

Cefas contract report C2848

# Radiological Habits Survey: Berkeley and Oldbury, 2007

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Environment Report RL 06/08

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## SUMMARY

This report presents the results of a survey conducted in 2007 to determine the habits and consumption patterns of people living, working and pursuing recreational activities in the vicinity of the Berkeley and Oldbury nuclear power stations in Gloucestershire and South Gloucestershire, respectively. Berkeley has twin Magnox reactors; the station ceased energy generation in 1989 and is undergoing decommissioning. Oldbury generates electricity from twin Magnox reactors; the station is scheduled to cease electricity production in 2008. Both sites discharge gaseous radioactive waste via separate stacks to the atmosphere and discharge liquid radioactive waste via separate pipelines to the River Severn. The sites contain sources of direct radiation. Due to the close proximity of the sites, the liquid waste and gaseous discharges from Berkeley and Oldbury are considered together for the purposes of habits surveys, environmental monitoring, and assessments. Direct radiation pathways from Berkeley and Oldbury are considered separately in this report.

The following potential exposure pathways related to the site were investigated:

- The consumption of food from the terrestrial survey area
- The production, use and destination of local produce
- The consumption and use of groundwater and surface water in the terrestrial survey area
- Occupancy within 1 km of the licensed site boundary
- The consumption of food from the aquatic survey area
- Activities and occupancy over intertidal substrates
- The handling of fishing gear and sediment
- Activities and occupancy in and on water
- New or unusual practices such as the use of seaweed as a fertiliser or livestock feed and the transfer of contamination off-site by wildlife

Interviews were conducted with members of the public and data collected for 432 individuals are presented and discussed. High rates of consumption, occupancy and handling are identified by using the 'cut off' method and 97.5<sup>th</sup> percentiles. These rates can be used in

dose assessments. Additionally, profiles of integrated habits data are presented specifically for use in total dose assessments.

In the aquatic survey area, internal and external exposure pathways were investigated because of the potential effects from liquid discharges. Foods consumed from the aquatic survey area were fish, crustaceans, wildfowl and salt marsh grazed cattle. The predominant foods consumed by the respective critical groups for these food groups were eel, cod, bass and whiting; brown shrimps; mallard, goose and wigeon; and salt marsh grazed beef. For fish and crustaceans, the adult mean critical group consumption rates did not exceed the respective generic 97.5<sup>th</sup> percentile rates (generic 97.5<sup>th</sup> percentile rates have not been determined for wildfowl or salt marsh grazed cattle). Critical group intertidal occupancy rates were calculated for people undertaking bird watching, dog walking, walking, fossil hunting, shore angling, commercial salmon fishing and wildfowling. Critical group handling rates for fishing gear were calculated for commercial salmon fishermen and sediment handling rates for wildfowlers and commercial fishermen. People were undertaking water based activities such as commercial fishing, sailing and inshore rescue duties. The human or animal consumption of seaweed, or use of seaweed as a fertiliser for vegetables was not identified.

The terrestrial survey covered an area up to 5 km from the site centre. In this area, internal exposure pathways were investigated because of the potential effects from gaseous discharges. Food production was identified at 35 farms in the Berkeley and Oldbury areas (including beef cattle, lamb, dairy cattle, chickens and arable), three allotment sites and many private gardens. Three beekeepers produced honey. One trout lake was identified from which rainbow trout was consumed. For foods consumed from the terrestrial survey area, the mean critical group consumption rates exceeded the respective generic 97.5<sup>th</sup> percentile rates for milk and sheep meat. Other local foods consumed were green vegetables, root vegetables, other vegetables, potato, domestic fruit, cattle meat, pig meat, poultry, eggs, wild/free foods, rabbits/hares, honey, wild fungi, venison and freshwater fish. The consumption of cereals was not noted. The consumption of groundwater or surface water was not identified. Livestock were drinking stream, pond, borehole and well water.

Investigations into the off-site transfer of radioactive contamination by wildlife established that although rabbits and pigeons were found on site, they were not considered by the site operators to be a problem within the perimeter fence. Members of the public who lived in the terrestrial survey areas of the Berkeley and Oldbury sites were consuming pigeons and rabbits that were shot within 5 km of both sites.

The direct radiation survey covered an area out to 1 km from the site boundary. In this area, external pathways were investigated because of potential effects from ionising radiation emanating directly from the site and from exposure to gases discharged to atmosphere from the site. In both the Berkeley and Oldbury survey areas, the highest outdoor occupancy rate was for a farmer and the highest indoor occupancy rate was for a resident.

Gamma dose rate measurements were taken at various locations in the aquatic survey area and both indoors and outdoors at properties in the direct radiation survey area. Background readings were taken outside the 5 km radius of the terrestrial survey area.

Comparisons were made with the results from the previous aquatic, terrestrial and direct radiation surveys.

In the aquatic survey, compared with 2001, there was a decrease in the adult critical group mean consumption rates for fish and an increase in crustaceans in 2007. Fish decreased from 18 kg/y to 14 kg/y and crustaceans increased from 1.5 kg/y to 2.7 kg/y. Adult critical group mean occupancy rates over intertidal substrates had changed significantly. The occupancy rate over mud had decreased in 2007 from 420 h/y to 78 h/y, and the occupancy rate over mud and sand had decreased from 650 h/y to 270 h/y. The handling rates of fishing gear also decreased in 2007 from 590 h/y to 350 h/y. These decreases reflect the changes in commercial fishing between 2001 and 2007. Intertidal occupancy rates over salt marsh increased significantly in 2007 from 190 h/y to 430 h/y.

In the terrestrial survey, there were significant changes in some of the adult critical group mean consumption rates compared to the results of the previous survey of 2001. Food groups with significant increases in consumption rates in 2007 were other vegetables, from 15 kg/y to 32 kg/y; potatoes, from 35 kg/y to 76 kg/y; domestic fruit, from 9.2 kg/y to 51 kg/y; milk, from 140 l/y to 270 l/y; pig meat, from 10 kg/y to 23 kg/y; sheep meat, from 11 kg/y to 45 kg/y; eggs, from 7.1 kg/y to 21 kg/y; and rabbit, from 1.7 kg/y to 11 kg/y. There was a decrease in consumption rates for wild fungi, from 7.9 to 1.5 kg/y.

In the direct radiation survey, there were differences in the survey areas between the 1996 and 2007 Oldbury survey, and the 2001 and 2007 Berkeley survey, however some comparisons can be made. At Berkeley, in the 2007 0 – 0.25 km zone, there was a decrease in the total occupancy rate within from 8500 h/y to 8200 h/y. At Oldbury, in the 2007 0 – 0.25 km zone, there was a slight decrease in the total occupancy rate from 8500 h/y to 8400 h/y. Gamma dose rate measurements at two houses in the Oldbury area were compared; these results were very similar in 1996 and 2007.

Suggestions are provided for changes to environmental monitoring programmes on the basis of the information collected during the survey (see Section 8.3). These include adding a sample of eel, salt marsh grazed beef and rabbit and gamma dose rate measurements at Slimbridge, Severn Beach, Aylburton Warth and Northwick Warth.

## **1 INTRODUCTION**

The public may be exposed to radiation as a result of the operations of the Berkeley and Oldbury sites either from discharges of liquid or gaseous radioactive wastes into the local environment, or from radiation emanating directly from the site. This report provides information about activities carried out by members of the public under everyday circumstances, which may influence their radiation exposure. The study has been funded by the Environment Agency, the Food Standards Agency and the Health and Safety Executive in order to support their respective roles in protecting the public from the effects of radiation.

### **1.1 Regulatory framework**

The Environment Agency regulates discharges of waste under the Radioactive Substances Act 1993 (RSA 93) (UK Parliament, 1993) as amended by: the Environment Act 1995 (EA 95) (UK Parliament, 1995a); by legislation implementing the European Union (EU) Basic Safety Standards (BSS) Directive 96/29/Euratom (CEC, 1996); and by the Energy Act 2004 (EA 04) (UK Parliament, 2004). The Directive takes into account Recommendations of the International Commission on Radiological Protection (ICRP), particularly ICRP 60 (ICRP, 1991). Authorisations under RSA 93 are issued by the Environment Agency after wide-ranging consultations that include the Food Standards Agency. As well as being a Statutory Consultee, the Food Standards Agency has responsibilities for ensuring that any radioactivity present in food does not compromise food safety and that authorised discharges of radioactivity do not result in unacceptable doses to consumers via the food chain. The Food Standards Agency also ensures that public radiation exposure via the food chain is within EU accepted limits. Consultation papers on Statutory Guidance to the Environment Agency on the regulation of radioactive waste discharges were issued by the Department of the Environment, Transport and the Regions (DETR) (the Department for Environment, Food and Rural Affairs (Defra)) in 2000 (DETR, 2000a) and the Welsh Assembly in 2002 (The Welsh Assembly Government, 2002). Most recently, in 2006, Defra published a decision document for application to dispose of or accumulate radioactive wastes from or on eight Magnox sites

(including Berkeley and Oldbury) (Defra, 2006) stating it was decided not to change any of the Environment Agency's decisions. These documents include, *inter alia*, affirmation that protection of the critical groups of the public is the appropriate radiological protection methodology to use. This report provides information to support assessments of critical groups.

Installation and operation of certain prescribed activities can only occur on sites if they are licensed under the Nuclear Installations Act 1965 (as amended) (NIA 65) (UK Parliament, 1965). The Nuclear Installations Inspectorate of the Health and Safety Executive implements this legislation and is also responsible for regulating, under the Ionising Radiations Regulations (IRR 99) (UK Parliament, 1999), the restriction of exposure of the public to direct radiation from operations occurring on these sites.

## **1.2 Radiological protection framework**

UK policy on the control of radiation exposure has long been based on the Recommendations of the ICRP which embody the principles of justification of practices, optimisation of protection and dose limitation. Radiological protection of the public is based on the concept of a critical group of individuals. This group is defined as those people who, because of both their residence and habits, receive the highest radiation dose due to the operations of a site. It follows that, if the dose to this group is acceptable when compared to relevant dose limits and constraints, other members of the public will receive lower doses, and overall protection to the public is provided from the effects of radiation. The ICRP have recommended that the term 'representative person' be used in preference to the term 'critical group'. (ICRP, 2007) However, this recommendation has not yet been formally adopted in the UK and therefore we continue to use the term 'critical group' in this report.

Dose standards for the public are embodied in national policy (UK Parliament, 1995b), in guidance from the International Atomic Energy Agency (IAEA), in the Basic Safety Standards for Radiation Protection (IAEA, 1996) and in European Community legislation in the EU BSS

Directive 96/29/Euratom. The public dose standards were incorporated into UK law in IRR 99. In order to implement the Directive in England and Wales, the Environment Agency was issued with a direction by the DETR in 2000 (DETR, 2000b). This included the requirements that the Environment Agency ensure, wherever applicable,

- all public radiation exposures from radioactive waste disposal are kept As Low As Reasonably Achievable (ALARA)
- the sum of such exposures does not exceed the dose limit of 1 mSv a year

The principal limit of 1 mSv per year to the public, is also the recommendation made by the ICRP.

The Environment Agency shall have regard for maximum doses to individuals for use at the planning stage:

- 0.3 mSv a year from any source
- 0.5 mSv a year from the discharges from any single site

The Environment Agency is also required to ensure that the dose estimates are as realistic as possible for the population as a whole and for reference groups of the population. It is required to take all necessary steps to identify the reference groups of the population taking into account the effective pathways of transmission of radioactive substances. Guidance on the principles underlying prospective radiological assessment (i.e. assessments of potential future doses) has been provided by a group of UK Government Bodies (EA, SEPA, DoENI, NRPB and FSA, 2002). The National Dose Assessment Working Group (NDAWG) has also published principles underlying retrospective radiological assessment (i.e. assessment of doses already received from past discharges) (Allott, 2005) and possible methods of carrying out these assessments using data from combined habits surveys (Camplin *et al.*, 2005). NDAWG agreed that the optimal method for performing retrospective dose assessments would be to use habits profiles (profiling method). This approach is being adopted in Radioactivity in Food and the Environment (RIFE) publications, (e.g. EA, EHS, FSA and SEPA, 2007), as combined habits surveys are completed.

This report provides information that allows the habits of members of the public to be quantified so that the most exposed groups can be identified and doses to the groups can be assessed in a realistic way.

## **2 THE SURVEY**

### **2.1 Site activity**

Details in this report relating to the ownership, licensing and operations of the sites were applicable at the time that the main period of fieldwork was undertaken in August 2007.

The Berkeley and Oldbury sites are located in Gloucestershire and South Gloucestershire respectively, both on the eastern shore of the River Severn. Oldbury is approximately 20 km north of Bristol, and Berkeley is located approximately 10 km north-east of Oldbury (see Figure 1).

Berkeley has twin Magnox reactors, one of which ceased energy production in 1988 (after 27 years in operation) and the second in 1989. Berkeley is the first commercial power station in the UK to be decommissioned. The decommissioning programme is well underway and radioactive wastes are still generated by decommissioning operations. The adjoining Berkeley Centre, which was delicensed in December 2006, provides a support function for the decommissioning and generating Magnox Sites. Activities at Berkeley Centre are limited to the provision of office accommodation and conference facilities for Magnox and the NDA; the analytical laboratories have been decommissioned. A small quantity of radioactivity is discharged by VT Nuclear Services from the dosimetry and instrument calibration facility it operates on the site. Whilst the habits survey fieldwork was being carried out, regular decommissioning activities were proceeding at Berkeley.

Oldbury generates electricity from twin Magnox reactors; the station is scheduled to cease electricity production in 2008. At Oldbury, both of the reactors were closed down for maintenance for the whole period of the fieldwork.

The Berkeley and Oldbury sites discharge gaseous radioactive waste via separate stacks to the atmosphere, liquid radioactive waste via separate outfalls into the River Severn and

contain sources of direct radiation. Oldbury also has a minor liquid discharge pipe, which releases effluent into the tidal reservoir adjacent to the site. Details of the amounts of gaseous and liquid radioactive waste discharged in 2006 have been published (EA, EHS, FSA and SEPA, 2007).

The Berkeley and Oldbury sites are owned by the Nuclear Decommissioning Authority (NDA). Magnox South manages decommissioning operations at Berkeley and Magnox North is the main management and operations contractor at Oldbury, operating under authorisation issued to Magnox Electric Ltd. Under NIA 65, the holder of the site licence for Berkeley and Oldbury is Magnox Electric Ltd., which allows the installation and operation of certain activities. Under RSA 93, Magnox Electric Ltd is authorised to discharge gaseous radioactive wastes via stacks to the atmosphere and liquid radioactive waste via separate outfalls into the River Severn.

Due to the close proximity of the sites, the liquid waste and gaseous discharges are considered together for the purposes of habits surveys, environmental monitoring, and assessments. Direct radiation pathways from Berkeley and Oldbury are considered separately in this report.

## **2.2 Survey objectives**

The Centre for Environment, Fisheries & Aquaculture Science (Cefas) undertook the survey in 2007 on behalf of the Environment Agency, the Food Standards Agency, and the Health and Safety Executive. The aim of the survey was to obtain information on the habits of the public that might lead to their exposure to atmospheric discharges, liquid discharges and direct radiation from the Berkeley and Oldbury nuclear sites. The survey provided comprehensive information to ensure that all potential exposure pathways were identified.

Specifically, investigations were conducted into the following:

- The consumption of food from the terrestrial survey area
- The production, use and destination of local produce
- The consumption and use of groundwater and surface water in the terrestrial survey area
- Occupancy within 1 km of the licensed site boundary
- The consumption of food from the aquatic survey area
- Activities and occupancy over intertidal substrates
- The handling of fishing gear and sediment
- Activities and occupancy in and on water
- New or unusual practices such as the use of seaweed as a fertiliser or livestock feed and the transfer of contamination off-site by wildlife

There were no additional site-specific investigations requested by the Environment Agency, the Food Standards Agency nor the Health and Safety Executive for the Berkeley and Oldbury survey.

### **2.3 Survey areas**

Three survey areas were defined to encompass the dominant activities expected for aquatic, terrestrial and direct radiation pathways. The same aquatic and terrestrial areas were used in the previous combined aquatic and terrestrial habits survey (which includes a representative sample of occupancy rates for direct radiation) conducted by Cefas in the Berkeley and Oldbury area, which was in 2001 (Tipple *et al.*, 2002). There were differences in the previous direct radiation survey areas used at Berkeley in 2001 (Smedley and McTaggart, 2002) and at Oldbury in 1996 (Duckett, 1997). In 2007, the direct radiation survey areas at Berkeley and Oldbury were 1 km from the nuclear licensed site boundaries. In 1996, the Oldbury direct radiation survey area was 1 km from the power station, and in 2001, the Berkeley direct radiation survey area was 1 km from the nuclear site licensed boundary, which had changed in 2007.

The aquatic survey area, shown in Figure 1, covered both shores of the River Severn upriver as far as Broadoak and downriver as far as Severn Beach on the east bank and Portskewett on the west bank. It encompassed all intertidal areas and fisheries within this area of the River Severn. The area is relevant to the potential affects of liquid discharges from both the Berkeley and the Oldbury sites.

The Berkeley and Oldbury terrestrial survey areas overlap, as shown in Figure 2. The two separate terrestrial survey areas are shown in Figure 3 and Figure 4 for Berkeley and Oldbury, respectively. These areas were defined as the circle to a radius of 5 km from the centre of the Berkeley site (NGR ST 654 999) and from the centre of the Oldbury site (NGR ST 605 945) to encompass the main areas of potential deposition from gaseous discharges. Watercourses and areas potentially containing contamination from only washout of gaseous discharges are discussed in the terrestrial section of this report.

The direct radiation survey area is also shown in Figure 3 and 4 for Berkeley and Oldbury respectively. The direct radiation survey area was defined as the area within 1 km of the licensed site boundary for both Berkeley and Oldbury.

## **2.4 Conduct of the survey**

Prior to the fieldwork, discussions were held between a member of the Cefas survey team and representatives from Magnox Electric, the Environment Agency, the Food Standards Agency and the Health and Safety Executive. These discussions provided an outline of the main aims of the survey and highlighted issues that required special attention or effort by the team.

As part of the pre-survey preparation, people with a local knowledge of the survey area were contacted for information on any aspects relevant to the various exposure pathways. These included representatives from local councils, the Tourist Information Centre, a beekeeping association, the British Association for Shooting and Conservation, commercial fishermen, the

Environment Agency and Natural England. These people provided information on allotments, beekeeping, wildfowling, commercial and non-commercial fishing and other activities in the aquatic survey area. Further information regarding the habits of people in the aquatic and terrestrial survey areas was obtained from Internet searches, Ordnance Survey maps and from previous habits surveys undertaken at Berkeley and Oldbury. A proposed programme for fieldwork was distributed to the Environment Agency, the Food Standards Agency, and the Health and Safety Executive before the fieldwork commenced, for their comment.

The fieldwork component of the survey was carried out in two parts due to an unexpected outbreak of Foot and Mouth. The first part of the survey, which included all components of the fieldwork with the exception of farms, was carried out from 15<sup>th</sup> – 22<sup>nd</sup> August 2007 by a survey team of four people, according to techniques described by Leonard *et al.* (1982). The second part of the survey was carried out from 4<sup>th</sup> – 9<sup>th</sup> November 2007 by the same team of people. At the start of the fieldwork, on 16<sup>th</sup> August, a meeting was held between the survey team and site representatives of Berkeley and Oldbury. This served to provide details about site operations, including waste disposal, and information about potential pathways and activities in the area.

Details obtained are as follows:

- Berkeley and Oldbury have separate pipelines for liquid discharges, Oldbury also has a minor discharge pipe into the tidal reservoir adjacent to the site.
- At Berkeley, the site activities during the habits survey included the decommissioning work, work on a caesium removal plant and civil construction projects.
- At Oldbury, both reactors were shut for maintenance for the duration of the habits survey.
- At Berkeley there is low-level direct radiation from an area, which used to be a fuel storage area. At Oldbury, direct radiation was considered by the site to be very low.
- Information about potential pathways and activities in the area included; use of the nature trails by the public around the site; a large sailing club at Oldbury Pill; access

to the foreshore near the sites used by walkers, anglers and birdwatchers; and one wildfowling club that shoots from both shores of the River Severn.

The site representatives were also asked about any wildlife studies and pest control measures in and immediately around the site (see Section 5.2). Animals are potential carriers for transporting radioactive materials off-site and are also potential food items for some individuals.

During the fieldwork, individuals who were identified in the pre-survey preparation as having the potential to be exposed to radioactivity from the site were contacted and interviewed. These included anglers, hobby fishermen, boat users, farmers, allotment holders, beekeepers and people living and working close to the site. Interviews were used to establish individuals' consumption rates of locally grown terrestrial foods and locally caught freshwater food, their handling rates of fishing gear, their occupancy rates relevant to external exposure and occupancy rates in and on water. Any general information of possible use to the survey was also obtained. Using the information obtained in the interviews, a list of occupations and activities was built up to produce a picture of potential exposure pathways.

For practical and resource reasons, the survey did not involve the whole population in the vicinity of Berkeley and Oldbury. Individuals or groups were targeted in order to identify the most potentially exposed. However, it is possible that even within a subset or group there may have been people not interviewed during the survey. Therefore, a further protocol has been adopted to aid interpretation and to address this issue. Where possible, a percentage has been determined for the number of interviewed individuals as a function of the estimated total number of potential individuals in each group. The results are summarised in Table 1; the 'groups' are described and quantified. For certain groups, such as anglers, it can be virtually impossible to calculate the total number of people who undertake the activity in the survey area because it is difficult to quantify visitors from outside the area or occasional visitors during the year. Overall, the number of potential interviewees in the terrestrial survey area was estimated to be 19,000; information was obtained for a significantly smaller number

than this. In particular, it should be noted that the survey did not include site employees or contractors while they were at work on the site. This is because dose criteria applicable to these people whilst at work and the dose assessment methods are different to those for members of the public. However, any consumption data, and activities and occupancy rates for these employees while outside work, are included in the results if employees were encountered during the survey.

For each of the three survey areas, the survey targeted pathways primarily relevant to that survey area. Where possible, people were also asked about habits relating to the other two survey areas. For example, people in the terrestrial survey were initially questioned because it was known that they grew significant quantities of terrestrial foodstuffs. However, they were also asked about habits that might lead to exposure to liquid discharges or direct radiation. During interviews with representatives from certain groups or organisations, such as the Inshore Rescue Services, it was not possible to collect data for all pathways (such as consumption of local foods) for each person. In this case, data were limited to occupancy rates on water. In Annexes 1 and 2, these individuals only have data for the pathway of primary interest.

Thirty-six person-days were spent investigating the survey areas and interviewing individuals who were relevant to the survey. Observations for 432 individuals were recorded. During the survey, gamma dose rate measurements were taken to aid assessment of external exposure pathways.

### **3 METHODS FOR DATA ANALYSIS**

#### **3.1 Data recording**

Data collected during the fieldwork were recorded in logbooks. On return to the laboratory, the data were examined and any notably high rates were double-checked, where possible, by way of a follow-up phone call. In rare cases where follow up phone calls were not possible (e.g. interviewees who wished to remain anonymous), the data were accepted at face value. The raw data were entered into a habits survey database where each individual for whom information was obtained was given a unique identifier (the observation number) to assist in maintaining data quality.

During the interviews, people could not always provide consumption rates in kilograms per year for food or litres per year for milk. In these circumstances, interviewees were asked to provide the information in a different format. For example, some estimated the size and number of items, (e.g. eggs) consumed per year, whereas others gave the number of plants in a crop or the length and number of rows in which the crop was grown per year. The database converted these data into consumption rates (kg/y for food and l/y for milk) using a variety of conversion factors. These factors included produce weights (Hessayon, 1990 and 1997 and Good Housekeeping, 1994), edible fraction data researched by Cefas, and information supplied by the Meat and Livestock Commission.

All consumption and occupancy data in the text of this report are rounded to two significant figures to reflect the authors' judgement on the accuracy of the methods used. In the tables and annexes, the consumption rate data are usually presented to one decimal place. Occasionally, this rounding process causes the row totals or mean rates to appear slightly erroneous ( $\pm 0.1$ ). Consumption rates less than 0.05 kg/y are presented to two decimal places in order to avoid the value of 0.0 kg/y. External exposure data are quoted as integers.

To ensure the quality of the data collected during the survey fieldwork and presented in the report, the following procedures have been employed:

- Experienced scientific staff were used for fieldwork and data assessment. They had been trained in the techniques of interviewing and obtaining data for all pathways that were relevant to the survey being conducted. Where individuals offered information during interview that was unusual, they were questioned further in order to double-check the validity of their claims.
- Where possible, interviewees were contacted again to confirm the results of the initial interview if, when final consumption or occupancy rates were calculated, observations were found to be high in relation to our experience of other surveys. Local factors were taken into account in these cases.
- Data were manipulated in a purpose built database using a consistent set of conversion factors.
- Data were stored in a database in order to minimise transcription and other errors.
- Draft reports were formally reviewed by a senior Cefas radiological scientist.
- Final reports were only issued when the Environment Agency, the Food Standards Agency and the Health and Safety Executive were entirely satisfied with the format and content of the draft.

For the purpose of data analysis, foodstuffs were aggregated into food groups as identified in Table 2. Specific food types relevant to this survey are presented in the subsequent tables. The data are structured into groups with similar attributes. For example, when considering terrestrial food consumption, all types of root vegetables are grouped together in a food group called 'root vegetables'. Similarly, for aquatic food consumption, all crustacean species are grouped as 'crustaceans'. For external exposure over intertidal sediments, occupancy over a common substrate (e.g. salt marsh) is chosen. The choice of a group of activities is made when it is reasonable to assume that consistent concentrations or dose rates would apply within the group.

In addition to grouping of activities, data are structured into age groups because different dose coefficients (i.e. the factors which convert intakes of radioactivity into dose) can apply to different ages. The age groups and their relevant age ranges are based on the recommendations in ICRP 72 (ICRP, 1996), and are listed below:

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<b>Age group</b>	<b>Age range in group</b>
3-month-old	Under 1-year-old
1-year-old	1-year-old
5-year-old	2-year-old to 6-year-old
10-year-old	7-year-old to 11-year-old
15-year-old	12-year-old to 16-year-old
Adult	17-year-old and over

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For direct radiation pathways, the data are grouped into distance zones from the site perimeter as a coarse indication of the potential dose rate distribution due to this source of exposure. The bands used were: 0 – 0.25 km, >0.25 – 0.5 km and >0.5 – 1 km. These distance bands are also useful when assessing exposure to gaseous discharges.

### **3.2 Data analysis**

The main outputs of the study are the statements of individuals' consumption, handling and occupancy rates given in Annexes 1 and 2. These can be used in radiological assessments of the effects of the operations at the Berkeley and Oldbury sites – taking into account the concentrations and/or dose rate distributions in space and time relevant to the assessments.

Annex 3 contains qualitative and estimated data for pathways where it was not possible to obtain quantifiable data from interviews. This includes activities that were reported during the survey e.g. activities which were occurring at a different time of year to the survey. Annex 3 has been included in this report so that the information can be used in dose assessments, thereby ensuring that all potential pathways have been covered in the assessments that

would otherwise be overlooked. An estimated rate has been given for occupancy over mud for elver fishermen, based on experience from previous habits surveys. Elver fishing was undertaken at a different time of year to the survey and although information was obtained during the survey, no one was available for interview to discuss the details of the activity.

The habits data have been analysed to indicate high rates of consumption, occupancy and handling, prior to a formal assessment being undertaken. Three approaches have been used:

Firstly, the 'cut-off' method described by Hunt *et al.* (1982) was used. With the 'cut-off' method, the appropriate high rate was calculated by taking the arithmetic mean of the maximum observed rate and all observed rates within a factor of 3 of the maximum value (termed the lower threshold value). It accords with the principle expressed by ICRP (ICRP, 1984) that the critical group should be small enough to be reasonably homogeneous with respect to age, diet and those aspects of behaviour that affect the doses received. For ease of presentation in this report, the term critical group rate is used to represent the data derived by the 'cut-off' method. A separate critical group rate was calculated for each food group, intertidal substrate and handling pathway identified in the survey. In certain cases, using the 'cut-off' method could result in only one person being in the critical group. In these cases, expert judgement was used to decide whether the critical group should remain as one individual or whether others should be included. If others were included, the second highest rate was divided by three to give a new cut-off value and all observations above this were included in the critical group.

Secondly, 97.5<sup>th</sup> percentile rates were calculated using the Excel mathematical function for calculating percentiles. This method accords with precedents used in risk assessment of the safety of food consumption. Mean and 97.5<sup>th</sup> percentile rates based on national statistics have been derived by the Ministry of Agriculture, Fisheries and Food (MAFF) (now part of Defra) and the Food Standards Agency (Byrom *et al.*, 1995 and FSA, 2002), and these are referred to as generic rates in this report.

Thirdly, profiles have been produced that give a complete view of the habits of the individual that might lead to exposure to all the discharges and radiation from the site. The profiles are based on values calculated by the 'cut off' method. The profiled data can be used to assess total dose integrated across all pathways of exposure.

For ingestion pathways, critical group rates for children have been calculated from the survey data. However, because few child consumers were identified, the rates should be viewed with caution. For assessment purposes, an alternative approach may be taken which involves scaling the critical group rates for adults by ratios. These ratios are given in Annex 4 and have been calculated using generic 97.5<sup>th</sup> percentile consumption rates.

