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Radiological Impact of Routine Discharges from UK Civil Nuclear Licensed Sites During the 2000s

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Radiological Impact of Routine Discharges from UK Civil Nuclear Licensed Sites During the 2000s

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Abstract

This report presents an assessment of the radiological impact of routine atmospheric and liquid discharges from UK civil nuclear licensed sites. It updates a previous report, NRPB-R312, in considering discharges in the mid-2000s and using the most recent assessment methodology. Calculations of collective effective doses integrated to 500 and 100,000 years, typical annual individual doses and per-caput doses were performed for discharges in the mid-1990s and mid-2000s using the updated PC-CREAM 08® software program, which implements the EC methodology for assessing doses from routine releases from nuclear installations. Annual discharges for the years 2003 and 2007 were taken to be typical discharges in the 2000s.

The calculations carried out for this report show that the collective doses to the European and UK populations calculated for discharges in the mid-1990s and in 2003 and 2007 have continued to decline from their peak values. The reduction is mainly due to a continued decline in the liquid radioactive discharges from Sellafield. Collective doses integrated to 500 years to the European population in 2003 and 2007 were estimated to be 41 man Sv and 19 man Sv, respectively. Collective doses to the UK population were calculated to be 12 man Sv and 6 man Sv, respectively, in 2003 and 2007. The doses calculated in the previous report show that the collective dose integrated to 500 years to the European and UK population from discharges from UK civil nuclear sites peaked at around 370 man Sv and 130 man Sv, respectively, for discharges in 1975. Collective doses to the European and UK populations for discharges in the mid-1990s calculated using PC-CREAM 98 were 92 man Sv and 17 man Sv, respectively.

The per-caput doses to the UK population in the 100th year from discharges in 2003 ranged across sites from 0.0013 nSv to 61 nSv; those for discharges in 2007 were between 0.00031 nSv and 16 nSv.

The average individual doses from discharges in 2003 and 2007 were estimated to be 1.0 μSv and 0.3 μSv, respectively, and show that doses from UK civil nuclear sites continue to decrease; the doses ranged across sites from 0.0004 μSv to 18 μSv in 2003 and 0.00009 μSv to 4.9 μSv in 2007. Individual doses for discharges in the mid-1990s calculated using PC-CREAM 08 ranged across sites from 0.004 μSv to 16 μSv, with a mean values of 1.5 μSv. The mean typical annual individual doses calculated in the previous report peaked at 32 μSv from discharges in 1975. Doses for discharges in 1985 and in the mid-1990s, calculated using PC-CREAM 98, were 3.9 μSv and 1.1 μSv, respectively.

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Contents

1 Introduction

In 2000 the National Radiological Protection Board (NRPB)* published a report on the radiological impact of routine discharges from UK civil nuclear licensed sites in the mid-1990s (Bexon, 2000), which provided the annual individual doses to typical adults and collective doses to the European and UK populations due to discharges during the 1970s, 1980s and 1990s.

The purpose of this assessment was to update the previous report (Bexon, 2000) and to calculate collective doses to the European and UK populations, annual doses to typical individuals residing near nuclear installations in the UK and the average dose to a member of the UK population (also known as per-caput doses) from discharges for the years 2003 and 2007 as representative of the decade from 2000 to 2010.

Doses were calculated using a revised methodology for assessing the radiological consequences of routine releases to the environment that was published by the Health Protection Agency in 2009 (Smith and Simmonds, 2009) and implemented as the computer code PC-CREAM 08® (PHE, 2014). In addition, doses due to the average annual discharges for the period from 1993 to 1995 estimated in the previous study (Bexon, 2000) were recalculated with PC-CREAM 08 to take account of any changes in the methodology. Collective and individual doses in this report were compared with those published in the previous report for discharges in the 1970s, 1980s and mid-1990s (Bexon, 2000). Doses for the 1970s and 1980s are not directly comparable as different models and values were used to calculate them, but were included to give an indication of the doses in those decades compared to those in later years.

Average doses to a member of the UK population, also known as the per-caput doses, in the 100th year are also presented for discharges in 2003 and 2007, as well as per-caput dose rates averaged over different time periods (Smith et al, 2007).

2 Sites Considered in This Study

There are 37 civil nuclear licensed sites in the UK. The sites considered in this study include installations in the UK civil nuclear industry and facilities involved in the manufacture of radiopharmaceuticals. Sites not considered are those in the defence industry, universities and waste disposal facilities. As of the end of 2010, the civil nuclear industry consists of nuclear power stations, nuclear fuel cycle facilities, and research and development facilities. The nuclear power generation industry in the UK consists of ten operating nuclear power stations, of which two operate Magnox reactors, seven operate advanced gas-cooled reactors (AGR) and one operates a pressurised water reactor (PWR). Eight nuclear power stations are presently in the defueling and/or decommissioning stage of their life cycle. Fuel cycle facilities are located at Capenhurst, Springfields and Sellafield where uranium enrichment, fuel fabrication, fuel reprocessing and spent fuel storage are carried out. The Sellafield site is a large and complex facility and includes Calder Hall, a nuclear power station that generated

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* The NRPB was subsequently incorporated into the Health Protection Agency (HPA). On 1 April 2013 the HPA was abolished and its functions transferred to Public Health England.

electricity from 1956 to 2003. Discharges from all facilities located at Sellafield are covered by a single permit. The former UK Atomic Energy Authority (UKAEA) has three sites that are currently in the decommissioning stage: Dounreay, where three nuclear reactors and fabrication and reprocessing facilities were built, Harwell and Winfrith. Two radioisotope production sites at Cardiff and Amersham were also included in the assessment. A summary of the sites considered in this study, including operational dates and current status, is presented in Table 1; the locations of all sites are shown in Figure 1. The sites have been grouped into operational types for the purpose of this report. Four types of facilities were chosen:

a fuel fabrication installations (Capenhurst and Springfields)

b power production installations (all AGR sites, the Magnox sites and the PWR site)

c reprocessing installations as the main activity (Sellafield and Dounreay)

d other installations (Amersham and Cardiff sites, Harwell and Winfrith)

3 Dosimetric Quantities

The term ‘dose’ is used in this report to mean the dosimetric quantity of effective dose as defined by the ICRP in its Publication 103 (ICRP, 2007) and is the sum of the annual external effective dose and the committed effective dose to adults for intakes over one year; doses from intakes were determined using dose coefficients given in ICRP Publication 119 (ICRP, 2012).

Annual doses to typical individuals residing near nuclear sites were calculated as a way of providing a general perspective on the comparative radiological impact of different sites. Doses to individuals representative of the people most likely to receive the highest dose, otherwise referred to as the ‘representative person’ (ICRP, 2007), were not calculated in this study. These doses are usually determined for comparison with the relevant dose criteria, eg the annual dose limit for members of the public or the dose constraint. Doses to representative persons based on monitoring surveys conducted at various installations in the UK are published annually in the *Radioactivity in Food and the Environment* (RIFE) series (EA et al, 2011).

Collective dose is the sum of the individual doses received by members of an exposed population from all significant pathways. To account for the fact that radionuclides can give rise to doses over an extended period of time, long after discharges have stopped, collective doses are integrated over various times following the year of release. In its most recent recommendations (ICRP, 2007) the ICRP stresses that collective effective dose is a tool for optimisation, for comparing technologies and procedures and that it is not intended for epidemiological studies and it is inappropriate to use in risk projections. Specifically, the ICRP recommends that the calculation of cancer deaths based on collective effective dose involving trivial exposures to large population is unreasonable and should be avoided. However, it is considered that collective doses can be used more widely than ICRP Publication 103 recommends for occupational and public exposure, eg to indicate if a particular situation warrants a detailed epidemiological study or comparison of past discharges from different sites (HPA, 2009).

Table 1: Installations included in this study

Site	Function	Dates of operation	Status as at 31 December 2010
Fuel fabrication installations			
Capenhurst	Uranium enrichment plant and associated facilities	1953–	Operational and partial decommissioning
Springfields	Fuel fabrication, decommissioning of redundant facilities	1948–	Operational and partial decommissioning
Power production installations			
Dungeness B	AGR power station	1982–	Operational
Hartlepool	AGR power station	1983–	Operational
Heysham 1	AGR power station	1983–	Operational
Heysham 2	AGR power station	1988–	Operational
Hinkley Point B	AGR power station	1976–	Operational
Hunterston B	AGR power station	1976–	Operational
Torness	AGR power station	1988–	Operational
Berkeley	Magnox power station and technology centre	1962–1989	Decommissioning and termination
Bradwell	Magnox power station	1962–2002	Decommissioning and termination
Chapelcross	Magnox power station	1959–2004	Defuelling
Dungeness A	Magnox power station	1965–2006	Decommissioning and termination
Hinkley Point A	Magnox power station	1965–2000	Decommissioning and termination
Hunterston A	Magnox power station	1964–1989	Decommissioning and termination
Oldbury*	Magnox power station	1968–	Operational
Sizewell A	Magnox power station	1966–2006	Defuelling
Trawsfynydd	Magnox power station	1965–1991	Decommissioning and termination
Wylfa	Magnox power station	1971–	Operational
Sizewell B	PWR power station	1995–	Operational
Fuel reprocessing installations			
Dounreay	Nuclear research reactor, low level solid waste disposal, fuel reprocessing	1958–1994	Decommissioning and termination
Sellafield	Fuel element storage, Magnox and oxide fuel reprocessing, Calder Hall Magnox power station, decommissioning of redundant facilities	1952–	Defuelling and partial decommissioning
Other installations			
Amersham	Radioisotope production for medicine, research and industry	1981†–	Operational
Cardiff	Radioisotope production for medicine and research	1981–	Operational
Harwell	Nuclear research reactor, waste storage	1946–1990	Decommissioning
Winfrith	Nuclear research reactor	1957–1990	Decommissioning and termination

* Defuelling commenced in 2012.
† Year that operation began in current role under Amersham International.

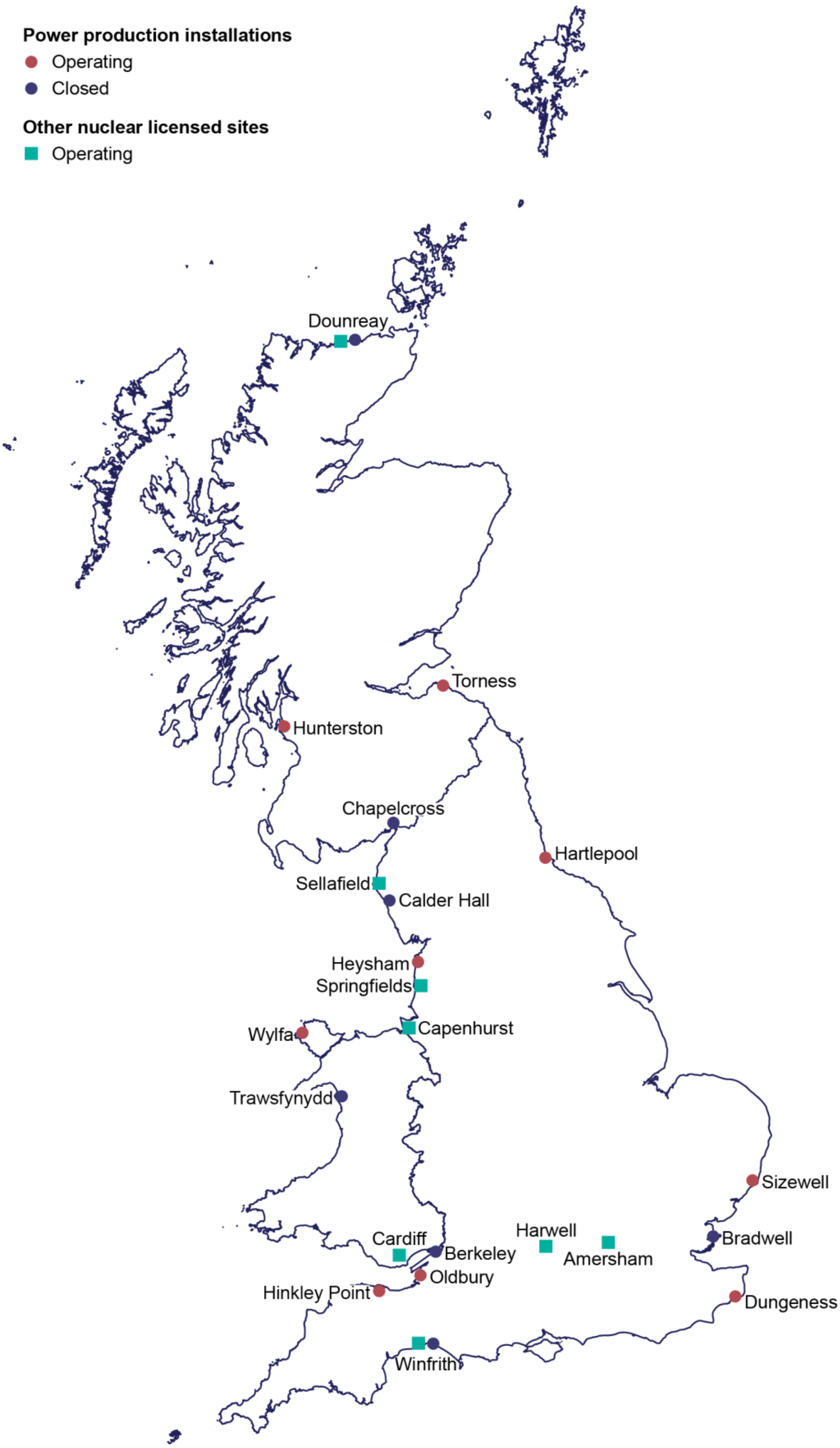

Figure 1: UK civil nuclear licensed sites considered in this study (contains Ordnance Survey data © Crown copyright and database right 2014)

The UK environment agencies recommend the use of collective doses integrated to 500 years from a single year of discharge for authorisation purposes (EA et al, 2012). It can be shown that the collective dose integrated to a particular time from one year's operation of a practice is numerically equal to the maximum annual collective dose rate if the practice operated unchanged for that time period, provided all other factors remained the same. The integration time of 500 years has been chosen because proposed new practices are assumed to operate unchanged for a period of not more than 500 years. Although individual facilities will not exist for such an extended period of time, they are likely to be replaced by similar installations. In this study the collective doses were calculated for the European and UK populations.

Although the ICRP also recommends that the distribution of individual doses in ranges should be provided when calculating collective doses, such disaggregation is not usually possible. For example, if ingestion of food is an important exposure pathway, disaggregation is impossible because food is typically widely distributed and not sourced from an individual's immediate vicinity. As an alternative, per-caput doses, that is the average individual doses received by each member of the UK population, provide another useful input in the decision making process for permitting purposes. In this report, the collective doses to the population of the UK from one year's discharge integrated to 100 years were divided by the UK population to obtain the per-caput dose in the 100th year. The period of 100 years is taken to represent the typical time a nuclear facility would be discharging radionuclides into the environment: 60 years for the operational stage and 40 years in decommissioning. This value gives the highest average annual individual dose to the UK population from discharges over this period, assuming that the facility operates unchanged for that time period and provided that all other factors remain the same. In addition, the indicative per-caput dose rates during selected time periods were produced (Smith et al, 2007).

More details of the methods used to calculate these doses are given in Section 4.2.3.

4 Data and Methods

4.1 Discharge data

In 2004, the European Commission issued a recommendation on standardising information on radioactive atmospheric and liquid discharges from nuclear reactors and reprocessing facilities (EC, 2004). Subsequently nuclear reactor and nuclear reprocessing sites across Europe were required to report radioactive discharges, defined by categories and individual radionuclides, depending on their relevance in terms of radiological protection. In this study extensive use was made of the discharges reported by UK sites under the EC recommendation. Sites that do not operate nuclear reactors (ie Amersham, Capenhurst, Cardiff, Harwell and Springfields) are not required to submit discharge data. Therefore for these sites discharge data was obtained from the RIFE reports (EA et al, 2004 and 2008). The discharges for the 1990s were taken from the previous report (Bexon, 2000).

Generally data reported to the EC includes the activity released over a year for individual radionuclides. In other cases discharges were reported as aggregated totals, such as total alpha or total beta/gamma radiation. In order to calculate doses it is necessary to use activity discharged for individual radionuclides, so assumptions with regard to the composition of aggregated total discharges were made using information contained in other reports (Bexon, 2000; EA et al, 2004, 2008; Jones et al, 2013).

In the previous assessment of doses from UK civil nuclear licensed sites, the beta/gamma aggregated category for atmospheric discharges was assumed to be all ^{65}Zn for discharges in 1993–1995 (Bexon, 2000). For this assessment it was decided that for discharges in both 2003 and 2007 the breakdown for this category would be 77% ^{137}Cs and 23% ^{60}Co for Magnox reactors; for AGR power stations it was assumed that beta discharges consisted entirely of ^{65}Zn; and for the PWR power station at Sizewell B it was assumed to be 96% ^{137}Cs and 4% ^{60}Co (EC, 2004).

All assumptions made for discharges are described in Appendix A, which gives the discharge data for 1993–1995 and 2003 and 2007 for each discharge route.

4.2 Assessment methodology

4.2.1 Radionuclide dispersion

The doses presented in this report were calculated using PC-CREAM 08 (PHE, 2014) – a computer program developed by PHE (and predecessor organisations) with endorsement from the European Commission – which implements an updated methodology for the assessment of the radiological consequences of routine discharges to the environment (Smith and Simmonds, 2009). PC-CREAM is a suite of models that calculate both activity concentrations in various media and doses.

The marine compartmental model in PC-CREAM 08 was used to calculate doses resulting from discharges into the marine environment (Smith and Simmonds, 2009). It comprises a generic regional model and a site-specific local model. The local model simulates the dispersion near the site and therefore is important in assessing individual doses in the local population, while the regional model is more important for collective doses. The local compartments typically extend for 5 km along the coastline either side of the site. The regional marine compartments surrounding the UK are presented in Figure 2.

PC-CREAM 08 does not have the capability to calculate collective doses for discharges to rivers and lakes. Therefore, the multicompartmental biosphere model (BIOS) (Martin et al, 1991) was used to calculate collective doses due to discharges from Harwell and Amersham into the river Thames and from Trawsfynydd into Trawsfynydd lake.

For discharges to atmosphere, the dispersion of the radionuclides was simulated using a Gaussian plume model within PC-CREAM 08 (Smith and Simmonds, 2009). A generic uniform wind rose using Pasquill 70% category D and 10% rain in C and D was assumed for each site (Smith and Simmonds, 2009). For nuclear power plants, Amersham, Capenhurst and Springfields, all discharges were assumed to have been emitted from a single 30 m effective stack height, as these installations have multiple discharge points which cannot easily be modelled within PC-CREAM; exceptions to this general rule were Dounreay (60 m), Cardiff (25 m), Harwell (10 m) and Sellafield (100 m) (Jones et al, 2013). Although they deviate from those used in the previous report (Bexon, 2000), the stack heights used are thought to be more representative. Both wet and dry deposition on to the ground were considered. Dry deposition was estimated using a source depletion model and a deposition velocity of 10^{-3} m s^{-1}, a value appropriate for 1 μm particles for all radionuclides except isotopes of iodine, which were assumed to have a dry deposition velocity of 10^{-2} m s^{-1} (Smith and Simmonds, 2009).

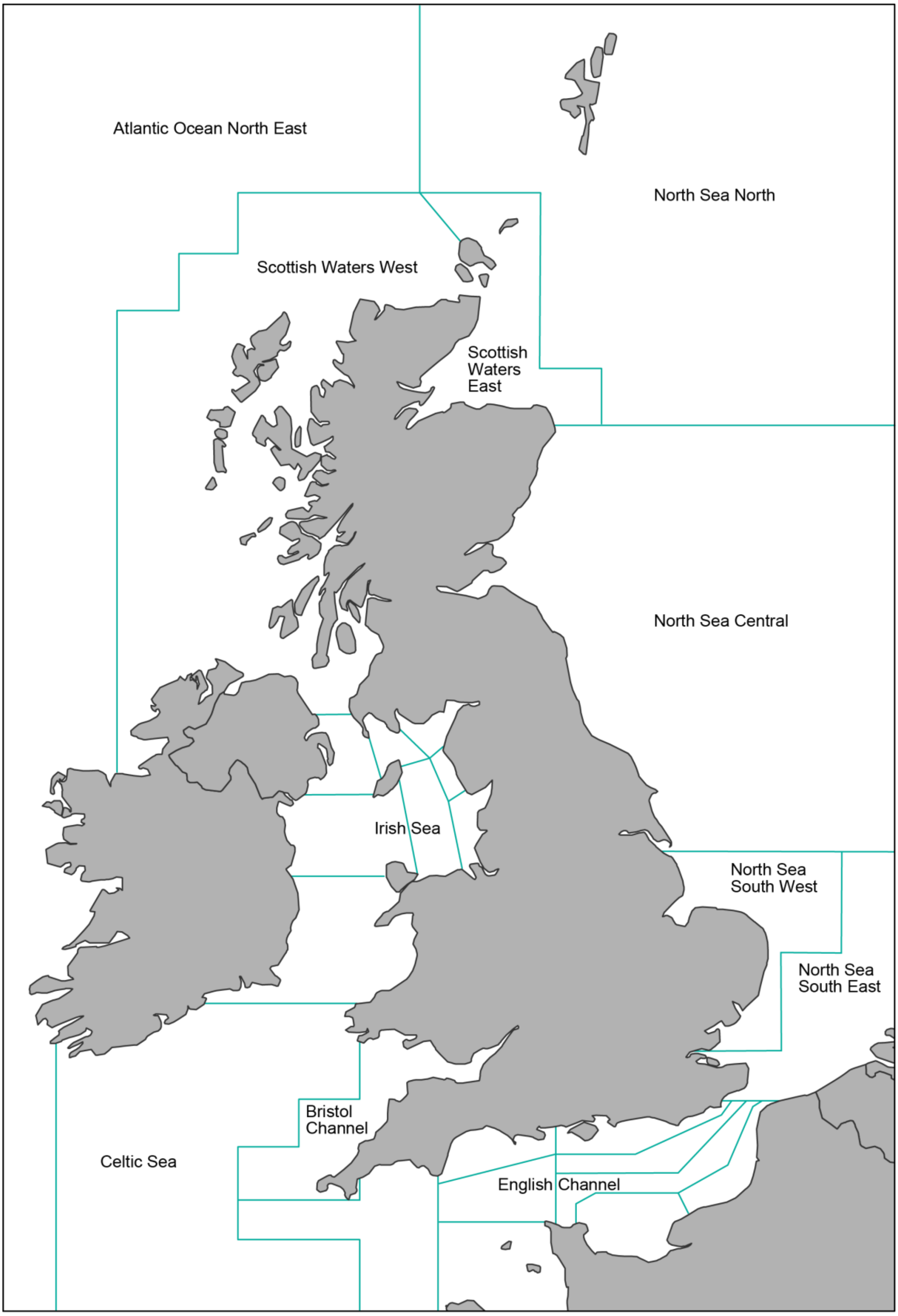

Figure 2: Regional marine compartments surrounding the UK

Wet deposition was accounted for by using a washout coefficient (Smith and Simmonds, 2009) of 10^{-4} s^{-1}. Noble gases (except the decay products of isotopes of ^{222}Rn), ^{3}H and ^{14}C were assumed not to deposit under either dry or wet conditions. Tritium and ^{14}C in environmental media were assumed to reach equilibrium very rapidly.

Other pathways considered were exposure to external gamma and beta radiation from radionuclides in the air. Activity concentrations in local terrestrial foods from deposited activity were calculated using the FARMLAND model (Smith and Simmonds, 2009). Doses were also calculated for inhalation of resuspended material and external exposure to deposited activity.

4.2.2 Calculation of collective doses

In this study collective doses integrated to 500 years for a single year of discharge were calculated for the populations of the UK and Europe. For the purposes of the calculations, the population sizes were taken to be 60 million for the UK and 360 million for 'EU12'. The countries considered to be in EU12 in PC-CREAM 08 are the 12 countries that made up the European Union in 1986: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain and the UK (Smith and Simmonds, 2009). However, in some cases doses were calculated for different European regions because data was not available for EU12.

For atmospheric discharges the first pass contribution to collective dose was calculated for the UK, but also for a greater European region which included all countries within a 3000 km radius of the UK, including western Russia, Turkey, parts of North Africa and the Middle East. This was the same as in the previous study (Bexon, 2000). Activity concentrations in environmental media calculated on a polar grid basis were combined with default population and agricultural production grids for the relevant region to obtain collective doses (Smith and Simmonds, 2009). It was assumed that all the relevant food produced in an annular segment of the polar grid was consumed by the populations of the UK and or 'greater' Europe. When calculating the activity concentrations in foods, allowance was made for the decay of radionuclides during the period between harvest and consumption using delay times given in HPA-RPD-043 (Jones and Sherwood, 2008). For the global component the UK and EU12 populations were considered; for the previous study the UK population was used but the European population was much larger, ie about 700 million.

For discharges to the marine environment, the activity concentrations in environmental media were combined with seafood catch data and coastline occupancies to estimate collective doses from the first pass dispersion (Smith and Simmonds, 2009). Seafood catch data for the UK and EU12 was used. For the UK the data was similar to that used in the previous report; however, for Europe the previous report included catch data for additional countries such as Finland and Sweden. The global component of the marine collective dose in this study considered the UK and EU12 populations, while the previous study considered the UK and 'Europe', the latter again comprising some 700 million people. The collective doses for discharges to the marine environment calculated in this report include doses due to the ingrowth of the first progeny; doses from any progeny further down the decay chain were not significant and were not considered.

Some radionuclides, which either have long half-lives or are mobile in the environment, such as ^{3}H, ^{14}C, ^{85}Kr and ^{129}I, become dispersed globally and lead to long-term exposure of regional or world populations. Collective doses from the global circulation of these radionuclides were added to those from their initial dispersion from their discharge point, More information on how doses from global circulation of ^{3}H, ^{14}C, ^{85}Kr and ^{129}I were calculated is given in Appendix B.

4.2.3 Calculations of per-caput doses

The per-caput doses to the UK population were calculated by dividing the collective doses integrated to 100 years, from single year discharges in 2003 and 2007, by the size of the UK population (ie 60 million). Since discharges from a single installation are unlikely to continue for more than 100 years, longer time periods were not considered.

In addition, per-caput dose rates for selected time periods were calculated by dividing the difference between the collective dose integrated to successive times T_{j+1} and T_j by the time period considered ($T_{j+1} - T_j$) and the UK population (Smith et al, 2007). The per-caput dose rates were calculated using the equation:

$$D_{\text{per caput}}(T_j) = \frac{S(T_{j+1}) - S(T_j)}{(T_{j+1} - T_j)P_{\text{UK}}}$$

where $S(T_j)$ is the collective dose to the UK population integrated to time T_j and P_{UK} is the population of the UK. The times selected for the calculations were 1, 50, 100, 500, 1000, 5000, 10 000, 50,000 and 100,000 years. Much longer times have been considered than were for the individual and collective doses to indicate the effect of long-lived radionuclides.

Although this is a simplistic approach which assumes that the collective doses increase linearly with time, it enables a broad estimate of levels of per-caput dose contributing to the collective dose at different times.

4.2.4 Calculation of individual doses

Annual doses in the year of discharge to typical adult individuals residing near nuclear sites were calculated by selecting appropriate habit and food consumption data and using calculated activity concentrations in environmental media near the site. The pathways and habit data considered in this assessment are representative of people living in the UK (Bexon, 2000; Smith and Jones, 2003) and are presented in Tables 2 and 3, respectively.

In calculating doses from marine discharges, it was assumed that 10% of the fish and 25% of the crustaceans and molluscs were caught from the local compartment and that time on the beach was spent entirely within the local compartment (Bexon, 2000).

For exposure from atmospheric discharges, it was assumed that the typical individual lived 5 km due east of the site except for sites on the east of the UK where the individual was assumed to live due north. It was further assumed that this individual obtained 25% of their annual food consumption from the local area. This individual was also assumed to reside at the chosen location throughout the year and spend 90% of this time indoors.

Table 2: Exposure pathways considered for each discharge type

Atmospheric discharges	Inhalation of radionuclides in the air and resuspended from the ground
	Ingestion of terrestrial foods (beef and cow offal, cow milk and milk products, sheep meat and offal, grain products, green and root vegetables, fruit*)
	External exposure to gamma radiation emitted by radionuclides in the air and deposited on the ground
	External exposure to beta radiation emitted by radionuclides in the air and deposited on the ground
Discharges to the sea	Inhalation of radionuclides in seaspray*
	Ingestion of marine foods (fish, crustaceans, molluscs)
	External exposure to gamma radiation emitted by radionuclides in sediments and on fishing gear
	External exposure to beta radiation emitted by radionuclides in sediments and on fishing gear
Discharges to rivers and lakes	Inhalation of resuspended radionuclides in sediment on the banks of the river or lake and in spray
	Ingestion of drinking water
	Ingestion of freshwater fish*
	Ingestion of cow meat and offal, cow milk, chicken*†, eggs*†, sheep meat and offal, grain products, green and root vegetables
	External exposure to gamma radiation emitted by radionuclides in irrigation water

* Considered for individual dose only.
† BIOS was used to calculate activity concentrations in these foods as they are not available in PC-CREAM 08 but are available in BIOS.

Table 3: Habit data used in assessment for typical adult individuals

Exposure pathway		**Annual rate**
Ingestion of terrestrial food	Cow meat	15 kg y^{-1}
	Cow offal	1 kg y^{-1}
	Cow milk	115 l y^{-1}
	Sheep meat	3 kg y^{-1}
	Sheep offal	2 kg y^{-1}
	Grain products	50 kg y^{-1}
	Green vegetables	30 kg y^{-1}
	Root vegetables	60 kg y^{-1}
	Fruit	15 kg y^{-1}
Ingestion of drinking water		600 l y^{-1}
Ingestion of freshwater fish		3 kg y^{-1}
Ingestion of seafood	Fish	15 kg y^{-1}
	Crustaceans	1.75 kg y^{-1}
	Molluscs	1.75 kg y^{-1}
Inhalation rate of air		8100 m^3 y^{-1}
Time spent on beach		30 h y^{-1}

5 Results and Discussion

5.1 Collective doses to the population of Europe

Table 4 presents the collective doses integrated to 500 years to the population of Europe from UK civil nuclear site discharges in the mid-1990s, 2003 and 2007. The table also gives the results calculated in the previous study (Bexon, 2000). The results show a general downward trend in the collective dose integrated to 500 years, although for AGR and PWR power stations the doses from discharges in both 2003 and 2007 have increased compared to those calculated in the mid-1990s due to an increase in discharges of some radionuclides.

Collective doses to the European population from discharges in the mid-1990s integrated to 500 years calculated using PC-CREAM 08 are lower than those given in the previous report (Bexon, 2000) for all sites except Springfields – the reasons for the changes are given below.

Collective doses integrated to 500 years to the European population from liquid discharges have decreased from 290 man Sv for discharges in 1975 to 24 man Sv for discharges in 1985, to 16 man Sv for discharges in the mid-1990s. The total collective dose from liquid discharges in the mid-1990s calculated using PC-CREAM 08 was 10 man Sv. The total collective doses integrated to 500 years from discharges in 2003 and 2007 were 13 man Sv and 4 man Sv, respectively.

The total collective doses due to atmospheric discharges calculated in the previous report remained generally steady, ranging from 78 man Sv due to 1975 discharges, to 84 man Sv from 1985 discharges, and 76 man Sv from discharges in the mid-1990s. The dose from discharges in the 1990s recalculated using PC-CREAM 08 decreased to 33 man Sv, while the collective doses from discharges in 2003 and 2007 were 28 man Sv and 15 man Sv, respectively. The main reason for the large decrease is due to the differences in the populations considered to be in Europe in PC-CREAM 98 and PC-CREAM 08 for the global circulation component of the dose calculation; in PC-CREAM 98, the population of Europe was considered to be 700 million people, in PC-CREAM 08, the population of EU12 was considered to be 360 million people.

Discharges from nuclear power plants contribute most to the collective dose, while the contribution from reprocessing sites has gradually decreased. The contribution to total doses due to discharges from Sellafield has continued to fall over the decades, from 92% in 1975 to 38% in 1985 and to 30% in the mid-1990s. Collective doses due to discharges from Sellafield in the mid-2000s rose to 40% in 2003 but fell to 22% in 2007. The increase in 2003 is mainly due to a larger discharge of ^{14}C during that year compared to the mid-1990s. Collective doses integrated to 500 years to the European population for all sites are shown in Figure 3. Collective effective doses per unit activity discharged are presented in Appendix C.

Table 4: Collective effective doses to the European population integrated to 500 years from discharges from UK civil nuclear sites

		Collective dose (man Sv)					
Site	**Discharge**	**1975***	**1985***	**1993–1995†**	**1993–1995‡**	**2003**	**2007**
Fuel fabrication installations							
Capenhurst	Atmospheric	$1.3\ 10^{-2}$	$2.9\ 10^{-4}$	$2.0\ 10^{-1}$	$1.1\ 10^{-1}$	$5.8\ 10^{-4}$	$1.7\ 10^{-5}$
	Liquid	$3.4\ 10^{-5}$	$9.0\ 10^{-6}$	$5.7\ 10^{-5}$	$7.3\ 10^{-5}$	$1.8\ 10^{-5}$	$9.8\ 10^{-6}$
	Total	$1.3\ 10^{-2}$	$3.0\ 10^{-4}$	$2.0\ 10^{-1}$	$1.1\ 10^{-1}$	$6.0\ 10^{-4}$	$2.6\ 10^{-5}$
Springfields	Atmospheric	$4.3\ 10^{-1}$	$4.1\ 10^{-2}$	$4.3\ 10^{-2}$	$4.7\ 10^{-2}$	$3.3\ 10^{-2}$	$1.9\ 10^{-2}$
	Liquid	$2.0\ 10^{-2}$	$1.1\ 10^{-2}$	$4.6\ 10^{-3}$	$7.0\ 10^{-3}$	$7.3\ 10^{-3}$	$2.3\ 10^{-3}$
	Total	$4.5\ 10^{-1}$	$5.2\ 10^{-2}$	$4.8\ 10^{-2}$	$5.4\ 10^{-2}$	$4.1\ 10^{-2}$	$2.2\ 10^{-2}$
Total (fuel fabrication)	**Atmospheric**	$\mathbf{4.4\ 10^{-1}}$	$\mathbf{4.1\ 10^{-2}}$	$\mathbf{2.5\ 10^{-1}}$	$\mathbf{1.6\ 10^{-1}}$	$\mathbf{3.4\ 10^{-2}}$	$\mathbf{1.9\ 10^{-2}}$
	Liquid	$\mathbf{2.0\ 10^{-2}}$	$\mathbf{1.1\ 10^{-2}}$	$\mathbf{4.7\ 10^{-3}}$	$\mathbf{7.1\ 10^{-3}}$	$\mathbf{7.3\ 10^{-3}}$	$\mathbf{2.3\ 10^{-3}}$
	Total	$\mathbf{4.6\ 10^{-1}}$	$\mathbf{5.3\ 10^{-2}}$	$\mathbf{2.5\ 10^{-1}}$	$\mathbf{1.6\ 10^{-1}}$	$\mathbf{4.1\ 10^{-2}}$	$\mathbf{2.2\ 10^{-2}}$
Power production installations							
AGR power stations							
Dungeness B	Atmospheric	nd§	$5.0\ 10^{0}$	$4.4\ 10^{-1}$	$2.1\ 10^{-1}$	$9.5\ 10^{-1}$	$1.0\ 10^{0}$
	Liquid	nd	$1.4\ 10^{-3}$	$1.4\ 10^{-3}$	$6.5\ 10^{-4}$	$1.1\ 10^{-3}$	$6.8\ 10^{-4}$
	Total	nd	$5.0\ 10^{0}$	$4.4\ 10^{-1}$	$2.1\ 10^{-1}$	$9.5\ 10^{-1}$	$1.0\ 10^{0}$
Hartlepool	Atmospheric	nd	$4.8\ 10^{0}$	$2.2\ 10^{0}$	$1.0\ 10^{0}$	$2.1\ 10^{0}$	$1.9\ 10^{0}$
	Liquid	nd	$3.1\ 10^{-4}$	$1.7\ 10^{-3}$	$1.4\ 10^{-3}$	$9.7\ 10^{-4}$	$7.3\ 10^{-4}$
	Total	nd	$4.8\ 10^{0}$	$2.2\ 10^{0}$	$1.0\ 10^{0}$	$2.1\ 10^{0}$	$1.9\ 10^{0}$
Heysham 1	Atmospheric	nd	$3.7\ 10^{0}$	$2.0\ 10^{0}$	$1.2\ 10^{0}$	$1.9\ 10^{0}$	$1.7\ 10^{0}$
	Liquid	nd	$2.6\ 10^{-4}$	$1.9\ 10^{-3}$	$1.4\ 10^{-3}$	$1.3\ 10^{-3}$	$8.1\ 10^{-4}$
	Total	nd	$3.7\ 10^{0}$	$2.0\ 10^{0}$	$1.2\ 10^{0}$	$1.9\ 10^{0}$	$1.7\ 10^{0}$
Heysham 2	Atmospheric	nd	nd	$1.3\ 10^{0}$	$7.8\ 10^{-1}$	$1.4\ 10^{0}$	$1.74\ 10^{0}$
	Liquid	nd	nd	$2.5\ 10^{-3}$	$1.7\ 10^{-3}$	$2.6\ 10^{-3}$	$6.0\ 10^{-4}$
	Total	nd	nd	$1.3\ 10^{0}$	$7.8\ 10^{-1}$	$1.4\ 10^{0}$	$1.7\ 10^{0}$
Hinkley Point B	Atmospheric	nd	$5.6\ 10^{0}$	$3.7\ 10^{0}$	$1.5\ 10^{0}$	$1.6\ 10^{0}$	$5.9\ 10^{-1}$
	Liquid	nd	$1.5\ 10^{-3}$	$1.4\ 10^{-3}$	$5.7\ 10^{-4}$	$5.6\ 10^{-4}$	$7.5\ 10^{-5}$
	Total	nd	$5.6\ 10^{0}$	$3.7\ 10^{0}$	$1.5\ 10^{0}$	$1.6\ 10^{0}$	$6.0\ 10^{-1}$
Hunterston B	Atmospheric	nd	$4.6\ 10^{0}$	$2.7\ 10^{0}$	$1.2\ 10^{0}$	$1.7\ 10^{0}$	$5.6\ 10^{-1}$
	Liquid	nd	$2.9\ 10^{-3}$	$2.1\ 10^{-3}$	$8.5\ 10^{-4}$	$2.5\ 10^{-4}$	$1.3\ 10^{-4}$
	Total	nd	$4.6\ 10^{0}$	$2.7\ 10^{0}$	$1.2\ 10^{0}$	$1.7\ 10^{0}$	$5.6\ 10^{-1}$
Torness	Atmospheric	nd	nd	$1.0\ 10^{0}$	$5.6\ 10^{-1}$	$7.2\ 10^{-1}$	$9.6\ 10^{-1}$
	Liquid	nd	nd	$8.7\ 10^{-4}$	$3.7\ 10^{-4}$	$4.7\ 10^{-4}$	$4.9\ 10^{-4}$
	Total	nd	nd	$1.0\ 10^{0}$	$5.6\ 10^{-1}$	$7.2\ 10^{-1}$	$9.6\ 10^{-1}$

