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Radiological Habits Survey: Harwell, 2007

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Radiological Habits Survey: Harwell, 2007

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FIGURES

TABLES

ANNEXES

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 United Kingdom Atomic Energy Authority nuclear research facility at Harwell in Oxfordshire. The last research reactors were shut down in the early 1990s and the site is undergoing decommissioning. There are a number of tenant organisations on the site, some of which handle radioactive materials. The site discharges gaseous radioactive waste via stacks to the atmosphere, liquid radioactive waste via an outfall into the River Thames at Sutton Courtenay and contains sources of direct radiation. Surface water run-off from the site is discharged into Lydebank Brook. One of the tenants on the site has an application pending for an authorisation to make radioactive liquid discharges to the water utility company's foul sewer. It is anticipated that other tenants will apply for authorisations to discharge to the sewer in the near future. Neighbouring organisations, situated outside the licensed site boundary, are already making liquid discharges to the sewer.

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 site perimeter fence
- The consumption of locally sourced aquatic foods
- Activities and occupancy over river bank substrates
- The handling of fishing gear and sediment
- Activities and occupancy in and on water
- New or unusual practices such as the transfer of contamination off-site by wildlife
- The discharge of liquid waste to the water utility company's foul sewer (a site-specific issue, as requested by the Environment Agency)

Interviews were conducted with members of the public and data collected for 453 individuals are presented and discussed. High rates of consumption, occupancy and handling are identified by using the 'cut off' method and 97.5th 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. (Fish caught in lakes and streams, which were subject to potential exposure to gaseous discharges, were recorded separately from fish caught in the river, which were potentially exposed to liquid discharges, and were included in the terrestrial survey). Foods consumed from the aquatic survey area were fish from the river and freshwater crustaceans. The only foods consumed by the respective critical groups for these food groups were perch and signal crayfish. Generic 97.5th percentile rates have not been determined for fish from the river or freshwater crustaceans. The critical group riverbank occupancy rate was calculated for anglers. The critical group handling rate for fishing gear was calculated for a hobby fisherman. No sediment handling was identified during the survey. People were undertaking water based activities such as swimming, kayaking, canoeing, rowing, sailing, houseboat dwelling and cruising. Occupancy in close proximity to sewage and sewage products was identified. Cattle were observed drinking river water. The consumption or use of freshwater plants was not identified.

The terrestrial survey covered an area up to 5 km from the site centre and included some watercourses that extended beyond the 5 km area. In this area, internal exposure pathways were investigated because of the potential effects from gaseous discharges. Food production was identified at 19 farms in the area (including beef cattle, pigs, lamb, dairy cattle, chickens eggs, fruit and arable), five allotment sites and several private gardens. Honey was produced from the hives of five beekeepers. Rainbow trout were consumed from a trout farm and a stocked sport fishery, and the consumption of wild brown trout caught from streams was also identified. For foods consumed from the terrestrial survey area, the mean critical group consumption rates exceeded the respective generic 97.5th percentile rates for green

vegetables, root vegetables, cattle meat, pig meat, sheep meat and honey. Other local foods consumed were other vegetables, potato, domestic fruit, milk, poultry, eggs, wild/free foods, rabbits/hares, wild fungi, venison and fish from lakes and streams. Two vineyards were identified and the wine produced was sold locally. Flour milled from cereal grown on a farm in the area was also on sale. Human consumption of well water and borehole water was identified at approximately 260 residential and business properties. Livestock were drinking stream, ditch, river, borehole and well water.

Investigations into the off-site transfer of radioactive contamination by wildlife established that although rabbits, pigeons and deer were found on site, they were not considered by the site operators to be a pest problem within the perimeter fence. Some members of the public who lived in the terrestrial survey area were consuming rabbits that were shot within the immediate vicinity of the site and others were consuming rabbits, pigeons and deer that were shot within 5 km of the site.

The direct radiation survey covered an area out to 1 km from the licensed site boundary. In this area, external pathways were investigated because of potential effects from ionising radiation. The highest outdoor occupancy rate was for three people who lived and worked at horse stables in the area; the highest indoor occupancy rate was for a resident. Occupancy rates were also recorded for people at work and children at a primary school. Two nursery schools were located in the area.

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 survey conducted in 1991 and the previous terrestrial survey conducted in 1999. No surveys for direct radiation have previously been carried out by Cefas so comparisons were not possible.

In the 2007 aquatic survey critical group mean consumption rates were calculated for fish from the river and freshwater crustaceans but no consumption of these food groups was identified in the 1991 survey. Adult critical group mean occupancy rate over riverbank mud was 360 h/y in 1991 and increased to 420 h/y over mud and grass in 2007. Fishing gear handling was identified in 2007 but not in 1991. Sediment handling was not identified in either survey. Occupancy rates in and on water and in close proximity to sewage products were obtained in 2007 but these pathways were not investigated in 1991.

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 1999. Food groups with significant increases in consumption rates in 2007 were: domestic fruit, from 37 kg/y to 63 kg/y; pig meat, from 21 kg/y to 49 kg/y; and wild/free food from 3.1 kg/y to 17 kg/y. Food groups with significant decreases in consumption rates in 2007 were: green vegetables, from 78 kg/y to 46 kg/y; other vegetables, from 73 kg/y to 28 kg/y; potato, from 97 kg/y to 50 kg/y; milk from 310 l/y to 59 l/y; poultry from 44 kg/y to 6.0 kg/y; eggs from 21 kg/y to 12 kg/y; venison from 11 kg/y to 5.0 kg/y; and fish from lakes and streams from 17 kg/y to 4.9 kg/y.

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 samples of signal crayfish, mushrooms, runner beans, rabbit and one of beef, pork or lamb; replacing a sample of pike with a sample of perch and replacing beetroot with onion; adding samples of river water and sediment from Clifton Hampton and a sample of sewage cake from Didcot Sewage Works.

1 INTRODUCTION

The public may be exposed to radiation as a result of the operations of the Harwell site 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) (now part of the Department for Environment, Food and Rural Affairs (Defra)) in 2000 (DETR, 2000a) and the Welsh Assembly in 2002 (The Welsh Assembly Government, 2002). 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 take place 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 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 where they live and their 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 (CEC, 1996). 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 includes 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

At the time of the survey the Harwell nuclear licensed site was operated by the United Kingdom Atomic Energy Authority (UKAEA) on behalf of the Nuclear Decommissioning Authority (NDA). It is anticipated that the operation of the site will be transferred to a new entity called Research Sites Restoration Ltd, probably early in 2009. The nuclear site forms part of the Harwell Science and Innovation Campus and is situated approximately 5 km southwest of the town of Didcot in Oxfordshire. The site opened in 1946 and was once the headquarters of the UK civil nuclear research programme, providing a range of reactors and other research facilities. In the early 1990s, the last research reactors were shut down and the site is currently being decommissioned and restored. Some areas of land that were previously part of the licensed site have already been delicensed, and it is proposed that, subject to funding and other constraints, the site will be progressively delicensed with the aim of delicensing the entire current nuclear licensed site, if possible by 2025.

GE Healthcare occupies buildings in two small areas embedded within the UKAEA licensed site, each with their own nuclear site licence. There are also several other tenant organisations operating within the UKAEA licensed site and some of these handle radioactive materials. The Harwell site produces liquid and gaseous discharges and contains sources of direct radiation. Routine operational discharges have ceased and current discharges are the result of decommissioning activities.

A revised discharge authorisation for UKAEA at Harwell came into effect in 2003 and a revised discharge authorisation for GE Healthcare at Harwell came into effect in 2005. In 2006 UKAEA received an authorisation to control transfers of wastes on to the licensed site from areas of UKAEA land outside the nuclear site boundary.

Under NIA 65, both UKAEA and GE Healthcare hold site licences that allow the installation and operation of certain activities. Under RSA 93, UKAEA, GE Healthcare and other tenants each hold separate authorisations to discharges radioactive wastes into the environment. The releases include the discharge of gaseous radioactive waste to the atmosphere and liquid radioactive waste via an outfall to the River Thames at Sutton Courtenay. Surface water run-off from the site is discharged into Lydebank Brook. One of the tenant organisations has an application pending for an authorisation to discharge liquid radioactive waste to Didcot Sewage Treatment Works via the water utility company's sewer. Other tenants are expected to apply for authorisations to discharge to the sewer in the near future. Details of the amounts of radioactive waste discharged in 2006 have been published (EA, EHS, FSA and SEPA, 2007).

There are three other organisations that may handle small amounts of radioactive materials that are situated on the campus but outside the boundary of the UKAEA licensed site. These organisations do not require nuclear site licences and are not explicitly covered in this report. However, they may transfer liquid waste to UKAEA and any such waste is then included with that of UKAEA. These organisations discharge liquid waste to the sewer.

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 Harwell nuclear site. 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 site perimeter fence
- The consumption of locally sourced aquatic foods
- Activities and occupancy over river bank substrates
- The handling of fishing gear and sediment
- Activities and occupancy in and on water
- New or unusual practices such as the transfer of contamination off-site by wildlife

Additionally, the following issue was investigated, as the result of a site-specific request from the Environment Agency:

- Potential exposure pathways arising from the discharge of liquid waste to the water utility company's foul sewer.

2.3 Survey areas

Three survey areas were defined to encompass the dominant activities expected for aquatic, terrestrial and direct radiation pathways.

The aquatic survey area (Figure 1) extended from the liquid effluent discharge point across a weir in a backwater at Sutton Courtenay, known as Mill Cut, and downstream along the River Thames to Day's Lock, a distance of approximately 10 km. Moor Ditch, which carries treated effluent from Didcot Sewage Treatment Works to the Thames at Little Wittenham was also included since some tenant organisations will soon discharge liquid waste to the sewage works. UKAEA is authorised to make liquid discharges to Lydebank Brook. However, since the discharges to the brook are only surface water run-off, which is only likely to be affected by washout of gaseous discharges, Lydebank Brook and the watercourses connecting it to the River Thames have been included in the terrestrial survey area.

The same section of the River Thames was covered in both the 2007 survey and the previous aquatic habits survey conducted by Cefas in the Harwell area, which was in 1991 (Thurston *et*

al., 1993). Moor Ditch was included in the 2007 survey but was not included in the 1991 survey. Lydebank Brook and the watercourses connecting it to the Thames were included in the aquatic survey area in 1991 but in 2007 they are included in the terrestrial survey area.

The terrestrial survey area, shown in Figure 2, was defined as the circle to a radius of 5 km from the Harwell site centre (NGR SU 471 867) to encompass the main areas of potential deposition from gaseous discharges. Activities relating to groundwater and surface water in the terrestrial area were also investigated. Watercourses and areas potentially containing contamination only from washout of gaseous discharges are discussed in the terrestrial sections of this report. As described earlier, this includes the watercourses from Lydebank Brook to the Thames (Figure 3), which extend beyond the 5 km radius. The survey area was broadly similar to that used in the last terrestrial habits survey conducted by Cefas in the Harwell area, which was in 1999 (Tipple *et al*., 1999). Since the 1999 survey, the site centre and hence the 2007 survey area had moved slightly owing to changes to the site boundary. An allotment site at Didcot, (included in the 1999 survey) was not surveyed in 2007 since it was now outside the 5 km area. In the 1999 survey, consumers were asked about the consumption of foods originating from lakes and streams situated only within the 5 km area.

In this report, the food group 'freshwater fish' is divided into two categories: 'Freshwater fish (river)' which denotes fish caught in the river that are potentially subject to the effects of liquid discharges and 'freshwater fish (lake and stream)' which denotes fish caught in lakes and streams that are potentially subject to the effects of gaseous discharges only.

The direct radiation survey area is also shown in Figure 2. The UKAEA licensed site consists of two separate pieces of land comprising of the main site and the much smaller liquid effluent treatment plant situated about 100m to the north of it. The direct radiation survey area was defined as the area within 1 km of the boundary of either of these licensed areas. It was noted that the boundary formed by the security fence was different from the boundary of the licensed site. The boundary of the licensed site was used as the baseline for determining the direct radiation survey area. Tenants of UKAEA operating within the licensed site were not

included in the survey. Cefas has not previously conducted a direct radiation survey at Harwell.

Due to the dense population within the direct radiation survey area, it was not possible to interview all the occupants. Therefore, interviewing effort was concentrated on residential properties since they were likely to have higher occupancy rates, rather than business properties. Also, since the site covered a large irregularly shaped area with multiple sources of direct radiation within it, effort was divided between residential and business properties that were located in different directions from the site and targeted at the closest properties in each direction. The properties of some organisations had tight security. Due to the difficulties in arranging personal visits these organisations were sent questionnaires by e-mail.

2.4 Conduct of the survey

Prior to the start of the fieldwork, discussions were held between members of the Cefas survey team and representatives from UKAEA, 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 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 a Harwell site representative, parish councils and members of the Local Stakeholders Group. 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 Harwell. A proposed fieldwork programme was sent 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 from 10th – 20th September 2007 by a survey team of four people, according to techniques described by Leonard *et al.* (1982).

At the start of the fieldwork, on 11th September, a meeting was held between two members of the survey team and a representative from UKAEA. This served to provide details about site operations, waste disposal and information about potential pathways and activities in the area. Details obtained are as follows:

- The site is now in progressive decommissioning and the intention is that it will eventually be entirely delicensed. The discharges are now mainly tritium with the possibility of some radon. They are sporadic, as determined by the dismantling of the buildings and facilities.
- There are cooling ponds at the southern end of the site that are operated by a tenant and contain sealed cobalt sources. They do not give rise to discharges.
- Discharges of liquid waste are declining. At the moment active waste is treated at the liquid effluent treatment plant and discharged two or three times a year via a pipeline to an outfall into the Thames at Sutton Courtenay. Trade effluent is discharged down the same pipeline every few weeks but is not treated because the activity is low. It is expected that liquid discharges will decline further and it is intended that eventually all discharge of liquid waste will be via the sewers to Didcot Sewage Works and that the pipeline to the Thames at Sutton Courtenay will be closed. Neighbouring organisations that have historically transferred low-level liquid waste to UKAEA for disposal are either already discharging directly to the sewers or are planning to do so.
- The sewage plant at the northern end of the site has been demolished. Lydebank Brook only receives surface water runoff from the site. This carries some tritium arising from rain washout of airborne discharges.
- Information about potential pathways and activities in the area included: anglers and other river users at Sutton Courtenay, horse riders and walkers along bridleways near the perimeter fence, and locations of residential and business areas on the campus.

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

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, house boat dwellers, hobby fishermen, boat users, farmers, allotment holders, beekeepers and people living, working or attending educational establishments 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.

The survey did not involve the whole population in the vicinity of Harwell, but targeted subsets or groups, chosen in order to identify those individuals potentially most exposed to radiation pathways. However, it is possible that even within a subset or group there may be people not interviewed at the time of the survey. Therefore, to aid interpretation, the number of people for whom data were obtained in each group as a percentage of the estimated complete coverage for that group has been calculated. The results are summarised in Table 1. The 'groups' are described and quantified, and the numbers of people for whom data were obtained are given as percentages of the totals. It should be noted that for certain groups, such as boat users, it can be virtually impossible to calculate the total number of people who undertake the activity in the survey area as many people visit from outside or only visit occasionally during the year. In other cases, it may be necessary, for example, to estimate the number of individuals from the number of clubs. These cases are explained in Table 1. Overall, although the number of potential interviewees in the terrestrial survey area was estimated to be around 19000, and approximately 4500 people worked in the direct radiation survey area, information was obtained for a significantly smaller number than this. In particular, it should be noted that the survey did not include the activities of the employees of UKAEA, GE Healthcare, tenant organisations 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 large organisations such as local businesses, it was not possible to collect data for all pathways (such as consumption of local foods) for each person. In these cases, the data were limited to those relating to the primary reason for the interview (e.g. in the case of businesses in the 1 km direct radiation area, for occupancy rates). In Annexes 1 and 2, such individuals only have data for the pathways of primary interest.

