuir Clydebank	Sediment	1		<15	<0.10		<0.10		<0.25
Downstream of Dalmuir	Freshwater	4			<0.10		<0.10		<0.18
River Clyde[c]	Freshwater	4	<1.1			<0.0050			
Firth of Forth	Freshwater	4	<1.1			<0.0050			
Daldowie	Sludge pellets	4			<0.10		<0.11		<0.37

Location	Material and selection[b]	No. of sampling observ-ations[a]	Mean radioactivity concentration (fresh)[b], Bq kg^{-1}						
			^{131}I	^{137}Cs	^{155}Eu	^{177}Lu	^{241}Am	Gross alpha	Gross beta
Between Finlaystone and Woodhall	Mussels	1	<0.68	<0.10	<0.19	<5.6	<0.11		
Between Finlaystone and Woodhall	Fucus vesiculosus	1	4	0.14	<0.14	<14	<0.16		
Dalmuir Clydebank	Sediment	1	<0.92	4.9	<0.37	<9.4	0.94		
Downstream of Dalmuir	Freshwater	4	<0.15	<0.10	<0.24	<0.46	<0.25		
River Clyde[c]	Freshwater	4	<1.9	<0.01		<0.50		<0.22	1.3
Firth of Forth	Freshwater	4		<0.01				<1.5	1.3
Daldowie	Sludge pellets	4	330	2.0	<0.83	140	<0.46		

a. Results are available for other radionuclides detected by gamma spectrometry,
All such results are less than the limit of detection
No ^{32}P analyses were performed in 2025

b. Except for water where units are Bq l^{-1}, and sludge pellets and sediment where dry concentrations apply

8 Regional Monitoring

Highlights

- Doses for the representative person were approximately 1% (or less) of the annual public dose limit in 2025

Regional monitoring in areas remote from nuclear sites continued in 2025:

- to establish long distance transport of radioactivity from UK and overseas nuclear sites
- to indicate general contamination of the food supply and the environment
- to provide data under UK obligations for the OSPAR Convention

The routine component parts of this programme are:

- sampling of seafood and environmental samples from the Channel Islands and Northern Ireland
- monitoring UK ports of entry for foodstuffs for other non-specific contamination
- sampling of the UK food supply, air, rain, sediments, sources of drinking water and seawater.

8.1 Channel Islands

Samples of marine environmental materials were provided by the Channel Island States of Jersey and Guernsey and analysed for a range of radionuclides, monitoring around Alderney ceased in 2019 [9]. The programme monitors the effects of radioactive discharges from the French reprocessing plant at La Hague and the power station at Flamanville. It also monitors any effects of historical disposals of radioactive waste in the Hurd Deep, a natural trough in the western English Channel. Fish and shellfish are monitored to determine exposure from the internal radiation pathway, and sediment is analysed for external exposures. Seawater and seaweeds are sampled as environmental indicator materials, and, in the latter case, because of their use as fertilisers. A review of marine radioactivity in the Channel Islands from 1990 to 2009 has been published [195].

The results of monitoring for 2025 are given in Table 8.1. There was evidence of routine releases from the nuclear industry in some food and environmental samples (for example, technetium-99). However, activity concentrations in shellfish were low and similar to those in previous years. It is generally difficult to attribute the results to different sources, including fallout from nuclear weapons testing, due to the low values detected. No evidence for significant releases of activity from the Hurd Deep site was found.

In 2025, the dose to the representative person, consuming large amounts of fish and shellfish was estimated to be less than 0.005mSv, or less than 0.5% of the dose limit for members of the public. The assessment included a contribution from external exposure. The concentrations of artificial radionuclides in the marine environment of the Channel Islands and the effects of discharges from local sources, therefore, continued to be of negligible radiological significance.

The collection of milk and crop samples from the Channel Island States ceased in 2014. Results up to 2013 are included in earlier RIFE reports (for example [98]) and the data indicated no significant effects from UK or other nuclear installations.

8.2 Isle of Man

Following review of their monitoring programmes, the FSA's terrestrial and aquatic monitoring and the Environment Agency's marine monitoring on the Isle of Man ceased in 2013 and 2016, respectively, see References [8,72,75,138] for more details. Results up to 2015 are included in earlier RIFE reports (for example [75]). Previous results have demonstrated that there has been no significant impact on the Isle of Man from discharges to sea from mainland nuclear installations in recent years.

The Government of the Isle of Man undertakes their own independent radioactivity monitoring programme and provides an indication of the far-field effects of current and historical discharges from Sellafield and other UK nuclear sites. These are reported annually: https://www.gov.im/about-the-government/departments/environment-food-and-agriculture/regulation-directorate/government-laboratory/environmental-radioactivity/.

8.3 Northern Ireland

The NIEA monitors the far-field effects of liquid discharges from Sellafield into the Irish Sea. The programme involved sampling fish, shellfish, and indicator materials from a range of locations along the coastline (Figure 8.1). The sample species, type and locations are listed in the respective site tables. Gamma dose rates were measured over intertidal areas to assess the external exposure pathway. The results of monitoring are given in Table 8.2(a) and Table 8.2(b).

Figure 8.1 Monitoring locations in Northern Ireland, 2025.



In 2025, the main effect of discharges from Sellafield was observed in concentrations of technetium-99 in shellfish and seaweed samples. These were similar to values reported in recent years, reflecting the considerably decreased inputs to the Irish Sea (see also Section 3.3.3). Caesium-137 concentrations were low and generally similar to those in 2024 and over the period 2002 to 2025. As expected, low concentrations of transuranic radionuclides were also detected in 2025. Reported concentrations are less than those found nearer to Sellafield and continued to be low, as in recent years (Figure 8.2 to Figure 8.4). Further information on the trends in radioactivity in the marine environment of Northern Ireland has been published [196]. The gamma dose rates over intertidal areas were similar to those in previous years.

Figure 8.2 Concentrations of americium-241 and caesium-137, in Bq kg^{-1} (dry), in coastal sediments at Portrush, Northern Ireland, 2002 to 2025.

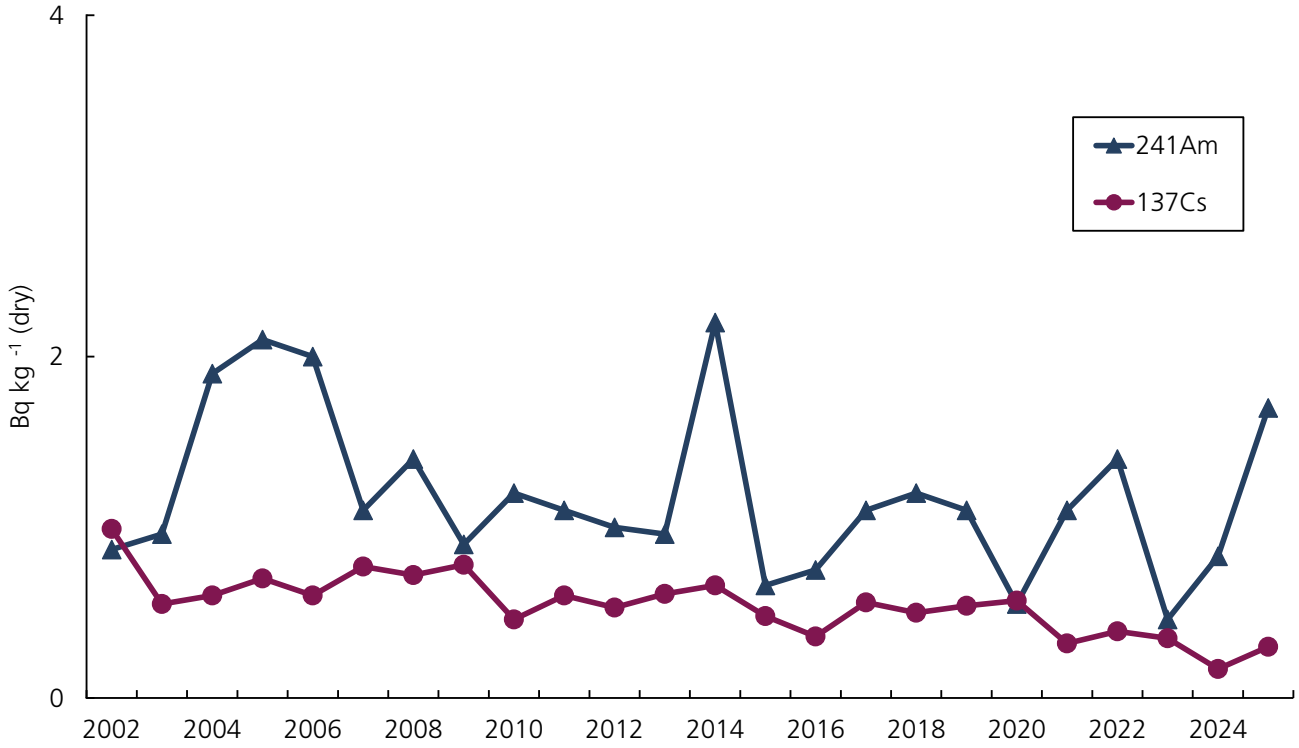


Figure 8.3 Concentrations of americium-241 and caesium-137, in Bq kg^{-1} (dry), in coastal sediments at Ballymacormick, Northern Ireland, 2002 to 2025.

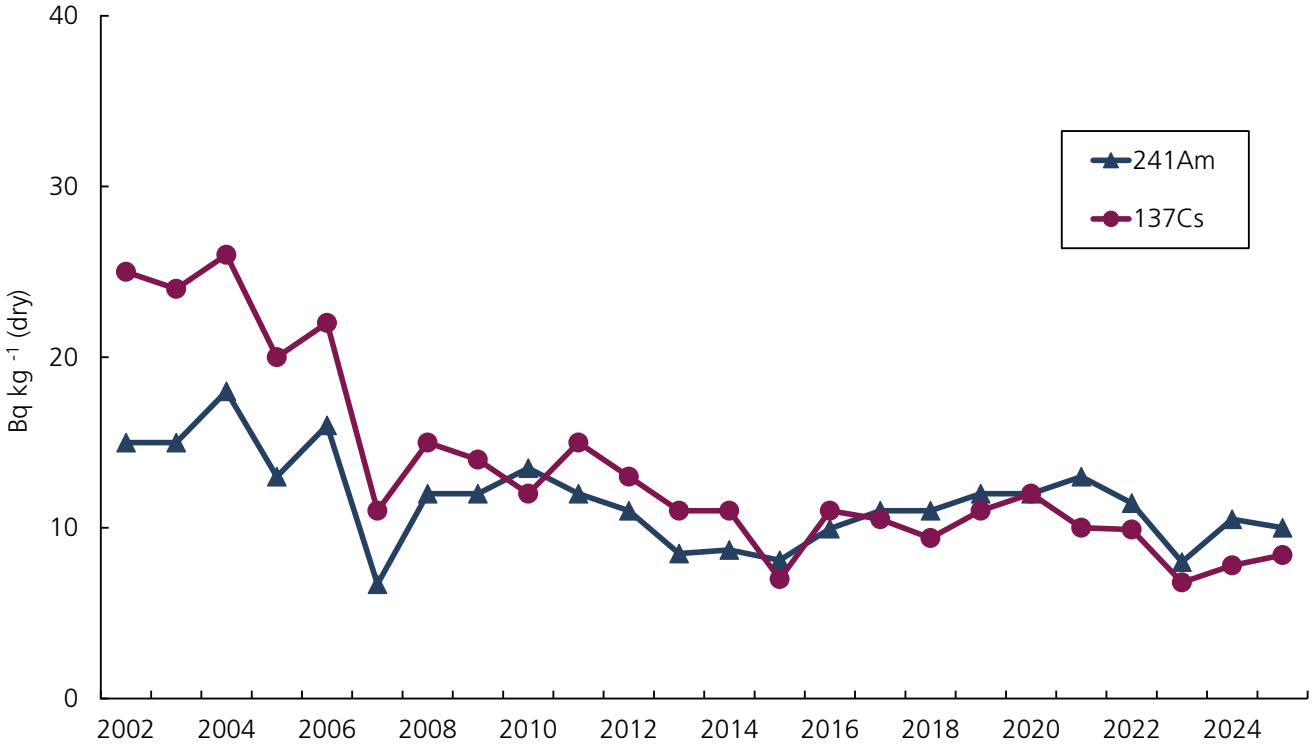
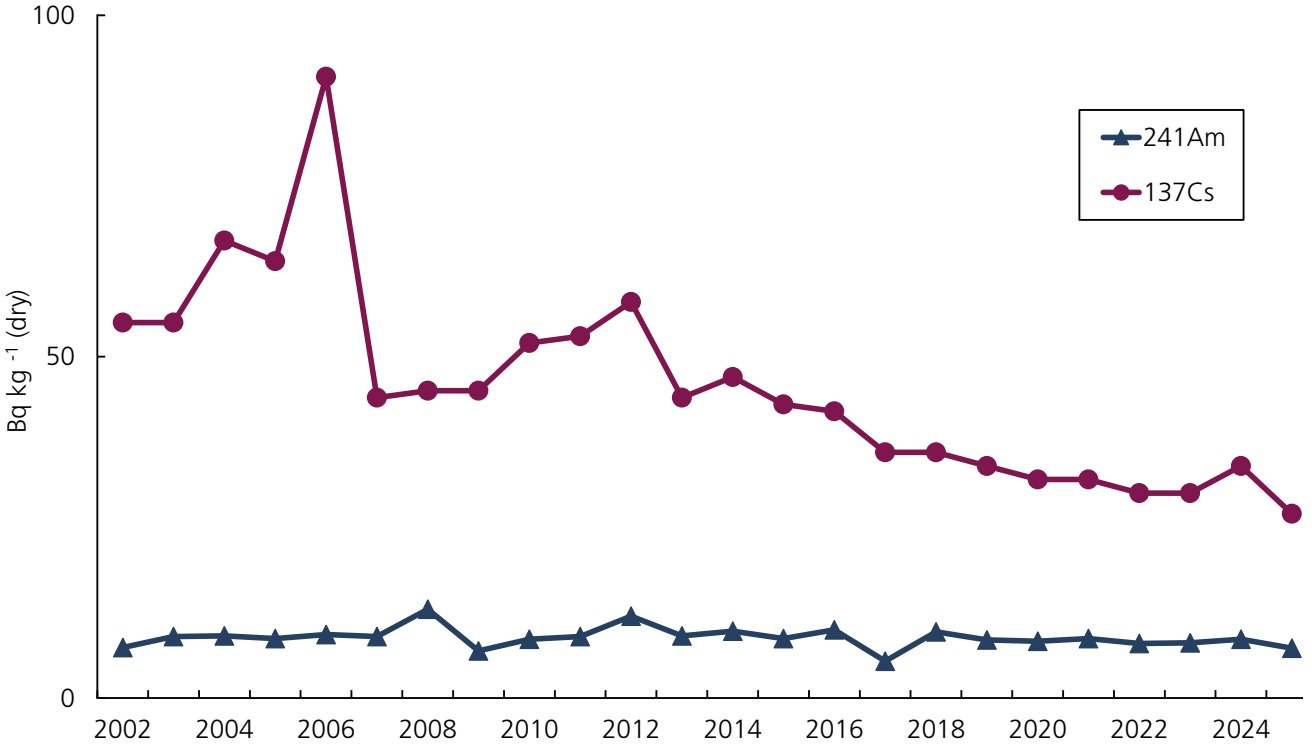


Figure 8.4 Concentrations of americium-241 and caesium-137, in Bq kg^{-1} (dry), in coastal sediments Carlingford Lough, Northern Ireland, 2002 to 2025.



A survey of consumption and occupancy in coastal regions of Northern Ireland established the habits of people consuming large quantities of fish and shellfish [197]. Based on the monitoring results from the marine environment in 2025, the annual dose from the consumption of seafood and exposure over intertidal areas was 0.007mSv (Table 3.15), or less than 1% of the dose limit for members of the public.

Monitoring results for the terrestrial environment of Northern Ireland are included in the following parts of Section 8.

8.4 General diet

As part of the UK government and devolved administrations' general responsibility for food safety, concentrations of radioactivity are determined in regional diets. These data (and data on other dietary components in Sections 8.5 and 8.6) previously formed the basis of the UK submission to the European Commission. While these data are no longer supplied to the European Commission for England, Wales and Northern Ireland, they will continue to be published in the RIFE reports.

In 2025, the concentrations found in a survey of radioactivity in canteen meals collected across the UK, and mixed diets in Scotland, were very low or typical of natural sources (Table 8.3). Activity concentrations were generally similar to those in previous years.

8.5 Milk

The programme of milk sampling across dairies in the UK continued in 2025. The aim is to collect monthly milk samples and analyse them for their radionuclide content. This programme provides useful information with which to compare data from farms close to nuclear sites and other establishments that may enhance values above background activity concentrations.

The results of milk monitoring for 2025 are summarised in Table 8.4. Most results were similar to those in previous years (where comparisons can be made). The mean carbon-14 concentrations in England, Northern Ireland, Wales, and Scotland were all close to the expected background concentration in milk (see Appendix 6). The maximum concentrations of carbon-14 in milk for England (Lancashire), Northern Ireland (Co. Tyrone), Wales (Clywd), and Scotland (all regions) were 27Bq l^{-1}, 30Bq l^{-1}, 27Bq l^{-1} and less than 15Bq l^{-1}, respectively. As in previous years, tritium concentrations were reported as 'less than values' at all remote sites. In 2025, strontium-90 concentrations were reported as 'less than values' (or just above the 'less than value'), and the mean concentration over the UK was less than 0.034Bq l^{-1} (compared to 0.034Bq l^{-1} in 2024). In the past, the highest concentrations of radiocaesium in milk were from those regions that received the greatest amounts of fallout from Chernobyl. However, the concentrations are now very low, and it is not possible to distinguish this trend.

The radiation dose from consuming milk at average rates was assessed for various age groups. In 2025, the most exposed age group was infants (1-year-old). For the range of radionuclides analysed, the annual dose was 0.005mSv or 0.5% of the dose limit. Previous surveys (for example, [198]) have shown that if a full range of nuclides were to be analysed and assessed, the dose would be dominated by naturally occurring lead-210 and polonium-210, and artificial radionuclides would contribute less than 10% of the dose.

8.6 Crops

The programme of monitoring naturally occurring and artificial radionuclides in crops (in England, Wales and the Channel Islands) as a check on general food contamination (remote from nuclear sites) ceased in 2014. Further information on previously reported monitoring is available in earlier RIFE reports (for example [138]).

8.7 Airborne particulate, rain, freshwater and groundwater

Radioactivity in rainwater and air was monitored at several UK locations as part of the programme of background sampling managed by the Environment Agency and SEPA. These data are collected on behalf of the DESNZ, NIEA and, the Scottish and Welsh Governments. The results of monitoring are given in Table 8.5. The routine programme is comprised of 2 components:

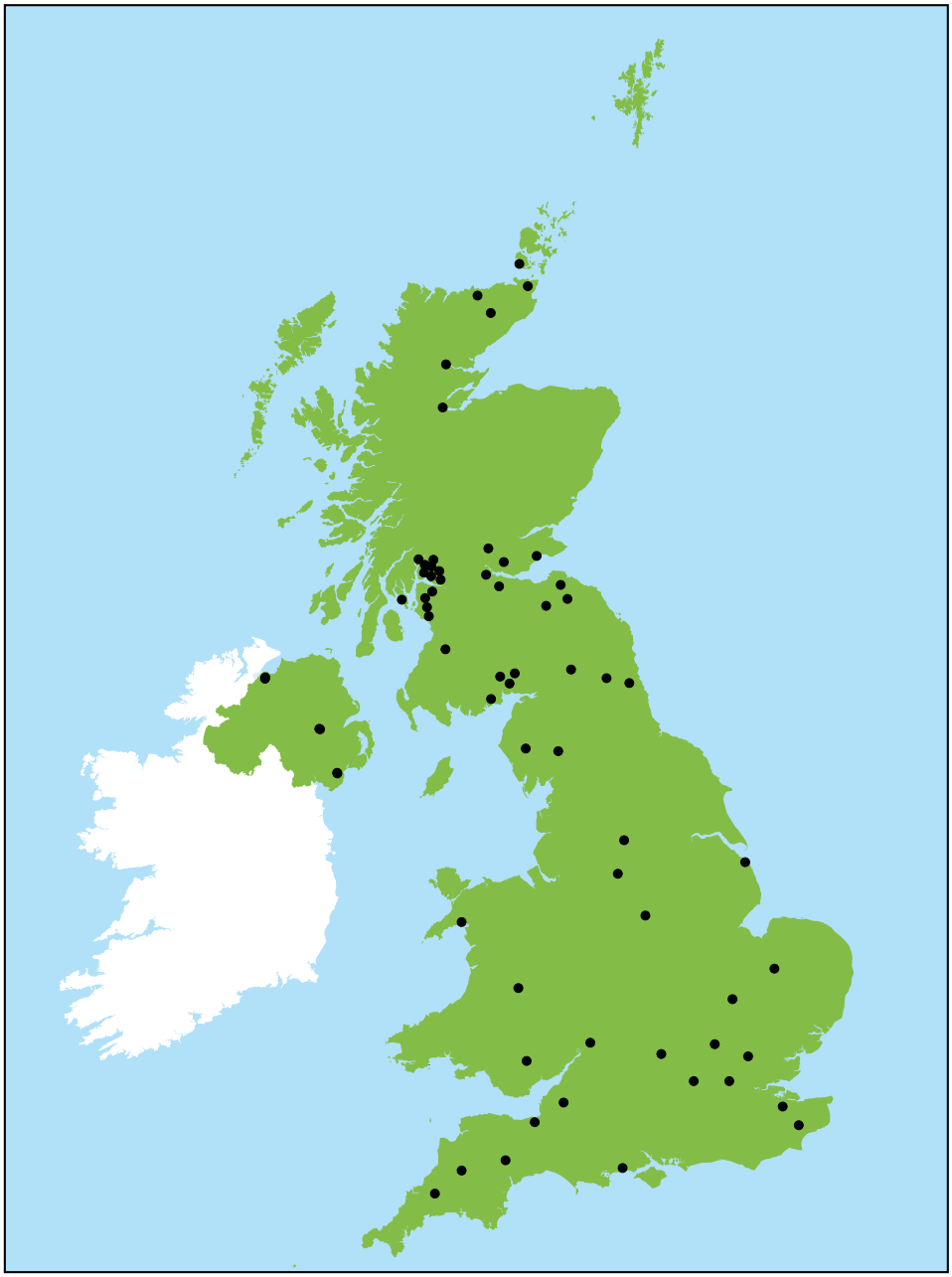
1. regular sampling and analysis on a quarterly basis
2. supplementary analysis on an 'ad hoc' basis

Tritium and caesium-137 concentrations in air and rainwater are reported as 'less than values' in 2024. Caesium-137 concentrations in air, as in recent years, remain less than 0.01% of those observed in 1986, the year of the Chernobyl reactor accident.

Concentrations of beryllium-7, a naturally occurring radionuclide formed by cosmic ray reactions in the upper atmosphere, were positively detected at similar values at all sampling locations. Peak air concentrations of this radionuclide tend to occur during spring and early summer, as a result of seasonal variations in the mixing of stratospheric and tropospheric air [153]. Activity concentrations of the radionuclides reported in air and rainwater were very low and do not currently merit radiological assessment.

Sampling and analysis of sources of drinking water throughout the UK continued in 2025 (Figure 8.5). The sample locations and regions are listed in the respective site tables. These water data are collected by the Environment Agency (for England and Wales), NIEA (for Northern Ireland) and SEPA (for Scotland). Sampling was designed to represent the main sources of drinking water, namely reservoirs, rivers and groundwater boreholes. Most of the water samples were representative of natural waters before treatment and supply to the public water system.