Table 4: continued

		Collective dose (man Sv)					
Site	**Discharge**	**1975***	**1985***	**1993–1995†**	**1993–1995‡**	**2003**	**2007**
Magnox power stations							
Berkeley	Atmospheric	$2.7\ 10^{0}$	$2.6\ 10^{0}$	$2.6\ 10^{-3}$	$9.3\ 10^{-4}$	$3.2\ 10^{-4}$	$3.2\ 10^{-4}$
	Liquid	$2.3\ 10^{-2}$	$4.1\ 10^{-3}$	$1.4\ 10^{-3}$	$5.9\ 10^{-4}$	$1.3\ 10^{-6}$	$3.6\ 10^{-7}$
	Total	$2.7\ 10^{0}$	$2.6\ 10^{0}$	$4.0\ 10^{-3}$	$1.5\ 10^{-3}$	$3.2\ 10^{-4}$	$3.2\ 10^{-4}$
Bradwell	Atmospheric	$1.9\ 10^{0}$	$2.0\ 10^{0}$	$1.2\ 10^{0}$	$5.9\ 10^{-1}$	$1.1\ 10^{-4}$	$1.7\ 10^{-5}$
	Liquid	$1.7\ 10^{-1}$	$9.8\ 10^{-2}$	$2.2\ 10^{-2}$	$1.2\ 10^{-2}$	$1.1\ 10^{-2}$	$5.4\ 10^{-4}$
	Total	$2.1\ 10^{0}$	$2.1\ 10^{0}$	$1.2\ 10^{0}$	$6.0\ 10^{-1}$	$1.1\ 10^{-2}$	$5.6\ 10^{-4}$
Chapelcross	Atmospheric	$5.6\ 10^{-1}$	$5.6\ 10^{0}$	$4.7\ 10^{0}$	$2.4\ 10^{0}$	$6.8\ 10^{-1}$	$7.0\ 10^{-2}$
	Liquid	$1.8\ 10^{-2}$	$2.3\ 10^{-2}$	$1.1\ 10^{-3}$	$1.8\ 10^{-3}$	$1.7\ 10^{-3}$	$2.8\ 10^{-5}$
	Total	$5.8\ 10^{-1}$	$5.6\ 10^{0}$	$4.7\ 10^{0}$	$2.4\ 10^{0}$	$6.8\ 10^{-1}$	$7.0\ 10^{-2}$
Dungeness A	Atmospheric	$2.1\ 10^{0}$	$2.1\ 10^{0}$	$9.3\ 10^{0}$	$4.5\ 10^{0}$	$4.4\ 10^{0}$	$3.1\ 10^{-1}$
	Liquid	$1.0\ 10^{-1}$	$8.1\ 10^{-2}$	$3.3\ 10^{-2}$	$1.8\ 10^{-2}$	$8.9\ 10^{-3}$	$1.5\ 10^{-3}$
	Total	$2.2\ 10^{0}$	$2.2\ 10^{0}$	$9.3\ 10^{0}$	$4.5\ 10^{0}$	$4.4\ 10^{0}$	$3.1\ 10^{-1}$
Hinkley Point A	Atmospheric	$2.8\ 10^{0}$	$2.8\ 10^{0}$	$5.0\ 10^{0}$	$1.9\ 10^{0}$	$3.1\ 10^{-3}$	$9.8\ 10^{-4}$
	Liquid	$6.9\ 10^{-2}$	$4.2\ 10^{-2}$	$8.9\ 10^{-3}$	$2.7\ 10^{-3}$	$2.3\ 10^{-3}$	$6.9\ 10^{-4}$
	Total	$2.9\ 10^{0}$	$2.8\ 10^{0}$	$5.0\ 10^{0}$	$1.9\ 10^{0}$	$5.5\ 10^{-3}$	$1.7\ 10^{-3}$
Hunterston A	Atmospheric	$1.9\ 10^{0}$	$1.9\ 10^{0}$	$6.5\ 10^{-2}$	$2.9\ 10^{-2}$	$1.9\ 10^{-4}$	$1.9\ 10^{-4}$
	Liquid	$1.5\ 10^{-1}$	$1.7\ 10^{-1}$	$7.0\ 10^{-3}$	$2.3\ 10^{-3}$	$4.2\ 10^{-4}$	$1.0\ 10^{-4}$
	Total	$2.0\ 10^{0}$	$2.1\ 10^{0}$	$7.2\ 10^{-2}$	$3.1\ 10^{-2}$	$6.2\ 10^{-4}$	$2.9\ 10^{-4}$
Oldbury	Atmospheric	$2.6\ 10^{0}$	$2.6\ 10^{0}$	$1.3\ 10^{1}$	$4.9\ 10^{0}$	$2.4\ 10^{0}$	$4.1\ 10^{-1}$
	Liquid	$1.1\ 10^{-2}$	$1.5\ 10^{-2}$	$8.0\ 10^{-4}$	$3.9\ 10^{-4}$	$2.8\ 10^{-3}$	$2.5\ 10^{-3}$
	Total	$2.6\ 10^{0}$	$2.6\ 10^{0}$	$1.3\ 10^{1}$	$4.9\ 10^{0}$	$2.4\ 10^{0}$	$4.1\ 10^{-1}$
Sizewell A	Atmospheric	$2.0\ 10^{0}$	$1.9\ 10^{0}$	$2.2\ 10^{0}$	$1.2\ 10^{0}$	$1.8\ 10^{0}$	$1.5\ 10^{-1}$
	Liquid	$3.1\ 10^{-2}$	$3.7\ 10^{-2}$	$7.8\ 10^{-3}$	$3.3\ 10^{-3}$	$1.5\ 10^{-2}$	$6.4\ 10^{-3}$
	Total	$2.0\ 10^{0}$	$2.0\ 10^{0}$	$2.2\ 10^{0}$	$1.2\ 10^{0}$	$1.8\ 10^{0}$	$1.6\ 10^{-1}$
Trawsfynydd	Atmospheric	$1.6\ 10^{0}$	$1.9\ 10^{0}$	$1.7\ 10^{-3}$	$9.7\ 10^{-4}$	$1.6\ 10^{-3}$	$3.2\ 10^{-3}$
	Liquid	$4.5\ 10^{-1}$	$1.7\ 10^{-1}$	$2.5\ 10^{-2}$	$5.4\ 10^{-3}$	$1.1\ 10^{-3}$	$5.8\ 10^{-4}$
	Total	$2.1\ 10^{0}$	$2.1\ 10^{0}$	$2.7\ 10^{-2}$	$6.4\ 10^{-3}$	$2.7\ 10^{-3}$	$3.8\ 10^{-3}$
Wylfa	Atmospheric	$1.4\ 10^{0}$	$1.5\ 10^{0}$	$2.4\ 10^{0}$	$1.4\ 10^{0}$	$1.6\ 10^{0}$	$1.1\ 10^{0}$
	Liquid	$3.1\ 10^{-3}$	$2.7\ 10^{-4}$	$5.5\ 10^{-4}$	$9.3\ 10^{-4}$	$6.8\ 10^{-4}$	$3.1\ 10^{-4}$
	Total	$1.4\ 10^{0}$	$1.5\ 10^{0}$	$2.4\ 10^{0}$	$1.4\ 10^{0}$	$1.6\ 10^{0}$	$1.1\ 10^{0}$
PWR power station							
Sizewell B	Atmospheric	nd	nd	$2.9\ 10^{-2}$	$1.7\ 10^{-2}$	$3.7\ 10^{-1}$	$3.9\ 10^{-1}$
	Liquid	nd	nd	$1.6\ 10^{-4}$	$6.5\ 10^{-5}$	$9.8\ 10^{-4}$	$3.2\ 10^{-4}$
	Total	nd	nd	$3.0\ 10^{-2}$	$1.7\ 10^{-2}$	$3.7\ 10^{-1}$	$3.9\ 10^{-1}$
Total (power production)	**Atmospheric**	$\mathbf{2.0\ 10^{1}}$	$\mathbf{4.9\ 10^{1}}$	$\mathbf{5.1\ 10^{1}}$	$\mathbf{2.3\ 10^{1}}$	$\mathbf{2.2\ 10^{1}}$	$\mathbf{1.1\ 10^{1}}$
	Liquid	$\mathbf{1.0\ 10^{0}}$	$\mathbf{6.5\ 10^{-1}}$	$\mathbf{1.2\ 10^{-1}}$	$\mathbf{5.5\ 10^{-2}}$	$\mathbf{5.2\ 10^{-2}}$	$\mathbf{1.7\ 10^{-2}}$
	Total	$\mathbf{2.1\ 10^{1}}$	$\mathbf{4.9\ 10^{1}}$	$\mathbf{5.1\ 10^{1}}$	$\mathbf{2.3\ 10^{1}}$	$\mathbf{2.2\ 10^{1}}$	$\mathbf{1.1\ 10^{1}}$

Table 4: continued

Site	Discharge	Collective dose (man Sv) 1975*	1985*	1993–1995†	1993–1995‡	2003	2007
Fuel reprocessing installations							
Dounreay	Atmospheric	1.6 10^{-1}	8.4 10^{-2}	5.0 10^{-2}	3.2 10^{-2}	7.8 10^{-3}	1.9 10^{-3}
	Liquid	1.8 10^{0}	7.1 10^{-1}	2.3 10^{-1}	3.1 10^{-2}	6.6 10^{-4}	4.6 10^{-6}
	Total	2.0 10^{0}	8.0 10^{-1}	2.8 10^{-1}	6.3 10^{-2}	8.5 10^{-3}	1.9 10^{-3}
Sellafield	Atmospheric	5.6 10^{1}	2.3 10^{1}	1.6 10^{1}	5.9 10^{0}	3.5 10^{0}	8.6 10^{-1}
	Liquid	2.8 10^{2}	1.9 10^{1}	1.2 10^{1}	8.4 10^{0}	1.3 10^{1}	3.4 10^{0}
	Total	3.4 10^{2}	4.2 10^{1}	2.8 10^{1}	1.4 10^{1}	1.6 10^{1}	4.3 10^{0}
Total (fuel reprocessing)	**Atmospheric**	**5.6 10^{1}**	**2.3 10^{1}**	**1.6 10^{1}**	**5.9 10^{0}**	**3.5 10^{0}**	**8.6 10^{-1}**
	Liquid	**2.8 10^{2}**	**2.0 10^{1}**	**1.3 10^{1}**	**8.5 10^{0}**	**1.3 10^{1}**	**3.4 10^{0}**
	Total	**3.4 10^{2}**	**4.3 10^{1}**	**2.9 10^{1}**	**1.4 10^{1}**	**1.6 0^{1}**	**4.3 10^{0}**
Other installations							
Amersham	Atmospheric	nd	2.2 10^{0}	5.6 10^{-1}	2.9 10^{-1}	2.0 10^{-1}	6.2 10^{-1}
	Liquid	nd	7.3 10^{-1}	1.5 10^{0}	6.7 10^{-1}	4.8 10^{-2}	1.5 10^{-2}
	Total	nd	3.0 10^{0}	2.0 10^{0}	9.6 10^{-1}	2.5 10^{-1}	6.3 10^{-1}
Cardiff	Atmospheric	nd	8.1 10^{0}	9.6 10^{0}	3.7 10^{0}	2.9 10^{0}	2.9 10^{0}
	Liquid	nd	1.2 10^{0}	1.3 10^{0}	5.9 10^{-1}	7.0 10^{-2}	7.0 10^{-2}
	Total	nd	9.3 10^{0}	1.1 10^{1}	4.3 10^{0}	3.0 10^{0}	3.0 10^{0}
Harwell	Atmospheric	8.3 10^{-1}	9.4 10^{-1}	6.0 10^{-2}	3.0 10^{-2}	6.4 10^{-2}	6.3 10^{-2}
	Liquid	1.3 10^{0}	2.3 10^{-1}	6.6 10^{-2}	3.6 10^{-2}	4.9 10^{-3}	1.6 10^{-3}
	Total	2.1 10^{0}	1.2 10^{0}	1.3 10^{-1}	6.6 10^{-2}	6.9 10^{-2}	6.5 10^{-2}
Winfrith	Atmospheric	7.6 10^{-1}	8.7 10^{-1}	4.4 10^{-2}	1.6 10^{-2}	5.1 10^{-2}	1.3 10^{-2}
	Liquid	2.9 10^{0}	1.8 10^{0}	7.5 10^{-3}	4.3 10^{-3}	4.5 10^{-3}	5.7 10^{-4}
	Total	3.6 10^{0}	2.7 10^{0}	5.2 10^{-2}	2.0 10^{-2}	5.6 10^{-2}	1.3 10^{-2}
Total (other installations)	**Atmospheric**	**1.6 10^{0}**	**1.2 10^{1}**	**1.0 10^{1}**	**4.0 10^{0}**	**3.2 10^{0}**	**3.6 10^{0}**
	Liquid	**4.2 10^{0}**	**4.0 10^{0}**	**2.9 10^{0}**	**1.3 10^{0}**	**1.3 10^{-1}**	**8.7 10^{-2}**
	Total	**5.7 10^{0}**	**1.6 10^{1}**	**1.3 10^{1}**	**5.3 10^{0}**	**3.4 10^{0}**	**3.7 10^{0}**
Total (all sites)	**Atmospheric**	**7.8 10^{1}**	**8.4 10^{1}**	**7.6 10^{1}**	**3.3 10^{1}**	**2.8 10^{1}**	**1.5 10^{1}**
	Liquid	**2.9 10^{2}**	**2.4 10^{1}**	**1.6 10^{1}**	**9.8 10^{0}**	**1.3 10^{1}**	**3.6 10^{0}**
	Total	**3.7 10^{2}**	**1.1 10^{2}**	**9.2 10^{1}**	**4.3 10^{1}**	**4.1 10^{1}**	**1.9 10^{1}**

* Taken from NRPB-R312.
† Calculated using PC-CREAM 98.
‡ Calculated using PC-CREAM 08.
§ nd = no discharges.

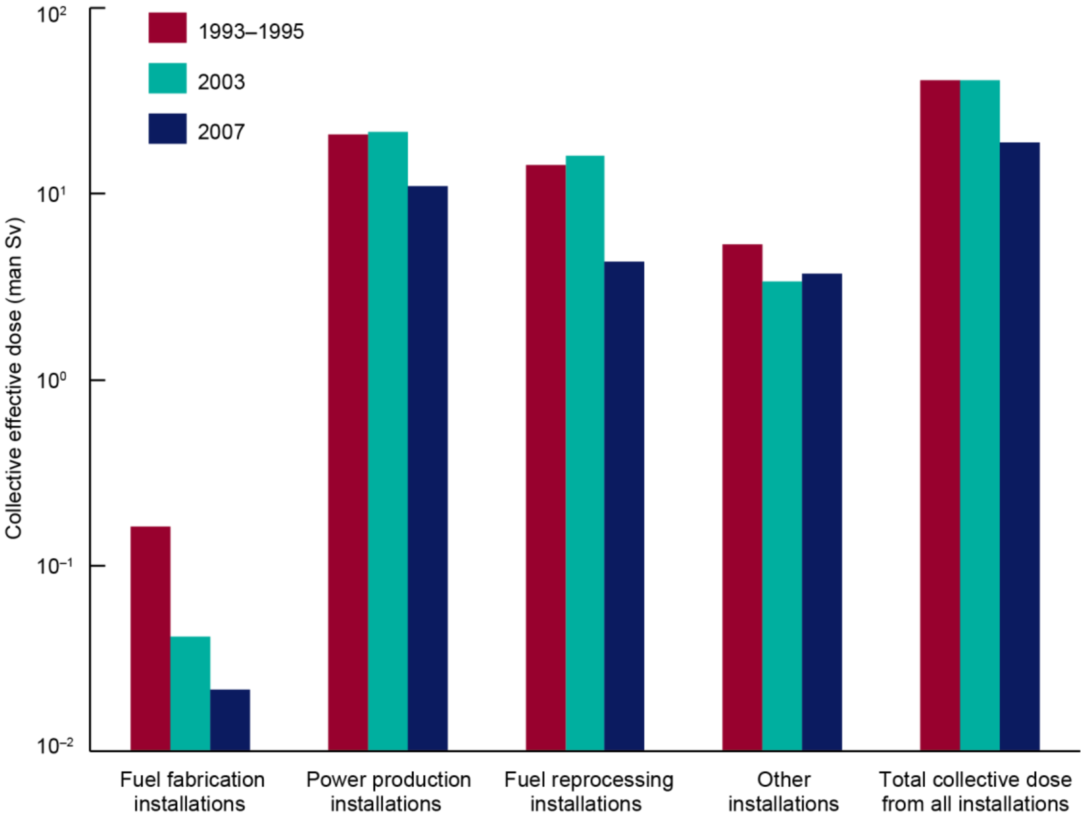

Figure 3: Collective doses integrated to 500 years to the European population due to discharges from all UK civil nuclear sites by installation type

5.2 Collective doses to the population of the UK

Collective doses to the UK population show a similar pattern to that of the collective doses to the European population (see Table 5). The collective dose integrated to 500 years to the UK population from discharges in the mid-1990s calculated with PC-CREAM 08 when compared to the dose calculated with PC-CREAM 98 has decreased from 17 man Sv to 14 man Sv. As was found with the collective dose to the European population, a comparison of the doses due to mid-1990s discharges calculated using different versions of PC-CREAM shows that, generally, PC-CREAM 08 calculates doses that are lower than those calculated using PC-CREAM 98 with the exception of the AGR power stations. Collective doses integrated to 500 years from discharges in 2003 and 2007 were 12 man Sv and 6 man Sv, respectively. Sellafield remains the highest contributor to the collective dose integrated to 500 years from discharges in the 2000s (approximately 25% for discharges in 2003 and 10% for discharges in 2007).

An analysis of the contribution by radionuclide to collective doses due to atmospheric discharges in 2003 and 2007, compared to the doses from discharges in the mid-1990s, shows that the contribution from ^{14}C has marginally increased (see Figure 4). The contributions from ^{3}H, ^{35}S, ^{41}Ar, ^{85}Kr and ^{129}I have continued to decrease throughout the 2000s, whereas the contribution from radon (^{222}Rn) has increased, reaching 11% from discharges in 2007, mostly from Amersham.

Table 5: Collective effective doses to the UK population integrated to 500 years from discharges from UK civil nuclear sites

Site	Discharge	Collective dose (man Sv)					
		1975*	1985*	1993–1995†	1993–1995‡	2003	2007
Fuel fabrication installations							
Capenhurst	Atmospheric	9.6 10^{-3}	2.2 10^{-4}	1.2 10^{-1}	6.7 10^{-2}	4.7 10^{-4}	1.5 10^{-5}
	Liquid	1.2 10^{-5}	3.3 10^{-6}	2.2 10^{-5}	3.5 10^{-5}	8.6 10^{-6}	4.6 10^{-6}
	Total	9.6 10^{-3}	2.2 10^{-4}	1.2 10^{-1}	6.7 10^{-2}	4.8 10^{-4}	1.9 10^{-5}
Springfields	Atmospheric	2.8 10^{-1}	2.7 10^{-2}	2.8 10^{-2}	3.5 10^{-2}	2.5 10^{-2}	1.4 10^{-2}
	Liquid	1.2 10^{-2}	7.0 10^{-3}	2.8 10^{-3}	3.3 10^{-3}	3.5 10^{-3}	1.1 10^{-3}
	Total	2.9 10^{-1}	3.3 10^{-2}	3.1 10^{-2}	3.8 10^{-2}	2.8 10^{-2}	1.5 10^{-2}
Total (fuel fabrication)	**Atmospheric**	**2.9 10^{-1}**	**2.7 10^{-2}**	**1.5 10^{-1}**	**1.0 10^{-1}**	**2.5 10^{-2}**	**1.4 10^{-2}**
	Liquid	**1.2 10^{-2}**	**7.0 10^{-3}**	**2.8 10^{-3}**	**3.3 10^{-3}**	**3.5 10^{-3}**	**1.1 10^{-3}**
	Total	**3.0 10^{-1}**	**3.3 10^{-2}**	**1.5 10^{-1}**	**1.1 10^{-1}**	**2.9 10^{-2}**	**1.5 10^{-2}**
Power production installations							
AGR power stations							
Dungeness B	Atmospheric	nd§	3.4 10^{-1}	3.2 10^{-2}	4.4 10^{-2}	2.0 10^{-1}	2.1 10^{-1}
	Liquid	nd	1.4 10^{-4}	1.5 10^{-4}	1.3 10^{-4}	1.6 10^{-4}	1.1 10^{-4}
	Total	nd	3.4 10^{-1}	3.2 10^{-2}	4.4 10^{-2}	2.0 10^{-1}	2.1 10^{-1}
Hartlepool	Atmospheric	nd	4.2 10^{-1}	2.0 10^{-1}	2.8 10^{-1}	5.8 10^{-1}	5.2 10^{-1}
	Liquid	nd	1.0 10^{-4}	4.7 10^{-4}	3.4 10^{-4}	2.0 10^{-4}	1.5 10^{-4}
	Total	nd	4.2 10^{-1}	2.0 10^{-1}	2.8 10^{-1}	5.8 10^{-1}	5.2 10^{-1}
Heysham 1	Atmospheric	nd	4.4 10^{-1}	2.4 10^{-1}	3.2 10^{-1}	5.2 10^{-1}	4.5 10^{-1}
	Liquid	nd	1.3 10^{-4}	5.4 10^{-4}	5.2 10^{-4}	4.2 10^{-4}	2.6 10^{-4}
	Total	nd	4.4 10^{-1}	2.5 10^{-1}	3.2 10^{-1}	5.2 10^{-1}	4.5 10^{-1}
Heysham 2	Atmospheric	nd	nd	1.6 10^{-1}	2.1 10^{-1}	3.8 10^{-1}	4.7 10^{-1}
	Liquid	nd	nd	6.6 10^{-4}	6.2 10^{-4}	8.5 10^{-4}	1.5 10^{-4}
	Total	nd	nd	1.6 10^{-1}	2.1 10^{-1}	3.8 10^{-1}	4.7 10^{-1}
Hinkley Point B	Atmospheric	nd	6.4 10^{-1}	4.5 10^{-1}	4.1 10^{-1}	4.6 10^{-1}	1.7 10^{-1}
	Liquid	nd	1.8 10^{-4}	1.4 10^{-4}	1.1 10^{-4}	9.8 10^{-5}	1.4 10^{-5}
	Total	nd	6.4 10^{-1}	4.5 10^{-1}	4.1 10^{-1}	4.6 10^{-1}	1.7 10^{-1}
Hunterston B	Atmospheric	nd	5.3 10^{-1}	3.1 10^{-1}	2.9 10^{-1}	3.9 10^{-1}	1.3 10^{-1}
	Liquid	nd	6.5 10^{-4}	3.9 10^{-4}	2.0 10^{-4}	6.9 10^{-5}	3.3 10^{-5}
	Total	nd	5.3 10^{-1}	3.1 10^{-1}	2.9 10^{-1}	3.9 10^{-1}	1.3 10^{-1}
Torness	Atmospheric	nd	nd	8.5 10^{-2}	1.5 10^{-1}	1.9 10^{-1}	2.5 10^{-1}
	Liquid	nd	nd	1.0 10^{-4}	6.4 10^{-5}	8.0 10^{-5}	8.2 10^{-5}
	Total	nd	nd	8.5 10^{-2}	1.5 10^{-1}	1.9 10^{-1}	2.5 10^{-1}

Table 5: continued

Site	Discharge	Collective dose (man Sv) 1975*	1985*	1993–1995†	1993–1995‡	2003	2007
Magnox power stations							
Berkeley	Atmospheric	$5.8\ 10^{-1}$	$5.0\ 10^{-1}$	$4.4\ 10^{-4}$	$2.9\ 10^{-4}$	$9.3\ 10^{-5}$	$9.3\ 10^{-5}$
	Liquid	$5.2\ 10^{-3}$	$7.7\ 10^{-4}$	$3.0\ 10^{-4}$	$2.1\ 10^{-4}$	$4.8\ 10^{-7}$	$1.2\ 10^{-7}$
	Total	$5.9\ 10^{-1}$	$5.0\ 10^{-1}$	$7.4\ 10^{-4}$	$5.0\ 10^{-4}$	$9.4\ 10^{-5}$	$9.3\ 10^{-5}$
Bradwell	Atmospheric	$3.2\ 10^{-1}$	$4.1\ 10^{-1}$	$3.0\ 10^{-1}$	$2.0\ 10^{-1}$	$1.5\ 10^{-3}$	$4.3\ 10^{-4}$
	Liquid	$4.2\ 10^{-2}$	$2.8\ 10^{-2}$	$4.5\ 10^{-3}$	$2.9\ 10^{-3}$	$2.4\ 10^{-3}$	$1.3\ 10^{-4}$
	Total	$3.6\ 10^{-1}$	$4.4\ 10^{-1}$	$3.0\ 10^{-1}$	$2.1\ 10^{-1}$	$3.9\ 10^{-3}$	$5.6\ 10^{-4}$
Chapelcross	Atmospheric	$1.4\ 10^{-1}$	$2.2\ 10^{0}$	$1.7\ 10^{0}$	$1.1\ 10^{0}$	$3.1\ 10^{-1}$	$3.5\ 10^{-2}$
	Liquid	$6.5\ 10^{-3}$	$8.4\ 10^{-3}$	$4.4\ 10^{-4}$	$7.9\ 10^{-4}$	$6.9\ 10^{-4}$	$1.1\ 10^{-5}$
	Total	$1.5\ 10^{-1}$	$2.2\ 10^{0}$	$1.7\ 10^{0}$	$1.1\ 10^{0}$	$3.1\ 10^{-1}$	$3.5\ 10^{-2}$
Dungeness A	Atmospheric	$2.3\ 10^{-1}$	$2.2\ 10^{-1}$	$7.1\ 10^{-1}$	$9.5\ 10^{-1}$	$9.1\ 10^{-1}$	$6.3\ 10^{-2}$
	Liquid	$1.6\ 10^{-2}$	$1.0\ 10^{-2}$	$5.3\ 10^{-3}$	$2.4\ 10^{-3}$	$1.1\ 10^{-3}$	$2.0\ 10^{-4}$
	Total	$2.4\ 10^{-1}$	$2.3\ 10^{-1}$	$7.2\ 10^{-1}$	$9.5\ 10^{-1}$	$9.2\ 10^{-1}$	$6.3\ 10^{-2}$
Hinkley Point A	Atmospheric	$7.7\ 10^{-1}$	$7.6\ 10^{-1}$	$1.0\ 10^{0}$	$6.4\ 10^{-1}$	$8.3\ 10^{-4}$	$2.9\ 10^{-4}$
	Liquid	$1.2\ 10^{-2}$	$6.9\ 10^{-3}$	$1.6\ 10^{-3}$	$6.4\ 10^{-4}$	$5.6\ 10^{-4}$	$1.5\ 10^{-4}$
	Total	$7.8\ 10^{-1}$	$7.6\ 10^{-1}$	$1.0\ 10^{0}$	$6.4\ 10^{-1}$	$1.4\ 10^{-3}$	$4.4\ 10^{-4}$
Hunterston A	Atmospheric	$2.0\ 10^{-1}$	$2.6\ 10^{-1}$	$3.1\ 10^{-3}$	$6.5\ 10^{-3}$	$4.5\ 10^{-5}$	$4.3\ 10^{-5}$
	Liquid	$4.7\ 10^{-2}$	$5.5\ 10^{-2}$	$2.2\ 10^{-3}$	$6.0\ 10^{-4}$	$1.2\ 10^{-4}$	$3.4\ 10^{-5}$
	Total	$2.4\ 10^{-1}$	$3.1\ 10^{-1}$	$5.3\ 10^{-3}$	$7.1\ 10^{-3}$	$1.7\ 10^{-4}$	$7.7\ 10^{-5}$
Oldbury	Atmospheric	$4.3\ 10^{-1}$	$4.2\ 10^{-1}$	$2.0\ 10^{0}$	$1.5\ 10^{0}$	$7.3\ 10^{-1}$	$1.2\ 10^{-1}$
	Liquid	$2.1\ 10^{-3}$	$2.8\ 10^{-3}$	$1.8\ 10^{-4}$	$1.5\ 10^{-4}$	$8.4\ 10^{-4}$	$7.5\ 10^{-4}$
	Total	$4.3\ 10^{-1}$	$4.2\ 10^{-1}$	$2.0\ 10^{0}$	$1.5\ 10^{0}$	$7.3\ 10^{-1}$	$1.2\ 10^{-1}$
Sizewell A	Atmospheric	$3.8\ 10^{-1}$	$3.4\ 10^{-1}$	$4.0\ 10^{-1}$	$3.6\ 10^{-1}$	$5.1\ 10^{-1}$	$4.0\ 10^{-2}$
	Liquid	$6.2\ 10^{-3}$	$7.0\ 10^{-3}$	$1.6\ 10^{-3}$	$6.3\ 10^{-4}$	$2.5\ 10^{-3}$	$1.1\ 10^{-3}$
	Total	$3.8\ 10^{-1}$	$3.4\ 10^{-1}$	$4.0\ 10^{-1}$	$3.6\ 10^{-1}$	$5.1\ 10^{-1}$	$4.1\ 10^{-2}$
Trawsfynydd	Atmospheric	$3.2\ 10^{-1}$	$5.8\ 10^{-1}$	$3.5\ 10^{-4}$	$3.4\ 10^{-4}$	$4.0\ 10^{-4}$	$7.9\ 10^{-4}$
	Liquid	$4.5\ 10^{-1}$	$1.7\ 10^{-1}$	$2.5\ 10^{-2}$	$5.4\ 10^{-3}$	$1.1\ 10^{-3}$	$5.8\ 10^{-4}$
	Total	$7.7\ 10^{-1}$	$7.5\ 10^{-1}$	$2.5\ 10^{-2}$	$5.8\ 10^{-3}$	$1.5\ 10^{-3}$	$1.4\ 10^{-3}$
Wylfa	Atmospheric	$1.6\ 10^{-1}$	$1.8\ 10^{-1}$	$3.0\ 10^{-1}$	$3.7\ 10^{-1}$	$4.0\ 10^{-1}$	$2.8\ 10^{-1}$
	Liquid	$1.3\ 10^{-3}$	$8.2\ 10^{-5}$	$2.2\ 10^{-4}$	$3.6\ 10^{-4}$	$2.5\ 10^{-4}$	$1.2\ 10^{-4}$
	Total	$1.7\ 10^{-1}$	$1.8\ 10^{-1}$	$3.1\ 10^{-1}$	$3.7\ 10^{-1}$	$4.0\ 10^{-1}$	$2.8\ 10^{-1}$
PWR power station							
Sizewell B	Atmospheric	nd	nd	$3.7\ 10^{-3}$	$4.5\ 10^{-3}$	$9.7\ 10^{-2}$	$1.0\ 10^{-1}$
	Liquid	nd	nd	$4.3\ 10^{-5}$	$2.0\ 10^{-5}$	$3.2\ 10^{-4}$	$5.8\ 10^{-5}$
	Total	nd	nd	$3.7\ 10^{-3}$	$4.5\ 10^{-3}$	$9.8\ 10^{-2}$	$1.0\ 10^{-1}$
Total (power production)	**Atmospheric**	**$3.5\ 10^{0}$**	**$8.2\ 10^{0}$**	**$7.9\ 10^{0}$**	**$6.8\ 10^{0}$**	**$5.7\ 10^{0}$**	**$2.8\ 10^{0}$**
	Liquid	**$5.9\ 10^{-1}$**	**$2.9\ 10^{-1}$**	**$4.4\ 10^{-2}$**	**$1.6\ 10^{-2}$**	**$1.2\ 10^{-2}$**	**$3.9\ 10^{-3}$**
	Total	**$4.1\ 10^{0}$**	**$8.5\ 10^{0}$**	**$8.0\ 10^{0}$**	**$6.9\ 10^{0}$**	**$5.7\ 10^{0}$**	**$2.8\ 10^{0}$**

Table 5: continued

		Collective dose (man Sv)					
Site	**Discharge**	**1975***	**1985***	**1993–1995†**	**1993–1995‡**	**2003**	**2007**
Fuel reprocessing installations							
Dounreay	Atmospheric	$3.2\ 10^{-2}$	$1.6\ 10^{-2}$	$8.3\ 10^{-3}$	$9.4\ 10^{-3}$	$2.9\ 10^{-3}$	$9.2\ 10^{-4}$
	Liquid	$4.2\ 10^{-1}$	$1.7\ 10^{-1}$	$5.4\ 10^{-2}$	$1.7\ 10^{-2}$	$3.5\ 10^{-4}$	$2.5\ 10^{-6}$
	Total	$4.5\ 10^{-1}$	$1.8\ 10^{-1}$	$6.2\ 10^{-2}$	$2.6\ 10^{-2}$	$3.3\ 10^{-3}$	$9.2\ 10^{-4}$
Sellafield	Atmospheric	$1.0\ 10^{1}$	$4.1\ 10^{0}$	$3.1\ 10^{0}$	$2.2\ 10^{0}$	$1.3\ 10^{0}$	$3.3\ 10^{-1}$
	Liquid	$1.1\ 10^{2}$	$7.1\ 10^{0}$	$2.6\ 10^{0}$	$2.4\ 10^{0}$	$3.3\ 10^{0}$	$8.8\ 10^{-1}$
	Total	$1.2\ 10^{2}$	$1.1\ 10^{1}$	$5.7\ 10^{0}$	$4.6\ 10^{0}$	$4.6\ 10^{0}$	$1.2\ 10^{0}$
Total (fuel reprocessing)	**Atmospheric**	$\mathbf{1.0\ 10^{1}}$	$\mathbf{4.1\ 10^{0}}$	$\mathbf{3.1\ 10^{0}}$	$\mathbf{2.2\ 10^{0}}$	$\mathbf{1.3\ 10^{0}}$	$\mathbf{3.3\ 10^{-1}}$
	Liquid	$\mathbf{1.1\ 10^{2}}$	$\mathbf{7.3\ 10^{0}}$	$\mathbf{2.7\ 10^{0}}$	$\mathbf{2.4\ 10^{0}}$	$\mathbf{3.3\ 10^{0}}$	$\mathbf{8.8\ 10^{-1}}$
	Total	$\mathbf{1.2\ 10^{2}}$	$\mathbf{1.1\ 10^{1}}$	$\mathbf{5.8\ 10^{0}}$	$\mathbf{4.6\ 10^{0}}$	$\mathbf{4.6\ 10^{0}}$	$\mathbf{1.2\ 10^{0}}$
Other installations							
Amersham	Atmospheric	nd	$1.4\ 10^{0}$	$3.4\ 10^{-1}$	$2.2\ 10^{-1}$	$1.4\ 10^{-1}$	$4.5\ 10^{-1}$
	Liquid	nd	$7.3\ 10^{-1}$	$1.5\ 10^{0}$	$6.4\ 10^{-1}$	$4.5\ 10^{-2}$	$1.4\ 10^{-2}$
	Total	nd	$2.2\ 10^{0}$	$1.8\ 10^{0}$	$8.7\ 10^{-1}$	$1.9\ 10^{-1}$	$4.6\ 10^{-1}$
Cardiff	Atmospheric	nd	$1.2\ 10^{0}$	$1.4\ 10^{0}$	$1.1\ 10^{0}$	$1.0\ 10^{0}$	$9.1\ 10^{-1}$
	Liquid	nd	$1.2\ 10^{-1}$	$1.3\ 10^{-1}$	$1.2\ 10^{-1}$	$1.4\ 10^{-2}$	$1.4\ 10^{-2}$
	Total	nd	$1.3\ 10^{0}$	$1.6\ 10^{0}$	$1.2\ 10^{0}$	$1.0\ 10^{0}$	$9.3\ 10^{-1}$
Harwell	Atmospheric	$2.0\ 10^{-1}$	$2.4\ 10^{-1}$	$2.4\ 10^{-2}$	$1.4\ 10^{-2}$	$6.1\ 10^{-2}$	$5.8\ 10^{-2}$
	Liquid	$1.3\ 10^{0}$	$2.3\ 10^{-1}$	$6.6\ 10^{-2}$	$3.9\ 10^{-2}$	$6.7\ 10^{-3}$	$2.6\ 10^{-3}$
	Total	$1.5\ 10^{0}$	$4.7\ 10^{-1}$	$9.0\ 10^{-2}$	$5.3\ 10^{-2}$	$6.8\ 10^{-2}$	$6.1\ 10^{-2}$
Winfrith	Atmospheric	$1.0\ 10^{-1}$	$1.2\ 10^{-1}$	$1.2\ 10^{-2}$	$6.2\ 10^{-3}$	$2.2\ 10^{-2}$	$5.5\ 10^{-3}$
	Liquid	$5.3\ 10^{-1}$	$3.6\ 10^{-1}$	$8.2\ 10^{-4}$	$1.0\ 10^{-3}$	$9.6\ 10^{-4}$	$1.2\ 10^{-4}$
	Total	$6.3\ 10^{-1}$	$4.8\ 10^{-1}$	$1.3\ 10^{-2}$	$7.3\ 10^{-3}$	$2.3\ 10^{-2}$	$5.7\ 10^{-3}$
Total (other installations)	**Atmospheric**	$\mathbf{3.0\ 10^{-1}}$	$\mathbf{3.0\ 10^{0}}$	$\mathbf{1.8\ 10^{0}}$	$\mathbf{1.3\ 10^{0}}$	$\mathbf{1.2\ 10^{0}}$	$\mathbf{1.4\ 10^{0}}$
	Liquid	$\mathbf{1.8\ 10^{0}}$	$\mathbf{1.4\ 10^{0}}$	$\mathbf{1.7\ 10^{0}}$	$\mathbf{8.0\ 10^{-1}}$	$\mathbf{6.6\ 10^{-2}}$	$\mathbf{3.1\ 10^{-2}}$
	Total	$\mathbf{2.1\ 10^{0}}$	$\mathbf{4.5\ 10^{0}}$	$\mathbf{3.5\ 10^{0}}$	$\mathbf{2.1\ 10^{0}}$	$\mathbf{1.3\ 10^{0}}$	$\mathbf{1.5\ 10^{0}}$
Total (all sites)	**Atmospheric**	$\mathbf{1.4\ 10^{1}}$	$\mathbf{1.5\ 10^{1}}$	$\mathbf{1.3\ 10^{1}}$	$\mathbf{1.0\ 10^{1}}$	$\mathbf{8.2\ 10^{0}}$	$\mathbf{4.6\ 10^{0}}$
	Liquid	$\mathbf{1.1\ 10^{2}}$	$\mathbf{9.0\ 10^{0}}$	$\mathbf{4.4\ 10^{0}}$	$\mathbf{3.2\ 10^{0}}$	$\mathbf{3.4\ 10^{0}}$	$\mathbf{9.2\ 10^{-1}}$
	Total	$\mathbf{1.3\ 10^{2}}$	$\mathbf{2.4\ 10^{1}}$	$\mathbf{1.7\ 10^{1}}$	$\mathbf{1.4\ 10^{1}}$	$\mathbf{1.2\ 10^{1}}$	$\mathbf{5.5\ 10^{0}}$

* Taken from NRPB-R312.
† Calculated using PC-CREAM 98.
‡ Calculated using PC-CREAM 08.
§ nd = no discharges.

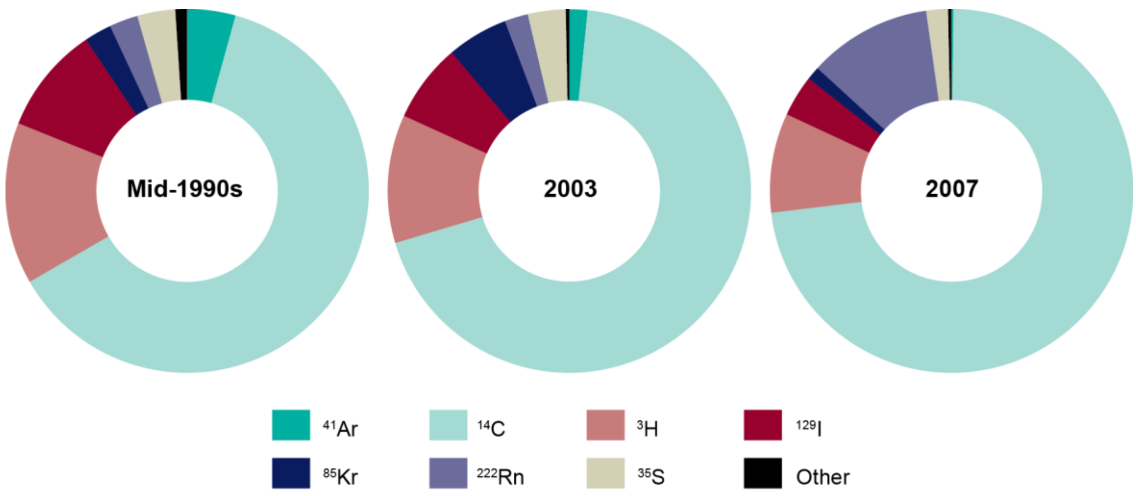

Figure 4: Breakdown by radionuclide of collective dose to the UK population due to atmospheric discharges in the mid-1990s, 2003 and 2007

5.3 Annual individual doses to a typical individual living near a nuclear installation in the UK

The doses to a typical adult individual living near a nuclear installation in the UK in the years of discharge are presented in Table 6. The typical annual individual doses for each operation type for all the discharge years considered in this series of reports are shown in Figure 5.

A comparison of the individual doses calculated using PC-CREAM 98 and PC-CREAM 08 for discharges in the mid-1990s shows that the doses calculated with the new version of the code are generally higher. The higher doses were mainly due to the updated marine model used in PC-CREAM 08. The revised marine dispersion model in PC-CREAM 08 is based on the findings of the MARINA II study (EC, 2003), which increased the number of regional compartments that can be considered in an assessment and better represented remobilisation of sediment. The doses calculated using PC-CREAM 08 range from a minimum of 0.004 μSv to 16 μSv, with a mean dose over all sites of 1.5 μSv. For comparison, the doses calculated using PC-CREAM 98 range from a minimum of 0.003 μSv to a maximum of 10 μSv, with a mean dose over all sites of 1.1 μSv.

For most sites, the doses for 2003 and 2007 are lower than those calculated for the mid-1990s. In 2003, the minimum dose was 0.0004 μSv and the maximum was 18 μSv, with a mean over all sites of 1.0 μSv; for 2007 the minimum was 0.0001 μSv and the maximum 5 μSv, with a mean over all sites of 0.3 μSv. The maximum individual dose is, as was reported before (Bexon, 2000), due to radioactive discharges from Sellafield. The minimum dose is due to discharges from Capenhurst; during the 1990s the minimum dose was from Wylfa.

Table 6 presents the individual doses from each site received by a typical individual from 1975 to 2007. Figure 5 shows the doses by site calculated in this study using PC-CREAM 08. Typical annual individual effective doses per unit activity discharged are presented in Appendix D.