Thirty-six person-days were spent investigating the survey areas and interviewing individuals who were relevant to the survey. Observations for 2480 individuals were recorded. However, 2086 of these were repetitive generic level observations; for example occupancy rates for employees of large organisations. Only representative samples of these generic data were included in the analysis, resulting in 453 observations being used in total.

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 cases, 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; 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. 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.
- The data were manipulated in a database using a consistent set of conversion factors.
- The data were stored in a purpose built 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 riverbank sediments, occupancy over a common substrate (e.g. mud and grass) 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:

Age group	**Age range in group**
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

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 output of the study is the statement 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 operation of the Harwell site – taking into account the concentration and/or dose rate distributions in space and time relevant to the assessment.

Annex 3 contains qualitative and estimated data for pathways where it was not possible to obtain quantifiable data from interviews. Information is given on alleged poaching of fish for human consumption from the River Thames but there were insufficient data available to estimate a consumption rate.

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 rates observed 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, riverbank 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 to be 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. When the second highest rate has been used, this is explained in the table notes.

Secondly, the 97.5^{th} percentile rate was calculated for each group 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^{th} 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, a matrix of profiles has been produced to account for all potential sources of radiation from the site that members of the critical groups may be exposed to. 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 97.5th percentile consumption rates.

Selection of 97.5th percentile and critical group rates for occupancy is not made 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) extended from the liquid effluent discharge point across a weir in a backwater at Sutton Courtenay, known as Mill Cut, and downstream along the River Thames to Day's Lock. Moor Ditch, which carried treated effluent from the sewage works at Didcot to the River Thames at Long Wittenham, was also included.

Overview of survey area

The River Thames meanders for about 10 km between Sutton Courtenay and Day's Lock. The flow of water is generally slow and the river level is regulated to some extent by intermittent weirs and locks. For most of this stretch the river cuts through farmland but it passes by, or through, the villages of Sutton Courtenay, Long Wittenham, Clifton Hampden and Burcot. The riverbank is mainly natural but small sections are reinforced with metal piles or wooden staves and the locks are lined with stone or concrete.

The main riverbank activity was angling and this took place over mud and grass. Small areas of exposed riverbed sand, no more than a square metre in size, were observed at a few locations. These were places that anglers might stand, or people might paddle in the river, but no activities over sand were observed at the time of the survey.

Boating was a popular activity all along this stretch of the River Thames. Relatively few boats had permanent moorings in the area but many vessels passed through it. They were predominantly narrow boats and motor cruisers. Most were hired for holidays although some were privately owned.

The Thames Path National Trail ran close by the river all along this stretch. It was popular with walkers and dog walkers in areas with easy access from the road, which were mainly

close to villages. No long distance walkers were encountered in the more remote parts of the path at the time of the survey. The path was mainly at the top of the bank and was unlikely to be prone to regular flooding, although it was vulnerable to extreme flooding events.

No regular dredging took place on this stretch of the river although it was carried out if required. The last dredging was at Day's Lock several years ago.

The lock keepers at Clifton Lock and Day's Lock had residences by the river but most of their duties were carried out high above the water on the stone and concrete of the lock side.

The culvert of Moor Ditch passed through the outskirts of Didcot before cutting across farmland to join the Thames at Long Wittenham.

The terms 'left bank' and 'right bank' are used to describe locations in the following section and they refer to the left and right hand sides of the river as seen by an observer facing downstream, towards the east in Figure 1.

The discharge point in Mill Cut to its confluence with the River Thames

The liquid effluent was discharged from a pipe with multiple release holes that spanned a weir across Mill Cut. Mill Cut only extended about 200 m downstream of the weir before it rejoined the main flow of the Thames below Sutton Pools. Below the weir, the left bank of Mill Cut was the garden of a private dwelling and the right bank was the property of UKAEA. The UKAEA property was not open to members of the general public, although the gate to the fenced area was not locked. Fishing along this small stretch was reserved for members of the Harwell Angling Club, which was part of the sports and social provision at UKAEA.

The Mill Cut/River Thames confluence to Sutton Bridge

This was only a short section of river (approximately 300 m) but was a popular location for angling. Access to the river was relatively easy with a nearby public car park at Culham. Most angling was observed on the left bank between the confluence and Sutton Bridge. The riverside path was also frequently used by walkers and anglers on their way to visit Sutton Pools, which was just upstream. A cattle drink was located on the right bank at the confluence and cattle were observed drinking on several occasions. A wooden angling platform had also been constructed over the mud.

Sutton Bridge to Appleford railway bridge

The Thames Path provided access to angling spots all along the left bank of the Thames between Sutton Bridge and Appleford railway bridge. However, this stretch was not heavily fished and most angling activity took place at the eastern end, which was closer to the car park at Culham. On the right bank, downstream from Sutton bridge there was no easy public access to the river until a track leading down to the Didcot Power Station pump house was reached. This section of riverbank was another popular location for angling and there were fishing positions up to approximately 300 m east and west of the track. Five canoes were observed passing along the river.

Appleford railway bridge to Clifton Lock

The Thames Path continued to provide access along the left bank of the river. However angling was not popular along the stretch down to Clifton Lock owing to the long walks required to reach the area. Access to the right bank of the river was by footpaths from the villages of Appleford and Long Wittenham. Again, this area was not close to easy parking and was not heavily fished. Clifton Cut, which was now the navigable route, left the river at a weir to the west of Long Wittenham and rejoined it at Clifton Lock. The outflow from Moor

Ditch entered the Thames just upstream from Long Wittenham. Residential properties backed on to the river at Long Wittenham preventing public access.

Clifton Lock to Clifton Hampden Bridge

The Thames Path continued all along the left bank of this section of river. This was a common mooring area for visiting pleasure craft since the path provided access from the river to the amenities of Clifton Hampden. Closer to the bridge the bank was unsuitable for mooring and several anglers fished in this area.

No angling was noted on the right bank downstream from Long Wittenham until a lay-by on the approach road to Clifton Hampden Bridge. The lay-by provided a convenient place for anglers to park their cars and the riverbank close by was a popular angling location. Further towards the bridge there were moorings for about 15 pleasure craft. One of these was a larger vessel that was used as a houseboat. The houseboat was permanently occupied by two adults. Just to the south of the bridge and alongside the river was a caravan park for both touring and permanently sited vans. Several of the caravan occupants were keen anglers and they fished from the bank close to their caravans. The park had been flooded earlier in the year. Several canoeists were observed paddling past the camp during the survey.

There was a large car park at Clifton Hampton Bridge close to the right bank of the river. Visitors had easy access by foot to both banks of the river in both upstream and downstream directions.

Clifton Hampton Bridge to Day's Lock

Several anglers fished a small stretch, about 100 m long, on the left bank of the river just north of Clifton Hampton Bridge. Further downstream, the buildings of Clifton Hampton blocked access to the riverbank. There was a short section of open riverbank between Clifton Hampton and Burcot but there was no easy access to this area. No activities were observed

there. Continuing downstream on the left bank the buildings of Burcot, and then private land, prevented access to the riverbank almost as far as Day's Lock. Just north of Day's Lock was a stretch of bank about 300 m long where passing pleasure craft were moored. Three families were observed having picnics on the grass bank by the side of their boats. This area could be reached by land along footpaths from Dorchester, which was over one kilometre away.

The Thames Path crossed from the left bank to the right bank at Clifton Hampton Bridge and provided access to the right bank of the river all the way down to Day's Lock. Angling was very popular close to the bridge. As in other areas, the number of anglers dwindled as the distance increased from the road access point. A troop of local sea-scouts had a regular camp in a field by the river about 400 m down stream from the bridge. The camp was held on one day a week through the summer. The scouts, aged between 10 and 16 years old, engaged in a number of water based activities including kayaking, swimming, canoeing, rowing and sailing. Generic level data was obtained for 20 scouts and a representative sample of eight have been included in the analysis. The four scoutmasters undertook the same water based activities as the children, except for swimming.

Some limited car parking was available at Little Wittenham and from there a footbridge crossed the river to Day's Lock. The lock keeper reported that very few anglers ever came past the lock to fish at potential angling areas further upstream.

Moor Ditch

Moor Ditch carried treated effluent from Didcot Sewage Works to an outfall into the Thames just upstream of Long Wittenham, a distance of about three kilometres. After leaving the sewage works, the culvert passed under a railway line and a road close to residential properties on the outskirts of Didcot, before crossing farmland to the river. A cycle track and footpath extended alongside the ditch for almost its entire length. Except in a couple of places, the banks of the ditch were very overgrown preventing access to the water. Between the railway and the road there was an area without undergrowth where access to the stream

was possible. Also, the ditch and cycle track passed under the road together and it was easy to access the water here. Both these locations appeared to be potential play areas for children from nearby properties although no activities were observed at the time of the survey. The cycle track was well used at the Didcot end.

4.2 Commercial fisheries and wholesalers

No commercial fisheries were identified during the survey although there is some potential for commercial fishing in the area.

Following enquires concerning potential commercial fisheries, EA Fisheries Officers provided the following information:

- Fyke netting for eels would not be allowed this far up the Thames.
- Electrofishing for eels would be permitted under licence but no licences had been issued.
- 'Several dozen' consents had been issued authorising the removal of signal crayfish. The usual method of catching signal crayfish was by using traps.
- Most of the crayfish consents were held by hobby fisherman (see below) but the Fisheries Officers knew of one commercial and one semi-commercial signal crayfish fisherman.
- The crayfish consents covered a wide region of the River Thames catchment and it was not known if any commercial fishing for signal crayfish actually took place within the survey area.
- No other potential commercial fisheries were known of in the area.

Enquiries were made with a commercial crayfish fisherman who had been identified in a previous Cefas survey of Aldermaston. He reported that, although there was potential, he did not usually fish in the Harwell survey area. Normal procedures are to set traps from the riverbank, between July and October each year, when the water is warmer and the crayfish are more active and easier to catch. Catches are exported to Sweden, France and Spain.

No wholesalers or retailers of aquatic produce were positively identified within the survey area on this occasion.

4.3 Angling and hobby fishing

Angling from the riverbank was a popular activity at several locations in the survey area. People were observed angling at Sutton Courtenay, Didcot Power Station pump house, a lay-by between Long Wittenham and Clifton Hampden and at Clifton Hampden. It was possible to fish from many other parts of the riverbank but these were more difficult to access. No anglers were observed in these more remote areas at the time of the survey. At least seven angling clubs held the fishing rights to various sections of the riverbank. As with all rivers in England, the Thames is subject to a 'closed season' lasting from 15 March to 15 June each year during which time no angling for coarse fish is permitted. No information could be obtained about fishing activities at the Harwell Angling Club site close to the discharge point in Mill Cut.

It is probable that some angling also occurred from moored pleasure craft, but this activity was not observed at the time of the survey.

All the anglers interviewed were fishing for sport on a 'catch and release' basis. However, one angler consumed perch (*Perca fluviatilis*) if they were damaged during capture and unlikely to survive if returned to the water. At least 12 anglers mentioned that they had observed, or knew of, people taking large quantities of fish from the River Thames for consumption. (See Annex 3) Anglers are allowed to keep fish, but under the Thames Region Fishery Bylaws there is bag limit of two fish per person per day of which not more than one fish may be tench, carp, barbell, bream or pike.

Several anglers reported that they caught signal crayfish (*Pacifastacus leniusculus)* as a by-catch whilst angling for fish. Most anglers returned the crayfish to the water (either dead or alive), but one person kept them to eat.

One hobby fisherman was interviewed during the survey. He intermittently used a few homemade traps to fish for signal crayfish at Clifton Hampden. The crayfish caught were consumed by himself and members of his family. Several anglers and pleasure boat users stated that trapping crayfish was a common practice in the region. They reported that they knew it occurred within the survey area, although the river at Abingdon, (upstream of the survey area), was a more popular place to fish. Traps were deployed both from boats and from the riverbank. Fisheries Officers reported that most hobby fishermen probably used just one or two traps. The catches were believed to be consumed by the fishermen's family and friends. It was possible that some hobby fishermen, in fact, operated on a semi-commercial basis but no evidence of this was found during the survey.

One angler reported that he had observed people taking freshwater mussels from the river but he did not know what they were used for.

4.4 Didcot Sewage Treatment Works

The sewage works were investigated because one of the tenants at the UKAEA Harwell site has applied for authorisation to release liquid discharges to the water utility company's foul sewer and other tenants are expected to apply for similar authorisations in the near future. (Note also that other organisations, situated outside the licensed site boundary, are already discharging liquid waste to the sewer.) Sewage from Harwell travels through pipes to the Didcot Sewage Treatment Works where it undergoes treatment. Activities in the sewers between Harwell and Didcot were not considered.

During the sewage treatment process solid matter settles out to form sludge. The sludge has more water removed to produce sewage cake, which is a solid. The cake is used as a fertiliser and soil conditioner on farmland. The treated water, which may still hold radionuclides in liquid phase, is discharged to Moor Ditch from where it flows to the Thames.

Three men were employed at the sewage works and they each spent 1700 hours per year at the plant. The plant was highly automated and mechanised. Consequently, the employees spent relatively little time in close proximity to the sewage, sewage sludge or sludge cake. They were in close proximity (<1 m) with the sewage during activities such as clearing pipes; cleaning rag traps, fat traps and grit traps; and sampling. They were also in close proximity (<3 m) of the sewage sludge or sludge cake during activities such as sampling and using a small mechanical digger to move the cake to a storage area. The sludge cake was collected from the site periodically by contractors using their own machinery for lorry loading.

4.5 Food consumption data

Consumption data for local aquatic foodstuffs are presented in Tables 3 and 4 for adults and in Table 5 for children. The tables include the mean consumption rates of the critical groups together with the observed 97.5th percentile rates calculated as described in Section 3.2. The data are summarised in Table 6 for adults and Tables 7 and 8 for children (15-year-olds and 10-year-olds, respectively). Mean rates and 97.5th percentile rates based on national data (referred to as 'generic' data in this report) are not available for freshwater species so comparisons with these cannot be made.

Adult consumption rates

Adults were found consuming foods from the following two food groups; freshwater fish (river) and freshwater crustaceans. No consumption of freshwater molluscs or freshwater plants was noted during the survey. The people consuming the greatest quantities of food from the aquatic survey area were an angler and a hobby fisherman and his family. The hobby fisherman used traps to catch crayfish.

The only species of freshwater fish (river) consumed by an adult was perch (*Perca fluviatilis*). A critical group of one individual was identified who had a consumption rate of 1.1 kg/y.

The only species of freshwater crustacean consumed by adults was signal crayfish (*Pacifastacus leniusculus).* A critical group of three individuals was identified with a maximum consumption rate of 1.2 kg/y and a mean of 1.1 kg/y. The observed 97.5th percentile rate based on three observations was 1.2 kg/y.

Children's consumption rates

15-year-old age group

The only species of freshwater crustacean consumed by the 15-year-old age group was signal crayfish (*Pacifastacus leniusculus)*. No consumption of freshwater fish (river), freshwater molluscs or freshwater plants was noted during the survey.

For freshwater crustaceans, a critical group of one individual was identified with a consumption rate of 1.2 kg/y.

10-year-old age group

The only species of freshwater crustacean consumed by the 10-year-old age group was signal crayfish (*Pacifastacus leniusculus)*. No consumption of freshwater fish (river), freshwater molluscs or freshwater plants was noted during the survey

For freshwater crustaceans, a critical group of one individual was identified with a consumption rate of 1.2 kg/y.