Figure 8.5 Sources of drinking water sampling locations, 2025.



The results are given in Table 8.6 to Table 8.8 (inclusive). Tritium concentrations were all substantially below the investigation level for drinking water of 100Bq l^{-1} in the Water Supply (Water Quality) (Amendment) 2018 Regulations (retained from European Directive 2013/51) (where applicable) and all are reported as 'less than values' except for one result). At Gullielands Burn (Table 8.6), which is near to the Chapelcross nuclear site, the tritium concentration was 9.2Bq l^{-1} in 2025 (similar to that in recent years).

The mean annual dose from consuming drinking water in the UK was 0.024mSv in 2025 (Table 8.9), which is higher than the mean annual dose in 2024 (0.012mSv). The highest annual dose was estimated to be 0.027mSv for drinking water from River Faughan, County Londonderry. The estimated doses were dominated by naturally occurring radionuclides and are generally similar to those reported in previous years. The annual dose from artificial radionuclides in drinking water was less than 0.001mSv.

Collection and analysis of groundwater samples from across Scotland was not performed in 2025. Collection and analysis of these samples resumed in 2026 and will be reported in RIFE 32 and thereafter. Results up to 2019 are included in earlier RIFE reports (for example, [9]).

8.8 Overseas incidents

Two overseas accidents have had direct implications for the UK: Chernobyl (1986) and Fukushima Dai-ichi (2011). Earlier RIFE reports have provided detailed results of monitoring by the environment agencies and the FSA [78].

For Chernobyl, the main sustained impact on the UK environment was in upland areas, where heavy rain fell in the days following the accident, but activity concentrations have now reduced substantially. The results of monitoring and estimated doses to consumers are available in earlier RIFE reports.

During 2025, SEPA received a number of enquiries from the public in relation to windfarm construction activities and the potential impact of release of Chernobyl contamination. A dose assessment has been prepared and is available on SEPA's website: https://www.sepa.org.uk/media/rwnfvp5s/radioactivity-wind-farm-developments-peatlands.pdf. SEPA calculated that windfarm construction activities did not pose a realistic risk to public health. Samples of peat were collected and analysed during 2025, and the results are presented in Table 8.10.

The accident at the Fukushima Dai-ichi nuclear power station in Japan in March 2011 resulted in significant quantities of radioactivity being released into the air and sea. Controls on imported food and animal feed products from Japan were implemented in 2011 (revised in 2016 and 2019). These controls were revoked in June 2022 for Great Britain (England, Wales and Scotland).

In Northern Ireland, European Regulations continued to apply under the terms of the UK's withdrawal agreement from the EU, until July 2023 when these regulations were repealed by the EU (under 2023/1453).

A full description of the legislation, requirements and procedures for imports are provided in earlier RIFE reports [16].

Screening instruments are used at importation points of entry to the UK as a general check on possible contamination from unknown sources. In 2025, these instruments were not triggered by a food consignment at any point of entry into the UK.

8.9 Seawater surveys

The UK government and devolved administrations are committed to preventing pollution of the marine environment from ionising radiation, with the main aim of reducing concentrations in the environment to near background values for naturally occurring radioactive substances, and close to zero for artificial radioactive substances [3]. Therefore, a programme of surveillance into the distribution of important radionuclides is maintained using research vessels and other means of sampling.

The seawater surveys reported here also support international studies concerned with the quality status of coastal seas. The programme of radiological surveillance work provided the source data and, therefore, the means to monitor and assess progress in line with the UK's commitments towards OSPAR's 1998 Strategy for Radioactive Substances target for 2020 (part of the North-East Atlantic Environment Strategy adopted by OSPAR for the period 2010 to 2020), see Section 1.3 of this report for more details. The surveys also provide information that can be used to distinguish different sources of artificial radioactivity (for example, [199]) and to derive dispersion factors for nuclear sites (for example, [200]). In addition, the distribution of radioactivity in seawater around the British Isles is a significant factor in determining the variation in individual exposures at coastal sites, as seafood is a major contribution to food chain doses.

The research vessel programme on radionuclide distribution currently comprises annual surveys of the Bristol Channel, western English Channel and biennial surveys of the Irish Sea and the North Sea. The results obtained in 2024 are given in Figure 8.6 to Figure 8.10 and are discussed in the text below.

Figure 8.6 Concentrations (Bq l^{-1}) of caesium-137 in surface water from the Irish Sea, September 2025. Figure generated with PyGMT v0.19.0 [201] and GMT v6.7.0 [202].

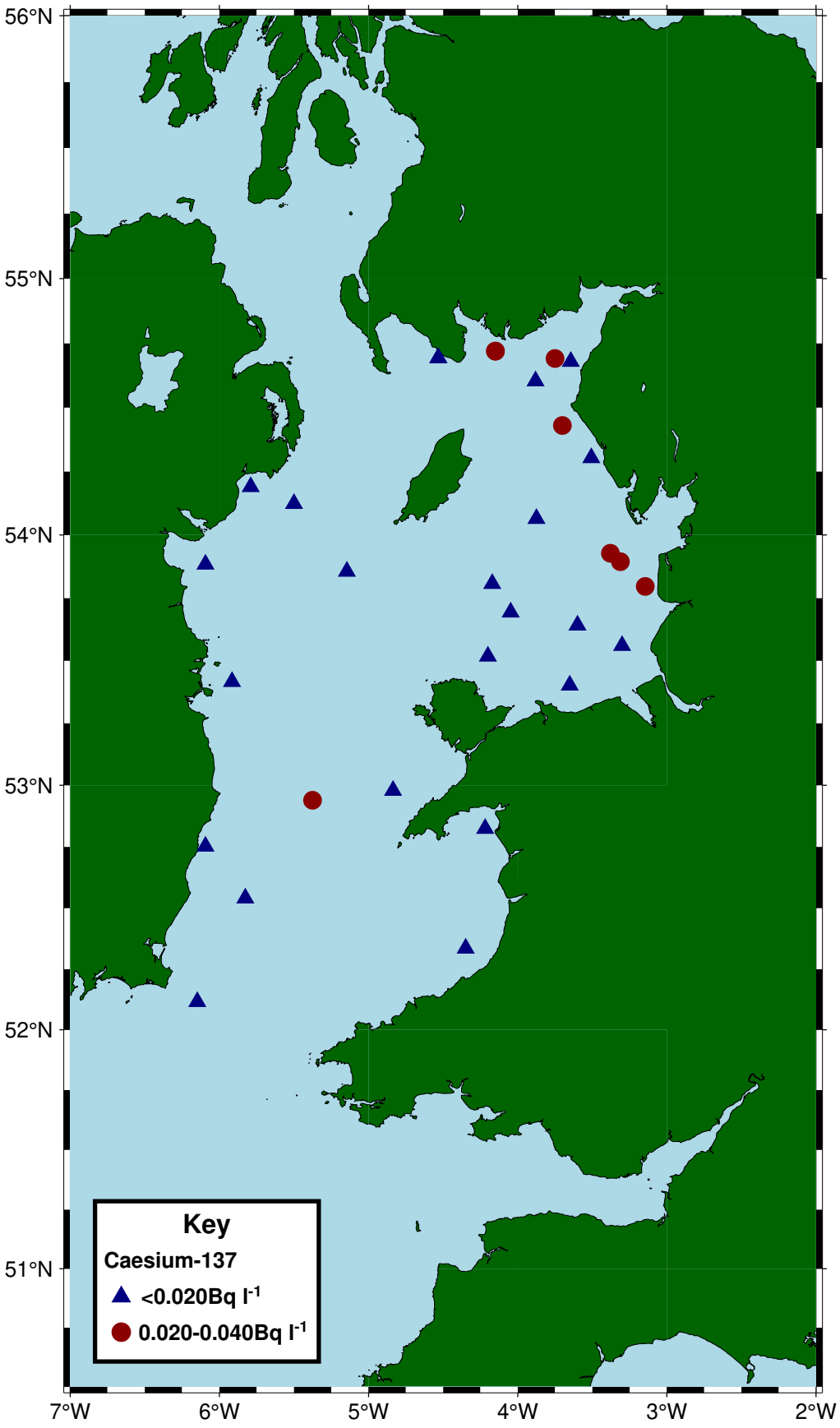


Figure 8.7 Concentrations (Bq l^{-1}) of caesium-137 in surface water from the English Channel, March 2025. Figure generated with PyGMT v0.19.0 [201] and GMT v6.7.0 [202].

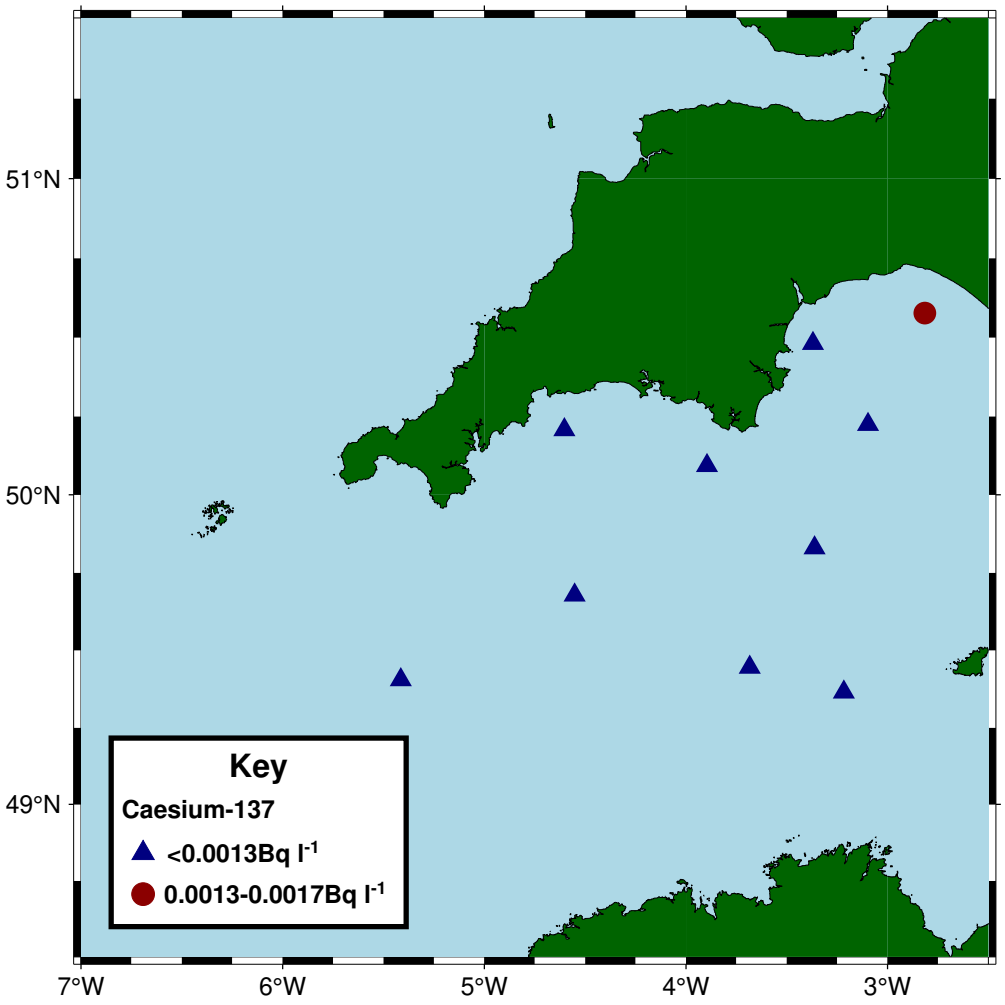


Figure 8.8 Concentrations (Bq l-1) of tritium in surface water from the Irish Sea, September 2025. Figure generated with PyGMT v0.19.0 [201] and GMT v6.7.0 [202].

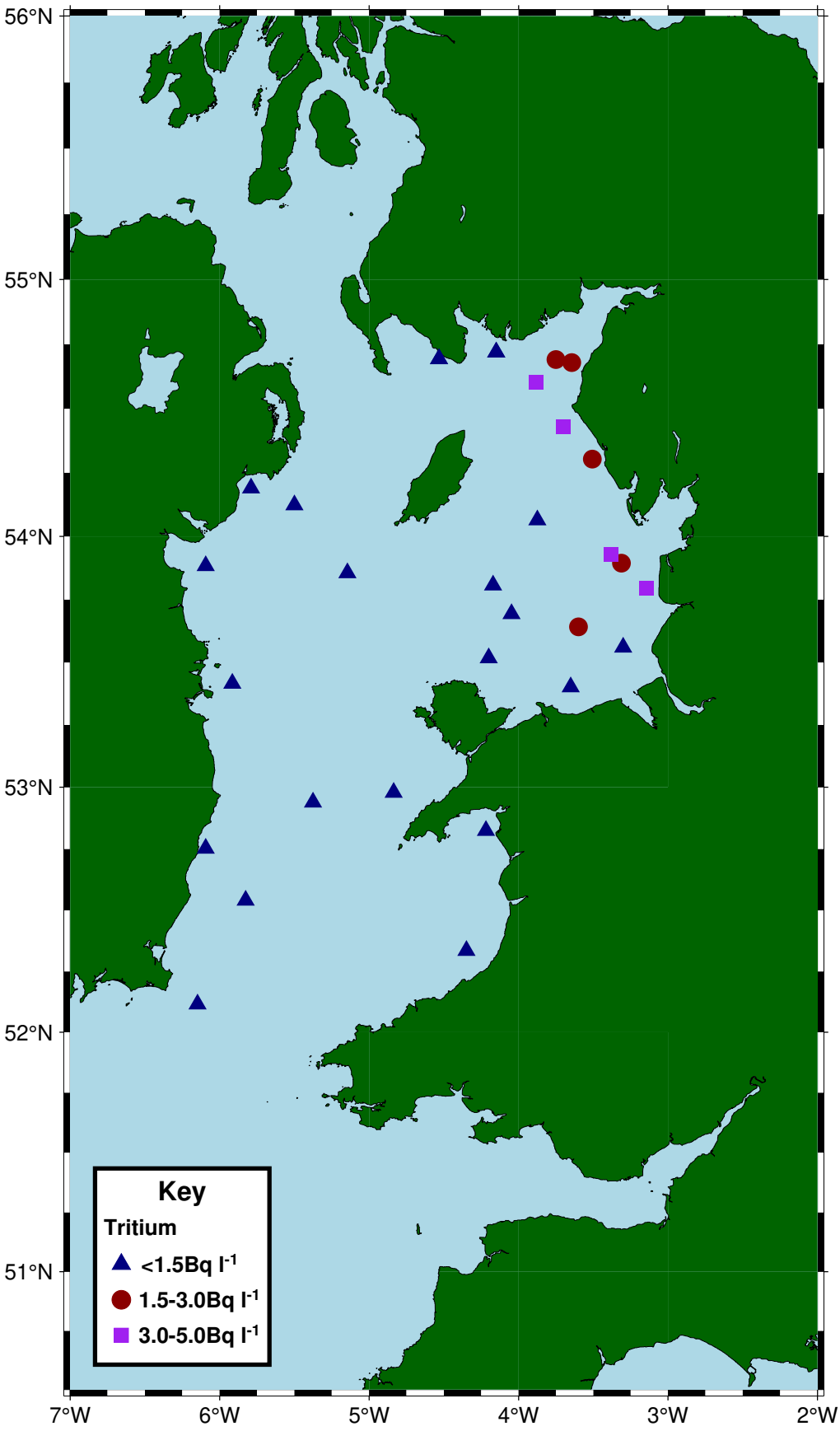


Figure 8.9 Concentrations (Bq l-1) of tritium in surface water from the Bristol Channel, September 2025. Figure generated with PyGMT v0.19.0 [201] and GMT v6.7.0 [202].

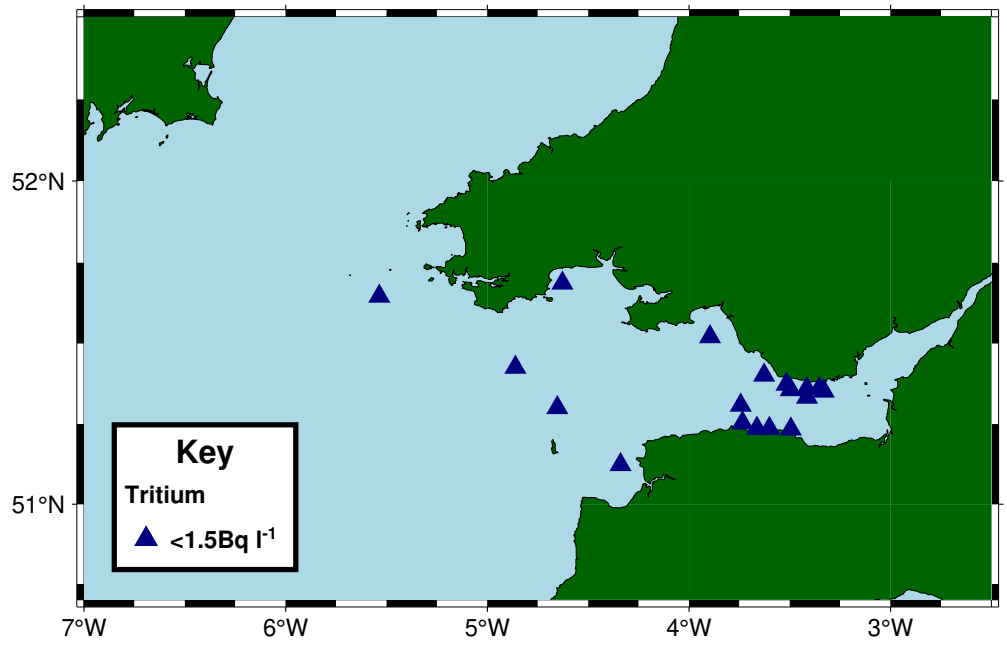
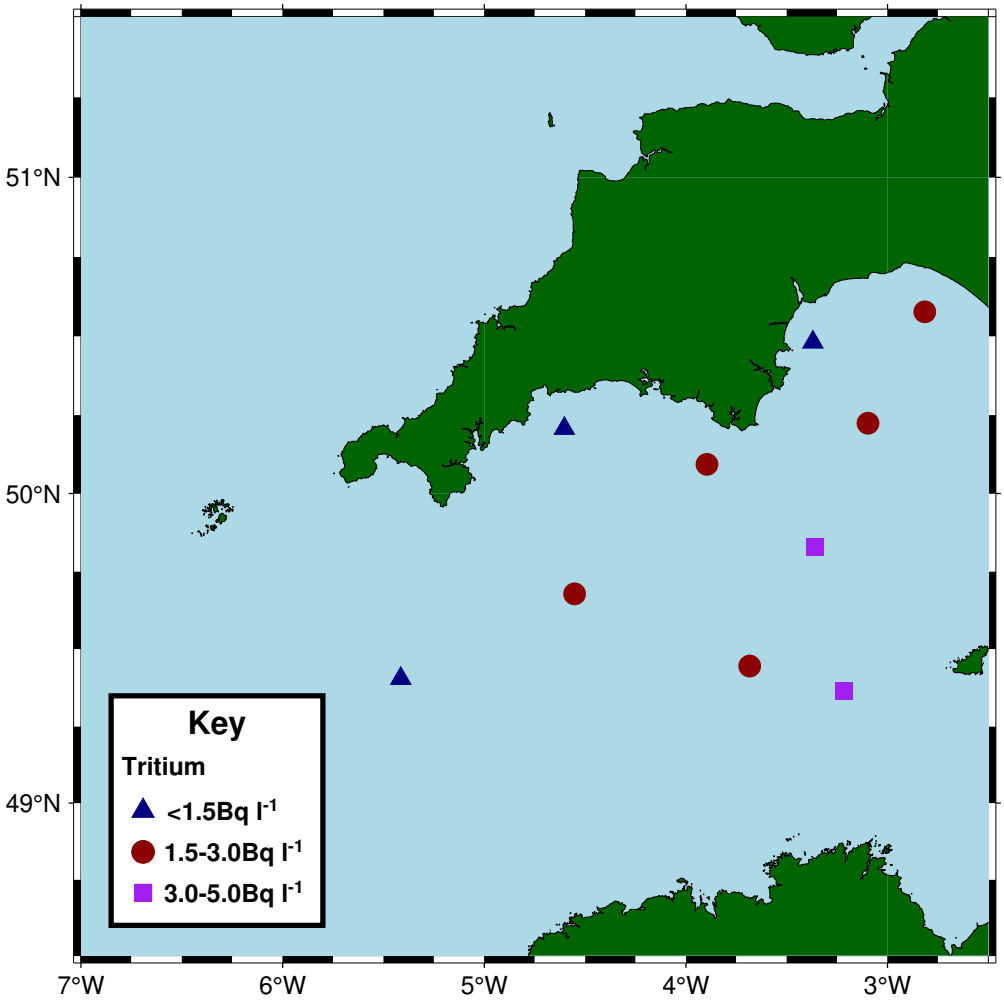


Figure 8.10 Concentrations (Bq l-1) of tritium in surface water from the English Channel, March 2025. Figure generated with PyGMT v0.19.0 [201] and GMT v6.7.0 [202].



A seawater survey of the Irish Sea was carried out in 2025. As in previous surveys, a band of slightly higher concentrations of caesium-137 was observed along the coast to the north and south of Sellafield, with levels generally decreasing with distance from the coast (Figure 8.6). The 2025 survey recorded concentrations of up to 0.04Bq l^{-1} in the Irish Sea (in comparison with 0.04Bq l^{-1} in the eastern Irish Sea in 2023). For the remainder of the Irish Sea, caesium-137 concentrations were reported as 'less than values', or close to 'less than values' (0.02Bq l^{-1}). Overall, concentrations were similar to those reported in the previous Irish Sea survey in 2023 [23]. Caesium-137 concentrations in the Irish Sea were only a very small percentage of those prevailing in the late 1970s, when discharges were substantially higher (typically up to 30Bq l^{-1} [203]).

The predominant source of caesium-137 to the Irish Sea is considered to be remobilisation into the water column from activity associated with seabed sediment [204]. Discharges from Sellafield have decreased substantially since the commissioning of the Site Ion Exchange Effluent Plant waste treatment process in the mid-1980s, and this has been reflected in a decrease in caesium-137 concentrations in shoreline seawater at St Bees (Figure 8.13). In more recent years, the rate of decline of caesium-137 concentrations over time has been decreasing at St Bees. Longer time series showing peak concentrations in the Irish Sea (Figure 8.11), and, with an associated time-lag, the North Sea are also shown in Figure 8.12.

Over several decades, the impact of discharges from the reprocessing plants at Sellafield and La Hague has been readily apparent, carried by the prevailing residual currents from the Irish Sea and the Channel, respectively [205]. Caesium-137 concentrations in the North Sea have tended to follow the temporal trends of the discharges, albeit with a time lag. The maximum discharge of caesium-137 occurred at Sellafield in 1975, with concentrations of caesium-137 of up to 0.5Bq l^{-1} in the North Sea surface waters in the late 1970s. Due to significantly decreasing discharges after 1978, remobilisation of caesium-137 from contaminated sediments in the Irish Sea was considered to be the dominant source of water contamination for most of the North Sea [206].

In 2024, very low concentrations (up to 0.016Bq l^{-1}) were found throughout most of the North Sea survey area [130]. The few positively detected values were only slightly above those observed for global fallout levels in surface seawaters (0.0001 to 0.0028Bq l^{-1}, [207]). The overall distribution in the North Sea is characteristic of that observed in previous surveys over the last decade, with generally positively detected values near the coast, due to the long-distance transfer, possibly from Sellafield or Chernobyl-derived activity. In 2024, there was no significant evidence of input of Chernobyl-derived caesium-137 from the Baltic (via the Skagerrak) close to the Norwegian Coast. Trends and observations of caesium-137 concentrations in the waters of the North Sea (and Irish Sea), over the period 1995 to 2015, have been published [208].