Table 6: Typical annual individual doses from discharges from UK civil nuclear sites

Site	Discharge	Typical individual dose ($\mu Sv\ y^{-1}$)					
		1975*	1985*	1993–1995†	1993–1995‡	2003	2007
Fuel fabrication installations							
Capenhurst	Atmospheric	$8.4\ 10^{-3}$	$1.9\ 10^{-4}$	$3.4\ 10^{-2}$	$2.9\ 10^{-2}$	$3.6\ 10^{-4}$	$5.6\ 10^{-5}$
	Liquid	$5.0\ 10^{-5}$	$1.3\ 10^{-5}$	$8.8\ 10^{-5}$	$2.4\ 10^{-4}$	$6.0\ 10^{-5}$	$3.1\ 10^{-5}$
	Total	$8.5\ 10^{-3}$	$2.0\ 10^{-4}$	$3.4\ 10^{-2}$	$2.9\ 10^{-2}$	$4.2\ 10^{-4}$	$8.7\ 10^{-5}$
Springfields	Atmospheric	$4.1\ 10^{-1}$	$3.8\ 10^{-2}$	$4.1\ 10^{-2}$	$4.3\ 10^{-2}$	$3.0\ 10^{-2}$	$1.7\ 10^{-2}$
	Liquid	$3.3\ 10^{-1}$	$2.2\ 10^{-1}$	$1.0\ 10^{-1}$	$2.2\ 10^{-1}$	$2.5\ 10^{-1}$	$3.0\ 10^{-2}$
	Total	$7.4\ 10^{-1}$	$2.6\ 10^{-1}$	$1.4\ 10^{-1}$	$2.7\ 10^{-1}$	$2.8\ 10^{-1}$	$4.7\ 10^{-2}$
Power production installations							
AGR power stations							
Dungeness B	Atmospheric	nd§	$1.0\ 10^{-1}$	$1.8\ 10^{-2}$	$2.4\ 10^{-2}$	$8.6\ 10^{-2}$	$7.5\ 10^{-2}$
	Liquid	nd	$2.3\ 10^{-3}$	$1.3\ 10^{-3}$	$2.4\ 10^{-3}$	$1.6\ 10^{-3}$	$9.2\ 10^{-4}$
	Total	nd	$1.0\ 10^{-1}$	$1.9\ 10^{-2}$	$2.6\ 10^{-2}$	$8.7\ 10^{-2}$	$7.6\ 10^{-2}$
Hartlepool	Atmospheric	nd	$2.5\ 10^{-1}$	$1.4\ 10^{-1}$	$7.9\ 10^{-2}$	$1.7\ 10^{-1}$	$1.2\ 10^{-1}$
	Liquid	nd	$4.4\ 10^{-3}$	$1.8\ 10^{-2}$	$2.6\ 10^{-2}$	$9.7\ 10^{-3}$	$5.3\ 10^{-3}$
	Total	nd	$2.5\ 10^{-1}$	$1.6\ 10^{-1}$	$1.1\ 10^{-1}$	$1.8\ 10^{-1}$	$1.3\ 10^{-1}$
Heysham 1	Atmospheric	nd	$1.3\ 10^{-1}$	$7.8\ 10^{-2}$	$8.4\ 10^{-2}$	$1.3\ 10^{-1}$	$1.1\ 10^{-1}$
	Liquid	nd	$5.9\ 10^{-3}$	$1.5\ 10^{-2}$	$2.4\ 10^{-2}$	$2.1\ 10^{-2}$	$1.0\ 10^{-2}$
	Total	nd	$1.4\ 10^{-1}$	$9.3\ 10^{-2}$	$1.1\ 10^{-1}$	$1.5\ 10^{-1}$	$1.2\ 10^{-1}$
Heysham 2	Atmospheric	nd	nd	$5.3\ 10^{-2}$	$5.7\ 10^{-2}$	$9.5\ 10^{-2}$	$1.1\ 10^{-1}$
	Liquid	nd	nd	$1.7\ 10^{-2}$	$2.7\ 10^{-2}$	$5.6\ 10^{-2}$	$3.8\ 10^{-3}$
	Total	nd	nd	$7.0\ 10^{-2}$	$8.4\ 10^{-2}$	$1.5\ 10^{-1}$	$1.2\ 10^{-1}$
Hinkley Point B	Atmospheric	nd	$2.9\ 10^{-1}$	$2.2\ 10^{-1}$	$1.3\ 10^{-1}$	$1.5\ 10^{-1}$	$5.3\ 10^{-2}$
	Liquid	nd	$4.0\ 10^{-4}$	$3.2\ 10^{-4}$	$7.5\ 10^{-4}$	$5.2\ 10^{-4}$	$1.0\ 10^{-4}$
	Total	nd	$2.9\ 10^{-1}$	$2.2\ 10^{-1}$	$1.3\ 10^{-1}$	$1.5\ 10^{-1}$	$5.3\ 10^{-2}$
Hunterston B	Atmospheric	nd	$3.6\ 10^{-1}$	$2.0\ 10^{-1}$	$1.2\ 10^{-1}$	$1.5\ 10^{-1}$	$4.5\ 10^{-2}$
	Liquid	nd	$2.7\ 10^{-3}$	$5.9\ 10^{-4}$	$3.0\ 10^{-3}$	$6.3\ 10^{-4}$	$2.7\ 10^{-4}$
	Total	nd	$3.6\ 10^{-1}$	$2.0\ 10^{-1}$	$1.3\ 10^{-1}$	$1.5\ 10^{-1}$	$4.6\ 10^{-2}$
Torness	Atmospheric	nd	nd	$6.3\ 10^{-2}$	$4.5\ 10^{-2}$	$5.4\ 10^{-2}$	$6.6\ 10^{-2}$
	Liquid	nd	nd	$1.2\ 10^{-3}$	$3.0\ 10^{-3}$	$4.0\ 10^{-3}$	$4.3\ 10^{-3}$
	Total	nd	nd	$6.5\ 10^{-2}$	$4.8\ 10^{-2}$	$5.8\ 10^{-2}$	$7.1\ 10^{-2}$
Magnox power stations							
Berkeley	Atmospheric	$6.3\ 10^{-1}$	$4.1\ 10^{-1}$	$1.6\ 10^{-4}$	$7.2\ 10^{-5}$	$1.9\ 10^{-5}$	$1.9\ 10^{-5}$
	Liquid	$3.4\ 10^{-1}$	$2.5\ 10^{-2}$	$1.3\ 10^{-2}$	$6.4\ 10^{-1}$	$1.1\ 10^{-3}$	$2.9\ 10^{-4}$
	Total	$9.7\ 10^{-1}$	$4.4\ 10^{-1}$	$1.3\ 10^{-2}$	$6.4\ 10^{-1}$	$1.1\ 10^{-3}$	$3.1\ 10^{-4}$
Bradwell	Atmospheric	$2.4\ 10^{-1}$	$4.0\ 10^{-1}$	$3.7\ 10^{-1}$	$3.3\ 10^{-1}$	$3.5\ 10^{-4}$	$9.2\ 10^{-5}$
	Liquid	$4.8\ 10^{-1}$	$2.1\ 10^{-1}$	$3.6\ 10^{-2}$	$2.0\ 10^{-1}$	$1.8\ 10^{-1}$	$8.1\ 10^{-3}$
	Total	$7.2\ 10^{-1}$	$6.1\ 10^{-1}$	$4.0\ 10^{-1}$	$5.3\ 10^{-1}$	$1.8\ 10^{-1}$	$8.2\ 10^{-2}$

Table 6: continued

Site	Discharge	Typical individual dose ($\mu Sv\ y^{-1}$) 1975*	1985*	1993–1995†	1993–1995‡	2003	2007
Chapelcross	Atmospheric	$8.7\ 10^{-1}$	$4.0\ 10^{0}$	$3.6\ 10^{0}$	$2.0\ 10^{0}$	$4.8\ 10^{-1}$	$1.8\ 10^{-1}$
	Liquid	$9.1\ 10^{-3}$	$1.1\ 10^{-2}$	$1.3\ 10^{-3}$	$4.5\ 10^{-3}$	$6.7\ 10^{-3}$	$1.0\ 10^{-4}$
	Total	$8.8\ 10^{-1}$	$4.0\ 10^{0}$	$3.6\ 10^{0}$	$2.0\ 10^{0}$	$4.9\ 10^{-1}$	$1.8\ 10^{-1}$
Dungeness A	Atmospheric	$4.7\ 10^{-1}$	$4.7\ 10^{-1}$	$6.0\ 10^{-1}$	$7.5\ 10^{-1}$	$6.6\ 10^{-1}$	$1.7\ 10^{-2}$
	Liquid	$2.8\ 10^{-2}$	$5.5\ 10^{-2}$	$1.0\ 10^{-2}$	$3.9\ 10^{-2}$	$1.7\ 10^{-2}$	$2.9\ 10^{-3}$
	Total	$5.0\ 10^{-1}$	$5.3\ 10^{-1}$	$6.1\ 10^{-1}$	$7.9\ 10^{-1}$	$6.8\ 10^{-1}$	$2.0\ 10^{-2}$
Hinkley Point A	Atmospheric	$2.7\ 10^{0}$	$2.8\ 10^{0}$	$2.9\ 10^{0}$	$1.4\ 10^{0}$	$1.9\ 10^{-4}$	$9.4\ 10^{-5}$
	Liquid	$4.1\ 10^{-2}$	$1.6\ 10^{-2}$	$3.4\ 10^{-3}$	$1.7\ 10^{-2}$	$1.3\ 10^{-2}$	$4.2\ 10^{-3}$
	Total	$2.7\ 10^{0}$	$2.8\ 10^{0}$	$2.9\ 10^{0}$	$1.4\ 10^{0}$	$1.3\ 10^{-2}$	$4.3\ 10^{-3}$
Hunterston A	Atmospheric	$4.0\ 10^{-1}$	$6.2\ 10^{-1}$	$3.1\ 10^{-3}$	$1.9\ 10^{-3}$	$1.4\ 10^{-5}$	$1.4\ 10^{-5}$
	Liquid	$6.3\ 10^{-2}$	$2.9\ 10^{-2}$	$1.3\ 10^{-3}$	$4.3\ 10^{-3}$	$1.0\ 10^{-3}$	$4.6\ 10^{-4}$
	Total	$4.6\ 10^{-1}$	$6.5\ 10^{-1}$	$4.4\ 10^{-3}$	$6.2\ 10^{-3}$	$1.0\ 10^{-3}$	$4.8\ 10^{-4}$
Oldbury	Atmospheric	$2.6\ 10^{-1}$	$2.5\ 10^{-1}$	$8.3\ 10^{-1}$	$4.3\ 10^{-1}$	$2.1\ 10^{-1}$	$2.9\ 10^{-2}$
	Liquid	$1.1\ 10^{-1}$	$1.2\ 10^{-1}$	$1.0\ 10^{-2}$	$2.6\ 10^{-2}$	$2.5\ 10^{-1}$	$2.2\ 10^{-1}$
	Total	$3.7\ 10^{-1}$	$3.7\ 10^{-1}$	$8.4\ 10^{-1}$	$4.5\ 10^{-1}$	$4.6\ 10^{-1}$	$2.5\ 10^{-1}$
Sizewell A	Atmospheric	$9.7\ 10^{-1}$	$7.6\ 10^{-1}$	$9.6\ 10^{-1}$	$9.5\ 10^{-1}$	$9.4\ 10^{-1}$	$1.2\ 10^{-2}$
	Liquid	$4.0\ 10^{-2}$	$3.1\ 10^{-2}$	$8.4\ 10^{-3}$	$3.0\ 10^{-2}$	$1.5\ 10^{-1}$	$5.9\ 10^{-2}$
	Total	$1.0\ 10^{0}$	$7.9\ 10^{-1}$	$9.7\ 10^{-1}$	$9.8\ 10^{-1}$	$1.1\ 10^{0}$	$7.2\ 10^{-2}$
Trawsfynydd	Atmospheric	$5.6\ 10^{-1}$	$1.7\ 10^{0}$	$1.5\ 10^{-4}$	$2.0\ 10^{-4}$	$1.2\ 10^{-4}$	$2.4\ 10^{-4}$
	Liquid	$8.5\ 10^{1}$	$3.1\ 10^{1}$	$4.5\ 10^{0}$	$7.4\ 10^{0}$	$1.7\ 10^{0}$	$7.4\ 10^{-1}$
	Total	$8.6\ 10^{1}$	$3.3\ 10^{1}$	$4.5\ 10^{0}$	$7.4\ 10^{0}$	$1.7\ 10^{0}$	$7.4\ 10^{-1}$
Wylfa	Atmospheric	$5.4\ 10^{-2}$	$8.3\ 10^{-2}$	$1.3\ 10^{-1}$	$1.9\ 10^{-1}$	$1.6\ 10^{-1}$	$1.1\ 10^{-1}$
	Liquid	$1.3\ 10^{-2}$	$8.4\ 10^{-4}$	$2.9\ 10^{-3}$	$2.7\ 10^{-2}$	$3.7\ 10^{-2}$	$2.2\ 10^{-2}$
	Total	$6.7\ 10^{-2}$	$8.4\ 10^{-2}$	$1.3\ 10^{-1}$	$2.1\ 10^{-1}$	$2.0\ 10^{-1}$	$1.3\ 10^{-1}$
PWR power station							
Sizewell B	Atmospheric	nd	nd	$2.4\ 10^{-3}$	$2.6\ 10^{-3}$	$2.0\ 10^{-2}$	$2.2\ 10^{-2}$
	Liquid	nd	nd	$3.6\ 10^{-4}$	$1.3\ 10^{-3}$	$1.4\ 10^{-2}$	$3.4\ 10^{-3}$
	Total	nd	nd	$2.8\ 10^{-3}$	$3.8\ 10^{-3}$	$3.3\ 10^{-2}$	$2.5\ 10^{-2}$
Fuel reprocessing installations							
Dounreay	Atmospheric	$3.1\ 10^{-1}$	$4.0\ 10^{-1}$	$1.6\ 10^{-1}$	$6.3\ 10^{-2}$	$1.9\ 10^{-2}$	$2.6\ 10^{-3}$
	Liquid	$4.4\ 10^{0}$	$1.5\ 10^{0}$	$4.2\ 10^{-1}$	$3.6\ 10^{-1}$	$5.7\ 10^{-3}$	$2.2\ 10^{-4}$
	Total	$4.7\ 10^{0}$	$1.9\ 10^{0}$	$5.7\ 10^{-1}$	$4.2\ 10^{-1}$	$2.5\ 10^{-2}$	$2.8\ 10^{-3}$
Sellafield	Atmospheric	$2.0\ 10^{1}$	$5.8\ 10^{0}$	$3.5\ 10^{0}$	$1.5\ 10^{0}$	$6.8\ 10^{-1}$	$1.8\ 10^{-1}$
	Liquid	$3.7\ 10^{2}$	$2.7\ 10^{1}$	$6.8\ 10^{0}$	$1.4\ 10^{1}$	$1.7\ 10^{1}$	$4.8\ 10^{0}$
	Total	$3.9\ 10^{2}$	$3.3\ 10^{1}$	$1.0\ 10^{1}$	$1.6\ 10^{1}$	$1.8\ 10^{1}$	$4.9\ 10^{0}$

Table 6: continued

		Typical individual dose (μSv y^{-1})					
Site	**Discharge**	**1975***	**1985***	**1993–1995†**	**1993–1995‡**	**2003**	**2007**
Other installations							
Amersham	Atmospheric	nd	$1.3\ 10^{0}$	$3.3\ 10^{-1}$	$1.9\ 10^{-1}$	$1.1\ 10^{-1}$	$3.2\ 10^{-1}$
	Liquid	nd	$3.7\ 10^{-1}$	$2.4\ 10^{0}$	$9.0\ 10^{-1}$	$7.3\ 10^{-2}$	$2.2\ 10^{-2}$
	Total	nd	$1.7\ 10^{0}$	$2.7\ 10^{0}$	$1.1\ 10^{0}$	$1.8\ 10^{-1}$	$3.5\ 10^{-1}$
Cardiff	Atmospheric	nd	$6.8\ 10^{-1}$	$7.9\ 10^{-1}$	$3.7\ 10^{-1}$	$4.0\ 10^{-1}$	$3.2\ 10^{-1}$
	Liquid	nd	$9.8\ 10^{-2}$	$1.1\ 10^{-1}$	$5.9\ 10^{0}$	$7.0\ 10^{-1}$	$7.0\ 10^{-1}$
	Total	nd	$7.8\ 10^{-1}$	$9.0\ 10^{-1}$	$6.2\ 10^{0}$	$1.1\ 10^{0}$	$1.0\ 10^{0}$
Harwell	Atmospheric	$1.0\ 10^{-1}$	$1.3\ 10^{-1}$	$9.8\ 10^{-3}$	$1.0\ 10^{-2}$	$8.0\ 10^{-2}$	$7.7\ 10^{-2}$
	Liquid	$1.9\ 10^{1}$	$1.5\ 10^{0}$	$1.9\ 10^{-1}$	$7.8\ 10^{-2}$	$9.4\ 10^{-3}$	$3.3\ 10^{-3}$
	Total	$1.9\ 10^{1}$	$1.6\ 10^{0}$	$2.0\ 10^{-1}$	$8.8\ 10^{-2}$	$9.0\ 10^{-2}$	$8.0\ 10^{-2}$
Winfrith	Atmospheric	$7.2\ 10^{-2}$	$9.4\ 10^{-2}$	$7.2\ 10^{-3}$	$4.0\ 10^{-3}$	$1.6\ 10^{-2}$	$3.9\ 10^{-3}$
	Liquid	$7.1\ 10^{0}$	$5.9\ 10^{0}$	$9.4\ 10^{-3}$	$9.4\ 10^{-4}$	$8.8\ 10^{-4}$	$1.3\ 10^{-4}$
	Total	$7.2\ 10^{0}$	$6.0\ 10^{0}$	$1.7\ 10^{-2}$	$5.0\ 10^{-3}$	$1.7\ 10^{-2}$	$4.0\ 10^{-3}$
Mean (all sites)	**Atmospheric**	**$1.8\ 10^{0}$**	**$9.2\ 10^{-1}$**	**$5.8\ 10^{-1}$**	**$3.4\ 10^{-1}$**	**$1.8\ 10^{-1}$**	**$7.2\ 10^{-2}$**
	Liquid	**$3.0\ 10^{1}$**	**$3.0\ 10^{0}$**	**$5.6\ 10^{-1}$**	**$1.2\ 10^{0}$**	**$8.0\ 10^{-1}$**	**$2.5\ 10^{-1}$**
	Total	**$3.2\ 10^{1}$**	**$3.9\ 10^{0}$**	**$1.1\ 10^{0}$**	**$1.5\ 10^{0}$**	**$9.8\ 10^{-1}$**	**$3.3\ 10^{-1}$**

* Taken from NRPB-R312.
† Calculated using PC-CREAM 98.
‡ Calculated using PC-CREAM 08.
§ nd = no discharges.

5.4 Average dose and dose rates for a member of the UK population

The per-caput doses to the UK population in the 100th year are presented in Table 7. In addition, the per-caput dose rates for different time periods are presented in Tables 8 and 9. The size of the UK population was taken to be 60 million people. The highest total per-caput doses from a UK civil nuclear site based on discharges in 2003 and 2007 were 61 nSv and 16 nSv, respectively, in both cases from Sellafield. The lowest per-caput dose for discharges in 2003 was calculated for Berkeley (0.0013 nSv), while the lowest per-caput dose for discharges in 2007 was calculated for Capenhurst (0.00031 nSv). The relatively large per-caput doses from the Cardiff installation are as a result of the high levels of ^{14}C and ^{3}H discharged.

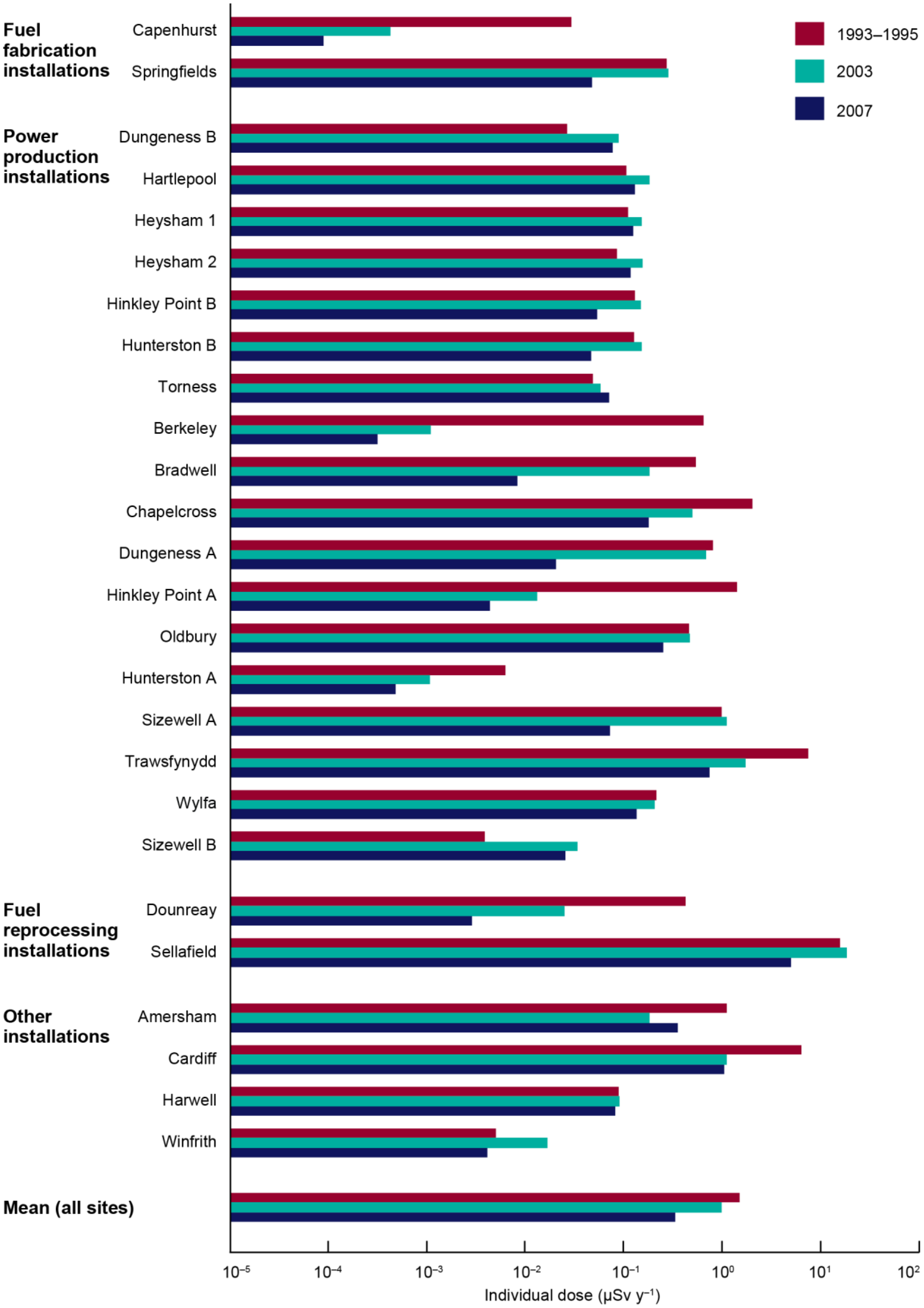

Figure 5: Breakdown of typical annual individual dose by site and installation type

Table 7: Per-caput doses to the UK population in the 100th year from discharges in 2003 and 2007 from all UK civil nuclear sites

	Per-caput dose (nSv)	
Site	**2003**	**2007**
Fuel fabrication installations		
Capenhurst	$7.9\ 10^{-3}$	$3.1\ 10^{-4}$
Springfields	$4.6\ 10^{-1}$	$2.5\ 10^{-1}$
Power production installations		
AGR power stations		
Dungeness B	$2.7\ 10^{0}$	$2.8\ 10^{0}$
Hartlepool	$8.1\ 10^{0}$	$7.2\ 10^{0}$
Heysham 1	$7.2\ 10^{0}$	$6.3\ 10^{0}$
Heysham 2	$5.2\ 10^{0}$	$6.5\ 10^{0}$
Hinkley Point B	$6.6\ 10^{0}$	$2.5\ 10^{0}$
Hunterston B	$5.2\ 10^{0}$	$1.7\ 10^{0}$
Torness	$2.5\ 10^{0}$	$3.4\ 10^{0}$
Magnox power stations		
Berkeley	$1.3\ 10^{-3}$	$1.3\ 10^{-3}$
Bradwell	$6.0\ 10^{-2}$	$8.3\ 10^{-3}$
Chapelcross	$5.0\ 10^{0}$	$5.9\ 10^{-1}$
Dungeness A	$1.2\ 10^{1}$	$8.4\ 10^{-1}$
Hinkley Point A	$2.0\ 10^{-2}$	$6.7\ 10^{-3}$
Hunterston A	$2.5\ 10^{-3}$	$1.1\ 10^{-3}$
Oldbury	$1.1\ 10^{1}$	$1.7\ 10^{0}$
Sizewell A	$7.4\ 10^{0}$	$5.9\ 10^{-1}$
Trawsfynydd	$5.5\ 10^{-3}$	$1.1\ 10^{-2}$
Wylfa	$5.4\ 10^{0}$	$3.8\ 10^{0}$
PWR power station		
Sizewell B	$1.4\ 10^{0}$	$1.4\ 10^{0}$
Fuel reprocessing installations		
Dounreay	$5.4\ 10^{-2}$	$1.5\ 10^{-2}$
Sellafield	$6.1\ 10^{1}$	$1.6\ 10^{1}$
Other installations		
Amersham	$3.1\ 10^{0}$	$7.7\ 10^{0}$
Cardiff	$1.5\ 10^{1}$	$1.4\ 10^{1}$
Harwell	$1.0\ 10^{0}$	$9.7\ 10^{-1}$
Winfrith	$3.8\ 10^{-1}$	$9.4\ 10^{-2}$

Table 8: Per-caput dose rates for different time periods following discharges in 2003 from all UK civil nuclear sites

	Per-caput dose rates for time period in years (nSv y^{-1})					
Site	**1–50**	**50–100**	**100–500**	**500–1,000**	**1,000–10,000**	**10,000–100,000**
Fuel fabrication installations						
Capenhurst	$2.6\ 10^{-6}$	$4.0\ 10^{-7}$	$4.2\ 10^{-7}$	$3.9\ 10^{-7}$	$3.8\ 10^{-7}$	$4.2\ 10^{-7}$
Springfields	$3.2\ 10^{-4}$	$9.0\ 10^{-5}$	$3.6\ 10^{-5}$	$2.8\ 10^{-5}$	$2.6\ 10^{-5}$	$2.8\ 10^{-5}$
Power production installations						
AGR power stations						
Dungeness B	$1.1\ 10^{-2}$	$3.5\ 10^{-3}$	$1.7\ 10^{-3}$	$1.0\ 10^{-3}$	$5.3\ 10^{-4}$	$2.3\ 10^{-6}$
Hartlepool	$2.7\ 10^{-2}$	$8.9\ 10^{-3}$	$4.2\ 10^{-3}$	$2.6\ 10^{-3}$	$1.3\ 10^{-3}$	$5.7\ 10^{-6}$
Heysham 1	$2.5\ 10^{-2}$	$8.3\ 10^{-3}$	$3.9\ 10^{-3}$	$2.4\ 10^{-3}$	$1.2\ 10^{-3}$	$5.3\ 10^{-6}$
Heysham 2	$1.8\ 10^{-2}$	$6.0\ 10^{-3}$	$2.8\ 10^{-3}$	$1.7\ 10^{-3}$	$9.0\ 10^{-4}$	$3.9\ 10^{-6}$
Hinkley Point B	$1.9\ 10^{-2}$	$6.0\ 10^{-3}$	$2.9\ 10^{-3}$	$1.7\ 10^{-3}$	$9.0\ 10^{-4}$	$3.9\ 10^{-6}$
Hunterston B	$2.4\ 10^{-2}$	$8.0\ 10^{-3}$	$3.8\ 10^{-3}$	$2.3\ 10^{-3}$	$1.2\ 10^{-3}$	$5.2\ 10^{-6}$
Torness	$9.6\ 10^{-3}$	$3.2\ 10^{-3}$	$1.5\ 10^{-3}$	$9.2\ 10^{-4}$	$4.8\ 10^{-4}$	$2.1\ 10^{-6}$
Magnox power stations						
Berkeley	$3.9\ 10^{-6}$	$1.3\ 10^{-6}$	$5.9\ 10^{-7}$	$3.6\ 10^{-7}$	$1.9\ 10^{-7}$	$8.0\ 10^{-10}$
Bradwell	$3.6\ 10^{-4}$	$5.2\ 10^{-5}$	$1.3\ 10^{-5}$	$5.4\ 10^{-6}$	$2.8\ 10^{-6}$	$1.2\ 10^{-8}$
Chapelcross	$2.5\ 10^{-3}$	$7.8\ 10^{-4}$	$3.6\ 10^{-4}$	$2.2\ 10^{-4}$	$1.1\ 10^{-4}$	$4.9\ 10^{-7}$
Dungeness A	$5.0\ 10^{-2}$	$1.7\ 10^{-2}$	$8.0\ 10^{-3}$	$4.8\ 10^{-3}$	$2.5\ 10^{-3}$	$1.1\ 10^{-5}$
Hinkley Point A	$1.0\ 10^{-4}$	$2.2\ 10^{-5}$	$8.2\ 10^{-6}$	$3.9\ 10^{-6}$	$2.0\ 10^{-6}$	$9.0\ 10^{-9}$
Hunterston A	$2.4\ 10^{-5}$	$2.9\ 10^{-6}$	$8.0\ 10^{-7}$	$2.9\ 10^{-7}$	$1.4\ 10^{-7}$	$9.2\ 10^{-10}$
Oldbury	$2.9\ 10^{-2}$	$9.4\ 10^{-3}$	$4.5\ 10^{-3}$	$2.7\ 10^{-3}$	$1.4\ 10^{-3}$	$6.1\ 10^{-6}$
Sizewell A	$1.9\ 10^{-2}$	$6.2\ 10^{-3}$	$3.0\ 10^{-3}$	$1.8\ 10^{-3}$	$9.3\ 10^{-4}$	$4.0\ 10^{-6}$
Trawsfynydd	$4.6\ 10^{-5}$	$7.2\ 10^{-6}$	$3.3\ 10^{-6}$	$2.0\ 10^{-6}$	$1.0\ 10^{-6}$	$4.5\ 10^{-9}$
Wylfa	$2.1\ 10^{-2}$	$7.0\ 10^{-3}$	$3.3\ 10^{-3}$	$2.0\ 10^{-3}$	$1.0\ 10^{-3}$	$4.5\ 10^{-6}$
PWR power station						
Sizewell B	$4.1\ 10^{-3}$	$1.4\ 10^{-3}$	$6.6\ 10^{-4}$	$4.0\ 10^{-4}$	$2.1\ 10^{-4}$	$9.0\ 10^{-7}$
Fuel reprocessing installations						
Dounreay	$1.0\ 10^{-4}$	$1.6\ 10^{-5}$	$1.7\ 10^{-6}$	$9.3\ 10^{-7}$	$4.3\ 10^{-7}$	$1.2\ 10^{-7}$
Sellafield	$5.6\ 10^{-1}$	$1.1\ 10^{-1}$	$4.2\ 10^{-2}$	$2.5\ 10^{-2}$	$1.3\ 10^{-2}$	$1.0\ 10^{-4}$
Other installations						
Amersham	$6.5\ 10^{-4}$	$3.3\ 10^{-5}$	$1.3\ 10^{-6}$	$1.5\ 10^{-8}$	$6.6\ 10^{-9}$	$1.1\ 10^{-9}$
Cardiff	$2.5\ 10^{-2}$	$8.9\ 10^{-3}$	$4.3\ 10^{-3}$	$2.6\ 10^{-3}$	$1.4\ 10^{-3}$	$6.1\ 10^{-6}$
Harwell	$1.6\ 10^{-4}$	$2.9\ 10^{-5}$	$1.9\ 10^{-5}$	$4.1\ 10^{-6}$	$1.8\ 10^{-6}$	$1.3\ 10^{-6}$
Winfrith	$1.3\ 10^{-4}$	$3.3\ 10^{-5}$	$4.3\ 10^{-6}$	$1.1\ 10^{-7}$	$2.2\ 10^{-8}$	$2.2\ 10^{-9}$

Table 9: Per-caput dose rates for different time periods following discharges in 2007 from all UK civil nuclear sites

	Per-caput dose rates for time period in years (nSv y^{-1})					
Site	**1–50**	**50–100**	**100–500**	**500–1,000**	**1,000–10,000**	**10,000–100,000**
Fuel fabrication installations						
Capenhurst	$6.4\ 10^{-7}$	$2.6\ 10^{-8}$	$1.6\ 10^{-8}$	$1.6\ 10^{-8}$	$1.5\ 10^{-8}$	$1.6\ 10^{-8}$
Springfields	$1.7\ 10^{-4}$	$4.4\ 10^{-5}$	$1.8\ 10^{-5}$	$1.6\ 10^{-5}$	$1.5\ 10^{-5}$	$1.6\ 10^{-5}$
Power production installations						
AGR power stations						
Dungeness B	$1.2\ 10^{-2}$	$3.9\ 10^{-3}$	$1.9\ 10^{-3}$	$1.1\ 10^{-3}$	$5.9\ 10^{-4}$	$2.5\ 10^{-6}$
Hartlepool	$2.4\ 10^{-2}$	$8.2\ 10^{-3}$	$3.9\ 10^{-3}$	$2.4\ 10^{-3}$	$1.2\ 10^{-3}$	$5.3\ 10^{-6}$
Heysham 1	$2.2\ 10^{-2}$	$7.3\ 10^{-3}$	$3.5\ 10^{-3}$	$2.1\ 10^{-3}$	$1.1\ 10^{-3}$	$4.7\ 10^{-6}$
Heysham 2	$2.2\ 10^{-2}$	$7.5\ 10^{-3}$	$3.6\ 10^{-3}$	$2.2\ 10^{-3}$	$1.1\ 10^{-3}$	$4.8\ 10^{-6}$
Hinkley Point B	$7.2\ 10^{-3}$	$2.3\ 10^{-3}$	$1.1\ 10^{-3}$	$6.7\ 10^{-4}$	$3.5\ 10^{-4}$	$1.5\ 10^{-6}$
Hunterston B	$7.9\ 10^{-3}$	$2.7\ 10^{-3}$	$1.3\ 10^{-3}$	$7.7\ 10^{-4}$	$4.0\ 10^{-4}$	$1.7\ 10^{-6}$
Torness	$1.3\ 10^{-2}$	$4.4\ 10^{-3}$	$2.1\ 10^{-3}$	$1.2\ 10^{-3}$	$6.5\ 10^{-4}$	$2.8\ 10^{-6}$
Magnox power stations						
Berkeley	$3.8\ 10^{-6}$	$1.2\ 10^{-6}$	$5.9\ 10^{-7}$	$3.5\ 10^{-7}$	$1.9\ 10^{-7}$	$8.0\ 10^{-10}$
Bradwell	$3.0\ 10^{-5}$	$6.9\ 10^{-6}$	$2.8\ 10^{-6}$	$1.6\ 10^{-6}$	$8.2\ 10^{-7}$	$3.6\ 10^{-9}$
Chapelcross	$2.9\ 10^{-5}$	$6.6\ 10^{-7}$	$1.9\ 10^{-7}$	$8.0\ 10^{-8}$	$4.2\ 10^{-8}$	$1.9\ 10^{-10}$
Dungeness A	$3.6\ 10^{-3}$	$1.2\ 10^{-3}$	$5.7\ 10^{-4}$	$3.4\ 10^{-4}$	$1.8\ 10^{-4}$	$7.7\ 10^{-7}$
Hinkley Point A	$2.8\ 10^{-5}$	$4.3\ 10^{-6}$	$1.7\ 10^{-6}$	$1.0\ 10^{-6}$	$5.3\ 10^{-7}$	$2.3\ 10^{-9}$
Hunterston A	$6.8\ 10^{-6}$	$1.5\ 10^{-6}$	$5.6\ 10^{-7}$	$2.6\ 10^{-7}$	$1.4\ 10^{-7}$	$7.0\ 10^{-10}$
Oldbury	$4.9\ 10^{-3}$	$1.6\ 10^{-3}$	$7.6\ 10^{-4}$	$4.6\ 10^{-4}$	$2.4\ 10^{-4}$	$1.0\ 10^{-6}$
Sizewell A	$1.8\ 10^{-3}$	$5.5\ 10^{-4}$	$2.6\ 10^{-4}$	$1.6\ 10^{-4}$	$8.2\ 10^{-5}$	$3.5\ 10^{-7}$
Trawsfynydd	$6.6\ 10^{-5}$	$1.4\ 10^{-5}$	$6.4\ 10^{-6}$	$3.9\ 10^{-6}$	$2.0\ 10^{-6}$	$8.7\ 10^{-9}$
Wylfa	$1.5\ 10^{-2}$	$4.9\ 10^{-3}$	$2.4\ 10^{-3}$	$1.4\ 10^{-3}$	$7.4\ 10^{-4}$	$3.2\ 10^{-6}$
PWR power station						
Sizewell B	$4.3\ 10^{-3}$	$1.5\ 10^{-3}$	$6.9\ 10^{-4}$	$4.2\ 10^{-4}$	$2.2\ 10^{-4}$	$9.4\ 10^{-7}$
Fuel reprocessing installations						
Dounreay	$2.1\ 10^{-5}$	$1.1\ 10^{-6}$	$5.8\ 10^{-7}$	$4.7\ 10^{-7}$	$2.2\ 10^{-7}$	$8.7\ 10^{-9}$
Sellafield	$1.5\ 10^{-1}$	$3.0\ 10^{-2}$	$1.2\ 10^{-2}$	$7.2\ 10^{-3}$	$3.8\ 10^{-3}$	$2.7\ 10^{-5}$
Other installations						
Amersham	$5.4\ 10^{-4}$	$3.1\ 10^{-5}$	$8.2\ 10^{-7}$	$6.1\ 10^{-8}$	$7.7\ 10^{-9}$	$8.6\ 10^{-10}$
Cardiff	$2.9\ 10^{-2}$	$1.0\ 10^{-2}$	$5.0\ 10^{-3}$	$3.0\ 10^{-3}$	$1.6\ 10^{-3}$	$6.9\ 10^{-6}$
Harwell	$5.1\ 10^{-5}$	$1.0\ 10^{-5}$	$3.0\ 10^{-6}$	$1.7\ 10^{-6}$	$1.2\ 10^{-6}$	$9.2\ 10^{-7}$
Winfrith	$2.0\ 10^{-5}$	$3.7\ 10^{-6}$	$4.7\ 10^{-7}$	$1.3\ 10^{-8}$	$2.4\ 10^{-9}$	$2.7\ 10^{-10}$

6 Summary

This report updates and extends an earlier report (NRPB-R312 – Bexon, 2000) on the radiological impact of routine discharges from UK civil nuclear licensed sites. Recent discharge data (EA et al, 2004, 2008) updated dose coefficients and a new version of the computer code PC-CREAM, called PC-CREAM 08 (PHE, 2014), were used to calculate doses. PC-CREAM 08 includes a revised methodology (Smith and Simmonds, 2009) and updates to the seafood catches, agricultural production and population grid data performed for another study (Jones et al, 2013). Collective doses were calculated integrated to 500 years for the populations of Europe and the UK and typical annual individual doses to residents living near nuclear sites. In addition, per-caput doses and dose rates were calculated using discharges in the years 2003 and 2007. The mid-1990s doses calculated in the previous report (Bexon, 2000) were recalculated using PC-CREAM 08 to provide a comparison.

The total collective doses integrated to 500 years to the European population due to discharges from UK civil nuclear sites in 2003 and 2007 were 41 man Sv and 19 man Sv, respectively, continuing the downward trend in dose seen in the previous report (Bexon, 2000). The highest calculated collective dose integrated to 500 years to the European population was 370 man Sv from discharges made in 1975. Reductions in discharges led to a related decrease in the collective dose to 110 man Sv due to 1985 discharges, and to 92 man Sv using mid-1990s discharges. The mid-1990s dose was recalculated using the updated PC-CREAM model and the collective dose was revised to 43 man Sv. Compared with previous decades there has been a significantly lower contribution from Sellafield discharges. The number of power production sites undergoing decommissioning has increased in the period considered; however, power production is the main contributor to collective dose. Reprocessing sites are the second greatest contributor to collective dose, both to the population of Europe and to that of the UK.

The collective doses integrated to 500 years to the UK population due to discharges from UK civil nuclear sites in in 2003 and 2007 are 12 man Sv and 6 man Sv, respectively. For the UK population, the pattern of declining doses is the same: from 130 man Sv in 1975 to 24 man Sv in 1985 and 17 man Sv in the mid-1990s. The recalculated mid-1990s collective dose is 14 man Sv.

The per-caput doses to the UK population in the 100th year from discharges in 2003 ranged from 0.0013 nSv to 61 nSv; those for discharges in 2007 were between 0.00031 nSv and 16 nSv. For both years the highest per-caput dose was calculated for discharges from Sellafield.

Annual doses calculated to typical individuals living in the vicinity of UK civil nuclear sites were not radiologically significant. The 1990s mean dose increased to about 1.5 μSv and the 2003 and 2007 doses were approximately 1 μSv and 0.3 μSv, respectively. The trend in the doses is downwards, as would be expected, with the largest drop from 1975 to 1985: in 1975 the dose was estimated to be 32 μSv, in 1985 approximately 4 μSv and 1 μSv in the mid-1990s. Reprocessing remains the operation leading to the highest typical annual individual doses.

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Appendix A Radioactive Discharges from UK Civil Nuclear Licensed Sites in 1993–1995, 2003 and 2007

The discharges used to calculate the doses in this report are presented here. Discharges to the atmospheric and aquatic environments in 2003 and 2007 were obtained from an EC database (EC, 2004) and RIFE reports (EA et al, 2004, 2008). Where no annual discharge was reported, 'nd' was used to indicate no discharge. The discharges for the 1990s are taken from the previous report (Bexon, 2000) and are the average of the three years 1993–1995. The tables are grouped according to the type of installation; nuclear power stations are also grouped according to the type of reactor. As stated in the main report (Section 4.1), some discharges were given as aggregated totals; assumptions made when apportioning discharges in 2003 and 2007 to different radionuclides are given in the sections below. Assumptions for the discharges in the years 1993–1995 are given in the previous report (Bexon, 2000) and have not been repeated here.

A1 Atmospheric radioactive discharges from UK civil nuclear licensed sites

Atmospheric radioactive discharges from UK civil nuclear licensed sites assumed in the calculations carried out for this study are given in Tables A1 to A4 for the different types of installation considered.

Atmospheric radioactive discharges from fuel fabrication installations are reported in Table A1. Discharges from these installations reported as uranium were assumed to be 49% ^{234}U, 49% ^{238}U and 2% ^{235}U; it was also assumed that ^{234}Th was in secular equilibrium with ^{238}U.

Atmospheric radioactive discharges from nuclear power plants are reported in Table A2. Discharges from AGR power stations reported as beta/gamma were assumed to be all ^{65}Zn. Discharges from Magnox reactors reported as beta/gamma were assumed to be 23% ^{60}Co and 77% ^{137}Cs. Discharges from Sizewell B reported as beta/gamma were assumed to be 4% ^{60}Co and 96% ^{137}Cs; discharges reported as noble gases were assumed to be all ^{133}Xe (EC, 2004).

Atmospheric radioactive discharges from nuclear fuel reprocessing installations are reported in Table A3. Discharges from Dounreay in 2003 reported as beta/gamma were assumed to be ^{60}Co; discharges reported as other alpha were assumed to be 16% ^{239}Pu and 84% ^{241}Am, while discharges reported as ^{243}Cm + ^{244}Cm were assumed to be 50% of each radionuclide. Discharges from Sellafield reported as ^{241}Am + ^{242}Cm were assumed to be all ^{241}Am.

Atmospheric radioactive discharges from other installations are reported in Table A4. Discharges from Amersham in 2007 reported as radionuclides with a half-life of less than two hours were assumed to be ^{18}F; discharges reported as other noble gases were assumed to be all ^{133}Xe, while discharges reported as 'other' were assumed to be ^{137}Cs (Shackleton, 2012). Discharges from Harwell reported as beta were assumed to be 30% ^{137}Cs, 25% ^{90}Sr, 20% ^{60}Co, 20% ^{241}Pu and 5% ^{154}Eu, while discharges reported as alpha were assumed to be 30% ^{239}Pu, 30% ^{240}Pu, 15% ^{238}Pu, 15% ^{241}Am, 2% ^{226}Ra, 2% ^{226}Th, 2% ^{232}Th, 2% ^{234}U and 2% ^{238}U (Bexon, 2000). Discharges from Winfrith reported as beta/gamma were assumed to be all ^{60}Co (EC, 2004).