Other age groups

No children in the 5-year-old, 1-year-old or 3-month-old age groups were noted to be consuming any local aquatic foods.

4.6 Riverbank occupancy

Adults' occupancy rates

Riverbank occupancy rates for adults over mud and grass are presented in Table 11. Individuals in the critical groups are shown in bold.

The maximum occupancy rate recorded over mud and grass was 780 h/y for two anglers. Fourteen other anglers had occupancy rates within a factor of three of this. This gives a critical group mean occupancy rate of 420 h/y.

Children's occupancy rates

Occupancy rates for children over mud and grass are presented in Table 12.

15-year-old age group

Only one child angler was noted with bank side occupancy in this age group. He spent 360 h/y occupancy over mud and grass.

10-year-old age group

The maximum occupancy rate recorded over mud and grass for this age group was 360 h/y for an angler. Three other anglers had occupancy rates within a factor of three of this. This gives a critical group mean occupancy rate of 280 h/y.

5-year-old age group

Only one child angler was noted with bank side occupancy in this age group. He spent 200 h/y occupancy over mud and grass.

Other age groups

No children in the 1-year-old or 3-month-old age groups were noted with bank side occupancy.

Gamma dose rate measurements

Representative gamma dose rate measurements at 1 m above the substrate were taken over mud, sand and grass. These measurements (shown in Table 13) ranged from 0.064 to 0.078 µGy/h over mud, 0.068 to 0.072 µGy/h over sand and 0.070 to 0.073 µGy/h over grass. The data in Table 13 (where comparisons can be made) are consistent with those reported by the Environment Agency (EA, EHS, FSA, SEPA, 2007). Natural levels of around 0.07 µGy/h over mud, 0.05 µGy/h over sand and 0.06 µGy/h over other substrates are expected.

4.7 Handling of sediment, fishing gear and nets

Handling sediment, or handling 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 bank side areas and it has therefore been omitted from the report.

Adults' handling

Table 14 shows the adult rate for handling fishing gear, as recorded during the survey. No handling of sediment was noted.

Only one individual was noted handling fishing gear. He handled crayfish traps for 12 h/y.

Children's handling

No children were noted to be handling either fishing gear (excluding angling equipment) or sediment during the survey.

4.8 Occupancy rates in close proximity to sewage, sewage sludge or sewage cake

Table 15 shows the occupancy rates in close proximity to sewage, sewage sludge or sewage cake for the employees at Didcot Sewage Works.

All three employees had the same occupancy rates. The occupancy rate in close proximity to sewage was 130 h/y. The combined occupancy rate in close proximity to sewage sludge or sewage cake was 160 h/y.

4.9 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 in or on water potentially affected by liquid discharges from Harwell are shown in Table 16 for adults and Table 17 for children. For the purposes of this report, activities where there is a high likelihood of the individual's face submerging under water have been classified as activities 'in water', as they are more likely to lead to ingestion of water. All other activities have been classified as activities 'on water'.

Adults' activities in the water

The only activity noted to be taking place in water in the survey area was kayaking. The maximum rate recorded, of 39 h/y, was for four individuals.

Adults' activities on the water

Activities taking place on the water included houseboat dwelling, sailing, canoeing, rowing, hobby fishing and cruising. The highest occupancy rate was 4900 h/y, for two individuals who were living on a houseboat. The houseboat was permanently afloat.

Children's activities in the water

15-year-old age group

Activities noted taking place in water for this age group were kayaking and swimming. The highest occupancy rate was 51 h/y, for five individuals.

10-year-old age group

Activities noted taking place in water for this age group were also kayaking and swimming. The highest occupancy rate was 51 h/y, for three individuals.

Other age groups

No children in the 5-year-old, 1-year-old or 3-month-old age groups were identified as participating in any activities in water during the survey.

Children's activities on the water

15-year-old age group

Activities noted taking place on water for this age group were canoeing, rowing and sailing. The highest occupancy rate was 120 h/y, for five individuals.

10-year-old age group

Activities noted taking place on water for this age group were also canoeing, rowing and sailing. The highest occupancy rate was 120 h/y, for three individuals.

Other age groups

No children in the 5-year-old, 1-year-old or 3-month-old age groups were identified as participating in any activities on water during the survey.

5 TERRESTRIAL RADIATION PATHWAYS

5.1 Terrestrial survey area

The terrestrial survey area covered all land and watercourses within 5 km of the Harwell site centre (NGR SU 471 867) as shown in Figure 2. The watercourses connecting the Lydebank Brook to the River Thames, which extended beyond the 5 km radius, have also been included in the terrestrial survey area since they carried surface run off water from the site (Figure 3).

Several villages were located within the terrestrial survey, including: Milton to the north of the site; Harwell to the north-east; West Hagbourne and Upton to the east; Chilton to the south-east; West Ilsley to the south, and Ardington, East Hendred and West Hendred to the north-west. Several brooks, including the Lydebank Brook, flowed through the survey area to the north and west of the site. Land in the terrestrial survey area was predominantly agricultural.

Nineteen working farms were identified in the area. Of these:

- Five farms produced crops
- Three farms produced crops and beef cattle
- Three farms produced crops, beef cattle and sheep
- One farm produced crops and free range chicken eggs
- One farm produced crops and dairy cattle
- One farm produced beef cattle
- One farm produced beef cattle, dairy cattle and crops
- One farm produced beef cattle, sheep and crops
- One farm produced beef cattle, sheep, pigs, free range chicken eggs and crops
- One farm produced dairy cattle
- One farm produced fruit

Beef cattle and lambs from the survey area were sold at livestock markets in Thame and Cirencester, and sent to abattoirs in England and Wales. Beef and lamb were also sold

directly from a farm and from farm shops located within the terrestrial survey area. Milk was sold to the national chains First Milk and First Dairy. Chicken eggs were sold from the farms where they were produced and from local farm shops. Crops (beans, oilseed rape, wheat, barley, maize and oats) were sold to national distributors for malting, milling and for animal feed. Grain from one farm was made into flour at a mill located outside the area and this was sold from shops in the area. Brussels sprouts, fruit, nuts and cider were sold directly from farms.

Farmers and their families were noted to be consuming beef, lamb, pork, milk, chicken and eggs (chicken and duck) from their own farms.

Two vineyards were identified in the survey area, both located to the northeast of the site. One vineyard had approximately 6000 vines and had a shop where their local wine, apples and plums were sold. Wine was also sold from local shops and via the Internet. The second vineyard had 1000 vines and sold their wine through local garden centres and on the Internet. They also grew fruit and nut trees, the produce of which was sold from the estate.

Four allotment sites were located within the survey area, at Harwell, East Hendred, Chilton and Ardington. One was located just outside the survey area at Steventon. The allotment sites were well used and well maintained, with the exception of the Chilton site, which only had a few well-maintained plots. There were approximately 20 plots at Harwell, 30 plots at East Hendred, 10 plots at Chilton (two not used), 10 plots at Ardington (three not used) and 50 plots at Steventon. Many varieties of fruit and vegetables were grown on the allotments. In addition, chickens were kept for egg production at one allotment site. Private gardens and farms with a range of fruit and vegetables were noted; one gardening club with keen members was identified in the area. Chickens were kept for egg production at two private residences where interviews were conducted. Several private houses were selling small amounts of fruit from their door and one individual was identified who sold boxes of mixed vegetables from his house.

Five beekeepers were identified in the survey area; three hives were located at Rowstock, three at East Hendred, two at Upton and four at Harwell. The production of honey per hive ranged from 7 kg/y to 34 kg/y and the average production per hive was 16 kg/y. The beekeepers consumed some of the honey and the rest was given to family and friends, sold to local customers and sold through shops.

The consumption of wild foods included blackberries, bullus plums, crab apples, damsons, elderberries, hazel nuts, plums and sloes. These were collected from the lanes around the villages and from fields and farmland in the survey area. Game from within the survey area, which included partridge, pheasant, pigeon, rabbit and venison, was consumed. Two organised game shoots were identified in the survey area. One was a private shoot on farmland and the birds were consumed by syndicate members and their families and sold through a village shop in the survey area. The other was a small private shoot on a country estate, which was for the estate owner's family members only. Rough shooting for rabbits and hares was carried out at several locations on farmland; individuals were consuming the rabbits they shot and some individuals were consuming rabbit liver.

Evidence of the human consumption of groundwater, and the consumption by livestock of groundwater and surface water, was found. A hamlet of about 10 houses, situated approximately 2 km west of the site, did not have the utility of mains water and was supplied with water from a well on a farm. A large country estate on the western edge of the terrestrial survey area also did not have mains utility water and had private water supplies from boreholes. Borehole water was supplied to a village, two hamlets and other properties on the estate, comprising a total of approximately 200 residences and 50 businesses. Another country estate bordered the western side of the Harwell site. It was reported that there were boreholes on the estate land but they were not used because the water was contaminated with chemicals (not with radioactivity). Livestock were identified drinking water from another borehole, a well and from streams, ditches and the River Thames.

Several brooks were identified in the north and west of the survey area. The Lydebank Brook was of particular interest as it carried the surface runoff (potentially containing gaseous discharges) from the Harwell site. From the site, the Lydebank Brook is very small and crosses open farmland and woodland before passing through an underground culvert at East Hendred. The Lydebank Brook then joins the Ginge Brook and the Ardington Brook to become a sizable stream called the East Hendred Brook. This stream flows through Steventon (the outer limit of the 5 km terrestrial area) and then across farmland, becoming Mill Brook before joining the River Thames at Sutton Courtenay.

The Lydebank Brook was investigated to identify any activities occurring on the banks or in the brook. Two public access points were identified along the Lydebank Brook. One was to the east of East Hendred village where a few metres of the brook could be accessed by a footpath through farmland and woodland. Here the brook was very narrow and the banks were heavily overgrown. There was very little water in the brook at the time of the survey. There was no evidence of activities along this stretch of the brook. The second access point was in the village of East Hendred where the brook flowed under a road and then passed through woodland. At this point there was a footpath alongside the brook, which was passable for about 20 metres before becoming overgrown. The water could be accessed near the road and this was potentially an area where children could play. However, no one was identified spending time there. The Lydebank Brook and the Ginge Brook flowed past a trout farm at East Hendred (see below). No activities were identified between the trout farm and the River Thames; for the most part the brook crossed farmland and access was extremely limited.

There was one trout farm located to the northwest of the site and one trout sport fishery located to the west of the site. The trout farm produced approximately 15 tonnes of trout annually, of which, 95% were rainbow trout (*Oncorhynchus mykiss*), and 5% were brown trout (*Salmo trutta*). Water was diverted predominantly from the Ginge Brook to fill the ponds, with a small amount of water originating from the Lydebank Brook. Trout remain in the ponds for six months to two years. There was also a trout pond for angling at the farm, which was

predominantly used by local families. Trout was being sold from the trout farm shop. The sport fishery was located to the west of the Harwell site and comprised of five lakes on a country estate. The lakes were stocked with brown trout and rainbow trout; the trout remained in the ponds for varying lengths of time, from several days up to two years. Approximately 50 anglers fished at the sport fishery; 50% of which had a full licence and 50% had a half licence. The maximum number of fish that each individual could keep was four per week. However, it was reported that most members gave away their catch so no people were identified with high consumption rates. A farmer fished for wild brown trout in streams that crossed his land and he and his family consumed the small catch.

5.2 Unusual pathways

The transfer of contamination from the Harwell site by wildlife was investigated. A representative from UKAEA was asked about wildlife that could act as carriers for the transfer of radioactivity off site. He reported that rabbits, pigeons and deer were found on site, but were not considered to be a pest problem. There were areas of low-level radioactive waste covered in soil mounds on the site, where rabbits could potentially burrow. The rabbits were periodically culled and disposed of but pigeons and deer were not being culled. Wildlife was not being routinely sampled; rabbits and pigeons had occasionally been analysed for radioactivity in the past, but no elevated levels were found. Eighteen individuals were consuming rabbits and hares from the survey area, three of which were consuming rabbits from the immediate vicinity of the site. Eleven people were consuming venison and one person was consuming pigeon from the survey area.

5.3 Wholesalers and retailers

Retailers and wholesalers were interviewed to find out whether they were selling local produce from within the survey area. Six outlets in total were visited, which were; three farm shops, a vineyard, a village shop and a trout farm shop. All six outlets were selling produce from within the terrestrial survey area. One farm shop was selling fruit, vegetables, meat (beef, lamb venison, duck, partridge and pheasant), apple juice, cider, flour and eggs; one farm shop was selling chicken eggs, meat (beef, lamb and pork) fruit, vegetables and honey; and one farm shop was selling cider, fruit and nuts. The vineyard shop sold wine, fruit and nuts, and the village shop sold beef, lamb, eggs, honey, flour, vegetables, and wine. The trout farm was selling trout from the farm, which was also sold at local farmers markets and to local pubs and restaurants.

5.4 Food consumption data

Consumption data for locally produced foodstuffs potentially affected by gaseous discharges are presented in Tables 18 to 34 for adults and Tables 35 to 47 for children. These tables include the mean consumption rates of the critical groups together with the observed 97.5th percentile rates calculated as described in Section 3.2. For purposes of comparison, the data are summarised in Table 6 for adults and in Tables 7 to 10 for children (15-year-olds, 10-year-olds, 5-year-olds and 1-year-olds, respectively). No children in the 3-month-old age group were noted to be consuming foods produced in the terrestrial survey area.

In order to provide information relevant to surveillance and assessment 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 48. Those food types shown in emboldened italics were sampled as part of the 2006 Food Standards Agency monitoring programme (EA, EHS, FSA and SEPA, 2007).

Adult's 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, pig meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey, wild fungi, venison and freshwater fish (lake & stream). No consumers of local cereals were identified but it was almost certain that local cereals were consumed since flour, milled from locally grown wheat, was sold through one of the farm shops.

Critical group mean consumption rates were found to be greater than the generic 97.5th percentile consumption rates in the green vegetables and pig meat food groups. A further eight critical group mean consumption rates exceeded the generic mean consumption rates. These were for other vegetables, root vegetables, domestic fruit, cattle meat, sheep meat, eggs, wild/free foods and honey. Six observed 97.5th percentile consumption rates exceeded the generic 97.5th percentile consumption rates. These were for green vegetables, root vegetables, cattle meat, pig meat, sheep meat and honey.

Children's consumption rates

15-year-old age group

Sixteen children in this age group were identified to be eating locally produced food. Consumption was identified in the following 13 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, cattle meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, venison and freshwater fish (lake & stream). No consumption was identified for milk, pig meat, honey, wild fungi or local cereals. Critical group mean consumption rates did not exceed the generic 97.5th percentile consumption rates for any food group. Four critical group mean consumption rates exceeded the generic mean consumption rates. These were for green vegetables, other vegetables, root vegetables and

eggs. Two observed 97.5th percentile consumption rates were greater than the generic 97.5th percentile consumption rates. These were for green vegetables and root vegetables.

10-year-old age group

Fourteen children in this age group were identified to be eating locally produced food. Consumption was identified in the following 12 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, cattle meat, sheep meat, poultry, eggs, wild/free foods, venison and freshwater fish (lake & stream). No consumption was identified for milk, pig meat, rabbits/hares, honey, wild fungi or local cereals. The critical group mean consumption rate for green vegetables exceeded the generic 97.5th percentile. Five critical group mean consumption rates exceeded the generic mean consumption rates. These were for other vegetables, root vegetables, domestic fruit, sheep meat and eggs. One observed 97.5th percentile consumption rate was greater than the generic 97.5th percentile consumption rate. This was for green vegetables.