Selection of critical group and 97.5<sup>th</sup> percentile rates for occupancy is not undertaken for the direct radiation pathway. Such an analysis is of limited value without a detailed knowledge of the spatial extent of dose rates due to direct radiation.

## **4 AQUATIC RADIATION PATHWAYS**

### **4.1 Aquatic survey area**

The aquatic survey area (Figure 1) covered the River Severn upriver as far as Broadoak and downriver as far as Severn Beach on the east bank and Portskewett on the west bank. It encompassed all intertidal areas and fisheries within this stretch of the River Severn.

#### **Overview of survey area**

The substrates of the shores of the River Severn were predominantly mud, sand and salt marsh, interspersed stone and rock. The River Severn has a large tidal range, resulting in fast running water and large areas of exposed mud and sand at low tide. Activities were restricted at some locations due to the dangerous nature of the soft mud and sand, and the strong tides. There were beach areas in the southern part of the survey area, but from the Severn road bridge heading north, the shore was predominantly salt marsh and mud. The Severn Way footpath proceeded through the aquatic survey area along the eastern shore of the river and along a man made embankment, which was built for flood defences purposes.

#### **River Severn - east shore (west to east)**

##### **Severn Beach to Severn Road Bridge**

Severn Beach is a small tourist village located 1 km south of the M4 Severn bridge with a small campsite to the north of the village. The beach was easily accessible through a residential area, and the area had ample car parking. Parallel to the beach was a concrete promenade, which was not tide washed. The promenade continued from Severn Beach, north to New Passage, a small residential area. At low tide, the substrate between Severn Beach and New Passage consisted of mud, sand and stones, salt marsh and rocky outcrops, backed by large sea defence boulders. Activities were limited due to the large tidal excursion,

such as angling, which was restricted to 2 hours either side of high tide. Activities were also restricted to the upper foreshore due to the soft mud substrate on the lower foreshore. Locals and visitors were using the area for walking and dog walking. The area was also reported to be popular with shore anglers using both the beach and the sea wall.

The area of salt marsh and mud between New Passage and Old Passage is called Northwick Warth. The salt marsh was a favoured location for anglers and could be accessed by a road from Old Passage. Birdwatchers were observed near Northwick Warth but not on tide washed areas. Cattle were observed grazing on the salt marsh.

Aust Cliff, just below the Severn road bridge, is accessible by a footpath from Old Passage. The high cliff is famous geologically for its range of fossils, therefore is a popular location for fossil collectors. There was a beach below Aust Cliff, the upper foreshore of the beach was rock, sand and stones, and the lower foreshore was mud and salt marsh. The beach was used by walkers and dog walkers and was reported to be busy on hot summer days with rock collectors, walkers, sunbathers and families.

### **Severn Road Bridge to Oldbury Power Station**

The shore of the River Severn between the Severn road bridge and Oldbury power station was a thin strip of salt marsh and mud. Access to the shore in this area was limited as were activities. The sewage works, north of the Severn road bridge, was reported to be a popular angling spot but there was no parking near by. The only public road area to the shore and car parking in this area was at Littleton Warth. On the upper foreshore there was a footpath along a grass embankment, and the lower foreshore was salt marsh and mud. It was reported by locals to be a popular area for anglers, particularly for angling matches, although no one was observed at the time of the survey. Local people were observed walking along the salt marsh, but most stayed on the embankment, which was not tide washed. During the survey, cattle were observed grazing on salt marsh at Littleton Warth.

At Oldbury Pill there was a local yacht club with approximately 200 members. The club had dinghies, sail boats, sailing cruisers, kite surfers and windsurfers. The larger yachts were moored at Oldbury Pill, and the smaller dinghies were kept in a dry compound near the clubhouse. The access road to the yacht club was private, although the public could walk along the Severn Way to the shore.

### **Oldbury Power Station to Sharpness**

North of Oldbury Pill is Oldbury power station, in front of which is a large tidal reservoir built to ensure a constant supply of cooling water. Road access to the power station was limited and parking was also limited to a few spaces in lay-bys along the road approaching the power station. There were several footpaths and bridleways that led to the shore, including the power station's nature trail. The substrate along this stretch of the shore was salt marsh and mud, and was backed by a grass embankment. It was reported that anglers used this stretch, but this was restricted to a limited number due to difficult access. People used the area for bird watching and walking but this was predominantly on the embankment.

The distance between Oldbury and Berkeley power stations is approximately 7 km. The substrate along this stretch of the shore was mainly mud, interspersed with areas of rock and large areas of sand were exposed at low tide. There were several farms along this section of the shore. The salt marsh was used for grazing cattle, however, farmers were spending minimal time on the salt marsh because the area was small. People were noted be walking their dogs in this area.

Approximately 1 km north of Oldbury power station was a road leading to the River Severn at Shepperdine, with a few car parking spaces. The Severn Path proceeded along the upper foreshore but was not tide washed. The shore was salt marsh and mud, and cattle were observed grazing on the salt marsh. No one was observed in this area at the time of the survey. North of Shepperdine is Hills Flats, an area of mud, salt marsh and rock which was

popular with wildfowlers, it was reported that at low tide the wildfowlers could shoot from a distance of up to ½ km from the shore.

The area between Hills Flats and Berkeley power station was used for grazing cattle. The shore at Berkeley power station could be accessed by footpath, and was predominantly used by walkers and birdwatchers. North of Berkeley, a fisherman was noted to be netting for brown shrimps (*Crangon crangon*) for non-commercial purposes.

### **Sharpness to Arlingham**

Sharpness Dock, situated approximately 2.5 km north of the Berkeley site, was the only commercial dock operating on the River Severn. There was a picnic area with parking at the dock. The shore was mud and salt marsh with steep slopes and was fenced off so it was difficult to reach the shore. There were large lock gates in operation that were inaccessible to the public, with the exception of a small group of anglers that were permitted by British Waterways to fish from the piers. A freshwater canal links the docks with Gloucester. Between Sharpness and Frampton-on-Severn, the canal extends parallel to the shore of the River Severn. A series of swing bridges were in operation along the canal to provide access to the shore. There was a swing bridge at Purton, although this stretch of the river shore was private.

From Sharpness to Frampton-on-Severn the substrate changed to predominantly sand. The Slimbridge Wildfowl and Wetlands Trust was located north of Purton, and encompassed a large area of salt marsh. Marsh wardens at the Trust were spending time fixing fences and bird watching on the salt marsh areas, although most of this time was spent on grass that was only tide washed during high tides. There was public access to the bird hides at Slimbridge and most bird watchers were visitors to the area, but there were local regulars. Wildfowling was popular at Frampton, on mud, salt marsh and rough grazing (where the river floods on high tides). Access to the shore north at Frampton was mostly private, which limited other

activities. At Arlingham, the substrate became a mixture of mud and sand again, with large areas of sand exposed in the middle of the river at low tide.

### **River Severn – west shore (west to east)**

#### **Portskewett to Beachley Point**

There are two access roads at Portskewett, one at Sudbrook and one at Black Rock. At Sudbrook there was limited parking on the road and a short footpath that led to the cliff. The footpath extended along the top of the cliff but there were no paths down to the shore, limiting activities in this area. Black Rock was the base for the Black Rock Lave Net Heritage Fishery. Seven fishermen operated hand held lave nets from the shore at Black Rock, where they waded into the pools of the river on the ebb tide. There was a car park and picnic area close to the shore, with steps and a footpath down to the shore. The upper foreshore was stones and mud with patches of salt marsh near the car park, rock and stones to the south, and salt marsh to the north. At low tide, the lower foreshore was predominantly mud. The main activities, with the exception of commercial fishing, were walking and dog walking, predominantly on the grass path at the top of the embankment. Occasionally people were dog walking on salt marsh and mud, rock and stone shore. Cattle were observed grazing on salt marsh.

Three kilometres north of Black Rock is the mouth of the River Wye. The Wye had low lying salt marsh at the lower reaches of the river and steep muddy banks further inland towards Chepstow. There were several small boats moored in the river at Chepstow. It was reported that there was a boat club at Chepstow, but no one was observed on any of the boats during the survey. No other activities observed on the River Wye.

### **Beachley Point to Lydney**

On the east side of the mouth of the River Wye is Beachley Point. This was a popular location for angling on salt marsh and could be reached by a bridleway from Beachley. Angling was also popular on the salt marsh at Beachley where one angling club held regular competitions. Under the Severn Road Bridge at Beachley, there was an unmanned inshore rescue base and a slipway. The slipway was used to launch the inshore rescue boats and by the public to launch boats and jet skis.

To the north of Beachley, the substrate was mud, sand, stones and salt marsh. Road access between Beachley and Lydney was limited to a few private tracks. The only activity noted along this stretch of the River Severn was commercial fishing for salmon (*Salmo salar*). Putter ranks (a line of funnel shaped fish traps constructed at right angles to the shore) were identified at Aylburton Warth and lave netting (hand held fishing nets) was identified near Alvington and Lydney.

### **Lydney to Bullo**

Lydney Harbour is situated on a freshwater canal, with a lock system that separates the canal from the River Severn. There was a sailing club at Lydney Harbour with approximately 80 members, 25% of which were enthusiastic sailors. The club members had dinghies and cruisers. Members could launch their dinghies from a slipway without coming into contact with the mud and cruisers were moored in the canal. Lydney Harbour was a popular area for lave net fishermen, who accessed the shore from the slipway. Many people were walking and dog walking at the harbour but only on the concrete quay as the shore was very muddy.

Between Lydney and Bullo, the substrate was a mixture of sand and mud interspersed with stones and rock. The only activities identified in this stretch of the River Severn were salmon fishing and wildfowling. Lave letting was reported to occur at Gatcombe, a small hamlet with parking space for a few cars. The shore was accessed by crossing a railway track and steps

to the shore. This was an access point for lave netters who waded into the river on an ebb tide. Patcher ranks were identified at Gatcombe and Poulton Court and wildfowling was identified occurring at Poulton Court.

### **Bullo to Broadoak**

Bullo is an old harbour, with limited parking and access to the shore through a private yard. There was a steel hulled houseboat at Bullo and it was reported that the boat was permanently occupied, however, no one was on board at the time of the survey. Bullo was not a well-used area as there was no easy access to the shore.

Newnham is a village situated on the shore of the River Severn. There was good access from the main road and parking in village. There was a steep grass riverbank and a muddy shore. There was a path along the top of the bank but the bank was too steep to walk down to the shore. Activities at Newnham included patcher rank fishing and beachcombing.

## **4.2 Commercial fisheries**

The main fishing effort in the survey area was for salmon, with most of the fishing activity occurring on the western shore of the River Severn. Two Environment Agency licensed methods were identified, which were patcher ranks and lave nets. Patcher ranks are fixed engines, which are constructed at right angles to the shore to create a line of traps to catch salmon on the ebb tide. The traps are made from willow and hazel and are funnel shaped. Patcher ranks were identified at Broadoak, Aylburton Warth and Poulton Court. Lave nets are hand held nets carried by fishermen when they waded into the river to catch salmon on the out going tide. Favourable locations for lave netting were Black Rock, Alvington, Lydney and Gatcombe. It was reported that approximately 13 people were using lave nets on upper stretch of River Severn and seven at Black Rock. Draft netting was identified in the previous survey but was not identified in 2007. One fisherman was identified with a draft net licence but had not fished by this method for many years.

The salmon season commenced on June 1<sup>st</sup> and finished on August 31<sup>st</sup> (16<sup>th</sup> August for the putcher ranks). However, due to flooding in the River Severn in the summer of 2007, the putcher ranks of several fishermen were damaged and they had only been able to fish for two weeks this season. Several other fishermen reported that they had not been fishing much this season due to the floods and bad weather and many reported a bad season for salmon.

Commercial eel fishing was not identified in the survey area.

Other species of fish caught as a by-catch by the salmon fishermen included bass (*Dicentrarchus labrax*) and flounder (*Platichthys flesus*).

Elver fishing was a popular activity on the River Severn from Sharpness north to Gloucester, most of which was outside the survey area. The fishing season for elvers is generally January/February to March/April, however this depends on environmental conditions. Information about elver fishing was sought from Environment Agency staff and local people because it was not the elver fishing season at the time of the survey. Approximately 370 licences to fish for elvers were issued by the Environment Agency for the River Severn. The fishermen used dip nets with long handles whilst standing on the steep muddy banks of the river. Two tides were sometimes fished, but in general fishermen preferred the night tide. One company was identified who exported elvers live to Holland and Scandinavia to restock rivers and fish farms.

Commercial fishing for crustaceans and the commercial collection of molluscs was not identified in the survey area.

### **4.3 Angling and hobby fishing**

Shore angling was popular at certain locations, predominantly at the southern end of the River Severn, including New Passage, Old Passage, Black Rock and Beachley. One angling club was identified whose members regularly held angling matches around Beachley. No boat anglers were identified during the survey.

The most abundant fish species caught in the winter by shore anglers in the area were cod (*Gadus morhua*) and whiting (*Merlangius merlangus*), and in the summer the fish species were bass, flounder, eel, Dover sole (*Solea solea*) and plaice (*Pleuronectes platessa*).

The only individuals fishing non-commercially for crustaceans were a putcher rank fisherman and a lave net fisherman, mentioned above, push netting for brown shrimps just north of the Berkeley power station and at Lydney.

The non-commercial collection of molluscs was not identified in the survey area. It was reported that winkles (*Littorina littorea*) were occasionally collected at Black Rock, but no one was identified during the survey.

### **4.4 Wildfowling**

One wildfowling club was identified whose members were shooting in the area covering 25 miles along both the east and west shores (more on the west than the east) of the River Severn. This covered the area from the Severn crossing to Lydney including the Awe peninsula on the west shore, and Frampton, Sheppardine and Hills Flats on the east shore. The club had approximately 150 members, half of which were enthusiastic wildfowlers. The club shot all duck species (except Goldeneye) and the main duck species being shot were mallard (*Anas platyrhynchos*), teal (*Anas crecca*), wigeon (*Anas penelope*), pintail (*Anas acuta*), and gadwall (*Anas strepera*). The main goose species being shot were Canada, Graylag and European geese.

#### **4.5 Other Pathways**

The consumption of seaweed by humans or animals and the use of seaweed as fertiliser were not identified. Several people reported that they had used seaweed as fertiliser years ago but not at present.

Two farmers were identified as grazing cattle on salt marsh in the aquatic survey area. One farmer grazed cattle on salt marsh between the Oldbury and Berkeley power stations and the other grazed cattle north of the Berkeley power station. The salt marsh in both areas were also in the terrestrial survey area. Cattle were sold to Cirencester and Ross markets. The farmers and their families were consuming beef from these farms.

No other unusual pathways were identified.

#### **4.6 Wholesalers and retailers**

Seafood retailers were interviewed to ascertain the quantities and species of fish and shellfish that were supplied from local sources. One main wholesaler was identified, just outside the survey area, who purchased salmon and bass from the lave net and putcher rank fishermen. One company was identified who bought elvers from the fishermen in the River Severn. The elvers were being exported live to Holland and Scandinavia to restock rivers and fish farms.

#### **4.7 Food consumption data**

Consumption data for local aquatic foodstuffs and salt marsh grazed cattle are presented in Tables 3 to 6 for adults and in Tables 7 and 9 for children. The tables include the mean consumption rates of the critical group together with the observed 97.5<sup>th</sup> percentile rates calculated as described in Section 3.2. For purposes of comparison, the data are summarised in Table 10 for adults and Tables 11 to 14 for children (15-year-olds, 10-year-olds, 5-year-olds and 1-year-olds respectively). The summary tables also include mean rates

and 97.5<sup>th</sup> percentile rates based on national data (referred to as 'generic' data in this report). No generic data are available for the 5-year-old and 1-year-old age groups.

### **Adults' consumption rates**

Adults were found consuming foods from the following four food groups: fish, crustaceans, wildfowl and salt marsh grazed cattle. The people consuming the greatest quantities of food from the aquatic survey area were commercial fishermen, shore anglers, wildfowlers, farmers and families of each of these groups.

The predominant species of fish consumed by adults were eel, cod, whiting, bass and flounder with smaller quantities of salmon, Dover sole, conger eel, grey mullet, and plaice. A critical group of 19 individuals was identified with a maximum consumption rate of 20 kg/y and a mean of 14 kg/y. The observed 97.5<sup>th</sup> percentile rate based on 39 observations was 20 kg/y. This compares with the adult generic mean and 97.5<sup>th</sup> percentile consumption rates for fish of 15 kg/y and 40 kg/y respectively. The percentage breakdown of species eaten by the critical group was 65% eel, 20% cod, 5% bass, 5% whiting and 5% other species as named in Table 3. These percentages, rounded to the nearest 5%, are based on the total amount of fish consumed by the critical group.

The only species of crustaceans consumed by adults was brown shrimps. One individual was identified in the critical group with a consumption rate of 2.7 kg/y. The observed 97.5<sup>th</sup> percentile rate based on two observations was 2.7 kg/y. This compares with the adult generic mean and 97.5<sup>th</sup> percentile consumption rates for crustaceans of 3.5 kg/y and 10 kg/y respectively.

The consumption of molluscs was not identified.

The species of wildfowl consumed by adults were mallard, teal, wigeon, pintail and goose. A critical group of three individuals was identified with a maximum consumption rate of 6.1 kg/y

and a mean of 3.4 kg/y. The observed 97.5<sup>th</sup> percentile rate based on nine observations was 5.3 kg/y. No generic data are available for this food group. The percentage breakdown of species, rounded to the nearest 5%, eaten by the critical group was 60% mallard, 20% goose 10% wigeon, 5% pintail and 5% teal.

The consumption of marine plants/algae was not identified.

For salt marsh grazed beef a critical group of two individuals was identified with an equivalent maximum consumption rate of 47 kg/y, therefore a mean of 47 kg/y. The observed 97.5<sup>th</sup> percentile rate based on eight observations was 47 kg/y. No generic data are available specifically for salt marsh grazed beef, however, a comparison can be made with generic consumption rates for beef of which the adult generic mean and 97.5<sup>th</sup> percentile are 15 kg/y and 45 kg/y respectively.

## **Children's consumption rates**

### **15-year-old age group**

Children in the 15-year-old age group were found to be consuming fish. No consumption was identified for the following five food groups: crustaceans, molluscs, wildfowl, marine plants/algae and salt marsh grazed cattle.

For fish, a one individual was identified with a consumption rate of 0.9 kg/y. This compares with the generic mean rate for fish of 6.5 kg/y. The observed 97.5<sup>th</sup> percentile rate is not applicable for one observation.

### **10-year-old age group**

Children in the 10-year-old age group were found consuming fish, wildfowl and salt marsh grazed cattle. No consumption was identified for the following three food groups: crustaceans, molluscs and marine plants/algae.

For fish, a critical group of two individuals was identified with identical consumption rates, therefore a maximum consumption rate of 0.3 kg/y and a mean of 0.3 kg/y. The observed 97.5<sup>th</sup> percentile rate based on two observations was 0.3 kg/y. This compares with the generic mean and 97.5<sup>th</sup> percentile consumption rates for fish of 6.0 kg/y and 20 kg/y respectively.

For wildfowl, a critical group of two individuals was identified with a maximum consumption rate of 1.6 kg/y and a mean of 1.3 kg/y. The observed 97.5<sup>th</sup> percentile rate based on four observations was 1.6 kg/y. No generic consumption rates have been derived for this age group.

For salt marsh grazed cattle a critical group of two individuals was identified with a maximum equivalent consumption rate of 19 kg/y, therefore a mean of 19 kg/y. The observed 97.5<sup>th</sup> percentile rate based on nine observations was 19 kg/y. No generic consumption rates have been derived for this age group.

### **5-year-old age group**

No children in the 5-year-old age group were noted to be consuming any local aquatic foodstuffs or salt marsh grazed cattle.

### **1-year-old age group**

No children in the 1-year-old age group were noted to be consuming any local aquatic foodstuffs or salt marsh grazed cattle.

### **3-month-old age group**

No children in the 3-month-old age group were noted to be consuming any local aquatic foodstuffs or salt marsh grazed cattle.

## **4.8 Intertidal occupancy**

Intertidal occupancy rates for adults and children are presented in Table 15 and Table 16, respectively. The table includes data on occupancy over the following seven different types of substrate: mud; mud and sand; mud and stones; mud, sand and stones; rock; salt marsh; sand and stones. Critical group rates are shown in bold.

### **Adults' intertidal occupancy**

The maximum occupancy rate recorded over mud was 78 h/y for one wildfowler. No other individuals had occupancy rates within a factor of three of this. This provides a mean occupancy rate for this group of 78 h/y.

The maximum occupancy rate recorded over mud and sand was 272 h/y for two commercial putcher rank fishermen. No other individuals had occupancy rates within a factor of three of this, so the mean occupancy rate for this group is 272 h/y.

The maximum occupancy rate recorded over mud and stones was 400 h/y for one shore angler. No other individuals had occupancy rates within a factor of three of this, so the mean occupancy rate for this group is 400 h/y.

The maximum occupancy rate recorded over mud, sand and stones was 120 h/y for two commercial putcher rank fishermen. No other individuals had occupancy rates within a factor of three of this, so the mean occupancy rate for this group is 120 h/y.

The maximum occupancy rate recorded over rock was 10 h/y for five fossil hunters. No other individuals had occupancy rates within a factor of three of this, so the mean occupancy rate for this group is 10 h/y.

The maximum occupancy rate recorded over salt marsh was 730 h/y for a dog walker. Four anglers and one birdwatcher had occupancy rates within a factor of three of this. This provides a mean occupancy rate for this group of 430 h/y.

The maximum occupancy rate recorded over sand and stone was 84 h/y for a beachcomber. Two dog walkers had occupancy rates within a factor of three of this. This provides a mean occupancy rate for this group of 80 h/y.

### **Children's intertidal occupancy**

#### **15-year-old age group**

The maximum occupancy rate recorded over rock was 10 h/y for three fossil hunters. No other individuals were identified over rock, so the mean occupancy rate for this group is 10 h/y.

The maximum occupancy rate recorded over salt marsh was 80 h/y for a walker. No other individuals had occupancy rates within a factor of three of this, so the mean occupancy rate for this group is 80 h/y.

The maximum occupancy rate recorded over sand and stone was 10 h/y for three walkers. No other individuals were identified over sand and stone, so the mean occupancy rate for this group is 10 h/y.

### **10-year-old age group**

The only occupancy rate recorded over rock was 10 h/y for one fossil hunter. No other individuals were identified over rock, so the mean occupancy rate for this group is 10 h/y.

The maximum occupancy rate recorded over salt marsh was 80 h/y for a walker. No other individuals had occupancy rates within a factor of three of this, so the mean occupancy rate for this group is 80 h/y.

The maximum occupancy rate recorded over sand and stone was 12 h/y for a walker. Three walkers had occupancy rates within a factor of three of this. This provides a mean occupancy rate for this group of 8 h/y.

### **5-year-old age group**

The only occupancy rate recorded over salt marsh was 80 h/y for a walker. No other individuals were identified over salt marsh, so the mean occupancy rate for this group is 80 h/y.

### **1-year-old and 3-month-old age groups**

No children in the 1-year-old or 3-month-old age group were identified spending time on intertidal areas.

## **Gamma dose rate measurements**

Representative gamma dose rate measurements at 1 m above the substrate were taken over mud, mud and sand, stones, and salt marsh. These measurements (shown in Table 17) ranged from 0.065 to 0.082  $\mu\text{Gy/h}$  over mud, and 0.069 to 0.084  $\mu\text{Gy/h}$  over salt marsh. Measurements were 0.099  $\mu\text{Gy/h}$  over mud, sand and stones, and 0.063  $\mu\text{Gy/h}$  over stones. The data in Table 17 (where comparison can be made) are consistent to those reported by the Environment Agency (EA, EHS, FSA and SEPA, 2007). Natural levels of around 0.05  $\mu\text{Gy/h}$  over sand and around 0.07  $\mu\text{Gy/h}$  over mud and salt marsh are expected. A value of 0.06  $\mu\text{Gy/h}$  is expected for all other substrate types.

### **4.9 Handling of fishing gear and sediment**

Handling sediment while bait digging or mollusc collecting, or handling commercial fishing gear, which has become entrained with fine sediment particles can potentially give rise to skin exposure from beta radiation. Doses to the skin need consideration as there is a separate dose limit for skin for members of the public. There is also a contribution to effective dose due to skin exposure (ICRP, 1991).

Handling of angling equipment was not considered to be a significant pathway. Therefore, as in previous surveys, data for this pathway were not collected.

Fishing gear can also be a source of whole body gamma exposure due to occupancy in the vicinity of the gear. However, this pathway is minor compared with the same exposure received during occupancy over intertidal areas and it has therefore been omitted from the report.

Table 18 shows the times spent handling fishing gear and intertidal sediment recorded during the survey.

The maximum fishing gear handling rate recorded was 500 h/y for one commercial lave net fisherman. One other commercial lave net/putcher rank fishermen had fishing gear handling rates that came within a factor of three of this. This gives a mean handling rate for this group of 350 h/y.

The maximum sediment handling rate recorded was 78 h/y for a wildfowler. Three other commercial putcher rank fishermen and one wildfowler had sediment handling rates that came within a factor of three of this. This provides a mean handling rate for this group of 60 h/y.

#### **4.10 Water based activities**

Activities taking place in or on the water can lead to ingestion of water and/or inhalation of spray. These pathways are generally considered to be minor in comparison with other exposure pathways such as the ingestion of foods produced in the vicinity of a nuclear site. However, in order to enable dose assessment, relevant data have been collected. No manipulation of the data (for example, calculating critical group rates) has been carried out.

Occupancy rates for activities taking place 'on water' in the survey area for adults and children are shown in Table 19 and Table 20, respectively. No activities occurring in water were recorded during the survey. Generic data for an inshore rescue boat crew were gained through an interview with a representative of the crew.

##### **Activities on the water**

Activities taking place on the water around Berkeley and Oldbury included lave netting, sailing, inshore boat rescue activities, and putcher rank fishing. Thirty-one observations were recorded for adults and two observations were recorded for children. The highest occupancy rate for adults was 500 h/y for a lave net fisherman and the highest occupancy rate for children was 150 h/y for two children who were sailing.

## **5 TERRESTRIAL RADIATION PATHWAYS**

### **5.1 Terrestrial survey area**

The terrestrial survey area covered all land and freshwater watercourses within 5 km of the site centre of Berkeley (NGR ST 654 999) and Oldbury (NGR ST 605 945). The Berkeley and Oldbury sites are located on the eastern shore of the River Severn, approximately 7 km apart. Due to the close proximity of the Berkeley and Oldbury sites, there is an overlap of both terrestrial survey areas (Figure 2); this forms an ellipse between the two sites. Figures 3 and 4 show the terrestrial survey areas for Berkeley and Oldbury, respectively. Due to the close proximity of the sites, the gaseous discharges from the Berkeley and Oldbury sites are considered together for the purposes of monitoring, habits surveys and assessments.

The terrestrial survey areas of both Berkeley and Oldbury are characterised by small towns and numerous villages such as; Berkeley, Newtown, Wanswell, Ham, Newport and Stone, near the Berkeley site; Oldbury-on-Severn and Littleton-on-Severn, near the Oldbury site. The largest town is Lydney, situated within the Berkeley survey area on the western shore of the River Severn.

The land in both survey areas was predominantly agricultural, with numerous working farms. At the time of the last survey in 2001 there was a Foot and Mouth outbreak, after which many farmers had culled their livestock. Since then, some farmers have restocked with the same type of livestock, others have diversified and some have ceased farming. The terrestrial survey areas of both sites are divided into two parts by the River Severn, which intersects both areas from north-east to south-west. Areas of salt marsh were identified along the eastern shores of the River Severn that were being used by farmers as rough grazing for cattle.

Nineteen farms were identified in the Berkeley survey area. Of these:

- Five produced beef cattle
- Two produced beef cattle and dairy cattle
- One produced beef cattle, dairy cattle and potatoes
- Seven produced dairy cattle
- One produced deer
- Two produced sheep
- One produced arable and a small quantity of beef cattle

One farm was identified in the overlap area, which produced beef cattle.

Fifteen farms were identified in the Oldbury survey area. Of these:

- One produced apples for cider
- Six produced beef cattle
- Two produced beef cattle and dairy cattle
- One produced beef cattle, dairy cattle and sheep
- One produced beef cattle, dairy cattle and eggs
- Two produced dairy cattle
- One produced sheep and eggs
- One produced eggs

In both the Berkeley and Oldbury areas, beef cattle and lamb were sold at Worcester, Highbridge and Cirencester markets and sold directly from two farms. Beef cattle were also sold to an abattoir outside the 5 km area. Milk was sold to Dairy Crest and the Organic Milk Cooperative. Milk was also sold to Cadbury. Eggs were sold from the farms and through local shops. Venison was sold from the farm and to local shops. Most of the farms produced arable crops (grass, wheat, oats, maize, barley, beans) for animal feed. Three farms produced crops for human consumption, which were malting barley for whisky or beer, and wheat, barley and maize for milling. Apples were made into cider, which was sold from the farm.

Farmers and their families from both sites were consuming beef, lamb, pork, chicken, eggs and milk from their own farms.