Table A1: Atmospheric radioactive discharges from nuclear fuel fabrication installations

		Annual discharges (Bq)		
Site	**Radionuclide**	**1993–1995**	**2003**	**2007**
Capenhurst	^{3}H	$6.70\ 10^{13}$	$1.02\ 10^{11}$	$5.20\ 10^{6}$
	^{234}Th	$2.94\ 10^{6}$	$5.00\ 10^{6}$	$1.96\ 10^{5}$
	^{234}U	$2.94\ 10^{6}$	$5.00\ 10^{6}$	$1.96\ 10^{5}$
	^{235}U	$1.20\ 10^{5}$	$2.04\ 10^{5}$	$8.00\ 10^{3}$
	^{238}U	$2.94\ 10^{6}$	$5.00\ 10^{6}$	$1.96\ 10^{5}$
Springfields	^{234}Th	$6.29\ 10^{8}$	$4.41\ 10^{8}$	$2.55\ 10^{8}$
	^{234}U	$6.29\ 10^{8}$	$4.41\ 10^{8}$	$2.55\ 10^{8}$
	^{235}U	$2.57\ 10^{7}$	$1.80\ 10^{7}$	$1.04\ 10^{7}$
	^{238}U	$6.29\ 10^{8}$	$4.41\ 10^{8}$	$2.55\ 10^{8}$

Table A2: Atmospheric radioactive discharges from nuclear power production installations

Site	Radionuclide	Annual discharges (Bq) 1993–1995	2003	2007
AGR power stations				
Dungeness B	^{3}H	$2.44\ 10^{12}$	$1.10\ 10^{13}$	$4.46\ 10^{12}$
	^{14}C	$1.61\ 10^{11}$	$7.14\ 10^{11}$	$7.97\ 10^{11}$
	^{35}S	$1.26\ 10^{10}$	$8.89\ 10^{10}$	$3.66\ 10^{10}$
	^{41}Ar	$2.01\ 10^{13}$	$1.87\ 10^{13}$	$2.09\ 10^{13}$
	^{60}Co	nd	nd	$3.67\ 10^{5}$
	^{65}Zn	$4.28\ 10^{7}$	$2.25\ 10^{8}$	$1.34\ 10^{6}$
	^{131}I	$4.35\ 10^{6}$	$2.10\ 10^{6}$	$1.03\ 10^{7}$
Hartlepool	^{3}H	$1.12\ 10^{12}$	$2.54\ 10^{12}$	$8.43\ 10^{11}$
	^{14}C	$8.77\ 10^{11}$	$1.80\ 10^{12}$	$1.66\ 10^{12}$
	^{35}S	$2.88\ 10^{10}$	$1.21\ 10^{11}$	$1.87\ 10^{10}$
	^{41}Ar	$2.57\ 10^{13}$	$3.03\ 10^{13}$	$6.83\ 10^{12}$
	^{60}Co	nd	nd	$1.95\ 10^{6}$
	^{65}Zn	$3.67\ 10^{7}$	$8.76\ 10^{6}$	$9.42\ 10^{5}$
	^{131}I	$2.64\ 10^{8}$	$2.49\ 10^{7}$	$4.76\ 10^{7}$
	^{133}Xe	nd	nd	$4.00\ 10^{12}$
Heysham 1	^{3}H	$7.30\ 10^{11}$	$1.36\ 10^{12}$	$1.18\ 10^{12}$
	^{14}C	$1.03\ 10^{12}$	$1.67\ 10^{12}$	$1.48\ 10^{12}$
	^{35}S	$1.73\ 10^{10}$	$2.62\ 10^{10}$	$2.10\ 10^{10}$
	^{41}Ar	$1.59\ 10^{13}$	$1.43\ 10^{13}$	$8.01\ 10^{12}$
	^{60}Co	nd	nd	$4.42\ 10^{6}$
	^{65}Zn	$4.80\ 10^{7}$	$7.89\ 10^{6}$	$1.91\ 10^{6}$
	^{131}I	$1.21\ 10^{9}$	$1.15\ 10^{8}$	$8.99\ 10^{7}$
	^{133}Xe	nd	nd	$4.00\ 10^{12}$
Heysham 2	^{3}H	$1.71\ 10^{12}$	$1.13\ 10^{12}$	$1.17\ 10^{12}$
	^{14}C	$6.77\ 10^{11}$	$1.21\ 10^{12}$	$1.52\ 10^{12}$
	^{35}S	$9.33\ 10^{9}$	$1.60\ 10^{10}$	$1.00\ 10^{10}$
	^{41}Ar	$1.63\ 10^{13}$	$1.80\ 10^{13}$	$8.84\ 10^{12}$
	^{60}Co	nd	nd	$6.94\ 10^{6}$
	^{65}Zn	$2.51\ 10^{7}$	$1.37\ 10^{7}$	$2.76\ 10^{6}$
	^{131}I	$2.59\ 10^{8}$	$3.95\ 10^{7}$	$3.82\ 10^{7}$
	^{133}Xe	nd	nd	$4.00\ 10^{12}$
Hinkley Point B	^{3}H	$1.98\ 10^{12}$	$7.18\ 10^{12}$	$9.02\ 10^{11}$
	^{14}C	$1.21\ 10^{12}$	$1.22\ 10^{12}$	$4.72\ 10^{11}$
	^{35}S	$9.53\ 10^{10}$	$1.93\ 10^{11}$	$6.70\ 10^{10}$
	^{41}Ar	$3.98\ 10^{13}$	$1.51\ 10^{13}$	$3.76\ 10^{12}$
	^{60}Co	nd	nd	$5.23\ 10^{6}$
	^{65}Zn	$2.63\ 10^{8}$	$3.88\ 10^{7}$	$6.24\ 10^{6}$
	^{131}I	$7.40\ 10^{7}$	$4.07\ 10^{6}$	$5.91\ 10^{6}$
	^{133}Xe	nd	nd	$4.00\ 10^{12}$
Hunterston B	^{3}H	$4.17\ 10^{12}$	$6.07\ 10^{12}$	$1.60\ 10^{12}$
	^{14}C	$1.13\ 10^{12}$	$1.62\ 10^{12}$	$5.40\ 10^{11}$
	^{35}S	$9.83\ 10^{10}$	$6.75\ 10^{10}$	$1.82\ 10^{10}$
	^{41}Ar	$3.83\ 10^{13}$	$3.94\ 10^{13}$	$5.90\ 10^{12}$

Table A2: continued

		Annual discharges (Bq)		
Site	**Radionuclide**	**1993–1995**	**2003**	**2007**
Hunterston B: continued	^{55}Fe	$4.27\ 10^{7}$	nd	nd
	^{60}Co	$4.27\ 10^{7}$	nd	nd
	^{65}Zn	nd	$9.00\ 10^{7}$	$4.47\ 10^{7}$
	^{131}I	nd	nd	$8.13\ 10^{7}$
Torness	^{3}H	$1.57\ 10^{12}$	$2.35\ 10^{12}$	$2.62\ 10^{12}$
	^{14}C	$5.10\ 10^{11}$	$6.52\ 10^{11}$	$8.80\ 10^{11}$
	^{35}S	$2.23\ 10^{10}$	$2.12\ 10^{10}$	$8.73\ 10^{9}$
	^{41}Ar	$6.70\ 10^{12}$	$5.26\ 10^{12}$	$5.45\ 10^{12}$
	^{55}Fe	$1.23\ 10^{7}$	nd	nd
	^{60}Co	$1.23\ 10^{7}$	nd	nd
	^{65}Zn	nd	$4.49\ 10^{6}$	$3.34\ 10^{6}$
	^{131}I	nd	nd	$2.21\ 10^{6}$
Magnox power stations				
Berkeley	^{3}H	$2.80\ 10^{10}$	$3.71\ 10^{9}$	$4.21\ 10^{9}$
	^{14}C	$7.03\ 10^{8}$	$2.51\ 10^{8}$	$2.50\ 10^{8}$
	^{35}S	$3.30\ 10^{7}$	nd	nd
	^{60}Co	nd	$9.03\ 10^{4}$	$5.71\ 10^{4}$
	^{65}Zn	$7.91\ 10^{6}$	nd	nd
	^{137}C	nd	$3.10\ 10^{5}$	$1.96\ 10^{5}$
Bradwell	^{3}H	$9.18\ 10^{11}$	$8.50\ 10^{10}$	$2.26\ 10^{10}$
	^{14}C	$3.85\ 10^{11}$	$3.76\ 10^{9}$	$1.11\ 10^{9}$
	^{35}S	$7.67\ 10^{10}$	$8.50\ 10^{7}$	nd
	^{41}Ar	$7.09\ 10^{14}$	nd	nd
	^{60}Co	nd	$4.54\ 10^{6}$	$9.32\ 10^{5}$
	^{65}Zn	$1.57\ 10^{8}$	$2.01\ 10^{7}$	$4.13\ 10^{6}$
	^{137}Cs	nd	$1.56\ 10^{7}$	$3.20\ 10^{6}$
Chapelcross	^{3}H	$1.57\ 10^{15}$	$4.10\ 10^{14}$	$5.81\ 10^{13}$
	^{14}C	$3.90\ 10^{11}$	$1.53\ 10^{11}$	$5.60\ 10^{7}$
	^{35}S	$2.27\ 10^{10}$	$3.71\ 10^{9}$	$2.70\ 10^{7}$
	^{41}Ar	$3.20\ 10^{15}$	$7.48\ 10^{14}$	nd
Dungeness A	^{3}H	$6.17\ 10^{11}$	$4.78\ 10^{11}$	$2.19\ 10^{11}$
	^{14}C	$3.50\ 10^{12}$	$3.41\ 10^{12}$	$2.43\ 10^{11}$
	^{35}S	$9.26\ 10^{10}$	$3.56\ 10^{10}$	$1.65\ 10^{9}$
	^{41}Ar	$1.21\ 10^{15}$	$1.05\ 10^{15}$	nd
	^{60}Co	nd	$5.08\ 10^{7}$	$1.45\ 10^{7}$
	^{65}Zn	$2.84\ 10^{8}$	$2.25\ 10^{8}$	$6.41\ 10^{7}$
	^{137}Cs	nd	$1.74\ 10^{8}$	$4.96\ 10^{7}$
Hinkley Point A	^{3}H	$2.26\ 10^{12}$	$1.26\ 10^{10}$	$1.03\ 10^{11}$
	^{14}C	$1.47\ 10^{12}$	$2.63\ 10^{9}$	$7.12\ 10^{8}$
	^{35}S	$7.54\ 10^{10}$	nd	nd
	^{41}Ar	$3.14\ 10^{15}$	nd	nd
	^{60}Co	nd	$6.86\ 10^{5}$	$9.86\ 10^{4}$
	^{65}Zn	$2.04\ 10^{8}$	$3.00\ 10^{6}$	$4.40\ 10^{5}$
	^{137}Cs	nd	$2.35\ 10^{6}$	$3.38\ 10^{5}$

Table A2: continued

Site	Radionuclide	Annual discharges (Bq)		
		1993–1995	2003	2007
Hunterston A	^{3}H	$2.73\ 10^{10}$	$1.59\ 10^{9}$	$1.61\ 10^{9}$
	^{14}C	$2.80\ 10^{10}$	$1.88\ 10^{8}$	$1.81\ 10^{8}$
	^{60}Co	nd	$1.02\ 10^{5}$	$8.58\ 10^{4}$
	^{65}Zn	$2.47\ 10^{6}$	nd	nd
	^{137}Cs	nd	$3.48\ 10^{5}$	$2.94\ 10^{5}$
Oldbury	^{3}H	$1.90\ 10^{12}$	$3.29\ 10^{12}$	$1.31\ 10^{12}$
	^{14}C	$3.90\ 10^{12}$	$1.91\ 10^{12}$	$3.25\ 10^{11}$
	^{35}S	$2.70\ 10^{11}$	$1.68\ 10^{11}$	$1.33\ 10^{10}$
	^{41}Ar	$2.09\ 10^{14}$	$7.57\ 10^{13}$	$5.20\ 10^{12}$
	^{60}Co	nd	$1.09\ 10^{7}$	$3.52\ 10^{6}$
	^{65}Zn	$9.13\ 10^{7}$	nd	nd
	^{137}Cs	nd	$3.76\ 10^{7}$	$1.21\ 10^{7}$
Sizewell A	^{3}H	$1.16\ 10^{12}$	$1.93\ 10^{12}$	$1.18\ 10^{12}$
	^{14}C	$8.10\ 10^{11}$	$1.26\ 10^{12}$	$1.10\ 10^{11}$
	^{35}S	$1.99\ 10^{11}$	$1.79\ 10^{11}$	$1.50\ 10^{10}$
	^{41}Ar	$2.11\ 10^{15}$	$2.03\ 10^{15}$	nd
	^{60}Co	nd	$2.05\ 10^{8}$	$8.58\ 10^{5}$
	^{65}Zn	$4.75\ 10^{8}$	nd	nd
	^{137}Cs	nd	nd	$2.94\ 10^{6}$
Trawsfynydd	^{3}H	$1.22\ 10^{11}$	$5.55\ 10^{10}$	$1.20\ 10^{11}$
	^{14}C	$6.13\ 10^{8}$	$1.40\ 10^{9}$	$2.74\ 10^{9}$
	^{35}S	$3.70\ 10^{8}$	nd	nd
	^{60}Co	nd	$1.08\ 10^{5}$	$8.89\ 10^{4}$
	^{65}Zn	$7.16\ 10^{6}$	nd	nd
	^{137}Cs	nd	$3.69\ 10^{5}$	$3.05\ 10^{5}$
Wylfa	^{3}H	$1.10\ 10^{13}$	$4.50\ 10^{12}$	$2.78\ 10^{12}$
	^{14}C	$1.17\ 10^{12}$	$1.41\ 10^{12}$	$1.00\ 10^{12}$
	^{35}S	$3.13\ 10^{11}$	$1.80\ 10^{11}$	$1.30\ 10^{11}$
	^{41}Ar	$3.69\ 10^{13}$	$4.11\ 10^{13}$	$1.44\ 10^{13}$
	^{60}Co	nd	$6.79\ 10^{6}$	$1.09\ 10^{7}$
	^{65}Zn	$1.12\ 10^{8}$	nd	nd
	^{137}Cs	nd	$2.33\ 10^{7}$	$3.75\ 10^{7}$
PWR power station				
Sizewell B	^{3}H	$1.41\ 10^{11}$	$8.82\ 10^{11}$	$1.18\ 10^{12}$
	^{14}C	$1.24\ 10^{10}$	$2.82\ 10^{11}$	$2.95\ 10^{11}$
	^{41}Ar	$4.15\ 10^{12}$	nd	$3.00\ 10^{12}$
	^{60}Co	nd	$4.15\ 10^{5}$	$1.81\ 10^{5}$
	^{65}Zn	$2.00\ 10^{7}$	nd	nd
	^{131}I	nd	nd	$1.90\ 10^{7}$
	^{133}Xe	nd	$4.30\ 10^{12}$	$2.90\ 10^{12}$
	^{137}Cs	nd	$1.11\ 10^{7}$	$4.82\ 10^{6}$

Table A3: Atmospheric radioactive discharges from nuclear fuel reprocessing installations

		Annual discharges (Bq)		
Site	**Radionuclide**	**1993–1995**	**2003**	**2007**
Dounreay	^{3}H	$2.91\ 10^{12}$	$4.40\ 10^{11}$	$1.84\ 10^{11}$
	^{41}Ar	$1.63\ 10^{11}$	nd	nd
	^{60}Co	nd	$3.38\ 10^{8}$	nd
	^{85}Kr	$5.94\ 10^{14}$	nd	nd
	^{85m}Kr	$3.87\ 10^{10}$	nd	nd
	^{87}Kr	$4.67\ 10^{10}$	nd	nd
	^{88}Kr	$6.37\ 10^{10}$	nd	nd
	^{90}Sr	$1.34\ 10^{9}$	$1.97\ 10^{8}$	$3.50\ 10^{7}$
	^{106}Ru	$4.30\ 10^{8}$	$6.71\ 10^{6}$	$6.32\ 10^{6}$
	^{129}I	$1.50\ 10^{8}$	$7.16\ 10^{7}$	$1.06\ 10^{8}$
	^{131}I	$2.07\ 10^{7}$	$2.84\ 10^{7}$	$6.62\ 10^{7}$
	^{133}Xe	$4.73\ 10^{12}$	nd	nd
	^{133m}Xe	$5.10\ 10^{11}$	nd	nd
	^{135}Xe	$1.53\ 10^{11}$	nd	nd
	^{134}Cs	$1.08\ 10^{8}$	$7.38\ 10^{5}$	$8.23\ 10^{5}$
	^{137}Cs	$2.01\ 10^{9}$	$1.05\ 10^{8}$	$5.92\ 10^{6}$
	^{144}Ce	$3.04\ 10^{8}$	$5.13\ 10^{6}$	$4.85\ 10^{6}$
	^{239}Pu	$4.67\ 10^{7}$	$1.02\ 10^{7}$	nd
	^{241}Pu	$1.63\ 10^{9}$	$2.60\ 10^{7}$	$2.78\ 10^{6}$
	^{241}Am	$7.63\ 10^{7}$	$5.24\ 10^{7}$	nd
	^{242}Cm	$3.64\ 10^{7}$	$3.75\ 10^{5}$	$5.50\ 10^{4}$
	^{243}Cm	nd	$3.97\ 10^{4}$	nd
	^{244}Cm	$6.53\ 10^{6}$	$3.97\ 10^{4}$	$4.55\ 10^{3}$
Sellafield	^{3}H	$6.70\ 10^{14}$	$3.73\ 10^{10}$	$8.29\ 10^{13}$
	^{14}C	$3.03\ 10^{12}$	$7.11\ 10^{11}$	$3.60\ 10^{11}$
	^{35}S	$9.63\ 10^{10}$	$6.50\ 10^{9}$	nd
	^{41}Ar	$2.73\ 10^{15}$	$1.50\ 10^{14}$	nd
	^{60}Co	$1.62\ 10^{8}$	$2.00\ 10^{6}$	nd
	^{85}Kr	$6.40\ 10^{16}$	$1.20\ 10^{17}$	$1.41\ 10^{16}$
	^{90}Sr	$1.85\ 10^{8}$	$5.26\ 10^{7}$	$3.64\ 10^{7}$
	^{106}Ru	$8.00\ 10^{8}$	$1.43\ 10^{9}$	$1.31\ 10^{9}$
	^{125}Sb	$5.78\ 10^{8}$	$1.06\ 10^{9}$	$7.07\ 10^{8}$
	^{129}I	$2.80\ 10^{10}$	$1.70\ 10^{10}$	$4.82\ 10^{9}$
	^{131}I	$1.60\ 10^{9}$	$6.00\ 10^{8}$	$5.65\ 10^{8}$
	^{137}Cs	$6.53\ 10^{8}$	$4.95\ 10^{8}$	$1.73\ 10^{8}$
	^{239}Pu	$3.58\ 10^{8}$	$6.51\ 10^{7}$	$2.72\ 10^{7}$
	^{241}Pu	$1.71\ 10^{9}$	$3.94\ 10^{8}$	$2.79\ 10^{8}$
	^{241}Am	$9.30\ 10^{7}$	$3.82\ 10^{7}$	$2.10\ 10^{7}$

Table A4: Atmospheric radioactive discharges from other installations

Site	Radionuclide	Annual discharges (Bq)		
		1993–1995	2003	2007
Amersham	^{3}H	$4.57\ 10^{11}$	nd	$1.08\ 10^{6}$
	^{18}F	nd	nd	$4.25\ 10^{10}$
	^{35}S	$1.32\ 10^{10}$	$6.00\ 10^{9}$	$1.05\ 10^{10}$
	^{75}Se	$1.30\ 10^{9}$	$2.80\ 10^{8}$	$2.89\ 10^{8}$
	^{90}Sr	$1.67\ 10^{8}$	$9.80\ 10^{7}$	$6.35\ 10^{6}$
	^{125}I	$1.70\ 10^{10}$	$2.00\ 10^{9}$	$9.05\ 10^{8}$
	^{131}I	$5.00\ 10^{9}$	$5.00\ 10^{8}$	$4.70\ 10^{8}$
	^{133}Xe	nd	nd	$4.64\ 10^{11}$
	^{137}Cs	nd	nd	$3.15\ 10^{8}$
	^{222}Rn	$1.80\ 10^{12}$	$1.40\ 10^{12}$	$4.48\ 10^{12}$
	^{241}Am	$6.97\ 10^{5}$	$7.50\ 10^{4}$	$1.68\ 10^{5}$
Cardiff	^{3}H	$3.23\ 10^{14}$	$5.89\ 10^{14}$	$3.69\ 10^{14}$
	^{14}C	$2.68\ 10^{12}$	$1.70\ 10^{12}$	$1.98\ 10^{12}$
	^{32}P	$5.25\ 10^{7}$	$1.15\ 10^{8}$	$8.30\ 10^{5}$
	^{125}I	$4.26\ 10^{9}$	$4.75\ 10^{6}$	$2.63\ 10^{7}$
Harwell	^{3}H	$1.47\ 10^{13}$	$1.10\ 10^{12}$	$3.00\ 10^{11}$
	^{60}Co	$8.17\ 10^{6}$	$7.00\ 10^{5}$	$1.90\ 10^{5}$
	^{85}Kr	nd	$1.10\ 10^{11}$	$2.14\ 10^{11}$
	^{90}Sr	$1.02\ 10^{7}$	$8.75\ 10^{5}$	$2.37\ 10^{5}$
	^{90}Y	nd	$8.75\ 10^{5}$	$2.37\ 10^{5}$
	^{137}Cs	$1.23\ 10^{7}$	$1.05\ 10^{6}$	$2.84\ 10^{5}$
	^{154}Eu	$2.04\ 10^{6}$	$1.75\ 10^{5}$	$4.74\ 10^{4}$
	^{220}Rn	nd	$1.14\ 10^{13}$	$1.01\ 10^{13}$
	^{222}Rn	nd	$3.60\ 10^{11}$	$3.80\ 10^{11}$
	^{226}Ra	$1.03\ 10^{4}$	$1.26\ 10^{3}$	$1.05\ 10^{3}$
	^{226}Th	$1.03\ 10^{4}$	$1.26\ 10^{3}$	$1.05\ 10^{3}$
	^{232}Th	$1.03\ 10^{4}$	$1.26\ 10^{3}$	$1.05\ 10^{3}$
	^{234}U	$1.03\ 10^{4}$	$1.26\ 10^{3}$	$1.05\ 10^{3}$
	^{238}U	$1.03\ 10^{4}$	$1.26\ 10^{3}$	$1.05\ 10^{3}$
	^{238}Pu	$7.75\ 10^{4}$	$9.45\ 10^{3}$	$7.89\ 10^{3}$
	^{239}Pu	$1.55\ 10^{5}$	$1.89\ 10^{4}$	$1.58\ 10^{4}$
	^{240}Pu	$1.55\ 10^{5}$	$1.89\ 10^{4}$	$1.58\ 10^{4}$
	^{241}Pu	$8.17\ 10^{6}$	$7.00\ 10^{5}$	$1.90\ 10^{5}$
	^{241}Am	$7.75\ 10^{4}$	$9.45\ 10^{3}$	$7.89\ 10^{3}$
Winfrith	^{3}H	$8.96\ 10^{12}$	$3.67\ 10^{13}$	$9.16\ 10^{12}$
	^{14}C	$2.77\ 10^{9}$	$6.16\ 10^{8}$	$1.38\ 10^{9}$
	^{60}Co	nd	$7.43\ 10^{6}$	$1.66\ 10^{4}$
	^{85}Kr	$2.38\ 10^{10}$	nd	nd
	^{239}Pu	nd	$6.00\ 10^{2}$	$3.30\ 10^{2}$

A2 Liquid radioactive discharges from UK civil nuclear licensed sites

Liquid radioactive discharges from UK civil nuclear licensed sites assumed in the calculations carried out for this assessment are given in Tables A5 to A8 for the different types of installation considered.

Liquid radioactive discharges from fuel fabrication installations are reported in Table A5. Discharges from Capenhurst reported as uranium were assumed to be 50% ^{234}U and 49% ^{238}U, discharges reported as non-uranic alpha emitters were assumed to be ^{237}Np, while those reported as uranium progeny were assumed to be 50% ^{234}Th (Bexon, 2000). Discharges from Springfields reported as uranium were assumed to be 50% ^{234}U and 49% ^{238}U, while those reported as total alpha were assumed to be 41% ^{235}U, 50% ^{230}Th, 7.5% ^{228}Th and 1.5% ^{232}Th. Discharges from Springfields reported as total beta were assumed to be 50% ^{234}Th (Bexon, 2000).

Liquid radioactive discharges from nuclear power plants are reported in Table A6. Liquid discharges reported as beta/gamma from AGR and Magnox sites, with the exception of Hunterston A and Chapelcross, were assumed to be 35% ^{137}Cs, 28% ^{134}Cs, 28% ^{144}Pr and 9% ^{90}Sr/^{90}Y; it was also assumed that ^{90}Y discharges were equal to ^{90}Sr discharges (EC, 2004). Discharges from Hunterston A reported as beta/gamma were assumed to be 50% ^{90}Sr, 20% ^{90}Y, 10% ^{103}Ru, 10% ^{134}Cs, 4% ^{45}Ca, 4% ^{55}Fe and 2% ^{60}Co (EC, 2004). Discharges from Chapelcross reported as beta/gamma were assumed to be 60% ^{137}Cs, 23% ^{90}Sr, 10% ^{90}Y, 3% ^{134}Cs, 3% ^{125}Sb and 1% ^{60}Co (EC, 2004).

Discharges from power production sites reported as alpha were assumed to be ^{239}Pu; discharges from most of the Magnox reactor sites reported as ^{239}Pu + ^{240}Pu in 2003 and 2007 were assumed to be 100% ^{239}Pu (EC, 2004). Discharges from Bradwell, Hinkley Point A and Sizewell A reported as ^{243}Cm + ^{244}Cm were split equally between the two radionuclides (EC, 2004).

Liquid radioactive discharges from nuclear fuel reprocessing installations are reported in Table A7. Discharges from Dounreay reported as alpha were assumed to be 70% ^{241}Am, 10% ^{238}Pu and 20% ^{239}Pu (EC, 2004). Discharges from Sellafield reported as ^{95}Zr/^{95}Nb were assumed to be all ^{95}Zr, discharges reported as plutonium alpha were assumed to be 75% ^{239}Pu and 25% ^{238}Pu, discharges reported as uranium were assumed to be 92% ^{234}U, 3% ^{235}U and 5% ^{238}U, while discharges reported as ^{243}Cm + ^{244}Cm were split equally between the two radionuclides (EC, 2004).

Liquid radioactive discharges from other installations are reported in Table A8. Discharges from Amersham reported as beta were assumed to be ^{90}Sr, discharges reported as other were assumed to be ^{65}Zn, while discharges reported as alpha were assumed to be ^{241}Am (Bexon, 2000). Discharges from Harwell reported as beta were assumed to be 30% ^{60}Co, 30% ^{137}Cs, 10% ^{90}Sr, 10% ^{90}Y, 2% ^{56}Mn, 2% ^{58}Co, 2% ^{103}Ru, 2% ^{106}Ru, 2% ^{125}Sb, 2% ^{125}I, 2% ^{131}I, 2% ^{134}Cs, 2% ^{154}Eu and 2% ^{155}Eu, while discharges reported as alpha were assumed to be 25% ^{234}U, 25% ^{238}U, 23% ^{226}Ra, 12% ^{241}Am, 8% ^{240}Pu and 7% ^{239}Pu (Bexon, 2000). In addition, discharges from Harwell to Lydebank brook were assumed to be discharged to the river Thames for assessment purposes. Discharges from Winfrith reported as total beta/gamma in 2003 were assumed to be 50% ^{90}Sr and 50% ^{137}Cs; in 2007 discharges of ^{137}Cs were quoted separately and it was assumed that 50% of the discharge reported as total beta/gamma was ^{90}Sr, while discharges reported as total alpha were assumed to be all ^{239}Pu (EC, 2004).

Table A5: Liquid radioactive discharges from nuclear fuel fabrication installations

Site	Radionuclide	Annual discharges (Bq) 1993–1995	2003	2007
Capenhurst	^{3}H	nd	$1.02\ 10^{11}$	$3.10\ 10^{10}$
	^{99}Tc	$4.53\ 10^{9}$	$9.20\ 10^{8}$	$3.90\ 10^{7}$
	^{234}Th	$3.37\ 10^{9}$	$4.60\ 10^{8}$	$3.30\ 10^{7}$
	^{234}U	$7.50\ 10^{8}$	$4.60\ 10^{8}$	$4.30\ 10^{7}$
	^{238}U	$7.35\ 10^{8}$	$4.51\ 10^{8}$	$4.21\ 10^{7}$
	^{237}Np	$8.17\ 10^{7}$	$6.70\ 10^{6}$	$2.90\ 10^{7}$
Springfields	^{99}Tc	$4.87\ 10^{10}$	$5.20\ 10^{10}$	$5.10\ 10^{10}$
	^{228}Th	$8.93\ 10^{9}$	$1.35\ 10^{10}$	$1.95\ 10^{9}$
	^{230}Th	$5.53\ 10^{10}$	$6.70\ 10^{10}$	$1.40\ 10^{9}$
	^{232}Th	$1.20\ 10^{9}$	$6.00\ 10^{8}$	$3.47\ 10^{8}$
	^{234}Th	$4.72\ 10^{13}$	$4.85\ 10^{13}$	$1.50\ 10^{12}$
	^{234}U	$2.53\ 10^{10}$	$2.80\ 10^{10}$	$9.00\ 10^{9}$
	^{235}U	nd	$2.80\ 10^{8}$	$9.00\ 10^{7}$
	^{238}U	$2.48\ 10^{10}$	$2.74\ 10^{10}$	$8.82\ 10^{9}$
	^{237}Np	$2.33\ 10^{8}$	$1.80\ 10^{9}$	$1.69\ 10^{9}$

Table A6: Liquid radioactive discharges from nuclear power production installations

Site	Radionuclide	Annual discharges (Bq) 1993–1995	2003	2007
AGR power stations				
Dungeness B	^{3}H	$1.73\ 10^{14}$	$4.46\ 10^{14}$	$3.39\ 10^{14}$
	^{14}C	$7.71\ 10^{7}$	nd	nd
	^{32}P	$7.71\ 10^{7}$	nd	nd
	^{35}S	$4.12\ 10^{11}$	$7.94\ 10^{11}$	$4.70\ 10^{11}$
	^{45}Ca	$1.98\ 10^{10}$	nd	nd
	^{54}Mn	$7.14\ 10^{8}$	nd	nd
	^{55}Fe	$5.71\ 10^{8}$	nd	nd
	^{59}Fe	$3.57\ 10^{8}$	nd	nd
	^{58}Co	$2.14\ 10^{8}$	nd	nd
	^{60}Co	$2.51\ 10^{9}$	$1.71\ 10^{9}$	$1.47\ 10^{9}$
	^{63}Ni	$2.14\ 10^{8}$	nd	nd
	^{65}Zn	$5.00\ 10^{8}$	nd	nd
	^{90}Sr	$1.43\ 10^{8}$	$2.27\ 10^{9}$	nd
	^{90}Y	$1.43\ 10^{8}$	nd	nd
	^{95}Zr	$2.86\ 10^{8}$	nd	nd
	^{95}Nb	$3.57\ 10^{8}$	nd	nd
	^{106}Ru	$1.43\ 10^{9}$	nd	nd
	^{110m}Ag	$2.86\ 10^{8}$	nd	nd
	^{124}Sb	$1.36\ 10^{9}$	nd	nd
	^{125}Sb	$1.43\ 10^{8}$	nd	nd
	^{125m}Te	$3.57\ 10^{7}$	nd	nd
	^{134}Cs	$1.71\ 10^{9}$	$7.06\ 10^{9}$	$6.30\ 10^{8}$
	^{137}Cs	$1.57\ 10^{9}$	$8.82\ 10^{9}$	$4.94\ 10^{9}$

Table A6: continued

Site	Radionuclide	Annual discharges (Bq) 1993–1995	2003	2007
Dungeness B: continued	^{144}Ce	$4.29\ 10^{8}$	nd	nd
	^{144}Pr	$4.29\ 10^{8}$	$7.06\ 10^{9}$	nd
	^{154}Eu	$7.14\ 10^{7}$	nd	nd
	^{155}Eu	$1.43\ 10^{8}$	nd	nd
	^{238}Pu	$7.14\ 10^{6}$	nd	nd
	^{239}Pu	$1.43\ 10^{6}$	nd	$4.50\ 10^{6}$
	^{241}Pu	$1.43\ 10^{8}$	nd	nd
	^{241}Am	$7.14\ 10^{5}$	nd	nd
	^{242}Cm	$7.14\ 10^{5}$	nd	nd
	^{243}Cm	$2.14\ 10^{5}$	nd	nd
Hartlepool	^{3}H	$2.93\ 10^{14}$	$3.60\ 10^{14}$	$3.35\ 10^{14}$
	^{14}C	$2.19\ 10^{7}$	nd	nd
	^{32}P	$5.47\ 10^{7}$	nd	nd
	^{35}S	$5.12\ 10^{11}$	$1.30\ 10^{12}$	$6.76\ 10^{11}$
	^{45}Ca	$4.63\ 10^{9}$	nd	nd
	^{54}Mn	$4.21\ 10^{8}$	nd	nd
	^{55}Fe	$2.53\ 10^{8}$	nd	nd
	^{59}Fe	$8.42\ 10^{8}$	nd	nd
	^{58}Co	$3.37\ 10^{8}$	nd	nd
	^{60}Co	$4.67\ 10^{9}$	$1.70\ 10^{9}$	$9.05\ 10^{7}$
	^{63}Ni	$3.37\ 10^{8}$	nd	nd
	^{65}Zn	$1.68\ 10^{9}$	nd	nd
	^{90}Sr	$4.21\ 10^{7}$	$1.17\ 10^{9}$	nd
	^{90}Y	$4.21\ 10^{7}$	nd	nd
	^{95}Zr	$8.42\ 10^{8}$	nd	nd
	^{95}Nb	$8.42\ 10^{8}$	nd	nd
	^{106}Ru	$1.68\ 10^{9}$	nd	nd
	^{110m}Ag	$2.53\ 10^{8}$	nd	nd
	^{124}Sb	$1.26\ 10^{9}$	nd	nd
	^{125}Sb	$8.42\ 10^{8}$	nd	nd
	^{125m}Te	$1.68\ 10^{8}$	nd	nd
	^{134}Cs	$3.37\ 10^{9}$	$3.64\ 10^{9}$	$1.00\ 10^{9}$
	^{137}Cs	$2.11\ 10^{9}$	$4.55\ 10^{9}$	$1.30\ 10^{9}$
	^{144}Ce	$3.79\ 10^{8}$	nd	nd
	^{144}Pr	$3.79\ 10^{8}$	$3.64\ 10^{9}$	nd
	^{154}Eu	$8.42\ 10^{8}$	nd	nd
	^{155}Eu	$3.79\ 10^{8}$	nd	nd
	^{238}Pu	$8.42\ 10^{5}$	nd	nd
	^{239}Pu	$2.11\ 10^{6}$	nd	$6.00\ 10^{6}$
	^{241}Pu	$2.53\ 10^{8}$	nd	nd
	^{241}Am	$8.42\ 10^{5}$	nd	nd
	^{242}Cm	$2.95\ 10^{6}$	nd	nd
	^{243}Cm	$8.42\ 10^{5}$	nd	nd
Heysham 1	^{3}H	$3.41\ 10^{14}$	$3.60\ 10^{14}$	$2.72\ 10^{14}$
	^{14}C	$5.29\ 10^{7}$	nd	nd

Table A6: continued

Site	Radionuclide	Annual discharges (Bq)		
		1993–1995	2003	2007
Heysham 1: continued	^{32}P	$3.31\ 10^{7}$	nd	nd
	^{35}S	$4.20\ 10^{11}$	$3.70\ 10^{11}$	$3.04\ 10^{11}$
	^{45}Ca	$1.77\ 10^{9}$	nd	nd
	^{54}Mn	$2.06\ 10^{9}$	nd	nd
	^{55}Fe	$5.89\ 10^{8}$	nd	nd
	^{59}Fe	$5.89\ 10^{8}$	nd	nd
	^{58}Co	$2.06\ 10^{8}$	nd	nd
	^{60}Co	$1.03\ 10^{9}$	$8.40\ 10^{8}$	$8.11\ 10^{8}$
	^{63}Ni	$2.06\ 10^{8}$	nd	nd
	^{65}Zn	$5.89\ 10^{8}$	nd	nd
	^{90}Sr	$5.89\ 10^{7}$	$3.87\ 10^{9}$	nd
	^{90}Y	$5.89\ 10^{7}$	nd	nd
	^{95}Zr	$5.89\ 10^{8}$	nd	nd
	^{95}Nb	$5.89\ 10^{8}$	nd	$1.00\ 10^{8}$
	^{106}Ru	$5.89\ 10^{8}$	nd	nd
	^{110m}Ag	$8.83\ 10^{7}$	nd	nd
	^{124}Sb	$8.83\ 10^{8}$	nd	nd
	^{125}Sb	$2.36\ 10^{8}$	nd	nd
	^{125m}Te	$5.89\ 10^{7}$	nd	nd
	^{134}Cs	$2.06\ 10^{9}$	$1.20\ 10^{10}$	$5.10\ 10^{9}$
	^{137}Cs	$1.47\ 10^{9}$	$1.51\ 10^{10}$	$2.90\ 10^{9}$
	^{144}Ce	$1.47\ 10^{8}$	nd	nd
	^{144}Pr	$1.47\ 10^{8}$	$1.20\ 10^{10}$	nd
	^{154}Eu	$2.36\ 10^{8}$	nd	nd
	^{155}Eu	$1.18\ 10^{8}$	nd	nd
	^{238}Pu	$5.89\ 10^{5}$	nd	nd
	^{239}Pu	$1.47\ 10^{6}$	nd	$2.60\ 10^{7}$
	^{241}Pu	$8.83\ 10^{7}$	nd	nd
	^{241}Am	$1.47\ 10^{6}$	nd	nd
	^{242}Cm	$1.47\ 10^{6}$	nd	nd
	^{243}Cm	$2.94\ 10^{5}$	nd	nd
Heysham 2	^{3}H	$3.83\ 10^{14}$	$3.90\ 10^{14}$	$3.25\ 10^{14}$
	^{14}C	$4.18\ 10^{8}$	nd	nd
	^{32}P	$6.14\ 10^{7}$	nd	nd
	^{35}S	$7.67\ 10^{10}$	$1.30\ 10^{11}$	$8.26\ 10^{10}$
	^{45}Ca	$1.07\ 10^{10}$	nd	nd
	^{54}Mn	$2.14\ 10^{9}$	nd	nd
	^{55}Fe	$2.14\ 10^{9}$	nd	nd
	^{59}Fe	$7.12\ 10^{8}$	nd	nd
	^{58}Co	$2.85\ 10^{8}$	nd	nd
	^{60}Co	$1.06\ 10^{9}$	$2.80\ 10^{8}$	$7.30\ 10^{7}$
	^{63}Ni	$2.85\ 10^{8}$	nd	nd
	^{65}Zn	$5.70\ 10^{8}$	nd	nd
	^{90}Sr	$5.70\ 10^{8}$	$1.44\ 10^{10}$	$1.10\ 10^{9}$
	^{90}Y	$5.70\ 10^{8}$	nd	nd

Table A6: continued

Site	Radionuclide	Annual discharges (Bq)		
		1993–1995	2003	2007
Heysham 2: continued	^{95}Zr	$6.41\ 10^{8}$	nd	nd
	^{95}Nb	$7.12\ 10^{8}$	nd	nd
	^{106}Ru	$7.12\ 10^{8}$	nd	nd
	^{110m}Ag	$7.12\ 10^{7}$	nd	nd
	^{124}Sb	$5.70\ 10^{8}$	nd	nd
	^{125}Sb	$2.85\ 10^{8}$	nd	nd
	^{125m}Te	$6.41\ 10^{7}$	nd	nd
	^{134}Cs	$1.42\ 10^{9}$	$4.48\ 10^{10}$	$1.60\ 10^{8}$
	^{137}Cs	$1.42\ 10^{9}$	$5.60\ 10^{10}$	$1.47\ 10^{9}$
	^{144}Ce	$1.42\ 10^{8}$	nd	nd
	^{144}Pr	$1.42\ 10^{8}$	$4.40\ 10^{10}$	nd
	^{154}Eu	$2.85\ 10^{8}$	nd	nd
	^{155}Eu	$1.42\ 10^{8}$	nd	nd
	^{238}Pu	$7.12\ 10^{5}$	nd	nd
	^{239}Pu	$2.85\ 10^{6}$	nd	$1.30\ 10^{7}$
	^{241}Pu	$2.85\ 10^{8}$	nd	nd
	^{241}Am	$1.42\ 10^{6}$	nd	nd
	^{242}Cm	$2.14\ 10^{6}$	nd	nd
	^{243}Cm	$4.98\ 10^{5}$	nd	nd
Hinkley Point B	^{3}H	$3.86\ 10^{14}$	$4.00\ 10^{14}$	$4.75\ 10^{13}$
	^{14}C	$8.35\ 10^{6}$	nd	nd
	^{32}P	$4.18\ 10^{7}$	nd	nd
	^{35}S	$1.48\ 10^{12}$	$4.31\ 10^{11}$	$5.40\ 10^{10}$
	^{45}Ca	$9.25\ 10^{8}$	nd	nd
	^{54}Mn	$4.74\ 10^{9}$	nd	nd
	^{55}Fe	$2.89\ 10^{9}$	nd	nd
	^{59}Fe	$2.31\ 10^{8}$	nd	nd
	^{58}Co	$2.31\ 10^{8}$	nd	nd
	^{60}Co	$9.87\ 10^{8}$	$7.20\ 10^{8}$	$6.40\ 10^{7}$
	^{63}Ni	$2.31\ 10^{8}$	nd	nd
	^{65}Zn	$2.31\ 10^{8}$	nd	nd
	^{90}Sr	$2.31\ 10^{7}$	$1.31\ 10^{9}$	nd
	^{90}Y	$2.31\ 10^{7}$	nd	nd
	^{95}Zr	$1.16\ 10^{8}$	nd	nd
	^{95}Nb	$1.16\ 10^{8}$	nd	nd
	^{106}Ru	$1.39\ 10^{9}$	nd	nd
	^{110m}Ag	$1.16\ 10^{8}$	nd	nd
	^{124}Sb	$5.78\ 10^{8}$	nd	nd
	^{125}Sb	$1.16\ 10^{8}$	nd	nd
	^{125m}Te	$3.47\ 10^{7}$	nd	nd
	^{134}Cs	$1.97\ 10^{9}$	$4.09\ 10^{9}$	$1.80\ 10^{8}$
	^{137}Cs	$2.08\ 10^{9}$	$5.11\ 10^{9}$	$2.74\ 10^{9}$
	^{144}Ce	$2.31\ 10^{8}$	nd	nd
	^{144}Pr	$2.31\ 10^{8}$	$4.09\ 10^{9}$	nd
	^{154}Eu	$1.16\ 10^{8}$	nd	nd