5-year-old age group

Five children in this age group were identified to be eating locally produced food. Consumption was identified in the following eight food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, eggs, wild/free foods and freshwater fish (lake & stream). No consumption was identified for milk, cattle meat, pig meat, sheep meat, poultry, rabbits/hares, honey, wild fungi, venison or local cereals. No generic 97.5th 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

Two children in this age group were identified to be eating locally produced food. Consumption was identified in the following seven food groups: green vegetables, other

vegetables, root vegetables, potato, domestic fruit, eggs and wild/free foods. No consumption was identified for milk, cattle meat, pig meat, sheep meat, poultry, rabbits/hares, honey, wild fungi, venison, freshwater fish (lake & stream) or local cereals. No generic 97.5th 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 this age group were identified to be eating locally produced food.

6 DIRECT RADIATION PATHWAYS

6.1 Direct radiation survey area

The direct radiation survey area is shown in Figure 2. It covered all land within 1 km of the UKAEA licensed site boundary. The occupancy data collected from the direct radiation survey area is also applicable to direct exposure arising from gaseous releases from the site.

The UKAEA licensed site occupied a broad arc of land along the northwest side of the Harwell Science and Innovation Campus. The liquid effluent treatment plant formed a separate, relatively small, licensed area about 100m north of the main licensed site. It was noted that the boundary formed by the security fence was different from the boundary of the licensed site and it was the boundary of the licensed site that was used as the baseline for determining the direct radiation survey area.

The whole campus was being developed and regenerated as a major business and science centre. Some of the buildings were disused and others were under construction. There were several small residential areas within, or close to, the campus. Outside the campus the area was predominantly farmland. There were plans for a new housing development of 200 to 300 homes to be built in the southern area of the campus.

Directly adjacent to the northeast corner of the site there was a business area. This consisted of a small shopping precinct, service businesses and several office blocks. Businesses and facilities included, for example: a newsagent, café, sandwich bar, bank, post office, hairdresser, dentist, health centre and conference hall. Some of the office blocks were occupied by single organisations while others were multi occupancy, housing a number of small organisations. A nursery school, squash courts and playing fields were located close by to the east. The facilities catered mainly for people working on the campus site or living close by. A small housing estate was situated slightly further to the northeast. Dog walkers used footpaths across small areas of grass and trees, close to the liquid effluent treatment plant.

Other paths provided short cuts between the housing estate and shopping area. All the area to the north and northeast of the housing estate was open farmland and two isolated residences were located in the far northeast close to the limit of the 1 km survey area. The A4185 road proceeded from north to south and formed the eastern boundary of the campus.

There was an area of land near the main entrance at the eastern side of the site that had recently been delicensed. Since the security fence had not been moved the area remained inside the secure area. One organisation had premises located within this area and they were sent an e-mail questionnaire.

The main buildings of the science campus were situated to the southeast of the licensed site. Several large, and many smaller, organisations were in the location. Some were enclosed by their own security fences and these organisations were sent e-mail questionnaires. The area was dominated by a large circular research building, which operates a synchrotron (Diamond Synchrotron) and produces ultraviolet and X-ray beams. There were several large lawned areas, a sports field, a hotel, a bus terminus and another nursery school.

Further to the southeast was an area of rough land and woodland criss-crossed by old airfield roads, some of which were blocked off. A row of houses was located along one road. Still further to the southeast and close to the limit of the 1 km area there were minor roads with a primary school, garden centre and small housing development. The A34 trunk road proceeded along the extreme limit of the 1 km zone to the southeast of the site.

The land to the south of the site was farmland that could be accessed by bridleways and tracks. Two sets of stables, with attached residences, were located in this area. One of the stables had a plot of pastureland, and employed a person that lived outside the area.

The restricted byway known as ‘Ridgeway’, part of the National Trail network, proceeded along the top of the chalk ridge in the southwest of the area close to the limit of the 1 km zone.

The land to the west and to the north of the licensed site was predominantly farmland with scattered small patches of woodland. A minor road ran north to south down the western edge of the 1km zone and there were several bridleways in the area. There were two isolated cottages to the west and a small hamlet and isolated farm to the northwest of the licensed site.

6.2 Residential activities

The main concentration of residences was on a housing estate to the northeast of the site. There were 85 residences on the estate with about 65 of these being in the 0 – 0.25 km zone and the other 20 in the >0.25 – 0.5 km zone. One road on the southern side of the estate was scheduled for redevelopment. The houses were being boarded up as they became vacant. Only 5 of the 12 properties in this road were occupied at the time of the survey.

There were two smaller groups of residences to the southeast of the site. These included a road with 12 neighbouring houses and a modern housing development of 11 properties with two older cottages close by. All these residences were in the >0.5 – 1.0 km zone.

There was another small hamlet of 7 residences to the northwest of the site in the >0.5 – 1.0 km zone.

There were several isolated residences in various locations. To the northeast of the site there were two houses in the >0.5 – 1.0 km zone. To the south there were two residences attached to stables in the 0 – 0.25 km zone and a house attached to another set of stables in the >0.5 – 1.0 km zone. To the west there were two cottages in the >0.5 – 1.0 km zone and to the northwest there was a farm in the >0.25 – 0.5 km zone.

Interviews were conducted at 26 residences. Twelve were on the housing estate to the northeast of the site; seven were on the road to the southeast; two were on the housing

development to the southeast; two were at the hamlet to the northwest and three were at the two sets of stables to the south of the site.

No interviews were conducted at the two isolated houses to the northeast of the site, or at the two cottages to the west or the farm to the northwest.

Thirteen of the residences interviewed were in the 0 – 0.25 km zone, one was in the >0.25 – 0.5 km zone and 12 were in the >0.5 – 1.0 km zone. Eight of the residences had families with children.

6.3 Leisure activities

Few leisure activities were observed around the Harwell site. Dog walking took place in the area surrounding the LETP to the north of the site and it was reported that horse riders and walkers occasionally used the bridleways to the south and west of the site. There were squash courts and two well maintained sports fields outside the main entrance on the eastern side of the site. Another sports field was located to the south of the site. No leisure activities were observed at the time of the survey. The 'Ridgeway' trail to the southwest of the site may have attracted walkers, horse riders and cyclists but was not investigated during the survey owing to its distance from the licensed site boundary and the expectation that users would only spend a little time passing through the survey area.

6.4 Employment activities

There were around 100 organisations located on the Harwell Science and Innovation Campus, employing about 4,500 people. These ranged in size from small enterprises with just two or three staff to large organisations employing almost 1500 people. They were engaged in a diverse array of activities and included high-tech businesses, commercial firms, scientific research institutes, government agencies and local service providers. The organisations were located in two main areas, one to the northeast of the licensed site and

the other to the southeast. All of the organisations to the northeast were in the 0 – 0.25 km zone and about three quarters of the organisations to the southeast were in the 0 – 0.25 km, with most of the rest in the >0.25 – 0.5 km zone. There was a garden centre to the southeast close to the limit of the >0.5 – 1 km zone and a farm to the northwest in the >0.25 – 0.5 km zone but interviews were not conducted at either of these premises. Building works were taking place at several places around the campus but information was not obtained for the construction workers.

Interviews were conducted at four of the smaller organisations located to the northwest of the site, which together employed 17 staff. Only one person spent time outdoors and this was limited to about 1 hour per week.

One organisation had one set of premises located inside the security fence on the delicensed land at the east of the site and another set of premises located to the southeast of the site. Generic data was obtained for the 392 full time staff and 50 part time staff that worked at the two sets of premises. A representative sample of 14 staff has been used in the analysis. None of the staff spent significant periods of time outdoors.

Another large organisation to the southeast of the site provided generic data for 1266 full time staff and 168 part time staff. A representative sample of 18 staff has been used in the analysis. Most of the staff did not spend significant periods of time outdoors but one of the employees used in the analysis, a security guard, spent about half his time outdoors.
One of the sets of stables to the south of the site employed a worker from outside the area who spent all their time at work outdoors. No information was collected for farm workers who may have worked in fields around the site.

The activities of the employees of UKAEA, GE Healthcare, tenant organisations and contractors while at work within the licensed site were not included in the direct radiation survey.

6.5 Educational activities

A primary school and two nursery schools were located in the direct radiation area.

The primary school employed 9 full-time staff, 20 part-time staff and had 190 pupils aged from 3 years to 11 years old. Occupancy rates were available for the staff but only generic level data were collected for the pupils and a representative sample of 20 observations were included in the analysis. Both staff and pupils spent some time outdoors.

One of the nursery schools employed 15 full-time staff, and had 70 registered children, aged from 3 months to 5 years. Attendance times for the children were very variable, ranging from 4 hours to 40 hours per week, but detailed attendance times were not available. Approximately 30 of the children were between 3 months and 2 years old and about 40 children were between 2 years and 5 years old. Usually about 50 to 60 children attended school on each day. The staff and children spent an average of one to two hours per day outdoors, depending on the weather.

The other nursery school employed 28 full-time staff, 7 part-time staff and had 96 registered children, aged from 3 months to 5 years. Again attendance times for the children were very variable and occupancy rates for the children were not collected. Some only attended on one day a week while others attended up to five days a week. The nursery was open from 7:30 am to 6:00 pm for five days a week. Twelve of the children were under 1-year-old, 36 children were 1 year to 2 years old and 48 children were between 3 years and 5 years old. Staff and children spent on average one to two hours per day outdoors, depending on the weather.

6.6 Occupancy rates

Table 49 presents indoor, outdoor and total occupancy data for adults and children. A total of 216 occupancy observations were obtained over the duration of the survey. An analysis of the data by distance zones and occupancy rates is shown in Table 50.

0 – 0.25 km from the site boundary

Occupancy data were collected for 122 individuals in the 0 to 0.25 km zone. In addition to residents, observations were obtained for staff at a nursery school, several businesses and a stable. Two of the residents, who were both children, had the highest total occupancy rates of 8100 h/y. An elderly resident had the highest indoor occupancy of 7900 h/y and three people who lived and worked at a horse stable had the highest outdoor occupancy rates of 3900 h/y.

>0.25 – 0.5 km from the site boundary

Occupancy data were collected for 17 individuals in the >0.25 - 0.5 km zone. Two were residents and the others were staff of another nursery school. One of the residents had the highest total occupancy rate of 6600 h/y. The same resident also had the highest indoor occupancy rate of 6200 h/y and this resident and his partner had the highest outdoor rate of 400 h/y.

>0.5 – 1.0 km from the site boundary

Occupancy data were collected for 77 people in the >0.5 - 1.0 km zone. These included residents and staff and pupils of a primary school. An elderly resident had the highest total occupancy rate of 8600 h/y. All of that time was spent indoors and the same resident had the highest indoor rate of 8600 h/y. The highest outdoor rate was 2100 h/y for a different resident who owned her own stables and horses.

6.7 Gamma dose rate measurements

Table 51 presents the gamma dose rate measurements for the Harwell direct radiation survey. Representative gamma dose rate measurements were taken at a height of 1 m both inside and outside residences, businesses and schools and at outdoor background locations outside the direct radiation survey area. Outdoor measurements were taken approximately 10 to 20 metres from the nearest buildings, and the background locations were on rough grassland. It should be noted that the measurements taken at residences, businesses and schools have not been adjusted for natural background dose rates.

In the survey area, the 25 outdoor measurements, which were all taken over grass, ranged from 0.057 to 0.088 µGy/h. The 20 measurements taken inside houses and businesses ranged from 0.062 to 0.116 µGy/h.

Outside the survey area, background readings over rough grassland ranged from 0.065 to 0.074 µGy/h. At the time of the survey, approximately 50% of the outdoor measurements within the survey area were above the maximum of 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 52. Each of the 20 combinations shown in Table 52 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 52 do not correlate directly with observation numbers in Annex 1. Other individuals from Annex 1 have combinations that are not listed in Table 52 because they have fewer pathways and a dose assessment for them would be adequately covered by one of the 20 listed combinations.

Qualitative and estimated data shown in Annex 3 have not been included in Table 44. This is because data in Annex 3 are for pathways that were identified by hearsay 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 Harwell 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 an appropriate approach. Retrospective total doses around Harwell 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 Harwell 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); 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 Harwell site, which were:

- Discharges of liquid radioactive waste into the River Thames from the discharge pipe at Sutton Courtenay and into the water utility company's foul sewer.
- Discharges of gaseous radioactive waste to the atmosphere
- Emissions of direct radiation

Data were collected for 453 individuals including riverbank anglers, hobby fishermen, houseboat dwellers, people pursuing water sports, farmers, allotment holders, beekeepers, sewage workers and people spending time within 1 km of the site. 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 in this report are only for foods produced or caught within the terrestrial and aquatic survey areas defined in Section 2.3.

The adult mean critical group rates (as defined in Section 3.2) for the separate aquatic consumption pathways were:

- 1.1 kg/y for freshwater fish (river)
- 1.1 kg/y for freshwater crustaceans

The predominant aquatic species consumed by the respective critical groups were perch and signal crayfish.

The mean critical group riverbank occupancy rate over mud and grass was 420 h/y.

The mean critical group rate for handling fishing gear was 12 h/y.

The occupancy rate for sewage workers in close proximity to sewage was 130 h/y. The combined occupancy rate in close proximity to sewage sludge and sewage cake was 160 h/y. Sewage cake was used as a fertiliser/soil conditioner on farmland.

The maximum occupancy rate spent in water was 39 h/y and the maximum occupancy rate spent on water was 4900 h/y on a houseboat.

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

- 46 kg/y for green vegetables
- 28 kg/y for other vegetables
- 31 kg/y for root vegetables
- 50 kg/y for potato
- 63 kg/y for domestic fruit
- 59 l/y for milk
- 42 kg/y for cattle meat
- 49 kg/y for pig meat
- 23 kg/y for sheep meat
- 6.0 kg/y for poultry
- 12 kg/y for eggs
- 17 kg/y for wild/free foods
- 1.6 kg/y for rabbits/hares
- 9.3 kg/y for honey
- 2.2 kg/y for wild fungi
- 5.0 kg/y for venison
- 4.9 kg/y for freshwater fish (lake & stream)

No consumption of cereals was positively identified, although it was noted that flour milled from wheat grown in the terrestrial survey area was sold at one of the farm shops. Consumption of foodstuffs by children 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.

Evidence of the human consumption of groundwater, and the consumption by livestock of groundwater and surface water, was found. The domestic supply for about 10 houses in a small hamlet was from a farm well and the domestic supply for approximately 200 houses and 50 businesses on a large country estate was from boreholes. Livestock were identified as drinking water from a borehole, a well, streams, ditches, and the River Thames.

Transfer of radioactive contamination from the site into the surrounding area by wildlife was investigated. Rabbits, pigeons and deer were reported on the site but none of these was considered by the site operators to be a pest problem. The rabbits were periodically culled but pigeons and deer were not. Eighteen individuals were consuming rabbits and hares from the survey area, three of which were consuming rabbits from the immediate vicinity of the site. Eleven people were consuming venison and one person was consuming pigeon from the survey area.

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

- For the 0 - 0.25 km zone; 8100 h/y total occupancy, 7900 h/y indoor occupancy and 3900 h/y outdoor occupancy
- For the >0.25 - 0.5 km zone; 6600 h/y total occupancy, 6200 h/y indoor occupancy and 400 h/y outdoor occupancy
- For the >0.5 - 1.0 km zone; 8600 h/y total occupancy, 8600 h/y indoor occupancy and 2100 h/y outdoor occupancy

In all three zones, the highest total occupancy, indoor occupancy and outdoor occupancy rates were all for permanent residents, some of whom worked at home.