Figure 8.11 Concentration of caesium-137, in Bq l^{-1}, in the Irish Sea, between 1965 and 2025

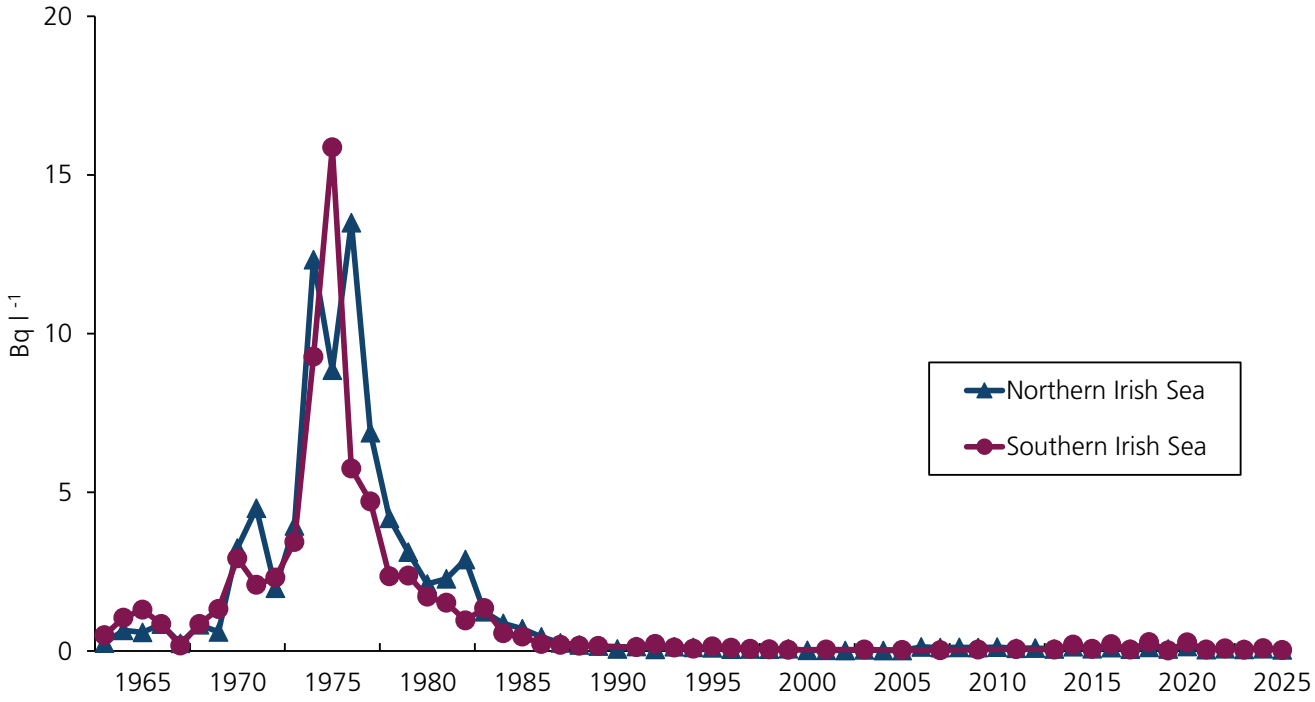


Figure 8.12 Concentration of caesium-137, in Bq l^{-1}, in the North Sea between 1965 and 2025

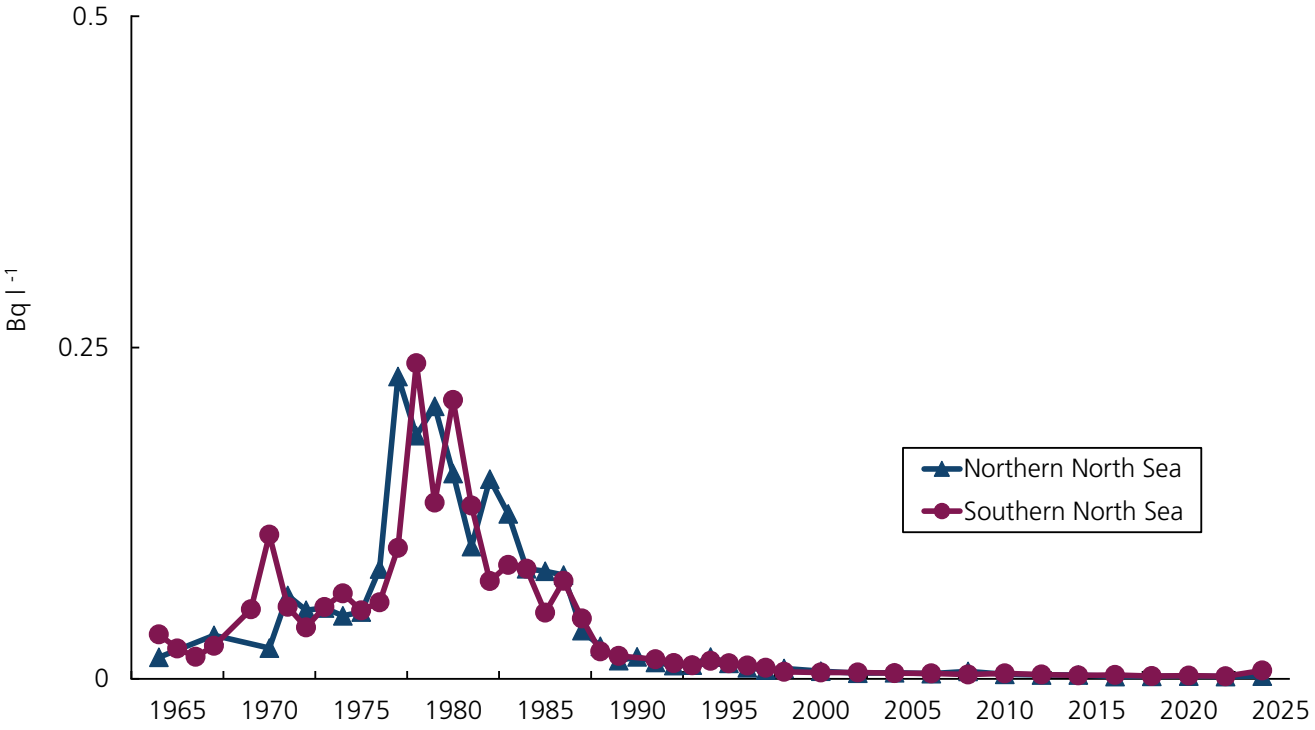
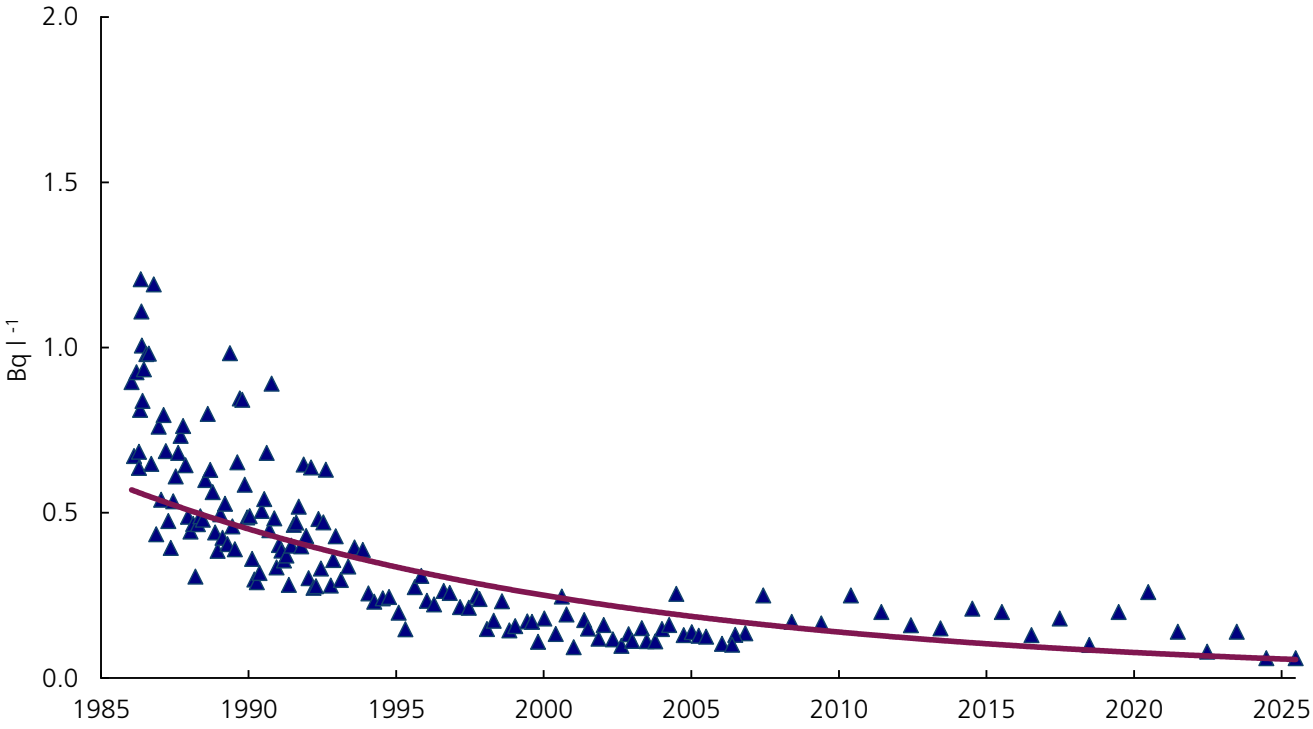


Figure 8.13 Concentration of caesium-137, in Bq l^{-1}, in shoreline seawater close to Sellafield at St. Bees



In 2025, caesium-137 concentrations were reported as 'less than values' (or close to the 'less than value') in the western English Channel (including those near the Channel Islands) and were not distinguishable from the background of fallout from nuclear weapons testing (Figure 8.7).

A full assessment of historic long-term trends of caesium-137 in surface waters of Northern European seas is provided elsewhere [205].

Tritium concentrations in Irish Sea seawater in 2025 are shown in Figure 8.8, reported as 'less than values' (or close to the 'less than value'). As expected, these are generally higher (by small amounts) than those observed in the North Sea in 2024 [23] due to the influence of discharges from Sellafield and other nuclear licensed sites. As in previous Irish Sea surveys, tritium concentrations to the south and west of the Isle of Man, including along the coastline of Ireland, were mostly reported as below (or close to) a 'less than value'. For comparison, the background concentration of tritium from natural and industrial sources (but excluding fallout from nuclear weapons testing) in seawater from the North Atlantic Ocean is estimated to be 0.05Bq l^{-1} [209]. In industrial activity, however, tritium is not normally removed from effluent prior to discharge, and locally elevated tritium concentrations in seawater of around 1 to 2 Bq l^{-1} have been observed near nuclear sites (for example, [209]).

In the Bristol Channel, the combined effect of historical tritium discharges from the Maynard Centre, the former GE Healthcare Limited facility at Cardiff[20], and those from Berkeley, Oldbury, and Hinkley Point, is shown in Figure 8.9. Tritium concentrations in the Bristol Channel were low in 2025 (all reported at the limit of detection). Most results are reported as 'less than values' (or close to the 'less than value') in the vicinity of the Welsh coast. Overall, tritium concentrations were lower in the inner region of the Bristol Channel, in comparison to recent years. There is no evidence of tritium entering the Irish Sea from the combined effect of discharges from the former GE Healthcare Limited facility at Cardiff, Berkeley, Oldbury, and Hinkley Point. Discharges from the Pharmaron UK radiolabelling facility, in Cardiff, also provide a minor contribution of tritium to this area. Tritium concentrations in the western English Channel were all reported as below the 'less than value' (or close to the 'less than value') (Figure 8.10).

Technetium-99 concentrations in seawater have decreased following the substantial reduction in discharges resulting from discharge abatement. This followed substantial increases observed from 1994 to their most recent peak in 2003. The results of research cruises to study this radionuclide have been published [206,210–213] and an estimate of the total inventory residing in the sub-tidal sediments of the Irish Sea has also been published [214]. Trends in plutonium and americium concentrations in seawater of the Irish Sea have also been published [215].

Full reviews of the quality status of the north Atlantic and a periodic evaluation of progress towards internationally agreed targets have been published by OSPAR [76,216–218]. The fifth periodic evaluation covers both radioactive discharges from the nuclear and non-nuclear sectors and environmental concentrations and demonstrated that Contracting Parties successfully fulfilled the RSS objectives for the nuclear and non-nuclear sectors [5].

Shoreline sampling was also carried out around the UK, as part of routine site and regional monitoring programmes. Much of the shoreline sampling was directed at establishing whether the impacts of discharges from individual sites are detectable. Where appropriate, these are reported in the relevant sections of this report, and the results are collated in Table 8.10. Most radionuclides are reported as 'less than values'. Tritium and caesium-137 concentrations remote from site discharge points are consistent with those in Figure 8.6 to Figure 8.10.

SEPA took a series of seawater samples near Uist. All radionuclides were reported as 'less than' (or close to the limit of detection). The results are presented in Table 8.11.

20. GE Healthcare ceased manufacturing tritium and carbon-14 radiolabelled compounds at its premises, the Maynard Centre, in Cardiff in 2009 and 2010, respectively. Its custom radiolabelling division was acquired by Quotient Bioresearch (Radiochemicals) Ltd in 2010, and subsequently by Pharmaron UK Ltd in 2017. This operation is located at a new premises in Cardiff under a non-nuclear permit, albeit at lower levels compared to the historic discharges from the Maynard Centre.

Table 8.1 Concentrations of radionuclides in seafood and the environment near the Channel Islands, 2025

Location	Material	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{3}H	^{60}Co	^{90}Sr	^{99}Tc	^{106}Ru	^{137}Cs	
Guernsey									
	Crabs	1		<0.09			<0.90	<0.09	
	Lobsters	1		<0.06			<0.51	<0.05	
	Limpets	1		<4.2			<0.39	<0.04	
	Oysters	1		<0.07			<0.61	<0.06	
	Scallops	1		<0.08			<0.80	<0.08	
St. Sampson's Harbour	Sand	1		<0.13			<1.2	<0.22	
	Seawater[b]	2						<0.0013	
Jersey									
	Crabs	1		<0.05			<0.44	<0.04	
	Spiny spider crabs	1		<0.05			<0.39	<0.04	
	Lobsters	1		<0.06		0.28	<0.50	<0.05	
La Rocque	Oysters	1		<0.01			<0.15	<0.01	
Rozel	Fucus spiralis	3		<0.05	<0.029	1.1	<0.39	<0.06	
Rozel	Fucus vesiculosus	1		<0.10			<0.59	<0.08	
Rozel	Ascophyllum nodosum	4		<0.06			<0.50	<0.09	
Archirondel	Fucus spiralis	1		<0.06			<0.33	0.11	
Archirondel	Fucus vesiculosus	1		<0.03			<0.29	<0.03	
Belval	Seawater[b]	1	3.1					<0.0013	

Location	Material	No. of sampling observations	Mean radioactivity concentration (fresh)[a], Bq kg^{-1}						
			^{155}Eu	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm	Gross beta
Guernsey									
	Crabs	1	<0.23	0.00020	0.00063	0.0026	*	0.00017	53
	Lobsters	1	<0.15			<0.19			70
	Limpets	1	<0.13			<0.17			97
	Oyster	1	<0.11			<0.09			34
	Scallops	1	<0.20	0.00050	0.0022	0.0013	*	0.000069	86
St. Sampson's Harbour	Mud	1	<0.55	0.017	0.076	0.083	*	0.0014	450
	Seawater[b]	2							
Jersey									
	Crabs	1	<0.11	0.00024	0.00078	0.0018	*	0.00010	81
	Spiny spider crabs	1	<0.09			<0.06			95
	Lobsters	1	<0.13	0.00014	0.00030	0.0050	*	0.00027	96
La Rocque	Oysters	1	<0.04	0.00067	0.0016	0.0025	*	0.00012	38
Rozel	Fucus spiralis	3	<0.11	0.0059	0.013	0.0022	0.00021	0.00020	280
Rozel	Fucus vesiculosus	1	<0.12			<0.08			260
Rozel	Ascophyllum nodosum	4	<0.18			<0.21			190
Archirondel	Fucus spiralis	1	<0.11			<0.30			300
Archirondel	Fucus vesiculosus	1	<0.10			<0.23			140
Belval	Seawater[b]	1							

* Not detected by the method used

a. Except for seawater where units are Bq l^{-1}, and for sediment where dry concentrations apply

b. Concentrations of ^{134}Cs were not detected by the method used

Table 8.2(a) Concentrations of radionuclides in seafood and the environment in Northern Ireland, 2025[a]

Location	Material	No. of sampling observations	Mean radioactivity concentration (fresh)[b], Bq kg^{-1}				
			^{14}C	^{60}Co	^{99}Tc	^{125}Sb	^{134}Cs	^{137}Cs
Cod	Kilkeel	3	32	<0.04		<0.10	<0.06	0.23
Plaice	Kilkeel	3		<0.04		<0.10	<0.04	<0.15
Haddock	Kilkeel	2		<0.04		<0.11	<0.06	0.17
Herring	Ardglass	2		<0.05		<0.16	<0.05	<0.17
Lesser spotted dogfish	North coast	2		<0.06		<0.15	<0.10	0.44
Lesser spotted dogfish	Kilkeel	3		<0.05		<0.13	<0.07	0.38
Crabs	Kilkeel	3		<0.04		<0.10	<0.06	<0.11
Lobsters	Ballycastle	2		<0.04	3.7	<0.12	<0.08	0.08
Lobsters	Kilkeel	3		<0.06	4.9	<0.15	<0.07	<0.10
Nephrops	Kilkeel	3		<0.16	<0.91	<0.31	<0.17	<0.22
Winkles	Minerstown	3		<0.09		<0.21	<0.07	<0.10
Mussels	Carlingford Lough	1		<0.09	<0.067	<0.21	<0.06	<0.08
Scallops	County Down	2		<0.04		<0.10	<0.06	0.12
Toothed winkles	Minerstown	1		<0.04		<0.10	<0.07	0.31
Fucus vesiculosus	Carlingford Lough	4		<0.04	19	<0.10	<0.07	0.21
Fucus serratus	Portrush	4		<0.04		<0.08	<0.04	<0.05
Ascophyllum nodosum	Ardglass	3		<0.07	23	<0.15	<0.07	0.20
Fucus spiralis	Ardglass	1		<0.05		<0.12	<0.05	0.17
Rhodymenia species	Strangford Lough - Island Hill	4		<0.10	1.4	<0.22	<0.12	0.87
Mud	Carlingford Lough	2		<0.25		<0.73	<0.37	27
Mud	Ballymacormick	2		<0.14		<0.41	<0.14	8.4
Mud	Dundrum Bay	1		<0.17		<0.47	<0.19	2.6
Sandy mud	Dundrum Bay	1		<0.16		<0.47	<0.12	2.9
Mud	Strangford Lough - Nicky's Point	2		<0.13		<0.38	<0.12	3.6
Mud	Oldmill Bay	1		<0.15		<0.44	<0.16	6.2
Sand	Oldmill Bay	1		<0.13		<0.36	<0.09	4.7
Sand	Portrush	2		<0.13		<0.36	<0.17	0.30
Sand	Ballykelly	2		<0.17		<0.38	<0.17	1.1
Seawater	North of Larne	2			0.0015		*	0.0043

Table 8.2(a) continued

Location	Material	No. of sampling observations	Mean radioactivity concentration (fresh)[b], Bq kg^{-1}					
			^{155}Eu	^{238}Pu	^{239}Pu+ ^{240}Pu	^{241}Am	^{242}Cm	^{243}Cm+ ^{244}Cm
Cod	Kilkeel	3	<0.13			<0.16		
Plaice	Kilkeel	3	<0.11			<0.18		
Haddock	Kilkeel	2	<0.13			<0.17		
Herring	Ardglass	2	<0.14			<0.18		
Lesser spotted dogfish	North coast	2	<0.16			<0.20		
Lesser spotted dogfish	Kilkeel	3	<0.13			<0.17		
Crabs	Kilkeel	3	<0.09			<0.11		
Lobsters	Ballycastle	2	<0.14			<0.17		
Lobsters	Kilkeel	3	<0.16			<0.22		
Nephrops	Kilkeel	3	<0.28	0.0017	0.012	0.062	*	*
Winkles	Minerstown	3	<0.22	0.016	0.12	0.12	*	*
Mussels	Carlingford Lough	1	<0.21			<0.27		
Scallops	County Down	2	<0.12			<0.29		
Toothed winkles	Minerstown	1	<0.13			0.38		
Fucus vesiculosus	Carlingford Lough	4	<0.21			<0.21		
Fucus serratus	Portrush	4	<0.07			<0.15		
Ascophyllum nodosum	Ardglass	3	<0.15			<0.22		
Fucus spiralis	Ardglass	1	<0.15			<0.39		
Rhodymenia species	Strangford Lough - Island Hill	4	<0.23	0.14	0.88	1.6	*	*
Mud	Carlingford Lough	2	<0.54	1.6	11	7.3	*	*
Mud	Ballymacormick	2	<1.2			10		
Mud	Dundrum Bay	1	<0.80			2.3		
Sandy mud	Dundrum Bay	1	<1.6			2.2		
Mud	Strangford Lough - Nicky's Point	2	<1.2			3.2		
Mud	Oldmill Bay	1	<0.69			7.8		
Sand	Oldmill Bay	1	<0.59			5.1		
Sand	Portrush	2	<0.55			<1.7		
Sand	Ballykelly	2	<0.63	0.027	0.17	0.50	*	*
Seawater	North of Larne	2						

* Not detected by the method used

a. All measurements are made on behalf of the Northern Ireland Environment Agency

b. Except for seawater where units are Bq l^{-1}, and for sediment where dry concentrations apply

Table 8.2(b) Monitoring of radiation dose rates in Northern Ireland, 2025[a]

Location	Ground type	No. of sampling observations	Mean gamma dose rate in air at 1m, μGy h^{-1}
Lisahally	Mud	1	0.055
Donnybrewer	Shingle	1	0.052
Ballykelly	Mud	1	0.064
Bellerena	Mud	1	0.056
Benone	Sand	1	0.073
Castlerock	Sand	1	0.064
Portstewart	Sand	1	0.059
Portrush, Blue Pool	Sand	1	0.060
Portrush, White Rocks	Sand	1	0.058
Portballintrae	Sand	1	0.052
Giant`s Causeway	Sand	1	0.049
Ballycastle	Sand	1	0.057
Cushendun	Sand	1	0.062
Cushendall	Sand and stones	1	0.062
Red Bay	Sand	1	0.063
Carnlough	Sand	1	0.057
Glenarm	Sand	1	0.054
Half Way House	Sand	1	0.052
Ballygally	Sand	1	0.054
Drains Bay	Sand	1	0.053
Larne	Sand	1	0.055
Whitehead	Sand	1	0.059
Carrickfergus	Sand	1	0.058
Jordanstown	Sand	1	0.054
Helen`s Bay	Sand	1	0.055
Groomsport	Sand	1	0.062
Millisle	Sand	1	0.063
Ballywalter	Sand	1	0.061
Ballyhalbert	Sand	1	0.063
Cloghy	Sand	1	0.063
Portaferry	Shingle and stones	1	0.082
Kircubbin	Sand	1	0.074
Greyabbey	Sand	1	0.083
Ards Maltings	Mud	1	0.070
Island Hill	Mud	1	0.075
Nicky`s Point	Mud	1	0.083
Strangford	Shingle and stones	1	0.10
Kilclief	Sand	1	0.074
Ardglass	Mud	1	0.092
Killough	Mud	1	0.082
Ringmore Point	Sand	1	0.074
Tyrella	Sand	1	0.071
Dundrum	Sand	1	0.079
Newcastle	Sand	1	0.093
Annalong	Sand	1	0.11
Cranfield Bay	Sand	1	0.078
Mill Bay	Sand	1	0.096
Greencastle	Sand	1	0.083
Rostrevor	Sand	1	0.11
Narrow Water	Mud	1	0.095

a. All measurements are made on behalf of the Northern Ireland Environment Agency