Table A6: continued

Site	Radionuclide	Annual discharges (Bq)		
		1993–1995	2003	2007
Hinkley Point B: continued	^{155}Eu	$8.09\ 10^{7}$	nd	nd
	^{238}Pu	$3.47\ 10^{6}$	nd	nd
	^{239}Pu	$5.78\ 10^{6}$	nd	$8.30\ 10^{6}$
	^{241}Pu	$2.31\ 10^{8}$	nd	nd
	^{241}Am	$2.31\ 10^{6}$	nd	nd
	^{242}Cm	$5.78\ 10^{5}$	nd	nd
	^{243}Cm	$1.16\ 10^{5}$	nd	nd
Hunterston B	^{3}H	$4.11\ 10^{14}$	$4.46\ 10^{13}$	$3.54\ 10^{13}$
	^{35}S	$1.77\ 10^{12}$	$1.47\ 10^{12}$	$3.99\ 10^{11}$
	^{45}Ca	$7.00\ 10^{9}$	nd	nd
	^{54}Mn	$2.00\ 10^{10}$	nd	nd
	^{60}Co	$5.70\ 10^{9}$	$6.00\ 10^{8}$	$2.80\ 10^{8}$
	^{90}Sr	$1.00\ 10^{9}$	nd	nd
	^{90}Y	$1.00\ 10^{9}$	$1.31\ 10^{9}$	$5.50\ 10^{8}$
	^{134}Cs	$4.00\ 10^{9}$	$4.09\ 10^{9}$	$1.71\ 10^{9}$
	^{137}Cs	$6.83\ 10^{9}$	$5.11\ 10^{9}$	$2.14\ 10^{9}$
	^{144}Pr	nd	$4.09\ 10^{9}$	$1.71\ 10^{9}$
	^{239}Pu	nd	$1.14\ 10^{8}$	$4.85\ 10^{7}$
Torness	^{3}H	$2.42\ 10^{14}$	$3.14\ 10^{14}$	$3.20\ 10^{14}$
	^{35}S	$2.73\ 10^{10}$	$2.16\ 10^{10}$	nd
	^{60}Co	$7.77\ 10^{8}$	$1.42\ 10^{8}$	$1.58\ 10^{8}$
	^{90}Sr	nd	$1.62\ 10^{8}$	$2.30\ 10^{8}$
	^{134}Cs	nd	$5.04\ 10^{8}$	$7.14\ 10^{8}$
	^{137}Cs	nd	$6.30\ 10^{8}$	$8.93\ 10^{8}$
	^{144}Pr	nd	$5.04\ 10^{8}$	$7.14\ 10^{8}$
	^{239}Pu	$9.67\ 10^{6}$	$5.18\ 10^{6}$	nd
Magnox power stations				
Berkeley	^{3}H	$1.11\ 10^{11}$	$3.00\ 10^{8}$	$2.11\ 10^{7}$
	^{35}S	$3.83\ 10^{7}$	nd	nd
	^{45}Ca	$1.92\ 10^{8}$	nd	nd
	^{54}Mn	$5.75\ 10^{7}$	nd	nd
	^{55}Fe	$7.66\ 10^{8}$	$1.50\ 10^{7}$	nd
	^{59}Fe	$1.92\ 10^{8}$	nd	nd
	^{58}Co	$5.75\ 10^{7}$	nd	nd
	^{60}Co	$7.66\ 10^{8}$	$1.80\ 10^{7}$	nd
	^{65}Zn	$1.92\ 10^{8}$	nd	nd
	^{90}Sr	$6.88\ 10^{10}$	$6.20\ 10^{7}$	$9.66\ 10^{7}$
	^{90}Y	$6.88\ 10^{10}$	$6.20\ 10^{7}$	nd
	^{95}Zr	$1.92\ 10^{8}$	nd	nd
	^{95}Nb	$1.92\ 10^{8}$	nd	nd
	^{106}Ru	$2.30\ 10^{9}$	nd	nd
	^{110m}Ag	$1.15\ 10^{8}$	nd	nd
	^{124}Sb	$7.66\ 10^{7}$	nd	nd
	^{125}Sb	$3.83\ 10^{8}$	nd	nd
	^{125m}Te	$1.15\ 10^{8}$	nd	nd

Table A6: continued

Site	Radionuclide	Annual discharges (Bq)		
		1993–1995	2003	2007
Berkeley: continued	^{134}Cs	$1.15\ 10^{9}$	nd	nd
	^{137}Cs	$6.89\ 10^{10}$	$1.57\ 10^{8}$	$4.87\ 10^{7}$
	^{144}Ce	$5.75\ 10^{8}$	nd	nd
	^{144}Pr	$5.75\ 10^{8}$	nd	nd
	^{154}Eu	$1.15\ 10^{8}$	nd	nd
	^{155}Eu	$1.53\ 10^{8}$	nd	nd
	^{238}Pu	$3.83\ 10^{7}$	nd	nd
	^{239}Pu	$1.72\ 10^{8}$	nd	$9.90\ 10^{4}$
	^{241}Pu	$3.45\ 10^{9}$	$2.20\ 10^{7}$	nd
	^{241}Am	$1.53\ 10^{8}$	$1.40\ 10^{6}$	$3.38\ 10^{5}$
	^{242}Cm	$3.83\ 10^{6}$	nd	nd
	^{243}Cm	$1.92\ 10^{6}$	nd	nd
Bradwell	^{3}H	$2.43\ 10^{12}$	$1.27\ 10^{11}$	$2.81\ 10^{10}$
	^{35}S	$1.50\ 10^{11}$	$2.30\ 10^{9}$	$1.00\ 10^{7}$
	^{45}Ca	$2.14\ 10^{10}$	nd	nd
	^{51}Cr	$3.83\ 10^{10}$	nd	nd
	^{54}Mn	$4.74\ 10^{8}$	nd	$4.00\ 10^{7}$
	^{55}Fe	$6.79\ 10^{9}$	$7.00\ 10^{8}$	$9.90\ 10^{8}$
	^{59}Fe	$6.32\ 10^{8}$	nd	$8.00\ 10^{7}$
	^{58}Co	$2.37\ 10^{8}$	nd	$3.00\ 10^{7}$
	^{60}Co	$3.16\ 10^{9}$	$3.50\ 10^{8}$	$1.71\ 10^{7}$
	^{65}Zn	$1.26\ 10^{9}$	nd	$1.10\ 10^{8}$
	^{90}Sr	$2.96\ 10^{10}$	$1.10\ 10^{11}$	$8.57\ 10^{9}$
	^{90}Y	$2.96\ 10^{10}$	$1.10\ 10^{11}$	nd
	^{95}Zr	$6.32\ 10^{8}$	nd	$7.00\ 10^{7}$
	^{95}Nb	$1.66\ 10^{9}$	nd	$8.00\ 10^{7}$
	^{106}Ru	$4.75\ 10^{9}$	nd	$1.10\ 10^{8}$
	^{110m}Ag	$3.16\ 10^{8}$	nd	$6.00\ 10^{7}$
	^{124}Sb	$3.63\ 10^{9}$	$3.20\ 10^{8}$	$3.00\ 10^{7}$
	^{125}Sb	$7.90\ 10^{8}$	$1.80\ 10^{9}$	$2.26\ 10^{8}$
	^{125m}Te	$1.58\ 10^{8}$	$4.00\ 10^{8}$	nd
	^{134}Cs	$6.15\ 10^{10}$	$3.80\ 10^{10}$	$4.50\ 10^{8}$
	^{137}Cs	$3.46\ 10^{11}$	$3.73\ 10^{11}$	$1.51\ 10^{10}$
	^{144}Ce	$1.58\ 10^{9}$	nd	$2.00\ 10^{8}$
	^{144}Pr	$1.58\ 10^{9}$	nd	nd
	^{154}Eu	$1.58\ 10^{8}$	nd	nd
	^{155}Eu	$3.95\ 10^{8}$	nd	nd
	^{238}Pu	$1.58\ 10^{8}$	$2.10\ 10^{8}$	$9.40\ 10^{6}$
	^{239}Pu	$3.16\ 10^{8}$	$5.00\ 10^{8}$	$2.36\ 10^{7}$
	^{241}Pu	$6.24\ 10^{9}$	$1.20\ 10^{10}$	nd
	^{241}Am	$5.53\ 10^{8}$	$2.90\ 10^{8}$	$1.61\ 10^{7}$
	^{242}Cm	$7.11\ 10^{7}$	nd	$1.00\ 10^{6}$
	^{243}Cm	$7.11\ 10^{6}$	$3.35\ 10^{6}$	$5.00\ 10^{5}$
	^{244}Cm	nd	$3.35\ 10^{6}$	$5.00\ 10^{5}$

Table A6: continued

Site	Radionuclide	Annual discharges (Bq)		
		1993–1995	2003	2007
Chapelcross	^{3}H	$4.97\ 10^{11}$	$2.49\ 10^{11}$	$8.20\ 10^{9}$
	^{35}S	$2.07\ 10^{10}$	$6.70\ 10^{9}$	nd
	^{60}Co	$1.60\ 10^{9}$	$1.60\ 10^{9}$	$1.00\ 10^{7}$
	^{65}Zn	$1.43\ 10^{8}$	nd	nd
	^{90}Sr	$8.60\ 10^{10}$	$8.10\ 10^{10}$	$3.30\ 10^{8}$
	^{106}Ru	$8.00\ 10^{8}$	nd	nd
	^{125}Sb	$8.13\ 10^{8}$	$4.00\ 10^{8}$	$3.00\ 10^{7}$
	^{134}Cs	$1.40\ 10^{9}$	$3.20\ 10^{9}$	$3.00\ 10^{7}$
	^{137}Cs	$1.60\ 10^{10}$	$3.60\ 10^{10}$	$6.00\ 10^{8}$
	^{144}Ce	$5.80\ 10^{8}$	nd	nd
	^{154}Eu	$1.17\ 10^{8}$	nd	nd
	^{238}Pu	$1.83\ 10^{8}$	nd	nd
	^{239}Pu	$2.80\ 10^{8}$	$8.01\ 10^{8}$	$1.66\ 10^{7}$
	^{241}Am	$1.83\ 10^{8}$	nd	nd
	^{242}Cm	$1.33\ 10^{7}$	nd	nd
	^{243}Cm	$6.67\ 10^{6}$	nd	nd
Dungeness A	^{3}H	$1.61\ 10^{12}$	$3.35\ 10^{11}$	$3.54\ 10^{12}$
	^{35}S	$1.95\ 10^{11}$	$7.50\ 10^{10}$	$2.10\ 10^{10}$
	^{45}Ca	$1.68\ 10^{10}$	$2.00\ 10^{8}$	nd
	^{54}Mn	$3.68\ 10^{8}$	nd	nd
	^{55}Fe	$2.21\ 10^{9}$	$2.00\ 10^{8}$	nd
	^{59}Fe	$1.66\ 10^{9}$	nd	nd
	^{58}Co	$5.53\ 10^{8}$	nd	nd
	^{60}Co	$1.47\ 10^{9}$	$2.70\ 10^{8}$	$2.90\ 10^{8}$
	^{65}Zn	$1.11\ 10^{9}$	nd	nd
	^{90}Sr	$5.12\ 10^{10}$	$1.20\ 10^{10}$	$2.00\ 10^{8}$
	^{90}Y	$5.12\ 10^{10}$	$1.20\ 10^{10}$	nd
	^{95}Zr	$1.66\ 10^{9}$	nd	$4.80\ 10^{7}$
	^{95}Nb	$1.84\ 10^{9}$	nd	$1.00\ 10^{8}$
	^{106}Ru	$6.26\ 10^{9}$	nd	$1.30\ 10^{8}$
	^{110m}Ag	$7.37\ 10^{8}$	nd	nd
	^{124}Sb	$1.01\ 10^{10}$	$2.40\ 10^{9}$	nd
	^{125}Sb	$2.21\ 10^{9}$	$2.80\ 10^{9}$	$3.20\ 10^{8}$
	^{125m}Te	$5.53\ 10^{8}$	$6.30\ 10^{8}$	nd
	^{134}Cs	$2.67\ 10^{11}$	$9.80\ 10^{10}$	$2.90\ 10^{9}$
	^{137}Cs	$5.48\ 10^{11}$	$3.08\ 10^{11}$	$6.99\ 10^{10}$
	^{144}Ce	$3.50\ 10^{9}$	nd	$9.80\ 10^{7}$
	^{144}Pr	$3.50\ 10^{9}$	nd	nd
	^{154}Eu	$3.68\ 10^{8}$	nd	nd
	^{155}Eu	$9.21\ 10^{8}$	nd	nd
	^{238}Pu	$5.53\ 10^{7}$	$3.60\ 10^{7}$	nd
	^{239}Pu	$1.11\ 10^{8}$	$5.20\ 10^{7}$	$9.00\ 10^{5}$
	^{241}Pu	$2.95\ 10^{9}$	$2.80\ 10^{9}$	nd
	^{241}Am	$7.37\ 10^{7}$	$3.20\ 10^{7}$	$3.50\ 10^{5}$
	^{242}Cm	$9.21\ 10^{6}$	nd	nd

Table A6: continued

Site	Radionuclide	Annual discharges (Bq) 1993–1995	2003	2007
Dungeness A: continued	^{243}Cm	$1.84\ 10^{6}$	$1.30\ 10^{6}$	$2.40\ 10^{5}$
	^{244}Cm	nd	$1.30\ 10^{6}$	nd
Hinkley Point A	^{3}H	$7.50\ 10^{11}$	$5.36\ 10^{11}$	$3.26\ 10^{11}$
	^{35}S	$1.16\ 10^{11}$	nd	nd
	^{45}Ca	$7.28\ 10^{8}$	nd	nd
	^{54}Mn	$1.62\ 10^{8}$	nd	nd
	^{55}Fe	$7.84\ 10^{9}$	$5.80\ 10^{8}$	nd
	^{59}Fe	$8.09\ 10^{8}$	nd	nd
	^{58}Co	$2.43\ 10^{8}$	nd	nd
	^{60}Co	$2.10\ 10^{9}$	$4.30\ 10^{8}$	nd
	^{65}Zn	$6.47\ 10^{8}$	nd	nd
	^{90}Sr	$8.09\ 10^{9}$	$7.50\ 10^{10}$	nd
	^{90}Y	$8.09\ 10^{9}$	$7.50\ 10^{10}$	nd
	^{95}Zr	$1.05\ 10^{9}$	nd	nd
	^{95}Nb	$4.93\ 10^{9}$	nd	nd
	^{106}Ru	$7.60\ 10^{9}$	nd	nd
	^{110m}Ag	$3.23\ 10^{8}$	nd	nd
	^{124}Sb	$2.51\ 10^{9}$	nd	nd
	^{125}Sb	$1.05\ 10^{9}$	$3.20\ 10^{9}$	nd
	^{125m}Te	$2.43\ 10^{8}$	$7.30\ 10^{8}$	nd
	^{134}Cs	$1.05\ 10^{11}$	$3.30\ 10^{10}$	nd
	^{137}Cs	$5.05\ 10^{11}$	$4.86\ 10^{11}$	$1.80\ 10^{11}$
	^{144}Ce	$6.79\ 10^{9}$	nd	nd
	^{144}Pr	$6.79\ 10^{9}$	nd	nd
	^{154}Eu	$2.43\ 10^{8}$	$7.20\ 10^{8}$	nd
	^{155}Eu	$6.47\ 10^{8}$	nd	nd
	^{238}Pu	$1.62\ 10^{8}$	$2.10\ 10^{8}$	nd
	^{239}Pu	$2.43\ 10^{8}$	$3.20\ 10^{8}$	nd
	^{241}Pu	$8.09\ 10^{9}$	$1.00\ 10^{10}$	nd
	^{241}Am	$4.04\ 10^{8}$	$8.20\ 10^{8}$	nd
	^{242}Cm	$1.05\ 10^{9}$	$8.90\ 10^{6}$	nd
	^{243}Cm	$4.85\ 10^{7}$	$2.45\ 10^{7}$	nd
	^{244}Cm	nd	$2.45\ 10^{7}$	nd
Hunterston A	^{3}H	$2.00\ 10^{11}$	$9.40\ 10^{8}$	$3.90\ 10^{8}$
	^{35}S	$4.50\ 10^{8}$	nd	nd
	^{45}Ca	nd	$1.23 10^{9}$	$1.47\ 10^{9}$
	^{55}Fe	nd	$1.23\ 10^{9}$	$1.47\ 10^{9}$
	^{60}Co	$8.57\ 10^{8}$	$6.16 10^{8}$	$7.34 10^{8}$
	^{90}Sr	$3.50\ 10^{10}$	$1.54\ 10^{10}$	$1.84\ 10^{10}$
	^{90}Y	$3.50\ 10^{10}$	$6.16\ 10^{9}$	$7.34\ 10^{9}$
	^{95}Zr	$3.00\ 10^{8}$	nd	nd
	^{95}Nb	$3.00\ 10^{8}$	nd	nd
	^{103}Ru	nd	$3.08\ 10^{9}$	$3.67\ 10^{9}$
	^{134}Cs	$6.40\ 10^{9}$	$3.08\ 10^{9}$	$3.67\ 10^{9}$
	^{137}Cs	$1.37\ 10^{11}$	$1.90\ 10^{10}$	nd

Table A6: continued

Site	Radionuclide	Annual discharges (Bq)		
		1993–1995	2003	2007
Hunterston A: continued	^{239}Pu	$2.57\ 10^{8}$	$1.79\ 10^{8}$	$6.93\ 10^{7}$
	^{241}Pu	nd	$1.79\ 10^{8}$	$5.40\ 10^{7}$
Oldbury	^{3}H	$2.42\ 10^{11}$	$3.34\ 10^{11}$	$1.78\ 10^{11}$
	^{35}S	$3.07\ 10^{11}$	$1.20\ 10^{11}$	$4.60\ 10^{10}$
	^{45}Ca	$5.28\ 10^{9}$	$3.70\ 10^{9}$	nd
	^{51}Cr	$5.51\ 10^{9}$	nd	nd
	^{54}Mn	$5.76\ 10^{7}$	nd	nd
	^{55}Fe	$5.76\ 10^{8}$	$3.20\ 10^{8}$	nd
	^{59}Fe	$2.88\ 10^{8}$	nd	nd
	^{58}Co	$8.63\ 10^{7}$	nd	nd
	^{60}Co	$1.92\ 10^{8}$	$1.80\ 10^{8}$	$1.35\ 10^{8}$
	^{65}Zn	$2.88\ 10^{8}$	nd	nd
	^{90}Sr	$2.38\ 10^{10}$	$5.50\ 10^{10}$	$1.01\ 10^{11}$
	^{90}Y	$2.38\ 10^{10}$	$5.50\ 10^{10}$	nd
	^{95}Zr	$2.88\ 10^{8}$	nd	nd
	^{95}Nb	$2.88\ 10^{8}$	nd	$3.06\ 10^{8}$
	^{106}Ru	$1.73\ 10^{9}$	nd	$2.04\ 10^{9}$
	^{110m}Ag	$9.59\ 10^{7}$	nd	nd
	^{124}Sb	$2.97\ 10^{9}$	$2.20\ 10^{9}$	nd
	^{125}Sb	$4.80\ 10^{8}$	nd	nd
	^{125m}Te	$9.59\ 10^{7}$	nd	nd
	^{134}Cs	$5.56\ 10^{9}$	$1.20\ 10^{11}$	$1.09\ 10^{11}$
	^{137}Cs	$3.93\ 10^{10}$	$4.49\ 10^{11}$	$3.76\ 10^{11}$
	^{144}Ce	$5.76\ 10^{8}$	$1.00\ 10^{9}$	$1.43\ 10^{9}$
	^{144}Pr	$5.76\ 10^{8}$	nd	nd
	^{154}Eu	$1.92\ 10^{8}$	nd	nd
	^{155}Eu	$1.92\ 10^{8}$	nd	nd
	^{238}Pu	$1.92\ 10^{7}$	$6.10\ 10^{6}$	nd
	^{239}Pu	$5.76\ 10^{7}$	$1.60\ 10^{7}$	$2.60\ 10^{7}$
	^{241}Pu	$1.34\ 10^{9}$	$6.00\ 10^{8}$	nd
	^{241}Am	$5.76\ 10^{7}$	$2.90\ 10^{7}$	nd
	^{242}Cm	$3.84\ 10^{6}$	nd	nd
	^{243}Cm	$9.59\ 10^{5}$	nd	nd
Sizewell A	^{3}H	$4.35\ 10^{12}$	$2.83\ 10^{12}$	$2.07\ 10^{12}$
	^{35}S	$1.02\ 10^{11}$	$9.20\ 10^{10}$	$2.67\ 10^{10}$
	^{45}Ca	$4.53\ 10^{9}$	$4.40\ 10^{9}$	nd
	^{54}Mn	$5.81\ 10^{7}$	nd	nd
	^{55}Fe	$1.16\ 10^{9}$	$1.10\ 10^{9}$	$2.63\ 10^{8}$
	^{59}Fe	$2.32\ 10^{8}$	nd	nd
	^{58}Co	$6.97\ 10^{7}$	nd	nd
	^{60}Co	$3.48\ 10^{8}$	$3.80\ 10^{8}$	$8.82\ 10^{7}$
	^{65}Zn	$2.32\ 10^{8}$	nd	nd
	^{90}Sr	$5.58\ 10^{10}$	$8.50\ 10^{10}$	$4.98\ 10^{10}$
	^{90}Y	$5.58\ 10^{10}$	$8.50\ 10^{10}$	nd
	^{95}Zr	$2.32\ 10^{8}$	nd	nd

Table A6: continued

Site	Radionuclide	Annual discharges (Bq) 1993–1995	2003	2007
Sizewell A: continued	^{95}Nb	$1.16\ 10^{8}$	nd	nd
	^{106}Ru	$1.86\ 10^{9}$	nd	nd
	^{110m}Ag	$1.16\ 10^{8}$	nd	nd
	^{124}Sb	$2.09\ 10^{9}$	$1.20\ 10^{9}$	nd
	^{125}Sb	$3.48\ 10^{8}$	nd	$1.18\ 10^{9}$
	^{125m}Te	$9.29\ 10^{7}$	nd	nd
	^{134}Cs	$6.27\ 10^{9}$	$1.10\ 10^{11}$	$2.12\ 10^{10}$
	^{137}Cs	$1.21\ 10^{11}$	$5.58\ 10^{11}$	$2.62\ 10^{11}$
	^{144}Ce	$5.81\ 10^{8}$	nd	nd
	^{144}Pr	$5.81\ 10^{8}$	nd	nd
	^{154}Eu	$8.13\ 10^{7}$	nd	nd
	^{155}Eu	$2.32\ 10^{8}$	nd	nd
	^{238}Pu	$1.16\ 10^{7}$	$3.00\ 10^{7}$	$3.80\ 10^{7}$
	^{239}Pu	$3.48\ 10^{7}$	$5.40\ 10^{7}$	$4.23\ 10^{7}$
	^{241}Pu	$9.29\ 10^{8}$	$1.50\ 10^{9}$	nd
	^{241}Am	$4.64\ 10^{7}$	$8.60\ 10^{7}$	nd
	^{242}Cm	$2.32\ 10^{6}$	$1.90\ 10^{7}$	$1.35\ 10^{8}$
	^{243}Cm	$1.04\ 10^{6}$	$2.60\ 10^{6}$	$1.16\ 10^{7}$
	^{244}Cm	nd	$2.60\ 10^{6}$	nd
Trawsfynydd	^{3}H	$1.43\ 10^{11}$	$3.58\ 10^{10}$	$3.00\ 10^{9}$
	^{35}S	$3.10\ 10^{8}$	nd	nd
	^{45}Ca	$4.65\ 10^{7}$	nd	nd
	^{54}Mn	$5.42\ 10^{7}$	nd	nd
	^{55}Fe	$5.42\ 10^{8}$	$1.80\ 10^{8}$	nd
	^{59}Fe	$2.32\ 10^{8}$	nd	nd
	^{58}Co	$5.42\ 10^{7}$	nd	nd
	^{60}Co	$1.55\ 10^{8}$	$1.10\ 10^{8}$	$4.01\ 10^{7}$
	^{65}Zn	$2.32\ 10^{8}$	nd	nd
	^{90}Sr	$3.40\ 10^{9}$	$2.20\ 10^{9}$	$1.45\ 10^{8}$
	^{90}Y	nd	$2.00\ 10^{9}$	nd
	^{95}Zr	$2.32\ 10^{8}$	nd	nd
	^{95}Nb	$1.55\ 10^{8}$	nd	nd
	^{106}Ru	$5.58\ 10^{9}$	nd	nd
	^{110m}Ag	$1.55\ 10^{8}$	nd	nd
	^{124}Sb	$1.55\ 10^{8}$	nd	nd
	^{125}Sb	$2.01\ 10^{9}$	nd	nd
	^{125m}Te	$4.65\ 10^{8}$	nd	nd
	^{134}Cs	$8.52\ 10^{8}$	nd	nd
	^{137}Cs	$9.69\ 10^{9}$	$1.93\ 10^{9}$	$1.19\ 10^{9}$
	^{144}Ce	$3.87\ 10^{8}$	nd	nd
	^{154}Eu	$3.10\ 10^{8}$	nd	nd
	^{155}Eu	$1.55\ 10^{8}$	nd	nd
	^{238}Pu	$5.42\ 10^{7}$	$5.90\ 10^{6}$	$9.83\ 10^{5}$
	^{239}Pu	$1.55\ 10^{8}$	$1.60\ 10^{7}$	$2.36\ 10^{6}$
	^{241}Pu	$3.95\ 10^{9}$	$3.70\ 10^{8}$	nd

Table A6: continued

Site	Radionuclide	Annual discharges (Bq)		
		1993–1995	2003	2007
Trawsfynydd: continued	^{241}Am	$1.55\ 10^{8}$	$6.20\ 10^{7}$	$7.75\ 10^{6}$
	^{242}Cm	$5.42\ 10^{6}$	nd	nd
	^{243}Cm	$7.75\ 10^{6}$	nd	nd
Wylfa	^{3}H	$6.82\ 10^{12}$	$8.60\ 10^{12}$	$6.19\ 10^{12}$
	^{35}S	$3.81\ 10^{10}$	$3.00\ 10^{10}$	$5.07\ 10^{6}$
	^{45}Ca	$2.44\ 10^{8}$	nd	nd
	^{54}Mn	$1.22\ 10^{8}$	$3.90\ 10^{8}$	nd
	^{55}Fe	$4.38\ 10^{9}$	$1.50\ 10^{9}$	nd
	^{59}Fe	$6.09\ 10^{8}$	nd	nd
	^{58}Co	$1.22\ 10^{8}$	nd	nd
	^{60}Co	$1.83\ 10^{9}$	$1.80\ 10^{9}$	$1.19\ 10^{9}$
	^{65}Zn	$4.87\ 10^{8}$	nd	nd
	^{90}Sr	$1.22\ 10^{8}$	$3.70\ 10^{8}$	$2.61\ 10^{8}$
	^{90}Y	$1.22\ 10^{8}$	$3.70\ 10^{8}$	nd
	^{95}Zr	$3.65\ 10^{8}$	nd	nd
	^{95}Nb	$2.44\ 10^{8}$	nd	$1.19\ 10^{8}$
	^{106}Ru	$1.95\ 10^{9}$	nd	nd
	^{110m}Ag	$2.44\ 10^{8}$	nd	nd
	^{124}Sb	$2.44\ 10^{8}$	nd	$1.54\ 10^{8}$
	^{125}Sb	$3.65\ 10^{8}$	nd	nd
	^{125m}Te	$7.31\ 10^{7}$	nd	nd
	^{134}Cs	$4.87\ 10^{8}$	$2.00\ 10^{9}$	$2.32\ 10^{8}$
	^{137}Cs	$6.33\ 10^{9}$	$1.50\ 10^{10}$	$3.94\ 10^{9}$
	^{144}Ce	$3.65\ 10^{8}$	nd	nd
	^{144}Pr	$3.65\ 10^{8}$	nd	nd
	^{154}Eu	$2.44\ 10^{8}$	nd	nd
	^{155}Eu	$1.22\ 10^{8}$	nd	nd
	^{238}Pu	$1.10\ 10^{7}$	nd	nd
	^{239}Pu	$4.87\ 10^{7}$	nd	$5.48\ 10^{6}$
	^{241}Pu	$7.31\ 10^{8}$	$1.50\ 10^{8}$	nd
	^{241}Am	$2.44\ 10^{7}$	$3.40\ 10^{6}$	nd
	^{242}Cm	$7.31\ 10^{6}$	nd	nd
	^{243}Cm	$2.44\ 10^{6}$	nd	nd
PWR power station				
Sizewell B	^{3}H	$1.07\ 10^{13}$	$6.89\ 10^{13}$	$2.92\ 10^{13}$
	^{54}Mn	$5.95\ 10^{8}$	nd	nd
	^{55}Fe	$2.72\ 10^{8}$	nd	nd
	^{58}Co	$1.61\ 10^{10}$	$1.11\ 10^{10}$	nd
	^{60}Co	$3.51\ 10^{8}$	$1.11\ 10^{10}$	$9.90\ 10^{8}$
	^{63}Ni	nd	$1.11\ 10^{10}$	$4.40\ 10^{8}$
	^{110m}Ag	nd	$3.32\ 10^{9}$	nd
	^{134}Cs	nd	$3.32\ 10^{9}$	$5.30\ 10^{9}$
	^{137}Cs	nd	$4.42\ 10^{9}$	$6.00\ 10^{9}$

Table A7: Liquid radioactive discharges from nuclear fuel reprocessing sites

		Annual discharges (Bq)		
Site	**Radionuclide**	**1993–1995**	**2003**	**2007**
Dounreay	^{3}H	$1.77\ 10^{12}$	$9.48\ 10^{10}$	$1.18\ 10^{11}$
	^{60}Co	$1.87\ 10^{10}$	$2.49\ 10^{8}$	nd
	^{90}Sr	$1.20\ 10^{12}$	$1.29\ 10^{11}$	$4.57\ 10^{10}$
	^{95}Zr	$2.42\ 10^{10}$	$2.37\ 10^{8}$	nd
	^{95}Nb	$2.82\ 10^{10}$	nd	nd
	^{106}Ru	$6.40\ 10^{11}$	$5.48\ 10^{8}$	nd
	^{110m}Ag	$6.70\ 10^{9}$	$9.61\ 10^{7}$	nd
	^{134}Cs	$5.11\ 10^{11}$	nd	nd
	^{137}Cs	$4.07\ 10^{12}$	$1.26\ 10^{10}$	$1.04\ 10^{10}$
	^{144}Ce	$5.03\ 10^{10}$	$4.46\ 10^{8}$	nd
	^{234}U	$8.80\ 10^{8}$	nd	nd
	^{235}U	$2.84\ 10^{7}$	nd	nd
	^{238}U	$4.48\ 10^{7}$	nd	nd
	^{238}Pu	$9.01\ 10^{9}$	$2.75\ 10^{8}$	nd
	^{239}Pu	$2.24\ 10^{10}$	$5.50\ 10^{8}$	nd
	^{241}Pu	$9.30\ 10^{11}$	$2.05\ 10^{8}$	nd
	^{241}Am	$7.16\ 10^{10}$	$1.93\ 10^{9}$	nd
	^{242}Cm	$2.83\ 10^{9}$	$4.04\ 10^{5}$	nd
	^{243}Cm	$6.82\ 10^{8}$	nd	nd
Sellafield	^{3}H	$2.23\ 10^{15}$	$3.90\ 10^{15}$	$6.28\ 10^{14}$
	^{14}C	$7.40\ 10^{12}$	$1.70\ 10^{13}$	$4.65\ 10^{12}$
	^{35}S	$6.20\ 10^{11}$	$1.90\ 10^{11}$	$5.30\ 10^{10}$
	^{54}Mn	$6.67\ 10^{10}$	$2.00\ 10^{10}$	nd
	^{55}Fe	$7.67\ 10^{10}$	$2.00\ 10^{10}$	nd
	^{60}Co	$5.00\ 10^{11}$	$4.30\ 10^{11}$	$5.00\ 10^{10}$
	^{63}Ni	$3.13\ 10^{11}$	$3.90\ 10^{11}$	nd
	^{65}Zn	$1.37\ 10^{11}$	$3.00\ 10^{10}$	nd
	^{89}Sr	$3.10\ 10^{11}$	$5.60\ 10^{11}$	nd
	^{90}Sr	$2.47\ 10^{13}$	$1.40\ 10^{13}$	$5.00\ 10^{12}$
	^{95}Zr	$2.91\ 10^{12}$	$3.06\ 10^{11}$	$1.20\ 10^{11}$
	^{95}Nb	$1.67\ 10^{12}$	nd	nd
	^{99}Tc	$8.94\ 10^{13}$	$3.70\ 10^{13}$	$4.89\ 10^{12}$
	^{103}Ru	$2.33\ 10^{11}$	$1.80\ 10^{11}$	nd
	^{106}Ru	$1.03\ 10^{13}$	$1.15\ 10^{13}$	$1.49\ 10^{12}$
	^{110m}Ag	$1.80\ 10^{11}$	$1.00\ 10^{11}$	nd
	^{125}Sb	$1.11\ 10^{13}$	$2.30\ 10^{13}$	$2.80\ 10^{12}$
	^{129}I	$1.90\ 10^{11}$	$5.54\ 10^{11}$	$1.04\ 10^{11}$
	^{134}Cs	$7.73\ 10^{11}$	$3.92\ 10^{11}$	$1.37\ 10^{11}$
	^{137}Cs	$1.60\ 10^{13}$	$6.24\ 10^{12}$	$6.98\ 10^{12}$
	^{144}Ce	$1.48\ 10^{12}$	$8.85\ 10^{11}$	nd
	^{147}Pm	$9.50\ 10^{11}$	$6.70\ 10^{11}$	nd
	^{152}Eu	$1.50\ 10^{11}$	$2.30\ 10^{11}$	nd
	^{154}Eu	$9.67\ 10^{10}$	$2.20\ 10^{11}$	nd
	^{155}Eu	$7.67\ 10^{10}$	$1.90\ 10^{11}$	nd

Table A7: continued

Site	Radionuclide	Annual discharges (Bq) 1993–1995	2003	2007
Sellafield: continued	^{234}U	$1.37\ 10^{10}$	$1.11\ 10^{10}$	$6.96\ 10^{9}$
	^{235}U	nd	$4.08\ 10^{8}$	$2.54\ 10^{8}$
	^{238}U	$1.37\ 10^{10}$	$5.44\ 10^{8}$	$3.39\ 10^{8}$
	^{237}Np	$3.00\ 10^{11}$	$5.00\ 10^{10}$	$3.80\ 10^{10}$
	^{238}Pu	$1.76\ 10^{11}$	$8.95\ 10^{10}$	$2.63\ 10^{10}$
	^{239}Pu	$5.81\ 10^{11}$	$2.69\ 10^{11}$	$7.88\ 10^{10}$
	^{241}Pu	$1.99\ 10^{13}$	$1.01\ 10^{13}$	$2.83\ 10^{12}$
	^{241}Am	$4.53\ 10^{11}$	$5.90\ 10^{10}$	$2.24\ 10^{10}$
	^{242}Cm	$2.30\ 10^{10}$	$1.00\ 10^{10}$	nd
	^{243}Cm	$5.00\ 10^{9}$	$5.00\ 10^{9}$	$1.56\ 10^{9}$
	^{244}Cm	nd	$5.00\ 10^{9}$	$1.56\ 10^{10}$

Table A8: Liquid radioactive discharges from other installations

Site	Radionuclide	Annual discharges (Bq) 1993–1995	2003	2007
Amersham	^{3}H	$1.59\ 10^{10}$	$1.11\ 10^{9}$	$5.34\ 10^{8}$
	^{65}Zn	$1.29\ 10^{11}$	$1.39\ 10^{10}$	$4.02\ 10^{9}$
	^{90}Sr	$9.51\ 10^{9}$	$7.35\ 10^{8}$	$3.05\ 10^{8}$
	^{125}I	$2.88\ 10^{10}$	$1.81\ 10^{8}$	$3.67\ 10^{7}$
	^{137}Cs	$4.33\ 10^{7}$	$3.90\ 10^{5}$	$1.23\ 10^{7}$
	^{241}Am	$6.56\ 10^{7}$	$1.58\ 10^{7}$	$1.25\ 10^{7}$
Cardiff	^{3}H	$4.63\ 10^{14}$	$3.02\ 10^{13}$	$2.81\ 10^{13}$
	^{14}C	$1.20\ 10^{12}$	$1.43\ 10^{11}$	$1.43\ 10^{11}$
	^{32}P	$7.30\ 10^{7}$	$3.48\ 10^{6}$	$7.40\ 10^{4}$
	^{35}S	$8.85\ 10^{7}$	nd	nd
	^{45}Ca	$1.83\ 10^{7}$	nd	nd
	^{57}Co	$6.99\ 10^{7}$	nd	nd
	^{125}I	$1.66\ 10^{10}$	$2.36\ 10^{7}$	$1.26\ 10^{6}$
Harwell	^{3}H	$4.05\ 10^{11}$	$1.73\ 10^{10}$	$1.05\ 10^{10}$
	^{56}Mn	$7.81\ 10^{7}$	$1.18\ 10^{7}$	$3.15\ 10^{5}$
	^{58}Co	$7.81\ 10^{7}$	$1.18\ 10^{7}$	$3.15\ 10^{5}$
	^{60}Co	$6.37\ 10^{8}$	$4.60\ 10^{6}$	$1.61\ 10^{6}$
	^{90}Sr	$7.81\ 10^{8}$	$5.90\ 10^{7}$	$1.58\ 10^{6}$
	^{90}Y	nd	$5.90\ 10^{7}$	$1.58\ 10^{6}$
	^{103}Ru	$7.81\ 10^{7}$	$1.18\ 10^{7}$	$3.15\ 10^{5}$
	^{106}Ru	$7.81\ 10^{7}$	$1.18\ 10^{7}$	$3.15\ 10^{5}$
	^{125}Sb	$7.81\ 10^{7}$	$1.18\ 10^{7}$	$3.15\ 10^{5}$
	^{125}I	$7.81\ 10^{7}$	$1.18\ 10^{7}$	$3.15\ 10^{5}$
	^{131}I	$7.81\ 10^{7}$	$1.18\ 10^{7}$	$3.15\ 10^{5}$
	^{134}Cs	$7.81\ 10^{7}$	$1.18\ 10^{7}$	$3.15\ 10^{5}$
	^{137}Cs	$1.17\ 10^{9}$	$5.60\ 10^{7}$	$3.63\ 10^{7}$
	^{154}Eu	$7.81\ 10^{7}$	$1.18\ 10^{7}$	$3.15\ 10^{5}$
	^{155}Eu	$7.81\ 10^{7}$	$1.18\ 10^{7}$	$3.15\ 10^{5}$
	^{226}Ra	$3.66\ 10^{7}$	$8.97\ 10^{6}$	$3.62\ 10^{6}$

Table A8: continued

Site	Radionuclide	Annual discharges (Bq)		
		1993–1995	2003	2007
Harwell: continued	^{234}U	$3.98\ 10^{7}$	nd	nd
	^{238}U	$3.98\ 10^{7}$	$9.75\ 10^{6}$	$3.94\ 10^{6}$
	^{239}Pu	$1.12\ 10^{7}$	$2.73\ 10^{6}$	$1.10\ 10^{6}$
	^{240}Pu	$1.27\ 10^{7}$	nd	nd
	^{241}Am	$1.91\ 10^{7}$	$4.68\ 10^{6}$	$1.89\ 10^{6}$
Winfrith	^{3}H	$4.39\ 10^{13}$	$1.27\ 10^{13}$	$2.34\ 10^{13}$
	^{54}Mn	$1.32\ 10^{8}$	nd	nd
	^{55}Fe	$1.89\ 10^{9}$	nd	nd
	^{60}Co	$4.79\ 10^{9}$	$1.15\ 10^{9}$	nd
	^{63}Ni	$5.26\ 10^{9}$	nd	nd
	^{65}Zn	$2.40\ 10^{8}$	$2.17\ 10^{8}$	nd
	^{90}Sr	$2.59\ 10^{9}$	$3.87\ 10^{10}$	$7.35\ 10^{9}$
	^{134}Cs	$1.32\ 10^{8}$	nd	nd
	^{137}Cs	$3.38\ 10^{10}$	$3.87\ 10^{10}$	$7.35\ 10^{9}$
	^{144}Ce	$8.77\ 10^{7}$	nd	nd
	^{234}U	$6.69\ 10^{7}$	nd	nd
	^{238}U	$1.42\ 10^{7}$	nd	nd
	^{238}Pu	$4.46\ 10^{8}$	nd	nd
	^{239}Pu	$1.11\ 10^{9}$	$1.57\ 10^{9}$	$1.74\ 10^{8}$
	^{241}Am	$3.85\ 10^{8}$	nd	nd

A3 References

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Appendix B Global Circulation of Radionuclides

The radionuclides considered in this report as globally circulating were ^{3}H, ^{14}C, ^{85}Kr and ^{129}I. The compartmental models used to calculate the collective doses due to global circulation are described in more detail elsewhere (Simmonds, 1998; Smith and Simmonds, 2009; Titley et al, 1995). The models are only suitable for the calculation of collective doses on a regional scale from continuous discharges, due to the size of the compartments and the assumption of instantaneous mixing and homogeneity within each compartment.

The collective doses to the world population due to global circulation from the release to the atmosphere of 1 Bq over one year of ^{3}H, ^{14}C, ^{85}Kr and ^{129}I are shown in Table B1. To obtain the collective dose to a population of interest, the values in Table B1 must be scaled according to the population of the region of interest. The world population was assumed to be 10 billion people.

The collective doses to the UK and European populations due to global circulation from release to the marine environment of 1 Bq over one year of ^{3}H, ^{14}C and ^{129}I are presented in Table B2. Unlike the collective doses for discharges to the atmosphere, these doses are specific for different populations and no scaling is necessary.

Table B1: World collective doses integrated to 500 years due to the global circulation for the release of 1 Bq over one year to the atmosphere

Radionuclide	Collective dose (man Sv)
^{3}H	$3.3\ 10^{-16}$
^{14}C	$1.7\ 10^{-11}$
^{85}Kr	$2.5\ 10^{-16}$
^{129}I	$9.8\ 10^{-11}$

Table B2: Collective doses integrated to 500 years due to global circulation for the release of 1 Bq over one year to the marine environment

Region	Radionuclide	Collective dose (man Sv)
UK	^{3}H	$2.0\ 10^{-19}$
	^{14}C	$6.7\ 10^{-14}$
	^{129}I	$1.8\ 10^{-15}$
Europe	^{3}H	$1.2\ 10^{-18}$
	^{14}C	$4.0\ 10^{-13}$
	^{129}I	$1.1\ 10^{-14}$

B1 References

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Appendix C Collective Effective Doses Integrated to 500 Years per Unit Activity Discharged

The unit collective effective doses integrated to 500 years calculated using an annual discharge of 1 Bq over one year are presented here. Tables C1 to C4 give the doses to the European population; Tables C5 to C8 give the doses to the UK population. An asterisk (*) indicates radionuclides for which the contribution of the first progeny to the dose was included.