8.2 Comparisons with previous surveys

Despite some changes to the survey areas the majority of aquatic and terrestrial results from this 2007 survey can be compared with the data from the aquatic survey undertaken by Cefas in 1991 (Thurston and Doddington, 1993) and the terrestrial habits survey undertaken by Cefas in 1999 (Tipple and McMeekan, 1999). No observations were recorded in the parts of the survey areas that had changed between the 1991, 1999 and 2007 surveys except at one of six of the allotment sites and the Didcot Sewage Works.

The results of the direct radiation component of this survey cannot be compared as no previous direct radiation survey has been conducted by Cefas at this site.

All comparisons for consumption and external pathways are for adult data only.

Aquatic survey

In 1991, no freshwater fish (river) consumption was identified during the survey. In 2007, one individual was identified consuming freshwater fish (river) at an annual rate of 1.1 kg/y. The only species consumed was perch.

In 1991, no freshwater crustacean consumption was identified during the survey. In 2007, a critical group of three individuals was identified consuming freshwater crustaceans at a mean annual rate of 1.1 kg/y. The maximum rate was 1.2 kg/y. The only species consumed was signal crayfish.

For external pathways, it should be noted that the methodology for determining the critical group has changed since the 1991 survey (see Section 3.2) so care is needed when

comparing results. In the following comparison, the critical group rate from the 1991 survey has been recalculated using the current method.

Using the current methodology the 1991 critical group mean bank side occupancy rate over mud was 360 h/y for five anglers. The maximum rate, which was for an angler fishing close to the discharge weir in Mill Cut, was 650 h/y, and this figure has been used for dose assessments purposes. In 2007 a critical group of 16 anglers was identified with a mean bank side occupancy rate over mud and grass of 420 h/y. The maximum rate, for anglers fishing throughout the survey area, was 780 h/y.

In 1991 no fishing gear handling was identified. In 2007 an individual was identified handling crayfish traps for 12 h/y.

No sediment handling was identified during either the 1991 survey or the 2007 survey.

A comparison of occupancy rates in close proximity to sewage, sewage sludge and sewage cake cannot be undertaken because these pathways were not investigated in the 1991 survey.

A comparison of occupancy rates in and on water cannot be carried out because these pathways were not investigated in the 1991 survey.

Terrestrial survey

The adult critical group mean consumption rates for terrestrial food groups from the 1999 and 2007 surveys are shown in Table A, below.

Table A. Comparison between 1999 and 2007 adult critical group mean consumption rates (kg/y or l/y) for terrestrial food groups at Harwell.

Food Group	**1999**	**2007**
Green vegetables	77.9	45.6
Other vegetables	72.5	28.2
Root vegetables	48.8	30.6
Potato	97.0	49.7
Domestic fruit	36.6	62.9
Milk	311.0	59.1
Cattle meat	55.6	41.8
Pig meat	21.4	49.4
Sheep meat	19.5	23.4
Poultry	43.9	6.0
Eggs	21.0	12.1
Wild/free foods	3.1	16.7
Rabbits/hares	2.4	1.6
Honey	7.9	9.3
Wild fungi	2.8	2.2
Venison	11.3	5.0
Freshwater fish (lake & stream)	17.0	4.9

Consumption rates had decreased in 2007 in 12 food groups: green vegetables, other vegetables, root vegetables, potato, milk, cattle meat, poultry, eggs, rabbits/hares, wild fungi, venison and freshwater fish (lake & stream). Consumption rates had increased in 2007 in the

remaining five food groups: domestic fruit, pig meat, sheep meat, wild/free foods and honey. There were large decreases in green vegetables, other vegetables, potato, milk, poultry, eggs, venison and freshwater fish (lake & stream) and large increases in domestic fruit, pig meat and wild/free foods.

Neither the 1999 nor 2007 surveys identified any individuals consuming local cereals although in 2007 it was noted that a farm shop sold flour milled from wheat that was grown on a farm in the survey area.

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:
(Some of these samples relate to the wider monitoring of the Thames catchment in areas potentially affected by discharges from Amersham and Aldermaston as well as from Harwell.)

- Pike from Sutton Courtenay outfall*
- Pike from Newbridge*
- Pike from Staines*
- Pike from Shepperton*
- Pike from Teddington*[*]
- Flounder from Beckton
- *Nuphar lutea* from Newbridge
- *Nuphar lutea* from Staines
- Sediment from Appleford
- Sediment from Sutton Courtenay outfall

[*] *All pike samples were removed from the programme in 2007*

- Sediment from Day's Lock
- Sediment from Lydebank Brook
- Freshwater from Day's Lock
- Freshwater from Lydebank Brook
- Freshwater from River Thames (above discharge point)
- Freshwater from River Thames (below discharge point)

Gamma dose rate measurements were taken over the following substrates:

- Mud at Appleford
- Mud and sand at Appleford
- Grass and mud at Sutton Courtenay
- Grass and mud at Day's Lock

Terrestrial surveillance:

- Milk
- Apples
- Beetroot
- Blackberries
- Cabbage/Brussel sprouts
- Honey
- Potatoes

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

Environment Agency monitoring:

- A sample of sewage cake from Didcot Sewage Treatment Works could be introduced since the works receives discharges from Harwell via the sewer network and discharges to the sewer are expected to increase. The sewage works employees have occupancy close to the sewage cake and it is subsequently spread on farmland.
- Sediment and water samples from the Thames at Clifton Hampden could be introduced since a wide range of activities was recorded there.

Food Standards Agency monitoring:

- A sample of signal crayfish from the River Thames could be introduced since this is the first survey that the consumption of fresh water crustaceans has been noted in the area.
- The sample of pike from the River Thames at Sutton Courtenay could be replaced by a sample of perch, since perch was definitely identified as being eaten. Previously a nominal consumption rate of pike has been used in dose assessments. However there was no direct evidence that pike, or any other freshwater fish from the river, was consumed.
- A sample of mushrooms could be introduced since this is the most commonly eaten wild fungi and no sample for this food group is currently taken. Fungi are known to have large concentration factors for radionuclides.
- A sample of runner bean could be introduced since this is the most commonly eaten other vegetable and no sample for this food group is currently taken.
- A sample of rabbit could be introduced since it was being consumed from the terrestrial survey area and rabbits could be potential carriers for off-site transfer of radioactive materials.
- The sample of beetroot could be replaced with a sample of onion since this is the most commonly eaten root vegetable.
- A sample of beef, pork or lamb could be introduced since they were all eaten at above the 97.5^{th} percentile rates.

9 ACKNOWLEDGEMENTS

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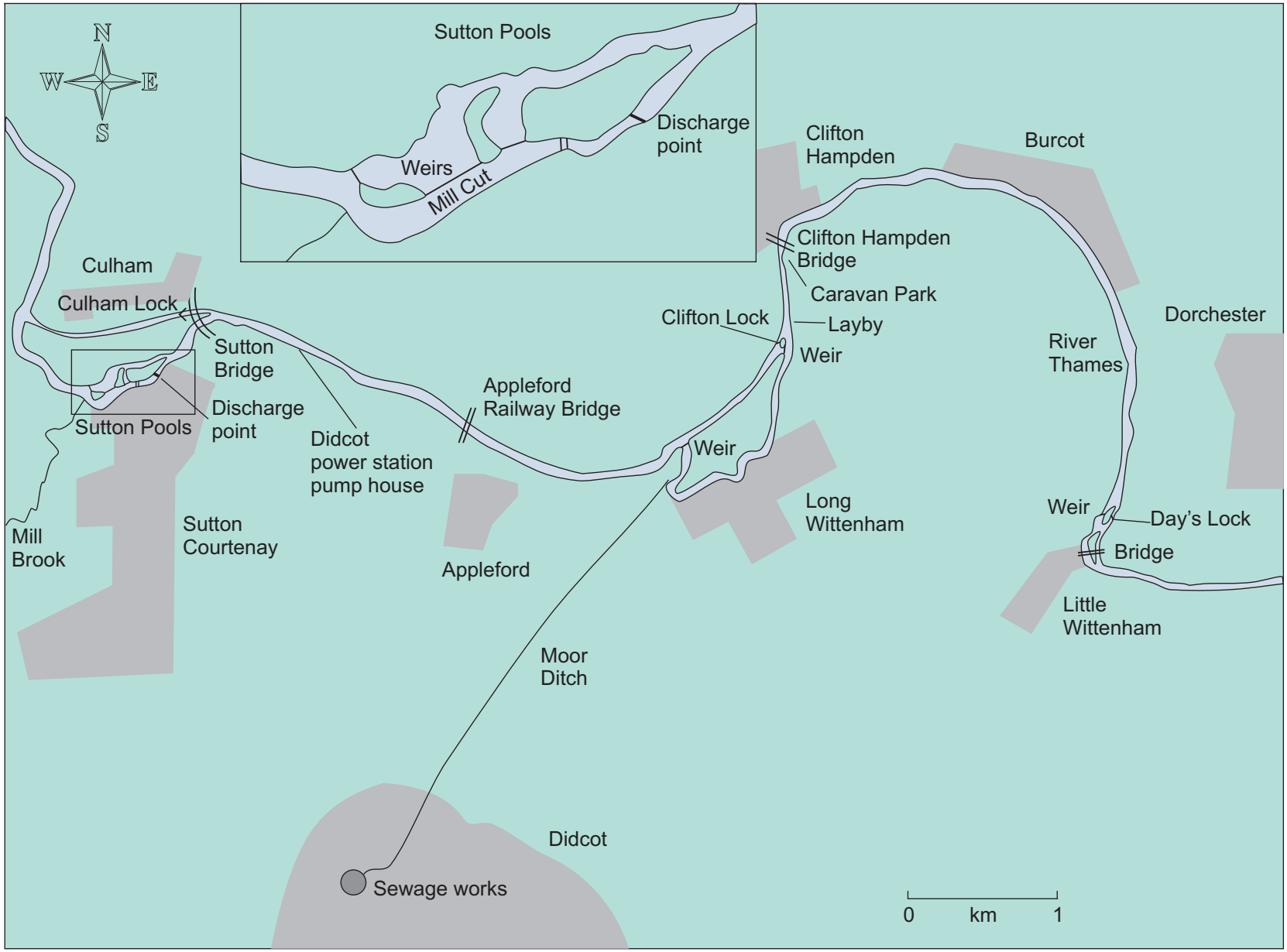

Figure 1. The Harwell aquatic survey area

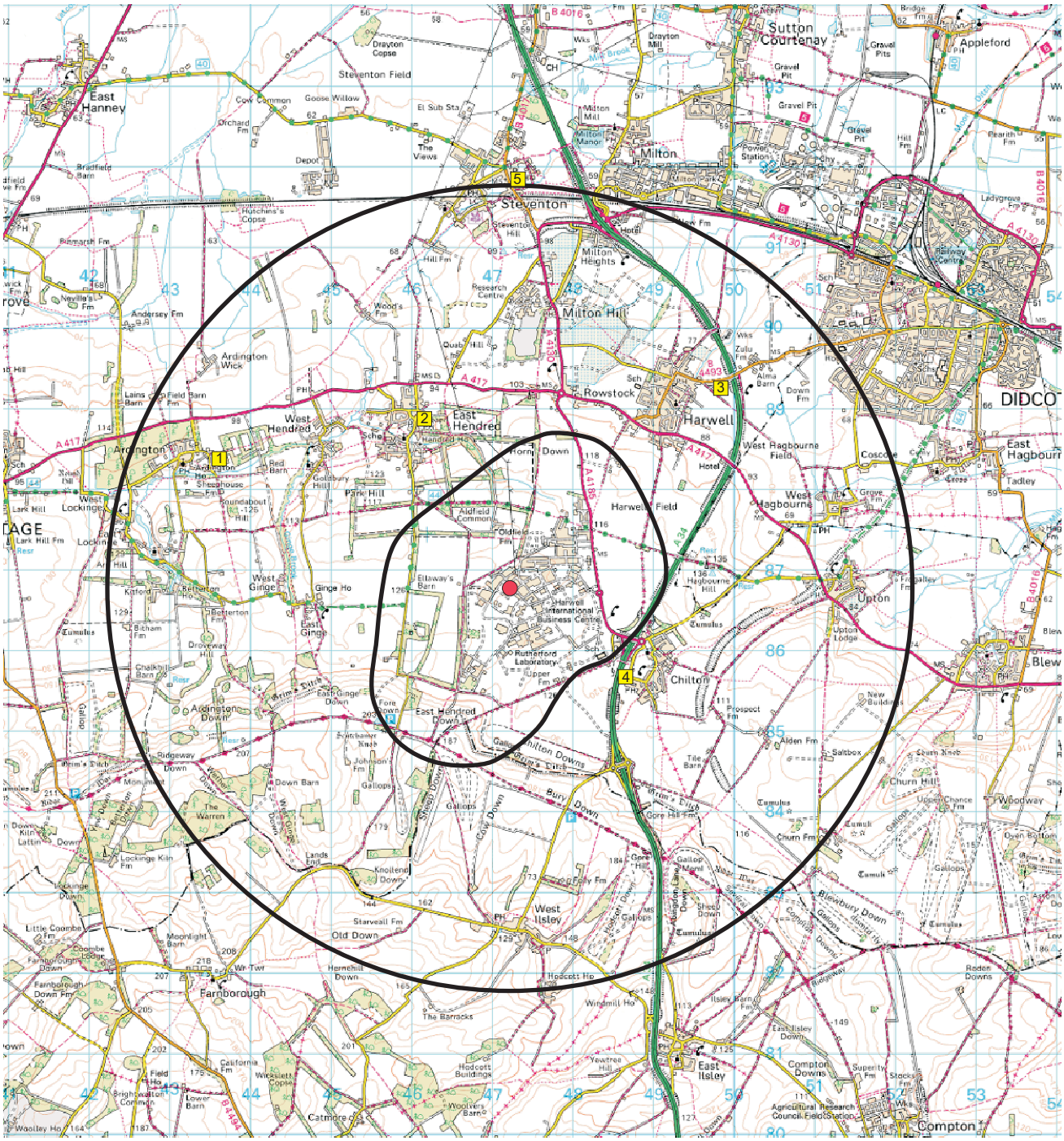

Figure 2. The Harwell terrestrial (outer ring) and direct radiation (inner ring) survey areas.

- The Harwell site centre
- 1 Ardington allotments
- 2 East Hendred allotments
- 3 Harwell allotments
- 4 Chilton allotments
- 5 Steventon allotments

Note. Based on the latest available OS map which does not show recent developments at the Harwell Science and Innovation Campus.