Three allotment sites were located in the Berkeley area, at Oakhunger, Newtown and Brookend. All three of the allotment sites were well maintained. At Oakhunger, there were approximately 20 plots in use. Newtown allotments had approximately 30 plots in use and Brookend had approximately 20 plots, of which only 10 were in use. People were growing a wide range of fruit and vegetables. Chickens were being kept for eggs at Newtown. There were no allotment sites identified in the Oldbury survey area. In both the Berkeley and Oldbury areas, there were many private gardens with a large range of fruit and vegetables being produced and the owners were selling fruit and vegetables from their door. Individuals at two private houses were identified as keeping chickens and producing eggs for their own consumption.

Three beekeepers were identified in the survey area. Two beekeepers had four hives each and one had between 20 – 30 hives, these were located near the villages of Stone, Newport and Halmore, and spread out over the survey area. The average production of honey per hive per year was 20 kg, although one beekeeper reported a particularly bad year with honey production at 7 kg per hive. The beekeepers and their families consumed honey from their hives. Excess was given to friends or sold to from their door. Some was also sold to shops and markets outside the survey area.

The consumption of wild foods included blackberries, elderberries, greengages, hazelnuts, mulberries, nettles, sloes, and mushrooms. Game from within the survey area was consumed, which included pheasant, pigeon, rabbit and venison. One private pheasant shoot was identified on farmland in the survey area.

No households were identified using groundwater or surface water as their domestic supply. Livestock were identified as drinking pond, stream, well or borehole water at seven farms.

There was one freshwater trout fishery in the survey area, located to the east of the Berkeley site. The trout lake was stocked with approximately 90% rainbow trout (*Oncorhynchus mykiss*), 5% brown trout (*Salmo trutta*) and 5% blue trout (*Oncorhynchus mykiss*) (a colour variant of rainbow trout). Rainbow trout and blue trout were caught for consumption, brown trout was for catch and release only. Twelve individuals were identified consuming rainbow trout from the trout lake.

## **5.2 Unusual pathways**

Transfer of radioactive contamination from the site into the surrounding area by wildlife was investigated. Representatives from Berkeley and Oldbury were asked about wildlife that could act as carriers for the transfer of radioactivity off site. Rabbits and pigeons were observed on both sites. At Berkeley, there was not a culling policy and wildlife was not considered to be a problem. At Oldbury, the policy was to use falcons to scare pigeons. A culling programme was in place to control the rabbit population. Members of the public who lived in the survey area were consuming pigeons and rabbits that were shot within the terrestrial survey area.

## **5.3 Wholesalers and retailers**

Retailers and wholesalers were interviewed in order to find out whether they were selling produce from within the survey area. Five outlets in total were visited, which were a farm shop, a village shop, a baker, a butcher and a cafe. The following outlets were selling produce from within the terrestrial survey area: the butcher was selling beef and lamb; and the farm shop was selling sausages, beef, lamb, potatoes, and ice cream from the farm.

## **5.4 Food consumption data**

Consumption data for locally produced foodstuffs potentially affected by gaseous discharges are presented in Tables 21 to 37 for adults and Tables 38 to 53 for children. These tables include the mean consumption rates of the critical groups together with the observed 97.5<sup>th</sup>

percentile rates calculated (as described in Section 3.2). For comparison purposes, the data are summarised in Table 10 for adults and in Tables 11 to 14 for children (15-year-olds, 10-year-olds, 5-year-olds and 1-year-olds, respectively). No children in the 3-month-old age groups were noted to be consuming locally produced foods potentially affected by gaseous discharges.

In order to provide information relevant to surveillance and assessments studies, the consumption rate data collected during the survey were analysed to indicate which food types most commonly contributed to each food group. The data are summarised in Table 54. Those food types (in Table 54) that are bold and italicised were sampled as part of the 2006 Food Standards Agency monitoring programme (EA, EHS, FSA and SEPA, 2007).

#### **Adults' consumption rates**

Consumption of locally produced foods was identified in the following 17 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat (excluding salt marsh grazed cattle), pig meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey, wild fungi, venison and freshwater fish. No consumption of local cereals was identified.

Critical group mean consumption rates were found to be greater than the generic 97.5<sup>th</sup> percentile consumption rates for milk and sheep meat. A further nine critical group mean consumption rates exceeded the generic mean consumption rates. These were for green vegetables, other vegetables, root vegetables, potato, domestic fruit, cattle meat, pig meat, eggs and honey. Five observed 97.5<sup>th</sup> percentile consumption rates exceeded the generic 97.5<sup>th</sup> percentile consumption rates. These were for root vegetables, milk, cattle meat, sheep meat and eggs.

## **Children's consumption rates**

### **15-year-old age group**

Six children in this age group were identified to be eating locally produced food. Consumption was identified in the following 15 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat, pig meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, wild fungi and venison. No consumption was identified for honey, freshwater fish and local cereals. Critical group mean consumption rates were found to be greater than the generic 97.5<sup>th</sup> percentile consumption rates for pig meat and sheep meat. A further six critical group mean consumption rates exceeded the generic mean consumption rates. These were for green vegetables, other vegetables, root vegetables, milk, cattle meat and eggs. Two observed 97.5<sup>th</sup> percentile consumption rates were greater than the generic 97.5<sup>th</sup> percentile consumption rates. These were for pig meat and sheep meat.

### **10-year-old age group**

Twenty-one children in this age group were identified as eating locally produced food. Consumption was identified in the following 15 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat, pig meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey and wild fungi. No consumption was identified for venison, freshwater fish and local cereals. Critical group mean consumption rates were found to be greater than the generic 97.5<sup>th</sup> percentile consumption rates for pig meat and sheep meat. In six food groups, the critical mean consumption rates were higher than the generic mean consumption rates. These were for green vegetables, other vegetables, milk, cattle meat, eggs and honey. Two observed 97.5<sup>th</sup> percentile consumption rates were greater than the generic 97.5<sup>th</sup> percentile consumption rates. These were for sheep meat and eggs.

### **5-year-old age group**

Five children in this age group were identified as eating locally produced food. Consumption was identified in the following 15 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat, pig meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey, and wild fungi. No consumption was identified for venison, freshwater fish and local cereals. No generic 97.5<sup>th</sup> percentile or generic mean consumption rates have been determined for this age group so no comparisons with the corresponding observed rates are possible.

### **1-year-old age group**

Three children in this age group were identified as eating locally produced food. Consumption was identified in the following 15 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat, pig meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey, and wild fungi. No consumption was identified for venison, freshwater fish and local cereals. No generic 97.5<sup>th</sup> percentile or generic mean consumption rates have been determined for this age group so no comparisons with the corresponding observed rates are possible.

### **3-month-old age group**

No children in the 3-month-old age groups were noted to be consuming locally produced foods.

## **6 DIRECT RADIATION PATHWAYS**

### **6.1 Direct radiation survey area**

The direct radiation survey areas are shown in Figures 3 and 4 for Berkeley and Oldbury, respectively. The direct radiation survey areas covered all land within 1 km of the Berkeley and 1 km of the Oldbury licensed site boundaries. The occupancy data collected from the direct radiation survey area is also applicable to direct exposure arising from gaseous releases from the site.

To the north-west, west and south-west of the Berkeley and Oldbury sites, the direct radiation survey area is riverine and includes the intertidal foreshore. The upper foreshore was a gradual sloping bank of rough grass and salt marsh, which led to the lower foreshore of mud, sand and rock. Within both the Berkeley and Oldbury direct radiation survey areas, the land to the north-east, east, south and south-west was predominantly farmland.

At Berkeley, the area was sparsely populated with four residences located to the east of the site and one residence located to the south. Access to the area was limited to one main road to the east of the site, which links the site to the town of Berkeley. A public footpath (the Severn Way) traversed the survey from north to east, following the course of Berkeley Pill away from the River Severn, then from east to south-west, towards the power station and back to the shore of the River Severn across farmland. It was reported that walkers and dog walkers used the Severn Way, however, no one was observed at the time of the survey.

Within the Oldbury direct radiation survey area there were small clusters of residential areas to the north-east, east and south-east of the site. Access to the area was limited to two main roads, one that transected the area from the north-east to south-east and one that linked the Oldbury site with Oldbury Naite to the south-east of the site. There were many public footpaths over farmland, one of which, the Severn Way, followed the upper foreshore between the Oldbury site and the River Severn. It was reported that the footpaths in the area

were used by walkers, dog walkers, and bird watchers. Angling was reported to occur on the shore in front of the Oldbury site.

## **6.2 Residential activities**

### **Berkeley**

The Berkeley direct radiation survey area was sparsely populated with only five residences. Three residences were within the 0 – 0.25 km zone and two were within the >0.5 – 1.0 km zone. Interviews were conducted at three residences. At the time of the survey one residence was unoccupied and members of one household were unavailable for an interview. No children were identified in the Berkeley direct radiation survey area.

### **Oldbury**

Eleven residences were identified in the Oldbury direct radiation survey area. Four residences were within the 0 – 0.25 km zone, three were within the >0.25 km to 5.0 km zone and four residences were within the >0.5 – 1.0 km zone. Data were collected from all residences, four of which were families with children.

## **6.3 Leisure activities**

The only leisure activity observed in the Berkeley and Oldbury direct radiation areas at the time of the survey was horse riding in the Oldbury area. The land in both of the survey areas was predominantly farmland and the shore could only be accessed by footpaths, which limited potential leisure activities.

Additionally, it was reported that walking and dog walking occurred around both sites. Angling and bird watching were also reported to occur around Oldbury. There was a bird hide that attracted birdwatchers near the lagoon south of the Oldbury site. The Oldbury Visitors Centre is now closed to the public and it is only opened for invited guests. There were a few nature trails close to the Oldbury site that were used by the public. There was an active

sports and social club at Berkeley, which was open to members of the public as well as employees of the Berkeley site. Leisure activities included football, cricket, tennis, horse riding and clay pigeon shooting. No one was observed at the Berkeley sport and social club at the time of the habits survey.

#### **6.4 Commercial activities**

In the Berkeley direct radiation survey area, one commercial business and one farm was identified. There were 46 employees in total. In the Oldbury direct radiation survey area, two commercial businesses and two working farms were identified. There were 37 employees in total. No commercial fishermen were identified fishing in the direct radiation survey areas. The commercial activities of the employees and contractors of the Berkeley and Oldbury sites, whilst at work, were not included in the direct radiation survey.

#### **6.5 Occupancy rates**

Table 55 presents indoor, outdoor and total occupancy data for adults and children. An analysis of the data by distance zones and occupancy rates is shown in Table 56.

#### **0 - 0.25 km from the licensed site perimeter**

##### **Berkeley**

Occupancy data were collected for four individuals in the 0 - 0.25 km zone. The observations were a farmer, his family and a farm employee. The farmer and two residents had equivalent highest total occupancy rates of 8200 h/y. One of these residents had the highest indoor rate of 5320 h/y and the farmer and one resident had equivalent highest outdoor rates of 4380 h/y.

### **Oldbury**

Occupancy data were collected for 13 individuals in the 0 - 0.25 km zone. The observations were for eight residents, and five people that worked in the area. A resident had the highest total occupancy rate of 8400 h/y and this resident also had the highest indoor rate of 8400 h/y. A farmer who also lived in the area had the highest outdoor rate of 1500 h/y.

### **>0.25 – 0.5 km from the site perimeter fence**

#### **Berkeley**

No one was identified as occupying the >0.25 - 0.5 km zone in the Berkeley direct radiation survey area.

### **Oldbury**

Occupancy data were collected for 46 individuals in the >0.25 to 5.0 km zone. The observations were for eight residents, and 38 employees and visitors. A resident had the highest total occupancy rate of 7700 h/y and this resident also had the highest outdoor rate of 3500 h/y. Another resident had the highest indoor rate of 6600 h/y.

### **>0.5 – 1.0 km from the site perimeter fence**

#### **Berkeley**

Occupancy data were collected for 46 people in the >0.5 - 1.0 km zone. The observations were for one farmer who lived and worked in the area, and 45 employees of a company in the area. The farmer had the highest total occupancy rate of 8500 h/y. This farmer also had the highest indoor rate of 4900 h/y and outdoor rate of 3600 h/y.

## Oldbury

Occupancy data were collected for 11 people in the >0.5 - 1.0 km zone. All of these observations were residents, one of which was also a farmer. The highest total occupancy rate was 8400 h/y. A different resident had the highest indoor rate of 7600 h/y and the farmer had the highest outdoor rate of 3900 h/y.

### 6.6 Gamma dose rate measurements

Table 57 presents gamma dose rate measurements for the Berkeley and Oldbury direct radiation survey areas. Representative gamma dose rate measurements were taken at a height of 1 metre both inside and outside residences and at outdoor background locations outside the direct radiation survey area. Outdoor measurements were taken approximately 5 to 10 metres from the nearest buildings, and the background measurements were taken over rough grass, in or near fields. It should be noted that the measurements taken at residences have not been adjusted for natural background dose rates.

In the Berkeley survey area, one outdoor measurement was taken over grass, which was 0.084  $\mu\text{Gy/h}$  and one indoor measurement over concrete, which was 0.098  $\mu\text{Gy/h}$ . In the Oldbury survey area, six outdoor measurements were taken over grass, which ranged from 0.065 to 0.083  $\mu\text{Gy/h}$ . Six indoor measurements, over concrete and tiles, ranged from 0.069 to 0.096  $\mu\text{Gy/h}$ . Outside the survey area, background readings over grass ranged from 0.069 to 0.079  $\mu\text{Gy/h}$ . The outdoor measurements taken during the survey were slightly higher than these background measurements.

Comprehensive studies of background radiation have been carried out on a national scale by the Radiation Protection Division of the Health Protection Agency (previously the National Radiological Protection Board), the most recent of these being a review conducted in 2005 (Watson *et al*, 2005). The results from this review could be used for comparison with the data collected during the survey.

## 7 COMBINED PATHWAYS

In determining habits data for the purposes of assessing radiological doses to the public, it may be necessary to consider a combination of pathways. Data are provided in Annexes 1 and 2 so that the full effect of combining pathways can be assessed for individual observations, given the concentrations and dose rates for a particular assessment. In some circumstances, it will be possible to make simplifying assumptions and define the consumption and external exposure rates appropriate to a series of potential critical groups. Such assumptions will depend on the assessment in question but some initial observations are provided here as a starting point for those undertaking assessments.

The most extensive combinations of pathways for adult dose assessment are shown in Table 58. Each of the 24 combinations shown in Table 58 represents an actual individual (or individuals) from Annex 1 who has positive data (irrespective of the magnitude), for each pathway marked with an asterisk. It should be noted that combination numbers in Table 58 do not correlate directly with observation numbers in Annex 1. Other individuals from Annex 1 have combinations that are not listed in Table 58 because they have fewer pathways and a dose assessment for them would be adequately covered by one of the 24 listed combinations.

Qualitative and estimated data shown in Annex 3 have not been included in Table 58. This is because data in Annex 3 are estimated rates for pathways that were heard about during the survey, but not quantified by interviewees.

Combinations of pathways at critical group rates may be achieved by considering the data in Annexes 1 and 2. Although critical group rates are not given in the annexes, the rates for individuals making up the groups are shown emboldened. Possible combinations of pathways and their associated critical group rates are therefore apparent.

## **7.1 Use of the data for assessing total dose**

The Environment Agencies and the Food Standards Agency have considered ways of using habits data to calculate total dose retrospectively. The adopted approach is to use the adult consumption and occupancy data collected in each habits survey to create a matrix with a series of habits profiles for each site. The relevant matrix for the Berkeley and Oldbury adults' profiled habits data is shown in Annex 5. The National Dose Assessment Working Group (NDAWG) has considered this approach to assessing retrospective total doses (Camplin *et al*, 2005) and has agreed that using habits profiles is a suitable approach. Retrospective total doses around Berkeley and Oldbury will in future be made using these profiles and reported in the Radioactivity in Food and the Environment Reports (e.g. EA, EHS, FSA and SEPA, 2007). Data from Annex 3 are not included in Annex 5.

## **7.2 Use of the data for foetal dose assessment**

Dose assessment of the prenatal age group was introduced routinely for the first time in the Radioactivity in Food and the Environment Report in 2005 (EA, EHS, FSA and SEPA, 2006), following the publication of recommendations by the Radiation Protection Division of the Health Protection Agency (National Radiological Protection Board, 2005). The adopted approach is to use consumption and occupancy data for women of childbearing age. Therefore, to assist in the assessment of foetal dose, consumption and occupancy data collected during the Berkeley and Oldbury habits survey for females of childbearing age are presented in Annex 6. The Office of National Statistics classifies women to be of childbearing age if they are between 15 – 44 years old ([www.statistics.gov.uk](http://www.statistics.gov.uk)); this age range has been used in Annex 6. It was not possible to collect ages for all female observations during the habits survey, however, these females with unknown ages have been included in Annex 6 as they are potentially women of childbearing age.

## **8 CONCLUSIONS AND SUGGESTIONS**

### **8.1 Survey findings**

The survey investigated the three potential sources of public radiation exposure from the Berkeley and Oldbury sites, which were:

- Discharges of liquid radioactive waste to the River Severn
- Discharges of gaseous radioactive waste to the atmosphere
- Emissions of direct radiation

Data were collected for 432 individuals including commercial fishermen, anglers, sailors, farmers, allotment holders and people spending time within 1 km of the licensed site boundary for Berkeley and Oldbury. These people were targeted because their habits and where they live may cause them to be exposed to radioactivity from the site. However, it should be noted that the most exposed people can only be defined with the outcome of a dose assessment.

All consumption rates recorded are only for foods produced or caught from within the aquatic and terrestrial survey areas as defined in Section 2.3.

The adult mean critical group rates (as defined in Section 3.2) for the separate aquatic consumption pathways for foods potentially affected by liquid discharges were:

- 14 kg/y for fish
- 2.7 kg/y for crustaceans
- 3.4 kg/y for wildfowl
- 47 kg/y for salt marsh grazed beef

The predominant foods consumed by the respective critical groups for these food groups were: eel, cod, bass and whiting; brown shrimps; mallard, goose and wigeon; and beef.

The consumption of molluscs was not identified. The consumption of seaweed by humans or animals and the use of seaweed as fertiliser were not identified. No other unusual pathways were identified.

The adult mean critical group occupancy rates over the separate intertidal substrates were:

- 78 h/y for mud
- 270 h/y for mud and sand
- 400 h/y for mud and stones
- 120 h/y for mud, sand and stones
- 10 h/y for rock
- 430 h/y for salt marsh
- 80 h/y for sand and stones

The adult mean critical group rate for handling fishing gear was 350 h/y and for handling sediment was 62 h/y.

The adult maximum occupancy rate for time spent on water was 500 h/y. No one was identified as spending time in water.

The adult mean critical group rates for the separate consumption pathways for foods potentially affected by gaseous discharges were:

- 28 kg/y for green vegetables
- 32 kg/y for other vegetables
- 34 kg/y for root vegetables
- 76 kg/y for potato
- 51 kg/y for domestic fruit
- 270 l/y for milk
- 39 kg/y for cattle meat (excluding salt marsh grazed cattle)
- 23 kg/y for pig meat
- 45 kg/y for sheep meat

- 11 kg/y for poultry
- 21 kg/y for eggs
- 4.7 kg/y for wild/free foods
- 11 kg/y for rabbits/hares
- 5.9 kg/y for honey
- 1.5 kg/y for wild fungi
- 1.5 kg/y for venison
- 11 kg/y for freshwater fish

No consumption of cereals from the survey area was identified. Consumption of foodstuffs by children (15-year-olds, 10-year-olds, 5-year-olds and 1-year-olds) was also recorded. Combinations of food groups (both aquatic and terrestrial) consumed at critical group rates, together with external pathway exposures, may be derived from the data for individuals in Annexes 1 and 2. Rates for individuals making up the critical groups are presented in bold type.

The human consumption of groundwater or surface water was not identified. Livestock were drinking stream, pond, borehole and well water.

The transfer of radioactive contamination from the site into the surrounding area by wildlife was investigated. Rabbits and pigeons were observed on both sites. At Berkeley, there was not a culling policy and wildlife was not considered to be a problem. At Oldbury, the policy was the use of falcons to scare pigeons and a culling programme to control the rabbit population. Members of the public who lived in the survey area were consuming pigeons and rabbits that were shot within the terrestrial survey area.

For occupancy by members of the public within 1 km of the Berkeley licensed site boundary, the highest total occupancy, highest indoor and highest outdoor rates were:

- For the 0 - 0.25 km zone; 8200 h/y total occupancy, 5300 h/y indoors and 4400 h/y outdoors
- No one was identified spending time in the >0.25 - 0.5 km zone
- For the >0.5 - 1.0 km zone; 8500 h/y total occupancy, 4900 h/y indoors and 3600 h/y outdoors

In the 0 - 0.25 km zone, the equivalent highest occupancy rate was for one farmer who lived and worked in the area and two residents. The highest indoor and outdoor occupancy rates were also for these residents. In the >0.5 - 1.0 km zone, one farmer who lived and worked in the area had the highest total, indoor and outdoor occupancy rates.

For occupancy by members of the public within 1 km of the Oldbury licensed site boundary, the highest total occupancy, highest indoor and highest outdoor rates were:

- For the 0 - 0.25 km zone; 8400 h/y total occupancy, 8400 h/y indoors and 1500 h/y outdoors
- For the >0.25 - 0.5 km zone; 7700 h/y total occupancy, 6600 h/y indoors and 3500 h/y outdoors
- For the >0.5 - 1.0 km zone; 8400 h/y total occupancy, 7600 h/y indoors and 3900 h/y outdoors

In the 0 - 0.25 km zone, the highest total occupancy rate and highest indoor rate was for a resident, who predominantly spent time indoors. The highest outdoors occupancy rate was for a farmer who lived and worked in the area. In the >0.25 - 0.5 km zone, the highest total and outdoor occupancy rates were for the same resident, and the highest indoor occupancy rate was for a different resident. In the >0.5 - 1.0 km zone, the highest total and indoor occupancy rates were for different residents, and the highest outdoor occupancy rate was for a farmer who lived and worked in the area.

## 8.2 Comparisons with previous surveys

The results from this 2007 survey can be compared with results from the last combined aquatic and terrestrial habits survey undertaken in 2001 as the terrestrial and aquatic survey areas are equivalent. There were differences in the direct radiation survey areas used in 2007 and those used at Berkeley in 2001 and at Oldbury in 1996, therefore only some comparisons can be made.

All comparisons for internal exposure pathways include data for adults only.

### Aquatic survey

#### *Internal exposure*

The main species of fish consumed by the critical group in 2001 were cod, salmon and bass, and in 2007 were eel, cod, bass and whiting. The only species of crustaceans consumed by the critical group in 2001 and 2007 was brown shrimp. The consumption of molluscs and marine plants/algae was identified in neither 2001 nor 2007. A comparison of the maximum consumption rates, critical group mean rates and number of individuals in each food group for 2001 and 2007 are shown in Table A.

*Table A. Comparison between 2001 and 2007 aquatic internal exposure pathways at Berkeley and Oldbury*

Food group	2001			2007		
	Number in critical group	Maximum rate kg/y	Critical group mean kg/y	Number in critical group	Maximum rate kg/y	Critical group mean kg/y
Fish	12	31.4	17.6	19	19.5	14.2
Crustaceans	2	3.1	1.5	2	2.7	2.7
Wildfowl	*	*	*	3	5.4	3.4
Salt marsh grazed beef	**	**	**	2	47.3	47.3

\* A comparison of wildfowl consumption rates cannot be undertaken because wildfowl was included in the poultry group in the 2001 survey, whereas in 2007 it formed a separate food group (see Section 4.5). It has not been possible to differentiate between poultry and wildfowl in the 2001 data.

\*\* Not identified in 2001.

The critical group mean consumption rates had decreased in 2007 from 18 kg/y to 14 kg/y for fish and had increased from 1.5 kg/y to 2.7 kg/y for crustaceans.

### ***External exposure***

For intertidal occupancy in 2001, the following four substrates were recorded: mud; mud and sand; salt marsh; and sand and stones. In 2007, the following seven substrates were identified: mud; mud and sand; mud and stones; mud, sand and stones; rock; salt marsh; and sand and stones. The following four substrates can therefore be compared: mud; mud and sand; sand and stones; and salt marsh. A comparison of sediment handling cannot be undertaken because it was not identified in the 2001 survey. A comparison of occupancy rates in and on water cannot be carried out because this pathway was not investigated in the 2001 survey. For external pathways, it should be noted that the methodology for determining the critical group has changed since the 2001 survey (see Section 3.2) so care is needed when comparing results. In the following comparison, the critical group rate from the 2001 survey has been recalculated using the current method.

A comparison of the 2001 and 2007 maximum rates, critical group mean rates and number of individuals in each group for intertidal occupancy and handling fishing gear in 2001 and 2007 is shown in Table B.

The intertidal occupancy activities undertaken by the individuals in the critical groups in 2001 were: putcher rank fishing over mud; putcher rank fishing and lave netting over mud and sand; bird watching and draft net fishing over sand and stones; and marsh warden duties over salt marsh. The activities undertaken by the individuals in the critical groups in 2007 were: wildfowling over mud; putcher rank fishing over mud and sand; beach combing and dog walking over sand and stones; and dog walking, bird watching and shore angling over salt marsh. The fishing activities in the critical group for handling fishing gear in 2001 included putcher rank and lave net fishing, the same fishing activities were included in the 2007 critical group for handling fishing gear.

*Table B. Comparison between 2001 and 2007 aquatic external exposure pathways at Berkeley and Oldbury*

Intertidal occupancy and handling	2001			2007		
	Number in critical group	Maximum rate h/y	Critical group mean h/y	Number in critical group	Maximum rate h/y	Critical group mean h/y
Mud	3	520	415	1	78	78
Mud and sand	2	851	650	2	272	272
Sand and stone	4	208	146	3	84	80
Salt marsh	4	200	190	6	730	428
Handling fishing gear	4	851	585	2	495	354

The critical group mean intertidal occupancy rates in 2007 decreased significantly over the following two substrates: mud, and mud and sand. The handling rates of fishing gear also decreased in 2007. These decreases reflect the changes in commercial fishing between 2001 and 2007, in particular the floods in 2007, which damaged many of the fixed putcher ranks and reduced the available fishing time. Intertidal occupancy rates over salt marsh increased significantly in 2007.

## Terrestrial survey

The adult critical group mean consumption rates for terrestrial food groups from the 2001 and 2007 surveys are shown in Table C below.

*Table C. Comparison between 2001 and 2007 adult critical group mean consumption rates (kg/y or l/y) for terrestrial food groups at Berkeley and Oldbury*

Food group	2001	2007
Green vegetables	29.4	27.7
Other vegetables	15.3	32.2
Root vegetables	31.9	34.4
Potato	34.6	76.1
Domestic fruit	9.2	51.4
Milk	138.3	271.6
Cattle meat	23.7	39.0
Pig meat	10.1	23.3
Sheep meat	11.3	45.1
Poultry	*	11.3
Eggs	7.1	20.8
Wild/free foods	3.0	4.7
Rabbits/hares	1.7	10.8
Honey	4.5	5.9
Wild fungi	7.9	1.5
Venison	**	1.5
Freshwater fish	**	10.6

\* The critical group mean consumption rate for poultry in the 2001 survey was 3.9 kg/y. A comparison of poultry consumption rates cannot be undertaken because wildfowl was included in the poultry group in the 2001 survey, whereas in 2007 it formed a separate food group (see Section 4.7). It has not been possible to differentiate between poultry and wildfowl in the 2001 data.

\*\* Not identified in 2001.

Consumption rates had increased in 2007 in the following 12 food groups: other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat, pig meat, sheep meat, eggs, wild/free foods, rabbits/hares, honey. Consumption rates had decreased in 2007 for green vegetables and wild fungi. There were large increases in the following nine food groups: other vegetables, potato, domestic fruit, milk, cattle meat, pig meat, sheep meat, eggs and rabbits/hares. There was a large decrease in wild fungi. The consumption of venison and freshwater fish was not identified in 2001.

## Direct radiation survey

Some comparisons for the direct radiation can be provided, which are shown in Table D for Berkeley and in Table E for Oldbury. There were differences in the direct radiation survey areas used in 2007 and those used at Berkeley in 2001 and at Oldbury in 1996. In 2007, the direct radiation survey areas at Berkeley and Oldbury were 1 km from the nuclear licensed site boundaries. In 1996, the Oldbury direct radiation survey area was 1 km from the power station. In 2001, the Berkeley direct radiation survey area was 1 km from the nuclear site licensed boundary, which had changed in 2007.

Data for the 2001 and 1996 surveys were not analysed in distance zones as carried out in the 2007 report. However due to the sparse number of residences, comparisons were undertaken with the same houses.

*Table D. Comparison between 2001 and 2007 (0 – 0.25 km zone) direct radiation occupancy rates at Berkeley (h/y)*

	Occupancy rates h/y	
	2001	2007
<i>Berkeley</i>		
Highest total	8500	8200
Highest indoor	4800	5300
Highest outdoor	4100	4400

The highest total, indoor and outdoor occupancy rates in 2001 and in 2007 are for residents in the same house at Berkeley. This house is in the 0 - 0.25 km zone in the 2007 survey.

*Table E. Comparison between 1996 and 2007 (0 – 0.25 km zone) direct radiation occupancy rates at Oldbury (h/y)*

	Occupancy rates h/y	
	1996	2007
<i>Oldbury</i>		
Highest total	8500	8400
Highest indoor	6900	8400
Highest outdoor	3600	1500

The highest total and highest indoor occupancy rates in 1996 and in 2007 are for residents in the same house at Oldbury. The highest outdoor occupancy rates are for residents living in the same house in both years. In the 2007 survey area, these houses are in the 0 - 0.25 km zone.