Table 8.3 Concentrations of radionuclides in diet, 2025[a]

Region	Number of sampling observations	Mean radioactivity concentration (fresh), Bq kg^{-1}			
		^{14}C	^{40}K	^{90}Sr	^{137}Cs
Canteen meals					
England	7		92	<0.038	<0.03
Northern Ireland	5		88	<0.038	<0.08
Scotland	12	36	99	0.025	<0.02
Wales	5		82	<0.058	<0.06

Region	Number of sampling observations	Mean radioactivity concentration (fresh), Bq kg^{-1}			
		^{14}C	^{40}K	^{90}Sr	^{137}Cs
Mixed diet in Scotland					
Dumfriesshire					
Dumfries	4		89	<0.10	<0.05
East Lothian					
North Berwick	4		84	<0.10	<0.05
Renfrewshire					
Paisley	4		88	<0.10	<0.05
Ross-shire					
Dingwall	4		93	<0.11	<0.05

a. Results are available for other artificial nuclides detected by gamma spectrometry
All such results were less than the limit of detection

Table 8.4 Concentrations of radionuclides in milk remote from nuclear sites, 2025

Location	Selection[a]	No. of farms / daries[b]	Mean radioactivity concentration , Bq l^{-1}			
			^{3}H	^{14}C	^{90}Sr	^{137}Cs
Milk						
Co. Antrim		2		23	<0.022	<0.06
	max				<0.025	<0.08
Buckinghamshire		1		26	<0.023	<0.04
Ceredigion		1			0.031	<0.05
Clywd		1		27	0.022	<0.05
Cornwall		1		25	0.024	<0.05
Devon		1		26	<0.023	<0.05
Dorset		1		24	<0.025	<0.05
Co. Down		1			0.022	<0.05
Dumfriesshire		1	<5.0	<15	<0.10	<0.05
Co. Fermanagh		1			0.023	<0.04
Gloucestershire		1		21	0.020	<0.06
Gwynedd		1		26	<0.024	<0.05
Humberside		1		26	<0.022	<0.06
Kent		1		19	<0.021	<0.05
Lanarkshire		1	<5.0	<15	<0.015	<0.03
Lancashire		1		27	<0.022	<0.05
Leicestershire		1		22	<0.019	<0.05
Middlesex		1		24	0.020	<0.05
Midlothian		1	<5.0	<15	<0.10	<0.05
Nairnshire		1	<5.0	<15	<0.10	<0.09
Norfolk		1		23	<0.022	<0.06
North Yorkshire		1		26	<0.022	<0.05
Renfrewshire		1	<5.0	<15	<0.10	<0.05
Shropshire		1		20	<0.022	<0.05
Suffolk		1			<0.023	<0.05
Co. Tyrone		2		30	<0.023	<0.06
	max				<0.025	
Mean Values						
England				24	<0.022	<0.05
Northern Ireland				27	<0.023	<0.06
Wales				27	<0.026	<0.05
Scotland			<5.0	<15	<0.083	<0.05
United Kingdom			<5.0	<22	<0.034	<0.05

a. Data are arithmetic means unless stated as 'max'. 'Max' data are selected to be maxima
If no 'max' value is given the mean value is the most appropriate for dose assessments

b. The number of farms or dairies from which milk is sampled. The number of analyses is greater than this and depends on the bulking regime

Table 8.5 Concentrations of radionuclides in rainwater and air, 2025

Location	Sample	Number of sampling observations	Mean radioactivity concentration[a]				
			^{3}H	^{7}Be	^{7}Be	^{90}Sr	^{137}Cs
Ceredigion							
Aberporth	Rainwater	4	<1.3	0.89			<0.008
	Air	4		0.0026			<6.3E-07
Co. Down							
Conlig	Rainwater	4		0.76			<0.011
	Air	4		0.0020			<5.2E-07
Dumfries and Galloway							
Eskdalemuir	Rainwater	12	<1.0	0.75		<0.0053	<0.010
	Air	8		0.0019			<1.0E-05
Newton Stewart	Air	11		0.0021			<1.0E-05
City of Edinburgh							
Edinburgh Silvan	Air	12		0.0021			<1.0E-05
North Lanarkshire							
Holytown	Rainwater	12	<1.0	<0.24		<0.0058	<0.012
	Air	12		0.0012			<1.0E-05
North Yorkshire							
Leeming	Rainwater	4		0.92			<0.021
	Air	4		0.0027			<6.4E-07
Oxfordshire							
Chilton	Rainwater	4		0.86	0.86[c]	0.0016[d]	<0.019
	Air	12		0.0026			<2.4E-07
Shetland							
Lerwick	Rainwater	12	<1.0	1.1		<0.0063	<0.018
	Air	12		0.0018			<1.0E-05
Suffolk							
Orfordness	Rainwater	4	<1.3	0.98			<0.022
	Air	4		0.0025			<5.7E-07

Table 8.5 continued

Location	Sample	Number of sampling observations	Mean radioactivity concentration[a]					
			^{137}Cs	^{238}Pu[b]	^{239}Pu+ ^{240}Pu[b]	^{241}Am[b]	Gross alpha	Gross beta
Ceredigion								
Aberporth	Rainwater	4		<3.0E-06	<5.0E-06	<8.0E-06		
	Air	4		<3.0E-10	6.9E-10	1.2E-09		
Co. Down								
Conlig	Rainwater	4						
	Air	4						
Dumfries and Galloway								
Eskdalemuir	Rainwater	12						
	Air	8						<0.00026
Newton Stewart	Air	11						<0.00032
City of Edinburgh								
Edinburgh Silvan	Air	12						<0.00031
North Lanarkshire								
Holytown	Rainwater	12						
	Air	12						<0.00022
North Yorkshire								
Leeming	Rainwater	4						
	Air	4						
Oxfordshire								
Chilton	Rainwater	4	<0.00039[c]				<0.020[c]	0.31[c]
	Air	12						
Shetland								
Lerwick	Rainwater	12						
	Air	12						<0.00027
Suffolk								
Orfordness	Rainwater	4						
	Air	4						

a. Bq l^{-1} for rainwater and Bq m^{-3} for air. 1.2 kg air occupies $1m^3$ at standard temperature and pressure
b. Separate bulks of 4 quarterly samples for air and rain
c. Bulked from 12 monthly samples
d. Bulked from 4 quarterly samples

Table 8.6 Concentrations of radionuclides in sources of drinking water in Scotland, 2025

Area	Location or selection	Number of sampling observations	Mean radioactivity concentration, Bq l^{-1}				
			^{3}H	^{90}Sr	^{137}Cs	Gross alpha	Gross beta
Annual Samples							
Angus	Loch Lee	4	<1.0	<0.0050	<0.010	<0.010	0.042
Argyll and Bute	Auchengaich	1	<1.0		<0.010	0.011	0.041
Argyll and Bute	Helensburgh Reservoir	1	<1.0		<0.010	<0.010	0.057
Argyll and Bute	Loch Ascog	1	<1.0		<0.010	<0.010	0.086
Argyll and Bute	Loch Eck	1	<1.0		<0.010	<0.010	0.026
Argyll and Bute	Lochan Ghlas Laoigh	1	<1.0		<0.010	<0.010	0.028
Argyll and Bute	Loch Finlas	1	<1.0		<0.010	<0.010	0.023
Clackmannanshire	Gartmorn Dam	1	<1.0		<0.010	<0.010	0.12
Dumfries and Galloway	Black Esk	1	<1.0		<0.010	0.013	0.016
Dumfries and Galloway	Gullielands Burn	1	9.2		<0.010	0.030	0.24
Dumfries and Galloway	Castle loch	1	<1.0		<0.010	0.011	0.15
Dumfries and Galloway	Winterhope	1	<1.0		<0.010	<0.010	0.056
East Lothian	Hopes Reservoir	1	<1.0		<0.010	<0.010	0.030
East Lothian	Thorters Reservoir	1	<1.0		<0.010	<0.010	0.070
East Lothian	Whiteadder	1	<1.0		<0.010	<0.010	0.035
East Lothian	Thornton Loch Burn	1	<1.0		<0.010	0.029	0.16
Fife	Holl Reservoir	1	<1.0		<0.010	<0.010	0.028
Highland	Loch Baligill	1	<1.0		<0.010	<0.010	0.067
Highland	Loch Calder	1	<1.0		<0.010	<0.010	0.054
Highland	Loch Glass	4	<1.1	<0.0050	<0.010	<0.013	0.050
Highland	Loch Shurrerey	1	<1.0		<0.010	<0.010	0.050
North Ayrshire	Camphill	1	<1.0		<0.010	<0.010	0.039
North Ayrshire	Knockendon Reservoir	1	<1.0		<0.010	<0.010	0.035
North Ayrshire	Outerwards	1	<1.0		<0.010	<0.010	0.023
North Ayrshire	Busbie Muir	1	<1.0		<0.010	<0.010	0.083
Orkney Islands	Heldale Water	1	<1.0		<0.010	0.010	0.053
Perth and Kinross	Castlehill Reservoir	1	<1.0		<0.010	<0.010	0.027
Scottish Borders	Knowesdean	4	<1.0	<0.0050	<0.010	<0.010	0.033
Stirling	Loch Katrine	12	<1.0	0.0018	<0.0011	<0.0069	0.049
West Dunbartonshire	Loch Lomond (Ross Priory)	1	<1.0		<0.010	0.010	0.045
West Lothian	Morton No 2 Reservoir	1	<1.0		<0.010	<0.010	0.025

Table 8.7 Concentrations of radionuclides in sources of drinking water in England and Wales, 2025

Location	Sample source	No. of sampling observations	Mean radioactivity concentration , Bq l^{-1}			
			^{3}H	^{40}K	^{90}Sr	^{125}I
England						
Buckinghamshire	Bourne End, Groundwater	4	<3.7	0.041	<0.00064	
Cambridgeshire	Grafham Water	4	<3.8	0.29	<0.00069	
Cheshire	River Dee	4	<3.6	0.086	<0.00080	<0.0018
Cornwall	River Fowey	4	<3.4	0.063	<0.00075	<0.0017
County Durham	Honey Hill Water Treatment Works, Consett	4	<3.3	<0.023	<0.00070	
County Durham	River Tees, Darlington	4	<3.5	0.035	<0.00072	<0.0015
Cumbria	Thirlmere Reservoir	4	<3.6	<0.014	<0.00078	
Cumbria	Haweswater Reservoir	4	<3.7	<0.014	<0.00071	
Derbyshire	Arnfield Water Treatment Plant	4	<3.7	<0.015	<0.00078	
Derbyshire	Matlock, Groundwatera	4	<3.6	0.023	<0.00073	
Devon	River Exe, Exeter	4	<3.5	0.10	<0.00082	<0.0016
Devon	Roadford Reservoir, Broadwoodwidger	4	<3.6	0.061	<0.00077	
Dorset	River Avon, Christchurch	4	<3.5	0.073	<0.00066	<0.0017
Gloucestershire	River Severn, Tewkesbury	4	<3.5	0.21	<0.00067	<0.0017
Greater London	River Lee, Walthamstow	4	<3.6	0.25	<0.00062	<0.0014
Humberside	Littlecoates, Groundwater	2	<3.5	0.088	<0.00064	
Kent	Sittingbourne, Deep Groundwater	4	<3.6	0.048	<0.00066	
Kent	Denge, Shallow Groundwater	4	<3.5	0.083	<0.00074	
Lancashire	Worsthorne, Groundwater	4	<3.7	<0.015	<0.00068	
Norfolk	River Drove, Stoke Ferry	4	<3.7	0.12	<0.00068	<0.0014
Northumberland	Kielder Reservoir	4	<3.4	<0.015	<0.00068	
Oxfordshire	River Thames, Oxford	4	<3.7	0.17	<0.00064	<0.0014
Somerset	Ashford Reservoir, Bridgwater	4	<3.7	0.055	<0.00070	
Somerset	Chew Valley Lake Reservoir, Bristol	4	<3.6	0.16	<0.00072	
Surrey	River Thames, Chertsey	4	<3.8	0.21	<0.00060	<0.0016
Surrey	River Thames, Walton	4	<3.6	0.17	<0.00069	<0.0016
Yorkshire	Chellow Heights, Bradford	4	<3.6	<0.020	<0.00060	
Yorkshire	Washburn Valley Reservoirs, Leeds	4	<3.6	0.046	<0.00075	
Wales						
Gwynedd	Cwm Ystradllyn Treatment Works	4	<3.7	<0.015	<0.00064	
Mid-Glamorgan	Llwyn-on Reservoir	4	<3.6	<0.014	<0.00076	
Powys	Elan Valley Reservoir	4	<3.6	<0.016	<0.00078	

Table 8.7 continued

Location	Sample source	No. of sampling observations	^{137}Cs	Gross alpha	Gross beta[1]	Gross beta[2]
England						
Buckinghamshire	Bourne End, Groundwater	4	<0.00068	<0.026	0.057	0.045
Cambridgeshire	Grafham Water	4	<0.00078	<0.033	0.37	0.31
Cheshire	River Dee	4	<0.00072	0.017	0.12	0.098
Cornwall	River Fowey	4	<0.00077	0.032	0.096	0.077
County Durham	Honey Hill Water Treatment Works, Consett	4	<0.00070	0.016	0.052	0.042
County Durham	River Tees, Darlington	4	<0.00071	0.011	0.053	0.044
Cumbria	Thirlmere Reservoir	4	<0.00073	<0.0084	0.021	0.017
Cumbria	Haweswater Reservoir	4	<0.00076	0.0074	0.022	0.018
Derbyshire	Arnfield Water Treatment Plant	4	<0.00075	0.011	0.037	0.030
Derbyshire	Matlock, Groundwatera	4	<0.00075	0.11	0.11	0.085
Devon	River Exe, Exeter	4	<0.00074	0.016	0.10	0.093
Devon	Roadford Reservoir, Broadwoodwidger	4	<0.00073	<0.0076	0.082	0.069
Dorset	River Avon, Christchurch	4	<0.00080	<0.026	0.092	0.078
Gloucestershire	River Severn, Tewkesbury	4	<0.00074	0.029	0.23	0.19
Greater London	River Lee, Walthamstow	4	<0.00072	<0.034	0.36	0.29
Humberside	Littlecoates, Groundwater	2	<0.00069	0.036	0.11	0.099
Kent	Sittingbourne, Deep Groundwater	4	<0.00076	<0.029	0.057	0.046
Kent	Denge, Shallow Groundwater	4	<0.00069	<0.014	0.12	0.10
Lancashire	Worsthorne, Groundwater	4	<0.00073	0.0093	0.037	0.031
Norfolk	River Drove, Stoke Ferry	4	<0.00071	<0.040	0.16	0.13
Northumberland	Kielder Reservoir	4	<0.00080	0.017	0.033	0.027
Oxfordshire	River Thames, Oxford	4	<0.00074	<0.026	0.23	0.19
Somerset	Ashford Reservoir, Bridgwater	4	<0.00077	<0.019	0.080	0.067
Somerset	Chew Valley Lake Reservoir, Bristol	4	<0.00069	<0.026	0.16	0.13
Surrey	River Thames, Chertsey	4	<0.00075	<0.029	0.26	0.23
Surrey	River Thames, Walton	4	<0.00073	<0.032	0.27	0.24
Yorkshire	Chellow Heights, Bradford	4	<0.00081	0.021	0.040	0.035
Yorkshire	Washburn Valley Reservoirs, Leeds	4	<0.00075	0.015	0.080	0.063
Wales						
Gwynedd	Cwm Ystradllyn Treatment Works	4	<0.00077	<0.0084	0.021	0.017
Mid-Glamorgan	Llwyn-on Reservoir	4	<0.00077	0.011	0.025	0.020
Powys	Elan Valley Reservoir	4	<0.00077	0.0085	0.019	0.017

1. Using ^{137}Cs standard
2. Using ^{40}K standard

a. The concentrations of ^{210}Po, ^{226}Ra, ^{234}U, ^{235}U and ^{238}U were 0.0074, 0.017, 0.046, 0.0014 and 0.026Bq l^{-1} respectively

Table 8.8 Concentrations of radionuclides in sources of drinking water in Northern Ireland, 2025

Area	Location	No. of sampling observations	Mean radioactivity concentration, Bq l^{-1}									
			^{3}H	^{90}Sr	^{137}Cs	^{210}Po	^{226}Ra	^{234}U	^{235}U	^{238}U	Gross alpha	Gross beta
Co. Londonderry	R Faughan	3	<5.4	0.0026	<0.0036	0.0014	<0.09	0.0050	<0.00050	0.0040	<0.070	<2.0
Co. Antrim	Lough Neagh	3	<3.9	0.0025	<0.0031	0.0013	<0.07	0.0040	<0.00050	0.0030	<0.070	<2.0
Co. Down	Silent Valley	3	<3.9	0.0019	0.0024	0.0053	<0.04	0.011	<0.00030	0.0080	0.080	<2.0

Table 8.9 Doses from radionuclides in drinking water, 2025[a]

Region	Mean exposure, mSv per year			Maximum exposure, mSv per year	
	Man-made radionuclides[b,c]	Naturally occurring radionuclides[b]	All radionuclides	Location	All radionuclides
England	<0.001	0.024	0.024	Matlock, Groundwater, Derbyshire	0.024
Wales[d]	<0.001			Elan Valley Reservoir Powys	<0.001
Northern Ireland	<0.001	0.024	0.024	R Faughan Co. Londonderry	0.027
Scotland[d]	<0.001			Gullielands Burn, Dumfries and Galloway	<0.001
UK	<0.001	0.024	0.024	R Faughan Co. Londonderry	0.027

a. Assessments of dose are based on some concentration results at limits of detection.
Exposures due to potassium-40 content of water are not included here because they do not vary according to the potassium-40 content of water.
Levels of potassium are homeostatically controlled

b. Average of the doses to the most exposed age group at each location

c. Including tritium

d. Analysis of naturally occurring radionuclides was not undertaken

Table 8.10 Concentrations of radionuclides in peat - Scotland, 2025

Sample location	Sample depth range	No. of sampling observations	Mean radioactivity concentration, Bq kg^{-1} (dry)	
			^{137}Cs	^{241}Am
Dumfries and Galloway				
Site 1	10 - 20cm	1	21	
Site 1	20 - 30cm	1	4.9	
Site 1	30 - 40cm	1	3.6	
Site 2	10 - 20cm	1	51	0.87
Site 2	20 - 30cm	1	4.4	
Site 2	30 - 40cm	1	1.3	
East Renfrewshire				
Site 3	10 - 20cm	1	33	
Site 3	20 - 30cm	1	15	
Site 3	30 - 40cm	1	26	

Table 8.11 Concentrations of radionuclides in seawater, 2025

Location	No. of sampling observations	Mean radioactivity concentration, Bq l^{-1}							
		^{3}H	^{14}C	^{60}Co	^{90}Sr	^{99}Tc	^{106}Ru	^{110m}Ag	^{129}I
Dounreay (Sandside Bay)	2[S]	<1.0		<0.10			<0.47	<0.10	
Dounreay (Brims Ness)	2[S]	<1.0		<0.10			<0.42	<0.10	
Rosyth	2[S]	<1.0		<0.10			<0.48	<0.10	
Torness[a]	2[S]	<3.2		<0.10			<0.48	<0.10	
Hartlepool (North Gare)[b]	2	<3.6		<0.25			<1.6	<0.27	
Sizewell	2	<3.8	<2.7	<0.34			<2.3	<0.41	
Bradwell (Beach pipeline)	2	<3.6		<0.38			<2.4	<0.41	
Dungeness south	2	<3.4		<0.28			<2.2	<0.34	
Winfrith (Lulworth Cove)	1			<0.27			<2.2	<0.33	
Jersey	1[C]	3.1							
Guernsey	2[C]								
Devonport (Millbrook Lake)	1	<3.9	<2.6	<0.26					
Devonport (Tor Point South)	1	<3.6	<2.4	<0.32					
Hinkley	1	<3.9		<0.15	<0.024		<1.2	<0.19	
Berkeley and Oldbury	2	<3.9		<0.30			<2.2	<0.34	
Holyhead	1[B]	<1.5							
Wylfa (Cemaes Bay)	2	<3.4		<0.24			<1.6	<0.27	
Llandudno	1[B]								
Prestatyn	1[B]								

Location	No. of sampling observations	Mean radioactivity concentration, Bq l^{-1}						
		^{134}Cs	^{137}Cs	^{144}Ce	^{237}Np	^{241}Am	Gross alpha	Gross beta
Dounreay (Sandside Bay)	2[S]	<0.10	<0.10	<0.27		<0.10		
Dounreay (Brims Ness)	2[S]	<0.10	<0.10	<0.24		<0.10		
Rosyth	2[S]	<0.10	<0.10	<0.25		<0.10		
Torness[a]	2[S]	<0.10	<0.10	<0.26		<0.10		
Hartlepool (North Gare)[b]	2	<0.20	<0.19	<1.0		<0.56	<3.6	16
Sizewell	2	<0.26	<0.27	<1.0		<0.37	<3.2	17
Bradwell (Beach pipeline)	2	<0.27	<0.27	<0.97		<0.35	<3.7	15
Dungeness south	2	<0.24	<0.24	<1.3		<0.43	<4.6	13
Winfrith (Lulworth Cove)	1	<0.24	<0.27	<1.4		<0.47	<2.5	15
Jersey	1[C]	*	<0.0013					
Guernsey	2[C]	*	<0.0013					
Devonport (Millbrook Lake)	1							
Devonport (Tor Point South)	1							
Hinkley	1	<0.15	<0.13	<0.83		<0.48	<3.3	17
Berkeley and Oldbury	2	<0.24	<0.26	<1.0		<0.37	<2.7	9.7
Holyhead	1[B]	*	0.0025					
Wylfa (Cemaes Bay)	2	<0.19	<0.20	<0.89		<0.42	<1.8	10
Llandudno	1[B]	*	0.0062					
Prestatyn	1[B]	*	0.011					

Table 8.11 continued

Location	No. of sampling observations	Mean radioactivity concentration, Bq l^{-1}							
		^{3}H	^{14}C	^{60}Co	^{90}Sr	^{99}Tc	^{106}Ru	^{110m}Ag	^{129}I
New Brighton	1[B]								
Rossall	1[B]								
Heysham[c]	2	<100		<0.18			<1.5	<0.23	
Half Moon Bay	1[B]								
Silecroft	1[B]								
Seascale (Particulate)[d]	2			<0.04	<0.014		<0.28	<0.04	<0.08
Seascale (Filtrate)	2	<3.5	<2.4	<0.06	<0.031	<0.043	<0.56	<0.09	<1.0
St. Bees (Particulate)[e]	2			<0.04	<0.012		<0.28	<0.05	<0.07
St. Bees (Filtrate)	2	<3.5	<11	<0.07	<0.034	<0.046	<0.57	<0.09	<1.1
Whitehaven	1[B]								
Maryport	1[B]								
Silloth	1[B]								
Seafield (near Chapelcross)	2[S]	<1.0		<0.10			<0.52	<0.10	
Southerness	2[S]	<1.1		<0.10			<0.60	<0.10	
Auchencairn	2[S]	<1.0		<0.10			<0.68	<0.10	
Ross Bay	1[B]								
Isle of Whithorn	1[B]								