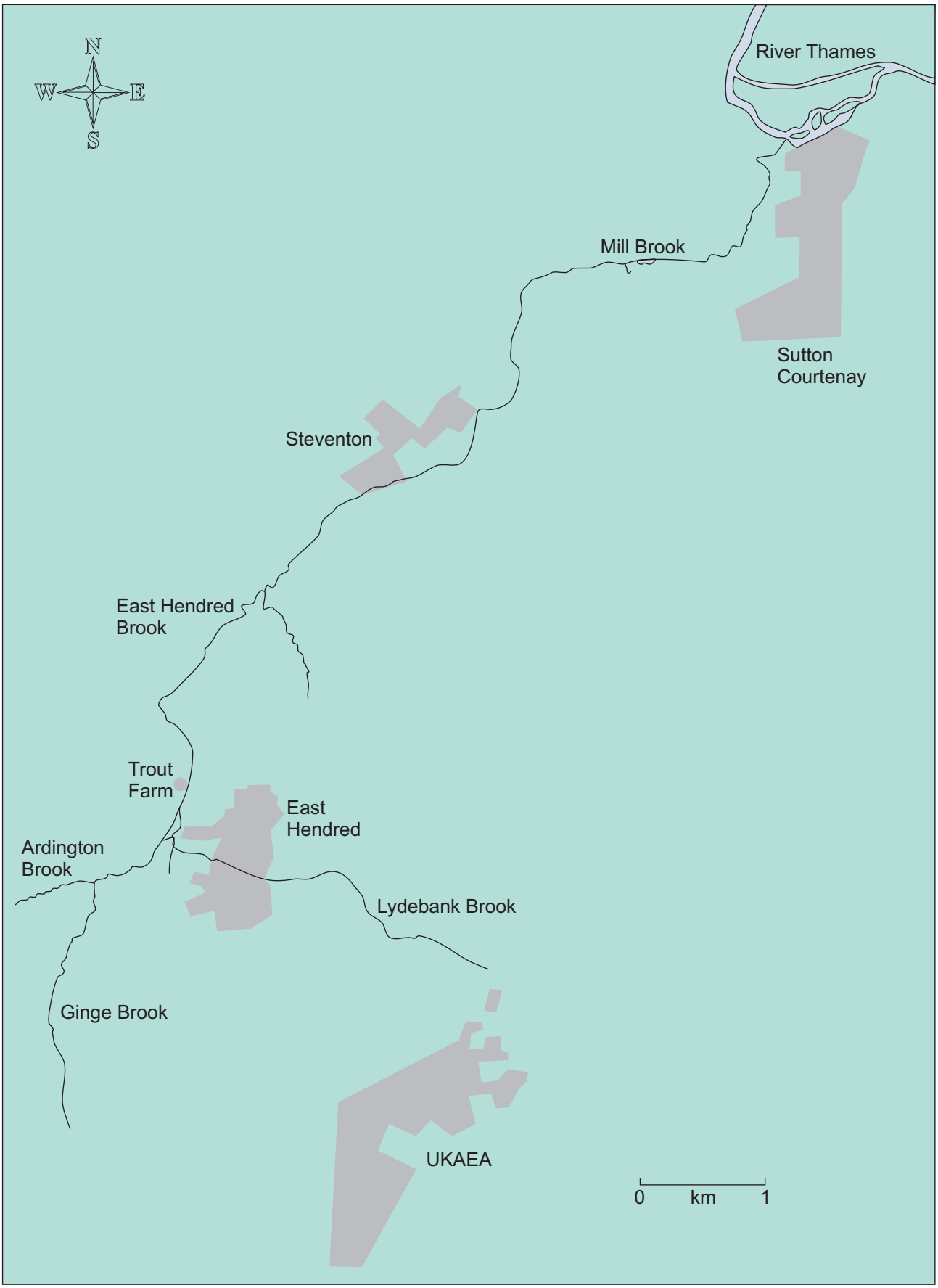

Figure 3. The water course from Lydebank Brook to the River Thames that carries surface water runoff from the site

Table 1. Survey coverage

Figures without parenthesis are those used in the analysis and include only representative samples of generic data. Figures in parenthesis include all generic data.

Group	Criteria	Estimate of complete coverage	Number for whom positive data were obtained	Coverage for positive observations	Notes
SUMMARY OF ALL PATHWAYS					
All potential people in Harwell 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[a]	174[b]	1%	The survey targeted individuals who were potentially the most exposed (See Section 2.4), mostly producers of local food (farmers and allotment holders). The number for whom positive data were obtained includes 24 people who only consumed terrestrial foods but lived outside 5 km.
	Number of people resident in the direct radiation survey area (See (C) direct radiation pathways)	290	64	22%	
	Number of people employed but not resident in the direct radiation survey area, excluding school staff. (See (C) direct radiation pathways)	4500	50 (1894)	1% (42%)	Excluding employees and contractors of UKAEA, GE Healthcare and tenant organisations and people living in the direct radiation survey area..
	School staff. (See (C) direct radiation pathways)	79	79	100%	
	School children and nursery school children. (See (C) direct radiation pathways)	356	20 (190)	6% (53%)	
	Number of people visiting area (See (C) direct radiation pathways)	U	3	U	
	Number of people affected by liquid discharges (excluding people resident in the terrestrial survey area) (See (A) aquatic pathways)	U	63[b] (75)	U	
	Total for aquatic, terrestrial and direct radiation survey areas	U	453[b] (2479)	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

Table 1. Survey coverage

Figures without parenthesis are those used in the analysis and include only representative samples of generic data. Figures in parenthesis include all generic data.

Group	Criteria	Estimate of complete coverage	Number for whom positive data were obtained	Coverage for positive observations	Notes
(A) AQUATIC PATHWAYS					
Riverbank anglers	Number of people interviewed during the survey	U	39	U	
Pleasure cruiser users	Number of people interviewed during the survey	U	5	U	
Watersports participants and hobby fisherman	Number of people interviewed during the survey	U	12 (24)	U	Sea Scouts provided generic data for 20 children but only 8 were included in the analysis
Houseboats	Number of people interviewed during the survey	2	2	100%	
Employees at Didcot Sewage Works	Number of people interviewed during the survey	3	3	100%	
Fish and shellfish consumers	Number of people consuming fish and/or crustaceans from the River Thames that were interviewed during the survey.	U	5	U	
(B) TERRESTRIAL PATHWAYS[c]					
Farms	Number of farmers and their family members consuming food from the survey area	51	49	96%	Estimate of 22 working farms in the area, 21 farmers were interviewed. Includes 2 vineyards.
Allotments	Number of allotment holders and their family members consuming food from the survey area	614	87	14%	Visited 4 allotment sites in the area and 1 just outside. Estimate of 120 plots in total, 17 plot holders were interviewed.
Bee keepers	Number of people consuming honey in the survey area	U	19	U	Estimate of 15 beekeepers in the area, 5 beekeepers were interviewed
Gardeners	Number of gardeners and their family members consuming food from the survey area	U	14	U	
Fish consumers	Number of people consuming fish from lakes and streams within the survey area.	U	11	U	

Table 1. Survey coverage

Figures without parenthesis are those used in the analysis and include only representative samples of generic data. Figures in parenthesis include all generic data.

Group	Criteria	Estimate of complete coverage	Number for whom positive data were obtained	Coverage for positive observations	Notes
(C) DIRECT RADIATION PATHWAYS					
Occupancy of area	Number with occupancies > 100 hours (excluding site employees)	U	216	U	
Residences	Number of residents in the survey area	290	64	22%	Estimate of 118 occupied houses in the area, 26 households were interviewed
Employees (excluding staff at schools)	Number of people employed in the survey area >100 hours	4500	50 (1894)	1% (42%)	Observations are for 7 organisations out of approximately 100 in the area. Two large organisations provided generic data for 1876 staff but only 32 of these were included in the analysis
School staff	Number of staff at school and nursery schools in area	79	79	100%	
School children and nursery school children	Number of children attending school or nursery school in the survey area	356	20 (190)	6% (53%)	Observations are for 1 school out of 3 in the area. Generic data were provided for 190 children but only 20 of these were included in the analysis
People visiting area	Number of people visiting area for >100 hours	U	3	U	
BREAKDOWN OF AGE GROUPS					
Adults	Individuals over 17	U	367 (2211)	U	
15 year old	More than 12.0 year old to 17.0 year old	U	28 (36)	U	
10 year old	More than 7.0 year old to 12.0 year old	U	35 (124)	U	
5 year old	More than 2.0 year old to 7.0 year old	U	20 (105)	U	
1 year old	More than 1.0 year old to 2.0 year old	U	3	U	
3 months old	From 0 to 1.0 year old	U	0	U	

Notes

[a] Data from www.statistics.gov.uk were used to estimate this figure for people resident in the 5 km survey area.

[b] 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 is an allotment holder but also consumes honey will be counted twice, whereas others, such as people only consuming produce bought at shops will not be counted at all.

[c] 6 retail outlets 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, kohl rabi, 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, *Nephrops* , 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 freshwater fish (river) in the Harwell area (kg/y)

Observation number	Perch
226	**1.1**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of freshwater fish (river) based on the only adult consumer is 1.1 kg/y

The observed 97.5th percentile rate is not applicable for 1 observation

Table 4. Adults' consumption rates of freshwater crustaceans in the Harwell area (kg/y)

Observation number	Signal crayfish
209	**1.2**
210	**1.2**
226	**1.0**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of freshwater crustaceans based on the 3 highest adult consumers is 1.1 kg/y

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

Table 5. Children's consumption rates of freshwater crustaceans in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Signal crayfish
211	**12**	**1.2**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of freshwater crustaceans based on the only 15-year-old age group consumer is 1.2 kg/y

The observed 97.5th percentile rate is not applicable for 1 observation

10-year-old age group

Observation number	Age	Signal crayfish
212	**11**	**1.2**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of freshwater crustaceans based on the only 10-year-old age group consumer is 1.2 kg/y

The observed 97.5th percentile rate is not applicable for 1 observation

Table 6. Summary of adults' consumption rates in the Harwell area (kg/y or l/y)

Food group	Number of observations	No. higher rate consumers	Observed maximum critical consumption rate	Observed minimum critical consumption rate	Observed critical group mean consumption rate	Observed 97.5th percentile consumption rate	Generic mean consumption rate	Generic 97.5th percentile consumption rate
Freshwater fish (river)	1	1	1.1	1.1	1.1	NA	ND	ND
Freshwater crustaceans	3	3	1.2	1.0	1.1	1.2	ND	ND
Freshwater molluscs	NC	NC	NC	NC	NC	NC	ND	ND
Wildfowl	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater plants	NC	NC	NC	NC	NC	NC	ND	ND
Green vegetables	85	19	80.1	29.9	45.6	57.2	15.0	45.0
Other vegetables	104	28	47.2	16.6	28.2	42.6	20.0	50.0
Root vegetables	82	29	51.3	17.5	30.6	51.3	10.0	40.0
Potato	89	44	85.7	29.9	49.7	83.8	50.0	120.0
Domestic fruit	90	3	101.6	43.5	62.9	39.6	20.0	75.0
Milk	5	5	59.1	59.1	59.1	59.1	95.0	240.0
Cattle meat	22	12	64.8	23.3	41.8	61.5	15.0	45.0
Pig meat	5	2	49.4	49.4	49.4	49.4	15.0	40.0
Sheep meat	15	9	35.1	11.8	23.4	35.1	8.0	25.0
Poultry	38	13	24.0	2.7	6.0	8.5	10.0	30.0
Eggs	50	44	17.8	5.9	12.1	17.8	8.5	25.0
Wild/free foods	44	2	20.6	12.9	16.7	12.3	7.0	25.0
Rabbits/hares	15	12	3.0	1.0	1.6	3.0	6.0	15.0
Honey	19	9	10.9	9.1	9.3	10.1	2.5	9.5
Wild fungi	16	10	3.4	1.5	2.2	3.4	3.0	10.0
Venison	8	2	5.0	5.0	5.0	5.0	ND	ND
Freshwater fish (lake & stream)	8	4	5.9	4.0	4.9	5.9	ND	ND

ND = not determined
NC = not consumed
NA = not applicable

Table 7. Summary of 15-year-old children's consumption rates in the Harwell area (kg/y or l/y)

Food group	Number of observations	No. higher rate consumers	Observed maximum critical consumption rate	Observed minimum critical consumption rate	Observed critical group mean consumption rate	Observed 97.5th percentile consumption rate	Generic mean consumption rate	Generic 97.5th percentile consumption rate
Freshwater fish (river)	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater crustaceans	1	1	1.2	1.2	1.2	NA	ND	ND
Freshwater molluscs	NC	NC	NC	NC	NC	NC	ND	ND
Wildfowl	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater plants	NC	NC	NC	NC	NC	NC	ND	ND
Green vegetables	11	5	28.6	14.0	18.7	26.7	9.0	25.0
Other vegetables	13	4	19.4	12.4	15.9	18.5	10.0	30.0
Root vegetables	9	5	23.3	8.3	13.7	22.1	7.5	20.0
Potato	11	6	45.7	17.5	32.1	43.8	60.0	130.0
Domestic fruit	11	7	19.3	7.2	14.1	18.8	15.0	50.0
Milk	NC	NC	NC	NC	NC	NC	110.0	260.0
Cattle meat	3	3	18.0	11.7	13.8	17.7	15.0	35.0
Pig meat	NC	NC	NC	NC	NC	NC	10.0	30.0
Sheep meat	2	2	5.9	3.5	4.7	5.8	5.5	15.0
Poultry	6	3	2.4	1.1	1.5	2.2	6.5	20.0
Eggs	5	3	15.8	14.2	15.3	15.8	7.0	25.0
Wild/free foods	3	3	2.5	2.2	2.4	2.5	3.0	13.0
Rabbits/hares	3	3	3.0	1.1	1.7	2.9	ND	ND
Honey	NC	NC	NC	NC	NC	NC	2.0	5.0
Wild fungi	NC	NC	NC	NC	NC	NC	2.0	5.5
Venison	2	2	1.2	1.2	1.2	1.2	ND	ND
Freshwater fish (lake & stream)	1	1	2.0	2.0	2.0	NA	ND	ND

ND = not determined
NC = not consumed
NA = not applicable

Table 8. Summary of 10-year-old children's consumption rates in the Harwell area (kg/y or l/y)

Food group	Number of observations	No. higher rate consumers	Observed maximum critical consumption rate	Observed minimum critical consumption rate	Observed critical group mean consumption rate	Observed 97.5th percentile consumption rate	Generic mean consumption rate	Generic 97.5th percentile consumption rate
Freshwater fish (river)	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater crustaceans	1	1	1.2	1.2	1.2	NA	ND	ND
Freshwater molluscs	NC	NC	NC	NC	NC	NC	ND	ND
Wildfowl	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater plants	NC	NC	NC	NC	NC	NC	ND	ND
Green vegetables	7	2	21.0	21.0	21.0	21.0	6.0	20.0
Other vegetables	9	5	12.4	5.0	9.1	12.4	8.0	25.0
Root vegetables	8	2	17.4	17.4	17.4	17.4	6.0	20.0
Potato	7	6	12.1	8.5	10.0	11.9	45.0	85.0
Domestic fruit	8	2	17.4	17.3	17.4	17.4	15.0	50.0
Milk	NC	NC	NC	NC	NC	NC	110.0	240.0
Cattle meat	3	3	11.8	11.7	11.7	11.8	15.0	30.0
Pig meat	NC	NC	NC	NC	NC	NC	8.5	25.0
Sheep meat	3	3	5.9	3.5	4.3	5.8	4.0	10.0
Poultry	1	1	1.1	1.1	1.1	NA	5.5	15.0
Eggs	8	5	14.2	7.1	10.0	14.2	6.5	20.0
Wild/free foods	1	1	0.4	0.4	0.4	NA	3.0	11.0
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	NC	NC	NC	NC	NC	NC	2.0	7.5
Wild fungi	NC	NC	NC	NC	NC	NC	1.5	4.5
Venison	1	1	1.2	1.2	1.2	NA	ND	ND
Freshwater fish (lake & stream)	1	1	5.9	5.9	5.9	NA	ND	ND

ND = not determined
NC = not consumed
NA = not applicable

Table 9. Summary of 5-year-old children's consumption rates in the Harwell area (kg/y or l/y)