The only commercial activity noted in the 1996 Oldbury survey and still being carried out in 2007 was farming. Leisure activities identified in 1996 and still noted in 2007 were horse riding, dog walking, walking and bird watching in the Oldbury area.

In the Oldbury direct radiation area, gamma dose measurements for two residences in 2007 can be compared with gamma dose rate measurements taken at the same location in 1996. These are shown in Table F.

*Table F. Comparison of the 1996 and 2007 gamma dose rates at Oldbury ( $\mu\text{Gy/h}$ ).*

<i>Oldbury</i>	Indoor		Outdoor	
	1996	2007	1996	2007
House 1	0.096	0.095	0.073	0.081
House 2	0.097	0.094	0.077	0.077

These measurements have not been adjusted for natural background dose rates.

### **8.3 Suggestions for environmental monitoring**

The 2006 monitoring programmes operated by the Environment Agency and the Food Standards Agency included the following samples and measurements (EA, EHS, FSA and SEPA, 2007):

#### Aquatic surveillance

- Salmon from Beachley
- Bass from the River Severn
- Cod from the River Severn
- Evers from the River Severn
- Shrimps from Guscar
- Seawater from a local beach
- Sediment from Hills Flats, from 1 km south of Oldbury, from 2 km south-west of Berkeley and Sharpness

#### Gamma dose rate measurements

- Grass and mud, 1 km south of Oldbury
- Grass and mud at Hills flats
- Grass and mud at Sharpness
- Grass and salt marsh, 1 km south of Oldbury
- Grass and salt marsh at Sharpness
- Mud at Aust Rock
- Mud and rock, 2 km south-west of Berkeley
- Mud and salt marsh at Guscar Rocks
- Mud and salt marsh at Lydney Rocks
- Mud and sand at Hills Flats
- Mud and stones, 2 km south-west of Berkeley
- Salt marsh at Guscar Rocks
- Salt marsh at Lydney Rocks

#### Terrestrial surveillance

- Apples
- Blackberries
- Honey
- Lettuce
- Milk
- Onions
- Potatoes
- Runner beans
- Wheat
- Freshwater from Gloucester and Sharpness Canal, and the public supply

The following lists are suggestions for changes to the current environmental monitoring programmes. It should be noted that the suggestions are based on the findings of this survey. They are not the outcome of any form of radiological assessment. It is suggested

that samples currently monitored, which are not listed below, remain unchanged in the monitoring programme.

#### Environment Agency monitoring

- Gamma dose rate measurements could be introduced over salt marsh at Slimbridge, over salt marsh at Northwick Warth and over mud and sand at Severn Beach. At all three locations there was high intertidal occupancy.
- Gamma dose rate measurements could be introduced at Aylburton Warth over mud and sand. At this location, commercial shore based fishermen have high occupancy rates.

#### Food Standards Agency monitoring

- A sample of eel from Newnham could be introduced as this was being caught by anglers and was consumed in high amounts.
- Lettuce could be changed to cabbage as this was being consumed in larger amounts.
- A sample of salt marsh grazed beef could be introduced because this was being consumed.
- A sample of rabbit could be introduced it was being consumed from the terrestrial survey area and could be potential carriers for off-site transfer of radioactive materials.

## **9 ACKNOWLEDGEMENTS**

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## 10 REFERENCES

Allott, R., 2005. Assessment of compliance with the public dose limit. Principles for the assessment of total retrospective public doses. NDAWG/2/2005. National Dose Assessment Working Group.

Byrom, J., Robinson, C., Simmonds, J.R., Walters, B., and Taylor, R.R., 1995. Food consumption rates for use in generalised radiological dose assessments. *J. Radiol. Prot.* 1995 Vol. 15 No 4 335-341.

Camplin, W.C., Grzechnik, M.P. and Smedley, C.A., 2005. Methods for assessment of total dose in the Radioactivity in Food and the Environment report. Presented to the *National Dose Assessments Working Group (NDAWG)*. Paper NDAWG/3/2005, 27<sup>th</sup> April 2005.

CEC, 1996. Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation. *Off. J. Eur. Commun.*, 39(L159): 1-114.

Department for Environment, Food and Rural Affairs, 2006. Magnox Decision Document. August 2006. Defra, London.

DETR, 2000a. Statutory Guidance on the Regulation of Radioactive Discharges into the Environment from Nuclear Licensed Sites. A consultation paper. DETR, London.

DETR, 2000b. Radioactive Substances (Basic Safety Standards) (England and Wales) Direction 2000. DETR, London.

Duckett, L., 1997. Radiological Habits Survey: Direct Radiation from Oldbury Power Station, 1996. HSE, Bootle.

EA, EHS, FSA and SEPA, 2006. Radioactivity in Food and the Environment, 2005. EA, EHS, FSA and SEPA, Warrington, Belfast, London and Stirling. RIFE (11).

EA, EHS, FSA and SEPA, 2007. Radioactivity in Food and the Environment, 2006. EA, EHS, FSA and SEPA, Warrington, Belfast, London and Stirling. RIFE (12).

EA, SEPA, DoENI, NRPB and FSA, 2002. Authorisation of discharges of radioactive waste to the environment. Principles for the assessment of prospective public doses. Interim Guidance. EA, SEPA, DoENI, NRPB and FSA, Lancaster.

FSA, 2002. Assessment Methodology for the Potential Impact on Food of Radioactive Discharges to the Environment. FSA, London.

Good Housekeeping, 1994. Good Housekeeping Cook Book. Ebury Press, London.

Hessayon, D. G., 1990. The Fruit Expert, pbi Publications, Waltham Cross.

Hessayon, D. G., 1997. The New Vegetable & Herb Expert, Expert Books, London.

Hunt, G.J., Hewett, C.J. and Shepherd, J.G., 1982. The identification of critical groups and its application to fish and shellfish consumers in the coastal area of the north-east Irish Sea. Health Physics, Vol. 43, No 6, pp. 875-889.

IAEA, 1996. International basic safety standards for protection against ionizing radiation and for the safety of radiation sources. Saf. Ser. No. 115. IAEA, Vienna.

ICRP, 1984. A Compilation of the Major Concepts and Quantities in use by ICRP. Pergamon Press, Oxford, (ICRP Publ. 42.).

ICRP, 1991. 1990 Recommendations of the International Commission on Radiological Protection. Annal. ICRP 21 (1-3). Pergamon Press, Oxford, 201 pp. (ICRP Publ. 60.).

ICRP, 1996. Age-dependent doses to members of the public from intake of radionuclides. Annal. ICRP 26 (1). Elsevier Science, Oxford, (ICRP Publ. (72)).

ICRP, 2007. Assessing the dose of the representative person for the purpose of radiological protection of the public and the optimisation of radiological protection. Annal. ICRP 36 (3). Elsevier Science, Oxford, (ICRP Publ. 101.).

Leonard, D.R.P., Hunt, G.J. and Jones, P.G.W., 1982. Investigation of individual radiation exposures from disposals to the aquatic environment: techniques used in habits surveys. pp. 512-517. In "Proc. 3<sup>rd</sup> Int. Symp. Soc. Radiol. Prot., Inverness, 2" Society of Radiological Protection.

National Radiological Protection Board, 2005. Guidance on the application of dose coefficients for the embryo and fetus from intakes of radionuclides by the mother. Docs NRPB 16(2). NRPB, Chilton, 41pp.

Smedley, C.A. and McTaggart, K.A., 2002. Radiological Habits Survey: Direct Radiation from BNFL Berkeley Power Station, 2001. HSE, Bootle.

Smith, K.R. and Jones, A.L., 2003. Generalised habit data for radiological assessments. NRPB-W41. NRPB, Chilton.

The Welsh Assembly Government, 2002. Statutory Guidance on the Regulation of Radioactive Discharges into the Environment from Nuclear Licensed Sites in Wales. A consultation paper. The Welsh Assembly Government, Cardiff.

Tipple, J.R., McTaggart, K. A., Joyce, A. E. and Sherlock, M, 2002. Radiological Habits Survey: Berkeley/Oldbury, 2001. FSA, London.

UK Parliament, 1965. Nuclear Installations Act, 1965 (as amended). HMSO, London.

UK Parliament, 1993. Radioactive Substances Act, 1993. HMSO, London.

UK Parliament, 1995a. Environment Act, 1995. HMSO, London.

UK Parliament, 1995b. Review of Radioactive Waste Management Policy. HMSO, London, 55pp. (Cm 2919).

UK Parliament, 1999. The Ionising Radiation Regulations 1999. Stat. Inst. 1999/3232. HMSO, London, 67pp.

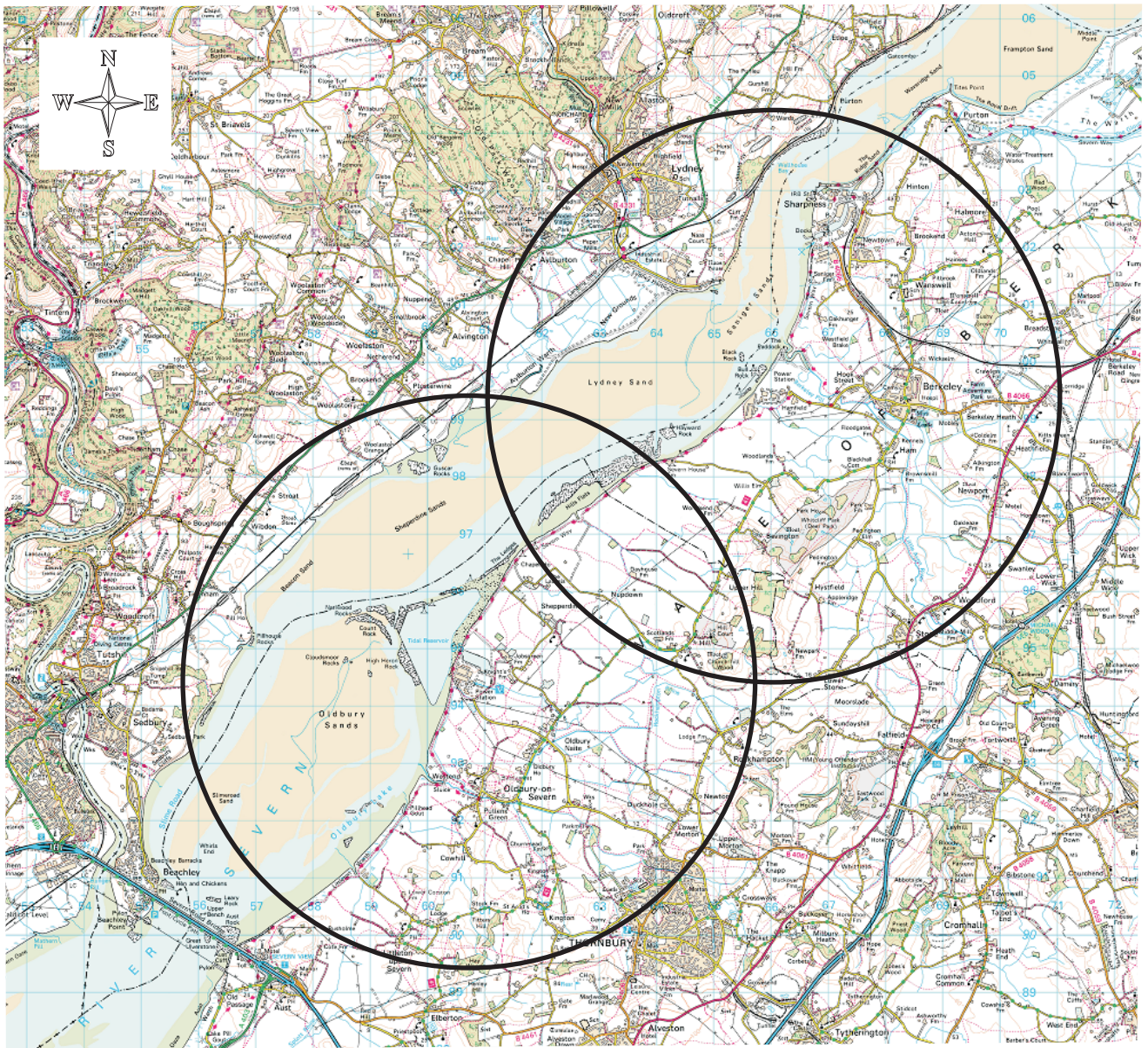
UK Parliament, 2004. Energy Act, 2004. HMSO, London.

Watson, S.J., Jones, A.L., Oatway, W.B. and Hughes, J.S., 2005. Ionising Radiation Exposure of the UK Population: 2005 review. HPA-RPD-001, Chilton.

[www.statistics.gov.uk](http://www.statistics.gov.uk)

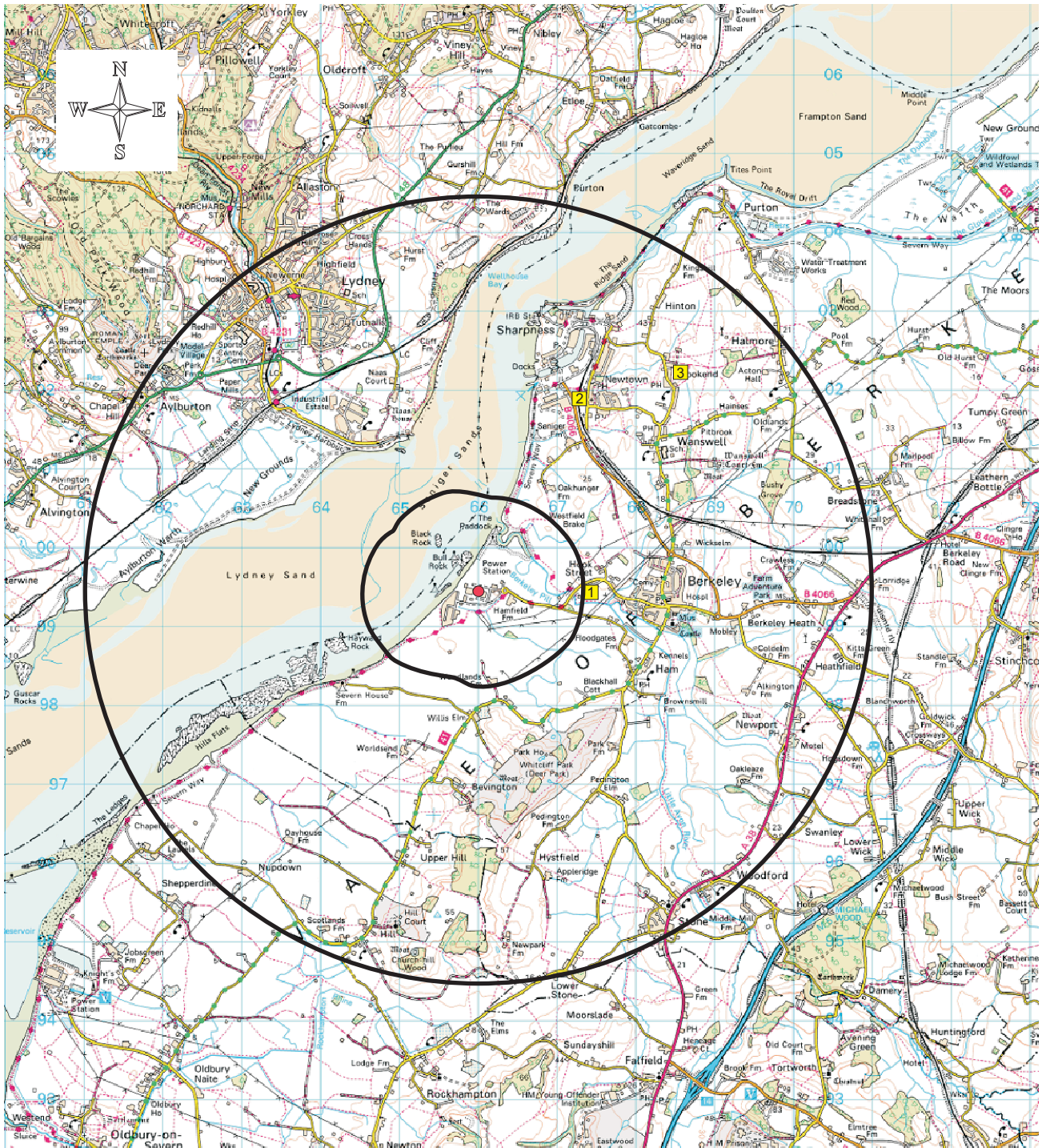


Figure 1. The Berkeley and Oldbury aquatic survey area



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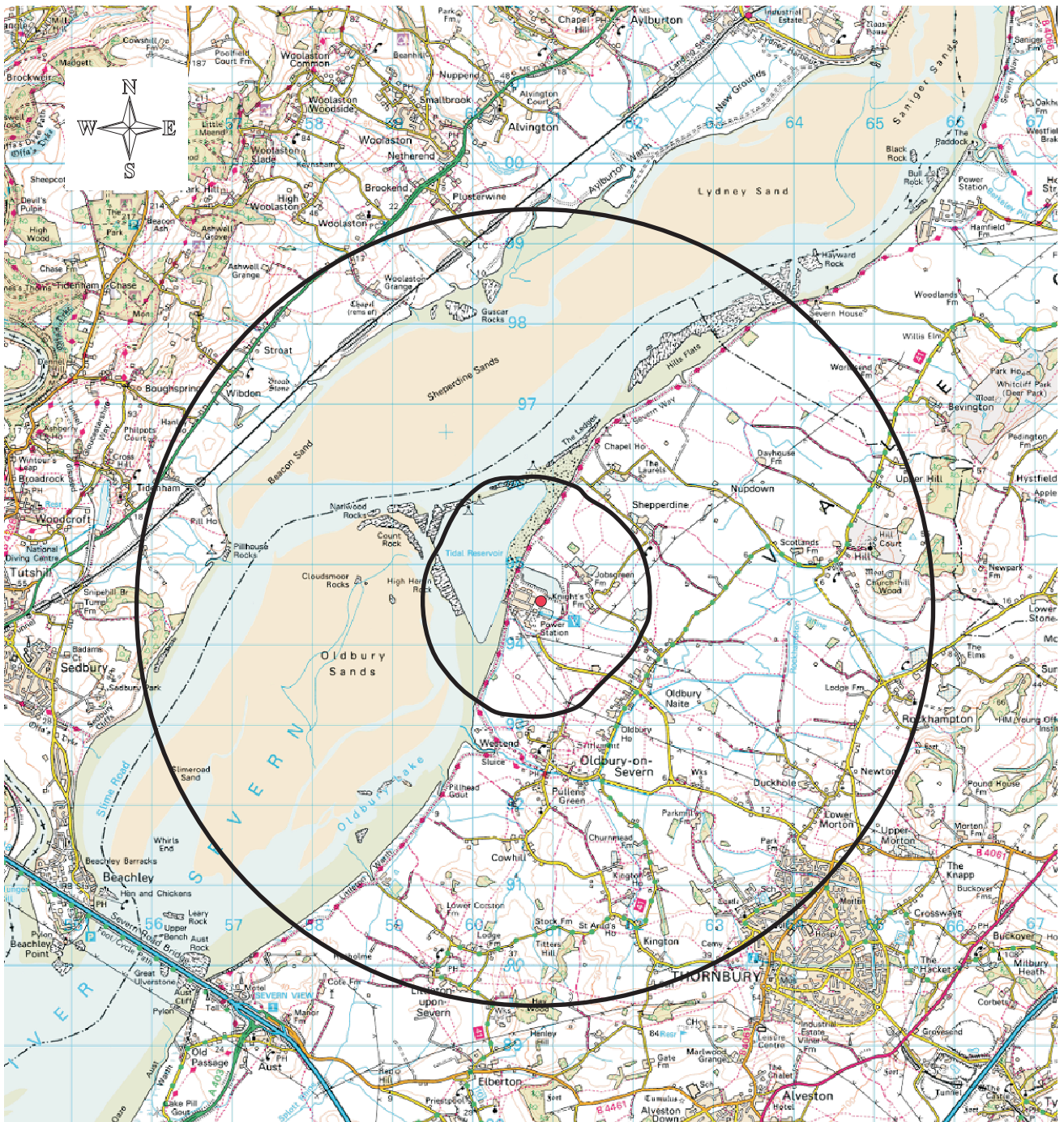
Figure 2. The Berkeley and Oldbury terrestrial survey area.



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Figure 3. The Berkeley terrestrial (outer ring) and direct radiation (inner ring) survey areas.

- 1 Oakhunger Lane allotments
- 2 Saniger Lane allotments
- 3 Brookend allotments
- The Berkeley site centre



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Figure 4. The Oldbury terrestrial (outer ring) and direct radiation (inner ring) survey areas.

- The Oldbury site centre

**Table 1. Survey coverage**

Group	Criteria	Estimate of complete coverage	Number for whom positive data were obtained	Coverage for positive observations	Notes
<b>SUMMARY OF ALL PATHWAYS</b>					
All potential people in Berkeley and Oldbury aquatic, terrestrial and direct radiation survey areas	Number of people resident in terrestrial survey area (excluding those resident in the direct radiation survey area) (See (B) terrestrial pathways)	19000 <sup>a</sup>	203 <sup>b</sup>	1%	The survey targeted individuals who were potentially the most exposed (see Section 2.4), mostly producers of local food (farmers and allotment holders).
	Number of people resident in the direct radiation survey area (See (C) direct radiation pathways)	35	31	89%	
	Number of people employed but not resident in the direct radiation survey area (See (C) direct radiation pathways)	100	83	92%	Excluding employees and contractors of Magnox Electric Ltd., and people living in the direct radiation survey area
	Number of people visiting the direct radiation area (See (C) direct radiation pathways)	U	6	U	
	Number of people affected by liquid discharges (excluding people resident in the terrestrial survey area) (See (A) aquatic pathways)	U	109 <sup>b</sup>	U	
	Total for aquatic, terrestrial and direct radiation survey areas	U	432 <sup>b</sup>	U	In the Summary of All Pathways section each interviewee has only been counted once. This is in the section where their predominant activities took place
<b>(A) AQUATIC PATHWAYS</b>					
Commercial fishermen	Number of commercial fishermen actively fishing in survey area	20	8	40%	
Shore anglers and other beach users	Number seen in action or spoken to during survey	U	54	U	
Sailors and inshore rescue volunteers	People seen in action or spoken to during survey period	U	25	U	Interview with an inshore rescue representative provided generic data for 10 people
Wildfowlers	Number seen or heard of during survey	75	2	3%	
<b>(B) TERRESTRIAL PATHWAYS<sup>c</sup></b>					
Farms	Number of farmers and their family members consuming food from the survey area	U	76	U	37 farmers in the survey area were interviewed
Allotments	Number of allotment holder and their family members consuming food from the survey area	150	68	45%	Three allotment sites in the area, 15 allotment holders were interviewed

**Table 1. Survey coverage**

Group	Criteria	Estimate of complete coverage	Number for whom positive data were obtained	Coverage for positive observations	Notes
Bee keepers	Number of people consuming honey in survey area	U	13	U	3 beekeepers in the area were interviewed
<b>(C) DIRECT RADIATION PATHWAYS</b>					
Occupancy of area	Number of occupancies excluding site employees	U	120	U	
Residences	Number of residents in the survey area	35	31	89%	Estimate of 16 occupied houses in the area, 14 households were interviewed
Employees	Number of people employed in the survey area	100	83	92%	
Leisure activities	Number of people undertaking leisure activities	U	6	U	
<b>BREAKDOWN OF AGE GROUPS</b>					
Adults	Individuals over 17	U	378	U	
15-year-old	> 12.0-year-old - 17.0-year-old	U	13	U	
10-year-old	> 7.0-year-old - 12.0-year-old	U	30	U	
5-year-old	> 2.0-year-old - 7.0-year-old	U	6	U	
1-year-old	> 1.0-year-old - 2.0-year-old	U	4	U	
3-months-old	0 - 1.0-year-old	U	0	U	

**Notes**

<sup>a</sup> Data from www.statistics.gov.uk were used to estimate this figure for people resident in the 5 km survey area.

<sup>b</sup> The number of people for whom positive data was obtained, for pathways (A) and (B), will not equal the relevant totals in the summary of all pathways. This is because some individuals, for example someone who fishes from a boat and the shore and digs their own bait, will be counted three times within the pathway, whereas others, such as the families of fishermen, will not be counted at all.

<sup>c</sup> 5 shops were visited during the survey.

U - Unknown

**Table 2. Typical food groups used in habits surveys**

Green vegetables	Globe artichoke, asparagus, broccoli, brussel sprout, cabbage, calabrese, cauliflower, chard, courgettes, cucumber, gherkin, herbs, kale, leaf beet, lettuce, marrow, spinach
Other vegetables	Aubergine, broad bean, chilli pepper, french bean, mangetout, pea, pepper, runner bean, sweetcorn, tomato, pumpkin
Root vegetables	Jerusalem artichoke, beetroot, carrot, celeriac, celery, chicory, fennel, garlic, kohlrabi, leek, onion, parsnip, radish, shallot, spring onion, swede, turnip
Potato	
Domestic fruit	Apple, apricot, blackberry, blackcurrant, boysenberry, cherry, damson, fig, gooseberry, grapes, greengages, huckleberry, loganberry, melon, nectarines, peach, pear, plum, raspberry, redcurrants, rhubarb, rowanberry, strawberry, tayberry, whitecurrant
Milk	Milk, butter, cream, cheese, yoghurt, goat's milk
Cattle meat †	
Pig meat †	
Sheep meat †	
Poultry	Chicken, duck, goose, grouse, guinea fowl, partridge, pheasant, pigeon, snipe, turkey, woodcock
Eggs	Chicken egg, duck egg, goose egg
Wild/free foods	Blackberry, blackcurrant, chestnut, crab apple, damson, dandelion root, elderberry, nettle, raspberry, rowanberry, samphire, sloe, strawberry, watercress, wild apple
Honey	
Wild Fungi	Mushrooms
Rabbits/Hare	Hare, rabbit
Venison †	
Fish (sea)	Bass, brill, cod, common ling, dab, Dover sole, flounder, gurnard, haddock, hake, herring, lemon sole, mackerel, monkfish, mullet, plaice, pollack, witch saithe, salmon, sea trout, squid*, cuttlefish*, rays, turbot, whitebait, whiting
Fish (freshwater)	Brown trout, rainbow trout, perch, pike, salmon (river), eels
Crustaceans	Brown crab, spider crab, crawfish, lobster, <i>Nephrops</i> , squat lobster, prawn, shrimp
Molluscs	Cockles, limpets, mussels, oysters, queens, scallops, razor shell, whelks, winkles

Notes:

\* Although squid and cuttlefish are molluscs, radiologically they are more akin to fish

† Including offal

**Table 3. Adults' consumption rates of fish in the Berkeley & Oldbury area (kg/y)**

Observation number	Bass	Cod	Dover sole	Conger eel	Eel	Flounder	Grey mullet	Plaice	Salmon	Whiting	Total
6					19.5						19.5
7					19.5						19.5
8					19.5						19.5
9					19.5						19.5
10					19.5						19.5
11					19.5						19.5
12					19.5						19.5
13					19.5						19.5
14					19.5						19.5
1	3.9	5.5				3.8			1.0		14.2
139	13.6										13.6
136		6.0	0.7			1.0		0.5		2.9	11.1
137		6.0	0.7			1.0		0.5		2.9	11.1
138		6.0	0.7			1.0		0.5		2.9	11.1
20		6.7				0.2					6.9
21		6.7				0.2					6.9
22		6.7				0.2					6.9
23		6.7				0.2					6.9
38									6.5		6.5
363		4.8	0.5								5.3
16									4.9		4.9
17									4.9		4.9
140	0.6	3.0									3.7
141	0.6	3.0									3.7
2	0.8	1.1				0.8					2.6
356		0.7		1.3		0.3					2.3
357		0.7		1.3		0.3					2.3
355		2.3									2.3
132		1.8									1.8
133		1.8									1.8
364									1.6		1.6
365									1.6		1.6

**Table 3. Adults' consumption rates of fish in the Berkeley & Oldbury area (kg/y)**

Observation number	Bass	Cod	Dover sole	Conger eel	Eel	Flounder	Grey mullet	Plaice	Salmon	Whiting	Total
128									0.9		0.9
129									0.9		0.9
130									0.9		0.9
118							0.3		0.3		0.7
119							0.3		0.3		0.7
134	0.4										0.4
135	0.4										0.4

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of fish based on the 19 highest adult consumers is 14.2 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 39 observations is 19.5 kg/y

**Table 4. Adults' consumption rates of crustaceans in the Berkeley & Oldbury area (kg/y)**

Observation number	Brown shrimp
<b>364</b>	<b>2.7</b>
38	0.6

**Notes**

Emboldened observations are the critical group consumers  
 The critical group consumption rate of crustaceans based on the highest adult consumer is 2.7 kg/y  
 The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 2.7 kg/y