Location	No. of sampling observations	Mean radioactivity concentration, Bq l^{-1}						
		^{134}Cs	^{137}Cs	^{144}Ce	^{237}Np	^{241}Am	Gross alpha	Gross beta
New Brighton	1[B]	*	0.0090					
Rossall	1[B]	*	0.016					
Heysham[c]	2	<0.17	<0.18	<0.91		<0.42	<2.9	13
Half Moon Bay	1[B]	*	0.023					
Silecroft	1[B]	*	0.015					
Seascale (Particulate)[d]	2	<0.04	<0.03	<0.16	<0.0021	<0.052	0.085	0.064
Seascale (Filtrate)	2	<0.07	<0.06	<0.40	<0.040	<0.22	<3.2	16
St. Bees (Particulate)[e]	2	<0.03	<0.04	<0.15	<0.0020	<0.046	<0.15	<0.063
St. Bees (Filtrate)	2	<0.07	<0.06	<0.40	<0.040	<0.22	<2.9	14
Whitehaven	1[B]	*	0.020					
Maryport	1[B]	*	0.014					
Silloth	1[B]	*	0.029					
Seafield (near Chapelcross)	2[S]	<0.10	<0.10	<0.29		<0.10		
Southerness	2[S]	<0.10	<0.10	<0.35		<0.10		
Auchencairn	2[S]	<0.10	<0.10	<0.35		<0.10		
Ross Bay	1[B]	*	0.020					
Isle of Whithorn	1[B]	*	0.0087					

Table 8.11 continued

Location	No. of sampling observations	Mean radioactivity concentration, Bq l^{-1}							
		^{3}H	^{14}C	^{60}Co	^{90}Sr	^{99}Tc	^{106}Ru	^{110m}Ag	^{129}I
Drummore	1[B]								
Port Patrick	2[S]	<1.0		<0.10			<0.62	<0.10	
Knock Bay	1[B]	<1.5							
Hunterston[f]	2[S]	<1.0		<0.10			<0.64	<0.10	
North of Larne	2[N]					0.0015			
Faslane (Carnban)	2[S]	<1.0		<0.10			<0.37	<0.10	

Location	No. of sampling observations	Mean radioactivity concentration, Bq l^{-1}						
		^{134}Cs	^{137}Cs	^{144}Ce	^{237}Np	^{241}Am	Gross alpha	Gross beta
Drummore	1[B]	*	0.0094					
Port Patrick	2[S]	<0.10	<0.10	<0.36		<0.10		
Knock Bay	1[B]	*	0.0057					
Hunterston[f]	2[S]	<0.10	<0.10	<0.36		<0.10		
North of Larne	2[N]	*	0.0043					
Faslane (Carnban)	2[S]	<0.10	<0.10	<0.19		<0.10		

* Not detected by the method used

a. The concentration of ^{35}S was <0.50 Bq l^{-1}

b. The concentration of ^{35}S was <0.090 Bq l^{-1}

c. The concentration of ^{35}S was <0.66 Bq l^{-1}

d. The concentrations of ^{238}Pu, $^{239/40}Pu$ and ^{241}Pu were <0.0015, 0.020 and <0.084 Bq l^{-1} respectively

e. The concentrations of ^{238}Pu, $^{239/40}Pu$ and ^{241}Pu were <0.0028, 0.016 and <0.044 Bq l^{-1} respectively

f. The concentration of ^{35}S was 0.50 Bq l^{-1}

Results are made on behalf of the Environment Agency unless indicated otherwise

B Measurements labelled "B" are made on behalf of the Department of Energy Security and Net Zero (DESNZ)

C Measurements labelled "C" are made on behalf of the Channel Islands States

N Measurements labelled "N" are made on behalf of the Northern Ireland Environment Agency

S Measurements labelled "S" are made on behalf of the Scottish Environment Protection Agency

Table 8.12 Concentrations of radionuclides in seawater - background survey in Scotland, 2025[a]

Sample location and type	No. of sampling observations	Mean radioactivity concentration, Bq kg^{-1} (dry)[b]							
		^{3}H	^{60}Co	^{95}Nb	^{110m}Ag	^{125}Sb	^{137}Cs	^{155}Eu	^{241}Am
Baseline Seawater survey									
Papa Sound	1	<1.0	<0.10	<0.32	<0.10	<0.23	<0.10	<0.17	<0.11
Stronsay	1	<1.0	<0.10	<0.19	<0.10	<0.22	<0.10	<0.19	<0.12
Wyre Gairsay	1	<1.0	<0.10	<0.31	<0.11	<0.19	<0.10	<0.17	<0.10
Veantrow	1	<1.0	<0.10	<0.35	<0.11	<0.23	<0.10	<0.17	<0.10
Kirkwall Bay	1	<1.0	<0.10	<0.14	<0.10	<0.20	<0.10	<0.16	<0.10
Moray Firth	1	<1.0	<0.10	<0.17	<0.10	<0.22	<0.10	<0.17	<0.11
Uist Seawater									
Location 1	1	<1.0	<0.10	<0.17	<0.10	<0.13	<0.10	<0.13	<0.10
Location 2	1	<1.0	<0.10	<0.12	<0.10	<0.10	<0.10	<0.10	<0.10
Location 3	1	<1.0	<0.10	<0.28	<0.12	<0.25	<0.10	<0.20	<0.13
Location 4	1	<1.0	<0.10	<0.28	<0.10	<0.24	<0.10	<0.19	<0.12
Location 5	1	<1.0	<0.10	<0.11	<0.10	<0.10	<0.10	<0.10	<0.10
Location 6	1	<1.0	<0.10	<0.27	<0.11	<0.23	<0.10	<0.18	<0.10
Location 7	1	<1.0	<0.10	<0.29	<0.11	<0.22	<0.10	<0.19	<0.10
Location 8	1	<1.0	<0.10	<0.27	<0.10	<0.20	<0.10	<0.16	<0.10
Location 9	1	<1.0	<0.10	<0.28	<0.10	<0.22	<0.10	<0.16	<0.11

a. Results are available for other radionuclides detected by gamma spectrometry
All such results were less than the limit of detection

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Appendix 1 Disposals of radioactive waste

Table A1.1 Principal discharges of gaseous radioactive wastes from nuclear establishments in the United Kingdom, 2025

Establishment	Radioactivity	Discharge limit (annual equivalent)[a] Bq[b]	Discharges during 2025 Bq[b]	% of annual limit[c]
Nuclear fuel production and reprocessing				
Capenhurst	Uranium	1.00E+07	Nil	Nil
(Urenco Nuclear Stewardship Ltd)	Alpha	1.00E+07	Nil	Nil
	Beta	5.00E+07	Nil	Nil
Capenhurst				
(Urenco UK Ltd)	Uranium	7.50E+06	9.50E+04	1.3
	Other alpha	2.40E+06	2.20E+05	9.2
	Technetium-99	1.00E+08	7.85E+05	<1
	Others	2.25E+09	Nil	Nil
Capenhurst				
(UCP)	Uranium	7.50E+06	7.13E+04	<1
	Other Alpha	2.40E+06	Nil	Nil
	Technetium-99	1.00E+08	Nil	Nil
	Other radionuclides	7.50E+06	Nil	Nil
Sellafield[d]	Alpha[1]	6.60E+08	6.76E+07	10
	Beta[1]	3.20E+10	5.29E+08	1.7
	Tritium	1.70E+14	7.27E+10	<1
	Carbon-14	3.80E+11	8.68E+10	23
	Strontium-90[1]	5.00E+08	2.47E+06	<1
	Ruthenium-106	2.80E+09	5.62E+08	20
	Iodine-129	1.30E+10	7.79E+08	6.0
	Caesium-137[1]	4.80E+09	3.87E+07	<1
	Plutonium alpha[1]	1.30E+08	4.81E+06	3.7
	Americium-241 and curium-242[1]	8.40E+07	1.31E+07	16
Springfields	Uranium	5.30E+09	9.79E+06	<1
Springfields	Tritium	1.00E+08	5.40E+05	<1
(UK National Nuclear Laboratory)	Carbon-14	1.00E+07	8.10E+05	8.1
	Krypton-85	7.20E+11	Nil	Nil
	Other alpha radionuclides	1.00E+06	Nil	Nil
	Other beta radionuclides	1.00E+07	1.80E+05	1.8
Research establishments				
Dounreay[e]				
	Alpha[f]	3.10E+07	7.0E+04	<1
	Non-alpha[g]	1.70E+09	1.2E+06	<1
	Tritium	1.72E+13	3.5E+10	<1
	Krypton-85[h]	5.69E+14	1.0E+09	<1
	Iodine-129	1.08E+08	1.2E+07	11

Table A1.1 continued

Establishment	Radioactivity	Discharge limit (annual equivalent)[a] Bq[b]	Discharges during 2025 Bq[b]	% of annual limit[c]
Harwell				
(NRS)	Alpha	8.00E+05	2.30E+04	2.9
	Beta	2.00E+07	6.20E+05	3.1
	Tritium	1.50E+13	7.80E+10	<1
	Krypton-85	2.00E+12	Nil	Nil
	Radon-220	1.00E+14	5.10E+12	5.1
	Radon-222	3.00E+12	2.90E+11	9.7
	Iodines	1.00E+10	Nil	Nil
	Other radionuclides	1.00E+11	9.20E+06	<1
Winfrith				
(Tradebe Inutec)	Alpha	1.00E+05	1.08E+02	<1
	Tritium	1.95E+13	2.52E+12	13
	Carbon-14	3.00E+10	2.04E+02	<1
	Other	1.00E+05	4.80E+02	<1
Winfrith				
(NRS)	Alpha	2.00E+06	1.07E+03	<1
	Tritium	4.95E+13	1.20E+10	<1
	Carbon-14	5.90E+09	1.46E+08	2.5
	Other	5.00E+06	1.25E+04	<1
Nuclear power stations				
Berkeley[i]	Beta	2.00E+07	1.31E+05	<1
	Tritium	1.00E+12	5.18E+09	<1
	Carbon-14	5.00E+09	6.85E+08	14
Bradwell	Beta	2.00E+07	1.70E+05	<1
	Tritium	6.00E+11	6.10E+09	1.0
	Carbon-14	4.00E+10	4.20E+08	1.1
Chapelcross	Tritium	7.50E+14	1.54E+13	2.1
	All other nuclides	2.50E+09	1.27E+09	51
Dungeness				
A Station	Beta[j]	5.00E+08	1.05E+06	<1
	Tritium	2.60E+12	4.13E+10	1.6
	Carbon-14	5.00E+12	4.04E+08	<1
Dungeness				
B Station	Tritium	1.20E+13	3.16E+10	<1
	Carbon-14	3.70E+12	6.42E+09	<1
	Sulphur-35	3.00E+11	2.60E+08	<1
	Argon-41	7.50E+13	Nil	Nil
	Cobalt-60[j]	1.00E+08	1.46E+06	1.5
	Iodine-131	1.50E+09	1.68E+07	1.1
Hartlepool	Tritium	1.00E+13	6.37E+11	6.4
	Carbon-14	4.50E+12	9.64E+11	21
	Sulphur-35	2.30E+11	1.04E+10	4.5
	Argon-41	1.50E+14	1.56E+12	1.0
	Cobalt-60[j]	1.00E+08	1.45E+07	15
	Iodine-131	1.50E+09	1.04E+08	7.0

Table A1.1 continued

Establishment	Radioactivity	Discharge limit (annual equivalent)[a] Bq[b]	Discharges during 2025 Bq[b]	% of annual limit[c]
Heysham				
Station 1	Tritium	1.00E+13	9.82E+11	9.8
	Carbon-14	4.50E+12	1.63E+12	36
	Sulphur-35	2.00E+11	1.93E+10	10
	Argon-41	1.50E+14	7.71E+12	5.1
	Cobalt-60[j]	1.00E+08	6.93E+06	6.9
	Iodine-131	1.50E+09	5.83E+07	3.9
Heysham				
Station 2	Tritium	1.00E+13	8.68E+11	8.7
	Carbon-14	3.70E+12	1.42E+12	38
	Sulphur-35	2.30E+11	2.33E+10	10
	Argon-41	7.50E+13	4.91E+12	6.5
	Cobalt-60[j]	1.00E+08	9.40E+06	9.4
	Iodine-131	1.50E+09	7.21E+07	4.8
Hinkley Point				
A Station	Beta	5.00E+07	2.00E+05	<1
	Tritium	7.50E+11	1.50E+10	2.0
	Carbon-14	5.00E+10	4.20E+08	<1
Hinkley Point				
B Station	Tritium	1.20E+13	7.11E+10	<1
	Carbon-14	3.70E+12	1.95E+08	<1
	Sulphur-35[2]	NA	5.65E+09	NA
	Argon-41[2]	NA	Nil	NA
	Cobalt-60[j]	1.00E+08	4.73E+06	4.7
	Iodine-131[2]	NA	2.04E+06	NA
Hunterston				
A Station	Tritium	2.00E+10	3.41E+08	1.7
	Carbon-14	2.00E+09	5.53E+07	2.8
	All other radionuclides	3.00E+06	8.68E+05	29
Hunterston				
B Station[e]	Particulate beta	5.00E+08	2.46E+07	4.9
	Tritium	1.50E+13	9.49E+10	<1
	Carbon-14	4.50E+12	9.03E+09	<1
	Sulphur-35	5.00E+11	2.53E+08	<1
	Argon-41	1.50E+14	Nil	Nil
	Iodine-131	2.00E+09	Nil	Nil
Oldbury	Beta	1.00E+08	1.44E+05	<1
	Tritium	9.00E+12	2.70E+09	<1
	Carbon-14	4.00E+12	5.69E+08	<1
Sizewell				
A Station	Beta	8.50E+08	4.90E+04	<1
	Tritium	3.50E+12	1.98E+10	<1
	Carbon-14	1.00E+11	7.32E+08	<1

Table A1.1 continued

Establishment	Radioactivity	Discharge limit (annual equivalent)[a] Bq[b]	Discharges during 2025 Bq[b]	% of annual limit[c]
Sizewell				
B Station	Noble gases	3.00E+13	2.60E+12	8.7
	Particulate Beta	1.00E+08	4.00E+06	4.0
	Tritium	3.00E+12	4.30E+11	14
	Carbon-14	6.00E+11	4.30E+11	72
	Iodine-131	5.00E+08	7.30E+06	1.5
Torness	Particulate beta	4.00E+08	1.49E+07	3.7
	Tritium	1.10E+13	1.26E+12	11
	Carbon-14	4.50E+12	1.52E+12	34
	Sulphur-35	3.00E+11	6.73E+10	22
	Argon-41	7.50E+13	1.45E+12	1.9
	Iodine-131	2.00E+09	3.61E+06	<1
Trawsfynydd	Particulate Beta	5.00E+07	2.17E+05	<1
	Tritium	3.75E+11	1.03E+10	2.7
	Carbon-14	1.00E+10	1.18E+09	12
Wylfa	Particulate Beta	7.00E+08	1.38E+06	<1
	Tritium	1.80E+13	3.2E+10	<1
	Carbon-14	2.30E+12	7.80E+08	<1
Defence establishments				
Aldermaston[k]	Alpha	1.65E+05	1.30E+04	7.9
	Particulate Beta	6.00E+05	6.60E+03	1.1
	Tritium	3.90E+13	3.00E+12	7.7
	Carbon-14	6.00E+06	Nil	Nil
	Activation products[l]	BAT	1.70E+07	NA
	Volatile beta	1.00E+08	7.70E+06	7.7
Barrow[m]	Tritium	3.20E+06	Nil	Nil
	Argon-41	4.80E+10	Nil	Nil
Burghfield[k]	Tritium	9.00E+09	Nil	Nil
	Alpha	5.00E+03	9.10E+02	18
HMNB Clyde Coulport[3]	Tritium	2.50E+10	1.40E+09	5.6
Derby[j, n]	Alpha[o]	3.00E+06	8.78E+05	29
	Alpha[p, q]	2.40E+04	NA	Nil
	Beta[p, q]	1.80E+06	2.97E+04	1.6
Devonport[r]	Beta[j]	3.00E+05	1.64E+04	5.5
	Tritium	4.00E+09	6.00E+07	1.5
	Carbon-14	6.60E+10	1.10E+08	<1
	Argon-41	1.50E+10	7.44E+06	<1
Dounreay[e]	All other radionuclides	5.10E+06	1.90E+05	3.7
(Vulcan)	Noble gases	5.00E+09	Nil	Nil
HMNB Clyde Faslane[3]	Tritium	2.00E+08	8.10E+06	4.1
	All other radionuclides	1.00E+08	6.10E+05	<1

Table A1.1 continued

Establishment	Radioactivity	Discharge limit (annual equivalent)[a]	Discharges during 2025	
		Bq[b]	Bq[b]	% of annual limit[c]
Rosyth[e, s]	Tritium	1.00E+07	5.27E+03	<1
	Carbon-14	5.00E+07	3.48E+05	<1
	Other radionuclides	1.00E+05	4.07E+04	41
Radiochemical production				
Grove Centre, Amersham	Other alpha-emitting radionuclides	2.25E+06	2.06E+04	<1
	Radionuclides T1/2<2hr[t]	7.50E+11	Nil	Nil
	Tritium	2.00E+12	1.27E+11	6.4
	Radon-222	1.00E+13	9.72E+11	10
	All other radionuclides	1.60E+10	1.11E+06	<1
Industrial and landfill sites				
LLWR	Alpha	BAT	1.17E+03	NA
	Beta	BAT	1.29E+04	NA
Lillyhall (Cyclife UK Limited)	Alpha (particulate)	5.00E+05	3.93E+03	<1
	Beta (particulate)	5.00E+05	1.57E+04	3.2

* As reported to SEPA and the Environment Agency

a. These are the limits in force at end of the calendar year, unless otherwise stated. There may be changes in limits during the year (see notes for each nuclear site). In some cases permits/authorisations specify limits in greater detail than can be summarised in a single table; in particular, periods shorter than one year are specified at some sites.

b. Data quoted to 3 significant figures, except where fewer significant figures are provided in source documents

c. Data quoted to 2 significant figures except where values are <1%. Where permit/authorisation limits have changed during the year, this will not necessarily reflect the compliance position

d. Revised discharge permit limits came into force with effect 1 October 2023. The new permit allows for upper limits to be in force for until completion of active commissioning of HEPA filtration in the Magnox Swarf Storage Silo stack; and specific remediation activities, subject to a best available techniques case. See EPR/KP3690SX/V013 for more details. Lower limits are in effect unless otherwise specified

e. Some discharges are upper estimates because they include 'less than' data derived from analyses of effluents at limits of detection

f. All alpha emitting nuclides taken together

g. All non-alpha emitting radionuclides, not specifically listed, taken together

h. Krypton-85 discharges are calculated

i. Combined data for Berkeley Power Station and Berkeley Centre

j. Particulate activity

k. Discharges were made by AWE plc

l. Argon-41 is reported under the Activation products total and the limit is the demonstration of Best Available Technique

m. Discharges from Barrow are included with those from MoD sites because they are related to submarine activities. Discharges were made by BAE Systems Marine Ltd

n. Discharges were made by Rolls Royce Submarines Ltd

o. Discharge limit is for the Nuclear Fuel Production Plant Site

p. Annual limits on beta and alpha derived from monthly and weekly notification levels

q. Discharge limit is for the Neptune Reactor Raynesway Site

r. Discharges were made by Devonport Royal Dockyard Ltd

s. Discharges were made by Rosyth Royal Dockyard Ltd

t. Denotes radionuclides with a half-life on less than 2 hours

1. Upper limit in force until completion of the active commisioning of HEPA filters in the MSSS stack. See Section 3.3 for further details

2. Permit limit no longer in force after 1 December 2025 and reported discharges are for January to November 2025 only

3. Revised Letter of Approval (LOA) effective 1 January 2025.

NA Not applicable under permit

BAT Best available technology

Table A1.2 Principal discharges of liquid radioactive waste from nuclear establishments in the United Kingdom, 2025

Establishment	Radioactivity	Discharge limit (annual equivalent)[a] Bq[b]	Discharges during 2025 Bq[b]	% of annual limit[c]
Nuclear fuel production and reprocessing				
Capenhurst				
(Urenco UK Ltd)	Uranium	7.50E+08	1.19E+06	<1
	Uranium daughters	1.36E+09	2.83E+06	<1
	Non-uranic alpha	2.20E+08	3.34E+06	1.5
	Technetium-99	1.00E+09	1.25E+06	<1
Sellafield[d]	Alpha	3.40E+11	5.20E+10	15
	Beta	6.30E+13	3.35E+12	5.3
	Tritium	7.00E+14	6.75E+12	<1
	Carbon-14	5.10E+12	7.74E+10	1.5
	Cobalt-60	2.50E+12	1.24E+10	<1
	Strontium-90	1.40E+13	1.23E+12	8.8
	Technetium-99	4.50E+12	3.69E+10	<1
	Ruthenium-106	3.10E+12	7.52E+10	2.4
	Iodine-129	3.20E+11	4.05E+09	1.3
	Caesium-137	1.70E+13	1.07E+12	6.3
	Uranium alpha	2.00E+10	9.48E+08	4.7
	Plutonium alpha	2.90E+11	4.20E+10	14
	Plutonium-241	6.00E+12	3.41E+11	5.7
	Americium-241	1.40E+11	4.62E+09	3.3
Springfields	Alpha	1.00E+11	5.96E+09	6.0
	Beta	2.00E+13	2.14E+10	<1
	Technetium-99	6.00E+11	1.60E+08	<1
	Thorium-230	2.00E+10	1.50E+07	<1
	Thorium-232[e]	1.50E+10	3.00E+06	<1
	Neptunium-237	4.00E+10	1.40E+07	<1
	Other transuranic radionuclides	2.00E+10	3.50E+07	<1
	Uranium	4.00E+10	5.84E+09	15
Research establishments				
Dounreay[e]	Alpha[f]	3.40E+09	2.2E+08	6.5
	Non-alpha[g]	4.80E+10	6.8E+09	14
	Tritium	6.90E+12	1.0E+10	<1
	Strontium-90	1.77E+11	4.1E+10	23
	Caesium-137	6.29E+11	2.5E+09	<1
Harwell (Lydebank Brook)	Alpha	3.00E+07	3.25E+06	11
	Beta	3.00E+08	9.37E+06	3.1
	Tritium	2.00E+10	2.64E+08	1.3
Harwell (sewer)	Alpha	1.00E+07	1.75E+04	<1
	Beta	6.00E+08	1.16E+05	<1
	Tritium	1.00E+11	2.17E+08	<1
	Cobalt-60	5.00E+06	1.65E+05	3.3
	Caesium-137	2.00E+08	1.62E+05	<1
Winfrith (inner pipeline)[h]	Alpha	1.40E+10	1.90E+05	<1
	Tritium	4.00E+13	4.10E+08	<1
	Caesium-137	1.98E+12	1.89E+07	<1
	Other radionuclides	9.80E+11	3.25E+06	<1