C1 Collective effective doses to the European population integrated to 500 years due to a discharge of 1 Bq over one year

Table C1: Collective effective doses to the European population integrated to 500 years due to a discharge of 1 Bq over one year from nuclear fuel fabrication installations

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Capenhurst	^{3}H	$1.6\ 10^{-15}$	$1.6\ 10^{-18}$
	^{99}Tc	–	$7.4\ 10^{-15}$
	^{234}Th*	$7.8\ 10^{-13}$	$3.4\ 10^{-17}$
	^{234}U*	$4.4\ 10^{-11}$	$1.1\ 10^{-14}$
	^{235}U*	$4.0\ 10^{-11}$	–
	^{238}U*	$3.7\ 10^{-11}$	$9.7\ 10^{-15}$
	^{237}Np*	–	$3.0\ 10^{-13}$
Springfields	^{99}Tc	–	$1.1\ 10^{-14}$
	^{228}Th*	–	$1.9\ 10^{-14}$
	^{230}Th*	–	$1.7\ 10^{-14}$
	^{232}Th*	–	$1.4\ 10^{-12}$
	^{234}Th*	$7.0\ 10^{-13}$	$5.7\ 10^{-17}$
	^{234}U*	$4.0\ 10^{-11}$	$1.6\ 10^{-14}$
	^{235}U*	$3.6\ 10^{-11}$	$1.6\ 10^{-14}$
	^{238}U*	$3.4\ 10^{-11}$	$1.5\ 10^{-14}$
	^{237}Np*	–	$4.6\ 10^{-13}$

Table C2: Collective effective doses to the European population integrated to 500 years due to a discharge of 1 Bq over one year from nuclear power production installations

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
AGR power stations			
Dungeness B	^{3}H	$1.5\ 10^{-15}$	$1.6\ 10^{-18}$
	^{14}C	$1.3\ 10^{-12}$	$6.6\ 10^{-13}$
	^{32}P	–	$1.3\ 10^{-13}$
	^{35}S	$3.5\ 10^{-13}$	$1.2\ 10^{-17}$
	^{41}Ar	$3.9\ 10^{-17}$	–
	^{45}Ca	–	$1.3\ 10^{-17}$
	^{54}Mn	–	$1.0\ 10^{-14}$

Table C2: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Dungeness B: continued	^{55}Fe	–	$9.8\ 10^{-15}$
	^{59}Fe	–	$3.1\ 10^{-14}$
	^{60}Co	$2.2\ 10^{-12}$	$1.8\ 10^{-15}$
	^{63}Ni	–	$1.4\ 10^{-15}$
	^{65}Zn	$1.0\ 10^{-12}$	$2.1\ 10^{-13}$
	^{90}Sr*	–	$1.0\ 10^{-15}$
	^{90}Y	–	$5.2\ 10^{-18}$
	^{95}Zr*	–	$2.7\ 10^{-16}$
	^{95}Nb	–	$6.5\ 10^{-17}$
	^{106}Ru	–	$3.0\ 10^{-14}$
	^{110m}Ag	–	$7.1\ 10^{-14}$
	^{124}Sb	–	$4.1\ 10^{-15}$
	^{125}Sb*	–	$5.5\ 10^{-15}$
	^{125m}Te	–	$4.6\ 10^{-15}$
	^{131}I*	$4.2\ 10^{-13}$	–
	^{134}Cs	–	$2.2\ 10^{-14}$
	^{137}Cs*	–	$2.1\ 10^{-14}$
	^{144}Ce*	–	$3.8\ 10^{-16}$
	^{144}Pr	–	$2.7\ 10^{-21}$
	^{154}Eu	–	$3.2\ 10^{-15}$
	^{155}Eu	–	$4.0\ 10^{-16}$
	^{238}Pu*	–	$1.0\ 10^{-12}$
	^{239}Pu*	–	$1.5\ 10^{-12}$
	^{241}Pu*	–	$1.3\ 10^{-14}$
	^{241}Am*	–	$6.2\ 10^{-13}$
	^{242}Cm*	–	$1.5\ 10^{-14}$
	^{243}Cm*	–	$2.6\ 10^{-13}$
Hartlepool	^{3}H	$1.3\ 10^{-15}$	$2.0\ 10^{-18}$
	^{14}C	$1.2\ 10^{-12}$	$8.2\ 10^{-13}$
	^{32}P	–	$8.0\ 10^{-13}$
	^{35}S	$3.1\ 10^{-13}$	$2.7\ 10^{-17}$
	^{41}Ar	$1.6\ 10^{-16}$	–
	^{45}Ca	–	$9.4\ 10^{-17}$
	^{54}Mn	–	$1.7\ 10^{-15}$
	^{55}Fe	–	$6.2\ 10^{-15}$
	^{59}Fe	–	$2.4\ 10^{-14}$
	^{58}Co	–	$4.7\ 10^{-15}$
	^{60}Co	$2.8\ 10^{-12}$	$2.8\ 10^{-14}$
	^{63}Ni	–	$7.5\ 10^{-16}$
	^{65}Zn	$8.4\ 10^{-13}$	$1.1\ 10^{-12}$
	^{90}Sr*	–	$2.0\ 10^{-15}$
	^{90}Y	–	$7.2\ 10^{-18}$
	^{95}Zr*	–	$7.4\ 10^{-17}$
	^{95}Nb	–	$3.4\ 10^{-17}$
	^{106}Ru	–	$4.0\ 10^{-14}$

Table C2: continued

		Collective dose (man Sv)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
Hartlepool: continued	^{110m}Ag	–	$3.7\ 10^{-13}$
	^{124}Sb	–	$2.6\ 10^{-15}$
	^{125}Sb*	–	$1.4\ 10^{-14}$
	^{125m}Te	–	$1.9\ 10^{-14}$
	^{131}I*	$5.1\ 10^{-13}$	–
	^{133}Xe	$2.0\ 10^{-17}$	–
	^{134}Cs	–	$2.2\ 10^{-14}$
	^{137}Cs*	–	$2.1\ 10^{-14}$
	^{144}Ce*	–	$4.1\ 10^{-16}$
	^{144}Pr	–	$3.6\ 10^{-21}$
	^{154}Eu	–	$1.3\ 10^{-15}$
	^{155}Eu	–	$1.6\ 10^{-16}$
	^{238}Pu*	–	$2.6\ 10^{-13}$
	^{239}Pu*	–	$4.1\ 10^{-13}$
	^{241}Pu*	–	$5.1\ 10^{-15}$
	^{241}Am*	–	$7.5\ 10^{-14}$
	^{242}Cm*	–	$2.5\ 10^{-15}$
	^{243}Cm*	–	$3.3\ 10^{-14}$
Heysham 1	^{3}H	$1.3\ 10^{-15}$	$1.7\ 10^{-18}$
	^{14}C	$1.1\ 10^{-12}$	$6.7\ 10^{-13}$
	^{32}P	–	$1.7\ 10^{-13}$
	^{35}S	$4.5\ 10^{-13}$	$1.5\ 10^{-17}$
	^{41}Ar	$8.7\ 10^{-17}$	–
	^{45}Ca	–	$1.4\ 10^{-17}$
	^{54}Mn	–	$1.8\ 10^{-14}$
	^{55}Fe	–	$1.5\ 10^{-14}$
	^{59}Fe	–	$7.2\ 10^{-14}$
	^{58}Co	–	$2.6\ 10^{-14}$
	^{60}Co	$2.3\ 10^{-12}$	$2.3\ 10^{-13}$
	^{63}Ni	–	$4.2\ 10^{-16}$
	^{65}Zn	$1.2\ 10^{-12}$	$4.8\ 10^{-13}$
	^{90}Sr*	–	$1.1\ 10^{-15}$
	^{90}Y	–	$2.9\ 10^{-17}$
	^{95}Zr*	–	$6.7\ 10^{-16}$
	^{95}Nb	–	$1.7\ 10^{-16}$
	^{106}Ru	–	$7.7\ 10^{-14}$
	^{110m}Ag	–	$1.8\ 10^{-13}$
	^{124}Sb	–	$6.6\ 10^{-16}$
	^{125}Sb*	–	$1.1\ 10^{-14}$
	^{125m}Te	–	$4.8\ 10^{-15}$
	^{131}I*	$7.1\ 10^{-13}$	–
	^{133}Xe	$1.8\ 10^{-17}$	–
	^{134}Cs	–	$1.6\ 10^{-14}$
	^{137}Cs*	–	$2.1\ 10^{-14}$
	^{144}Ce*	–	$7.8\ 10^{-16}$

Table C2: continued

		Collective dose (man Sv)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
Heysham 1: continued	^{144}Pr	–	$3.0\ 10^{-20}$
	^{154}Eu	–	$6.1\ 10^{-15}$
	^{155}Eu	–	$6.6\ 10^{-16}$
	^{238}Pu*	–	$7.5\ 10^{-13}$
	^{239}Pu*	–	$8.5\ 10^{-13}$
	^{241}Pu*	–	$2.9\ 10^{-14}$
	^{241}Am*	–	$4.4\ 10^{-12}$
	^{242}Cm*	–	$2.2\ 10^{-14}$
	^{243}Cm*	–	$3.2\ 10^{-13}$
Heysham 2	^{3}H	$1.3\ 10^{-15}$	$1.7\ 10^{-18}$
	^{14}C	$1.1\ 10^{-12}$	$6.7\ 10^{-13}$
	^{32}P	–	$1.7\ 10^{-13}$
	^{35}S	$4.5\ 10^{-13}$	$1.5\ 10^{-17}$
	^{41}Ar	$8.7\ 10^{-17}$	–
	^{45}Ca	–	$1.4\ 10^{-17}$
	^{54}Mn	–	$1.8\ 10^{-14}$
	^{55}Fe	–	$1.5\ 10^{-14}$
	^{59}Fe	–	$7.2\ 10^{-14}$
	^{58}Co	–	$2.6\ 10^{-14}$
	^{60}Co	$2.3\ 10^{-12}$	$2.3\ 10^{-13}$
	^{63}Ni	–	$4.2\ 10^{-16}$
	^{65}Zn	$1.2\ 10^{-12}$	$4.8\ 10^{-13}$
	^{90}Sr*	–	$1.1\ 10^{-15}$
	^{90}Y	–	$2.9\ 10^{-17}$
	^{95}Zr*	–	$6.7\ 10^{-16}$
	^{95}Nb	–	$1.7\ 10^{-16}$
	^{106}Ru	–	$7.7\ 10^{-14}$
	^{110m}Ag	–	$1.8\ 10^{-13}$
	^{124}Sb	–	$6.6\ 10^{-16}$
	^{125}Sb*	–	$1.1\ 10^{-14}$
	^{125m}Te	–	$4.8\ 10^{-15}$
	^{131}I*	$7.1\ 10^{-13}$	–
	^{133}Xe	$1.8\ 10^{-17}$	–
	^{134}Cs	–	$1.6\ 10^{-14}$
	^{137}Cs*	–	$2.1\ 10^{-14}$
	^{144}Ce*	–	$7.8\ 10^{-16}$
	^{144}Pr	–	$3.0\ 10^{-20}$
	^{154}Eu	–	$6.1\ 10^{-15}$
	^{155}Eu	–	$6.6\ 10^{-16}$
	^{238}Pu*	–	$7.5\ 10^{-13}$
	^{239}Pu*	–	$8.5\ 10^{-13}$
	^{241}Pu*	–	$2.9\ 10^{-14}$
	^{241}Am*	–	$4.4\ 10^{-12}$
	^{242}Cm*	–	$2.2\ 10^{-14}$
	^{243}Cm*	–	$3.2\ 10^{-13}$

Table C2: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Hinkley Point B	^{3}H	$1.4\ 10^{-15}$	$1.3\ 10^{-18}$
	^{14}C	$1.2\ 10^{-12}$	$4.6\ 10^{-13}$
	^{32}P	–	$2.7\ 10^{-14}$
	^{35}S	$5.4\ 10^{-13}$	$2.4\ 10^{-18}$
	^{41}Ar	$4.9\ 10^{-17}$	–
	^{45}Ca	–	$3.2\ 10^{-18}$
	^{54}Mn	–	$1.3\ 10^{-15}$
	^{55}Fe	–	$1.5\ 10^{-15}$
	^{59}Fe	–	$3.3\ 10^{-15}$
	^{58}Co	–	$4.2\ 10^{-16}$
	^{60}Co	$2.0\ 10^{-12}$	$3.8\ 10^{-15}$
	^{63}Ni	–	$2.9\ 10^{-16}$
	^{65}Zn	$1.4\ 10^{-12}$	$5.7\ 10^{-14}$
	^{90}Sr*	–	$2.0\ 10^{-16}$
	^{90}Y	–	$4.2\ 10^{-19}$
	^{95}Zr*	–	$4.0\ 10^{-17}$
	^{95}Nb	–	$8.6\ 10^{-18}$
	^{106}Ru	–	$6.4\ 10^{-15}$
	^{110m}Ag	–	$1.8\ 10^{-14}$
	^{124}Sb	–	$5.9\ 10^{-16}$
	^{125}Sb*	–	$2.7\ 10^{-15}$
	^{125m}Te	–	$9.0\ 10^{-16}$
	^{131}I*	$8.2\ 10^{-13}$	–
	^{133}Xe	$1.7\ 10^{-17}$	–
	^{134}Cs	–	$3.7\ 10^{-15}$
	^{137}Cs*	–	$3.8\ 10^{-15}$
	^{144}Ce*	–	$7.0\ 10^{-17}$
	^{144}Pr	–	$6.2\ 10^{-23}$
	^{154}Eu	–	$7.5\ 10^{-16}$
	^{155}Eu	–	$6.9\ 10^{-17}$
	^{238}Pu*	–	$1.8\ 10^{-13}$
	^{239}Pu*	–	$4.0\ 10^{-13}$
	^{241}Pu*	–	$5.2\ 10^{-15}$
	^{241}Am*	–	$1.6\ 10^{-13}$
	^{242}Cm*	–	$2.0\ 10^{-15}$
	^{243}Cm*	–	$4.7\ 10^{-14}$
Hunterston B	^{3}H	$9.8\ 10^{-16}$	$1.5\ 10^{-18}$
	^{14}C	$1.0\ 10^{-12}$	–
	^{35}S	$2.8\ 10^{-13}$	$3.0\ 10^{-18}$
	^{41}Ar	$4.4\ 10^{-17}$	–
	^{45}Ca	–	$6.1\ 10^{-18}$
	^{54}Mn	–	$2.0\ 10^{-15}$
	^{55}Fe	$7.0\ 10^{-15}$	–
	^{60}Co	$1.3\ 10^{-12}$	$1.0\ 10^{-14}$
	^{65}Zn	$7.1\ 10^{-13}$	–

Table C2: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Hunterston B: continued	^{131}I*	6.6 10^{-13}	–
	^{90}Sr*	–	7.6 10^{-16}
	^{134}Cs	–	1.2 10^{-14}
	^{137}Cs*	–	1.5 10^{-14}
	^{144}Pr	–	2.0 10^{-21}
	^{239}Pu*	–	4.6 10^{-13}
Torness	^{3}H	1.1 10^{-15}	1.5 10^{-18}
	^{14}C	1.1 10^{-12}	–
	^{35}S	2.2 10^{-13}	4.5 10^{-18}
	^{41}Ar	1.5 10^{-17}	–
	^{55}Fe	8.5 10^{-15}	–
	^{60}Co	1.0 10^{-12}	1.8 10^{-14}
	^{65}Zn	5.4 10^{-13}	–
	^{90}Sr*	–	7.3 10^{-16}
	^{131}I*	4.4 10^{-13}	–
	^{134}Cs	–	1.2 10^{-14}
	^{137}Cs*	–	1.4 10^{-14}
	^{144}Pr	–	7.0 10^{-21}
	^{239}Pu*	–	3.6 10^{-13}
Magnox power stations			
Berkeley	^{3}H	1.5 10^{-15}	1.4 10^{-18}
	^{14}C	1.2 10^{-12}	–
	^{35}S	5.1 10^{-13}	8.4 10^{-18}
	^{41}Ar	8.6 10^{-17}	–
	^{45}Ca	–	1.0 10^{-17}
	^{54}Mn	–	2.6 10^{-15}
	^{55}Fe	–	3.2 10^{-15}
	^{59}Fe	–	1.1 10^{-14}
	^{58}Co	–	8.3 10^{-16}
	^{60}Co	2.7 10^{-12}	6.4 10^{-15}
	^{65}Zn	1.3 10^{-12}	1.6 10^{-13}
	^{90}Sr*	–	3.4 10^{-16}
	^{90}Y	–	1.3 10^{-18}
	^{95}Zr*	–	9.7 10^{-17}
	^{95}Nb	–	1.9 10^{-17}
	^{106}Ru	–	3.0 10^{-14}
	^{110m}Ag	–	7.8 10^{-14}
	^{124}Sb	–	7.4 10^{-16}
	^{125}Sb*	–	3.3 10^{-15}
	^{125m}Te	–	3.1 10^{-15}
	^{134}Cs	5.6 10^{-12}	5.0 10^{-15}
	^{137}Cs*	–	4.8 10^{-15}
	^{144}Ce*	–	1.3 10^{-16}
	^{144}Pr	–	5.1 10^{-22}
	^{154}Eu	–	1.2 10^{-15}

Table C2: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Berkeley: continued	^{155}Eu	–	1.2 10^{-16}
	^{238}Pu*	–	2.4 10^{-13}
	^{239}Pu*	–	3.7 10^{-13}
	^{241}Pu*	–	6.6 10^{-15}
	^{241}Am*	–	1.8 10^{-13}
	^{242}Cm*	–	3.4 10^{-15}
	^{243}Cm*	–	6.6 10^{-14}
Bradwell	^{3}H	1.6 10^{-15}	1.8 10^{-18}
	^{14}C	1.3 10^{-12}	–
	^{35}S	3.2 10^{-13}	3.4 10^{-17}
	^{41}Ar	8.1 10^{-17}	–
	^{45}Ca	–	2.8 10^{-17}
	^{51}Cr	–	2.9 10^{-17}
	^{54}Mn	–	1.1 10^{-14}
	^{55}Fe	–	1.3 10^{-14}
	^{59}Fe	–	4.3 10^{-14}
	^{58}Co	–	2.1 10^{-15}
	^{60}Co	3.0 10^{-12}	1.6 10^{-14}
	^{65}Zn	9.9 10^{-13}	4.7 10^{-13}
	^{90}Sr*	–	1.4 10^{-15}
	^{90}Y	–	3.2 10^{-18}
	^{95}Zr*	–	2.8 10^{-16}
	^{95}Nb	–	5.9 10^{-17}
	^{106}Ru	–	1.3 10^{-13}
	^{110m}Ag	–	2.8 10^{-13}
	^{124}Sb	–	3.2 10^{-15}
	^{125}Sb*	–	1.8 10^{-14}
	^{125m}Te	–	1.0 10^{-14}
	^{134}Cs	–	2.4 10^{-14}
	^{137}Cs*	5.6 10^{-12}	2.4 10^{-14}
	^{144}Ce*	–	4.2 10^{-16}
	^{144}Pr	–	1.5 10^{-21}
	^{154}Eu	–	3.1 10^{-15}
	^{155}Eu	–	3.9 10^{-16}
	^{238}Pu*	–	9.7 10^{-13}
	^{239}Pu*	–	1.5 10^{-12}
	^{241}Pu*	–	2.2 10^{-14}
	^{241}Am*	–	5.1 10^{-13}
	^{242}Cm*	–	1.4 10^{-14}
	^{243}Cm*	–	2.5 10^{-13}
	^{244}Cm*	–	1.8 10^{-13}
Chapelcross	^{3}H	1.2 10^{-15}	1.6 10^{-18}
	^{14}C	1.1 10^{-12}	–
	^{35}S	3.2 10^{-14}	6.2 10^{-18}
	^{41}Ar	2.0 10^{-17}	–

Table C2: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Chapelcross: continued	^{60}Co	–	$1.5\ 10^{-13}$
	^{65}Zn	–	$2.2\ 10^{-13}$
	^{90}Sr*	–	$9.4\ 10^{-16}$
	^{106}Ru	–	$3.7\ 10^{-14}$
	^{125}Sb*	–	$1.1\ 10^{-14}$
	^{134}Cs	–	$1.4\ 10^{-14}$
	^{137}Cs*	–	$1.9\ 10^{-14}$
	^{144}Ce*	–	$2.1\ 10^{-16}$
	^{154}Eu	–	$2.1\ 10^{-15}$
	^{238}Pu*	–	$5.7\ 10^{-13}$
	^{239}Pu*	–	$8.5\ 10^{-13}$
	^{241}Am*	–	$3.8\ 10^{-12}$
	^{242}Cm*	–	$7.4\ 10^{-15}$
	^{243}Cm*	–	$1.6\ 10^{-13}$
Dungeness A	^{3}H	$1.5\ 10^{-15}$	$1.6\ 10^{-18}$
	^{14}C	$1.3\ 10^{-12}$	–
	^{35}S	$3.5\ 10^{-13}$	$1.2\ 10^{-17}$
	^{41}Ar	$3.9\ 10^{-17}$	–
	^{45}Ca	–	$1.3\ 10^{-17}$
	^{54}Mn	–	$1.0\ 10^{-14}$
	^{55}Fe	–	$9.8\ 10^{-15}$
	^{59}Fe	–	$3.1\ 10^{-14}$
	^{58}Co	–	$1.8\ 10^{-15}$
	^{60}Co	$2.3\ 10^{-12}$	$1.3\ 10^{-14}$
	^{65}Zn	$1.0\ 10^{-12}$	$2.1\ 10^{-13}$
	^{90}Sr*	–	$1.0\ 10^{-15}$
	^{90}Y	–	$5.2\ 10^{-18}$
	^{95}Zr*	–	$2.9\ 10^{-16}$
	^{95}Nb	–	$6.5\ 10^{-17}$
	^{106}Ru	–	$3.0\ 10^{-14}$
	^{110m}Ag	–	$7.1\ 10^{-14}$
	^{124}Sb	–	$4.1\ 10^{-15}$
	^{125}Sb*	–	$1.5\ 10^{-14}$
	^{125m}Te	–	$4.6\ 10^{-15}$
	^{134}Cs	–	$2.2\ 10^{-14}$
	^{137}Cs*	$4.6\ 10^{-12}$	$2.1\ 10^{-14}$
	^{144}Ce*	–	$3.8\ 10^{-16}$
	^{144}Pr	–	$2.7\ 10^{-21}$
	^{154}Eu	–	$3.2\ 10^{-15}$
	^{155}Eu	–	$4.0\ 10^{-16}$
	^{238}Pu*	–	$1.0\ 10^{-12}$
	^{239}Pu*	–	$1.5\ 10^{-12}$
	^{241}Pu*	–	$2.4\ 10^{-14}$
	^{241}Am*	–	$6.2\ 10^{-13}$
	^{242}Cm*	–	$1.5\ 10^{-14}$

Table C2: continued

		Collective dose (man Sv)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
Dungeness A: continued	^{243}Cm*	–	2.6 10^{-13}
	^{244}Cm*	–	1.8 10^{-13}
Hinkley Point A	^{3}H	1.4 10^{-15}	1.3 10^{-18}
	^{14}C	1.2 10^{-12}	–
	^{35}S	5.4 10^{-13}	2.4 10^{-18}
	^{41}Ar	5.0 10^{-17}	–
	^{45}Ca	–	3.2 10^{-18}
	^{54}Mn	–	1.3 10^{-15}
	^{55}Fe	–	1.5 10^{-15}
	^{59}Fe	–	3.3 10^{-15}
	^{58}Co	–	4.2 10^{-16}
	^{60}Co	2.0 10^{-12}	3.8 10^{-15}
	^{65}Zn	1.4 10^{-12}	5.7 10^{-14}
	^{90}Sr*	–	2.0 10^{-16}
	^{90}Y	–	4.2 10^{-19}
	^{95}Zr*	–	4.8 10^{-17}
	^{95}Nb	–	8.6 10^{-18}
	^{106}Ru	–	6.4 10^{-15}
	^{110m}Ag	–	1.8 10^{-14}
	^{124}Sb	–	5.9 10^{-16}
	^{125}Sb*	–	2.7 10^{-15}
	^{125m}Te	–	9.0 10^{-16}
	^{134}Cs	–	3.7 10^{-15}
	^{137}Cs*	4.9 10^{-12}	3.8 10^{-15}
	^{144}Ce*	–	7.0 10^{-17}
	^{144}Pr	–	6.2 10^{-23}
	^{154}Eu	–	7.5 10^{-16}
	^{155}Eu	–	6.9 10^{-17}
	^{238}Pu*	–	1.8 10^{-13}
	^{239}Pu*	–	3.0 10^{-13}
	^{241}Pu*	–	5.2 10^{-15}
	^{241}Am*	–	1.6 10^{-13}
	^{242}Cm*	–	2.1 10^{-15}
	^{243}Cm*	–	4.7 10^{-14}
	^{244}Cm*	–	3.0 10^{-14}
Hunterston A	^{3}H	9.8 10^{-16}	1.5 10^{-18}
	^{14}C	1.0 10^{-12}	–
	^{35}S	2.8 10^{-13}	3.0 10^{-18}
	^{41}Ar	4.4 10^{-17}	–
	^{45}Ca	–	6.1 10^{-18}
	^{55}Fe	–	2.6 10^{-15}
	^{60}Co	1.3 10^{-12}	1.0 10^{-14}
	^{65}Zn	7.1 10^{-13}	1.5 10^{-13}
	^{90}Sr*	–	7.6 10^{-16}
	^{90}Y	–	3.7 10^{-18}

Table C2: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Hunterston A: continued	^{95}Zr*	–	$6.5\ 10^{-17}$
	^{95}Nb	–	$2.2\ 10^{-17}$
	^{103}Ru	–	$2.8\ 10^{-16}$
	^{134}Cs	–	$1.2\ 10^{-14}$
	^{137}Cs*	$2.7\ 10^{-12}$	$1.5\ 10^{-14}$
	^{239}Pu*	–	$4.6\ 10^{-13}$
	^{241}Pu*	–	$5.5\ 10^{-15}$
Oldbury	^{3}H	$1.5\ 10^{-15}$	$1.4\ 10^{-18}$
	^{14}C	$1.2\ 10^{-12}$	–
	^{35}S	$5.1\ 10^{-13}$	$8.4\ 10^{-18}$
	^{41}Ar	$9.1\ 10^{-17}$	–
	^{45}Ca	–	$1.0\ 10^{-17}$
	^{51}Cr	–	$8.6\ 10^{-18}$
	^{54}Mn	–	$2.6\ 10^{-15}$
	^{55}Fe	–	$3.2\ 10^{-15}$
	^{59}Fe	–	$1.1\ 10^{-14}$
	^{58}Co	–	$8.3\ 10^{-16}$
	^{60}Co	$2.7\ 10^{-12}$	$6.4\ 10^{-15}$
	^{65}Zn	$1.3\ 10^{-12}$	$1.6\ 10^{-13}$
	^{90}Sr*	–	$3.4\ 10^{-16}$
	^{90}Y	–	$1.3\ 10^{-18}$
	^{95}Zr*	–	$7.0\ 10^{-17}$
	^{95}Nb	–	$1.9\ 10^{-17}$
	^{106}Ru	–	$3.0\ 10^{-14}$
	^{110m}Ag	–	$7.8\ 10^{-14}$
	^{124}Sb	–	$7.4\ 10^{-16}$
	^{125}Sb*	–	$3.3\ 10^{-15}$
	^{125m}Te	–	$3.1\ 10^{-15}$
	^{134}Cs	–	$5.0\ 10^{-15}$
	^{137}Cs*	$5.5\ 10^{-12}$	$4.8\ 10^{-15}$
	^{144}Ce*	–	$1.3\ 10^{-16}$
	^{144}Pr	–	$5.1\ 10^{-22}$
	^{154}Eu	–	$1.2\ 10^{-15}$
	^{155}Eu	–	$1.2\ 10^{-16}$
	^{238}Pu*	–	$2.4\ 10^{-13}$
	^{239}Pu*	–	$3.7\ 10^{-13}$
	^{241}Pu*	–	$6.6\ 10^{-15}$
	^{241}Am*	–	$1.8\ 10^{-13}$
	^{242}Cm*	–	$3.4\ 10^{-15}$
	^{243}Cm*	–	$6.6\ 10^{-14}$
Sizewell A	^{3}H	$1.6\ 10^{-15}$	$1.7\ 10^{-18}$
	^{14}C	$1.3\ 10^{-12}$	–
	^{35}S	$3.1\ 10^{-13}$	$1.8\ 10^{-17}$
	^{41}Ar	$2.9\ 10^{-17}$	–
	^{45}Ca	–	$1.8\ 10^{-17}$

Table C2: continued

		Collective dose (man Sv)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
Sizewell A: continued	^{54}Mn	–	1.0 10^{-14}
	^{55}Fe	–	1.1 10^{-14}
	^{59}Fe	–	4.0 10^{-14}
	^{58}Co	–	2.0 10^{-15}
	^{60}Co	1.9 10^{-12}	1.5 10^{-14}
	^{65}Zn	9.3 10^{-13}	3.9 10^{-13}
	^{90}Sr*	–	1.2 10^{-15}
	^{90}Y	–	4.7 10^{-18}
	^{95}Zr*	–	2.5 10^{-16}
	^{95}Nb	–	6.0 10^{-17}
	^{106}Ru	–	6.3 10^{-14}
	^{110m}Ag	–	1.5 10^{-13}
	^{124}Sb	–	3.0 10^{-15}
	^{125}Sb*	–	1.6 10^{-14}
	^{125m}Te	–	6.2 10^{-15}
	^{134}Cs	–	2.2 10^{-14}
	^{137}Cs*	4.8 10^{-12}	2.2 10^{-14}
	^{144}Ce*	–	4.0 10^{-16}
	^{144}Pr	–	2.5 10^{-21}
	^{154}Eu	–	3.0 10^{-15}
	^{155}Eu	–	3.7 10^{-16}
	^{238}Pu*	–	9.3 10^{-13}
	^{239}Pu*	–	1.4 10^{-12}
	^{241}Pu*	–	2.1 10^{-14}
	^{241}Am*	–	5.0 10^{-13}
	^{242}Cm*	–	1.3 10^{-14}
	^{243}Cm*	–	2.4 10^{-13}
	^{244}Cm*	–	1.7 10^{-13}
Trawsfynydd	^{3}H	1.2 10^{-15}	7.7 10^{-19}
	^{14}C	1.1 10^{-12}	–
	^{35}S	3.8 10^{-13}	–
	^{41}Ar	1.9 10^{-17}	–
	^{65}Zn	9.3 10^{-13}	–
	^{60}Co	1.1 10^{-12}	1.1 10^{-14}
	^{90}Sr	–	5.9 10^{-14}
	^{134}Cs	–	6.2 10^{-13}
	^{137}Cs*	3.4 10^{-12}	4.8 10^{-13}
Wylfa	^{3}H	1.1 10^{-15}	1.6 10^{-18}
	^{14}C	1.1 10^{-12}	–
	^{35}S	3.4 10^{-13}	6.2 10^{-18}
	^{41}Ar	1.3 10^{-17}	–
	^{45}Ca	–	1.0 10^{-17}
	^{54}Mn	–	6.7 10^{-15}
	^{55}Fe	–	7.8 10^{-15}
	^{59}Fe	–	2.8 10^{-14}

Table C2: continued

		Collective dose (man Sv)	
Site	**Radionuclide**	**Atmospheric discharges**	**Liquid discharges**
Wylfa: continued	^{58}Co	–	1.5 10^{-14}
	^{60}Co	1.1 10^{-12}	1.8 10^{-13}
	^{65}Zn	8.3 10^{-13}	3.6 10^{-13}
	^{90}Sr*	–	9.7 10^{-16}
	^{90}Y	–	9.3 10^{-18}
	^{95}Zr*	–	1.9 10^{-16}
	^{95}Nb	–	5.3 10^{-17}
	^{106}Ru	–	3.1 10^{-14}
	^{110m}Ag	–	8.6 10^{-14}
	^{124}Sb	–	5.5 10^{-16}
	^{125}Sb*	–	1.1 10^{-14}
	^{125m}Te	–	2.5 10^{-15}
	^{134}Cs	–	1.3 10^{-14}
	^{137}Cs*	3.0 10^{-12}	1.9 10^{-14}
	^{144}Ce*	–	3.6 10^{-16}
	^{144}Pr	–	6.0 10^{-21}
	^{154}Eu	–	2.1 10^{-15}
	^{155}Eu	–	2.6 10^{-16}
	^{238}Pu*	–	4.9 10^{-13}
	^{239}Pu*	–	7.0 10^{-13}
	^{241}Pu*	–	4.9 10^{-14}
	^{241}Am*	–	3.1 10^{-12}
	^{242}Cm*	–	8.4 10^{-15}
	^{243}Cm*	–	1.4 10^{-13}
PWR power station			
Sizewell B	^{3}H	1.6 10^{-15}	1.7 10^{-18}
	^{14}C	1.3 10^{-12}	–
	^{35}S	3.1 10^{-13}	–
	^{41}Ar	2.9 10^{-17}	–
	^{54}Mn	–	1.0 10^{-14}
	^{55}Fe	–	1.1 10^{-14}
	^{58}Co	–	2.0 10^{-15}
	^{60}Co	1.9 10^{-12}	1.5 10^{-14}
	^{63}Ni	–	1.2 10^{-15}
	^{65}Zn	9.3 10^{-13}	–
	^{110m}Ag	–	1.5 10^{-13}
	^{131}I*	4.0 10^{-13}	–
	^{133}Xe	2.0 10^{-17}	–
	^{134}Cs	–	2.2 10^{-14}
	^{137}Cs*	4.8 10^{-12}	2.2 10^{-14}
	^{239}Pu*	–	1.4 10^{-12}

Table C3: Collective effective doses to the European population integrated to 500 years due to a discharge of 1 Bq over one year from nuclear fuel reprocessing installations

		Collective dose (man Sv)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
Dounreay	^{3}H	5.6 10^{-16}	1.2 10^{-18}
	^{41}Ar	1.8 10^{-18}	–
	^{60}Co	5.0 10^{-13}	1.0 10^{-14}
	^{85}Kr	1.3 10^{-17}	–
	^{85m}Kr	6.4 10^{-19}	–
	^{87}Kr	9.0 10^{-19}	–
	^{88}Kr	4.1 10^{-18}	–
	^{90}Sr	1.5 10^{-12}	2.7 10^{-17}
	^{95}Zr*	–	3.3 10^{-16}
	^{95}Nb	–	7.0 10^{-17}
	^{106}Ru*	1.6 10^{-13}	3.1 10^{-15}
	^{110m}Ag	–	9.7 10^{-15}
	^{129}I	1.7 10^{-11}	–
	^{131}I*	7.0 10^{-14}	–
	^{133}Xe	5.8 10^{-18}	–
	^{133m}Xe	4.9 10^{-18}	–
	^{135}Xe	3.0 10^{-18}	–
	^{134}Cs	1.2 10^{-12}	4.2 10^{-16}
	^{137}Cs*	1.4 10^{-12}	3.1 10^{-16}
	^{144}Ce*	1.7 10^{-13}	5.9 10^{-16}
	^{234}U*	–	5.0 10^{-16}
	^{235}U*	–	4.8 10^{-16}
	^{238}U*	–	4.6 10^{-16}
	^{238}Pu*	–	1.4 10^{-13}
	^{239}Pu*	1.1 10^{-10}	1.6 10^{-13}
	^{241}Pu*	1.9 10^{-12}	3.4 10^{-15}
	^{241}Am*	8.9 10^{-11}	2.7 10^{-13}
	^{242}Cm*	1.1 10^{-11}	1.2 10^{-14}
	^{243}Cm*	6.5 10^{-11}	2.3 10^{-13}
	^{244}Cm*	5.6 10^{-11}	–
Sellafield	^{3}H	8.2 10^{-16}	1.6 10^{-18}
	^{14}C	9.6 10^{-13}	6.4 10^{-13}
	^{35}S	2.5 10^{-14}	5.1 10^{-18}
	^{41}Ar	2.1 10^{-17}	–
	^{54}Mn	–	3.4 10^{-15}
	^{55}Fe	–	4.5 10^{-15}
	^{60}Co	1.3 10^{-12}	1.4 10^{-13}
	^{63}Ni	–	2.9 10^{-16}
	^{65}Zn	–	1.8 10^{-13}
	^{85}Kr	1.4 10^{-17}	–
	^{89}Sr	–	6.3 10^{-18}
	^{90}Sr	3.7 10^{-12}	9.3 10^{-16}
	^{95}Zr	–	1.1 10^{-16}
	^{99}Tc	–	5.7 10^{-15}

Table C3: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Sellafield: continued	^{103}Ru	–	9.3 10^{-16}
	^{106}Ru*	4.1 10^{-13}	3.2 10^{-14}
	^{110m}Ag	–	7.4 10^{-14}
	^{125}Sb*	1.6 10^{-13}	2.6 10^{-15}
	^{129}I	4.9 10^{-11}	3.7 10^{-14}
	^{131}I*	4.7 10^{-13}	–
	^{134}Cs	–	1.3 10^{-14}
	^{137}Cs*	3.5 10^{-12}	1.9 10^{-14}
	^{144}Ce*	–	1.4 10^{-16}
	^{147}Pm	–	1.6 10^{-17}
	^{152}Eu*	–	1.1 10^{-15}
	^{154}Eu	–	1.3 10^{-15}
	^{155}Eu	–	1.3 10^{-16}
	^{234}U*	–	8.4 10^{-15}
	^{235}U*	–	8.1 10^{-15}
	^{238}U*	–	7.7 10^{-15}
	^{237}Np*	–	2.3 10^{-13}
	^{238}Pu*	–	3.4 10^{-13}
	^{239}Pu*	2.3 10^{-10}	5.1 10^{-13}
	^{241}Pu*	4.1 10^{-12}	4.2 10^{-14}
	^{241}Am*	1.9 10^{-10}	2.3 10^{-12}
	^{242}Cm*	–	4.2 10^{-15}
	^{243}Cm*	–	7.8 10^{-14}

Table C4: Collective effective doses to the European population integrated to 500 years due to a discharge of 1 Bq over one year from other installations

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Amersham	^{3}H	1.7 10^{-15}	9.1 10^{-15}
	^{35}S	3.6 10^{-13}	–
	^{65}Zn	–	2.6 10^{-12}
	^{75}Se	7.0 10^{-13}	–
	^{90}Sr*	6.9 10^{-12}	1.5 10^{-11}
	^{125}I	1.9 10^{-12}	7.0 10^{-12}
	^{131}I*	7.3 10^{-13}	–
	^{133}Xe	3.2 10^{-17}	–
	^{137}Cs*	7.2 10^{-12}	5.2 10^{-12}
	^{222}Rn*	1.4 10^{-13}	–
	^{241}Am*	7.1 10^{-10}	7.8 10^{-12}
Cardiff	^{3}H	1.5 10^{-15}	1.4 10^{-18}
	^{14}C	1.2 10^{-12}	4.9 10^{-13}
	^{32}P	2.9 10^{-13}	1.2 10^{-13}
	^{35}S	–	8.4 10^{-18}
	^{45}Ca	–	1.0 10^{-17}

Table C4: continued

		Collective dose (man Sv)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
Cardiff: continued	^{57}Co	–	3.0 10^{-16}
	^{125}I	2.2 10^{-12}	6.4 10^{-16}
Harwell	^{3}H	2.0 10^{-15}	9.3 10^{-15}
	^{56}Mn	–	8.6 10^{-16}
	^{58}Co	–	1.0 10^{-13}
	^{60}Co	4.0 10^{-12}	5.1 10^{-13}
	^{85}Kr	2.4 10^{-17}	–
	^{90}Sr*	7.7 10^{-12}	1.4 10^{-11}
	^{90}Y	2.9 10^{-13}	–
	^{103}Ru	–	2.7 10^{-13}
	^{106}Ru*	–	2.7 10^{-12}
	^{125}Sb*	–	5.0 10^{-13}
	^{125}I	–	7.6 10^{-12}
	^{131}I*	–	7.6 10^{-12}
	^{134}Cs	8.1 10^{-12}	6.0 10^{-12}
	^{137}Cs*	–	4.4 10^{-12}
	^{154}Eu	3.1 10^{-12}	7.3 10^{-13}
	^{155}Eu	–	1.2 10^{-13}
	^{220}Rn*	1.6 10^{-15}	–
	^{222}Rn*	1.2 10^{-13}	–
	^{226}Ra*	7.3 10^{-11}	3.2 10^{-10}
	^{226}Th*	5.0 10^{-14}	–
	^{232}Th*	3.4 10^{-10}	–
	^{234}U*	4.8 10^{-11}	2.2 10^{-11}
	^{238}U*	4.0 10^{-11}	1.5 10^{-11}
	^{238}Pu*	6.0 10^{-10}	–
	^{239}Pu*	6.7 10^{-10}	1.5 10^{-11}
	^{240}Pu*	6.7 10^{-10}	1.5 10^{-11}
	^{241}Pu*	1.2 10^{-11}	–
	^{241}Am*	5.6 10^{-10}	4.9 10^{-12}
Winfrith	^{3}H	1.4 10^{-15}	1.6 10^{-18}
	^{14}C	1.2 10^{-12}	–
	^{54}Mn	–	1.5 10^{-14}
	^{55}Fe	–	1.4 10^{-14}
	^{60}Co	2.1 10^{-12}	1.6 10^{-14}
	^{63}Ni	–	1.5 10^{-15}
	^{65}Zn	–	3.1 10^{-13}
	^{90}Sr	–	1.0 10^{-15}
	^{134}Cs	–	2.0 10^{-14}
	^{137}Cs*	–	2.1 10^{-14}
	^{144}Ce*	–	5.6 10^{-16}
	^{234}U*	–	7.5 10^{-15}
	^{238}U*	–	7.1 10^{-15}
	^{238}Pu*	–	1.4 10^{-12}
	^{239}Pu*	3.8 10^{-10}	2.1 10^{-12}

C2 Collective effective doses to the UK population integrated to 500 years due to a discharge of 1 Bq over one year

Table C5: Collective effective doses to the UK population integrated to 500 years due to a discharge of 1 Bq over one year from nuclear fuel fabrication installations

		Collective dose (man Sv)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
Capenhurst	^{3}H	$9.9\ 10^{-16}$	$3.5\ 10^{-19}$
	^{99}Tc	–	$3.6\ 10^{-15}$
	^{234}Th*	$7.2\ 10^{-13}$	$1.8\ 10^{-17}$
	^{234}U*	$3.9\ 10^{-11}$	$5.0\ 10^{-15}$
	^{235}U*	$3.6\ 10^{-11}$	–
	^{238}U*	$3.3\ 10^{-11}$	$4.6\ 10^{-15}$
	^{237}Np*	–	$1.4\ 10^{-13}$
Springfields	^{99}Tc	–	$5.6\ 10^{-15}$
	^{228}Th*	–	$9.7\ 10^{-15}$
	^{230}Th*	–	$7.4\ 10^{-15}$
	^{232}Th*	–	$5.7\ 10^{-13}$
	^{234}Th*	$5.6\ 10^{-13}$	$2.9\ 10^{-17}$
	^{234}U*	$3.0\ 10^{-11}$	$8.0\ 10^{-15}$
	^{235}U*	$2.7\ 10^{-11}$	$7.7\ 10^{-15}$
	^{238}U*	$2.5\ 10^{-11}$	$7.3\ 10^{-15}$
	^{237}Np*	–	$2.3\ 10^{-13}$

Table C6: Collective effective doses to the UK population integrated to 500 years due to a discharge of 1 Bq over one year from nuclear power production installations