Food group	Number of observations	No. higher rate consumers	Observed maximum critical consumption rate	Observed minimum critical consumption rate	Observed critical group mean consumption rate	Observed 97.5th percentile consumption rate	Generic mean consumption rate	Generic 97.5th percentile consumption rate
Freshwater fish (river)	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater crustaceans	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater molluscs	NC	NC	NC	NC	NC	NC	ND	ND
Wildfowl	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater plants	NC	NC	NC	NC	NC	NC	ND	ND
Green vegetables	1	1	2.4	2.4	2.4	NA	ND	ND
Other vegetables	3	2	3.9	1.6	2.7	3.7	ND	ND
Root vegetables	2	2	1.7	1.2	1.5	1.7	ND	ND
Potato	2	2	6.1	4.6	5.3	6.0	ND	ND
Domestic fruit	2	2	3.9	2.2	3.1	3.9	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	2	1	7.9	7.9	7.9	7.8	ND	ND
Wild/free foods	1	1	1.3	1.3	1.3	NA	ND	ND
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	NC	NC	NC	NC	NC	NC	ND	ND
Wild fungi	NC	NC	NC	NC	NC	NC	ND	ND
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater fish (lake & stream)	1	1	5.9	5.9	5.9	NA	ND	ND

ND = not determined
NC = not consumed
NA = not applicable

Table 10. Summary of 1-year-old children's consumption rates in the Harwell area (kg/y or l/y)

Food group	Number of observations	No. higher rate consumers	Observed maximum critical consumption rate	Observed minimum critical consumption rate	Observed critical group mean consumption rate	Observed 97.5th percentile consumption rate	Generic mean consumption rate	Generic 97.5th percentile consumption rate
Freshwater fish (river)	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater crustaceans	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater molluscs	NC	NC	NC	NC	NC	NC	ND	ND
Wildfowl	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater plants	NC	NC	NC	NC	NC	NC	ND	ND
Green vegetables	2	2	1.0	0.5	0.7	1.0	ND	ND
Other vegetables	2	1	0.8	0.8	0.8	0.8	ND	ND
Root vegetables	1	1	1.6	1.6	1.6	NA	ND	ND
Potato	2	2	2.7	1.0	1.9	2.7	ND	ND
Domestic fruit	2	1	0.9	0.9	0.9	0.9	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	1	1	0.05	0.05	0.05	NA	ND	ND
Wild/free foods	1	1	0.2	0.2	0.2	NA	ND	ND
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	NC	NC	NC	NC	NC	NC	ND	ND
Wild fungi	NC	NC	NC	NC	NC	NC	ND	ND
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Freshwater fish (lake & stream)	NC	NC	NC	NC	NC	NC	ND	ND

ND = not determined
NC = not consumed
NA = not applicable

Table 11. Adults' riverbank occupancy rates in the Harwell area (h/y)

Observation number	Location	Activity	Mud & grass
104	**River Thames at Sutton Courtenay**	**Angling**	**780**
105	**River Thames at Sutton Courtenay**	**Angling**	**780**
112	**River Thames at Caravan Park at Clifton Hampden**	**Angling**	**475**
113	**River Thames at Caravan Park at Clifton Hampden**	**Angling**	**475**
114	**River Thames at Caravan Park at Clifton Hampden**	**Angling**	**475**
222	**River Thames various venues**	**Angling**	**440**
198	**River Thames various venues**	**Angling**	**390**
220	**River Thames at Sutton Courtenay**	**Angling**	**390**
221	**River Thames at Sutton Courtenay**	**Angling**	**390**
224	**River Thames at Sutton Courtenay**	**Angling**	**312**
228	**River Thames at Sutton Courtenay**	**Angling**	**312**
229	**River Thames at Sutton Courtenay**	**Angling**	**312**
225	**River Thames at Sutton Courtenay**	**Angling**	**297**
226	**River Thames at Sutton Courtenay**	**Angling**	**297**
218	**River Thames at Sutton Courtenay**	**Angling**	**273**
230	**River Thames at Sutton Courtenay**	**Angling**	**273**
102	River Thames at Sutton Courtenay	Angling	250
103	River Thames at Sutton Courtenay	Angling	250
213	River Thames at Caravan Park at Clifton Hampden	Angling	240
223	River Thames at Sutton Courtenay and Appleford	Angling	240
193	River Thames various venues	Angling	234
227	River Thames at Sutton Courtenay	Angling	234
108	River Thames at Clifton Hampden	Angling	198
109	River Thames at Clifton Hampden	Angling	198
214	River Thames at Caravan Park at Clifton Hampden	Angling	120
196	River Thames various venues	Angling	108
233	River Thames at Sutton Courtenay	Angling	84
106	River Thames at Clifton Hampden	Angling	81
107	River Thames at Clifton Hampden	Angling	81
219	River Thames at Sutton Courtenay	Angling	50
197	River Thames various venues	Angling	18

Notes

Emboldened observations are the critical group members

The critical group riverbank occupancy rate over mud & grass based on 16 observations is 417 h/y

The observed 97.5th percentile rate based on 31 observations for mud & grass is 780 h/y

Table 12. Children's riverbank occupancy rates in the Harwell area (h/y)

15-year-old age group

Observation number	Age	Location	Activity	Mud & grass
191	**13**	**River Thames at Clifton Hampden**	**Angling**	**360**

Notes
Emboldened observations are the critical group members
The critical group riverbank occupancy rate over mud & grass based on the only 15-year-old age group member is 360 h/y
The observed 97.5th percentile rate is not applicable for 1 observation

10-year-old age group

Observation number	Age	Location	Activity	Mud & grass
192	**11**	**River Thames at Clifton Hampden**	**Angling**	**360**
231	**11**	**River Thames at Didcot Power Station pump house**	**Angling**	**273**
232	**11**	**River Thames at Didcot Power Station pump house**	**Angling**	**273**
110	**9**	**River Thames at layby near Clifton Hampden**	**Angling**	**198**
194	11	River Thames at Clifton Hampden	Angling	63
195	11	River Thames at Clifton Hampden	Angling	63

Notes
Emboldened observations are the critical group members
The critical group riverbank occupancy rate over mud & grass based on 4 observations is 276 h/y
The observed 97.5th percentile rate based on 6 observations for mud & grass is 349 h/y

5-year-old age group

Observation number	Age	Location	Activity	Mud & grass
111	**6**	**River Thames at layby near Clifton Hampden**	**Angling**	**198**

Notes
Emboldened observations are the critical group members
The critical group riverbank occupancy rate over mud & grass based on the only 5-year-old age group member is 198 h/y
The observed 97.5th percentile rate is not applicable for 1 observation

Table 13. Gamma dose rate measurements over riverbank substrates in the Harwell area (µGy/h)

Location	NGR	Substrate	Gamma dose rate at 1 metre[a]
Mill Cut - east bank	SU 507 945	Mud	0.076
Mill Cut - east bank	SU 508 946	Mud	0.078
Sutton Courtenay - west bank	SU 507 947	Sand	0.072
Culham - north bank	SU 513 948	Mud	0.064
Near Didcot power station pumphouse	SU 518 945	Mud	0.069
Clifton Hampden - caravan park	SU 547 952	Grass	0.070
Clifton Hampden - south bank	SU 548 955	Sand	0.068
Days Lock - west bank	SU 569 938	Grass	0.073

Notes

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

Table 14. Handling rates of fishing gear in the Harwell area (h/y)

Observation number	Location	Activity	Fishing gear
209	**River Thames at Clifton Hampden and Long Wittenham**	**Gear handling**	**12**

Notes

Emboldened observations are the critical group members

The critical group fishing gear handling rate based on 1 observation is 12 h/y

The observed 97.5th percentile rate is not applicable for 1 observation

Table 15. Occupancy rates in close proximity to sewage, sewage sludge or sewage cake (h/y)

Observation number	Activity	Occupancy in close proximity (<1m) to the sewage	Occupancy in close proximity (<3m) to the sewage sludge or sewage cake
451-453	Clearing inlet pipes, rag traps,fat traps and grit traps. Sampling. Moving sewage cake to storage area.	130	156

Table 16. Adults' occupancy rates in and on water in the Harwell area (h/y)

Observation number	Location	Activity	In water	On water
199	River Thames at Clifton Hampden	Kayaking	39	
	River Thames at Clifton Hampden	Canoeing, rowing, sailing		117
200	River Thames at Clifton Hampden	Kayaking	39	
	River Thames at Clifton Hampden	Canoeing, rowing, sailing		117
201	River Thames at Clifton Hampden	Kayaking	39	
	River Thames at Clifton Hampden	Canoeing, rowing, sailing		117
209	River Thames at Clifton Hampden	Kayaking	39	
	River Thames at Clifton Hampden	Canoeing, rowing, sailing, hobby fishing		117
215	River Thames at Clifton Hampden	Boat dwelling (afloat)		4874
216	River Thames at Clifton Hampden	Boat dwelling (afloat)		4874
187	River Thames	Cruising		450
188	River Thames	Cruising		450
217	River Thames	Cruising		400
189	River Thames	Cruising		240
190	River Thames	Cruising		240

Table 17. Children's occupancy rates in and on water in the Harwell area (h/y)

15-year-old age group

Observation number	Age	Location	Activity	In water	On water
204	12	River Thames at Clifton Hampden	Kayaking, swimming	51	
		River Thames at Clifton Hampden	Canoeing, rowing, sailing		117
205	13	River Thames at Clifton Hampden	Kayaking, swimming	51	
		River Thames at Clifton Hampden	Canoeing, rowing, sailing		117
206	14	River Thames at Clifton Hampden	Kayaking, swimming	51	
		River Thames at Clifton Hampden	Canoeing, rowing, sailing		117
207	15	River Thames at Clifton Hampden	Kayaking, swimming	51	
		River Thames at Clifton Hampden	Canoeing, rowing, sailing		117
208	16	River Thames at Clifton Hampden	Kayaking, swimming	51	
		River Thames at Clifton Hampden	Canoeing, rowing, sailing		117

10-year-old age group

Observation number	Age	Location	Activity	In water	On water
202	10	River Thames at Clifton Hampden	Kayaking, swimming	51	
		River Thames at Clifton Hampden	Canoeing, rowing, sailing		117
203	11	River Thames at Clifton Hampden	Kayaking, swimming	51	
		River Thames at Clifton Hampden	Canoeing, rowing, sailing		117
212	11	River Thames at Clifton Hampden	Kayaking, swimming	51	
		River Thames at Clifton Hampden	Canoeing, rowing, sailing		117

Table 18. Adults' consumption rates of green vegetables in the Harwell area (kg/y)

Observation number	Artichoke	Asparagus	Broccoli	Brussel sprout	Cabbage	Calabrese	Cauliflower	Courgettes	Cucumber	Leaf beet	Lettuce	Marrow	Spinach	Total
57			**6.8**	**9.1**	**28.7**		**6.8**	**6.8**			**10.0**	**9.1**	**2.8**	**80.1**
56			**6.8**	**9.1**	**28.7**		**6.8**	**6.8**			**10.0**		**2.8**	**71.0**
234				**16.4**	**26.3**			**5.2**			**4.3**	**5.0**		**57.2**
235				**16.4**	**26.3**			**5.2**			**4.3**	**5.0**		**57.2**
64			**5.1**	**11.4**	**13.6**						**10.0**	**9.1**		**49.1**
48			**3.4**	**17.1**	**10.6**	**3.4**	**6.8**				**5.0**	**2.3**		**48.6**
49			**3.4**	**17.1**	**10.6**	**3.4**	**6.8**				**5.0**	**2.3**		**48.6**
50			**3.4**	**17.1**	**10.6**	**3.4**	**6.8**				**5.0**	**2.3**		**48.6**
51			**3.4**	**17.1**	**10.6**	**3.4**	**6.8**				**5.0**	**2.3**		**48.6**
115				**12.5**	**11.7**		**7.8**	**10.1**						**42.0**
116				**12.5**	**11.7**		**7.8**	**10.1**						**42.0**
65			**5.1**	**11.4**	**13.6**						**10.0**			**40.1**
66			**5.1**	**11.4**	**13.6**						**10.0**			**40.1**
67			**5.1**	**11.4**	**13.6**						**10.0**			**40.1**
41			**6.8**		**20.0**						**4.9**			**31.7**
42			**6.8**		**20.0**						**4.9**			**31.7**
78				**6.1**	**11.3**		**4.5**					**8.0**		**29.9**
79				**6.1**	**11.3**		**4.5**					**8.0**		**29.9**
77				**6.1**	**11.3**		**4.5**					**8.0**		**29.9**
80					5.1		4.1	9.1			5.0		3.4	26.7
81					5.1		4.1	9.1			5.0		3.4	26.7
310				7.2	16.0									23.2
311				7.2	16.0									23.2
318							0.2	6.7			0.5	6.7	1.7	15.7
319							0.2	6.7			0.5	6.7	1.7	15.7
82					4.3		2.3	1.1		0.4		6.0		14.0
83					4.3		2.3	1.1		0.4		6.0		14.0
84					4.3		2.3	1.1		0.4		6.0		14.0
85					4.3		2.3	1.1		0.4		6.0		14.0
12					3.4			1.1				8.2		12.7
13					3.4			1.1				8.2		12.7
1			2.2		3.4		2.0					3.6		11.3

Table 18. Adults' consumption rates of green vegetables in the Harwell area (kg/y)

Observation number	Artichoke	Asparagus	Broccoli	Brussel sprout	Cabbage	Calabrese	Cauliflower	Courgettes	Cucumber	Leaf beet	Lettuce	Marrow	Spinach	Total
3			2.2		3.4		2.0					3.6		11.3
5			2.2		3.4		2.0					3.6		11.3
8			2.2		3.4		2.0					3.6		11.3
2			2.2		3.4		2.0					3.6		11.3
4			2.2		3.4		2.0					3.6		11.3
6			2.2		3.4		2.0					3.6		11.3
7			2.2		3.4		2.0					3.6		11.3
9			2.2		3.4		2.0					3.6		11.3
10			2.2		3.4		2.0					3.6		11.3
132								5.5				5.4		10.9
133								5.5				5.4		10.9
72			10.9											10.9
34					5.7				1.1		3.3			10.1
35					5.7				1.1		3.3			10.1
36					5.7				1.1		3.3			10.1
39					5.7				1.1		3.3			10.1
40					5.7				1.1		3.3			10.1
309									3.4		6.4			9.8
94				1.2	5.7		1.2				1.6			9.7
95				1.2	5.7		1.2				1.6			9.7
96				1.2	5.7		1.2				1.6			9.7
97				1.2	5.7		1.2				1.6			9.7
100				1.2	5.7		1.2				1.6			9.7
101				1.2	5.7		1.2				1.6			9.7
321	3.2							2.6			1.3		1.4	8.4
322	3.2							2.6			1.3		1.4	8.4
369								0.8	0.8		6.7			8.2
370								0.8	0.8		6.7			8.2
371								0.8	0.8		6.7			8.2
237											8.1			8.1
238											8.1			8.1
354								4.5	2.7					7.3

Table 18. Adults' consumption rates of green vegetables in the Harwell area (kg/y)

Observation number	Artichoke	Asparagus	Broccoli	Brussel sprout	Cabbage	Calabrese	Cauliflower	Courgettes	Cucumber	Leaf beet	Lettuce	Marrow	Spinach	Total
355								4.5	2.7					7.3
307				2.7				0.7			1.8			5.2
308				2.7				0.7			1.8			5.2
312								4.9						4.9
313								4.9						4.9
302								4.6						4.6
303								4.6						4.6
323		1.0	0.3	0.7	0.3	0.3					1.7			4.3
324		1.0	0.3	0.7	0.3	0.3					1.7			4.3
186								4.1						4.1
255											2.4			2.4
304								2.3						2.3
305								2.3						2.3
293								1.5			0.6			2.1
294								1.5			0.6			2.1
30		1.5												1.5
31		1.5												1.5
68								1.3						1.3
69								1.3						1.3
70								1.3						1.3
71								1.3						1.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 19 highest adult consumers is 45.6 kg/y