Table A1.2 continued

Establishment	Radioactivity	Discharge limit (annual equivalent)[a] Bq[b]	Discharges during 2025 Bq[b]	% of annual limit[c]
Winfrith (outer pipeline)[h]	Alpha	2.00E+09	5.48E+05	<1
	Tritium	1.50E+11	1.13E+08	<1
	Other radionuclides	1.00E+09	1.08E+06	<1
Nuclear power stations				
Berkeley	Tritium	1.00E+12	1.43E+08	<1
	Caesium-137	2.00E+11	1.30E+07	<1
	Other radionuclides	2.00E+11	9.00E+06	<1
Bradwell	Tritium	7.00E+10	1.20E+09	1.7
	Caesium-137	7.00E+09	4.50E+07	<1
	Other radionuclides	7.00E+09	1.70E+08	2.4
Chapelcross	Alpha	1.00E+09	3.61E+05	<1
	Non-alpha[i]	1.00E+12	2.39E+08	<1
	Tritium	6.50E+12	2.11E+08	<1
Dungeness	Tritium	8.00E+12	4.79E+09	<1
A Station	Caesium-137	1.10E+12	7.32E+08	<1
	Other radionuclides	8.00E+11	2.85E+09	<1
Dungeness	Tritium	6.50E+14	2.01E+09	<1
B Station	Sulphur-35	2.00E+12	Nil	Nil
	Cobalt-60	1.00E+10	8.73E+07	<1
	Caesium-137	1.00E+11	5.74E+08	<1
	Other radionuclides	8.00E+10	6.50E+08	<1
Hartlepool	Tritium	6.50E+14	1.00E+14	15
	Sulphur-35	3.60E+12	1.91E+11	5.3
	Cobalt-60	1.00E+10	2.07E+08	2.1
	Caesium-137	1.00E+11	1.96E+09	2.0
	Other radionuclides	8.00E+10	1.15E+09	1.4
Heysham	Tritium	6.50E+14	2.25E+14	35
Station 1	Sulphur-35	2.00E+12	2.80E+11	14
	Cobalt-60	1.00E+10	1.88E+08	1.9
	Caesium-137	1.00E+11	1.69E+08	<1
	Other radionuclides	8.00E+10	3.08E+09	3.9
Heysham	Tritium	6.50E+14	2.64E+14	41
Station 2	Sulphur-35	2.00E+12	8.71E+10	4.4
	Cobalt-60	1.00E+10	7.69E+07	<1
	Caesium-137	1.00E+11	2.62E+08	<1
	Other radionuclides	8.00E+10	8.44E+09	11
Hinkley Point				
A Station	Tritium	1.00E+12	7.91E+08	<1
	Caesium-137	1.00E+12	3.20E+07	<1
	Other radionuclides	7.00E+11	6.10E+07	<1

Table A1.2 continued

Establishment	Radioactivity	Discharge limit (annual equivalent)[a] Bq[b]	Discharges during 2025 Bq[b]	% of annual limit[c]
Hinkley Point				
B Station	Tritium	6.50E+14	1.07E+08	<1
	Sulphur-35	2.00E+12	4.33E+07	<1
	Cobalt-60	1.00E+10	5.08E+07	<1
	Caesium-137	1.00E+11	4.59E+08	<1
	Other radionuclides	8.00E+10	2.43E+08	<1
Hunterston				
A Station	Alpha	2.00E+09	Nil	Nil
	All other non-alpha[j]	6.00E+10	2.70E+07	<1
	Tritium	3.00E+10	4.10E+07	<1
	Caesium-137	1.60E+11	2.90E+07	<1
	Plutonium-241	2.00E+09	Nil	Nil
Hunterston				
B Station	Alpha	1.00E+09	3.51E+06	<1
	All other non-alpha	1.50E+11	1.47E+09	<1
	Tritium	7.00E+14	3.84E+08	<1
	Sulphur-35	6.00E+12	3.43E+07	<1
	Cobalt-60	1.00E+10	6.58E+07	<1
Oldbury	Tritium	1.00E+12	2.10E+07	<1
	Caesium-137	7.00E+11	9.90E+07	<1
	Other radionuclides	7.00E+11	4.60E+07	<1
Sizewell				
A Station	Tritium	5.00E+12	1.50E+08	<1
	Caesium-137	1.00E+12	6.00E+08	<1
	Other radionuclides	7.00E+11	4.53E+09	<1
Sizewell				
B Station	Tritium	8.00E+13	1.04E+13	13
	Caesium-137	2.00E+10	2.00E+08	1.0
	Other radionuclides	1.30E+11	4.60E+09	3.5
Torness	Alpha	5.00E+08	7.10E+06	1.4
	All other non-alpha	1.50E+11	1.00E+10	6.7
	Tritium	7.00E+14	3.05E+14	44
	Sulphur-35	3.00E+12	3.05E+11	10
	Cobalt-60	1.00E+10	2.40E+08	2.4
Trawsfynydd	Tritium	3.00E+11	2.62E+09	<1
	Caesium-137	1.50E+10	2.31E+08	1.5
	Other radionuclides[k]	3.00E+10	7.22E+08	2.4
Wylfa	Tritium	1.50E+13	1.5E+08	<1
	Other radionuclides	1.10E+11	7.0E+07	<1

Table A1.2 continued

Establishment	Radioactivity	Discharge limit (annual equivalent)[a] Bq[b]	Discharges during 2025 Bq[b]	% of annual limit[c]
Defence establishments				
Aldermaston (Silchester)[l]	Alpha	1.00E+07	2.20E+06	22
	Other beta emitting radionuclides	2.00E+07	6.90E+06	35
	Tritium	2.50E+10	1.20E+08	<1
Aldermaston (to Stream)[l, m]	Tritium	NA	1.30E+08	NA
Barrow[n]	Tritium	1.20E+10	9.55E+05	<1
	Carbon-14	2.95E+08	8.33E+04	<1
	Cobalt-60	1.34E+07	1.78E+04	<1
	Other beta-gamma emitting radionuclides	3.50E+06	1.47E+05	4.2
Burghfield (Sewer)	Alpha[o]	NA	2.45E+03	NA
Derby[p]	Alpha[q]	2.00E+09	6.49E+07	3.2
	Alpha[r]	3.00E+05	9.20E+03	3.1
	Beta[r]	3.00E+08	2.95E+05	<1
Devonport (sewer)[s]	Tritium	2.00E+09	6.97E+06	<1
	Cobalt-60	3.50E+08	1.13E+06	<1
	Other radionuclides	6.50E+08	1.73E+07	2.7
Devonport (estuary)[s]	Tritium	7.00E+11	1.11E+10	1.6
	Carbon-14	1.70E+09	2.48E+07	1.5
	Cobalt-60	8.00E+08	6.21E+05	<1
	Other radionuclides	3.00E+08	2.01E+06	<1
HMNB Clyde Faslane[1]	Alpha	5.00E+06	Nil	Nil
	Beta[i,t]	1.00E+08	Nil	Nil
	Tritium	5.00E+11	Nil	Nil
	Cobalt-60	1.00E+08	Nil	Nil
	Carbon-14	1.00E+08	Nil	Nil
	Tritium in General Effluents[v]	1.00E+10	8.11E+08	8.1
Rosyth[e, u]	Tritium	3.00E+08	3.88E+06	1.3
	Cobalt-60	1.00E+08	6.00E+04	<1
	Other radionuclides	1.00E+08	2.60E+05	<1
Radiochemical production				
Grove Centre, Amersham	Alpha	3.00E+08	6.60E+05	<1
	Tritium	1.41E+11	3.00E+05	<1
	Other radionuclides	6.50E+10	1.39E+07	<1

Table A1.2 continued

Establishment	Radioactivity	Discharge limit (annual equivalent)[a] Bq[b]	Discharges during 2025 Bq[b]	% of annual limit[c]
Industrial and landfill sites				
LLWR	Alpha	BAT	3.38E+07	NA
	Beta	BAT	5.09E+08	NA
	Tritium	BAT	2.30E+10	NA
Lillyhall (Cyclife UK limited)				
	Alpha	5.00E+05	5.40E+02	<1
	Other radionuclides	5.00E+05	1.49E+04	3.0

a. These are the limits in force at end of the calendar year, unless otherwise stated. There may be changes in limits during the year (see notes for each nuclear site). In some cases permits/authorisations specify limits in greater detail than can be summarised in a single table; in particular, periods shorter than one year are specified at some sites.

b. Data quoted to 3 significant figures, except where fewer significant figures are provided in source documents

c. Data quoted to 2 significant figures except where values are <1%. Where permit/authorisation limits have changed during the year, this will not necessarily reflect the compliance position

d. Includes discharges made via the sea pipelines, factory sewer and Calder interceptor sewer. Revised discharge permit limits came into force with effect 1 October 2023. The new permit allows for upper limits to be in force for specific remediation activities, subject to a best available techniques case. See EPR/KP3690SX/V013 for more details. Lower limits are in effect unless otherwise specified

e. Some discharges are upper estimates because they include 'less than' data derived from analyses of effluents at limits of detection. Data quoted to 2 decimal places

f. All alpha emitting radionuclides taken together

g. All non-alpha emitting radionuclides, not specifically listed, taken together

h. Discharges reported are from NRS Winfrith only, discharges from Tradebe-Inutec are transferred off-site for disposal into Southampton Water under a non-nuclear permit (see Section 7.3)

i. Excluding tritium

j. Excluding Tritium, caesium-137 and plutonium-241

k. Including strontium

l. Discharges were made by AWE plc

m. The discharge limit has been replaced by an activity notification level of 30 Bq l^{-1}

n. Discharges from Barrow are included with those from MOD sites because they are related to submarine activities. Discharges were made by BAE Systems Marine Ltd

o. A quarterly notification level of 5.00E+03 Bq is in effect

p. Discharges were made by Rolls Royce Submarines Ltd

q. Discharge limit is for Nuclear Fuel Production Plant

r. Discharge limit is for Neptune Reactor Raynesway Site

s. Discharges were made by Devonport Royal Dockyard Ltd

t. Excluding cobalt-60

u. Discharges were made by Rosyth Royal Dockyard Ltd

v. "general effluents" means liquid wastes which are produced on board a submarine as part of normal operations that are not directly associated with the submarine reactor plant and that contain only tritium

1 Revised Letter of Approval (LOA) effective 1 January 2025.

NA Not applicable under permit

BAT Best available technology

Table A1.3 Disposals and receipt with the intention of disposal of solid radioactive waste at the Low Level Waste Repository, Cumbria, in the United Kingdom, Financial Year 2025/26

Radionuclide or group of radionuclides	Total vault disposed[a] waste FY25/26 (Bq)	Cumulative total vault disposed[a] waste (Bq)
Tritium	7.37E+10	2.84E+13
Carbon-14	1.38E+09	6.51E+11
Chlorine-36	1.47E+08	6.05E+11
Calcium-41	Nil	1.26E+10
Selenium-79	Nil	7.08E+03
Molybdenum-93	Nil	1.72E+07
Zirconium-93	Nil	2.14E+11
Niobium-94	6.36E+06	7.03E+09
Technetium-99	1.16E+09	2.74E+12
Silver-108m	7.29E+08	2.10E+10
Iodine-129	6.30E+06	3.37E+09
Caesium-135	Nil	5.30E+08
Radium-226	2.92E+02	1.09E+11
Thorium-229	8.17E-05	3.22E+05
Thorium-230	1.06E+05	7.61E+09
Thorium-232	2.14E+05	7.45E+10
Protactinium-231	3.18E+03	6.21E+08
Uranium-233	1.00E+06	9.84E+08
Uranium-234	9.17E+08	7.33E+11
Uranium-235	2.14E+07	3.21E+10
Uranium-236	1.38E+08	2.90E+10
Uranium-238	6.55E+08	1.13E+12
Neptunium-237	5.05E+07	4.60E+10
Plutonium-238	2.00E+09	3.38E+11
Plutonium-239	2.90E+09	5.90E+11
Plutonium-240	2.99E+09	3.82E+11
Plutonium-241	4.26E+10	1.02E+13
Plutonium-242	1.97E+06	9.43E+08
Americium-241	7.74E+09	1.40E+12
Americium-242m	Nil	5.09E+08
Americium-243	7.67E+06	4.33E+08
Curium-243	4.67E+06	1.23E+09
Curium-244	8.00E+07	2.02E+10
Curium-245	7.24E+04	5.93E+06
Curium-246	7.05E+03	1.63E+06
Curium-248	Nil	2.45E+07
OTHRT**	1.06E+05	1.23E+11
PUALD**	Nil	1.92E+11
UALD**	Nil	5.96E+10
URRM**	Nil	4.55E+10
Others*	6.13E+10	7.35E+13

a. In this context, the term 'disposed' refers to those wastes that have already been emplaced in their final disposal locations within Vault 8. It also includes those wastes within Vault 8 and 9 that have been 'accepted with the intention to dispose' but await their final disposal positions.

* 'Others' includes all radionuclides not listed above and radionuclides with 'no value' listed above, but excludes radionuclides of less than three months half-life.

** 'OTHRT' is the sum of activity from radium and thorium isotopes other than Ra-226 and Th-232; 'PUALD', 'UALD' and 'URRM' represent plutonium and uranium, respectively, arising from defence-related activities.

Table A1.3 continued

Year	Actual receipt data[a, b, c]		Projected data	
	Total vault disposed waste for financial year (m^3)	Cumulative (to financial year end) total vault disposed waste (m^3)	Total vault disposed waste for financial year (m^3)	Cumulative (to financial year end) total vault disposed waste (m^3)
2015/16	3.32E+03	2.44E+05	1.94E+04	3.68E+05
2016/17	3.35E+03	2.47E+05	2.00E+04	3.88E+05
2017/18	1.81E+03	2.49E+05	2.00E+04	4.31E+05
2018/19	1.72E+03	2.51E+05	2.31E+04	4.54E+05
2019/20	6.93E+02	2.51E+05	2.39E+04	4.78E+05
2020/21	4.36E+02	2.52E+05	2.78E+04	5.06E+05
2021/22	5.33E+02	2.52E+05	2.53E+04	5.31E+05
2022/23	1.04E+03	2.54E+05	3.19E+04	5.63E+05
2023/24	6.24E+02	2.54E+05	2.36E+04	5.87E+05
2024/25	2.19E+02	2.35E+05	2.30E+04	6.10E+05
2025/26	2.39E+02	2.35E+05	2.66E+04	6.36E+05

a. In this context, the term 'disposed' refers to those wastes that have already been emplaced in their final disposal locations within Vault 8. It also includes those wastes within Vault 8 and 9 that have been 'accepted with the intention to dispose' but await their final disposal positions

b. 'disposed waste' volumes refer to the gross package volume of each container or cumulative gross package volume of all containers received at the LLWR site

c. 'Actual receipt data' quoted in this report have been revised following investigations by the site operator and therefore different to those quoted in previous RIFE reports. Refer to the RIFE errata for further information

Table A1.4 Solid waste transfers from nuclear establishments in Scotland, 2025*,[a]

Establishment Transfer from	Volume m^3	Total Activity Bq	Alpha Bq	Beta/Gamma Bq
Research establishments				
Dounreay	6.09E+02		1.08E+10	3.95E+10
Nuclear Power Stations				
Chapelcross[b]	1.23E+02	1.95E+09		
Hunterston A[b]	1.66E+01	1.67E+02		
Hunterston B	5.68E+01		2.69E+06	8.87E+13
Torness	5.56E+01		1.17E+08	2.39E+09
Defence establishments				
HMNB Clyde Coulport	Nil	Nil	Nil	Nil
Dounreay (Vulcan)	Nil	Nil	Nil	Nil
HMNB Clyde Faslane	1.20E+01	1.93E+01		
Rosyth	2.76E+01	1.79E+10		

* As reported by site operators to SEPA

a. Zero transfers reported as Nil

b. Reported as total activity only

Table A1.5 Summary of unintended leakages, spillages, emissions or unusual findings of radioactive substances from nuclear licensed sites in the UK in 2025

Site	Month/Year	Summary of incident	Consequences and action taken
Dounreay	June 2024	Nuclear Restoration Services (NRS) notified SEPA of possible loss of radioactively contaminated water to the ground from the Carbon Bed Filter (CBF) structure located within the Fuel Cycle Area.	NRS' investigation concluded that there was a small leak from the CBF. NRS has subsequently removed water from the structure and installed level monitoring equipment. In July 2025 SEPA issued a regulatory notice requiring NRS to: • undertake a review of existing groundwater monitoring arrangements • assess compliance with the requirement to dispose of radioactive waste via an authorised route • undertake characterisation to establish the extent of the radioactive contamination and develop a programme for undertaking the appropriate remediation
Dounreay	August 2024	NRS informed SEPA that very low levels of radioactivity had been identified in samples taken from a sump collecting water ingress within a non-radioactive facility on the Dounreay site. The arrangements in place at the time involved the intercepted water being pumped from the sump and discharged to the marine environment via the non-active drainage system, which is not an authorised route for the disposal of liquid radioactive waste. NRS subsequently undertook work to estimate the annual volume discharged from the sump and the radionuclide components present.	SEPA's investigation concluded that NRS had contravened conditions of its EASR radioactive substances authorisation. In October 2025, SEPA issued a Regulatory Notice requiring NRS to undertake a review of the management arrangements in place for the disposal of aqueous liquid waste.
Dungeness A	February 2025	Nuclear Restoration Services (NRS) Limited notified the Environment Agency of two small perforations to the Reactor 1 Blowdown Stack and a crack observed within the Magnox Dissolution plant ventilation system. Repairs were actioned promptly.	NRS Limited concluded that the environmental impacts were likely to be negligible due to the location and size of the pipework faults. In November 2025, the Environment Agency issued a Radioactive Substances Compliance Assessment Report (RASCAR) with three CCS4 non-compliances. Subsequent to further follow-up investigations a Warning Letter was issued regarding asset management of gaseous stacks and resource capability in 2026. NRS Limited have provided a response to the actions which are currently being assessed by the Environment Agency.

Appendix 2 Abbreviations and glossary

AGR	Advanced Gas-cooled Reactor
AWE	Atomic Weapons Establishment
Cefas	Centre for Environment, Fisheries & Aquaculture Science
DESNZ	Department for Energy Security & Net Zero
DSRL	Dounreay Site Restoration Limited
Euratom	European Atomic Energy Community
EASR	Environmental Authorisations (Scotland) Regulations 2018
EPR	Environmental Permitting Regulations
EPR 16	Environmental Permitting (England and Wales) Regulations 2016
EU	European Union
FEPA	Food and Environment Protection Act
FSA	Food Standards Agency
FSS	Food Standards Scotland
GES	Good Environmental Status
HAW	Higher Activity Radioactive Waste
HPA	Health Protection Agency
ICRP	International Commission on Radiological Protection
LLW	Low-Level Waste
LLWR	Low Level Waste Repository
LoA	Letter of Agreement
MOD	Ministry of Defence
MRF	Metals Recycling Facility
NDA	Nuclear Decommissioning Authority
NDAWG	National Dose Assessment Working Group
NIEA	Northern Ireland Environment Agency
NORM	Naturally Occurring Radioactive Material
NRPB	National Radiological Protection Board
NRS	Nuclear Restoration Services

NRW	Natural Resources Wales
NRTE	Naval Reactor Test Establishment
NWS	Nuclear Waste Services
OBT	Organically Bound Tritium
ONR	Office for Nuclear Regulation
OSPAR	Oslo and Paris Convention for the Protection of the marine environment of the North-East Atlantic
PRAG(D)	Particles Retrieval Advisory Group (Dounreay)
PHE	Public Health England
RIFE	Radioactivity in Food and the Environment
RRDL	Rosyth Royal Dockyard Limited
RSS	Radioactive Substances Strategy
SEPA	Scottish Environment Protection Agency
STW	Sewage Treatment Works
THORP	Thermal Oxide Reprocessing Plant
UKHSA	UK Health Security Agency (formerly PHE and HPA)

Absorbed dose	The ionising radiation energy absorbed in a material per unit mass. The unit for absorbed dose is the gray (Gy) which is equivalent to J kg^{-1}.
Artificial radionuclides	These are radioactive isotopes that are not found readily in nature. They are generally produced during nuclear power generation, nuclear fuel reprocessing, from nuclear weapons testing or in specialist devices by neutron bombardment.
Authorised Premises	These are premises that has been authorised by the environment agencies to discharge to the environment.
Becquerel	One radioactive transformation per second.
Bioaccumulation	Excretion may occur; however, the rate of excretion is less than the rate of intake + accumulation.
Biota	Flora and fauna.
Canteen meals	Canteen meals are used to represent a typical or mixed diet at locations remote from nuclear sites throughout the UK. Prior to leaving the EU, these data were collected and reported to comply with Articles 35 and 36 of Euratom. These samples are maintained to demonstrate compliance with Euratom recommendations. Additional information is provided in Section 2.1.3.
Committed effective dose	The sum of the committed equivalent doses for all organs and tissues in the body resulting from an intake (of a radionuclide), having been weighted by their tissue weighting factors. The unit of committed effective dose is the sievert (Sv). The 'committed' refers to the fact that the dose is received over a number of years, but it is accounted for in the year of the intake of the activity.
Direct radiation	Ionising radiation which arises directly from processes or operations on premises using radioactive substances and not as a result of discharges of those substances to the environment.
Dose	Shortened form of 'effective dose' or 'absorbed dose'.
Dose limits	Maximum permissible dose resulting from ionising radiation from practices covered by the Euratom Basic Safety Standards Directive, excluding medical exposures. It applies to the sum of the relevant doses from external exposures in the specified period and the 50 year committed doses (up to age 70 for children) from intakes in the same period. Currently, the limit has been defined as 1mSv per year for the UK. The dose limit for external exposure to skin (for example, from handling fishing gear) is 50mSv. The dose limits apply to all age groups.
Dose rates	The radiation dose delivered per unit of time.
Effective dose	The sum of the equivalent doses from internal and external radiation in all tissue and organs of the body, having been weighted by their tissue weighting factors. The unit of effective dose is the sievert (Sv).

Environmental materials	Environmental materials include freshwater, grass, seawater, seaweed, sediment, soil and various species of plants.
Equivalent dose	The absorbed dose in a tissue or organ weighted for the type and quality of the radiation by a radiation-weighting factor. The unit of equivalent dose is the sievert (Sv).
External dose	Doses to humans from sources that do not involve ingestion or inhalation of the radionuclides.
Fuel-free verification	Fuel-free verification is when all of the spent fuel has been certified as being removed from the site.
Fragments	'Fragments' are considered to be fragments of irradiated fuel, which are up to a few millimetres in diameter.
Ionising radiation	Radiation composed of particles that individually carry enough kinetic energy to liberate an electron from an atom or molecule, ionising it. Ionising radiation is generated through nuclear reactions, either artificial or natural, by very high temperature (for example, plasma discharge or the corona of the Sun), via production of high energy particles in particle accelerators, or due to acceleration of charged particles by the electromagnetic fields produced by natural processes, from lightning to supernova explosions. Additional information on the basic concepts of radiation is available - https://www.gov.uk/government/publications/nuclear-emergencies-information-for-the-public/basic-concepts-of-radiation
Indicator materials	Environmental materials may be sampled for the purpose of indicating trends in environmental performance or likely impacts on the food chain. These include seaweed, soil and grass.
In-growth	Additional activity produced as a result of radioactive decay of parent radionuclides.
Kerma air rate	Air kerma is the quotient of the sum of the kinetic energies of all the charged particles liberated by indirectly ionising particles in a specified mass of air.
Millisievert	The millisievert is a 1/1000 of a sievert. A sievert is one of the International System of Units used for the measurement of dose equivalent.
Non-Nuclear sites	These are other sites that use radioactive materials, such as hospitals, research of industrial facilities
Nuclear Sites	Shortened form of 'Nuclear Licensed sites'.
Orphan source	Is a radioactive source which is neither exempted nor under regulatory control. For example, this could be because it has never been under regulatory control or abandoned, lost misplaced, stolen or otherwise transferred without proper approval.