**Table 5. Adults' consumption rates of wildfowl in the Berkeley & Oldbury area (kg/y)**

Observation number	Duck	Goose	Mallard	Pintail	Teal	Wigeon	Total
<b>369</b>			<b>5.4</b>			<b>0.7</b>	<b>6.1</b>
<b>372</b>		<b>1.1</b>	<b>0.5</b>	<b>0.2</b>	<b>0.1</b>	<b>0.2</b>	<b>2.1</b>
<b>373</b>		<b>1.1</b>	<b>0.5</b>	<b>0.2</b>	<b>0.1</b>	<b>0.2</b>	<b>2.1</b>
370			0.5		0.1	0.2	0.7
371			0.5		0.1	0.2	0.7
364			0.5		0.2		0.6
365			0.5		0.2		0.6
118	0.2						0.2
119	0.2						0.2

**Notes**

Emboldened observations are the critical group consumers  
 The critical group consumption rate of wildfowl based on the 3 highest adult consumers is 3.4 kg/y  
 The observed 97.5<sup>th</sup> percentile rate based on 9 observations is 5.3 kg/y

**Table 6. Adults' consumption rates of salt marsh grazed cattle in the Berkeley & Oldbury area (kg/y)**

Observation number	Beef
<b>377</b>	<b>47.3</b>
<b>378</b>	<b>47.3</b>
188	10.4
189	10.4
190	10.4
191	10.4
192	10.4
193	10.4

**Notes**

Emboldened observations are the critical group consumers  
 The critical group consumption rate of salt marsh grazed cattle based on the 2 highest adult consumers is 47.3 kg/y  
 The observed 97.5<sup>th</sup> percentile rate based on 8 observations is 47.3 kg/y

**Table 7. Children's consumption rates of fish in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Salmon
<b>131</b>	<b>15</b>	<b>0.9</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of fish based on the only 15-year-old age group consumer is 0.9 kg/y

The observed 97.5<sup>th</sup> percentile rate is not applicable for 1 observation

**10-year-old age group**

Observation number	Age	Grey mullet	Salmon	Total
<b>120</b>	<b>8</b>	<b>0.2</b>	<b>0.2</b>	<b>0.3</b>
<b>121</b>	<b>7</b>	<b>0.2</b>	<b>0.2</b>	<b>0.3</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of fish based on the 2 highest 10-year-old age group consumers is 0.3 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 0.3 kg/y

**Table 8. Children's consumption rates of wildfowl in the Berkeley & Oldbury area (kg/y)**

**10-year-old age group**

Observation number	Age	Duck	Goose	Mallard	Pintail	Teal	Wigeon	Total
<b>375</b>	<b>7</b>		<b>0.8</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.2</b>	<b>1.6</b>
<b>374</b>	<b>10</b>		<b>0.6</b>	<b>0.2</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>1.1</b>
120	8	0.1						0.1
121	7	0.1						0.1

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of wildfowl based on the 2 highest 10-year-old age group consumers is 1.3 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 4 observations is 1.6 kg/y

**Table 9. Children's consumption rates of salt marsh grazed cattle in the Berkeley & Oldbury area (kg/y)**

**10-year-old age group**

Observation number	Age	Beef
<b>379</b>	<b>11</b>	<b>18.9</b>
<b>380</b>	<b>9</b>	<b>18.9</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of salt marsh grazed cattle based on the 2 highest 10-year-old age group consumers is 18.9 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 18.9 kg/y

**Table 10. Summary of adults' consumption rates in the Berkeley & Oldbury area (kg/y or l/y)**

Food group	Number of observations	No. higher rate consumers	Observed maximum critical group consumption rate	Observed minimum critical group consumption rate	Observed mean critical group consumption rate	Observed 97.5 <sup>th</sup> percentile consumption rate	Generic mean consumption rate	Generic 97.5 <sup>th</sup> percentile consumption rate
Fish	39	19	19.5	6.5	14.2	19.5	15.0	40.0
Crustaceans	2	1	2.7	2.7	2.7	2.7	3.5	10.0
Molluscs	NC	NC	NC	NC	NC	NC	3.5	10.0
Wildfowl	9	3	6.1	2.1	3.4	5.3	ND	ND
Marine plants/algae	NC	NC	NC	NC	NC	NC	ND	ND
Salt marsh grazed cattle	8	2	47.3	47.3	47.3	47.3	ND	ND
Green vegetables	99	30	48.1	16.5	27.7	43.6	15.0	45.0
Other vegetables	131	46	49.9	17.0	32.2	46.9	20.0	50.0
Root vegetables	113	23	63.0	21.1	34.4	53.4	10.0	40.0
Potato	114	20	150.0	50.8	76.1	81.9	50.0	120.0
Domestic fruit	93	18	87.5	29.5	51.4	68.1	20.0	75.0
Milk	40	34	414.9	182.0	271.6	414.9	95.0	240.0
Cattle meat	37	21	62.1	21.8	39.0	47.9	15.0	45.0
Pig meat	15	13	38.6	15.8	23.3	38.6	15.0	40.0
Sheep meat	37	6	62.1	23.0	45.1	47.9	8.0	25.0
Poultry	26	1	11.3	11.3	11.3	5.9	10.0	30.0
Eggs	32	27	35.6	11.9	20.8	35.6	8.5	25.0
Wild/free foods	45	16	6.8	3.4	4.7	6.7	7.0	25.0
Rabbits/hares	9	1	10.8	10.8	10.8	9.3	6.0	15.0
Honey	13	10	8.3	3.2	5.9	8.3	2.5	9.5
Wild fungi	34	11	2.3	0.9	1.5	2.3	3.0	10.0
Venison	5	5	2.0	1.1	1.5	2.0	ND	ND
Freshwater fish	12	12	10.6	10.6	10.6	10.6	ND	ND

ND = not determined

NC = not consumed

**Table 11. Summary of 15-year-old children's consumption rates in the Berkeley & Oldbury area (kg/y or l/y)**

Food group	Number of observations	No. higher rate consumers	Observed maximum critical group consumption rate	Observed minimum critical group consumption rate	Observed mean critical group consumption rate	Observed 97.5 <sup>th</sup> percentile consumption rate	Generic mean consumption rate	Generic 97.5 <sup>th</sup> percentile consumption rate
Fish	1	1	0.9	0.9	0.9	NA	6.5	20.0
Crustaceans	NC	NC	NC	NC	NC	NC	2.5	6.0
Molluscs	NC	NC	NC	NC	NC	NC	2.5	6.0
Wildfowl	NC	NC	NC	NC	NC	NC	ND	ND
Marine plants/algae	NC	NC	NC	NC	NC	NC	ND	ND
Salt marsh grazed cattle	NC	NC	NC	NC	NC	NC	ND	ND
Green vegetables	3	3	13.2	5.7	10.2	13.1	9.0	25.0
Other vegetables	3	3	30.1	14.0	21.6	29.7	10.0	30.0
Root vegetables	2	1	17.4	4.5	17.4	17.1	7.5	20.0
Potato	5	4	43.7	20.5	37.5	43.6	60.0	130.0
Domestic fruit	3	2	7.9	3.6	5.7	7.7	15.0	50.0
Milk	3	3	208.0	207.4	207.8	208.0	110.0	260.0
Cattle meat	2	2	21.8	21.8	21.8	21.8	15.0	35.0
Pig meat	2	2	38.6	38.6	38.6	38.6	10.0	30.0
Sheep meat	3	2	17.1	17.1	17.1	17.1	5.5	15.0
Poultry	5	4	1.3	0.8	1.1	1.3	6.5	20.0
Eggs	4	4	18.7	8.9	14.5	18.5	7.0	25.0
Wild/free foods	2	1	0.9	0.3	0.9	0.9	3.0	13.0
Rabbits/hares	1	1	0.2	0.2	0.2	NA	ND	ND
Honey	NC	NC	NC	NC	NC	NC	2.0	5.0
Wild fungi	2	1	0.3	0.3	0.3	0.3	2.0	5.5
Venison	1	1	1.1	1.1	1.1	NA	ND	ND
Freshwater fish	NC	NC	NC	NC	NC	NC	ND	ND

ND = not determined

NC = not consumed

NA = not applicable

**Table 12. Summary of 10-year-old children's consumption rates in the Berkeley & Oldbury area (kg/y or l/y)**

Food group	Number of observations	No. higher rate consumers	Observed maximum critical group consumption rate	Observed minimum critical group consumption rate	Observed mean critical group consumption rate	Observed 97.5 <sup>th</sup> percentile consumption rate	Generic mean consumption rate	Generic 97.5 <sup>th</sup> percentile consumption rate
Fish	2	2	0.3	0.3	0.3	0.3	6.0	20.0
Crustaceans	NC	NC	NC	NC	NC	NC	2.5	7.0
Molluscs	NC	NC	NC	NC	NC	NC	2.5	7.0
Wildfowl	4	2	1.6	1.1	1.3	1.6	ND	ND
Marine plants/algae	NC	NC	NC	NC	NC	NC	ND	ND
Salt marsh grazed cattle	2	2	18.9	18.9	18.9	18.9	ND	ND
Green vegetables	9	3	8.5	7.3	8.1	8.5	6.0	20.0
Other vegetables	17	9	17.0	7.8	11.3	17.0	8.0	25.0
Root vegetables	16	14	5.7	2.2	4.5	5.7	6.0	20.0
Potato	17	1	42.9	42.9	42.9	30.8	45.0	85.0
Domestic fruit	16	4	16.3	9.0	12.6	16.3	15.0	50.0
Milk	2	2	208.0	103.7	155.9	205.4	110.0	240.0
Cattle meat	2	1	21.8	21.8	21.8	21.4	15.0	30.0
Pig meat	1	1	38.6	38.6	38.6	NA	8.5	25.0
Sheep meat	3	3	17.1	3.8	8.2	16.5	4.0	10.0
Poultry	3	3	1.3	0.5	0.7	1.2	5.5	15.0
Eggs	5	5	20.8	10.4	15.5	20.8	6.5	20.0
Wild/free foods	11	6	1.0	1.0	1.0	1.0	3.0	11.0
Rabbits/hares	2	2	0.1	0.1	0.1	0.1	ND	ND
Honey	1	1	2.5	2.5	2.5	NA	2.0	7.5
Wild fungi	2	2	0.1	0.1	0.1	0.1	1.5	4.5
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater fish	NC	NC	NC	NC	NC	NC	ND	ND

ND = not determined

NC = not consumed

NA = not applicable

**Table 13. Summary of 5-year-old children's consumption rates in the Berkeley & Oldbury area (kg/y or l/y)**

Food group	Number of observations	No. higher rate consumers	Observed maximum critical group consumption rate	Observed minimum critical group consumption rate	Observed mean critical group consumption rate	Observed 97.5 <sup>th</sup> percentile consumption rate	Generic mean consumption rate	Generic 97.5 <sup>th</sup> percentile consumption rate
Fish	NC	NC	NC	NC	NC	NA	ND	ND
Crustaceans	NC	NC	NC	NC	NC	NC	ND	ND
Molluscs	NC	NC	NC	NC	NC	NC	ND	ND
Wildfowl	NC	NC	NC	NC	NC	NC	ND	ND
Marine plants/algae	NC	NC	NC	NC	NC	NC	ND	ND
Salt marsh grazed cattle	NC	NC	NC	NC	NC	NC	ND	ND
Green vegetables	1	1	1.2	1.2	1.2	NA	ND	ND
Other vegetables	4	2	10.0	5.6	7.8	9.6	ND	ND
Root vegetables	3	2	5.7	2.2	3.9	5.5	ND	ND
Potato	3	2	7.7	6.4	7.0	7.6	ND	ND
Domestic fruit	2	2	4.6	3.6	4.1	4.6	ND	ND
Milk	1	1	103.7	103.7	103.7	NA	ND	ND
Cattle meat	1	1	5.9	5.9	5.9	NA	ND	ND
Pig meat	NC	NC	NC	NC	NC	NC	ND	ND
Sheep meat	NC	NC	NC	NC	NC	NC	ND	ND
Poultry	NC	NC	NC	NC	NC	NC	ND	ND
Eggs	1	1	20.8	20.8	20.8	NA	ND	ND
Wild/free foods	3	1	1.0	1.0	1.0	1.0	ND	ND
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	1	1	1.9	1.9	1.9	NA	ND	ND
Wild fungi	NC	NC	NC	NC	NC	NC	ND	ND
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater fish	NC	NC	NC	NC	NC	NC	ND	ND

ND = not determined

NC = not consumed

NA = not applicable

**Table 14. Summary of 1-year-old children's consumption rates in the Berkeley & Oldbury area (kg/y or l/y)**

Food group	Number of observations	No. higher rate consumers	Observed maximum critical group consumption rate	Observed minimum critical group consumption rate	Observed mean critical group consumption rate	Observed 97.5 <sup>th</sup> percentile consumption rate	Generic mean consumption rate	Generic 97.5 <sup>th</sup> percentile consumption rate
Fish	NC	NC	NC	NC	NC	NA	ND	ND
Crustaceans	NC	NC	NC	NC	NC	NC	ND	ND
Molluscs	NC	NC	NC	NC	NC	NC	ND	ND
Wildfowl	NC	NC	NC	NC	NC	NC	ND	ND
Marine plants/algae	NC	NC	NC	NC	NC	NC	ND	ND
Salt marsh grazed cattle	NC	NC	NC	NC	NC	NC	ND	ND
Green vegetables	2	2	3.6	3.6	3.6	3.6	ND	ND
Other vegetables	2	2	4.2	4.2	4.2	4.2	ND	ND
Root vegetables	2	2	2.3	2.3	2.3	2.3	ND	ND
Potato	2	2	6.1	6.1	6.1	6.1	ND	ND
Domestic fruit	NC	NC	NC	NC	NC	NC	ND	ND
Milk	NC	NC	NC	NC	NC	NC	ND	ND
Cattle meat	NC	NC	NC	NC	NC	NC	ND	ND
Pig meat	NC	NC	NC	NC	NC	NC	ND	ND
Sheep meat	NC	NC	NC	NC	NC	NC	ND	ND
Poultry	NC	NC	NC	NC	NC	NC	ND	ND
Eggs	NC	NC	NC	NC	NC	NC	ND	ND
Wild/free foods	NC	NC	NC	NC	NC	NC	ND	ND
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	1	1	0.9	0.9	0.9	NA	ND	ND
Wild fungi	NC	NC	NC	NC	NC	NC	ND	ND
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater fish	NC	NC	NC	NC	NC	NC	ND	ND

ND = not determined

NC = not consumed

NA = not applicable

**Table 15. Adults' intertidal occupancy rates in the Berkeley & Oldbury area (h/y)**

Observation number	Location	Activity	Mud	Mud and sand	Mud and stones	Mud, sand and stones	Rock	Salt marsh	Sand and stones
<b>370</b>	<b>Hills Flats</b>	<b>Wildfowling</b>	<b>78</b>						
372	Frampton, Hills Flats, Poulton Court	Wildfowling	25						
	Frampton, Hills Flats, Poulton Court	Wildfowling						25	
170	Oldbury Pill	Fixing moorings	15						
345	River Severn	Inshore rescue duties	4						
346	River Severn	Inshore rescue duties	4						
347	River Severn	Inshore rescue duties	4						
348	River Severn	Inshore rescue duties	4						
349	River Severn	Inshore rescue duties	4						
350	River Severn	Inshore rescue duties	4						
351	River Severn	Inshore rescue duties	4						
352	River Severn	Inshore rescue duties	4						
353	River Severn	Inshore rescue duties	4						
354	River Severn	Inshore rescue duties	4						
<b>16</b>	<b>Aylburton Warth</b>	<b>Putcher rank fishing</b>		<b>272</b>					
<b>18</b>	<b>Aylburton Warth</b>	<b>Putcher rank fishing</b>		<b>272</b>					
19	Aylburton Warth	Putcher rank fishing		60					
<b>139</b>	<b>Severn Beach, River Severn</b>	<b>Shore angling</b>			<b>400</b>				
	<b>Northwick Warth</b>	<b>Shore angling</b>						<b>500</b>	
136	Severn Beach, River Severn	Shore angling			54				
	Northwick Warth	Shore angling						54	
<b>367</b>	<b>Poulton Court</b>	<b>Putcher rank fishing</b>				<b>120</b>			
<b>368</b>	<b>Poulton Court</b>	<b>Putcher rank fishing</b>				<b>120</b>			
<b>325</b>	<b>Aust Cliff</b>	<b>Fossil hunting</b>					<b>10</b>		
	Littleton-on-Severn, Oldbury and Shepperdine	Dog walking						25	
	Aust Cliff, Old Passage	Walking							10
<b>329</b>	<b>Aust Cliff, Old Passage</b>	<b>Fossil hunting</b>					<b>10</b>		
	Old Passage	Walking							10
<b>342</b>	<b>Aust Cliff, Old Passage</b>	<b>Fossil hunting</b>					<b>10</b>		
<b>343</b>	<b>Aust Cliff, Old Passage</b>	<b>Fossil hunting</b>					<b>10</b>		
<b>344</b>	<b>Aust Cliff, Old Passage</b>	<b>Fossil hunting</b>					<b>10</b>		

**Table 15. Adults' intertidal occupancy rates in the Berkeley & Oldbury area (h/y)**

Observation number	Location	Activity	Mud	Mud and sand	Mud and stones	Mud, sand and stones	Rock	Salt marsh	Sand and stones
<b>203</b>	<b>Shores of River Severn</b>	<b>Dog walking</b>						<b>730</b>	
<b>432</b>	<b>Slimbridge WWT</b>	<b>Bird watching</b>						<b>560</b>	
<b>3</b>	<b>Newnham</b>	<b>Shore angling</b>						<b>260</b>	
<b>4</b>	<b>Newnham</b>	<b>Shore angling</b>						<b>260</b>	
<b>5</b>	<b>Newnham</b>	<b>Shore angling</b>						<b>260</b>	
20	Black Rock and Beachley	Shore angling						210	
21	Black Rock and Beachley	Shore angling						210	
140	Northwick Warth	Shore angling						200	
134	Northwick Warth	Shore angling						96	
135	Northwick Warth	Shore angling						96	
361	Beachley	Shore angling						86	
362	Beachley	Shore angling						86	
355	Beachley	Shore angling						80	
356	Beachley	Shore angling						80	
357	Beachley	Walking						80	
146	Littleton Warth	Walking						60	
262	River Severn	Walking						52	
263	River Severn	Walking						52	
363	Beachley Point	Shore angling						48	
429	Slimbridge WWT	Bird watching, mending fences						35	
430	Slimbridge WWT	Bird watching, mending fences						35	
431	Slimbridge WWT	Bird watching, mending fences						35	
132	Northwick Warth	Shore angling						13	
115	Black Rock	Dog walking						6	
116	Black Rock	Dog walking						6	
152	Shepperdine	Walking						4	
153	Shepperdine	Walking						4	
<b>366</b>	<b>Broadoak</b>	<b>Beach combing</b>							<b>84</b>
<b>334</b>	<b>Severn Beach, shores of River Severn</b>	<b>Dog walking</b>							<b>78</b>
<b>335</b>	<b>Severn Beach, shores of River Severn</b>	<b>Dog walking</b>							<b>78</b>
331	Severn Beach, Shores of River Severn	Walking							12

**Table 15. Adults' intertidal occupancy rates in the Berkeley & Oldbury area (h/y)**

Observation number	Location	Activity	Mud	Mud and sand	Mud and stones	Mud, sand and stones	Rock	Salt marsh	Sand and stones
332	Severn Beach, Shores of River Severn	Walking							12
142	Aust Cliff	Walking							5
143	Aust Cliff	Walking							5

**Notes**

Emboldened observations are the critical group members

The critical group intertidal occupancy rate over mud based on 1 observation is 78 h/y

The observed 97.5<sup>th</sup> percentile rate based on 13 observations for mud is 62 h/y

The critical group intertidal occupancy rate over mud and sand based on 2 observations is 272 h/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations for mud and sand is 272 h/y

The critical group intertidal occupancy rate over mud and stones based on 1 observation is 400 h/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations for mud and stones is 391 h/y

The critical group intertidal occupancy rate over mud, sand and stones based on 2 observations is 120 h/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations for mud, sand and stones is 120 h/y

The critical group intertidal occupancy rate over rock based on 5 observations is 10 h/y

The observed 97.5<sup>th</sup> percentile rate based on 5 observations for rock is 10 h/y

The critical group intertidal occupancy rate over salt marsh based on 6 observations is 428 h/y

The observed 97.5<sup>th</sup> percentile rate based on 27 observations for salt marsh is 603 h/y

The critical group intertidal occupancy rate over sand and stones based on 3 observations is 80 h/y

The observed 97.5<sup>th</sup> percentile rate based on 9 observations for sand and stones is 83 h/y

**Table 16. Children's intertidal occupancy rates in the Berkeley & Oldbury area (h/y)**

**15-year-old age group**

Observation number	Age	Location	Activity	Rock	Salt marsh	Sand and stones
<b>327</b>	<b>15</b>	<b>Aust Cliff, Old Passage</b>	<b>Fossil hunting</b>	<b>10</b>		
		Littleton-on-Severn, Oldbury and Shepperdine	Dog walking		25	
		<b>Aust Cliff, Old Passage</b>	<b>Walking</b>			<b>10</b>
<b>326</b>	<b>13</b>	<b>Aust Cliff, Old Passage</b>	<b>Fossil hunting</b>	<b>10</b>		
		Littleton-on-Severn, Oldbury and Shepperdine	Dog walking		25	
		<b>Aust Cliff, Old Passage</b>	<b>Walking</b>			<b>10</b>
<b>330</b>	<b>13</b>	<b>Aust Cliff, Old Passage</b>	<b>Fossil hunting</b>	<b>10</b>		
		<b>Aust Cliff, Old Passage</b>	<b>Walking</b>			<b>10</b>
<b>358</b>	<b>12</b>	<b>Beachley</b>	<b>Walking</b>		<b>80</b>	

**Notes**

Emboldened observations are the critical group members

The critical group intertidal occupancy rate over rock based on 3 observations in the 15-year-old age group is 10 h/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations for rock is 10 h/y

The critical group intertidal occupancy rate over salt marsh based on 1 observation in the 15-year-age group is 80 h/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations for salt marsh is 77 h/y

The critical group intertidal occupancy rate over sand and stones based on the 3 observations in the 15-year-old age group is 10 h/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations for sand and stones is 10 h/y

**Table 16. Children's intertidal occupancy rates in the Berkeley & Oldbury area (h/y)**

**10-year-old age group**

Observation number	Age	Location	Activity	Rock	Salt marsh	Sand and stones
<b>328</b>	<b>11</b>	<b>Aust Cliff, Old Passage</b>	<b>Fossil hunting</b>	<b>10</b>		
		Littleton-on-Severn, Oldbury and Shepperdine	Dog walking		25	
		<b>Aust Cliff, Old Passage</b>	<b>Walking</b>			<b>10</b>
<b>360</b>	<b>8</b>	<b>Beachley</b>	<b>Walking</b>		<b>80</b>	
117	11	Black Rock	Dog walking		6	
<b>333</b>	<b>7</b>	<b>Severn Beach, River Severn</b>	<b>Walking</b>			<b>12</b>
<b>144</b>	<b>11</b>	<b>Aust Cliff</b>	<b>Walking</b>			<b>5</b>
<b>145</b>	<b>9</b>	<b>Aust Cliff</b>	<b>Walking</b>			<b>5</b>

**Notes**

Emboldened observations are the critical group members

The critical group intertidal occupancy rate over rock based on 1 observation in the 10-year-old age group is 10 h/y

The observed 97.5<sup>th</sup> percentile is not applicable for 1 observation

The critical group intertidal occupancy rate over salt marsh based on 1 observation in the 10-year-old age group is 80 h/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations for salt marsh is 77 h/y

The critical group intertidal occupancy rate over sand and stones based on 4 observations in the 10-year-old age group is 8 h/y

The observed 97.5<sup>th</sup> percentile rate based on 4 observations for sand and stones is 12 h/y

**5-year-old age group**

Observation number	Age	Location	Activity	Salt marsh
<b>359</b>	<b>6</b>	<b>Beachley</b>	<b>Walking</b>	<b>80</b>

**Notes**

Emboldened observations are the critical group members

The critical group intertidal occupancy rate over salt marsh based on the only observation in the 5-year-old age group is 80 h/y

The observed 97.5<sup>th</sup> percentile is not applicable for 1 observation

**Table 17. Gamma dose rate measurements over intertidal substrates in the Berkeley and Oldbury area ( $\mu\text{Gy/h}$ )**

Location	NGR	Substrate	Gamma dose rate at 1 metre <sup>a</sup>
<b>East shore</b>			
Severn Beach	ST 539 856	Stones	0.063
Severn Beach	ST 539 855	Mud	0.065
Northwick Warth	ST 559 882	Salt marsh	0.074
Severn road bridge	ST 565 895	Mud, sand and stones	0.099
Severn road bridge	ST 565 895	Salt marsh	0.079
Littleton Warth	ST 586 911	Salt marsh	0.084
Oldbury Pill	ST 599 930	Salt marsh	0.069
Oldbury power station	ST 604 943	Mud	0.081
Shepperdine	ST 612 961	Salt marsh	0.071
<b>West shore</b>			
Black Rock	ST 514 882	Salt marsh	0.084
Black Rock	ST 514 882	Mud	0.075
Beachley	ST 551 905	Salt marsh	0.071
Lydney Harbour	SO 653 014	Mud	0.082
Newnham	SO 693 119	Salt marsh	0.073

<sup>a</sup> These measurements have not been adjusted for natural background dose rates.