		Collective dose (man Sv)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
AGR power stations			
Dungeness B	^{3}H	$4.3\ 10^{-16}$	$2.5\ 10^{-19}$
	^{14}C	$2.6\ 10^{-13}$	$1.0\ 10^{-13}$
	^{32}P	–	$2.0\ 10^{-14}$
	^{35}S	$8.8\ 10^{-14}$	$2.1\ 10^{-18}$
	^{41}Ar	$3.2\ 10^{-17}$	–
	^{45}Ca	–	$1.7\ 10^{-18}$
	^{54}Mn	–	$4.2\ 10^{-15}$
	^{55}Fe	–	$3.1\ 10^{-15}$
	^{59}Fe	–	$1.2\ 10^{-14}$
	^{58}Co	–	$5.1\ 10^{-16}$
	^{60}Co	$1.2\ 10^{-12}$	$3.6\ 10^{-15}$
	^{63}Ni	–	$1.9\ 10^{-16}$
	^{65}Zn	$2.5\ 10^{-13}$	$6.1\ 10^{-14}$
	^{90}Sr*	–	$1.4\ 10^{-16}$
	^{90}Y	–	$2.4\ 10^{-18}$
	^{95}Zr*	–	$1.4\ 10^{-16}$

Table C6: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Dungeness B: continued	^{95}Nb	–	2.9 10^{-17}
	^{106}Ru	–	8.0 10^{-15}
	^{110m}Ag	–	1.8 10^{-14}
	^{124}Sb	–	3.4 10^{-16}
	^{125}Sb*	–	1.9 10^{-15}
	^{125m}Te	–	6.7 10^{-16}
	^{131}I*	1.9 10^{-13}	–
	^{134}Cs	–	2.5 10^{-15}
	^{137}Cs*	–	2.7 10^{-15}
	^{144}Ce*	–	1.6 10^{-16}
	^{144}Pr	–	1.3 10^{-21}
	^{154}Eu	–	1.3 10^{-15}
	^{155}Eu	–	1.5 10^{-16}
	^{238}Pu*	–	2.3 10^{-13}
	^{239}Pu*	–	3.1 10^{-13}
	^{241}Pu*	–	5.2 10^{-15}
	^{241}Am*	–	1.4 10^{-13}
	^{242}Cm*	–	5.7 10^{-15}
	^{243}Cm*	–	9.9 10^{-14}
Hartlepool	^{3}H	6.0 10^{-16}	3.9 10^{-19}
	^{14}C	3.1 10^{-13}	1.7 10^{-13}
	^{32}P	–	2.1 10^{-13}
	^{35}S	2.0 10^{-13}	7.7 10^{-18}
	^{41}Ar	1.2 10^{-16}	–
	^{45}Ca	–	2.4 10^{-17}
	^{54}Mn	–	7.4 10^{-16}
	^{55}Fe	–	1.9 10^{-15}
	^{59}Fe	–	7.6 10^{-15}
	^{58}Co	–	1.2 10^{-15}
	^{60}Co	2.0 10^{-12}	7.5 10^{-15}
	^{63}Ni	–	1.5 10^{-16}
	^{65}Zn	4.9 10^{-13}	3.0 10^{-13}
	^{90}Sr*	–	4.9 10^{-16}
	^{90}Y	–	2.0 10^{-18}
	^{95}Zr*	–	3.4 10^{-17}
	^{95}Nb	–	1.2 10^{-17}
	^{106}Ru	–	1.5 10^{-14}
	^{110m}Ag	–	1.0 10^{-13}
	^{124}Sb	–	5.3 10^{-16}
	^{125}Sb*	–	2.8 10^{-15}
	^{125m}Te	–	5.2 10^{-15}
	^{131}I*	4.0 10^{-13}	–
	^{133}Xe	1.1 10^{-17}	–
	^{134}Cs	–	4.7 10^{-15}
	^{137}Cs*	–	4.3 10^{-15}

Table C6: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Hartlepool: continued	^{144}Ce	–	$1.2\ 10^{-16}$
	^{144}Pr	–	$1.0\ 10^{-21}$
	^{154}Eu	–	$5.8\ 10^{-16}$
	^{155}Eu	–	$5.4\ 10^{-17}$
	^{238}Pu*	–	$7.3\ 10^{-14}$
	^{239}Pu*	–	$1.1\ 10^{-13}$
	^{241}Pu*	–	$1.5\ 10^{-15}$
	^{241}Am*	–	$2.3\ 10^{-14}$
	^{242}Cm*	–	$9.1\ 10^{-16}$
	^{243}Cm*	–	$1.3\ 10^{-14}$
Heysham 1	^{3}H	$7.3\ 10^{-16}$	$3.8\ 10^{-19}$
	^{14}C	$3.0\ 10^{-13}$	$1.7\ 10^{-13}$
	^{32}P	–	$8.8\ 10^{-14}$
	^{35}S	$3.5\ 10^{-13}$	$7.6\ 10^{-18}$
	^{41}Ar	$1.2\ 10^{-16}$	–
	^{45}Ca	–	$7.2\ 10^{-18}$
	^{54}Mn	–	$9.4\ 10^{-15}$
	^{55}Fe	–	$7.9\ 10^{-15}$
	^{59}Fe	–	$3.7\ 10^{-14}$
	^{58}Co	–	$1.4\ 10^{-14}$
	^{60}Co	$2.0\ 10^{-12}$	$1.2\ 10^{-13}$
	^{63}Ni	–	$2.2\ 10^{-16}$
	^{65}Zn	$8.7\ 10^{-13}$	$2.5\ 10^{-13}$
	^{90}Sr*	–	$4.1\ 10^{-16}$
	^{90}Y	–	$1.5\ 10^{-17}$
	^{95}Zr*	–	$4.1\ 10^{-16}$
	^{95}Nb	–	$1.0\ 10^{-16}$
	^{106}Ru	–	$3.9\ 10^{-14}$
	^{110m}Ag	–	$9.1\ 10^{-14}$
	^{124}Sb	–	$3.0\ 10^{-16}$
	^{125}Sb*	–	$4.4\ 10^{-15}$
	^{125m}Te	–	$2.5\ 10^{-15}$
	^{131}I*	$7.1\ 10^{-13}$	–
	^{133}Xe	$1.2\ 10^{-17}$	–
	^{134}Cs	–	$6.1\ 10^{-15}$
	^{137}Cs*	–	$7.0\ 10^{-15}$
	^{144}Ce*	–	$4.2\ 10^{-16}$
	^{144}Pr	–	$1.6\ 10^{-20}$
	^{154}Eu	–	$4.4\ 10^{-15}$
	^{155}Eu	–	$3.8\ 10^{-16}$
	^{238}Pu*	–	$3.9\ 10^{-13}$
	^{239}Pu*	–	$4.4\ 10^{-13}$
	^{241}Pu*	–	$1.5\ 10^{-14}$
	^{241}Am*	–	$2.3\ 10^{-12}$
	^{242}Cm*	–	$1.1\ 10^{-14}$
	^{243}Cm*	–	$1.7\ 10^{-13}$

Table C6: continued

		Collective dose (man Sv)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
Heysham 2	^{3}H	$7.3\ 10^{-16}$	$3.8\ 10^{-19}$
	^{14}C	$3.0\ 10^{-13}$	$1.7\ 10^{-13}$
	^{32}P	–	$8.8\ 10^{-14}$
	^{35}S	$3.5\ 10^{-13}$	$7.6\ 10^{-18}$
	^{45}Ca	–	$7.2\ 10^{-18}$
	^{41}Ar	$1.2\ 10^{-16}$	–
	^{54}Mn	–	$9.4\ 10^{-15}$
	^{55}Fe	–	$7.9\ 10^{-15}$
	^{59}Fe	–	$3.7\ 10^{-14}$
	^{58}Co	–	$1.4\ 10^{-14}$
	^{60}Co	$2.0\ 10^{-12}$	$1.2\ 10^{-13}$
	^{63}Ni	–	$2.2\ 10^{-16}$
	^{65}Zn	$8.7\ 10^{-13}$	$2.5\ 10^{-13}$
	^{90}Sr*	–	$4.1\ 10^{-16}$
	^{90}Y	–	$1.5\ 10^{-17}$
	^{95}Zr*	–	$4.1\ 10^{-16}$
	^{95}Nb	–	$1.0\ 10^{-16}$
	^{106}Ru	–	$3.9\ 10^{-14}$
	^{110m}Ag	–	$9.1\ 10^{-14}$
	^{124}Sb	–	$3.0\ 10^{-16}$
	^{125}Sb*	–	$4.4\ 10^{-15}$
	^{125m}Te	–	$2.5\ 10^{-15}$
	^{131}I*	$7.1\ 10^{-13}$	–
	^{133}Xe	$1.2\ 10^{-17}$	–
	^{134}Cs	–	$6.1\ 10^{-15}$
	^{137}Cs*	–	$7.0\ 10^{-15}$
	^{144}Ce	–	$4.2\ 10^{-16}$
	^{144}Pr	–	$1.6\ 10^{-20}$
	^{154}Eu	–	$4.4\ 10^{-15}$
	^{155}Eu	–	$3.8\ 10^{-16}$
	^{238}Pu*	–	$3.9\ 10^{-13}$
	^{239}Pu*	–	$4.4\ 10^{-13}$
	^{241}Pu*	–	$1.5\ 10^{-14}$
	^{241}Am*	–	$2.3\ 10^{-12}$
	^{242}Cm*	–	$1.1\ 10^{-14}$
	^{243}Cm*	–	$1.7\ 10^{-13}$
Hinkley Point B	^{3}H	$6.6\ 10^{-16}$	$2.2\ 10^{-19}$
	^{14}C	$3.1\ 10^{-13}$	$8.1\ 10^{-14}$
	^{32}P	–	$1.1\ 10^{-14}$
	^{35}S	$4.2\ 10^{-13}$	$8.4\ 10^{-19}$
	^{41}Ar	$5.0\ 10^{-17}$	–
	^{45}Ca	–	$1.3\ 10^{-18}$
	^{54}Mn	–	$5.8\ 10^{-16}$
	^{55}Fe	–	$6.7\ 10^{-16}$
	^{59}Fe	–	$1.6\ 10^{-15}$

Table C6: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Hinkley Point B: continued	^{58}Co	–	$2.1\ 10^{-16}$
	^{60}Co	$1.4\ 10^{-12}$	$2.0\ 10^{-15}$
	^{63}Ni	–	$7.9\ 10^{-17}$
	^{65}Zn	$1.1\ 10^{-12}$	$3.1\ 10^{-14}$
	^{90}Sr*	–	$5.4\ 10^{-17}$
	^{90}Y	–	$2.3\ 10^{-19}$
	^{95}Zr*	–	$2.2\ 10^{-17}$
	^{95}Nb	–	$4.7\ 10^{-18}$
	^{106}Ru	–	$2.8\ 10^{-15}$
	^{110m}Ag	–	$8.5\ 10^{-15}$
	^{124}Sb	–	$1.3\ 10^{-16}$
	^{125}Sb*	–	$6.4\ 10^{-16}$
	^{125m}Te	–	$3.3\ 10^{-16}$
	^{131}I*	$8.1\ 10^{-13}$	–
	^{133}Xe	$9.2\ 10^{-18}$	–
	^{134}Cs	–	$8.6\ 10^{-16}$
	^{137}Cs*	–	$8.3\ 10^{-16}$
	^{144}Ce*	–	$3.6\ 10^{-17}$
	^{144}Pr	–	$3.5\ 10^{-23}$
	^{154}Eu	–	$4.9\ 10^{-16}$
	^{155}Eu	–	$3.4\ 10^{-17}$
	^{238}Pu*	–	$6.5\ 10^{-14}$
	^{239}Pu*	–	$9.9\ 10^{-14}$
	^{241}Pu*	–	$2.0\ 10^{-15}$
	^{241}Am*	–	$6.5\ 10^{-14}$
	^{242}Cm*	–	$8.7\ 10^{-16}$
	^{243}Cm*	–	$2.1\ 10^{-14}$
Hunterston B	^{3}H	$4.4\ 10^{-16}$	$2.7\ 10^{-19}$
	^{14}C	$2.3\ 10^{-13}$	–
	^{35}S	$2.1\ 10^{-13}$	$1.2\ 10^{-18}$
	^{41}Ar	$4.0\ 10^{-17}$	–
	^{45}Ca	–	$2.7\ 10^{-18}$
	^{54}Mn	–	$8.5\ 10^{-16}$
	^{55}Fe	$4.3\ 10^{-15}$	–
	^{60}Co	$9.3\ 10^{-13}$	$5.7\ 10^{-15}$
	^{65}Zn	$5.0\ 10^{-13}$	–
	^{90}Sr*	–	$2.1\ 10^{-16}$
	^{90}Y	–	$2.0\ 10^{-18}$
	^{131}I*	$6.1\ 10^{-13}$	–
	^{134}Cs	–	$3.4\ 10^{-15}$
	^{137}Cs*	–	$3.9\ 10^{-15}$
	^{144}Pr	–	$1.1\ 10^{-21}$
	^{239}Pu*	–	$1.6\ 10^{-13}$
Torness	^{3}H	$4.7\ 10^{-16}$	$2.4\ 10^{-19}$
	^{14}C	$2.8\ 10^{-13}$	–

Table C6: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Torness: continued	^{35}S	$1.3\ 10^{-13}$	$8.6\ 10^{-19}$
	^{41}Ar	$1.4\ 10^{-17}$	–
	^{55}Fe	$5.4\ 10^{-15}$	–
	^{60}Co	$6.4\ 10^{-13}$	$4.8\ 10^{-15}$
	^{65}Zn	$2.7\ 10^{-13}$	–
	^{90}Sr*	–	$1.3\ 10^{-16}$
	^{131}I*	$3.1\ 10^{-13}$	–
	^{134}Cs	–	$2.0\ 10^{-15}$
	^{137}Cs*	–	$2.3\ 10^{-15}$
	^{144}Pr	–	$1.9\ 10^{-21}$
	^{239}Pu*	–	$8.6\ 10^{-14}$
Magnox power stations			
Berkeley	^{3}H	$7.2\ 10^{-16}$	$2.6\ 10^{-19}$
	^{14}C	$3.6\ 10^{-13}$	–
	^{35}S	$3.7\ 10^{-13}$	$3.9\ 10^{-18}$
	^{41}Ar	$8.1\ 10^{-17}$	–
	^{45}Ca	–	$5.8\ 10^{-18}$
	^{54}Mn	–	$1.2\ 10^{-15}$
	^{55}Fe	–	$1.5\ 10^{-15}$
	^{59}Fe	–	$5.3\ 10^{-15}$
	^{58}Co	–	$4.6\ 10^{-16}$
	^{60}Co	$2.1\ 10^{-12}$	$3.7\ 10^{-15}$
	^{65}Zn	$9.3\ 10^{-13}$	$9.4\ 10^{-14}$
	^{90}Sr*	–	$1.3\ 10^{-16}$
	^{90}Y	–	$7.2\ 10^{-19}$
	^{95}Zr*	–	$5.8\ 10^{-17}$
	^{95}Nb	–	$1.1\ 10^{-17}$
	^{106}Ru	–	$1.4\ 10^{-14}$
	^{110m}Ag	–	$4.1\ 10^{-14}$
	^{124}Sb	–	$2.2\ 10^{-16}$
	^{125}Sb*	–	$9.6\ 10^{-16}$
	^{125m}Te	–	$1.6\ 10^{-15}$
	^{134}Cs	–	$1.6\ 10^{-15}$
	^{137}Cs*	$4.1\ 10^{-12}$	$1.4\ 10^{-15}$
	^{144}Ce*	–	$7.0\ 10^{-17}$
	^{144}Pr	–	$2.9\ 10^{-22}$
	^{154}Eu	–	$8.5\ 10^{-16}$
	^{155}Eu	–	$6.2\ 10^{-17}$
	^{238}Pu*	–	$9.5\ 10^{-14}$
	^{239}Pu*	–	$1.3\ 10^{-13}$
	^{241}Pu*	–	$2.7\ 10^{-15}$
	^{241}Am*	–	$7.5\ 10^{-14}$
	^{242}Cm*	–	$1.5\ 10^{-15}$
	^{243}Cm*	–	$3.0\ 10^{-14}$

Table C6: continued

		Collective dose (man Sv)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
Bradwell	^{3}H	$6.2\ 10^{-16}$	$3.6\ 10^{-19}$
	^{14}C	$3.6\ 10^{-13}$	–
	^{35}S	$1.1\ 10^{-13}$	$1.4\ 10^{-17}$
	^{41}Ar	$3.6\ 10^{-13}$	–
	^{45}Ca	–	$6.9\ 10^{-18}$
	^{51}Cr	–	$1.1\ 10^{-17}$
	^{54}Mn	–	$5.6\ 10^{-15}$
	^{55}Fe	–	$6.1\ 10^{-15}$
	^{59}Fe	–	$2.1\ 10^{-14}$
	^{58}Co	–	$7.0\ 10^{-16}$
	^{60}Co	$2.1\ 10^{-12}$	$5.3\ 10^{-15}$
	^{65}Zn	$3.6\ 10^{-13}$	$1.7\ 10^{-13}$
	^{90}Sr*	–	$3.1\ 10^{-16}$
	^{90}Y	–	$1.4\ 10^{-18}$
	^{95}Zr*	–	$1.5\ 10^{-16}$
	^{95}Nb	–	$3.0\ 10^{-17}$
	^{106}Ru	–	$6.6\ 10^{-14}$
	^{110m}Ag	–	$1.2\ 10^{-13}$
	^{124}Sb	–	$4.7\ 10^{-16}$
	^{125}Sb*	–	$3.2\ 10^{-15}$
	^{125m}Te	–	$3.6\ 10^{-15}$
	^{134}Cs	–	$4.4\ 10^{-15}$
	^{137}Cs*	$3.3\ 10^{-12}$	$4.3\ 10^{-15}$
	^{144}Ce*	–	$1.9\ 10^{-16}$
	^{144}Pr	–	$6.2\ 10^{-22}$
	^{154}Eu	–	$1.7\ 10^{-15}$
	^{155}Eu	–	$1.9\ 10^{-16}$
	^{238}Pu*	–	$4.1\ 10^{-13}$
	^{239}Pu*	–	$5.8\ 10^{-13}$
	^{241}Pu*	–	$9.6\ 10^{-15}$
	^{241}Am*	–	$2.3\ 10^{-13}$
	^{242}Cm*	–	$6.7\ 10^{-15}$
	^{243}Cm*	–	$1.3\ 10^{-13}$
	^{244}Cm*	–	$8.9\ 10^{-14}$
Chapelcross	^{3}H	$6.1\ 10^{-16}$	$3.2\ 10^{-19}$
	^{14}C	$2.9\ 10^{-13}$	–
	^{35}S	$2.2\ 10^{-14}$	$3.1\ 10^{-18}$
	^{41}Ar	$2.3\ 10^{-17}$	–
	^{60}Co	–	$7.1\ 10^{-14}$
	^{65}Zn	–	$1.2\ 10^{-13}$
	^{90}Sr*	–	$3.2\ 10^{-16}$
	^{106}Ru	–	$1.9\ 10^{-14}$
	^{125}Sb*	–	$4.0\ 10^{-15}$
	^{134}Cs	–	$4.7\ 10^{-15}$
	^{137}Cs*	–	$5.8\ 10^{-15}$

Table C6: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Chapelcross: continued	^{144}Ce	–	1.1 10^{-16}
	^{154}Eu	–	1.5 10^{-15}
	^{238}Pu*	–	2.8 10^{-13}
	^{239}Pu*	–	4.1 10^{-13}
	^{241}Am*	–	1.9 10^{-12}
	^{242}Cm*	–	3.8 10^{-15}
	^{243}Cm*	–	8.1 10^{-14}
Dungeness A	^{3}H	4.3 10^{-16}	2.5 10^{-19}
	^{14}C	2.6 10^{-13}	–
	^{35}S	8.8 10^{-14}	2.1 10^{-18}
	^{41}Ar	3.2 10^{-17}	–
	^{45}Ca	–	1.7 10^{-18}
	^{54}Mn	–	4.2 10^{-15}
	^{55}Fe	–	3.1 10^{-15}
	^{59}Fe	–	1.2 10^{-14}
	^{58}Co	–	5.1 10^{-16}
	^{60}Co	1.2 10^{-12}	3.6 10^{-15}
	^{65}Zn	2.5 10^{-13}	6.1 10^{-14}
	^{90}Sr*	–	1.4 10^{-16}
	^{90}Y	–	2.4 10^{-18}
	^{95}Zr*	–	1.4 10^{-16}
	^{95}Nb	–	2.9 10^{-17}
	^{106}Ru	–	8.0 10^{-15}
	^{110m}Ag	–	1.8 10^{-14}
	^{124}Sb	–	3.4 10^{-16}
	^{125}Sb*	–	1.9 10^{-15}
	^{125m}Te	–	6.7 10^{-16}
	^{134}Cs	–	2.5 10^{-15}
	^{137}Cs*	1.7 10^{-12}	2.7 10^{-15}
	^{144}Ce	–	1.6 10^{-16}
	^{144}Pr	–	1.3 10^{-21}
	^{154}Eu	–	1.3 10^{-15}
	^{155}Eu	–	1.5 10^{-16}
	^{238}Pu*	–	2.3 10^{-13}
	^{239}Pu*	–	3.1 10^{-13}
	^{241}Pu*	–	5.2 10^{-15}
	^{241}Am*	–	1.4 10^{-13}
	^{243}Cm*	–	9.9 10^{-14}
	^{244}Cm*	–	7.3 10^{-14}
Hinkley Point A	^{3}H	6.6 10^{-16}	2.2 10^{-19}
	^{14}C	3.1 10^{-13}	–
	^{35}S	–	8.4 10^{-19}
	^{41}Ar	5.0 10^{-17}	–
	^{45}Ca	–	1.3 10^{-18}
	^{54}Mn	–	5.8 10^{-16}

Table C6: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Hinkley Point A: continued	^{55}Fe	–	$6.7\ 10^{-16}$
	^{59}Fe	–	$1.6\ 10^{-15}$
	^{58}Co	–	$2.1\ 10^{-16}$
	^{60}Co	$1.4\ 10^{-12}$	$2.0\ 10^{-15}$
	^{65}Zn	$1.1\ 10^{-12}$	$3.1\ 10^{-14}$
	^{90}Sr*	–	$5.4\ 10^{-17}$
	^{90}Y	–	$2.3\ 10^{-19}$
	^{95}Zr*	–	$2.8\ 10^{-17}$
	^{95}Nb	–	$4.7\ 10^{-18}$
	^{106}Ru	–	$2.8\ 10^{-15}$
	^{110m}Ag	–	$8.5\ 10^{-15}$
	^{124}Sb	–	$1.3\ 10^{-16}$
	^{125}Sb*	–	$6.4\ 10^{-16}$
	^{125m}Te	–	$3.3\ 10^{-16}$
	^{134}Cs	–	$8.6\ 10^{-16}$
	^{137}Cs*	$3.5\ 10^{-12}$	$8.3\ 10^{-16}$
	^{144}Ce	–	$3.6\ 10^{-17}$
	^{144}Pr	–	$3.5\ 10^{-23}$
	^{154}Eu	–	$4.9\ 10^{-16}$
	^{155}Eu	–	$3.4\ 10^{-17}$
	^{238}Pu*	–	$6.5\ 10^{-14}$
	^{239}Pu*	–	$9.9\ 10^{-14}$
	^{241}Pu*	–	$2.0\ 10^{-15}$
	^{241}Am*	–	$6.5\ 10^{-14}$
	^{242}Cm*	–	$8.7\ 10^{-16}$
	^{243}Cm*	–	$2.1\ 10^{-14}$
	^{244}Cm*	–	$1.3\ 10^{-14}$
Hunterston A	^{3}H	$4.4\ 10^{-16}$	$2.7\ 10^{-19}$
	^{14}C	$2.3\ 10^{-13}$	–
	^{35}S	$2.1\ 10^{-13}$	$1.2\ 10^{-18}$
	^{41}Ar	$4.0\ 10^{-17}$	–
	^{45}Ca	–	$2.7\ 10^{-18}$
	^{55}Fe	–	$1.2\ 10^{-15}$
	^{60}Co	$9.3\ 10^{-13}$	$5.7\ 10^{-15}$
	^{65}Zn	$5.0\ 10^{-13}$	–
	^{90}Sr*	–	$2.1\ 10^{-16}$
	^{90}Y	–	$2.0\ 10^{-18}$
	^{95}Zr*	–	$3.2\ 10^{-17}$
	^{95}Nb	–	$1.2\ 10^{-17}$
	^{103}Ru	–	$1.2\ 10^{-16}$
	^{134}Cs	–	$3.4\ 10^{-15}$
	^{137}Cs*	$1.8\ 10^{-12}$	$3.9\ 10^{-15}$
	^{239}Pu*	–	$1.6\ 10^{-13}$
	^{241}Pu*	–	$2.2\ 10^{-15}$

Table C6: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Oldbury	^{3}H	$7.1\ 10^{-16}$	$2.6\ 10^{-19}$
	^{14}C	$3.5\ 10^{-13}$	–
	^{35}S	$3.7\ 10^{-13}$	$3.9\ 10^{-18}$
	^{41}Ar	$8.5\ 10^{-17}$	–
	^{45}Ca	–	$5.8\ 10^{-18}$
	^{51}Cr	–	$4.3\ 10^{-18}$
	^{54}Mn	–	$1.2\ 10^{-15}$
	^{55}Fe	–	$1.5\ 10^{-15}$
	^{59}Fe	–	$5.3\ 10^{-15}$
	^{58}Co	–	$4.6\ 10^{-16}$
	^{60}Co	$2.1\ 10^{-12}$	$3.7\ 10^{-15}$
	^{65}Zn	$9.2\ 10^{-13}$	$9.4\ 10^{-14}$
	^{90}Sr*	–	$1.3\ 10^{-16}$
	^{90}Y	–	$7.2\ 10^{-19}$
	^{95}Zr*	–	$3.6\ 10^{-17}$
	^{95}Nb*	–	$1.1\ 10^{-17}$
	^{106}Ru	–	$1.4\ 10^{-14}$
	^{110m}Ag	–	$4.1\ 10^{-14}$
	^{124}Sb	–	$2.2\ 10^{-16}$
	^{125m}Te	–	$1.6\ 10^{-15}$
	^{134}Cs	–	$1.6\ 10^{-15}$
	^{137}Cs*	$4.0\ 10^{-12}$	$1.4\ 10^{-15}$
	^{144}Ce*	–	$7.0\ 10^{-17}$
	^{144}Pr	–	$2.9\ 10^{-22}$
	^{154}Eu	–	$8.5\ 10^{-16}$
	^{155}Eu	–	$6.2\ 10^{-17}$
	^{238}Pu*	–	$9.5\ 10^{-14}$
	^{239}Pu*	–	$1.3\ 10^{-13}$
	^{241}Pu*	–	$2.7\ 10^{-15}$
	^{241}Am*	–	$7.5\ 10^{-14}$
	^{242}Cm*	–	$1.5\ 10^{-15}$
	^{243}Cm*	–	$3.0\ 10^{-14}$
Sizewell A	^{3}H	$6.0\ 10^{-16}$	$3.0\ 10^{-19}$
	^{14}C	$3.4\ 10^{-13}$	–
	^{35}S	$9.0\ 10^{-14}$	$6.5\ 10^{-18}$
	^{41}Ar	$2.9\ 10^{-17}$	–
	^{45}Ca	–	$3.8\ 10^{-18}$
	^{54}Mn	–	$5.1\ 10^{-15}$
	^{55}Fe	–	$5.3\ 10^{-15}$
	^{59}Fe	–	$2.0\ 10^{-14}$
	^{58}Co	–	$6.7\ 10^{-16}$
	^{60}Co	$1.1\ 10^{-12}$	$4.9\ 10^{-15}$
	^{65}Zn	$2.8\ 10^{-13}$	$1.4\ 10^{-13}$
	^{90}Sr*	–	$2.2\ 10^{-16}$
	^{90}Y	–	$2.0\ 10^{-18}$

Table C6: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Sizewell A: continued	^{95}Zr*	–	$1.3\ 10^{-16}$
	^{95}Nb	–	$3.0\ 10^{-17}$
	^{106}Ru	–	$3.1\ 10^{-14}$
	^{110m}Ag	–	$6.3\ 10^{-14}$
	^{124}Sb	–	$3.7\ 10^{-16}$
	^{125}Sb*	–	$2.6\ 10^{-15}$
	^{125m}Te	–	$1.9\ 10^{-15}$
	^{134}Cs	–	$3.5\ 10^{-15}$
	^{137}Cs*	$2.5\ 10^{-12}$	$3.6\ 10^{-15}$
	^{144}Ce	–	$1.8\ 10^{-16}$
	^{144}Pr	–	$1.0\ 10^{-21}$
	^{154}Eu	–	$1.6\ 10^{-15}$
	^{155}Eu	–	$1.8\ 10^{-16}$
	^{238}Pu*	–	$3.9\ 10^{-13}$
	^{239}Pu*	–	$5.6\ 10^{-13}$
	^{241}Pu*	–	$9.1\ 10^{-15}$
	^{241}Am*	–	$2.2\ 10^{-13}$
	^{242}Cm*	–	$6.4\ 10^{-15}$
	^{243}Cm*	–	$1.2\ 10^{-13}$
	^{244}Cm*	–	$8.5\ 10^{-14}$
Trawsfynydd	^{3}H	$5.5\ 10^{-16}$	$7.7\ 10^{-19}$
	^{14}C	$2.7\ 10^{-13}$	–
	^{35}S	$2.8\ 10^{-13}$	–
	^{41}Ar	$1.9\ 10^{-17}$	–
	^{60}Co	$9.5\ 10^{-13}$	$1.1\ 10^{-14}$
	^{65}Zn	$6.1\ 10^{-13}$	–
	^{90}Sr*	–	$5.9\ 10^{-14}$
	^{134}Cs	–	$6.2\ 10^{-13}$
	^{137}Cs*	$2.2\ 10^{-12}$	$4.8\ 10^{-13}$
Wylfa	^{3}H	$5.0\ 10^{-16}$	$3.2\ 10^{-19}$
	^{14}C	$2.5\ 10^{-13}$	–
	^{35}S	$2.4\ 10^{-13}$	$2.1\ 10^{-18}$
	^{41}Ar	$1.3\ 10^{-17}$	–
	^{45}Ca	–	$4.8\ 10^{-18}$
	^{54}Mn	–	$1.7\ 10^{-15}$
	^{55}Fe	–	$2.5\ 10^{-15}$
	^{59}Fe	–	$8.4\ 10^{-15}$
	^{58}Co	–	$7.0\ 10^{-15}$
	^{60}Co	$7.2\ 10^{-13}$	$8.1\ 10^{-14}$
	^{65}Zn	$5.2\ 10^{-13}$	$1.6\ 10^{-13}$
	^{90}Sr*	–	$3.3\ 10^{-16}$
	^{90}Y	–	$3.7\ 10^{-18}$
	^{95}Zr*	–	$5.5\ 10^{-17}$
	^{95}Nb*	–	$1.9\ 10^{-17}$
	^{106}Ru	–	$1.0\ 10^{-14}$

Table C6: continued

Site	Radionuclide	Collective dose (man Sv) Atmospheric discharges	Liquid discharges
Wylfa: continued	^{110m}Ag	–	3.4 10^{-14}
	^{124}Sb	–	2.2 10^{-16}
	^{125}Sb*	–	3.7 10^{-15}
	^{125m}Te	–	1.0 10^{-15}
	^{134}Cs	1.8 10^{-12}	4.5 10^{-15}
	^{137}Cs*	–	5.7 10^{-15}
	^{144}Ce	–	1.3 10^{-16}
	^{144}Pr	–	2.4 10^{-21}
	^{154}Eu	–	8.7 10^{-16}
	^{155}Eu	–	8.5 10^{-17}
	^{238}Pu	–	1.6 10^{-13}
	^{239}Pu*	–	2.3 10^{-13}
	^{241}Pu*	–	1.8 10^{-14}
	^{241}Am*	–	9.8 10^{-13}
	^{242}Cm*	–	2.2 10^{-15}
	^{243}Cm*	–	3.6 10^{-14}
PWR power station			
Sizewell B	^{3}H	6.0 10^{-16}	3.0 10^{-19}
	^{14}C	3.4 10^{-13}	–
	^{35}S	9.0 10^{-14}	–
	^{41}Ar	2.9 10^{-17}	–
	^{54}Mn	–	5.1 10^{-15}
	^{55}Fe	–	5.3 10^{-15}
	^{58}Co	–	6.7 10^{-16}
	^{60}Co	1.1 10^{-12}	4.9 10^{-15}
	^{63}Ni	–	2.6 10^{-16}
	^{65}Zn	2.8 10^{-13}	–
	^{110m}Ag	–	6.3 10^{-14}
	^{131}I*	2.3 10^{-13}	–
	^{133}Xe	7.7 10^{-18}	–
	^{134}Cs	–	3.5 10^{-15}
	^{137}Cs*	2.5 10^{-12}	3.6 10^{-15}
	^{239}Pu*	–	5.6 10^{-13}

Table C7: Collective effective doses to the UK population integrated to 500 years due to a discharge of 1 Bq over one year from nuclear fuel reprocessing installations

Site	Radionuclide	Collective dose (man Sv) Atmospheric discharges	Liquid discharges
Dounreay	^{3}H	1.6 10^{-16}	2.1 10^{-19}
	^{41}Ar	1.9 10^{-18}	–
	^{60}Co	2.0 10^{-13}	6.8 10^{-15}
	^{85}Kr	2.4 10^{-18}	–
	^{85m}Kr	6.3 10^{-19}	–
	^{87}Kr	9.6 10^{-19}	–

Table C7: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Dounreay: continued	^{88}Kr	$4.2\ 10^{-18}$	–
	^{90}Sr*	$4.9\ 10^{-13}$	$1.6\ 10^{-17}$
	^{95}Zr*	–	$2.0\ 10^{-16}$
	^{103}Ru	–	$1.6\ 10^{-15}$
	^{106}Ru*	$5.9\ 10^{-14}$	$1.6\ 10^{-15}$
	^{110m}Ag	–	$5.7\ 10^{-15}$
	^{129}I	$8.1\ 10^{-12}$	–
	^{131}I*	$4.8\ 10^{-14}$	–
	^{133}Xe	$1.\ 9\ 10^{-18}$	–
	^{133m}Xe	$1.7\ 10^{-18}$	–
	^{135}Xe	$2.4\ 10^{-18}$	–
	^{134}Cs	$4.7\ 10^{-13}$	–
	^{137}Cs*	$5.4\ 10^{-13}$	$1.7\ 10^{-16}$
	^{144}Ce*	$6.0\ 10^{-14}$	$3.6\ 10^{-16}$
	^{238}Pu*	$3.4\ 10^{-11}$	$7.5\ 10^{-14}$
	^{239}Pu*	$3.8\ 10^{-11}$	$8.4\ 10^{-14}$
	^{240}Pu*	$3.8\ 10^{-11}$	–
	^{241}Pu	$6.7\ 10^{-13}$	$1.8\ 10^{-15}$
	^{241}Am*	$3.2\ 10^{-11}$	$1.4\ 10^{-13}$
	^{242}Cm*	$3.8\ 10^{-12}$	$6.6\ 10^{-15}$
	^{243}Cm*	$2.3\ 10^{-11}$	–
	^{244}Cm*	$2.0\ 10^{-11}$	–
Sellafield	^{3}H	$3.7\ 10^{-16}$	$3.3\ 10^{-19}$
	^{14}C	$2.2\ 10^{-13}$	$1.5\ 10^{-13}$
	^{35}S	$1.5\ 10^{-14}$	$2.5\ 10^{-18}$
	^{41}Ar	$2.1\ 10^{-17}$	–
	^{54}Mn	–	$1.8\ 10^{-15}$
	^{55}Fe	–	$2.3\ 10^{-15}$
	^{60}Co	$8.8\ 10^{-13}$	$6.9\ 10^{-14}$
	^{63}Ni	–	$1.3\ 10^{-16}$
	^{65}Zn	–	$9.2\ 10^{-14}$
	^{85}Kr	$3.6\ 10^{-18}$	–
	^{89}Sr	–	$3.1\ 10^{-18}$
	^{90}Sr*	$2.3\ 10^{-12}$	$3.2\ 10^{-16}$
	^{95}Zr*	–	$5.7\ 10^{-17}$
	^{99}Tc	–	$2.7\ 10^{-15}$
	^{103}Ru	–	$4.8\ 10^{-16}$
	^{106}Ru*	$2.6\ 10^{-13}$	$1.6\ 10^{-14}$
	^{110m}Ag	–	$3.7\ 10^{-14}$
	^{125}Sb*	$1.0\ 10^{-13}$	$8.2\ 10^{-16}$
	^{129}I	$3.3\ 10^{-11}$	$1.1\ 10^{-14}$
	^{131}I*	$4.0\ 10^{-13}$	–
	^{134}Cs	–	$4.6\ 10^{-15}$
	^{137}Cs*	$2.2\ 10^{-12}$	$5.8\ 10^{-15}$
	^{144}Ce*	–	$7.7\ 10^{-17}$

Table C7: continued

		Collective dose (man Sv)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
Sellafield: continued	^{147}Pm*	–	8.5 10^{-18}
	^{152}Eu*	–	8.5 10^{-16}
	^{154}Eu	–	8.8 10^{-16}
	^{155}Eu	–	7.6 10^{-17}
	^{234}U*	–	3.8 10^{-15}
	^{235}U*	–	3.7 10^{-15}
	^{238}U*	–	3.5 10^{-15}
	^{237}Np*	–	1.1 10^{-13}
	^{238}Pu*	–	1.7 10^{-13}
	^{239}Pu*	1.3 10^{-10}	2.4 10^{-13}
	^{241}Pu*	2.4 10^{-12}	2.2 10^{-15}
	^{241}Am*	1.1 10^{-10}	1.1 10^{-12}
	^{242}Cm*	–	2.2 10^{-15}
	^{243}Cm*	–	4.1 10^{-14}

Table C8: Collective effective doses to the UK population integrated to 500 years due to a discharge of 1 Bq over one year from other installations

		Collective dose (man Sv)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
Amersham	^{3}H	8.2 10^{-16}	9.1 10^{-15}
	^{35}S	1.9 10^{-13}	–
	^{65}Zn	–	2.3 10^{-12}
	^{75}Se	4.0 10^{-13}	–
	^{90}Sr*	4.2 10^{-12}	1.5 10^{-11}
	^{125}I	1.2 10^{-12}	7.0 10^{-12}
	^{131}I*	6.2 10^{-13}	–
	^{133}Xe	2.2 10^{-17}	–
	^{137}Cs*	5.4 10^{-12}	5.2 10^{-12}
	^{222}Rn*	9.9 10^{-14}	–
	^{241}Am*	5.6 10^{-10}	7.3 10^{-12}
Cardiff	^{3}H	8.1 10^{-16}	2.6 10^{-19}
	^{14}C	3.1 10^{-13}	9.8 10^{-14}
	^{32}P	2.9 10^{-13}	6.4 10^{-14}
	^{125}I	1.7 10^{-12}	3.3 10^{-16}
Harwell	^{3}H	9.5 10^{-16}	9.3 10^{-15}
	^{56}Mn	–	8.6 10^{-17}
	^{58}Co	–	9.9 10^{-14}
	^{60}Co	3.2 10^{-12}	4.5 10^{-13}
	^{85}Kr	9.4 10^{-18}	–
	^{90}Sr*	5.0 10^{-12}	1.4 10^{-11}
	^{103}Ru	–	2.7 10^{-13}
	^{106}Ru	–	2.7 10^{-12}
	^{125}Sb*	–	5.0 10^{-13}
	^{125}I	–	5.5 10^{-12}

Table C8: continued

Site	Radionuclide	Collective dose (man Sv)	
		Atmospheric discharges	Liquid discharges
Harwell: continued	^{131}I*	–	$7.6\ 10^{-12}$
	^{134}Cs	–	$5.9\ 10^{-12}$
	^{137}Cs*	$5.8\ 10^{-12}$	$4.4\ 10^{-12}$
	^{154}Eu	$2.4\ 10^{-12}$	$7.3\ 10^{-13}$
	^{155}Eu	–	$1.2\ 10^{-13}$
	^{220}Rn*	$2.7\ 10^{-15}$	–
	^{222}Rn*	$8.1\ 10^{-14}$	–
	^{226}Ra*	$5.4\ 10^{-11}$	$2.9\ 10^{-10}$
	^{226}Th*	$5.4\ 10^{-14}$	–
	^{232}Th*	$2.5\ 10^{-10}$	–
	^{234}U*	$3.4\ 10^{-11}$	$2.2\ 10^{-11}$
	^{238}U*	$2.9\ 10^{-11}$	$1.3\ 10^{-11}$
	^{238}Pu	$4.3\ 10^{-10}$	–
	^{239}Pu*	$4.8\ 10^{-10}$	$1.3\ 10^{-11}$
	^{240}Pu*	$4.8\ 10^{-10}$	$1.5\ 10^{-11}$
	^{241}Pu*	$8.4\ 10^{-12}$	–
	^{241}Am*	$4.0\ 10^{-10}$	$4.2\ 10^{-12}$
Winfrith	^{3}H	$6.0\ 10^{-16}$	$2.6\ 10^{-19}$
	^{14}C	$2.9\ 10^{-13}$	–
	^{54}Mn	–	$6.7\ 10^{-15}$
	^{55}Fe	–	$5.2\ 10^{-15}$
	^{60}Co	$1.4\ 10^{-12}$	$6.0\ 10^{-15}$
	^{63}Ni	–	$2.7\ 10^{-16}$
	^{65}Zn	–	$1.1\ 10^{-13}$
	^{85}Kr	$5.2\ 10^{-18}$	–
	^{90}Sr*	–	$1.6\ 10^{-16}$
	^{134}Cs	–	$2.8\ 10^{-15}$
	^{137}Cs*	–	$2.9\ 10^{-15}$
	^{144}Ce*	–	$2.6\ 10^{-16}$
	^{234}U*	–	$2.0\ 10^{-15}$
	^{238}U*	–	$1.9\ 10^{-15}$
	^{238}Pu*	–	$3.9\ 10^{-13}$
	^{239}Pu*	$2.2\ 10^{-10}$	$5.2\ 10^{-13}$
	^{241}Am*	–	$2.6\ 10^{-13}$

Appendix D Typical Annual Individual Effective Doses per Unit Activity Discharged

The annual doses to typical individuals calculated in the year of discharge using an annual discharge of 1 Bq are presented here. An asterisk (*) indicates radionuclides for which the contribution of the first progeny to the dose was included.