Permits and authorisations	In England and Wales, the term 'permit' replaced 'authorisation' under the Environmental Permitting Regulations (EPR). In this report 'permit' has been used to apply to all sites in England and Wales, irrespective of whether the period considered includes activities prior to EPR coming into force in 2010. In Scotland, the term 'permit' replaced 'authorisation' under the Environmental Authorisations (Scotland) Regulations 2018 (EASR), irrespective of whether the period includes activities prior to EASR coming into force in 2018. 'Authorisation' remains the relevant term for Northern Ireland.
Radiation exposure	Being exposed to radiation from which a dose can be received.
Radiation weighting	Factor used to weight the tissue or organ absorbed dose to take account of the type and quality of the radiation. Example radiation weighting factors: alpha particles = 20; beta particles = 1; photons = 1.
Radioactivity	The emission of alpha particles, beta particles, neutrons and gamma or x-radiation from the transformation of an atomic nucleus.
Radionuclide	An unstable form of an element that undergoes radioactive decay.
Representative person	Representative person is an approach used in the assessment of radiation exposures ('total dose') to the public. Direct measurement of doses to the public is not possible under most normal conditions. Instead, doses to the public are estimated using environmental radionuclide concentrations, dose rates and habits data. The estimated doses are compared with dose criteria. In this report, the dose criteria are legal limits for the public. The representative person are usually members of the public who consume large quantities of locally harvested food or spending long periods in locations being assessed for external exposure.
Source-specific dose	An assessment of dose that focuses on specific sources on sites (for example, liquid or gaseous discharges) and their associated pathways (for example, external exposure over shoreline areas). See Section 2, and Appendix 4 for more information on these dose calculations. In some cases, assessments may include the impacts from multiple sites. For example, the source-specific assessment of the Dumfries and Galloway coast includes the impacts of discharges from Chapelcross and Sellafield.
NORM	Naturally occurring radioactive materials that may have been technologically enhanced in some way. The enhancement has occurred when a naturally occurring radioactive material has its composition, concentration, availability, or proximity to people altered by human activity. The term is usually applied when the naturally occurring radionuclide is present in sufficient quantities or concentrations to require control for purposes of radiological protection of the public or the environment.

Tissue weighting factors	Factor used to weight the equivalent dose in a tissue or organ to take account of the different radiosensitivity of each tissue and organ. Example tissue weighting factors: lung = 0.12; bone marrow = 0.12; skin = 0.01.
'Total dose'	An assessment of dose that takes into account all exposure pathways such as radionuclides in food and the environment and direct radiation.

Appendix 3 Modelling of concentrations of radionuclides in foodstuffs, air, and sewage systems

A3.1 Foodstuffs

At Sellafield and the LLWR, a simple food chain model has been used to provide concentrations of activity in milk and livestock for selected radionuclides to supplement data obtained by direct measurements. This is done where relatively high limits of detection exist or where no measurements were made.

Activities in milk, meat and offal were calculated for technetium-99, ruthenium-106, and plutonium-241 using the equations:

$$C_m = F_m \, Ca \, Q_f \quad \text{and}$$
$$C_f = F_f \, Ca \, Q_f \quad \text{where}$$

C_m is the concentration in milk (Bq l^{-1}),
C_f is the concentration in meat or offal (Bq kg^{-1} (fresh)),
F_m is the fraction of the animal's daily intake by ingestion transferred to milk (d l^{-1})
F_f is the fraction of the animal's daily intake by ingestion transferred to meat or offal (d kg^{-1} (fresh)),
Ca is the concentration in fodder (Bq kg^{-1} (dry)),
Q_f is the amount of fodder eaten per day (kg (dry) d^{-1})

No direct account is taken of radionuclide decay or the intake by the animal of soil associated activity. The concentration in fodder is assumed to be the same as the maximum observed concentration in grass or, in the absence of such data, in leafy green vegetables. The food chain data for the calculations are given in Table A3.1 [219,220] and the estimated concentrations in milk, meat and offal are presented in Table A3.2.

A3.2 Air

For some sites, discharges to air may lead to significant doses. Doses may arise from radionuclides transferred from the plume to food crops and animal products, inhalation of radionuclides in the plume itself and external doses from radionuclides in the plume.

Average annual concentrations of radionuclides in the air at nearest habitations were calculated using a Gaussian plume model, PC CREAM 08®[232], and the reported discharges of radionuclides to air. Each site assessment uses generic meteorological data based on the Pasquill stability category shown in Table A3.3. The core modelling assumptions (such as the effective discharge or stack height and distance to habitation) are also shown in Table A3.3. The discharge stack is assumed to be at the centre of the site. For multi-station sites (for example, Sizewell A and B), the gaseous discharges are summed together and assumed to be discharged via a common discharge point (at the centre of both sites).

External radiation doses from radionuclides in the plume and from deposited activity were calculated taking into account occupancy levels indoors and outdoors and location factors to allow for building shielding. During the time people are assumed to be indoors, the standard assumption that the dose from gamma-emitting radionuclides in the plume will be reduced by 80% has been made. Internal radiation doses from inhalation of discharged radionuclides were assessed using breathing rates. Doses were initially assessed for 3 age groups: adults, children (10-year-old), and infants (1-year-old). All ages are assumed to have year-round occupancy at the nearest habitation. The assumptions of the inhalation and occupancy rates assessment are shown in Table A3.4. The dose to the prenatal children age group was taken to be the same as that for an adult.

A3.3 Sewage systems

The facilities at AWE Aldermaston and the Grove Centre, Amersham discharge liquid radioactive waste to local sewers. Wastes are processed at local sewage treatment works (STW). The prolonged proximity to raw sewage and sludge experienced by sewage treatment workers could lead to an increase in the dose received, via a combination of external irradiation from the raw sewage and sludge and the inadvertent ingestion and inhalation of resuspended radionuclides.

An assessment of the dose received by workers at the Maple Lodge STW, near Amersham and the Silchester STW, near Aldermaston has been conducted using the methodology and data given by the Environment Agency [221,222]. The flow rate through the sewage works is used to calculate a mean concentration in raw sewage and sludge of each nuclide discharged. These mean concentrations are combined with habits data concerning the workers' occupancy near raw sewage and sludge, external and internal dosimetric data, and physical data such as inhalation rates to provide dose estimates. Workers are assumed to spend 75% of a working year in proximity to the raw sewage, and the other 25% in proximity to the sewage sludge. Where liquid discharges are not nuclide-specific, a composition has been assumed based on advice from the operators and concentrations calculated accordingly.

The model parameters and habits data used to assess the dose to sewage treatment workers are given in Table A3.5 and the amounts of radioactivity discharged from each site can be found in Appendix 1 of this report.

Table A3.1 Data for food chain model

Parameter	Nuclide	Food				
		Milk	Beef	Beef offal	Sheep	Sheep offal
Q_f		13	13	13	1.5	1.5
F_m or F_f	^{99}Tc	1E-02	1E-02	4E-02	1E-01	4E-01
	^{106}Ru	1E-06	1E-03	1E-03	1E-02	1E-02
	^{241}Pu	1E-06	1E-04	2E-02	4E-04	3E-02

Table A3.2 Predicted concentrations of radionuclides from food chain model used in assessments of exposures

Foodstuff	Location	Radioactivity concentration (fresh weight), Bq kg^{-1}		
		^{99}Tc	^{106}Ru	^{241}Pu
Milk	Sellafield	[b]	4.8E-05	2.3E-05
	LLWR near Drigg[c]	[a]	3.3E-04	6.7E-05
Beef	Sellafield	[b]	4.8E-02	2.3E-03
	LLWR near Drigg[c]	1.3E-01	3.3E-01	6.7E-03
Sheep	Sellafield	[b]	5.5E-02	1.1E-03
	LLWR near Drigg[c]	[a]	[a]	3.1E-03
Beef offal	Sellafield	[b]	4.8E-02	4.7E-01
	LLWR near Drigg[c]	4.9E-01	3.3E-01	1.3E+00
Sheep offal	Sellafield	[b]	5.5E-02	8.1E-02
	LLWR near Drigg[c]	[a]	3.8E-01	2.3E-01

a. Positive result used, or LoD result used because modelling result greater than LoD
b. No grass or leafy green vegetable data available
c. 2025 data for the LLWR based on oats sample (no grass or leafy green vegetable samples available)

Table A3.3 Air concentrations modelling assumptions

Nuclear site	Stack height, m	Estimated site diameter, km	Estimated distance from stack to nearest habitation, km	Frequency of Pasquill stability catergory D
Aldermaston	15	2	0.3	60
Amersham	20	0.4	0.3	55
Berkeley	20	1.6	0.4	55
Bradwell	14	0.4	0.3	65
Burghfield	15	0.6	0.3	60
Capenhurst	15	1.1	0.3	65
Chapelcross	30	1.2	0.7	60
Derby	50	0.5	0.5	55
Devonport	15	1	0.3	65
Dounreay	15	1	1	75
Dungeness	17	1	0.3	70
Hartlepool	23	0.6	2	70
Harwell	20	1	0.2	55
Heysham	21	1	0.5	70
Hinkley	21	0.8	1	55
Hunterston	15	0.4	0.4	60
Oldbury	20	0.8	0.7	55
Sellafield	93	2	0.5	65
Sizewell	18	0.4	1	70
Springfields	27	1	0.3	70
Torness	72	0.5	0.6	70
Trawsfynydd	18	0.6	0.6	70
Winfrith	15	1.6	0.4	60
Wylfa	17	1	0.4	70

Table A3.4 Inhalation and occupancy data for dose assessment of discharges to air

Age group	Inhalation rates, $m^3 h^{-1}$	Fraction of time indoors
1-year-old	0.22	0.9
10-year-old	0.64	0.8
Adults	0.92	0.7

Table A3.5 Sewage workers dose assessment modelling assumptions and occupancy data.

Flow rate, $m^3 d^{-1}$	Aldermaston (Silchester STW) Amersham (Maple Lodge STW)	[a]6.7E03 [b]1.5E05
Occupancy - sewage, h y^{-1}		1380
Occupancy - sludge, h y^{-1}		[c]460
Inadvertent ingestion rate, kg h^{-1}		[d]5.0E-06
Inhalation rate, $m^3 h^{-1}$		[d]1.2
Airborne concentration of sewage or sludge, kg m^{-3}		[d]1.0E-07
Density of raw sewage and treated sludge, kg l^{-1}		[d]1

a. Based on average flow rate of 0.078 $m^3 s^{-1}$ [224]
b. Based on average flow rate of 1.8 $m^3 s^{-1}$ [223]
c. A working year is assumed to be 40 hours per week and 48 weeks per year
d. Parameter values used in Environment Agency methodology (see text for reference)

Appendix 4 Consumption, inhalation, handling and occupancy rates

This appendix gives the consumption, handling and occupancy rate data used in the source-specific assessment of exposures from consumption of terrestrial foods and aquatic pathways. Consumption rates for terrestrial foods are based on [114] and are given in Table A4.1. These are derived from national statistics and are taken to apply at each site. Site-specific data for aquatic pathways based on local surveys are given in Table A4.2. These site-specific data have been supplemented with referenceable generic information [153,225] where appropriate. Occupancy over intertidal areas and rates of handling from local surveys has been reassessed to take account of a change in the factor used to determine the range of rates typical of those most exposed. For using the 'cut-off' method to define those most exposed [226,227] a factor of 3.0 is used to describe the ratio of the maximum to the minimum rate within the group. Data used for routine assessments of external and inhalation pathways from gaseous discharges are given in Appendix 3.

Consumption rates refer to the mass of a foodstuff as prepared for consumption (with, for example, stalks or shells removed) and are consistent with the mass quantity used for presentation of concentration data in this report. The term 'fresh weight' is used in the data tables of concentrations. For shellfish, the consumption rates and concentrations are for cooked weights. For other foodstuffs, uncooked weights are used.

Table A4.1 Consumption rates for terrestrial foods

Food Group	Consumption rates (kg y^{-1})#					
	Average			Above average consumption rate*		
	Adult	10-year-old	Infant	Adult	10-year-old	Infant
Beef	15	15	3	45	30	10
Cereals	50	45	15	100	75	30
Eggs	8.5	6.5	5	25	20	15
Fruit	20	15	9	75	50	35
Game	6	4	0.8	15	7.5	2.1
Green vegetables	15	6	3.5	45	20	10
Honey	2.5	2	2	9.5	7.5	7.5
Legumes	20	8	3	50	25	10
Milk	95	110	130	240	240	320
Mushrooms	3	1.5	0.6	10	4.5	1.5
Nuts	3	1.5	1	10	7	2
Offal	5.5	3	1	20	10	5.5
Pig	15	8.5	1.5	40	25	5.5
Potatoes	50	45	10	120	85	35
Poultry	10	5.5	2	30	15	5.5
Root crops	10	6	5	40	20	15
Sheep	8	4	0.8	25	10	3
Wild fruit	7	3	1	25	10	2

\# Except for milk where units are l y^{-1}

* These rates are the 97.5th percentile of the distribution across all consumers

Table A4.2 Consumption, inhalation, handling and occupancy rates for aquatic pathways

Site (Year of Last Survey)	Representative person[a]	Rates
Aldermaston and Burghfield (2022)		1 kg y^{-1} pike
		1600 h y^{-1} over riverbank
Barrow (2025)	A	22 kg y^{-1} fish
		2.5 kg y^{-1} crabs and lobsters
		9.3 kg y^{-1} molluscs
		640 h y^{-1} over mud, sand and stones
	B (houseboat)	3800 h y^{-1} over mud and sand
Berkeley and Oldbury (2014)	A	10 kg y^{-1} fish
		0.3 kg y^{-1} crabs and lobsters
		310 h y^{-1} over mud, stones and saltmarsh
	B (houseboat)	3700 h y^{-1} over mud
Bradwell (2015)		21 kg y^{-1} fish
		1.0 kg y^{-1} lobsters
		5.0 kg y^{-1} Pacific and European oysters
		2600 h y^{-1} over mud
Capenhurst (NA)	10 year old children	500 h y^{-1} over sediment
		5 10^{-3} kg y^{-1} sediment by inadvertent ingestion
		20 l y^{-1} water by inadvertent ingestion
Channel Islands (1997)		62 kg y^{-1} fish
		30 kg y^{-1} crabs, spider crabs and lobsters
		30 kg y^{-1} scallops and whelks
		1400 h y^{-1} over mud and sand
Chapelcross (2022)	A	5 kg y^{-1} salmonids
		130 kg y^{-1} wildfowl
		790 h y^{-1} over mud and salt marsh
	B	500 h y^{-1} handling nets
Clyde (small users) (NA)		20 kg y^{-1} molluscs
Culham (NA)		600 l y^{-1} water
Derby (2021)		600 l y^{-1} water
		1 kg y^{-1} freshwater fish
		1 kg y^{-1} freshwater crustaceans
		600 h y^{-1} over riverbank
Devonport (2017)	A	38 kg y^{-1} fish
		3.4 kg y^{-1} Crustaceans
		1.2 kg y^{-1} Molluscs
		580 h y^{-1} over mud, sand and stones
	B	2100 h y^{-1} over mud

Table A4.2 continued

Site (Year of Last Survey)	Representative person[a]	Rates
Dounreay (2025)	A	3500 h y^{-1} handling fishing gear
	B	16 kg y^{-1} fish
		30 kg y^{-1} crab and lobster
		2.0 kg y^{-1} Molluscs
		570 h y^{-1} over sand
	C (2013)	6 h y^{-1} in a Geo
Drinking water (NA)	Adults	600 l y^{-1}
	10 y	350 l y^{-1}
	1 y	260 l y^{-1}
Dungeness (2019)		49 kg y^{-1} fish
		34 kg y^{-1} crustaceans
		18 kg y^{-1} molluscs
		770 h y^{-1} over sand
Faslane (2023)		140 kg y^{-1} fish
		430 h y^{-1} sand
Grove Centre, Amersham (2016)		1 kg y^{-1} pike
		1 kg y^{-1} crayfish
		530 h y^{-1} over riverbank
Hartlepool (2024)		32 kg y^{-1} fish
		20 kg y^{-1} crab and lobster
		16 kg y^{-1} winkles and whelks
		630 h y^{-1} over sand
Harwell (2015)		1.0 kg y^{-1} fish
		1.0 kg y^{-1} crayfish
		520 h y^{-1} over riverbank
Heysham (2016)	A	24 kg y^{-1} fish
		10 kg y^{-1} shrimps
		4.5 kg y^{-1} mussels
		750 h y^{-1} over sand
	B	560 h y^{-1} over salt marsh
Hinkley Point (2024)	A	33 kg y^{-1} fish
		2.0 kg y^{-1} shrimps
		490 h y^{-1} over mud
Holy Loch (1989)		730 h y^{-1} over mud
Hunterston (2024)	A	120 kg y^{-1} fish
		24 kg y^{-1} crustaceans
		52 kg y^{-1} Mussels and scallops
		870 h y^{-1} over sand
	B	730 h y^{-1} handling fishing gear
		390 h y^{-1} handling sediment

Table A4.2 continued

Site (Year of Last Survey)	Representative person[a]	Rates
Landfill (NA)		2.5 l y^{-1} water
Low Level Waste Repository	NA	35 l y^{-1} water
	2023	Marine pathways as Sellafield
Rosyth (2022)		31 kg y^{-1} fish
		28 kg y^{-1} crabs and lobsters
		820 h y^{-1} over mud and sand
Sellafield	A (Sellafield fishing community) (2025)	72kg y^{-1} cod (10%) and other fish (90%)
		31kg y^{-1} crab (35%), lobster (50%) and other crustaceans (15%)
		0.2 kg y^{-1} Other molluscs (100% other molluscs)
		590 h y^{-1} over mud and sand
	B (Fishermen's nets and pots) (2023)	1900 h y^{-1} handling nets and pots
	C (Bait digging and mollusc collecting) (2023)	620 h y^{-1} handling sediment
	D (Whitehaven commercial) (1998)	40 kg y^{-1} plaice and cod
		9.7 kg y^{-1} Nephrops
		15 kg y^{-1} whelks
	E (Morecambe Bay)	see Heysham
	F (Fleetwood) (1995)	93 kg y^{-1} plaice and cod
		29 kg y^{-1} shrimps
		23 kg y^{-1} whelks
	G (Dumfries and Galloway) (2024)	100 kg y^{-1} fish
		31 kg y^{-1} crabs and other crustaceans
		1.3 kg y^{-1} scallops
		110 kg y^{-1} wildfowl
		720 h y^{-1} over mud and salt marsh
	H (Laverbread) (1972)	47 kg y^{-1} laverbread
	I (Typical fish consumer) (NA)	15 kg y^{-1} cod and plaice
	J (Isle of Man) (NA)	100 kg y^{-1} fish
		20 kg y^{-1} crustaceans
		20 kg y^{-1} molluscs
	K (Northern Ireland) (2000)	99 kg y^{-1} haddock and other fish
		34 kg y^{-1} Nephrops and crabs
		7.7 kg y^{-1} mussels and other molluscs
		1100 h y^{-1} over mud and sand

Table A4.2 continued

Site (Year of Last Survey)	Representative person[a]	Rates
	L (North Wales) (NA)	100 kg y^{-1} fish
		20 kg y^{-1} crustaceans
		20 kg y^{-1} molluscs
		300 h y^{-1} over mud and sand
	M (Sellafield fishing community 2021-2025) (NA)	11 kg y^{-1} cod
		36 kg y^{-1} other fish
		8.2 kg y^{-1} crabs
		13 kg y^{-1} lobsters
		2.0 kg y^{-1} other crustaceans (Nephrops)
		1.8 kg y^{-1} winkles
		1.4 kg y^{-1} other molluscs
		670 h y^{-1} over mud and sand
	N (Typical recreational use over beaches, muddy areas or salt marsh) (NA)	300 h y^{-1} over intertidal substrates
	O (Typical beach user e.g. tourist) (NA)	1 kg y^{-1} fish
		0.2 kg y^{-1} crustaceans
		0.2 kg y^{-1} molluscs
		30 h y^{-1} over sand
	P (Ravenglass marsh users) (2025)	260 h y^{-1} over salt marsh
		5.0 10^{-6} kg h^{-1} mud by inadvertent ingestion
		9.2 10^{-8} kg h^{-1} mud by resuspension and inhalation
Sizewell (2025)	A	35 kg y^{-1} fish
		12 kg y^{-1} crab
		2.2 kg y^{-1} mussels and oysters
		440 h y^{-1} over mud, sand and stones
Springfields	A (2022)	29 kg y^{-1} fish
		4.0 kg y^{-1} crustaceans
		44 kg y^{-1} wildfowl
		420 h y^{-1} over mud and sand
	B (2022)	550 h y^{-1} handling nets
	C (10 year old children) (NA)	30 h y^{-1} over mud
		1.0 10^{-5} kg h^{-1} mud by inadvertent ingestion
		6.3 10^{-8} kg h^{-1} mud by resuspension and inhalation
	D (Farmers) (2022)	330 h y^{-1} over salt marsh

Table A4.2 continued

Site (Year of Last Survey)	Representative person[a]	Rates
Torness (2023)	A	35 kg y^{-1} fish
		33 kg y^{-1} crustaceans
		6.0 kg y^{-1} molluscs
		640 h y^{-1} over sand
	B	2800 h y^{-1} handling fishing gear
Trawsfynydd (2018)		12 kg y^{-1} brown trout
		50 kg y^{-1} rainbow trout
		470 h y^{-1} over lake shore
Upland lake (NA)		37 kg y^{-1} fish
Whitehaven (phosphate processing) (NA)		Marine pathways as Sellafield
Winfrith (2019)		21 kg y^{-1} fish
		20 kg y^{-1} crustaceans
		14 kg y^{-1} molluscs
		560 h y^{-1} over sand and stones
Wylfa (2023)		37 kg y^{-1} fish
		5.0 kg y^{-1} crustaceans
		60 h y^{-1} over mud and sand

[a] Where more than one group exists at a site the groups are denoted A, B etc. Year of habits survey is given where appropriate
NA Not appropriate

Appendix 5 Dosimetric data

The dose coefficients used in assessments in this report are provided in Table A5.1 for ease of reference. For adults and postnatal children, they are based on generic data contained in ICRP Publication 119 [119]. Dose coefficients for prenatal children have been obtained primarily from ICRP 88 [120] and NRPB [121]. For a few radionuclides where prenatal dose coefficients are unavailable the relevant adult dose coefficient has been used.

In the case of tritium, polonium, plutonium and americium radionuclides, dose coefficients have been adjusted according to specific research work of relevance to assessments in this report.

A5.1 Polonium

The current ICRP advice is that a gut uptake factor of 0.5 is appropriate for dietary intakes of polonium by adults [228]. A study involving the consumption of crab meat containing natural concentrations of polonium-210 has suggested that the factor could be as high as 0.8 [229]. More recently, similar experiments with mussels, cockles and crabs suggested a factor in the range 0.15 to 0.65, close to the ICRP value of 0.5 [230–232]. Previous assessments have considered the effects of a factor of 0.8 for considering monitoring results in RIFE. In view of the most recent review [232], a value of 0.5 has been adopted for all food, consistent with ICRP advice.

A5.2 Plutonium and americium

Studies using adult human volunteers have suggested a gut uptake factor of 0.0002 is appropriate for the consumption of plutonium and americium in winkles from near Sellafield [233,234]. For these and other actinides in food in general, a factor of 0.0005 is considered as a reasonable best estimate [235]. These values are to be used if data are not available for the specific circumstances under consideration. In this report, a gut uptake factor of 0.0002 is used for plutonium and americium, for estimating doses to consumers of winkles from Cumbria and this is consistent with UKHSA advice. For other foods and for winkles outside Cumbria, the factor of 0.0005 is used for these radionuclides. This choice is supported by studies of cockle consumption [236].

A5.3 Technetium-99

Volunteer studies have been extended to consider the transfer of technetium-99 in lobsters across the human gut [237]. Although values of the gut uptake factor found in this study were lower than the ICRP value of 0.5, dose coefficients are relatively insensitive to changes in the gut uptake factor. This is because the effective dose is dominated by 'first pass' dose to the gut [238]. In this report, we have therefore retained use of the standard ICRP factor and dose coefficient for technetium-99.