**Table 18. Adults' handling rates of fishing gear and sediment in the Berkeley & Oldbury area (h/y)**

Observation number	Location	Activity	Fishing gear	Sediment
<b>38</b>	<b>Lydney and Alvington</b>	<b>Handling lave nets</b>	<b>495</b>	
<b>16</b>	<b>Aylburton Warth</b>	<b>Handling lave nets and putcher ranks</b>	<b>212</b>	
	<b>Aylburton Warth</b>	<b>Setting up putcher ranks</b>		<b>60</b>
364	Broadoak and north of Berkeley	Handling putcher ranks and push nets	128	
367	Poulton Court	Handling putcher ranks	120	
368	Poulton Court	Handling putcher ranks	120	
369	Lydney	Handling lave nets	100	
15	Lydney	Handling lave nets	91	
<b>370</b>	<b>Hills Flats</b>	<b>Wildfowling</b>		<b>78</b>
<b>18</b>	<b>Aylburton Warth</b>	<b>Setting up putcher ranks</b>		<b>60</b>
<b>19</b>	<b>Aylburton Warth</b>	<b>Setting up putcher ranks</b>		<b>60</b>
<b>372</b>	<b>Frampton, Hills Flats and Poulton Court</b>	<b>Wildfowling</b>		<b>50</b>
1	Black Rock	Handling lave nets	45	
170	Oldbury Pill	Fixing moorings		15

**Notes**

Emboldened observations are the critical group members

The critical group fishing gear handling rate based on 2 observations is 354 h/y

The observed 97.5<sup>th</sup> percentile rate based on 8 observations for fishing gear is 445 h/y

The critical group sediment handling rate based on 5 observations is 62 h/y

The observed 97.5<sup>th</sup> percentile rate based on 6 observations for sediment is 76 h/y

**Table 19. Adults' occupancy rates on water in the Berkeley & Oldbury area (h/y)**

Observation number	Location	Activity	On water
38	Lydney and Alvington	Lave netting	495
336	M4 road bridge to Purton	Sailing	300
337	M4 road bridge to Purton	Sailing	300
128	River Severn	Sailing	288
122	River Severn	Sailing	247
123	River Severn	Sailing	247
124	River Severn	Sailing	247
125	River Severn	Sailing	247
126	River Severn	Sailing	247
127	River Severn	Sailing	240
339	River Severn	Sailing	150
345	River Severn	Inshore rescue	144
346	River Severn	Inshore rescue	144
347	River Severn	Inshore rescue	144
348	River Severn	Inshore rescue	144
349	River Severn	Inshore rescue	144
350	River Severn	Inshore rescue	144
351	River Severn	Inshore rescue	144
352	River Severn	Inshore rescue	144
353	River Severn	Inshore rescue	144
354	River Severn	Inshore rescue	144
338	M4 road bridge to Purton	Sailing	132
364	Broadoak and north of Berkeley power station	Putcher rank fishing and push netting	128
170	River Severn	Sailing	100
171	River Severn	Sailing	100
369	Lydney	Lave netting	100
15	Lydney	Lave netting	91
16	Aylburton Warth	Lave netting	80
172	River Severn	Sailing	80
173	River Severn	Sailing	80
1	Black Rock	Lave netting	45

**Notes**

There were no activities identified occurring in water at the time of the survey

**Table 20. Children's occupancy rates on water in the Berkeley & Oldbury area (h/y)**

Observation number	Age	Location	Activity	On water
<b>15-year-old age group</b>				
341	12	River Severn	Sailing	150
<b>10-year-old age group</b>				
340	9	River Severn	Sailing	150

**Notes**

There were no activities identified occurring in water at the time of the survey



**Table 21. Adults' consumption rates of green vegetables in the Berkeley & Oldbury area (kg/y)**

Observation number	Artichoke	Asparagus	Broccoli	Brussel sprout	Cabbage	Calabrese	Cauliflower	Courgette	Cucumber	Herbs	Kale	Lettuce	Marrow	Spinach	Total
178				5.5	5.5	2.2									13.2
179				5.5	5.5	2.2									13.2
275				1.4	3.4		1.0		5.1		0.9	1.2			13.0
221					11.0								0.7		11.7
222					11.0								0.7		11.7
224					11.0								0.7		11.7
225					11.0								0.7		11.7
226					11.0								0.7		11.7
227					11.0								0.7		11.7
109				11.4											11.4
110				11.4											11.4
111				11.4											11.4
112				11.4											11.4
267					0.3			5.0	5.8						11.1
266					0.3			5.0	5.8						11.1
299			2.9	6.2	1.6										10.7
300			2.9	6.2	1.6										10.7
271					1.1			3.7	4.3						9.1
272					1.1			3.7	4.3						9.1
215										1.5		3.0		4.5	9.0
153		1.2		2.9				2.7	1.8						8.7
277				0.7	1.7		0.5	4.6			0.5	0.6			8.5
278				0.7	1.7		0.5	4.6			0.5	0.6			8.5
152		1.2		2.9					1.8						6.0
185									5.7						5.7
186									5.7						5.7
302	3.6												1.8		5.4
303	3.6												1.8		5.4
86												5.0			5.0
87												5.0			5.0
304				2.7				1.8							4.6
305				2.7				1.8							4.6
118		0.7	0.7						1.0			0.3	1.3		4.0
119		0.7	0.7						1.0			0.3	1.3		4.0
273					0.5			1.5	1.7						3.6
274					0.5			1.5	1.7						3.6

**Table 21. Adults' consumption rates of green vegetables in the Berkeley & Oldbury area (kg/y)**

Observation number	Artichoke	Asparagus	Broccoli	Brussel sprout	Cabbage	Calabrese	Cauliflower	Courgette	Cucumber	Herbs	Kale	Lettuce	Marrow	Spinach	Total
41					2.0				0.8			0.8			3.5
47					2.0				0.8			0.8			3.5
48					2.0				0.8			0.8			3.5
170												3.0			3.0
171												3.0			3.0
181		2.7													2.7
182		2.7													2.7
203		0.2			0.9		0.6	0.5				0.5			2.5
204		0.2			0.9		0.6	0.5				0.5			2.5
205		0.2			0.9		0.6	0.5				0.5			2.5
306				1.4				0.9							2.3
307				1.4				0.9							2.3
308				1.4				0.9							2.3
309				1.4				0.9							2.3
214		0.1			0.7			0.4				0.4			1.6
230	0.1	0.03	0.1	0.1	0.04		0.04		0.3	0.5		0.03		0.02	1.2
231	0.1	0.03	0.1	0.1	0.04		0.04		0.3	0.5		0.03		0.02	1.2
262												1.1			1.1
263												1.1			1.1
264												1.1			1.1
265												1.1			1.1
206		0.1			0.4		0.2	0.2				0.2			1.0
207		0.1			0.4		0.2	0.2				0.2			1.0
209		0.1			0.4		0.2	0.2				0.2			1.0
210		0.1			0.4		0.2	0.2				0.2			1.0
212		0.1			0.4		0.2	0.2				0.2			1.0
213		0.1			0.4		0.2	0.2				0.2			1.0

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 30 highest adult consumers is 27.7 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 99 observations is 43.6 kg/y

Table 22. Adults' consumption rates of other vegetables in the Berkeley & Oldbury area (kg/y)

Observation number	Broad bean	Chilli pepper	French bean	Pea	Pepper	Pumpkin	Runner bean	Squash	Sweetcorn	Tomato	Total
281	10.2						10.2		0.9	28.6	49.9
282	10.2						10.2		0.9	28.6	49.9
201				8.1			28.6			10.8	47.5
202				8.1			28.6			10.8	47.5
215				13.5			13.6			18.0	45.1
262	21.8			3.4			10.2			9.5	44.9
263	21.8			3.4			10.2			9.5	44.9
264	21.8			3.4			10.2			9.5	44.9
265	21.8			3.4			10.2			9.5	44.9
302	11.8			8.8		1.5	17.7		3.0		42.7
303	11.8			8.8		1.5	17.7		3.0		42.7
275	1.4	0.8	0.6	1.8	1.5		8.0			25.2	39.1
219	28.4			1.6			8.7				38.8
220	28.4			1.6			8.7				38.8
256					0.6	1.8	24.5		1.6	6.5	34.9
257					0.6	1.8	24.5		1.6	6.5	34.9
258					0.6	1.8	24.5		1.6	6.5	34.9
301	16.4		2.1	4.1			12.2				34.7
229	1.4		1.2	3.0	1.0	3.9	4.1		4.8	14.3	33.5
228	1.4		1.2	3.0	1.0	3.9	4.1		4.8	14.3	33.5
238	14.3		0.5	1.4		1.8	8.2			5.7	31.9
239	14.3		0.5	1.4		1.8	8.2			5.7	31.9
241	30.5								0.5		31.0
242	30.5								0.5		31.0
297	6.8			3.4			20.4				30.6
298	6.8			3.4			20.4				30.6
176	16.4						10.9			2.9	30.1
177	16.4						10.9			2.9	30.1
178	16.4						10.9			2.9	30.1
179	16.4						10.9			2.9	30.1
323	8.2			8.1			10.2				26.5
324	8.2			8.1			10.2				26.5
235	11.5		0.6	1.1		0.7	6.5			4.6	25.0
236	11.5		0.6	1.1		0.7	6.5			4.6	25.0
237	11.5		0.6	1.1		0.7	6.5			4.6	25.0
86										21.6	21.6

**Table 22. Adults' consumption rates of other vegetables in the Berkeley & Oldbury area (kg/y)**

Observation number	Broad bean	Chilli pepper	French bean	Pea	Pepper	Pumpkin	Runner bean	Squash	Sweetcorn	Tomato	Total
87										21.6	21.6
185							13.6			7.2	20.8
186							13.6			7.2	20.8
260							20.4				20.4
293							20.4				20.4
294							20.4				20.4
299	9.3		1.4	2.3			6.9				19.9
300	9.3		1.4	2.3			6.9				19.9
277	2.0	0.4	0.3	0.9	0.7					12.6	17.0
278	2.0	0.4	0.3	0.9	0.7					12.6	17.0
261							16.3				16.3
221	11.4			0.4			2.2				14.0
222	11.4			0.4			2.2				14.0
224	11.4			0.4			2.2				14.0
225	11.4			0.4			2.2				14.0
226	11.4			0.4			2.2				14.0
227	11.4			0.4			2.2				14.0
259					0.2	0.6	8.2		0.5	4.3	13.8
181							13.6				13.6
182							13.6				13.6
266				1.1	0.7	0.7	6.9	0.2		3.7	13.2
267				1.1	0.7	0.7	6.9	0.2		3.7	13.2
152	2.6		0.9				6.4			3.2	12.9
153	2.6		0.9				6.4			3.2	12.9
88	3.8						7.6				11.3
89	3.8						7.6				11.3
90	3.8						7.6				11.3
194							10.9				10.9
195							10.9				10.9
196							10.9				10.9
197							10.9				10.9
198							10.9				10.9
271				0.8	0.5	0.5	5.1	0.1		2.7	9.7
295	6.8		2.7								9.5
296	6.8		2.7								9.5
272				0.8	0.5	0.2	5.1	0.1		2.7	9.4

**Table 22. Adults' consumption rates of other vegetables in the Berkeley & Oldbury area (kg/y)**

Observation number	Broad bean	Chilli pepper	French bean	Pea	Pepper	Pumpkin	Runner bean	Squash	Sweetcorn	Tomato	Total
240	6.1								3.1		9.2
36	9.1										9.1
37	9.1										9.1
113							9.1				9.1
114							9.1				9.1
188							9.1				9.1
189							9.1				9.1
190							9.1				9.1
191							9.1				9.1
192							9.1				9.1
193							9.1				9.1
118	0.7			1.0			3.3			3.3	8.3
119	0.7			1.0			3.3			3.3	8.3
199		0.2	3.7	2.3				2.0			8.2
203	1.4			1.4		0.4	4.1	0.03	0.3		7.4
204	1.4			1.4		0.4	4.1	0.03	0.3		7.4
205	1.4			1.4		0.4	4.1	0.03	0.3		7.4
214	1.1			1.1		0.3	3.3	0.02	0.2		6.0
200		0.1	2.6	1.6				1.4			5.7
109							5.7				5.7
110							5.7				5.7
111							5.7				5.7
112							5.7				5.7
304					0.5		5.1				5.6
305					0.5		5.1				5.6
230				0.1	0.03	0.1	4.8		0.1	0.4	5.6
231				0.1	0.03	0.1	4.8		0.1	0.4	5.6
147							3.6			1.5	5.1
148							3.6			1.5	5.1
149							3.6			1.5	5.1
183	4.6										4.6
184	4.6										4.6
273				0.7	0.2	0.2	2.0	0.05		1.1	4.2
274				0.7	0.2	0.2	2.0	0.05		1.1	4.2
164							1.8			2.3	4.1
165							1.8			2.3	4.1

**Table 22. Adults' consumption rates of other vegetables in the Berkeley & Oldbury area (kg/y)**

Observation number	Broad bean	Chilli pepper	French bean	Pea	Pepper	Pumpkin	Runner bean	Squash	Sweetcorn	Tomato	Total
166							1.8			2.3	4.1
167							1.8			2.3	4.1
383							3.0				3.0
206	0.5			0.5		0.1	1.6	0.01	0.1		3.0
210	0.5			0.5		0.1	1.6	0.01	0.1		3.0
212	0.5			0.5		0.1	1.6	0.01	0.1		3.0
207	0.5			0.5		0.1	1.6	0.01	0.1		3.0
209	0.5			0.5		0.1	1.6	0.01	0.1		3.0
213	0.5			0.5		0.1	1.6	0.01	0.1		3.0
306					0.2		2.6				2.8
307					0.2		2.6				2.8
308					0.2		2.6				2.8
309					0.2		2.6				2.8
157							1.8			0.9	2.7
158							1.8			0.9	2.7
159							1.8			0.9	2.7
160							1.8			0.9	2.7
161							1.8			0.9	2.7
41							1.5				1.5
47							1.5				1.5
48							1.5				1.5
170										1.1	1.1
171										1.1	1.1

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 46 highest adult consumers is 32.2 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 131 observations is 46.9 kg/y

**Table 23. Adults' consumption rates of root vegetables in the Berkeley & Oldbury area (kg/y)**

Observation number	Beetroot	Carrot	Celeriac	Celery	Garlic	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
219	8.2	6.5				4.9	5.2	6.5		11.5	0.7	19.6		63.0
220	8.2	6.5				4.9	5.2	6.5		11.5	0.7	19.6		63.0
215	8.2	9.0					36.5		0.9					54.6
147	2.9	23.6					23.6	2.9						53.1
148	2.9	23.6					23.6	2.9						53.1
149	2.9	23.6					23.6	2.9						53.1
240	14.8	2.0				6.1	14.6	1.6				6.1		45.2
260		3.2				8.1	7.8	6.5		6.9				32.5
323	3.7	8.1		2.4		4.1	8.1	3.2						29.6
324	3.7	8.1		2.4		4.1	8.1	3.2						29.6
281	4.6	3.4				5.1	13.5	2.0						28.6
282	4.6	3.4				5.1	13.5	2.0						28.6
201	7.4	6.1				10.1		4.9						28.4
202	7.4	6.1				10.1		4.9						28.4
295	12.3	3.4				3.4	2.7	2.7						24.5
296	12.3	3.4				3.4	2.7	2.7						24.5
242	7.0	1.9				2.9	6.9	0.8				2.9		22.4
241	7.0	1.9				2.9	6.9	0.8				2.9		22.4
199	4.2	2.3			0.7	7.0	7.4							21.6
113	6.8	9.1				4.5		0.9						21.3
114	6.8	9.1				4.5		0.9						21.3
297	3.1	3.4				3.4	5.4		0.3	4.8	0.8			21.1
298	3.1	3.4				3.4	5.4		0.3	4.8	0.8			21.1
261		0.5				5.4	5.2	4.3		4.6				20.1
256	5.5	2.0						3.2		7.9	0.9			19.6
257	5.5	2.0						3.2		7.9	0.9			19.6
258	5.5	2.0						3.2		7.9	0.9			19.6
302		5.9					1.2	4.7		6.2				17.9
303		5.9					1.2	4.7		6.2				17.9
238	3.7	4.7				4.7				4.2	0.3			17.7
239	3.7	4.7				4.7				4.2	0.3			17.7
225	3.7	1.6				1.2	1.3	1.6		2.9	0.2	4.9		17.4



**Table 23. Adults' consumption rates of root vegetables in the Berkeley & Oldbury area (kg/y)**

Observation number	Beetroot	Carrot	Celeriac	Celery	Garlic	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
112		5.7												5.7
266	2.1	1.1					0.9	0.9			0.5			5.6
267	2.1	1.1					0.9	0.9			0.5			5.6
207	1.2	0.9				0.5	0.4	0.9	0.1	0.2		0.8	0.3	5.5
213	1.2	0.9				0.5	0.4	0.9	0.1	0.2		0.8	0.3	5.5
209	1.2	0.9				0.5	0.4	0.9	0.1	0.2		0.8	0.3	5.5
210	1.2	0.9				0.5	0.4	0.9	0.1	0.2		0.8	0.3	5.5
212	1.2	0.9				0.5	0.4	0.9	0.1	0.2		0.8	0.3	5.5
206	1.2	0.9				0.5	0.4	0.9	0.1	0.2		0.8	0.3	5.5
86		4.5												4.5
87		4.5												4.5
183		4.5												4.5
184		4.5												4.5
176	2.5					2.0								4.5
177	2.5					2.0								4.5
178	2.5					2.0								4.5
179	2.5					2.0								4.5
118	1.0	1.0				1.0	1.3							4.3
119	1.0	1.0				1.0	1.3							4.3
164		1.8					2.5							4.3
165		1.8					2.5							4.3
166		1.8					2.5							4.3
167		1.8					2.5							4.3
271	1.5	0.8					0.7	0.7			0.4			4.1
272	1.5	0.8					0.7	0.7			0.4			4.1
277	0.6	0.5		1.3		0.3	1.1	0.4						4.1
278	0.6	0.5		1.3		0.3	1.1	0.4						4.1
181						2.3		1.8						4.1
182						2.3		1.8						4.1
47	1.1	1.5				0.8		0.2						3.6
48	1.1	1.5				0.8		0.2						3.6
41	1.1	1.5				0.8		0.2						3.6

**Table 23. Adults' consumption rates of root vegetables in the Berkeley & Oldbury area (kg/y)**

Observation number	Beetroot	Carrot	Celeriac	Celery	Garlic	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
152								2.9						2.9
153								2.9						2.9
273	1.2	0.3					0.3	0.3			0.2			2.3
274	1.2	0.3					0.3	0.3			0.2			2.3
194		1.8												1.8
195		1.8												1.8
196		1.8												1.8
197		1.8												1.8
198		1.8												1.8
188		1.5												1.5
189		1.5												1.5
190		1.5												1.5
191		1.5												1.5
192		1.5												1.5
193		1.5												1.5
230	0.04		0.01			0.1	0.02	0.1						0.2
231	0.04		0.01			0.1	0.02	0.1						0.2

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 23 highest adult consumers is 34.4 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 113 observations is 53.4 kg/y

**Table 24. Adults' consumption rates of potato in the Berkeley & Oldbury area (kg/y)**

Observation number	Potato
107	150.0
108	150.0
219	81.9
220	81.9
256	81.9
257	81.9
258	81.9
260	78.6
109	75.0
110	75.0
111	75.0
112	75.0
302	63.7
303	63.7
261	52.4
88	50.8
89	50.8
90	50.8
170	50.8
171	50.8
147	47.2
148	47.2
149	47.2
176	43.7
177	43.7
178	43.7
179	43.7
113	43.5
114	43.5
91	42.9
92	42.9
93	42.9
94	42.9
262	41.0
263	41.0
264	41.0
265	41.0
301	41.0
181	40.0
182	40.0
281	31.9
282	31.9
194	29.1
195	29.1
196	29.1
197	29.1
198	29.1
259	27.3
297	27.3
298	27.3
275	25.5
238	24.6
239	24.6
299	23.2
300	23.2
266	20.9
267	20.9
152	20.7
153	20.7
221	20.5
222	20.5
224	20.5

**Table 24. Adults' consumption rates of potato in the Berkeley & Oldbury area (kg/y)**

Observation number	Potato
225	20.5
226	20.5
227	20.5
235	19.7
236	19.7
237	19.7
241	17.5
242	17.5
118	16.7
119	16.7
164	15.4
165	15.4
166	15.4
167	15.4
271	15.4
272	15.4
277	12.7
278	12.7
188	12.1
189	12.1
190	12.1
191	12.1
192	12.1
193	12.1
243	9.0
244	9.0
245	9.0
246	9.0
247	9.0
41	7.3
47	7.3
48	7.3
273	6.1
274	6.1
228	5.4
229	5.4
248	4.5
185	3.0
186	3.0
383	3.0
203	2.7
204	2.7
205	2.7
214	2.2
206	1.1
207	1.1
209	1.1
210	1.1
212	1.1
213	1.1
230	0.2
231	0.2

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of potato based on the 20 highest adult consumers is 76.1 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 114 observations is 81.9 kg/y



Table 25. Adults' consumption rates of domestic fruit in the Berkeley & Oldbury area (kg/y)

Observation number	Apple	Blackberry	Blackcurrant	Blueberry	Cherry	Gooseberry	Greengage	Loganberry	Pear	Plum	Quince	Raspberry	Redcurrant	Rhubarb	Strawberry	Tayberry	Whitecurrant	Total
199		2.5	4.9	2.2		3.5						2.9			1.8			17.7
261		1.6	4.5					1.6				0.7	0.9	5.5		1.6		16.4
241			1.6			1.2						8.7		1.0	0.3			12.8
242			1.6			1.2						8.7		1.0	0.3			12.8
256			3.4									3.5			5.1			12.0
257			3.4									3.5			5.1			12.0
258			3.4									3.5			5.1			12.0
304	2.5											2.0			7.1			11.7
305	2.5											2.0			7.1			11.7
200		2.5	1.7	1.5		2.5						2.0			1.2			11.4
41	4.9								4.8									9.7
47	4.9								4.8									9.7
48	4.9								4.8									9.7
42	3.4								3.4			1.1						7.9
43	3.4								3.4			1.1						7.9
44	3.4								3.4			1.1						7.9
204			2.1									0.8		0.3	4.3			7.5
203			2.1									0.8		0.3	4.3			7.5
205			2.1									0.8		0.3	4.3			7.5
306	2.5											1.0			3.6			7.1
307	2.5											1.0			3.6			7.1
308	2.5											1.0			3.6			7.1
309	2.5											1.0			3.6			7.1
214			1.7									0.8		0.2	3.4			6.1
291	4.5									0.9								5.4
292	4.5									0.9								5.4
259			1.1									1.2			2.9			5.1
275	2.0		0.2			0.2				2.0		0.7	0.2					5.1
230	1.7					0.1			0.7	1.4	0.3	0.2	0.2		0.1			4.6



**Table 25. Adults' consumption rates of domestic fruit in the Berkeley & Oldbury area (kg/y)**

Observation number	Apple	Blackberry	Blackcurrant	Blueberry	Cherry	Gooseberry	Greengage	Loganberry	Pear	Plum	Quince	Raspberry	Redcurrant	Rhubarb	Strawberry	Tayberry	Whitecurrant	Total
221												0.2			0.3			0.6
222												0.2			0.3			0.6
224												0.2			0.3			0.6
225												0.2			0.3			0.6
226												0.2			0.3			0.6
227												0.2			0.3			0.6

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 18 highest adult consumers is 51.4 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 93 observations is 68.1 kg/y

**Table 26. Adults' consumption rates of milk in the Berkeley & Oldbury area (l/y)**

Observation number	Milk
<b>174</b>	<b>414.9</b>
<b>175</b>	<b>414.9</b>
<b>109</b>	<b>390.0</b>
<b>110</b>	<b>390.0</b>
<b>111</b>	<b>390.0</b>
<b>112</b>	<b>390.0</b>
<b>88</b>	<b>365.0</b>
<b>89</b>	<b>365.0</b>
<b>90</b>	<b>365.0</b>
<b>183</b>	<b>365.0</b>
<b>184</b>	<b>365.0</b>
<b>293</b>	<b>365.0</b>
<b>294</b>	<b>365.0</b>
<b>194</b>	<b>219.0</b>
<b>195</b>	<b>219.0</b>
<b>196</b>	<b>219.0</b>
<b>197</b>	<b>219.0</b>
<b>198</b>	<b>219.0</b>
<b>91</b>	<b>208.0</b>
<b>92</b>	<b>208.0</b>
<b>93</b>	<b>208.0</b>
<b>94</b>	<b>208.0</b>
<b>147</b>	<b>207.4</b>
<b>148</b>	<b>207.4</b>
<b>149</b>	<b>207.4</b>
<b>164</b>	<b>207.4</b>
<b>185</b>	<b>207.4</b>
<b>186</b>	<b>207.4</b>
<b>292</b>	<b>207.4</b>
<b>181</b>	<b>182.5</b>
<b>182</b>	<b>182.5</b>
<b>376</b>	<b>182.5</b>
<b>80</b>	<b>182.0</b>
<b>81</b>	<b>182.0</b>
84	118.2
166	103.7
167	103.7
291	103.7
82	59.1
83	59.1

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of milk based on the 34 highest adult consumers is 271.6 l/y

The observed 97.5<sup>th</sup> percentile rate based on 40 observations is 414.9 l/y

**Table 27. Adults' consumption rates of cattle meat in the Berkeley & Oldbury area (kg/y)**

Observation number	Beef
<b>243</b>	<b>62.1</b>
<b>244</b>	<b>46.4</b>
<b>245</b>	<b>46.4</b>
<b>246</b>	<b>46.4</b>
<b>247</b>	<b>46.4</b>
<b>98</b>	<b>43.3</b>
<b>99</b>	<b>43.3</b>
<b>100</b>	<b>43.3</b>
<b>101</b>	<b>43.3</b>
<b>102</b>	<b>43.3</b>
<b>103</b>	<b>43.3</b>
<b>104</b>	<b>43.3</b>
<b>105</b>	<b>43.3</b>
<b>106</b>	<b>43.3</b>
<b>157</b>	<b>35.4</b>
<b>158</b>	<b>35.4</b>
<b>248</b>	<b>23.0</b>
<b>91</b>	<b>21.8</b>
<b>92</b>	<b>21.8</b>
<b>93</b>	<b>21.8</b>
<b>94</b>	<b>21.8</b>
147	15.8
148	15.8
149	15.8
159	11.8
160	11.8
161	11.8
201	8.8
202	8.8
203	8.8
204	8.8
205	8.8
215	8.8
262	6.5
263	6.5
264	6.5
265	6.5

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of cattle meat based on the 21 highest adult consumers is 39.0 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 37 observations is 47.9 kg/y

**Table 28. Adults' consumption rates of pig meat in the Berkeley & Oldbury area (kg/y)**

Observation number	Pork
<b>91</b>	<b>38.6</b>
<b>92</b>	<b>38.6</b>
<b>93</b>	<b>38.6</b>
<b>94</b>	<b>38.6</b>
<b>188</b>	<b>16.9</b>
<b>189</b>	<b>16.9</b>
<b>190</b>	<b>16.9</b>
<b>191</b>	<b>16.9</b>
<b>192</b>	<b>16.9</b>
<b>193</b>	<b>16.9</b>
<b>147</b>	<b>15.8</b>
<b>148</b>	<b>15.8</b>
<b>149</b>	<b>15.8</b>
381	6.3
382	6.3

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of pig meat based on the 13 highest adult consumers is 23.3 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 15 observations is 38.6 kg/y

**Table 29. Adults' consumption rates of sheep meat in the Berkeley & Oldbury area (kg/y)**

Observation number	Lamb
<b>243</b>	<b>62.1</b>
<b>244</b>	<b>46.4</b>
<b>245</b>	<b>46.4</b>
<b>246</b>	<b>46.4</b>
<b>247</b>	<b>46.4</b>
<b>248</b>	<b>23.0</b>
292	17.7
91	17.1
92	17.1
93	17.1
94	17.1
107	17.0
108	17.0
147	15.8
148	15.8
149	15.8
109	15.0
110	15.0
111	15.0
112	15.0
291	14.2
201	8.8
202	8.8
203	8.8
204	8.8
205	8.8
215	8.8
383	7.9
118	7.5
119	7.5
262	6.5
263	6.5
264	6.5
265	6.5
42	4.2
43	4.2
44	4.2

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of sheep meat based on the 6 highest adult consumers is 45.1 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 37 observations is 47.9 kg/y

**Table 30. Adults' consumption rates of poultry in the Berkeley & Oldbury area (kg/y)**

Observation number	Duck	Pheasant	Pigeon	Total
<b>215</b>		<b>11.3</b>		<b>11.3</b>
181		2.7		2.7
182		2.7		2.7
91		1.3		1.3
92		1.3		1.3
93		1.3		1.3
94		1.3		1.3
383	1.1			1.1
118		0.9		0.9
119		0.9		0.9
152		0.9		0.9
153		0.9		0.9
185		0.9		0.9
186		0.9		0.9
42		0.7	0.1	0.8
43		0.7	0.1	0.8
44		0.7	0.1	0.8
194		0.7		0.7
195		0.7		0.7
196		0.7		0.7
197		0.7		0.7
198		0.7		0.7
176		0.4		0.4
177		0.4		0.4
178		0.4		0.4
179		0.4		0.4

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of poultry based on the highest adult consumer is 11.3 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 26 observations is 5.9 kg/y

**Table 31. Adults' consumption rates of eggs in the Berkeley & Oldbury area (kg/y)**

Observation number	Chicken egg
<b>291</b>	<b>35.6</b>
<b>292</b>	<b>35.6</b>
<b>41</b>	<b>27.7</b>
<b>47</b>	<b>27.7</b>
<b>48</b>	<b>27.7</b>
<b>228</b>	<b>26.0</b>
<b>229</b>	<b>26.0</b>
<b>118</b>	<b>20.8</b>
<b>119</b>	<b>20.8</b>
<b>230</b>	<b>20.8</b>
<b>231</b>	<b>20.8</b>
<b>176</b>	<b>18.7</b>
<b>177</b>	<b>18.7</b>
<b>178</b>	<b>18.7</b>
<b>179</b>	<b>18.7</b>
<b>43</b>	<b>17.8</b>
<b>84</b>	<b>17.8</b>
<b>85</b>	<b>17.8</b>
<b>107</b>	<b>17.8</b>
<b>108</b>	<b>17.8</b>
<b>281</b>	<b>17.8</b>
<b>282</b>	<b>17.8</b>
<b>91</b>	<b>15.2</b>
<b>92</b>	<b>15.2</b>
<b>93</b>	<b>15.2</b>
<b>94</b>	<b>15.2</b>
<b>42</b>	<b>11.9</b>
44	8.9
275	8.9
203	6.9
204	6.9
205	6.9

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of eggs based on the 27 highest adult consumers is 20.8 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 32 observations is 35.6 kg/y

**Table 32. Adults' consumption rates of wild/free foods in the Berkeley & Oldbury area (kg/y)**

Observation number	Blackberry	Elderberry	Greengage	Hazel nut	Mulberry	Nettle	Sloe	Total
<b>113</b>	<b>6.8</b>							<b>6.8</b>
<b>114</b>	<b>6.8</b>							<b>6.8</b>
<b>228</b>					<b>5.6</b>			<b>5.6</b>
<b>229</b>					<b>5.6</b>			<b>5.6</b>
<b>281</b>			<b>5.0</b>					<b>5.0</b>
<b>282</b>			<b>5.0</b>					<b>5.0</b>
<b>84</b>	<b>2.7</b>						<b>2.3</b>	<b>5.0</b>
<b>85</b>	<b>2.7</b>						<b>2.3</b>	<b>5.0</b>
<b>147</b>	<b>2.3</b>						<b>2.3</b>	<b>4.5</b>
<b>148</b>	<b>2.3</b>						<b>2.3</b>	<b>4.5</b>
<b>149</b>	<b>2.3</b>						<b>2.3</b>	<b>4.5</b>
<b>41</b>	<b>3.0</b>						<b>0.5</b>	<b>3.5</b>
<b>47</b>	<b>3.0</b>						<b>0.5</b>	<b>3.5</b>
<b>48</b>	<b>3.0</b>						<b>0.5</b>	<b>3.5</b>
<b>39</b>	<b>3.4</b>							<b>3.4</b>
<b>40</b>	<b>3.4</b>							<b>3.4</b>
240							1.0	1.0
293							1.0	1.0
294							1.0	1.0
42	0.5			0.2			0.2	0.9
43	0.5			0.2			0.2	0.9
44	0.5			0.2			0.2	0.9
80	0.9							0.9
81	0.9							0.9
88	0.5							0.5
89	0.5							0.5
90	0.5							0.5
181	0.5							0.5
182	0.5							0.5
176	0.3						0.1	0.4
177	0.3						0.1	0.4
178	0.3						0.1	0.4
179	0.3						0.1	0.4
152	0.2							0.2
153	0.2							0.2
157	0.2							0.2
158	0.2							0.2
159	0.2							0.2
160	0.2							0.2
161	0.2							0.2
215							0.2	0.2
230					0.2			0.2
231					0.2			0.2
118		0.04				0.1		0.1
119		0.04				0.1		0.1

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of wild/free foods based on the 16 highest adult consumers is 4.7 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 45 observations is 6.7 kg/y