Table D1: Typical annual individual doses in the year of discharge from a discharge of 1 Bq over one year from nuclear fuel fabrication installations

		Individual dose (μSv y^{-1})	
Site	**Radionuclide**	**Atmospheric discharges**	**Liquid discharges**
Capenhurst	^{3}H	$4.3\ 10^{-16}$	$2.8\ 10^{-18}$
	^{99}Tc	–	$2.4\ 10^{-14}$
	^{234}Th*	$6.9\ 10^{-13}$	$9.9\ 10^{-16}$
	^{234}U*	$3.6\ 10^{-11}$	$3.5\ 10^{-14}$
	^{235}U*	$3.2\ 10^{-11}$	–
	^{237}Np*	–	$9.4\ 10^{-13}$
	^{238}U*	$3.0\ 10^{-11}$	$3.2\ 10^{-14}$
Springfields	^{99}Tc	–	$1.6\ 10^{-13}$
	^{228}Th*	–	$8.4\ 10^{-13}$
	^{230}Th*	–	$2.4\ 10^{-13}$
	^{232}Th*	–	$9.6\ 10^{-13}$
	^{234}Th*	$6.9\ 10^{-13}$	$3.9\ 10^{-15}$
	^{234}U*	$3.6\ 10^{-11}$	$2.1\ 10^{-13}$
	^{235}U*	$3.2\ 10^{-11}$	$2.2\ 10^{-13}$
	^{237}Np*	–	$5.8\ 10^{-12}$
	^{238}U*	$3.0\ 10^{-11}$	$2.0\ 10^{-13}$

Table D2: Typical annual individual doses in the year of discharge from a discharge of 1 Bq over one year from nuclear power production installations

		Individual dose (μSv y^{-1})	
Site	**Radionuclide**	**Atmospheric discharges**	**Liquid discharges**
AGR power stations			
Dungeness B	^{3}H	$4.3\ 10^{-16}$	$6.4\ 10^{-19}$
	^{14}C	$6.9\ 10^{-14}$	–
	^{32}P	–	$1.4\ 10^{-12}$
	^{35}S	$2.8\ 10^{-13}$	$5.3\ 10^{-17}$
	^{45}Ca	–	$5.6\ 10^{-17}$
	^{41}Ar	$4.0\ 10^{-16}$	–
	^{54}Mn	–	$1.1\ 10^{-13}$
	^{55}Fe	–	$4.2\ 10^{-14}$
	^{59}Fe	–	$2.1\ 10^{-13}$
	^{58}Co	–	$4.2\ 10^{-14}$
	^{60}Co	$4.7\ 10^{-13}$	$3.1\ 10^{-13}$

Table D2: continued

Site	Radionuclide	Individual dose (μSv y^{-1})	
		Atmospheric discharges	Liquid discharges
Dungeness B: continued	^{63}Ni	–	2.5 10^{-15}
	^{65}Zn	3.3 10^{-13}	–
	^{90}Sr*	–	1.9 10^{-15}
	^{95}Zr*	–	2.2 10^{-14}
	^{95}Nb	–	1.1 10^{-14}
	^{106}Ru	–	8.6 10^{-14}
	^{110m}Ag	–	2.8 10^{-13}
	^{124}Sb	–	2.1 10^{-14}
	^{125}Sb*	–	1.1 10^{-14}
	^{125m}Te	–	2.6 10^{-14}
	^{131}I*	1.8 10^{-12}	–
	^{134}Cs	–	5.5 10^{-14}
	^{137}Cs*	–	3.7 10^{-14}
	^{144}Ce	–	1.1 10^{-14}
	^{144}Pr	–	5.3 10^{-20}
	^{154}Eu	–	1.4 10^{-13}
	^{155}Eu	–	7.9 10^{-15}
	^{238}Pu	–	2.0 10^{-12}
	^{239}Pu*	–	2.2 10^{-12}
	^{241}Pu	–	4.2 10^{-14}
	^{241}Am	–	8.4 10^{-13}
	^{242}Cm	–	7.1 10^{-14}
	^{243}Cm	–	9.3 10^{-13}
Hartlepool	^{3}H	4.3 10^{-16}	1.1 10^{-17}
	^{14}C	6.9 10^{-14}	–
	^{32}P	–	1.9 10^{-11}
	^{35}S	2.8 10^{-13}	8.7 10^{-16}
	^{41}Ar	4.0 10^{-16}	–
	^{45}Ca	–	8.5 10^{-16}
	^{54}Mn	–	1.7 10^{-13}
	^{55}Fe	–	1.1 10^{-13}
	^{59}Fe	–	5.1 10^{-13}
	^{58}Co	–	6.4 10^{-14}
	^{60}Co	4.7 10^{-13}	5.0 10^{-13}
	^{63}Ni	–	4.7 10^{-15}
	^{65}Zn	3.3 10^{-13}	6.4 10^{-12}
	^{90}Sr*	–	2.6 10^{-14}
	^{95}Zr*	–	2.7 10^{-14}
	^{95}Nb	–	1.3 10^{-14}
	^{106}Ru	–	1.5 10^{-12}
	^{110m}Ag	–	4.1 10^{-12}
	^{124}Sb	–	2.8 10^{-13}
	^{125}Sb*	–	1.5 10^{-13}
	^{125m}Te	–	3.5 10^{-13}
	^{131}I*	1.8 10^{-12}	–

Table D2: continued

Site	Radionuclide	Individual dose ($\mu Sv\ y^{-1}$)	
		Atmospheric discharges	Liquid discharges
Hartlepool: continued	^{133}Xe	$1.5\ 10^{-17}$	–
	^{134}Cs	–	$5.8\ 10^{-13}$
	^{137}Cs*	–	$3.8\ 10^{-13}$
	^{144}Ce	–	$1.3\ 10^{-14}$
	^{144}Pr	–	$2.8\ 10^{-20}$
	^{154}Eu	–	$2.0\ 10^{-13}$
	^{155}Eu	–	$1.1\ 10^{-14}$
	^{238}Pu	–	$4.0\ 10^{-12}$
	^{239}Pu*	–	$4.3\ 10^{-12}$
	^{241}Pu	–	$8.2\ 10^{-14}$
	^{241}Am	–	$1.1\ 10^{-12}$
	^{242}Cm	–	$8.7\ 10^{-14}$
	^{243}Cm	–	$1.2\ 10^{-12}$
Heysham 1	^{3}H	$4.3\ 10^{-16}$	$7.6\ 10^{-18}$
	^{14}C	$6.9\ 10^{-14}$	–
	^{32}P	–	$1.7\ 10^{-11}$
	^{35}S	$2.8\ 10^{-13}$	$6.0\ 10^{-16}$
	^{45}Ca	–	$6.4\ 10^{-16}$
	^{41}Ar	$4.0\ 10^{-16}$	–
	^{54}Mn	–	$1.3\ 10^{-12}$
	^{55}Fe	–	$3.5\ 10^{-13}$
	^{59}Fe	–	$2.0\ 10^{-12}$
	^{58}Co	–	$7.9\ 10^{-13}$
	^{60}Co	$4.7\ 10^{-13}$	$4.1\ 10^{-12}$
	^{63}Ni	–	$1.8\ 10^{-14}$
	^{65}Zn	$3.3\ 10^{-13}$	–
	^{90}Sr*	–	$2.6\ 10^{-14}$
	^{95}Zr*	–	$2.7\ 10^{-14}$
	^{95}Nb	–	$1.3\ 10^{-14}$
	^{106}Ru	–	$1.5\ 10^{-12}$
	^{110m}Ag	–	$4.1\ 10^{-12}$
	^{124}Sb	–	$2.8\ 10^{-13}$
	^{125}Sb*	–	$1.5\ 10^{-13}$
	^{125m}Te	–	$3.5\ 10^{-13}$
	^{131}I*	$1.8\ 10^{-12}$	–
	^{133}Xe	$1.5\ 10^{-17}$	–
	^{134}Cs	–	$6.2\ 10^{-13}$
	^{137}Cs*	–	$4.3\ 10^{-13}$
	^{144}Ce	–	$1.5\ 10^{-13}$
	^{144}Pr	–	$1.1\ 10^{-18}$
	^{154}Eu	–	$2.3\ 10^{-12}$
	^{155}Eu	–	$1.1\ 10^{-13}$
	^{238}Pu	–	$1.5\ 10^{-11}$
	^{239}Pu*	–	$1.7\ 10^{-11}$
	^{241}Pu	–	$3.2\ 10^{-13}$

Table D2: continued

Site	Radionuclide	Individual dose ($\mu Sv\ y^{-1}$)	
		Atmospheric discharges	Liquid discharges
Heysham 1: continued	^{241}Am	–	$5.0\ 10^{-12}$
	^{242}Cm	–	$5.0\ 10^{-13}$
	^{243}Cm	–	$6.6\ 10^{-12}$
Heysham 2	^{3}H	$4.3\ 10^{-16}$	$7.6\ 10^{-18}$
	^{14}C	$6.9\ 10^{-14}$	–
	^{32}P	–	$1.7\ 10^{-11}$
	^{35}S	$2.8\ 10^{-13}$	$6.0\ 10^{-16}$
	^{45}Ca	–	$6.4\ 10^{-16}$
	^{41}Ar	$4.0\ 10^{-16}$	–
	^{54}Mn	–	$1.3\ 10^{-12}$
	^{55}Fe	–	$3.5\ 10^{-13}$
	^{59}Fe	–	$2.0\ 10^{-12}$
	^{58}Co	–	$7.9\ 10^{-13}$
	^{60}Co	$4.7\ 10^{-13}$	$4.1\ 10^{-12}$
	^{63}Ni	–	$1.8\ 10^{-14}$
	^{65}Zn	$3.3\ 10^{-13}$	–
	^{90}Sr*	–	$2.6\ 10^{-14}$
	^{95}Zr*	–	$2.7\ 10^{-14}$
	^{95}Nb	–	$1.3\ 10^{-14}$
	^{106}Ru	–	$1.5\ 10^{-12}$
	^{110m}Ag	–	$4.1\ 10^{-12}$
	^{124}Sb	–	$2.8\ 10^{-13}$
	^{125}Sb*	–	$1.5\ 10^{-13}$
	^{125m}Te	–	$3.5\ 10^{-13}$
	^{131}I*	$1.8\ 10^{-12}$	–
	^{133}Xe	$1.5\ 10^{-17}$	–
	^{134}Cs	–	$6.2\ 10^{-13}$
	^{137}Cs*	–	$4.3\ 10^{-13}$
	^{144}Ce	–	$1.5\ 10^{-13}$
	^{144}Pr	–	$1.1\ 10^{-18}$
	^{154}Eu	–	$2.3\ 10^{-12}$
	^{155}Eu	–	$1.1\ 10^{-13}$
	^{238}Pu	–	$1.5\ 10^{-11}$
	^{239}Pu*	–	$1.7\ 10^{-11}$
	^{241}Pu	–	$3.2\ 10^{-13}$
	^{241}Am	–	$5.0\ 10^{-12}$
	^{242}Cm	–	$5.0\ 10^{-13}$
	^{243}Cm	–	$6.6\ 10^{-12}$
Hinkley Point B	^{3}H	$4.3\ 10^{-16}$	$5.7\ 10^{-19}$
	^{14}C	$6.9\ 10^{-14}$	–
	^{32}P	–	$8.1\ 10^{-13}$
	^{35}S	$2.8\ 10^{-13}$	$4.0\ 10^{-17}$
	^{45}Ca	–	$4.1\ 10^{-17}$
	^{41}Ar	$4.0\ 10^{-16}$	–
	^{54}Mn	–	$1.0\ 10^{-14}$

Table D2: continued

		Individual dose ($\mu Sv\ y^{-1}$)	
Site	**Radionuclide**	**Atmospheric discharges**	**Liquid discharges**
Hinkley Point B: continued	^{55}Fe	–	7.6 10^{-15}
	^{59}Fe	–	2.7 10^{-14}
	^{58}Co	–	3.7 10^{-15}
	^{60}Co	4.7 10^{-13}	2.8 10^{-14}
	^{63}Ni	–	4.9 10^{-16}
	^{65}Zn	3.3 10^{-13}	–
	^{90}Sr*	–	1.4 10^{-15}
	^{95}Zr*	–	1.2 10^{-15}
	^{95}Nb	–	5.7 10^{-16}
	^{106}Ru	–	6.7 10^{-14}
	^{110m}Ag	–	1.9 10^{-13}
	^{124}Sb	–	1.3 10^{-14}
	^{125}Sb*	–	8.5 10^{-15}
	^{125m}Te	–	1.6 10^{-14}
	^{131}I*[	1.8 10^{-12}	–
	^{133}Xe	1.5 10^{-17}	–
	^{134}Cs	–	3.4 10^{-14}
	^{137}Cs*	–	2.3 10^{-14}
	^{144}Ce	–	7.2 10^{-16}
	^{144}Pr	–	1.1 10^{-21}
	^{154}Eu	–	9.0 10^{-15}
	^{155}Eu	–	5.9 10^{-16}
	^{238}Pu	–	3.1 10^{-13}
	^{239}Pu*	–	3.3 10^{-13}
	^{241}Pu	–	6.4 10^{-15}
	^{241}Am	–	8.5 10^{-14}
	^{242}Cm	–	6.7 10^{-15}
	^{243}Cm	–	9.3 10^{-14}
Hunterston B	^{3}H	4.3 10^{-16}	4.4 10^{-19}
	^{14}C	6.9 10^{-14}	–
	^{35}S	2.8 10^{-13}	3.6 10^{-17}
	^{45}Ca	–	3.8 10^{-17}
	^{41}Ar	4.0 10^{-16}	–
	^{54}Mn	–	6.6 10^{-14}
	^{60}Co	4.7 10^{-13}	1.9 10^{-13}
	^{65}Zn	3.3 10^{-13}	–
	^{90}Sr	–	1.3 10^{-15}
	^{90}Y	–	4.5 10^{-17}
	^{131}I*	1.8 10^{-12}	–
	^{134}Cs	–	3.8 10^{-14}
	^{137}Cs*	–	2.5 10^{-14}
	^{144}Pr	–	2.1 10^{-20}
	^{239}Pu*	–	1.4 10^{-12}
Torness	^{3}H	4.3 10^{-16}	1.1 10^{-17}
	^{14}C	6.9 10^{-14}	–

Table D2: continued

		Individual dose ($\mu Sv\ y^{-1}$)	
Site	**Radionuclide**	**Atmospheric discharges**	**Liquid discharges**
Torness: continued	^{35}S	$2.8\ 10^{-13}$	$8.7\ 10^{-16}$
	^{41}Ar	$4.0\ 10^{-16}$	–
	^{55}Fe	$1.9\ 10^{-14}$	–
	^{60}Co	$4.7\ 10^{-13}$	$5.0\ 10^{-13}$
	^{90}Sr*	–	$2.6\ 10^{-14}$
	^{131}I*	$1.8\ 10^{-12}$	–
	^{134}Cs	–	$5.8\ 10^{-13}$
	^{137}Cs*	–	$3.8\ 10^{-13}$
	^{144}Pr	–	$2.8\ 10^{-20}$
	^{239}Pu*	–	$4.3\ 10^{-12}$
Magnox power stations			
Berkeley	^{3}H	$4.3\ 10^{-16}$	$2.3\ 10^{-16}$
	^{14}C	$6.9\ 10^{-14}$	–
	^{35}S	$2.8\ 10^{-13}$	$2.0\ 10^{-14}$
	^{41}Ar	$4.0\ 10^{-16}$	–
	^{45}Ca	–	$2.1\ 10^{-14}$
	^{54}Mn	–	$4.0\ 10^{-12}$
	^{55}Fe	–	$4.9\ 10^{-12}$
	^{59}Fe	–	$2.1\ 10^{-11}$
	^{58}Co	–	$1.2\ 10^{-12}$
	^{60}Co	$4.6\ 10^{-13}$	$6.3\ 10^{-12}$
	^{65}Zn	$3.3\ 10^{-13}$	–
	^{90}Sr	–	$4.6\ 10^{-13}$
	^{90}Y	–	$2.3\ 10^{-15}$
	^{95}Zr*	–	$1.2\ 10^{-13}$
	^{95}Nb	–	$3.7\ 10^{-14}$
	^{106}Ru	–	$6.7\ 10^{-11}$
	^{110m}Ag	–	$1.7\ 10^{-10}$
	^{124}Sb	–	$2.1\ 10^{-12}$
	^{125}Sb*	–	$1.1\ 10^{-12}$
	^{125m}Te	–	$7.4\ 10^{-12}$
	^{134}Cs	–	$6.4\ 10^{-12}$
	^{137}Cs*	$1.1\ 10^{-12}$	$4.4\ 10^{-12}$
	^{144}Ce	–	$1.8\ 10^{-13}$
	^{144}Pr	–	$6.6\ 10^{-20}$
	^{154}Eu	–	$9.3\ 10^{-13}$
	^{155}Eu	–	$5.5\ 10^{-13}$
	^{238}Pu	–	$1.7\ 10^{-10}$
	^{239}Pu*	–	$1.8\ 10^{-10}$
	^{241}Pu*	–	$3.5\ 10^{-12}$
	^{241}Am*	–	$4.7\ 10^{-11}$
	^{242}Cm*	–	$3.9\ 10^{-12}$
	^{243}Cm*	–	$5.3\ 10^{-11}$
Bradwell	^{3}H	$4.3\ 10^{-16}$	$1.1\ 10^{-17}$
	^{14}C	$6.9\ 10^{-14}$	–

Table D2: continued

Site	Radionuclide	Individual dose ($\mu Sv\ y^{-1}$)	
		Atmospheric discharges	Liquid discharges
Bradwell: continued	^{35}S	$2.8\ 10^{-13}$	$8.8\ 10^{-16}$
	^{41}Ar	$4.0\ 10^{-16}$	–
	^{45}Ca	–	$8.7\ 10^{-16}$
	^{51}Cr	–	$2.5\ 10^{-14}$
	^{54}Mn	–	$1.7\ 10^{-13}$
	^{55}Fe	–	$1.2\ 10^{-13}$
	^{59}Fe	–	$5.2\ 10^{-13}$
	^{58}Co	–	$6.6\ 10^{-14}$
	^{60}Co	$4.7\ 10^{-13}$	$5.1\ 10^{-13}$
	^{65}Zn	$3.3\ 10^{-13}$	$6.6\ 10^{-12}$
	^{90}Sr	–	$2.7\ 10^{-14}$
	^{90}Y	–	$6.4\ 10^{-17}$
	^{95}Zr	–	$5.5\ 10^{-14}$
	^{95}Nb	–	$1.3\ 10^{-14}$
	^{106}Ru*	–	$1.5\ 10^{-12}$
	^{110m}Ag	–	$4.1\ 10^{-12}$
	^{124}Sb	–	$2.8\ 10^{-13}$
	^{125}Sb*	–	$2.9\ 10^{-13}$
	^{125m}Te	–	$3.5\ 10^{-13}$
	^{134}Cs	–	$8.7\ 10^{-16}$
	^{137}Cs*	$1.2\ 10^{-12}$	$6.0\ 10^{-13}$
	^{144}Ce*	–	$1.4\ 10^{-14}$
	^{144}Pr	–	$6.6\ 10^{-20}$
	^{154}Eu	–	$2.0\ 10^{-13}$
	^{155}Eu	–	$5.5\ 10^{-13}$
	^{238}Pu*	–	$4.2\ 10^{-12}$
	^{239}Pu*	–	$4.5\ 10^{-12}$
	^{241}Pu*	–	$8.6\ 10^{-14}$
	^{241}Am*	–	$1.1\ 10^{-12}$
	^{242}Cm*	–	$9.1\ 10^{-14}$
	^{243}Cm*	–	$1.2\ 10^{-12}$
	^{244}Cm*	–	$9.7\ 10^{-13}$
Chapelcross	^{3}H	$4.3\ 10^{-16}$	$1.6\ 10^{-18}$
	^{14}C	$6.9\ 10^{-14}$	–
	^{35}S	$2.8\ 10^{-13}$	$9.1\ 10^{-17}$
	^{41}Ar	$4.0\ 10^{-16}$	–
	^{60}Co	–	$6.9\ 10^{-13}$
	^{65}Zn	–	$1.6\ 10^{-12}$
	^{90}Sr*	–	$4.7\ 10^{-15}$
	^{106}Ru	–	$1.4\ 10^{-13}$
	^{125}Sb*	–	$6.3\ 10^{-14}$
	^{134}Cs	–	$1.3\ 10^{-13}$
	^{137}Cs*	–	$9.8\ 10^{-14}$
	^{144}Ce	–	$8.4\ 10^{-15}$
	^{154}Eu	–	$1.3\ 10^{-13}$

Table D2: continued

Site	Radionuclide	Individual dose ($\mu Sv\ y^{-1}$)	
		Atmospheric discharges	Liquid discharges
Chapelcross: continued	^{238}Pu	–	$1.5\ 10^{-12}$
	^{239}Pu*	–	$1.6\ 10^{-12}$
	^{241}Am	–	$4.3\ 10^{-13}$
	^{242}Cm*	–	$3.5\ 10^{-14}$
	^{243}Cm*	–	$4.\ 8\ 10^{-13}$
Dungeness A	^{3}H	$4.3\ 10^{-16}$	$6.4\ 10^{-19}$
	^{14}C	$6.9\ 10^{-14}$	–
	^{35}S	$2.8\ 10^{-13}$	$5.3\ 10^{-17}$
	^{41}Ar	$4.0\ 10^{-16}$	–
	^{45}Ca	–	$5.6\ 10^{-17}$
	^{54}Mn	–	$1.1\ 10^{-13}$
	^{55}Fe	–	$4.2\ 10^{-14}$
	^{59}Fe	–	$2.1\ 10^{-13}$
	^{58}Co	–	$4.2\ 10^{-14}$
	^{60}Co	$4.7\ 10^{-13}$	$3.1\ 10^{-13}$
	^{65}Zn	$3.3\ 10^{-13}$	–
	^{90}Sr	–	$1.9\ 10^{-15}$
	^{90}Y	–	$9.9\ 10^{-17}$
	^{95}Zr	–	$4.3\ 10^{-14}$
	^{95}Nb	–	$1.1\ 10^{-14}$
	^{106}Ru*	–	$8.6\ 10^{-14}$
	^{124}Sb	–	$2.1\ 10^{-14}$
	^{125}Sb*	–	$1.6\ 10^{-14}$
	^{125m}Te	–	$2.6\ 10^{-14}$
	^{134}Cs	–	$5.5\ 10^{-14}$
	^{137}Cs*	$1.2\ 10^{-12}$	$3.7\ 10^{-14}$
	^{144}Ce*	–	$1.1\ 10^{-14}$
	^{144}Pr	–	$1.3\ 10^{-19}$
	^{154}Eu	–	$1.4\ 10^{-13}$
	^{155}Eu	–	$3.8\ 10^{-13}$
	^{238}Pu*	–	$2.0\ 10^{-12}$
	^{239}Pu*	–	$2.2\ 10^{-12}$
	^{241}Pu*	–	$4.2\ 10^{-14}$
	^{241}Am*	–	$8.4\ 10^{-13}$
	^{242}Cm*	–	$7.1\ 10^{-14}$
	^{243}Cm*	–	$9.3\ 10^{-13}$
	^{244}Cm*	–	$7.3\ 10^{-13}$
Hinkley Point A	^{3}H	$4.3\ 10^{-16}$	$5.7\ 10^{-19}$
	^{14}C	$6.9\ 10^{-14}$	–
	^{35}S	–	$4.0\ 10^{-17}$
	^{45}Ca	–	$4.1\ 10^{-17}$
	^{54}Mn	–	$1.0\ 10^{-14}$
	^{55}Fe	–	$7.6\ 10^{-15}$
	^{59}Fe	–	$2.7\ 10^{-14}$
	^{58}Co	–	$3.7\ 10^{-15}$

Table D2: continued

		Individual dose ($\mu Sv\ y^{-1}$)	
Site	Radionuclide	Atmospheric discharges	Liquid discharges
Hinkley Point A: continued	^{60}Co	$4.7\ 10^{-13}$	$2.8\ 10^{-14}$
	^{65}Zn	$3.3\ 10^{-13}$	–
	^{90}Sr	–	$1.5\ 10^{-15}$
	^{90}Y	–	$3.4\ 10^{-18}$
	^{95}Zr*	–	$1.2\ 10^{-15}$
	^{95}Nb	–	$5.7\ 10^{-16}$
	^{106}Ru	–	$7.3\ 10^{-14}$
	^{110m}Ag	–	$1.9\ 10^{-13}$
	^{124}Sb	–	$1.3\ 10^{-14}$
	^{125}Sb*	–	$1.6\ 10^{-14}$
	^{125m}Te	–	$1.6\ 10^{-14}$
	^{134}Cs	–	$3.4\ 10^{-14}$
	^{137}Cs*	$1.2\ 10^{-12}$	$2.3\ 10^{-14}$
	^{144}Ce	–	$7.2\ 10^{-16}$
	^{144}Pr	–	$2.6\ 10^{-21}$
	^{154}Eu	–	$9.0\ 10^{-15}$
	^{155}Eu	–	$2.3\ 10^{-14}$
	^{238}Pu*	–	$3.1\ 10^{-13}$
	^{239}Pu*	–	$3.3\ 10^{-13}$
	^{241}Pu*	–	$6.4\ 10^{-15}$
	^{241}Am*	–	$8.5\ 10^{-14}$
	^{242}Cm*	–	$6.7\ 10^{-15}$
	^{243}Cm*	–	$9.3\ 10^{-14}$
	^{244}Cm*	–	$7.4\ 10^{-14}$
Hunterston A	^{3}H	$4.3\ 10^{-16}$	$4.4\ 10^{-19}$
	^{14}C	$6.9\ 10^{-14}$	–
	^{35}S	–	$3.6\ 10^{-17}$
	^{45}Ca	–	$3.8\ 10^{-17}$
	^{55}Fe	–	$2.8\ 10^{-14}$
	^{60}Co	$4.7\ 10^{-13}$	$1.9\ 10^{-13}$
	^{90}Sr	–	$1.3\ 10^{-15}$
	^{90}Y	–	$4.5\ 10^{-17}$
	^{95}Zr*	–	$1.3\ 10^{-14}$
	^{95}Nb	–	$6.3\ 10^{-15}$
	^{103}Ru*	–	$5.1\ 10^{-15}$
	^{134}Cs	–	$3.8\ 10^{-14}$
	^{137}Cs*	$1.2\ 10^{-12}$	$2.5\ 10^{-14}$
	^{144}Pr	–	$5.0\ 10^{-20}$
	^{239}Pu*	–	$1.4\ 10^{-12}$
	^{241}Pu*	–	$2.7\ 10^{-14}$
Oldbury	^{3}H	$4.3\ 10^{-16}$	$1.1\ 10^{-17}$
	^{14}C	$6.9\ 10^{-14}$	–
	^{35}S	$2.8\ 10^{-13}$	$8.8\ 10^{-16}$
	^{41}Ar	$4.0\ 10^{-16}$	–
	^{45}Ca	–	$8.6\ 10^{-16}$

Table D2: continued

Site	Radionuclide	Individual dose ($\mu Sv\ y^{-1}$)	
		Atmospheric discharges	Liquid discharges
Oldbury: continued	^{51}Cr	–	2.5 10^{-14}
	^{54}Mn	–	1.7 10^{-13}
	^{55}Fe	–	1.1 10^{-13}
	^{59}Fe	–	5.2 10^{-13}
	^{58}Co	–	6.5 10^{-14}
	^{60}Co	4.7 10^{-13}	5.1 10^{-13}
	^{65}Zn	3.3 10^{-13}	–
	^{90}Sr	–	2.7 10^{-14}
	^{90}Y	–	6.5 10^{-17}
	^{95}Zr*	–	5.5 10^{-14}
	^{95}Nb	–	1.3 10^{-14}
	^{106}Ru*	–	1.5 10^{-12}
	^{110m}Ag	–	4.1 10^{-12}
	^{124}Sb	–	2.8 10^{-13}
	^{125}Sb*	–	1.5 10^{-13}
	^{125m}Te	–	3.5 10^{-13}
	^{134}Cs	–	5.9 10^{-13}
	^{137}Cs*	1.2 10^{-12}	3.9 10^{-13}
	^{144}Ce*	–	1.4 10^{-14}
	^{144}Pr	–	6.6 10^{-20}
	^{154}Eu	–	2.0 10^{-13}
	^{155}Eu	–	5.5 10^{-13}
	^{238}Pu*	–	4.1 10^{-12}
	^{239}Pu*	–	4.5 10^{-12}
	^{241}Pu*	–	8.5 10^{-14}
	^{241}Am*	–	1.1 10^{-12}
	^{242}Cm*	–	9.0 10^{-14}
	^{243}Cm*	–	1.2 10^{-12}
Sizewell A	^{3}H	4.3 10^{-16}	4.2 10^{-18}
	^{14}C	6.9 10^{-14}	–
	^{35}S	2.8 10^{-13}	3.5 10^{-16}
	^{45}Ca	–	3.6 10^{-16}
	^{41}Ar	4.0 10^{-16}	–
	^{54}Mn	–	1.5 10^{-13}
	^{55}Fe	–	9.3 10^{-14}
	^{59}Fe	–	4.6 10^{-13}
	^{58}Co	–	6.1 10^{-14}
	^{60}Co	4.7 10^{-13}	4.4 10^{-13}
	^{65}Zn	3.3 10^{-13}	–
	^{90}Sr	–	1.1 10^{-14}
	^{90}Y	–	9.3 10^{-17}
	^{95}Zr*	–	2.6 10^{-14}
	^{95}Nb	–	1.3 10^{-14}
	^{106}Ru	–	5.8 10^{-13}
	^{110m}Ag	–	5.8 10^{-13}

Table D2: continued

		Individual dose ($\mu Sv\ y^{-1}$)	
Site	**Radionuclide**	**Atmospheric discharges**	**Liquid discharges**
Sizewell A: continued	^{124}Sb	–	1.3 10^{-13}
	^{125}Sb*	–	9.3 10^{-14}
	^{125m}Te	–	1.6 10^{-13}
	^{134}Cs	–	3.0 10^{-13}
	^{137}Cs*	1.2 10^{-12}	2.0 10^{-13}
	^{144}Ce	–	1.2 10^{-14}
	^{144}Pr	–	1.1 10^{-19}
	^{154}Eu	–	1.8 10^{-13}
	^{155}Eu	–	4.9 10^{-13}
	^{238}Pu*	–	3.5 10^{-12}
	^{239}Pu*	–	3.8 10^{-12}
	^{241}Pu*	–	7.3 10^{-14}
	^{241}Am*	–	9.8 10^{-13}
	^{242}Cm*	–	8.4 10^{-14}
	^{243}Cm*	–	1.1 10^{-12}
	^{244}Cm*	–	8.6 10^{-13}
Trawsfynydd	^{3}H	4.3 10^{-16}	1.1 10^{-12}
	^{14}C	6.9 10^{-14}	–
	^{35}S	2.8 10^{-13}	–
	^{41}Ar	4.0 10^{-16}	–
	^{60}Co	4.7 10^{-13}	1.1 10^{-11}
	^{65}Zn	3.3 10^{-13}	–
	^{90}Sr	–	2.5 10^{-10}
	^{134}Cs	–	8.1 10^{-10}
	^{137}Cs*	1.2 10^{-12}	5.9 10^{-10}
Wylfa	^{3}H	4.3 10^{-16}	3.3 10^{-15}
	^{14}C	6.9 10^{-14}	–
	^{35}S	2.8 10^{-13}	4.7 10^{-16}
	^{45}Ca	–	1.6 10^{-14}
	^{41}Ar	4.0 10^{-16}	–
	^{54}Mn	–	1.5 10^{-13-}
	^{55}Fe	–	6.4 10^{-16}
	^{59}Fe	–	5.5 10^{-14}
	^{58}Co	–	4.6 10^{-15}
	^{60}Co	4.7 10^{-13}	4.4 10^{-14}
	^{65}Zn	3.3 10^{-13}	–
	^{90}Sr	–	4.7 10^{-15}
	^{90}Y	–	1.1 10^{-13}
	^{95}Zr*	–	1.1 10^{-13}
	^{95}Nb	–	2.6 10^{-14}
	^{106}Ru	–	1.6 10^{-13}
	^{110m}Ag	–	1.7 10^{-14}
	^{124}Sb	–	1.0 10^{-13}
	^{125}Sb*	–	8.7 10^{-14}
	^{125m}Te	–	1.4 10^{-13}

Table D2: continued

Site	Radionuclide	Individual dose (µSv y^{-1})	
		Atmospheric discharges	Liquid discharges
Wylfa: continued	^{134}Cs	–	6.6 10^{-13}
	^{137}Cs*	1.2 10^{-12}	4.7 10^{-13}
	^{144}Ce	–	9.5 10^{-13}
	^{144}Pr	–	2.3 10^{-19}
	^{154}Eu	–	1.4 10^{-13}
	^{155}Eu	–	9.1 10^{-13}
	^{238}Pu	–	9.4 10^{-14}
	^{239}Pu*	–	1.0 10^{-13}
	^{241}Pu*	–	2.0 10^{-15}
	^{241}Am*	–	7.5 10^{-13}
	^{242}Cm*	–	1.7 10^{-15}
	^{243}Cm*	–	2.3 10^{-14}
PWR power station			
Sizewell B	^{3}H	4.3 10^{-16}	4.2 10^{-18}
	^{14}C	6.9 10^{-14}	–
	^{35}S	2.8 10^{-13}	–
	^{41}Ar	4.0 10^{-16}	–
	^{54}Mn	–	1.5 10^{-13}
	^{55}Fe	–	9.3 10^{-14}
	^{58}Co	–	6.1 10^{-14}
	^{60}Co	4.7 10^{-13}	4.4 10^{-13}
	^{63}Ni	–	4.3 10^{-15}
	^{65}Zn	3.3 10^{-13}	–
	^{110m}Ag*	–	1.7 10^{-12}
	^{131}I*	1.81$10^{-12}$	–
	^{133}Xe	1.4 10^{-17}	–
	^{134}Cs	–	1.7 10^{-12}
	^{137}Cs*	1.2 10^{-12}	3.0 10^{-13}
	^{239}Pu*	–	3.8 10^{-12}

Table D3: Typical annual individual doses in the year of discharge from a discharge of 1 Bq over one year from nuclear fuel reprocessing installations

Site	Radionuclide	Individual dose (µSv y^{-1})	
		Atmospheric discharges	Liquid discharges
Dounreay	^{3}H	2.6 10^{-16}	3.0 10^{-19}
	^{41}Ar	3.0 10^{-16}	–
	^{60}Co	3.3 10^{-13}	3.8 10^{-13}
	^{85}Kr	3.9 10^{-18}	–
	^{85m}Kr	4.5 10^{-17}	–
	^{87}Kr	1.9 10^{-16}	–
	^{88}Kr	1.1 10^{-13}	–
	^{90}Sr*	7.8 10^{-13}	8.8 10^{-16}
	^{95}Nb	3.1 10^{-14}	1.9 10^{-14}
	^{95}Zr	–	8.9 10^{-14}

Table D3: continued

Site	Radionuclide	Individual dose ($\mu Sv\ y^{-1}$) Atmospheric discharges	Liquid discharges
Dounreay: continued	^{106}Ru*	$7.6\ 10^{-13}$	$4.2\ 10^{-14}$
	^{110m}Ag*	–	$1.3\ 10^{-13}$
	^{129}I	$2.3\ 10^{-11}$	–
	^{131}I*	$1.2\ 10^{-12}$	–
	^{133}Xe	$1.0\ 10^{-17}$	–
	^{133m}Xe	$9.3\ 10^{-18}$	–
	^{135}Xe	$6.8\ 10^{-17}$	–
	^{134}Cs	$1.2\ 10^{-12}$	$2.7\ 10^{-14}$
	^{137}Cs*	$8.8\ 10^{-13}$	$1.8\ 10^{-14}$
	^{144}Ce*	$6.1\ 10^{-13}$	$2.4\ 10^{-14}$
	^{234}U	–	$6.2\ 10^{-15}$
	^{235}U	–	$6.1\ 10^{-15}$
	^{238}U	–	$5.8\ 10^{-15}$
	^{238}Pu*	–	$1.8\ 10^{-12}$
	^{239}Pu*	$3.1\ 10^{-10}$	$2.0\ 10^{-12}$
	^{241}Pu*	$5.6\ 10^{-12}$	$3.8\ 10^{-14}$
	^{241}Am*	$2.6\ 10^{-10}$	$1.9\ 10^{-12}$
	^{242}Cm*	$3.2\ 10^{-11}$	$1.6\ 10^{-13}$
	^{243}Cm*	$1.9\ 10^{-10}$	$2.1\ 10^{-12}$
	^{244}Cm*	$1.7\ 10^{-10}$	–
Sellafield	^{3}H	$1.6\ 10^{-16}$	$1.3\ 10^{-18}$
	^{14}C	$2.5\ 10^{-14}$	$7.5\ 10^{-13}$
	^{35}S	$1.5\ 10^{-13}$	$7.7\ 10^{-17}$
	^{41}Ar	$2.3\ 10^{-16}$	–
	^{54}Mn	–	$8.6\ 10^{-14}$
	^{55}Fe	–	$2.5\ 10^{-14}$
	^{60}Co	$2.4\ 10^{-13}$	$5.0\ 10^{-13}$
	^{63}Ni	–	$1.8\ 10^{-15}$
	^{65}Zn	–	$1.1\ 10^{-12}$
	^{85}Kr	$2.4\ 10^{-18}$	–
	^{89}Sr	–	$2.0\ 10^{-16}$
	^{90}Sr*	$5.6\ 10^{-13}$	$3.7\ 10^{-15}$
	^{95}Zr*	–	$5.4\ 10^{-14}$
	^{99}Tc	–	$1.1\ 10^{-14}$
	^{103}Ru	–	$5.7\ 10^{-15}$
	^{106}Ru*	$3.4\ 10^{-13}$	$9.3\ 10^{-14}$
	^{110m}Ag*	–	$3.2\ 10^{-13}$
	^{125}Sb*	$7.4\ 10^{-14}$	$4.8\ 10^{-14}$
	^{129}I	$1.5\ 10^{-11}$	$8.1\ 10^{-14}$
	^{131}I*	$8.0\ 10^{-13}$	–
	^{134}Cs	–	$1.1\ 10^{-13}$
	^{137}Cs*	$6.5\ 10^{-13}$	$8.1\ 10^{-14}$
	^{144}Ce*	–	$1.1\ 10^{-14}$
	^{147}Pm*	–	$3.5\ 10^{-16}$
	^{152}Eu*	–	$1.5\ 10^{-13}$

Table D3: continued

Site	Radionuclide	Individual dose (μSv y^{-1})	
		Atmospheric discharges	Liquid discharges
Sellafield: continued	^{154}Eu	–	1.6 10^{-13}
	^{155}Eu	–	8.1 10^{-15}
	^{234}U*	–	1.6 10^{-14}
	^{235}U*	–	1.6 10^{-14}
	^{238}U*	–	1.5 10^{-14}
	^{237}Np*	–	4.4 10^{-13}
	^{238}Pu*	–	1.1 10^{-12}
	^{239}Pu*	1.9 10^{-10}	1.2 10^{-12}
	^{241}Pu*	3.4 10^{-12}	2.3 10^{-14}
	^{241}Am*	1.6 10^{-10}	5.3 10^{-12}
	^{242}Cm*	–	3.3 10^{-14}
	^{243}Cm*	–	4.4 10^{-13}

Table D4: Typical annual individual doses in the year of discharge from a discharge of 1 Bq over one year from other installations

Site	Radionuclide	Individual dose (μSv y^{-1})	
		Atmospheric discharges	Liquid discharges
Amersham	^{3}H	4.3 10^{-16}	1.1 10^{-14}
	^{18}F	8.9 10^{-14}	–
	^{35}S	2.8 10^{-13}	–
	^{65}Zn	–	4.5 10^{-12}
	^{75}Se	9.8 10^{-13}	–
	^{90}Sr*	1.1 10^{-12}	1.2 10^{-11}
	^{125}I	3.0 10^{-12}	7.0 10^{-12}
	^{131}I*	1.8 10^{-12}	–
	^{133}Xe	1.5 10^{-17}	–
	^{137}Cs*	1.2 10^{-12}	2.0 10^{-11}
	^{222}Rn*	7.0 10^{-14}	–
	^{241}Am*	4.3 10^{-10}	1.2 10^{-11}
Cardiff	^{3}H	4.7 10^{-16}	1.1 10^{-17}
	^{14}C	7.5 10^{-14}	4.9 10^{-12}
	^{32}P	5.7 10^{-13}	2.0 10^{-11}
	^{35}S	–	8.8 10^{-16}
	^{45}Ca	–	8.6 10^{-16}
	^{57}Co	–	2.1 10^{-14}
	^{125}I	3.2 10^{-12}	7.3 10^{-14}
Harwell	^{3}H	6.5 10^{-16}	2.0 10^{-14}
	^{56}Mn	–	1.1 10^{-13}
	^{58}Co	–	2.9 10^{-12}
	^{60}Co	6.6 10^{-13}	1.1 10^{-11}
	^{85}Kr	9.2 10^{-18}	–
	^{90}Sr*	1.6 10^{-12}	2.4 10^{-11}
	^{90}Y	4.6 10^{-13}	–
	^{103}Ru*	–	4.7 10^{-13}

Table D4: continued

Site	Radionuclide	Individual dose (μSv y^{-1}) Atmospheric discharges	Liquid discharges
Harwell: continued	^{106}Ru*	–	4.5 10^{-12}
	^{125}Sb*	–	9.4 10^{-13}
	^{125}I	–	1.3 10^{-11}
	^{131}I*	–	1.7 10^{-11}
	^{134}Cs	–	5.5 10^{-11}
	^{137}Cs*	1.7 10^{-12}	3.8 10^{-11}
	^{154}Eu	1.2 10^{-12}	5.5 10^{-12}
	^{155}Eu	–	7.0 10^{-13}
	^{226}Ra*	–	2.2 10^{-10}
	^{220}Rn*	3.7 10^{-15}	–
	^{222}Rn*	1.1 10^{-13}	–
	^{226}Ra*	5.5 10^{-11}	–
	^{226}Th*	5.2 10^{-13}	–
	^{232}Th*	3.7 10^{-10}	–
	^{234}U*	5.3 10^{-11}	1.1 10^{-10}
	^{238}U*	4.4 10^{-11}	3.3 10^{-11}
	^{238}Pu*	6.9 10^{-10}	–
	^{239}Pu*	7.5 10^{-10}	6.0 10^{-11}
	^{240}Pu*	7.5 10^{-10}	1.2 10^{-10}
	^{241}Pu*	1.3 10^{-11}	–
	^{241}Am*	6.3 10^{-10}	2.2 10^{-11}
Winfrith	^{3}H	4.3 10^{-16}	2.1 10^{-19}
	^{14}C	6.9 10^{-14}	–
	^{54}Mn	–	8.6 10^{-15}
	^{55}Fe	–	5.8 10^{-15}
	^{60}Co	4.7 10^{-13}	2.5 10^{-14}
	^{63}Ni		2.6 10^{-16}
	^{65}Zn	–	2.4 10^{-13}
	^{90}Sr*	–	5.8 10^{-16}
	^{85}Kr	6.2 10^{-18}	–
	^{134}Cs	–	1.4 10^{-14}
	^{137}Cs*	–	1.0 10^{-14}
	^{144}Ce	–	7.0 10^{-16}
	^{234}U	–	4.4 10^{-15}
	^{238}U	–	4.1 10^{-15}
	^{238}Pu	–	2.2 10^{-13}
	^{239}Pu*	5.1 10^{-10}	2.4 10^{-13}
	^{241}Pu	9.1 10^{-12}	–
	^{241}Am	–	5.6 10^{-14}