A5.4 Tritium

In 2002, UKHSA reviewed the use of dose coefficients for tritium associated with organic material [239]. Subsequently, UKHSA published a study of the uptake and retention of organically bound tritium (OBT) in rats fed with fish from Cardiff Bay [240]. These experiments suggested that the dose coefficient for OBT in fish from the Severn Estuary near Cardiff should be 6.0×10^{-11} Sv Bq^{-1}, higher than the standard ICRP value for OBT ingestion. The higher value is used for adults in the assessment of seafood collected in the Bristol Channel in this report, and the standard ICRP value for other assessments. This approach is consistent with advice [241] which takes account of the conclusions reached by the Independent Advisory Group on Ionising Radiation concerning relative biological effectiveness and radiation weighting [242]. Thereafter, results of uptake experiments involving adult volunteers, who ate samples of sole from Cardiff Bay, provided further evidence that this approach is indeed cautious [243].

A5.5 Nuclear data

The nuclear data (half-life, mean beta and gamma energies) have been updated to values presented in ICRP 107 [244–247] from ICRP 38 [248] data. The nuclear data are primarily used to calculate external dose rates over mud and sand where gamma dose rates are below background or highly variable. The differences in external doses at several sites using ICRP 38 and ICRP 107 were calculated, the differences in dose were less than 5%. The Environment Agency has produced a document that includes radionuclide information, such as the sources, uses, modes of release and nuclear decay data [249].

Table A5.1 Dosimetric data

Radionuclide	Half life (years)	Mean β energy (MeV per disintegration)	Mean γ energy (MeV per disintegration)	Dose per unit intake by ingestion using ICRP-60 methodology (Sv Bq^{-1})			
				Adults	10 yr.	1 yr.	Foetus
H-3	1.23E+01	5.68E-03	0.00E+00	1.8E-11	2.3E-11	4.8E-11	3.1E-11
H-3 (a)				4.2E-11	5.7E-11	1.2E-10	6.3E-11
H-3 (b)				6.0E-11	8.0E-11	2.0E-10	9.0E-11
C-14	5.70E+03	4.95E-02	0.00E+00	5.8E-10	8.0E-10	1.6E-09	8.0E-10
P-32	3.90E-02	6.95E-01	0.00E+00	2.4E-09	5.3E-09	1.9E-08	2.5E-08
S-35 (c)	2.40E-01	4.87E-02	0.00E+00	7.7E-10	1.6E-09	5.4E-09	1.6E-09
Ca-45	4.45E-01	7.72E-02	1.39E-08	7.1E-10	1.8E-09	4.9E-09	8.7E-09
Cr-51	7.58E-02	3.82E-03	3.29E-02	3.8E-11	7.8E-11	2.3E-10	3.8E-11
Mn-54	8.55E-01	4.21E-03	8.36E-01	7.1E-10	1.3E-09	3.1E-09	7.1E-10
Fe-55	2.74E+00	4.17E-03	1.67E-03	3.3E-10	1.1E-09	2.4E-09	8.1E-11
Co-57	7.43E-01	1.86E-02	1.25E-01	2.1E-10	5.8E-10	1.6E-09	1.1E-10
Co-58	1.94E-01	3.40E-02	9.75E-01	7.4E-10	1.7E-09	4.4E-09	5.8E-10
Co-60	5.27E+00	9.69E-02	2.50E+00	3.4E-09	1.1E-08	2.7E-08	1.9E-09
Zn-65	6.68E-01	6.88E-03	5.82E-01	3.9E-09	6.4E-09	1.6E-08	4.1E-09
Se-75	3.28E-01	1.44E-02	3.89E-01	2.6E-09	6.0E-09	1.3E-08	2.7E-09
Sr-90†	2.88E+01	1.13E+00	1.23E-06	3.1E-08	6.6E-08	9.3E-08	4.6E-08
Zr-95†	1.75E-01	1.63E-01	1.49E+00	1.5E-09	3.0E-09	8.8E-09	7.6E-10
Nb-95	9.58E-02	4.46E-02	7.65E-01	5.8E-10	1.1E-09	3.2E-09	3.7E-10
Tc-99	2.11E+05	1.01E-01	7.03E-07	6.4E-10	1.3E-09	4.8E-09	4.6E-10
Ru-103†	1.07E-01	6.61E-02	4.96E-01	7.3E-10	1.5E-09	4.6E-09	2.7E-10
Ru-106†	1.02E+00	1.42E+00	2.06E-01	7.0E-09	1.5E-08	4.9E-08	3.8E-10
Ag-110m†	6.84E-01	9.18E-02	2.76E+00	2.8E-09	5.2E-09	1.4E-08	2.1E-09
Sb-124	1.65E-01	3.83E-01	1.85E+00	2.5E-09	5.2E-09	1.6E-08	1.0E-09
Sb-125	2.76E+00	1.01E-01	4.37E-01	1.1E-09	2.1E-09	6.1E-09	4.7E-10
Te-125m	1.57E-01	1.09E-01	3.60E-02	8.7E-10	1.9E-09	6.3E-09	8.7E-10
I-125	1.63E-01	1.92E-02	4.28E-02	1.5E-08	3.1E-08	5.7E-08	9.1E-09
I-129	1.57E+07	6.51E-02	2.52E-02	1.1E-07	1.9E-07	2.2E-07	4.4E-08
I-131†	2.20E-02	1.94E-01	3.83E-01	2.2E-08	5.2E-08	1.8E-07	2.3E-08
Cs-134	2.06E+00	1.64E-01	1.56E+00	1.9E-08	1.4E-08	1.6E-08	8.7E-09
Cs-137†	3.02E+01	2.50E-01	5.63E-01	1.3E-08	1.0E-08	1.2E-08	5.7E-09
Ba-140†	3.49E-02	8.55E-01	2.49E+00	4.6E-09	1.0E-08	3.1E-08	3.5E-09
Ce-144†	7.80E-01	1.29E+00	4.81E-02	5.2E-09	1.1E-08	3.9E-08	3.1E-11
Pm-147	2.62E+00	6.19E-02	4.39E-06	2.6E-10	5.7E-10	1.9E-09	2.6E-10
Eu-154	8.59E+00	2.73E-01	1.25E+00	2.0E-09	4.1E-09	1.2E-08	2.0E-09
Eu-155	4.76E+00	6.47E-02	6.12E-02	3.2E-10	6.8E-10	2.2E-09	3.2E-10
Lu-177	1.82E-02	1.48E-01	3.51E-02	5.3E-10	1.2E-09	3.9E-09	5.3E-10
Pb-210†	2.22E+01	4.29E-01	5.34E-03	6.9E-07	1.9E-06	3.6E-06	1.4E-07
Bi-210	1.37E-02	3.89E-01	3.10E-07	1.3E-09	2.9E-09	9.7E-09	6.6E-12
Po-210(d)	3.79E-01	9.37E-08	9.73E-06	1.2E-06	2.6E-06	8.8E-06	1.3E-07
Po-210(e)				1.9E-06	4.2E-06	1.4E-05	2.1E-07
Ra-226†	1.60E+03	9.62E-01	1.74E+00	2.8E-07	8.0E-07	9.6E-07	3.2E-07
Th-228†	1.91E+00	9.24E-01	1.47E+00	1.4E-07	4.3E-07	1.1E-06	2.4E-07
Th-230	7.54E+04	1.46E-02	1.78E-03	2.1E-07	2.4E-07	4.1E-07	8.6E-09
Th-232	1.41E+10	1.26E-02	1.49E-03	2.3E-07	2.9E-07	4.5E-07	9.4E-09
Th-234†	6.60E-02	8.79E-01	2.68E-02	3.4E-09	7.4E-09	2.5E-08	1.5E-11
U-234	2.46E+05	1.37E-02	2.02E-03	4.9E-08	7.4E-08	1.3E-07	1.5E-08
U-235†	7.04E+08	2.15E-01	1.94E-01	4.7E-08	7.1E-08	1.3E-07	1.4E-08

Table A5.1 continued

Radionuclide	Half life (years)	Mean β energy (MeV per disintegration)	Mean γ energy (MeV per disintegration)	Dose per unit intake by ingestion using ICRP-60 methodology (Sv Bq^{-1})			
				Adults	10 yr.	1 yr.	Foetus
U-238†	4.47E+09	8.79E-01	2.68E-02	4.8E-08	7.5E-08	1.5E-07	1.3E-08
U-238†	4.47E+09	8.79E-01	2.68E-02	4.8E-08	7.5E-08	1.5E-07	1.3E-08
Np-237†	2.14E+06	2.83E-01	2.58E-01	1.1E-07	1.1E-07	2.1E-07	3.6E-09
Pu-238(f)	8.77E+01	1.07E-02	2.05E-03	2.3E-07	2.4E-07	4.0E-07	9.0E-09
Pu-238(g)				9.2E-08	9.6E-08	1.6E-07	3.6E-09
Pu-239(f)	2.41E+04	7.46E-03	1.08E-03	2.5E-07	2.7E-07	4.2E-07	9.5E-09
Pu-239(g)				1.0E-07	1.1E-07	1.7E-07	3.8E-09
Pu-alpha(h)	2.41E+04	7.46E-03	1.08E-03	2.5E-07	2.7E-07	4.2E-07	9.5E-09
Pu-240(f)	6.56E+03	1.05E-02	1.94E-03	2.5E-07	2.7E-07	4.2E-07	9.5E-09
Pu-240(g)				1.0E-07	1.1E-07	1.7E-07	3.8E-09
Pu-241(f)	1.44E+01	5.24E-03	1.78E-06	4.8E-09	5.1E-09	5.7E-09	1.1E-10
Pu-241(g)				1.9E-09	2.0E-09	2.3E-09	4.4E-11
Am-241(f)	4.32E+02	3.73E-02	2.93E-02	2.0E-07	2.2E-07	3.7E-07	2.7E-09
Am-241(g)				8.0E-08	8.8E-08	1.5E-07	1.1E-09
Cm-242	4.46E-01	9.56E-03	1.98E-03	1.2E-08	2.4E-08	7.6E-08	4.7E-10
Cm-243	2.91E+01	1.34E-01	1.35E-01	1.5E-07	1.6E-07	3.3E-07	1.5E-07
Cm-244	1.81E+01	7.93E-03	1.70E-03	1.2E-07	1.4E-07	2.9E-07	2.2E-09

Radionuclide	Dose per unit intake by inhalation using ICRP-60 methodology (Sv Bq^{-1})			
	Adults	10 yr.	1 yr.	Foetus
H-3	4.5E-11	8.2E-11	2.7E-10	2.6E-12
H-3(a)	4.1E-11	5.5E-11	1.1E-10	6.3E-11
C-14	2.0E-09	2.8E-09	6.6E-09	6.6E-11
P-32	3.4E-09	5.3E-09	1.5E-08	6.5E-09
S-35(c)	1.4E-09	2.0E-09	4.5E-09	1.5E-11
Ca-45	2.7E-09	3.9E-09	8.8E-09	1.7E-09
Cr-51	3.7E-11	6.6E-11	2.1E-10	3.7E-11
Mn-54	1.5E-09	2.4E-09	6.2E-09	1.5E-09
Fe-55	3.8E-10	6.2E-10	1.4E-09	6.6E-11
Co-57	5.5E-10	8.5E-10	2.2E-09	6.1E-11
Co-58	1.6E-09	2.4E-09	6.5E-09	2.5E-10
Co-60	1.0E-08	1.5E-08	3.4E-08	1.2E-09
Zn-65	1.6E-09	2.4E-09	6.5E-09	7.4E-10
Se-75	1.0E-09	2.5E-09	6.0E-09	1.1E-09
Sr-90†	3.8E-08	5.4E-08	1.2E-07	1.0E-08
Zr-95†	6.3E-09	9.0E-09	2.1E-08	4.6E-10
Nb-95	1.5E-09	2.2E-09	5.2E-09	1.6E-10
Tc-99	4.0E-09	5.7E-09	1.3E-08	8.3E-11
Ru-103†	2.4E-09	3.5E-09	8.4E-09	1.1E-10
Ru-106†	2.8E-08	4.1E-08	1.1E-07	4.1E-10
Ag-110m†	7.6E-09	1.2E-08	2.8E-08	1.5E-09
Sb-124	6.4E-09	9.6E-09	2.4E-08	4.4E-10

Table A5.1 continued

Radionuclide	Dose per unit intake by inhalation using ICRP-60 methodology (Sv Bq^{-1})			
	Adults	10 yr.	1 yr.	Foetus
Sb-125	4.8E-09	6.8E-09	1.6E-08	2.6E-10
Te-125m	3.4E-09	4.8E-09	1.1E-08	3.4E-09
I-125	5.1E-09	1.1E-08	2.3E-08	3.1E-09
I-129	3.6E-08	6.7E-08	8.6E-08	1.5E-08
I-131†	7.4E-09	1.9E-08	7.2E-08	8.1E-09
Cs-134	6.6E-09	5.3E-09	7.3E-09	3.0E-09
Cs-137†	4.6E-09	3.7E-09	5.4E-09	2.0E-09
Ba-140†	6.2E-09	9.6E-09	2.6E-08	1.4E-09
Ce-144†	3.6E-08	5.5E-08	1.6E-07	4.2E-10
Pm-147	5.0E-09	7.0E-09	1.8E-08	5.0E-09
Eu-154	5.3E-08	6.5E-08	1.5E-07	5.3E-08
Eu-155	6.9E-09	9.2E-09	2.3E-08	6.9E-09
Lu-177	1.2E-09	1.7E-09	4.1E-09	1.2E-09
Pb-210†	1.2E-06	1.6E-06	4.0E-06	6.1E-08
Bi-210	9.3E-08	1.3E-07	3.0E-07	9.1E-12
Po-210	3.3E-06	4.6E-06	1.1E-05	1.9E-08
Ra-226†	3.5E-06	4.9E-06	1.1E-05	9.9E-08
Th-228†	4.3E-05	5.9E-05	1.4E-04	2.5E-07
Th-230	1.4E-05	1.6E-05	3.5E-05	2.6E-08
Th-232	2.5E-05	2.6E-05	5.0E-05	2.8E-08
Th-234†	7.7E-09	1.1E-08	3.1E-08	6.7E-12
U-234	3.5E-06	4.8E-06	1.1E-05	4.9E-08
U-235†	3.1E-06	4.3E-06	1.0E-05	4.5E-08
U-238†	2.9E-06	4.0E-06	9.4E-06	4.4E-08
Np-237†	2.3E-05	2.2E-05	4.0E-05	4.3E-07
Pu-238	4.6E-05	4.4E-05	7.4E-05	1.1E-06
Pu-239	5.0E-05	4.8E-05	7.7E-05	1.2E-06
Pu-alpha[h]	5.0E-05	4.8E-05	7.7E-05	1.2E-06
Pu-240	5.0E-05	4.8E-05	7.7E-05	1.2E-06
Pu-241	9.0E-07	8.3E-07	9.7E-07	1.4E-08
Am-241	4.2E-05	4.0E-05	6.9E-05	3.2E-07
Cm-242	5.2E-06	7.3E-06	1.8E-05	5.1E-08
Cm-243	3.1E-05	3.1E-05	6.1E-05	3.1E-05
Cm-244	2.7E-05	2.7E-05	5.7E-05	2.6E-07

† Energy and dose per unit intake data include the effects of radiations of short-lived daughter products

a. Organically bound tritium
b. Organically bound tritium for seafood near the Cardiff site
c. Organically bound sulphur
d. Gut transfer factor 0.5
e. Gut transfer factor 0.8
f. Gut transfer factor 5.00E-4 for consumption of all foodstuffs except Cumbrian winkles
g. Gut transfer factor 2.00E-4 for consumption of Cumbrian winkles
h. Pu-239 data used

Appendix 6 Estimates of concentrations of natural radionuclides

A6.1 Aquatic foodstuffs

Table A6.1 gives estimated values of concentrations of radionuclides due to natural sources in aquatic foodstuffs. The values are based on sampling and analysis conducted by Cefas [187,188]. Data for lead-210 and polonium-210 are quoted as medians with minimum and maximum values, observed in measured samples [187,188], given in brackets. Dose assessments for aquatic foodstuffs are based on concentrations of these radionuclides net of natural background.

The carbon-14 concentrations are adjusted to take account of the dilution of natural atmospheric carbon-14 by the emission of carbon dioxide from fossil fuel burning. A dilution of 0.28% for each part per million of carbon dioxide added due to fossil fuel burning is used [250]. Values for the carbon dioxide additions are taken each year from: https://gml.noaa.gov/webdata/ccgg/trends/co2/co2_annmean_mlo.txt.

The initial specific activity of carbon-14 was 256Bq kg^{-1} [91]. In 2025, the adjusted value used as the basis for Table A6.2 was 207Bq kg^{-1}.

A6.2 Terrestrial foodstuffs

The values of carbon-14 in terrestrial foodstuffs due to natural sources that are used in dose assessments are given in Table A6.2 and based on earlier data [91]. The value for the specific activity of carbon-14 in 2025 (given in Section A6.1) was used to derive these estimates.

Table A6.1 Concentrations of radionuclides in seafood due to natural sources

Radionuclide	Concentration of radioactivity (Bq kg^{-1} (fresh))[a]					
	Fish	Cod	Plaice	Crustaceans	Crabs	Lobsters
Carbon-14	19			23		
Lead-210	0.042 (0.0030-0.55)			0.20 (0.013-2.4)	0.24 (0.043-0.76)	0.080 (0.020-0.79)
Polonium-210	0.82 (0.18-4.4)	0.38 (0.18-1.1)	2.5 (0.88-4.4)	9.1 (1.1-35)	19 (4.1-35)	5.3 (1.9-10)
Radium-226	0.04			0.03	0.03	0.06
Thorium-228	0.0054			0.0096	0.04	0.0096
Thorium-230	0.00081			0.0026	0.008	0.0026
Thorium-232	0.00097			0.0014	0.01	0.0014
Uranium-234	0.0045			0.040	0.055	0.040
Uranium-238	0.0039			0.035	0.046	0.035

Radionuclide	Concentration of radioactivity (Bq kg^{-1} (fresh))[a]					
	Molluscs	Winkles	Mussels	Cockles	Whelks	Limpets
Carbon-14	20					
Lead-210	1.2 (0.18-6.8)	1.5 (0.69-2.6)	1.6 (0.68-6.8)	0.94 (0.59-1.3)	0.39 (0.18-0.61)	1.5 (0.68-4.9)
Polonium-210	17 (1.2-69)	13 (6.1-25)	42 (19-69)	18 (11-36)	6.5 (1.2-11)	8.4 (5.9-15)
Radium-226	0.08	0.08				
Thorium-228	0.37	0.46		0.37		
Thorium-230	0.19	0.26		0.19		
Thorium-232	0.28	0.33		0.28		
Uranium-234	0.99	0.99				
Uranium-238	0.89	0.89				

[a] Values are quoted as medians with observed minimum and maximum values given in brackets

Table A6.2 Carbon-14 in terrestrial foodstuffs due to natural sources

Food category	% Carbon content (fresh)	Concentration of carbon-14 (Bq kg^{-1} (fresh))
Milk	7	15
Beef meat	17	36
Sheep meat	21	44
Pig meat	21	44
Poultry	28	58
Game	15	31
Offal	12	25
Eggs	15	31
Green vegetables	3	6
Root vegetables	3	6
Legumes / other domestic vegetables	8	16
Dry beans	20	41
Potato	9	19
Cereals	41	85
Cultivated fruit	4	8
Wild fruit	4	8
Mushrooms	2	4
Honey	31	64
Nuts	58	120

Appendix 7 Research in support of the monitoring programmes

The environment agencies, FSA and FSS have programmes of special investigations and supporting research and development studies to complement the routine monitoring programmes. This additional work is primarily directed at the following objectives:

- to evaluate the significance of potential sources of radionuclide contamination of the food chain and the environment
- to identify and investigate specific topics or pathways not currently addressed by the routine monitoring programmes and the need for their inclusion in future routine monitoring
- to develop and maintain site-specific habits and agricultural practice data, to ensure that dose assessment calculations reflect the real-world situation
- to develop more sensitive and/or efficient analytical techniques for measurement of radionuclides in natural matrices
- to evaluate the competence of laboratories' radiochemical analytical techniques for specific radionuclides in food and environmental materials
- to develop improved methods for handling and processing monitoring data

Other studies include projects relating to effects on wildlife, emergency response and planning and development of new environmental models and data.

Information on ongoing and recently completed extramural research is presented in Table A7.1. Those sponsored by the Environment Agency and FSA are also listed on their websites: https://www.gov.uk/government/organisations/environment-agency, and https://www.gov.uk/government/organisations/food-standards-agency, respectively. Copies of the final reports for each of the projects funded by the FSA are available from 11th Floor, 64 Victoria Street, London, SW1E 6QP. Further information on studies funded by SEPA is available by emailing RSEnquiries@sepa.org.uk. Environment Agency reports are available from https://www.gov.uk/government/organisations/environment-agency. A charge may be made to cover costs.

Table A7.1 Extramural Projects

Topic	Further Details	Target completion date
Soil and herbage survey	S	Q4, 2025
Offshore Dose Assessment Model	S	Q4, 2024
Thorium Transfer Work	S	In press[1]
NORM Biota Project	S	In press[1]
McGuire, C. (2023). Radiological Protection of the Public from Radioactive Particles (PhD thesis). University of Stirling.	S	Q1 2023[2]
Clyde Estuary Assessment	S	Q2 2025
Soil and herbage follow-up	S	Complete Q1 2024
Coastal Monitoring	S	In press[1]
Shetland Background Sampling	S	In press[1]
SW Scotland Background Sampling	S	In press[1]
Partitioning Behaviour of Radionuclides in Sewer Systems - https://www.gov.uk/government/publications/behaviour-of-radionuclides-in-wastewater-systems-a-laboratory-study	E	Q3 2024
Behaviour of Colloids in Radioactive Waste Transfer and Dispersion in Aqueous Environments	E	Q4 2024
IRAT2 Transfer Parameters Review - https://www.gov.uk/government/publications/radionuclide-transfer-parameter-review	E	Q1 2025
Aerial Monitoring of Environmental Radioactivity (SC240042/R) - https://www.gov.uk/government/publications/aerial-monitoring-of-environmental-radioactivity	E	Q1 2025
Investigation of the fate and behaviour of lutetium-177 in the environment - https://www.gov.uk/government/publications/behaviour-of-lutetium-177-discharged-into-uk-wastewater-systems	E	Q1 2025

Notes

E Environment Agency
S SEPA

1 The work is complete and the intent is to publish on the SEPA website, in accordance with accessibility requirements, in 2026
2 The official completion date was 25th January 2023. It is now available in the University of Stirling repository. https://www.storre.stir.ac.uk/handle/1893/35173

In 2025/26, the following reports have been published.

- The Environment Agency Chief Regulators report 2024-25. https://www.gov.uk/government/publications/environment-agency-chief-regulators-report-2024-25/environment-agency-chief-regulators-report-2024-25
- Radiological Habits Survey: Barrow 2025
- Radiological Habits Survey: Sellafield Review 2025.
- Radiological Habits Survey: Sizewell 2025

The habits survey reports can be downloaded from https://www.cefas.co.uk/expertise/surveys/habits/.

Environment Agency
Ghyll Mount, Gillian Way, Penrith 40 Business Park, Penrith, Cumbria CA11 9BP

Food Standards Agency
Food Policy Division
11th Floor, 64 Victoria Street, London, SW1E 6QP.

Food Standards Scotland
4th Floor, Pilgrim House,
Old Ford Road, Aberdeen AB11 5RL

Cyfoeth Naturiol Cymru / Natural Resources Wales
Welsh Government Offices, Cathays Park,
King Edward VII Avenue, Cardiff, CF10 3NQ

Northern Ireland Environment Agency
Industrial Pollution and Radiochemical Inspectorate
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Scottish Environment Protection Agency
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