**Table 33. Adults' consumption rates of rabbits/hares in the Berkeley & Oldbury area (kg/y)**

Observation number	Rabbit
<b>215</b>	<b>10.8</b>
84	3.4
85	3.4
267	2.0
42	0.2
43	0.2
44	0.2
118	0.2
119	0.2

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of rabbits/hares based on the highest adult consumer is 10.8 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 9 observations is 9.3 kg/y

**Table 34. Adults' consumption rates of honey in the Berkeley & Oldbury area (kg/y)**

Observation number	Honey
<b>249</b>	<b>8.3</b>
<b>250</b>	<b>8.3</b>
<b>228</b>	<b>7.1</b>
<b>229</b>	<b>7.1</b>
<b>251</b>	<b>5.8</b>
<b>252</b>	<b>5.8</b>
<b>215</b>	<b>5.4</b>
<b>216</b>	<b>5.4</b>
<b>217</b>	<b>3.2</b>
<b>218</b>	<b>3.2</b>
275	0.7
323	0.5
324	0.5

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of honey based on the 10 highest adult consumers is 5.9 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 13 observations is 8.3 kg/y

**Table 35. Adults' consumption rates of wild fungi in the Berkeley & Oldbury area (kg/y)**

Observation number	Mushrooms
<b>147</b>	<b>2.3</b>
<b>148</b>	<b>2.3</b>
<b>149</b>	<b>2.3</b>
<b>152</b>	<b>1.8</b>
<b>153</b>	<b>1.8</b>
<b>113</b>	<b>1.1</b>
<b>114</b>	<b>1.1</b>
<b>228</b>	<b>1.1</b>
<b>229</b>	<b>1.1</b>
<b>240</b>	<b>1.0</b>
<b>151</b>	<b>0.9</b>
88	0.6
89	0.6
90	0.6
275	0.5
84	0.5
85	0.5
164	0.5
165	0.5
42	0.3
43	0.3
44	0.3
41	0.3
47	0.3
48	0.3
203	0.3
204	0.3
205	0.3
118	0.2
119	0.2
176	0.1
177	0.1
178	0.1
179	0.1

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of wild fungi based on the 11 highest adult consumers is 1.5 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 34 observations is 2.3 kg/y

**Table 36. Adults' consumption rates of venison in the Berkeley & Oldbury area (kg/y)**

Observation number	Venison
<b>215</b>	<b>2.0</b>
<b>267</b>	<b>2.0</b>
<b>42</b>	<b>1.1</b>
<b>43</b>	<b>1.1</b>
<b>44</b>	<b>1.1</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of venison based on the 5 highest adult consumers is 1.5 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 5 observations is 2.0 kg/y

**Table 37. Adults' consumption rates of freshwater fish in the Berkeley & Oldbury area (kg/y)**

Observation number	Rainbow trout
<b>24</b>	<b>10.6</b>
<b>25</b>	<b>10.6</b>
<b>26</b>	<b>10.6</b>
<b>27</b>	<b>10.6</b>
<b>28</b>	<b>10.6</b>
<b>29</b>	<b>10.6</b>
<b>30</b>	<b>10.6</b>
<b>31</b>	<b>10.6</b>
<b>32</b>	<b>10.6</b>
<b>33</b>	<b>10.6</b>
<b>34</b>	<b>10.6</b>
<b>35</b>	<b>10.6</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of freshwater fish based on the 12 highest adult consumers is 10.6 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 12 observations is 10.6 kg/y

**Table 38. Children's consumption rates of green vegetables in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Brussel sprout	Cabbage	Calabrese	Cucumber	Marrow	Total
<b>180</b>	<b>12</b>	<b>5.5</b>	<b>5.5</b>	<b>2.2</b>			<b>13.2</b>
<b>223</b>	<b>13</b>		<b>11.0</b>			<b>0.7</b>	<b>11.7</b>
<b>187</b>	<b>13</b>				<b>5.7</b>		<b>5.7</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 3 highest 15-year-old age group consumers is 10.2 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations is 13.1 kg/y

**10-year-old age group**

Observation number	Age	Artichoke	Asparagus	Broccoli	Brussel sprout	Cabbage	Cauliflower	Courgette	Cucumber	Herbs	Kale	Lettuce	Marrow	Spinach	Total
<b>279</b>	<b>10</b>				<b>0.7</b>	<b>1.7</b>	<b>0.5</b>	<b>4.6</b>			<b>0.5</b>	<b>0.6</b>			<b>8.5</b>
<b>280</b>	<b>8</b>				<b>0.7</b>	<b>1.7</b>	<b>0.5</b>	<b>4.6</b>			<b>0.5</b>	<b>0.6</b>			<b>8.5</b>
<b>268</b>	<b>7</b>					<b>0.9</b>		<b>2.9</b>	<b>3.4</b>						<b>7.3</b>
120	8		0.3	0.3					0.5			0.2	0.7		2.0
121	7		0.3	0.3					0.5			0.2	0.7		2.0
233	8	0.1	0.03	0.1	0.1	0.04	0.04		0.3	0.5		0.03		0.02	1.2
232	10	0.1	0.03	0.1	0.1	0.04	0.04		0.3	0.5		0.03		0.02	1.2
208	7		0.1			0.4	0.2	0.2				0.2			1.0
211	7		0.1			0.4	0.2	0.2				0.2			1.0

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 3 highest 10-year-old age group consumers is 8.1 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 9 observations is 8.5 kg/y

**Table 38. Children's consumption rates of green vegetables in the Berkeley & Oldbury area (kg/y)**

**5-year-old age group**

Observation number	Age	Artichoke	Asparagus	Broccoli	Brussel sprout	Cabbage	Cauliflower	Cucumber	Herbs	Lettuce	Spinach	Total
<b>234</b>	<b>6</b>	<b>0.1</b>	<b>0.03</b>	<b>0.1</b>	<b>0.1</b>	<b>0.04</b>	<b>0.04</b>	<b>0.3</b>	<b>0.5</b>	<b>0.03</b>	<b>0.02</b>	<b>1.2</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the only 5-year-old age group consumer is 1.2 kg/y

The observed 97.5<sup>th</sup> percentile rate is not applicable for 1 observation

**1-year-old age group**

Observation number	Age	Cabbage	Courgette	Cucumber	Total
<b>269</b>	<b>1.5</b>	<b>0.5</b>	<b>1.5</b>	<b>1.7</b>	<b>3.6</b>
<b>270</b>	<b>1.5</b>	<b>0.5</b>	<b>1.5</b>	<b>1.7</b>	<b>3.6</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 2 highest 1-year-old age group consumers is 3.6 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 3.6 kg/y

**Table 39. Children's consumption rates of other vegetables in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Broad bean	Pea	Runner bean	Tomato	Total
<b>180</b>	<b>12</b>	<b>16.4</b>		<b>10.9</b>	<b>2.9</b>	<b>30.1</b>
<b>187</b>	<b>13</b>			<b>13.6</b>	<b>7.2</b>	<b>20.8</b>
<b>223</b>	<b>13</b>	<b>11.4</b>	<b>0.4</b>	<b>2.2</b>		<b>14.0</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 3 highest 15-year-old age group consumers is 21.6 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations is 29.7 kg/y

**10-year-old age group**

Observation number	Age	Broad bean	Chilli pepper	French bean	Pea	Pumpkin	Pepper	Runner bean	Squash	Sweetcorn	Tomato	Total
<b>279</b>	<b>10</b>	<b>2.0</b>	<b>0.4</b>	<b>0.3</b>	<b>0.9</b>	<b>0.7</b>					<b>12.6</b>	<b>17.0</b>
<b>280</b>	<b>8</b>	<b>2.0</b>	<b>0.4</b>	<b>0.3</b>	<b>0.9</b>	<b>0.7</b>					<b>12.6</b>	<b>17.0</b>
<b>283</b>	<b>11</b>	<b>2.0</b>						<b>2.0</b>		<b>0.2</b>	<b>5.7</b>	<b>10.0</b>
<b>284</b>	<b>10</b>	<b>2.0</b>						<b>2.0</b>		<b>0.2</b>	<b>5.7</b>	<b>10.0</b>
<b>285</b>	<b>10</b>	<b>2.0</b>						<b>2.0</b>		<b>0.2</b>	<b>5.7</b>	<b>10.0</b>
<b>286</b>	<b>9</b>	<b>2.0</b>						<b>2.0</b>		<b>0.2</b>	<b>5.7</b>	<b>10.0</b>
<b>287</b>	<b>9</b>	<b>2.0</b>						<b>2.0</b>		<b>0.2</b>	<b>5.7</b>	<b>10.0</b>
<b>288</b>	<b>8</b>	<b>2.0</b>						<b>2.0</b>		<b>0.2</b>	<b>5.7</b>	<b>10.0</b>
<b>268</b>	<b>7</b>				<b>0.7</b>	<b>0.4</b>	<b>0.4</b>	<b>4.1</b>	<b>0.1</b>		<b>2.2</b>	<b>7.8</b>
232	10				0.1	0.03	0.1	4.8		0.1	0.4	5.6
233	8				0.1	0.03	0.1	4.8		0.1	0.4	5.6
120	8	0.3			0.5			1.7			1.7	4.2
121	7	0.3			0.5			1.7			1.7	4.2
208	7	0.5			0.5		0.1	1.6	0.01	0.1		3.0
211	7	0.5			0.5		0.1	1.6	0.01	0.1		3.0
168	8							0.9			1.1	2.0
162	9							0.9			0.5	1.4

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 9 highest 10-year-old age group consumers is 11.3 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 17 observations is 17.0 kg/y

**Table 39. Children's consumption rates of other vegetables in the Berkeley & Oldbury area (kg/y)**

**5-year-old age group**

Observation number	Age	Broad bean	Pea	Pepper	Pumpkin	Runner bean	Sweetcorn	Tomato	Total
<b>289</b>	<b>3</b>	<b>2.0</b>				<b>2.0</b>	<b>0.2</b>	<b>5.7</b>	<b>10.0</b>
<b>234</b>	<b>6</b>		<b>0.1</b>	<b>0.03</b>	<b>0.1</b>	<b>4.8</b>	<b>0.1</b>	<b>0.4</b>	<b>5.6</b>
169	5					0.9		1.1	2.0
163	6					0.9		0.5	1.4

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 2 highest 5-year-old age group consumers is 7.8 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 4 observations is 9.6 kg/y

**1-year-old age group**

Observation number	Age	Pea	Pepper	Pumpkin	Runner bean	Squash	Tomato	Total
<b>269</b>	<b>1.5</b>	<b>0.7</b>	<b>0.2</b>	<b>0.2</b>	<b>2.0</b>	<b>0.05</b>	<b>1.1</b>	<b>4.2</b>
<b>270</b>	<b>1.5</b>	<b>0.7</b>	<b>0.2</b>	<b>0.2</b>	<b>2.0</b>	<b>0.05</b>	<b>1.1</b>	<b>4.2</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 2 highest 1-year-old age group consumers is 4.2 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 4.2 kg/y

**Table 40. Children's consumption rates of root vegetables in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Beetroot	Carrot	Leek	Onion	Parsnip	Shallot	Spring onion	Swede	Total
<b>223</b>	<b>13</b>	<b>3.7</b>	<b>1.6</b>	<b>1.2</b>	<b>1.3</b>	<b>1.6</b>	<b>2.9</b>	<b>0.2</b>	<b>4.9</b>	<b>17.4</b>
<b>180</b>	<b>12</b>	<b>2.5</b>		<b>2.0</b>						4.5

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the highest 15-year-old age group consumer is 17.4 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 17.1 kg/y

**10-year-old age group**

Observation number	Age	Beetroot	Carrot	Celeriac	Celery	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
<b>283</b>	<b>11</b>	<b>0.9</b>	<b>0.7</b>			<b>1.0</b>	<b>2.7</b>	<b>0.4</b>						<b>5.7</b>
<b>284</b>	<b>10</b>	<b>0.9</b>	<b>0.7</b>			<b>1.0</b>	<b>2.7</b>	<b>0.4</b>						<b>5.7</b>
<b>285</b>	<b>10</b>	<b>0.9</b>	<b>0.7</b>			<b>1.0</b>	<b>2.7</b>	<b>0.4</b>						<b>5.7</b>
<b>286</b>	<b>9</b>	<b>0.9</b>	<b>0.7</b>			<b>1.0</b>	<b>2.7</b>	<b>0.4</b>						<b>5.7</b>
<b>287</b>	<b>9</b>	<b>0.9</b>	<b>0.7</b>			<b>1.0</b>	<b>2.7</b>	<b>0.4</b>						<b>5.7</b>
<b>288</b>	<b>8</b>	<b>0.9</b>	<b>0.7</b>			<b>1.0</b>	<b>2.7</b>	<b>0.4</b>						<b>5.7</b>
<b>211</b>	<b>7</b>	<b>1.2</b>	<b>0.9</b>			<b>0.5</b>	<b>0.4</b>	<b>0.9</b>	<b>0.1</b>	<b>0.2</b>		<b>0.8</b>	<b>0.3</b>	<b>5.5</b>
<b>208</b>	<b>7</b>	<b>1.2</b>	<b>0.9</b>			<b>0.5</b>	<b>0.4</b>	<b>0.9</b>	<b>0.1</b>	<b>0.2</b>		<b>0.8</b>	<b>0.3</b>	<b>5.5</b>
<b>279</b>	<b>10</b>	<b>0.6</b>	<b>0.5</b>		<b>1.3</b>	<b>0.3</b>	<b>1.1</b>	<b>0.4</b>						<b>4.1</b>
<b>280</b>	<b>8</b>	<b>0.6</b>	<b>0.5</b>		<b>1.3</b>	<b>0.3</b>	<b>1.1</b>	<b>0.4</b>						<b>4.1</b>
<b>268</b>	<b>7</b>	<b>1.2</b>	<b>0.7</b>				<b>0.5</b>	<b>0.5</b>			<b>0.3</b>			<b>3.3</b>
<b>120</b>	<b>8</b>	<b>0.5</b>	<b>0.5</b>			<b>0.5</b>	<b>0.7</b>							<b>2.2</b>
<b>121</b>	<b>7</b>	<b>0.5</b>	<b>0.5</b>			<b>0.5</b>	<b>0.7</b>							<b>2.2</b>
<b>168</b>	<b>8</b>		<b>0.9</b>				<b>1.2</b>							<b>2.2</b>
233	8	0.04		0.01		0.1	0.02	0.1						0.2
232	10	0.04		0.01		0.1	0.02	0.1						0.2

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 14 highest 10-year-old age group consumers is 4.5 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 16 observations is 5.7 kg/y

**Table 40. Children's consumption rates of root vegetables in the Berkeley & Oldbury area (kg/y)**

**5-year-old age group**

Observation number	Age	Beetroot	Carrot	Celeriac	Leek	Onion	Parsnip	Total
<b>289</b>	<b>3</b>	<b>0.9</b>	<b>0.7</b>		<b>1.0</b>	<b>2.7</b>	<b>0.4</b>	<b>5.7</b>
<b>169</b>	<b>5</b>		<b>0.9</b>			<b>1.2</b>		<b>2.2</b>
234	6	0.04		0.01	0.1	0.02	0.1	0.2

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 2 highest 5-year-old age group consumers is 3.9 kg/y

The observed 97.5 percentile rate based on 3 observations is 5.5 kg/y

**1-year-old age group**

Observation number	Age	Beetroot	Carrot	Onion	Parsnip	Spring onion	Total
<b>269</b>	<b>1.5</b>	<b>1.2</b>	<b>0.3</b>	<b>0.3</b>	<b>0.3</b>	<b>0.2</b>	<b>2.3</b>
<b>270</b>	<b>1.5</b>	<b>1.2</b>	<b>0.3</b>	<b>0.3</b>	<b>0.3</b>	<b>0.2</b>	<b>2.3</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 2 highest 1-year-old age group consumers is 2.3 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 2.3 kg/y

**Table 41. Children's consumption rates of potato in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Potato
<b>180</b>	<b>12</b>	<b>43.7</b>
<b>95</b>	<b>15</b>	<b>42.9</b>
<b>96</b>	<b>13</b>	<b>42.9</b>
<b>223</b>	<b>13</b>	<b>20.5</b>
187	13	3.0

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of potato based on the 4 highest 15-year-old age group consumers is 37.5 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 5 observations is 43.6 kg/y

**10-year-old age group**

Observation number	Age	Potato
<b>97</b>	<b>11</b>	<b>42.9</b>
279	10	12.7
280	8	12.7
268	7	12.3
120	8	8.3
121	7	8.3
168	8	7.7
283	11	6.4
284	10	6.4
285	10	6.4
286	9	6.4
287	9	6.4
288	8	6.4
208	7	1.1
211	7	1.1
232	10	0.2
233	8	0.2

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of potato based on the highest 10-year-old age group consumer is 42.9 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 17 observations is 30.8 kg/y

**Table 41. Children's consumption rates of potato in the Berkeley & Oldbury area (kg/y)**

**5-year-old age group**

Observation number	Age	Potato
<b>169</b>	<b>5</b>	<b>7.7</b>
<b>289</b>	<b>3</b>	<b>6.4</b>
234	6	0.2

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of potato based on the 2 highest 5-year-old age group consumers is 7.0 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations is 7.6 kg/y

**1-year-old age group**

Observation number	Age	Potato
<b>269</b>	<b>1.5</b>	<b>6.1</b>
<b>270</b>	<b>1.5</b>	<b>6.1</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of potato based on the 2 highest 1-year-old age group consumers is 6.1 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 6.1 kg/y

**Table 42. Children's consumption rates of domestic fruit in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Apple	Pear	Plum	Raspberry	Rhubarb	Strawberry	Total
<b>45</b>	<b>12</b>	<b>3.4</b>	<b>3.4</b>		<b>1.1</b>			<b>7.9</b>
<b>180</b>	<b>12</b>	<b>2.3</b>		<b>0.4</b>		<b>0.9</b>		<b>3.6</b>
223	13				0.2		0.3	0.6

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 2 highest 15-year-old age group consumers is 5.7 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations is 7.7 kg/y

**10-year-old age group**

Observation number	Age	Apple	Blackberry	Blackcurrant	Gooseberry	Greengage	Pear	Plum	Quince	Raspberry	Redcurrant	Rhubarb	Strawberry	Tayberry	Whitecurrant	Total
<b>379</b>	<b>11</b>	<b>12.5</b>					<b>3.8</b>									<b>16.3</b>
<b>380</b>	<b>9</b>	<b>12.5</b>					<b>3.8</b>									<b>16.3</b>
<b>120</b>	<b>8</b>	<b>1.7</b>		<b>1.0</b>		<b>0.8</b>	<b>1.7</b>	<b>1.7</b>		<b>0.8</b>	<b>0.3</b>	<b>0.2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.3</b>	<b>9.0</b>
<b>121</b>	<b>7</b>	<b>1.7</b>		<b>1.0</b>		<b>0.8</b>	<b>1.7</b>	<b>1.7</b>		<b>0.8</b>	<b>0.3</b>	<b>0.2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.3</b>	<b>9.0</b>
232	10	1.7			0.1		0.7	1.4	0.3	0.2	0.2		0.1			4.6
233	8	1.7			0.1		0.7	1.4	0.3	0.2	0.2		0.1			4.6
279	10	2.0		0.1	0.1			1.0		0.3	0.2					3.6
280	8	2.0		0.1	0.1			1.0		0.3	0.2					3.6
283	11	1.5	0.1				1.0	1.0								3.6
284	10	1.5	0.1				1.0	1.0								3.6
285	10	1.5	0.1				1.0	1.0								3.6
286	9	1.5	0.1				1.0	1.0								3.6
287	9	1.5	0.1				1.0	1.0								3.6
288	8	1.5	0.1				1.0	1.0								3.6
208	7			0.9						0.4		0.1	1.7			3.1
211	7			0.9						0.4		0.1	1.7			3.1

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 4 highest 10-year-old age group consumers is 12.6 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 16 observations is 16.3 kg/y

**5-year-old age group**

Observation number	Age	Apple	Blackberry	Gooseberry	Pear	Plum	Quince	Raspberry	Redcurrant	Strawberry	Total
<b>234</b>	<b>6</b>	<b>1.7</b>		<b>0.1</b>	<b>0.7</b>	<b>1.4</b>	<b>0.3</b>	<b>0.2</b>	<b>0.2</b>	<b>0.1</b>	<b>4.6</b>
<b>289</b>	<b>3</b>	<b>1.5</b>	<b>0.1</b>		<b>1.0</b>	<b>1.0</b>					<b>3.6</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 2 highest 5-year-old age group consumers is 4.1 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 4.6 kg/y

**Table 43. Children's consumption rates of milk in the Berkeley & Oldbury area (l/y)**

**15-year-old age group**

Observation number	Age	Milk
<b>95</b>	<b>15</b>	<b>208.0</b>
<b>96</b>	<b>13</b>	<b>208.0</b>
<b>187</b>	<b>13</b>	<b>207.4</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of milk based on the 3 highest 15-year-old age group consumers is 207.8 l/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations is 208.0 l/y

**10-year-old age group**

Observation number	Age	Milk
<b>97</b>	<b>11</b>	<b>208.0</b>
<b>168</b>	<b>8</b>	<b>103.7</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of milk based on the 2 highest 10-year-old age group consumers is 155.9 l/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 205.4 l/y

**5-year-old age group**

Observation number	Age	Milk
<b>169</b>	<b>5</b>	<b>103.7</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of milk based on the only 5-year-old age group consumer is 103.7 l/y

The observed 97.5<sup>th</sup> percentile rate is not applicable for 1 observation

**Table 44. Children's consumption rates of cattle meat in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Beef
<b>95</b>	<b>15</b>	<b>21.8</b>
<b>96</b>	<b>13</b>	<b>21.8</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of cattle meat based on the 2 highest 15-year-old age group consumers is 21.8 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 21.8 kg/y

**10-year-old age group**

Observation number	Age	Beef
<b>97</b>	<b>11</b>	<b>21.8</b>
162	9	5.9

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of cattle meat based on the highest 10-year-old age group consumer is 21.8 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 21.4 kg/y

**5-year-old age group**

Observation number	Age	Beef
<b>163</b>	<b>6</b>	<b>5.9</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of cattle meat based on the only 5-year-old age group consumer is 5.9 kg/y

The observed 97.5<sup>th</sup> percentile rate is not applicable for 1 observation

**Table 45. Children's consumption rates of pig meat in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Pork
<b>95</b>	<b>15</b>	<b>38.6</b>
<b>96</b>	<b>13</b>	<b>38.6</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of pig meat based on the 2 highest 15-year-old age group consumers is 38.6 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 38.6 kg/y

**10-year-old age group**

Observation number	Age	Pork
<b>97</b>	<b>11</b>	<b>38.6</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of pig meat based on the only 10-year-old age group consumer is 38.6 kg/y

The observed 97.5<sup>th</sup> percentile rate is not applicable for 1 observation

**Table 46. Children's consumption rates of sheep meat in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Lamb
<b>95</b>	<b>15</b>	<b>17.1</b>
<b>96</b>	<b>13</b>	<b>17.1</b>
45	12	4.2

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of sheep meat based on the 2 highest 15 year old age group consumers is 17.1 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations is 17.1 kg/y

**10-year-old age group**

Observation number	Age	Lamb
<b>97</b>	<b>11</b>	<b>17.1</b>
<b>120</b>	<b>8</b>	<b>3.8</b>
<b>121</b>	<b>7</b>	<b>3.8</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of sheep meat based on the 3 highest 10 year old age group consumers is 8.2 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations is 16.5 kg/y

**Table 47. Children's consumption rates of poultry in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Pheasant	Pigeon	Total
<b>95</b>	<b>15</b>	<b>1.3</b>		<b>1.3</b>
<b>96</b>	<b>13</b>	<b>1.3</b>		<b>1.3</b>
<b>187</b>	<b>13</b>	<b>0.9</b>		<b>0.9</b>
<b>45</b>	<b>12</b>	<b>0.7</b>	<b>0.1</b>	<b>0.8</b>
180	12	0.4		0.4

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of poultry based on the 4 highest 15-year-old age group consumers is 1.1 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 5 observations is 1.3 kg/y

**10-year-old age group**

Observation number	Age	Pheasant
<b>97</b>	<b>11</b>	<b>1.3</b>
<b>120</b>	<b>8</b>	<b>0.5</b>
<b>121</b>	<b>7</b>	<b>0.5</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of poultry based on the 3 highest 10-year-old age group consumers is 0.7 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations is 1.2 kg/y

**Table 48. Children's consumption rates of eggs in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Chicken egg
<b>180</b>	<b>12</b>	<b>18.7</b>
<b>95</b>	<b>15</b>	<b>15.2</b>
<b>96</b>	<b>13</b>	<b>15.2</b>
<b>45</b>	<b>12</b>	<b>8.9</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of eggs based on the 4 highest 15-year-old age group consumers is 14.5 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 4 observations is 18.5 kg/y

**10-year-old age group**

Observation number	Age	Chicken egg
<b>232</b>	<b>10</b>	<b>20.8</b>
<b>233</b>	<b>8</b>	<b>20.8</b>
<b>97</b>	<b>11</b>	<b>15.2</b>
<b>120</b>	<b>8</b>	<b>10.4</b>
<b>121</b>	<b>7</b>	<b>10.4</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of eggs based on the 5 highest 10-year-old age group consumers is 15.5 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 5 observations is 20.8 kg/y

**5-year-old age group**

Observation number	Age	Chicken egg
<b>234</b>	<b>6</b>	<b>20.8</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of eggs based on the only 5-year-old age group consumer is 20.8 kg/y

The observed 97.5<sup>th</sup> percentile rate is not applicable for 1 observation

**Table 49. Children's consumption rates of wild/free foods in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Blackberry	Hazel nut	Sloe	Total
<b>45</b>	<b>12</b>	<b>0.5</b>	<b>0.2</b>	<b>0.2</b>	<b>0.9</b>
180	12	0.3			0.3

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of wild/free foods based on the highest 15-year-old age group consumer is 0.9 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 0.9 kg/y

The rate for observation number 180 is 0.272 kg/y, therefore, it has not been included in the critical group

**10-year-old age group**

Observation number	Age	Blackberry	Elderberry	Greengage	Mulberry	Total
<b>283</b>	<b>11</b>			<b>1.0</b>		<b>1.0</b>
<b>284</b>	<b>10</b>			<b>1.0</b>		<b>1.0</b>
<b>285</b>	<b>10</b>			<b>1.0</b>		<b>1.0</b>
<b>286</b>	<b>9</b>			<b>1.0</b>		<b>1.0</b>
<b>287</b>	<b>9</b>			<b>1.0</b>		<b>1.0</b>
<b>288</b>	<b>8</b>			<b>1.0</b>		<b>1.0</b>
162	9	0.2				0.2
232	10				0.2	0.2
233	8				0.2	0.2
120	8		0.02			0.02
121	7		0.02			0.02

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of wild/free foods based on the 6 highest 10-year-old age group consumers is 1.0 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 11 observations is 1.0 kg/y

**5-year-old age group**

Observation number	Age	Blackberry	Greengage	Mulberry	Total
<b>289</b>	<b>3</b>		<b>1.0</b>		<b>1.0</b>
163	6	0.2			0.2
234	6			0.2	0.2

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of wild/free foods based on the highest 5-year-old age group consumer is 1.0 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 3 observations is 1.0 kg/y

**Table 50. Children's consumption rates of rabbits/hares in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Rabbit
<b>45</b>	<b>12</b>	<b>0.2</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of rabbits/hares based on the only 15-year-old age group consumer is 0.2 kg/y

The observed 97.5<sup>th</sup> percentile rate is not applicable for 1 observation

**10-year-old age group**

Observation number	Age	Rabbit
<b>120</b>	<b>8</b>	<b>0.1</b>
<b>121</b>	<b>7</b>	<b>0.1</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of rabbits/hares based on the 2 highest 10-year-old age group consumers is 0.1 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 0.1 kg/y

**Table 51. Children's consumption rates of honey in the Berkeley & Oldbury area (kg/y)**

**10-year-old age group**

Observation number	Age	Honey
<b>253</b>	<b>7</b>	<b>2.5</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of honey based on the only 10-year-old age group consumer is 2.5 kg/y

The observed 97.5<sup>th</sup> percentile rate is not applicable for 1 observation

**5-year-old age group**

Observation number	Age	Honey
<b>254</b>	<b>5</b>	<b>1.9</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of honey based on the only 5-year-old age group consumer is 1.9 kg/y

The observed 97.5<sup>th</sup> percentile rate is not applicable for 1 observation

**1-year-old age group**

Observation number	Age	Honey
<b>255</b>	<b>1</b>	<b>0.9</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of honey based on the only 1-year-old age group consumer is 0.9 kg/y

The observed 97.5<sup>th</sup> percentile rate is not applicable for 1 observation

**Table 52. Children's consumption rates of wild fungi in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Mushroom
<b>45</b>	<b>12</b>	<b>0.3</b>
180	12	0.1

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of wild fungi based on the highest 15-year-old age group consumer is 0.3 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 0.3 kg/y

The rate for observation number 180 is 0.09 kg/y, therefore, it has not been included in the critical group

**10-year-old age group**

Observation number	Age	Mushroom
<b>120</b>	<b>8</b>	<b>0.1</b>
<b>121</b>	<b>7</b>	<b>0.1</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of wild fungi based on the 2 highest 10-year-old age group consumers is 0.1 kg/y

The observed 97.5<sup>th</sup> percentile rate based on 2 observations is 0.1 kg/y

**Table 53. Children's consumption rates of venison in the Berkeley & Oldbury area (kg/y)**

**15-year-old age group**

Observation number	Age	Venison
<b>45</b>	<b>12</b>	<b>1.1</b>

**Notes**

Emboldened observations are the critical group consumers

The critical group consumption rate of venison based on the only 15-year-old age group consumer is 1.1 kg/y

The observed 97.5<sup>th</sup> percentile rate is not applicable for 1 observation

**Table 54. Percentage contribution each food type makes to its terrestrial food group for adults**

<b>Green vegetables</b>  Cabbage 32.4 % Broccoli 18.8 % Brussel sprout 15.7 % Cucumber 9.3 % <b>Lettuce</b> 6.4 % Courgette 6.3 % Marrow 3.0 % Cauliflower 2.0 % Asparagus 1.5 % Calabrese 1.5 % Artichoke 0.9 % Spinach 0.9 % Kale 0.6 % Herbs 0.6 %	<b>Potato</b>  <b>Potato</b> 100.0 %	<b>Poultry</b>  Pheasant 95.9 % Duck 3.1 % Pigeon 1.0 %		
	<b>Other vegetables</b>  <b>Runner bean</b> 42.9 % Broad bean 28.1 % Tomato 18.1 % Pea 6.3 % Sweetcorn 1.4 % Pumpkin 1.3 % French bean 1.2 % Pepper 0.5 % Squash 0.2 % Chilli pepper 0.09 %	<b>Domestic fruit</b>  <b>Apple</b> 36.4 % Raspberry 13.0 % Strawberry 12.7 % Pear 10.2 % Plum 7.7 % Blackcurrant 6.1 % Gooseberry 3.7 % Rhubarb 3.7 % Blackberry 2.5 % Quince 1.5 % Redcurrant 1.4 % Tayberry 0.3 % Loganberry 0.3 % Blueberry 0.2 % Greengages 0.2 % Whitecurrant 0.09 % Cherry 0.07 %	<b>Eggs</b>  Chicken egg 100.0 %	
		<b>Root vegetables</b>  Carrot 21.9 % <b>Onion</b> 21.7 % Beetroot 18.2 % Leek 12.7 % Shallot 8.6 % Parsnip 8.5 % Swede 6.2 % Spring onion 0.7 % Celery 0.7 % Radish 0.4 % Turnip 0.3 % Garlic 0.08 % Celeriac 0.04 %	<b>Milk</b>  <b>Cow's milk</b> 100.0 %	<b>Wild/free foods</b>  <b>*Blackberry</b> 55.8 % Sloe 19.1 % Mulberry 12.9 % Greengage 11.2 % Hazel nut 0.8 % Nettle 0.1 % Elderberry 0.09 %
			<b>Cattle meat</b>  Beef 100.0 %	<b>Rabbits/hares</b>  Rabbit 100.0 %
			<b>Pig meat</b>  Pork 100.0 %	<b>Honey</b>  <b>Honey</b> 100.0 %
			<b>Sheep meat</b>  Lamb 100.0 %	<b>Wild fungi</b>  Mushroom 100.0 %
				<b>Venison</b>  Venison 100.0 %
				<b>Freshwater fish</b>  Rainbow trout 100.0 %

**Notes**

Food types in emboldened italics were monitored by FSA in 2006 (EA, EHS, FSA and SEPA, 2007).  
Wheat was also monitored.

Percentages are based on the consumption of all adults in the survey consuming that particular food group.

**Table 55. Occupancy rates in the Berkeley & Oldbury direct radiation survey area for adults and children (h/y)**

Observation number	Age (years)	Indoor occupancy	Outdoor occupancy	Total occupancy
<b>Berkeley</b>				
<b>0 - 0.25 km zone</b>				
147	U	3860	4380	8240
148	U	5320	2920	8240
149	U	3860	4380	8240
150	U	0	30	30
<b>&gt;0.25 - 0.5 km</b>				
No one was identified spending time in this zone.				
<b>&gt;0.5 - 1 km zone</b>				
151	U	4910	3580	8490
396	U	2115	0	2115
397	U	2115	0	2115
398	U	2115	0	2115
399	U	0	1763	1763
400	U	0	1763	1763
401	U	0	1763	1763
402	U	0	1763	1763
403	U	0	1763	1763
404	U	0	1763	1763
405	U	0	1763	1763
406	U	0	1763	1763
407	U	0	1763	1763
408	U	0	1763	1763
409	U	0	1763	1763
410	U	0	1763	1763
411	U	0	1763	1763
412	U	0	1763	1763
413	U	0	1763	1763
414	U	0	1763	1763
415	U	0	1763	1763
416	U	0	1763	1763
417	U	1763	0	1763
418	U	1763	0	1763
419	U	1763	0	1763
420	U	1763	0	1763
421	U	1763	0	1763
422	U	1763	0	1763
423	U	1763	0	1763
424	U	1763	0	1763
425	U	1763	0	1763
426	U	1763	0	1763
427	U	1763	0	1763
428	U	1763	0	1763
384	U	1104	0	1104
385	U	1104	0	1104
386	U	1104	0	1104
387	U	1104	0	1104
388	U	1104	0	1104
389	U	1104	0	1104
390	U	1104	0	1104
391	U	1104	0	1104

**Table 55. Occupancy rates in the Berkeley & Oldbury direct radiation survey area for adults and children (h/y)**

Observation number	Age (years)	Indoor occupancy	Outdoor occupancy	Total occupancy
392	U	1104	0	1104
393	U	1104	0	1104
394	U	1104	0	1104
395	U	1104	0	1104
<b>Oldbury</b>				
<b>0 - 0.25 km zone</b>				
318	88	8368	80	8448
153	U	6966	1274	8240
113	U	7004	1120	8124
114	U	7004	1120	8124
47	U	5804	350	6154
41	U	4524	1250	5774
48	U	5274	250	5524
152	U	3660	1460	5120
154	U	2450	350	2800
155	U	1911	273	2184
156	U	1274	182	1456
49	U	0	16	16
50	U	0	16	16
<b>&gt;0.25 - 0.5 km zone</b>				
43	21	4252	3468	7720
165	U	6636	1032	7668
167	U	5780	688	6468
168	8	5780	688	6468
169	5	5780	688	6468
164	U	3981	2064	6045
166	U	5414	294	5708
310	48	0	3450	3450
42	45	1854	416	2270
46	U	1864	0	1864
51	U	1864	0	1864
52	U	1864	0	1864
53	U	1864	0	1864
54	U	1864	0	1864
55	U	1864	0	1864
56	U	1864	0	1864
57	U	1864	0	1864
58	U	1864	0	1864
59	U	1864	0	1864
60	U	1864	0	1864
61	U	1864	0	1864
62	U	1864	0	1864
63	U	1864	0	1864
64	U	1864	0	1864
65	U	1864	0	1864
66	U	1864	0	1864
67	U	1864	0	1864
68	U	1864	0	1864
69	U	1864	0	1864
70	U	1864	0	1864
71	U	1864	0	1864

**Table 55. Occupancy rates in the Berkeley & Oldbury direct radiation survey area for adults and children (h/y)**

Observation number	Age (years)	Indoor occupancy	Outdoor occupancy	Total occupancy
72	U	1864	0	1864
73	U	1864	0	1864
74	U	1864	0	1864
75	U	1864	0	1864
76	U	1864	0	1864
77	U	1864	0	1864
78	U	1864	0	1864
79	U	1864	0	1864
311	51	0	704	704
312	U	0	700	700
313	U	0	700	700
314	U	0	700	700
315	U	0	700	700
316	U	0	700	700
317	U	0	700	700
<b>&gt;0.5 - 1 km zone</b>				
322	1	7530	840	8370
160	U	7572	714	8286
319	37	7170	840	8010
157	U	4074	3850	7924
162	9	6745	448	7192
163	6	6118	1074	7192
320	29	5010	1950	6960
159	U	6198	686	6884
158	U	5924	750	6674
321	16	5879	528	6407
161	U	5838	459	6297

**Notes**

U = Unknown

**Table 56. Analysis of occupancy rates in the Berkeley & Oldbury direct radiation survey area for adults and children**

Number of hours per year	Number of observations
<b>Berkeley</b>	
<b>0 - 0.25 km zone</b>	
8000 to 8760	3
7000 to 8000	0
6000 to 7000	0
5000 to 6000	0
4000 to 5000	0
3000 to 4000	0
2000 to 3000	0
1000 to 2000	0
0 to 1000	1
<b>0 to 8760</b>	<b>4</b>
<b>&gt;0.25 - 0.5 km zone</b>	
<b>0 to 8760</b>	<b>0</b>
<b>&gt;0.5 - 1 km zone</b>	
8000 to 8760	1
7000 to 8000	0
6000 to 7000	0
5000 to 6000	0
4000 to 5000	0
3000 to 4000	0
2000 to 3000	3
1000 to 2000	42
0 to 1000	0
<b>0 to 8760</b>	<b>46</b>
<b>Oldbury</b>	
<b>0 - 0.25 km zone</b>	
8000 to 8760	4
7000 to 8000	0
6000 to 7000	1
5000 to 6000	3
4000 to 5000	0
3000 to 4000	0
2000 to 3000	2
1000 to 2000	1
0 to 1000	2
<b>0 to 8760</b>	<b>13</b>
<b>&gt;0.25 - 0.5 km zone</b>	
8000 to 8760	0
7000 to 8000	2
6000 to 7000	4
5000 to 6000	1
4000 to 5000	0
3000 to 4000	1
2000 to 3000	1
1000 to 2000	30
0 to 1000	7
<b>0 to 8760</b>	<b>46</b>
<b>&gt;0.5 - 1 km zone</b>	
8000 to 8760	3
7000 to 8000	3
6000 to 7000	5
5000 to 6000	0
4000 to 5000	0
3000 to 4000	0
2000 to 3000	0
1000 to 2000	0
0 to 1000	0
<b>0 to 8760</b>	<b>11</b>

**Table 57. Gamma dose rate measurements for the Berkeley & Oldbury direct radiation survey ( $\mu\text{Gy/h}$ )**

Location	Outdoor substrate	Gamma dose rate at 1 metre <sup>a</sup>	Indoor substrate	Gamma dose rate at 1 metre <sup>a</sup>
<b>Berkeley</b>				
House 1	Grass	0.084	Tiles/cement	0.098
House 2	Grass	0.083	Cement	0.096
<b>Oldbury</b>				
House 3	Grass	0.081	Cement	0.095
House 4	Grass	0.081	Tiles/cement	0.071
House 5	Grass	0.077	Quarry tiles	0.094
House 6	Grass	0.083	Concrete with laminate	0.069
House 7	Grass	0.065	Tiles/cement	0.093

	Location	NGR	Substrate	Gamma dose rate at 1 metre
Background 1	Nr Wollaston	ST 581 989	Rough grass	0.069
Background 2	Alveston	ST 620 884	Grass	0.079
Background 3	Tortworth	ST 695 925	Grass	0.070

<sup>a</sup> These measurements have not been adjusted for natural background dose rates.

**Table 58. Combinations of adult pathways for use in dose assessments in the Berkeley & Oldbury area**

Combination number	Fish	Crustaceans	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Freshwater fish	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over mud, sand and stones	Intertidal occupancy over mud	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary			
1	*																				*														
2	*																					*													
3																					*														
4				*	*	*	*	*						*	*				*													*	*	*	
5	*	*	*																									*		*					
6								*				*	*	*	*	*	*	*	*	*												*	*	*	
7									*					*	*	*	*	*	*	*													*	*	
8				*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*															
9							*	*	*	*	*	*	*	*	*	*	*	*	*	*															
10				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*															
11	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12																									*	*	*								
13				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21							*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22												*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23			*																					*	*	*	*	*	*	*	*	*	*	*	*

**Notes**

The food groups and external exposure pathways marked with an asterisk are combined for the corresponding combination number. For example, combination number 1 represents an individual (or individuals) from Annex 1 who had positive data in the following pathways; fish, occupancy over mud and sand, handling fishing gear, handling sediment and occupancy on water.











Annex 1. Adults' consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Berkeley & Oldbury area

Observation number	Sex	Age (years)	Fish	Crustaceans	Wildfowl	Salt marsh grazed cattle	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Freshwater fish	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over mud, sand and stones	Intertidal occupancy over mud	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary		
139	M	U	13.6																					400													
140	M	U	3.7																																		
141	F	U	3.7																																		
142	M	U																																			
143	F	U																																			
146	F	U																																			
147	M	U					5.1	53.1	47.2	29.5	207.4	15.8	15.8	15.8			4.5				2.3													3860	4380		
148	F	U					5.1	53.1	47.2	29.5	207.4	15.8	15.8	15.8			4.5				2.3													5320	2920		
149	M	U					5.1	53.1	47.2	29.5	207.4	15.8	15.8	15.8			4.5				2.3													3860	4380		
150	M	U																																	30		
151	M	U																			0.9													4910	3580		
152	M	U					6.0	12.9	2.9	20.7	3.6					0.9	0.2				1.8													3660	1460		
153	F	U					8.7	12.9	2.9	20.7	3.6					0.9	0.2				1.8														6966	1274	
154	M	U																																	2450	350	
155	M	U																																	1911	273	
156	M	U																																	1274	182	
157	M	U						2.7					35.4					0.2																	4074	3850	
158	F	U						2.7					35.4					0.2																	5924	750	
159	F	U						2.7					11.8					0.2																	6198	686	
160	F	U						2.7					11.8					0.2																	7572	714	
161	M	U						2.7					11.8					0.2																	5838	459	
164	M	U						4.1	4.3	15.4		207.4									0.5														3981	2064	
165	F	U						4.1	4.3	15.4											0.5														6636	1032	
166	M	U						4.1	4.3	15.4		103.7																							5414	294	
167	F	U						4.1	4.3	15.4		103.7																							5780	688	
170	M	U					3.0	1.1	12.5	50.8																	15									15	100









Annex 1. Adults' consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Berkeley & Oldbury area

Observation number	Sex	Age (years)	Fish	Crustaceans	Wildfowl	Salt marsh grazed cattle	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Freshwater fish	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over mud, sand and stones	Intertidal occupancy over mud	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary	
298	F	U					19.6	30.6	21.1	27.3																										
299	M	U					10.7	19.9	11.7	23.2	2.3																									
300	F	U					10.7	19.9	11.7	23.2	2.3																									
301	F	U					18.8	34.7	14.1	41.0	4.1																									
302	M	U					5.4	42.7	17.9	63.7																										
303	F	U					5.4	42.7	17.9	63.7																										
304	F	U					4.6	5.6			11.7																									
305	M	U					4.6	5.6			11.7																									
306	F	U					2.3	2.8			7.1																									
307	M	U					2.3	2.8			7.1																									
308	F	U					2.3	2.8			7.1																									
309	M	U					2.3	2.8			7.1																									
310	F	48																																		3450
311	F	51																																		704
312	U	U																																		700
313	U	U																																		700
314	U	U																																		700
315	U	U																																		700
316	U	U																																		700
317	U	U																																		700
318	M	88																																		8368
319	F	37																																		80
320	M	29																																		7170
323	F	U					23.8	26.5	29.6		49.5									0.5															5010	
324	M	U					23.8	26.5	29.6		49.5									0.5																1950
325	F	41																										10	10	25						







Annex 1. Adults' consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Berkeley & Oldbury area

Observation number	Sex	Age (years)	Fish	Crustaceans	Wildfowl	Salt marsh grazed cattle	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Freshwater fish	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over mud, sand and stones	Intertidal occupancy over mud	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary		
418	U	U																																	1763		
419	U	U																																		1763	
420	U	U																																		1763	
421	U	U																																		1763	
422	U	U																																		1763	
423	U	U																																		1763	
424	U	U																																		1763	
425	U	U																																		1763	
426	U	U																																		1763	
427	U	U																																		1763	
428	U	U																																		1763	
429	M	U																																	35		
430	M	U																																	35		
431	M	U																																	35		
432	M	80																																	<b>560</b>		

**Notes**

Emboldened observations are included in the critical groups.

U = Unknown

**Annex 2. Children's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Berkeley & Oldbury area**

Observation number	Sex	Age (years)	Fish	Wildfowl	Salt marsh grazed cattle	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary		
<b>15-year-old age group</b>																													
45	M	12								7.9				4.2	0.8	8.9	0.9	0.2			0.3	1.1							
95	M	15							42.9		208.0	21.8	38.6	17.1	1.3	15.2													
96	F	13							42.9		208.0	21.8	38.6	17.1	1.3	15.2													
131	M	15	0.9																										
180	M	12				13.2	30.1	4.5	43.7	3.6				0.4	18.7	0.3				0.1									
187	F	13				5.7	20.8		3.0		207.4			0.9															
223	M	13				11.7	14.0	17.4	20.5	0.6																			
321	F	16																								5879	528		
326	M	13																				10	10	25					
327	F	15																				10	10	25					
330	F	13																				10	10						
341	M	12																							150				
358	F	12																							80				
<b>10-year-old age group</b>																													
97	M	11							42.9		208.0	21.8	38.6	17.1	1.3	15.2													
117	F	11																								6			
120	M	8	0.3	0.1		2.0	4.2	2.2	8.3	9.0				3.8	0.5	10.4	0.02	0.1		0.1									
121	F	7	0.3	0.1		2.0	4.2	2.2	8.3	9.0				3.8	0.5	10.4	0.02	0.1		0.1									
144	M	11																								5			
145	F	9																								5			



**Annex 2. Children's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Berkeley & Oldbury area**

Observation number	Sex	Age (years)	Fish	Wildfowl	Salt marsh grazed cattle	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary	
379	F	11			<b>18.9</b>					<b>16.3</b>																		
380	M	9			<b>18.9</b>					<b>16.3</b>																		
<b>5-year-old age group</b>																												
163	M	6					1.4					<b>5.9</b>					0.2										6118	1074
169	F	5					2.0	<b>2.2</b>	<b>7.7</b>		<b>103.7</b>																5780	688
234	F	6				<b>1.2</b>	<b>5.6</b>	0.2	0.2	<b>4.6</b>						<b>20.8</b>	0.2											
254	F	5																	<b>1.9</b>									
289	M	3					<b>10.0</b>	<b>5.7</b>	<b>6.4</b>	<b>3.6</b>							<b>1.0</b>											
359	F	6																							<b>80</b>			
<b>1-year-old age group</b>																												
255	M	1																	<b>0.9</b>									
269	F	1.5				<b>3.6</b>	<b>4.2</b>	<b>2.3</b>	<b>6.1</b>																			
270	M	1.5				<b>3.6</b>	<b>4.2</b>	<b>2.3</b>	<b>6.1</b>																			
322	M	1																									7530	840

**Notes**

Emboldened observations are included in the critical groups.

**Annex 3. Qualitative and estimated data for use in dose assessment**

	Details of activity	Exposure pathways involved	Estimated rate
1	Elver fishing on the River Severn	Occupancy over mud	Experience from other habits surveys suggest rates are unlikely to exceed 200 hours per year

#### Annex 4. Ratios for determining child consumption and occupancy rates for dose assessments

Group	Ratio child/adult <sup>a</sup>	
	1-year-old	10-year-old
Fish <sup>b</sup>	0.050	0.200
Crustaceans <sup>b</sup>	0.050	0.250
Molluscs <sup>b</sup>	0.050	0.250
Green vegetables	0.222	0.444
Other vegetables	0.200	0.500
Root vegetables	0.375	0.500
Potatoes	0.292	0.708
Domestic fruit	0.467	0.667
Milk	1.333	1.000
Cattle meat	0.222	0.667
Pig meat	0.138	0.625
Sheep meat	0.120	0.400
Poultry	0.183	0.500
Eggs	0.600	0.800
Wild/free foods <sup>c</sup>	0.110	0.490
Game <sup>d</sup>	0.140	0.500
Honey	0.789	0.789
Wild fungi	0.150	0.450
Freshwater fish <sup>b</sup>	0.050	0.250
Direct radiation	1.000	1.000
External exposure	0.030	0.500
Plume	1.000	1.000

#### Notes

<sup>a</sup> The age groups suggested for assessment in this table are those relating to dose coefficients representing 1 to 2-year-olds (labelled 1-year-old) and 7 to 12-year-olds (labelled 10-year-old). Excepting notes <sup>b</sup> and <sup>c</sup>, consumption ratios were derived from Byrom *et al.*, (1995) for 1-year-old (6 to 12 months) and 10-year-old children (10 to 11 years).

<sup>b</sup> Ratios were derived from Smith and Jones, (2003) which presented data for infants and children.

<sup>c</sup> Ratios were derived from FSA data for wild fruit and nuts for infants and 10-yr-old children.

<sup>d</sup> Game includes rabbits/hares and venison.

Annex 5. Summary of adults' profiled consumption data (kg/y or l/y) and occupancy data (h/y) in the Berkeley & Oldbury area

Profile Name	Number of individuals	Pathway Name																							
		Crustacea	Direct <sup>a</sup>	Eggs	Fish - Freshwater	Fish - Sea	Fruit - Domestic	Fruit and Nuts - Wild	Gamma ext - Sediment <sup>b</sup>	Honey	Meat - Cattle	Meat - Game <sup>c</sup>	Meat - Pig	Meat - Poultry	Meat - Sheep	Milk	Mushrooms	Occupancy on water	Plume (IN; 0-0.25km) <sup>d</sup>	Plume (MID; 0.25-0.5km) <sup>5</sup>	Plume (OUT; >0.5-1km) <sup>d</sup>	Vegetables - Green	Vegetables - Other Domestic	Vegetables - Potatoes	Vegetables - Root
Crustacean consumers	1	2.7				1.6					0.6							130							
Occupants for direct radiation	114		1	1			2.3	0.4		1.3		0.4		0.5	9.1	0.1		760	880	1160	0.6	0.8	3.1	2.1	
Egg consumers	27		0.2	20.8			15.4	1.7		0.5	3.2	0.4	5.7	0.4	5.8	46.7	0.2	650	370		4.7	11.8	28.7	4.1	
Freshwater fish consumers	12				10.6																				
Sea fish consumers	19					14.2			80									30							
Domestic fruit consumers	18		0.3	5.2		0.1	51.4	2.2		0.8	8.9		2.6	0.1	4.5	34.6	0.7	2280			19.5	16.3	15.2	24.2	
Wild fruit and nut consumers	16		0.5	12.9			28.1	4.7		0.9	3	0.4	3		3	46.3	0.8	3650			6.6	12.8	20.3	17.8	
Occupants for exposure - Sediment	3			2.3		4.5	2.5		730		2.9				2.9		0.1				0.8	2.5	0.9	4.5	
Honey consumers	10			5.2			19.7	1.1		5.9	0.9	1.3	1.1	0.9			0.2				6.1	11.2	1.1	7	
Cattle meat consumers	23		0.1	2.7			2.8			39.7			6.7	0.2	14.7	36.2				630		0.2	9.6		
Game meat consumers	2						11	0.1		2.7	4.4	9.5		5.6	4.4			50			4.5	22.6		27.3	
Pig meat consumers	13		0.2	4.7			6.8	1		15.1		23.3	0.4	8.9	111.9	0.5		1900				5.4	29.7	12.9	
Poultry meat consumers	1						22	0.2		5.4	8.8	13		11	8.8						9	45.1		54.6	
Sheep meat consumers	6									45.1					45.1									8.3	
Milk consumers	34		0.1	2.8			3	0.6			4		5.9	0.5	5.7	271.6	0.3	730	180		3.1	7.3	29.8	6.6	
Mushroom consumers	11		0.7	4.7			39	3.6		1.3	4.3		4.3	0.2	4.3	56.6	1.5	4940		770	13.4	12.3	25.5	24.4	
Occupants on water	10	0.1				0.7												290							
Occupants for plume pathways (inner area)	11		1	7.6			22.4	3.5		4.3		4.3	0.2	4.3	56.6	1.2		7290			6.2	5.8	26.5	19.9	
Occupants for plume pathways (middle area)	6		1	3			1.3	0.2			0.2		0.1	0.7	69.1	0.2		6180			2.7	10.3	2.9		
Occupants for plume pathways (outer area)	8		1					0.1			13.3						0.1			7440			1.7		
Green vegetable consumers	30		0.1	1.7			26.2	0.9		0.5	0.6				0.6		0.2	540			27.7	26.4	29.2	24	
Other domestic vegetable consumers	46			3.7			15.4	0.5		0.5	1.1	0.3		0.3	1.1	24.9	0.1				16.7	32.2	29.8	17.3	
Potato consumers	20			1.8			4	0.1							4.7	132.8	0.1	10			16.8	18.2	76.1	16	
Root vegetable consumers	23		0.2	1.5			29.8	1.7		0.3	3.2	0.6	2.1	0.5	3.2	27.1	0.4	1780			20.5	25.4	27.1	34.4	

**Notes**

- <sup>a</sup> Direct radiation is expressed as a proportion of the group who are present within 1 km of the site
- <sup>b</sup> Gamma ext - sediment includes occupancy over mud, mud & sand, mud, sand & stones, salt marsh, sand, and sand & stones
- <sup>c</sup> Game meat includes rabbits/hares, venison and wildfowl
- <sup>d</sup> Plume times are the sums of individuals' indoor and outdoor times









Annex 6. Female consumption (kg/y or l/y) and occupancy rates (h/y) in the Berkeley & Oldbury area, for use in foetal dose assessments

Observation number	Sex	Age (years)	Fish	Crustaceans	Wildfowl	Salt marsh grazed cattle	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Freshwater fish	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over mud, sand and stones	Intertidal occupancy over mud	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary		
259	F	U					15.5	13.8	9.2	27.3	5.1																										
261	F	U					24.5	16.3	20.1	52.4	16.4																										
263	F	U					1.1	44.9	10.5	41.0	18.0		6.5		6.5														52								
264	F	U					1.1	44.9	10.5	41.0	18.0		6.5		6.5																						
266	F	U					11.1	13.2	5.6	20.9																											
271	F	U					9.1	9.7	4.1	15.4																											
275	F	U					13.0	39.1	8.7	25.5	5.1						8.9			0.7	0.5																
276	F	U									2.0																										
277	F	U					8.5	17.0	4.1	12.7	3.6																										
281	F	U						49.9	28.6	31.9	17.8						17.8	5.0																			
291	F	U									5.4	103.7			14.2	35.6																					
293	F	U						20.4	6.2		1.0	365.0					1.0																				
296	F	U					33.0	9.5	24.5		38.7																										
298	F	U					19.6	30.6	21.1	27.3																											
300	F	U					10.7	19.9	11.7	23.2	2.3																										
301	F	U					18.8	34.7	14.1	41.0	4.1																										
303	F	U					5.4	42.7	17.9	63.7																											
304	F	U					4.6	5.6			11.7																										
306	F	U					2.3	2.8			7.1																										
308	F	U					2.3	2.8			7.1																										
319	F	37																																	7170	840	
321	F	16																																	5879	528	
323	F	U					23.8	26.5	29.6		49.5									0.5																	
325	F	41																										10	10	25							

Annex 6. Female consumption (kg/y or l/y) and occupancy rates (h/y) in the Berkeley & Oldbury area, for use in foetal dose assessments

Observation number	Sex	Age (years)	Fish	Crustaceans	Wildfowl	Salt marsh grazed cattle	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Freshwater fish	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over mud, sand and stones	Intertidal occupancy over mud	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary		
339	F	40																																			
350	F	U																								4										144	
351	F	U																								4										144	
352	F	U																								4										144	
353	F	U																								4										144	
354	F	U																								4										144	
357	F	38	2.3																																		
365	F	U	1.6	0.6																																	
371	F	U		0.7																																	
373	F	40		2.1																																	
378	F	41			47.3						32.5																										
382	F	U												6.3																							
327	F	15																									10	10	25								

**Notes**

U = Unknown

## About us

Cefas is a multi-disciplinary scientific research and consultancy centre providing a comprehensive range of services in fisheries management, environmental monitoring and assessment, and aquaculture to a large number of clients worldwide.

We have more than 500 staff based in 3 laboratories, our own ocean-going research vessel, and over 100 years of fisheries experience.

We have a long and successful track record in delivering high-quality services to clients in a confidential and impartial manner.  
([www.cefas.co.uk](http://www.cefas.co.uk))

Cefas Technology Limited (CTL) is a wholly owned subsidiary of Cefas specialising in the application of Cefas technology to specific customer needs in a cost-effective and focussed manner.

CTL systems and services are developed by teams that are experienced in fisheries, environmental management and aquaculture, and in working closely with clients to ensure that their needs are fully met.  
([www.cefastechnology.co.uk](http://www.cefastechnology.co.uk))

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## Customer focus

With our unique facilities and our breadth of expertise in environmental and fisheries management, we can rapidly put together a multi-disciplinary team of experienced specialists, fully supported by our comprehensive in-house resources.

Our existing customers are drawn from a broad spectrum with wide ranging interests. Clients include:

- international and UK government departments
- the European Commission
- the World Bank
- Food and Agriculture Organisation of the United Nations (FAO)
- oil, water, chemical, pharmaceutical, agro-chemical, aggregate and marine industries
- non-governmental and environmental organisations
- regulators and enforcement agencies
- local authorities and other public bodies

We also work successfully in partnership with other organisations, operate in international consortia and have several joint ventures commercialising our intellectual property.