The observed 97.5th percentile rate based on 85 observations is 57.2 kg/y

Table 19. Adults' consumption rates of other vegetables in the Harwell area (kg/y)

Observation number	Broad bean	Chilli pepper	French bean	Pea	Pepper	Pumpkin	Runner bean	Squash	Sweetcorn	Tomato	Total
309							**9.8**			**37.4**	**47.2**
56	**4.5**			**6.8**			**12.5**		**9.2**	**13.6**	**46.6**
57	**4.5**			**6.8**			**12.5**		**9.2**	**13.6**	**46.6**
310	**11.9**				**1.0**		**19.0**			**7.6**	**39.6**
311	**11.9**				**1.0**		**19.0**			**7.6**	**39.6**
234			**2.6**				**26.1**			**10.2**	**38.9**
235			**2.6**				**26.1**			**10.2**	**38.9**
237	**12.3**		**2.4**	**3.0**			**18.4**				**36.1**
238	**12.3**		**2.4**	**3.0**			**18.4**				**36.1**
68	**8.5**		**10.1**	**8.4**							**27.1**
69	**8.5**		**10.1**	**8.4**							**27.1**
70	**8.5**		**10.1**	**8.4**							**27.1**
71	**8.5**		**10.1**	**8.4**							**27.1**
41				**11.1**			**13.9**				**25.0**
42				**11.1**			**13.9**				**25.0**
115	**6.2**						**18.7**				**24.9**
116	**6.2**						**18.7**				**24.9**
318		**0.7**	**4.8**			**1.0**	**16.3**	**0.2**		**0.7**	**23.7**
319		**0.7**	**4.8**			**1.0**	**16.3**	**0.2**		**0.7**	**23.7**
80	**4.5**		**4.5**	**1.8**			**4.5**		**1.2**	**5.4**	**22.0**
81	**4.5**		**4.5**	**1.8**			**4.5**		**1.2**	**5.4**	**22.0**
132	**8.8**	**0.1**					**8.8**			**0.9**	**18.7**
133	**8.8**	**0.1**					**8.8**			**0.9**	**18.7**
186			**2.7**				**2.7**			**11.8**	**17.2**
64	**2.3**		**3.4**	**0.7**			**6.8**			**3.4**	**16.6**
65	**2.3**		**3.4**	**0.7**			**6.8**			**3.4**	**16.6**
66	**2.3**		**3.4**	**0.7**			**6.8**			**3.4**	**16.6**
67	**2.3**		**3.4**	**0.7**			**6.8**			**3.4**	**16.6**
323	1.7		0.3		0.5	1.0	2.5	1.0	1.0	7.5	15.5
324	1.7		0.3		0.5	1.0	2.5	1.0	1.0	7.5	15.5
43				6.8			8.6				15.4
44				6.8			8.6				15.4

Table 19. Adults' consumption rates of other vegetables in the Harwell area (kg/y)

Observation number	Broad bean	Chilli pepper	French bean	Pea	Pepper	Pumpkin	Runner bean	Squash	Sweetcorn	Tomato	Total
330										15.1	15.1
331										15.1	15.1
49				4.5			6.8			3.4	14.7
50				4.5			6.8			3.4	14.7
51				4.5			6.8			3.4	14.7
48				4.5			6.8			3.4	14.7
354							8.2			6.4	14.5
355							8.2			6.4	14.5
77	3.0		3.0				6.0		2.3		14.4
78	3.0		3.0				6.0		2.3		14.4
79	3.0		3.0				6.0		2.3		14.4
321			1.5				5.7		1.0	3.8	12.0
322			1.5				5.7		1.0	3.8	12.0
338										10.8	10.8
339										10.8	10.8
40	1.5						4.5		1.5	2.4	10.0
34	1.5						4.5		1.5	2.4	10.0
35	1.5						4.5		1.5	2.4	10.0
36	1.5						4.5		1.5	2.4	10.0
39	1.5						4.5		1.5	2.4	10.0
363										9.0	9.0
364										9.0	9.0
369	0.3		0.3				3.8		3.8		8.2
370	0.3		0.3				3.8		3.8		8.2
371	0.3		0.3				3.8		3.8		8.2
52							6.8				6.8
53							6.8				6.8
54							6.8				6.8
55							6.8				6.8
94	2.7				0.9		2.0			1.0	6.6
95	2.7				0.9		2.0			1.0	6.6
96	2.7				0.9		2.0			1.0	6.6

Table 19. Adults' consumption rates of other vegetables in the Harwell area (kg/y)

Observation number	Broad bean	Chilli pepper	French bean	Pea	Pepper	Pumpkin	Runner bean	Squash	Sweetcorn	Tomato	Total
97	2.7				0.9		2.0			1.0	6.6
100	2.7				0.9		2.0			1.0	6.6
101	2.7				0.9		2.0			1.0	6.6
2				0.5		1.4	2.7		1.4		5.9
1				0.5		1.4	2.7		1.4		5.9
12										5.7	5.7
13										5.7	5.7
243										5.4	5.4
244										5.4	5.4
316										5.4	5.4
317										5.4	5.4
307							4.5				4.5
308							4.5				4.5
3				0.5		1.4	2.7				4.5
4				0.5		1.4	2.7				4.5
5				0.5		1.4	2.7				4.5
6				0.5		1.4	2.7				4.5
7				0.5		1.4	2.7				4.5
8				0.5		1.4	2.7				4.5
9				0.5		1.4	2.7				4.5
10				0.5		1.4	2.7				4.5
302			0.5			0.5	2.6		0.7		4.2
303			0.5			0.5	2.6		0.7		4.2
255	0.9						2.7				3.6
82	0.8						0.8			1.5	3.0
83	0.8						0.8			1.5	3.0
84	0.8						0.8			1.5	3.0
85	0.8						0.8			1.5	3.0
367							2.3				2.3
368							2.3				2.3
304			0.2			0.2	1.3		0.3		2.1
305			0.2			0.2	1.3		0.3		2.1

Table 19. Adults' consumption rates of other vegetables in the Harwell area (kg/y)

Observation number	Broad bean	Chilli pepper	French bean	Pea	Pepper	Pumpkin	Runner bean	Squash	Sweetcorn	Tomato	Total
127							1.8				1.8
128							1.8				1.8
293	0.9										0.9
294	0.9										0.9
245										0.4	0.4
246										0.4	0.4
312							0.3				0.3
313							0.3				0.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 28 highest adult consumers is 28.2 kg/y

The observed 97.5th percentile rate based on 104 observations is 42.6 kg/y

Table 20. Adults' consumption rates of root vegetables in the Harwell area (kg/y)

Observation number	Artichoke (Jerusalem)	Beetroot	Carrot	Celeriac	Garlic	Kohl rabi	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Total
64		**12.7**	**5.7**					**25.4**			**6.4**		**1.1**	**51.3**
65		**12.7**	**5.7**					**25.4**			**6.4**		**1.1**	**51.3**
66		**12.7**	**5.7**					**25.4**			**6.4**		**1.1**	**51.3**
67		**12.7**	**5.7**					**25.4**			**6.4**		**1.1**	**51.3**
234		**17.7**	**9.7**				**16.2**					**2.9**		**46.5**
235		**17.7**	**9.7**				**16.2**					**2.9**		**46.5**
115			**4.1**				**9.1**	**9.1**					**12.5**	**34.8**
116			**4.1**				**9.1**	**9.1**					**12.5**	**34.8**
41			**3.7**					**7.4**					**22.3**	**33.4**
42			**3.7**					**7.4**					**22.3**	**33.4**
72			**10.9**				**10.9**	**10.9**						**32.7**
56		**3.6**			**2.6**		**7.6**	**16.5**						**30.3**
57		**3.6**			**2.6**		**7.6**	**16.5**						**30.3**
132		**14.7**	**5.9**				**1.9**		**3.9**					**26.4**
133		**14.7**	**5.9**				**1.9**		**3.9**					**26.4**
48		**4.5**	**4.5**				**2.5**	**14.3**						**25.9**
49		**4.5**	**4.5**				**2.5**	**14.3**						**25.9**
50		**4.5**	**4.5**				**2.5**	**14.3**						**25.9**
51		**4.5**	**4.5**				**2.5**	**14.3**						**25.9**
237			**9.1**				**3.0**	**9.7**	**2.4**					**24.3**
238			**9.1**				**3.0**	**9.7**	**2.4**					**24.3**
77		**6.0**	**4.5**					**7.6**			**3.0**			**21.2**
78		**6.0**	**4.5**					**7.6**			**3.0**			**21.2**
79		**6.0**	**4.5**					**7.6**			**3.0**			**21.2**
309		**12.3**	**7.2**									**1.6**		**21.1**
68		**3.8**	**5.0**				**2.5**	**6.3**						**17.5**
69		**3.8**	**5.0**				**2.5**	**6.3**						**17.5**
70		**3.8**	**5.0**				**2.5**	**6.3**						**17.5**
71		**3.8**	**5.0**				**2.5**	**6.3**						**17.5**
52								14.3						14.3
53								14.3						14.3
54								14.3						14.3

Table 20. Adults' consumption rates of root vegetables in the Harwell area (kg/y)

Observation number	Artichoke (Jerusalem)	Beetroot	Carrot	Celeriac	Garlic	Kohl rabi	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Total
55								14.3						14.3
310			9.5				3.5							13.0
311			9.5				3.5							13.0
323			3.3	1.0			1.0	3.3	1.7	0.3	0.7			11.3
324			3.3	1.0			1.0	3.3	1.7	0.3	0.7			11.3
321		3.4	3.8					1.5	1.5					10.2
322		3.4	3.8					1.5	1.5					10.2
307	9.1													9.1
308	9.1													9.1
82		1.9	1.1			0.4		3.8			1.1			8.3
84		1.9	1.1			0.4		3.8			1.1			8.3
83		1.9	1.1			0.4		3.8			1.1			8.3
85		1.9	1.1			0.4		3.8			1.1			8.3
43			2.3					4.5						6.8
44			2.3					4.5						6.8
1		0.5	2.7				2.2		1.1					6.5
2		0.5	2.7				2.2		1.1					6.5
3		0.5	2.7				2.2		1.1					6.5
4		0.5	2.7				2.2		1.1					6.5
5		0.5	2.7				2.2		1.1					6.5
6		0.5	2.7				2.2		1.1					6.5
7		0.5	2.7				2.2		1.1					6.5
8		0.5	2.7				2.2		1.1					6.5
9		0.5	2.7				2.2		1.1					6.5
10		0.5	2.7				2.2		1.1					6.5
80							1.8	4.5						6.3
81							1.8	4.5						6.3
34			2.3					3.8						6.0
35			2.3					3.8						6.0
36			2.3					3.8						6.0
39			2.3					3.8						6.0
40			2.3					3.8						6.0

Table 20. Adults' consumption rates of root vegetables in the Harwell area (kg/y)

Observation number	Artichoke (Jerusalem)	Beetroot	Carrot	Celeriac	Garlic	Kohl rabi	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Total
255		1.8	2.7				1.4							5.9
94							3.0	2.0						5.0
95							3.0	2.0						5.0
96							3.0	2.0						5.0
97							3.0	2.0						5.0
100							3.0	2.0						5.0
101							3.0	2.0						5.0
369		0.8	1.2					1.1				0.3		3.3
370		0.8	1.2					1.1				0.3		3.3
371		0.8	1.2					1.1				0.3		3.3
318		1.7	0.7		0.1			0.7						3.1
319		1.7	0.7		0.1			0.7						3.1
293			1.4					0.4						1.7
294			1.4					0.4						1.7
12			1.1									0.5		1.6
13			1.1									0.5		1.6
312					0.8									0.8
313					0.8									0.8

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 29 highest adult consumers is 30.6 kg/y

The observed 97.5th percentile rate based on 82 observations is 51.3 kg/y

Table 21. Adults' consumption rates of potato in the Harwell area (kg/y)

Observation number	Potato
56	**85.7**
57	**85.7**
64	**83.8**
65	**83.8**
66	**83.8**
67	**83.8**
48	**50.8**
49	**50.8**
50	**50.8**
51	**50.8**
52	**50.8**
53	**50.8**
54	**50.8**
55	**50.8**
68	**50.8**
69	**50.8**
70	**50.8**
71	**50.8**
80	**50.8**
81	**50.8**
82	**50.8**
83	**50.8**
84	**50.8**
85	**50.8**
354	**50.8**
355	**50.8**
310	**49.1**
311	**49.1**
132	**44.2**
133	**44.2**
72	**43.5**
237	**36.9**
238	**36.9**
234	**34.9**
235	**34.9**
321	**34.4**
322	**34.4**
77	**33.9**
78	**33.9**
79	**33.9**
127	**30.5**
128	**30.5**
41	**29.9**
42	**29.9**
186	25.4
94	24.3
95	24.3
96	24.3
97	24.3
100	24.3
101	24.3
115	20.8

Table 21. Adults' consumption rates of potato in the Harwell area (kg/y)

Observation number	Potato
116	20.8
302	18.7
303	18.7
43	18.4
44	18.4
255	18.1
34	16.9
35	16.9
36	16.9
39	16.9
40	16.9
323	13.3
324	13.3
1	10.9
2	10.9
3	10.9
4	10.9
5	10.9
6	10.9
7	10.9
8	10.9
9	10.9
10	10.9
369	9.5
370	9.5
371	9.5
304	9.3
305	9.3
309	7.3
312	5.0
313	5.0
367	2.3
368	2.3
318	1.7
319	1.7
12	1.4
13	1.4

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of potato based on the 44 highest adult consumers is 49.7 kg/y

The observed 97.5th percentile rate based on 89 observations is 83.8 kg/y

Table 22. Adults' consumption rates of domestic fruit in the Harwell area (kg/y)

Observation number	Apple	Blackberry	Blackcurrant	Cherry	Damson	Fig	Gooseberry	Greengages	Peach	Pear	Plum	Raspberry	Redcurrants	Rhubarb	Strawberry	Total
30	**25.4**			**12.7**						**25.4**	**12.7**	**12.7**			**12.7**	**101.6**
56	**25.4**		**4.5**				**3.4**				**6.8**	**2.3**			**1.1**	**43.5**
57	**25.4**		**4.5**				**3.4**				**6.8**	**2.3**			**1.1**	**43.5**
354	17.1							4.5			4.5					26.2
355	17.1							4.5			4.5					26.2
20	24.0															24.0
307	7.3		1.1				2.3			3.6	2.7	4.5	1.1			22.7
308	7.3		1.1				2.3			3.6	2.7	4.5	1.1			22.7
72	21.8															21.8
234	9.1		0.9									3.6			6.9	20.5
235	9.1		0.9									3.6			6.9	20.5
323	10.0							1.7	1.0	1.7	3.3	1.7				19.3
324	10.0							1.7	1.0	1.7	3.3	1.7				19.3
302	3.5		2.8	2.3						3.4		4.9	2.3			19.2
303	3.5		2.8	2.3						3.4		4.9	2.3			19.2
293	10.0	2.0								0.9	4.0			0.5		17.4
294	10.0	2.0								0.9	4.0			0.5		17.4
31	2.9			2.9						2.9	2.9	2.9			2.9	17.3
186	13.6			2.7												16.3
365	15.0										1.0					16.0
366	15.0										1.0					16.0
344	9.0										3.0					12.0
345	9.0										3.0					12.0
22	1.6			1.6						1.6	1.6	1.6			1.6	9.8
23	1.6			1.6						1.6	1.6	1.6			1.6	9.8
24	1.6			1.6						1.6	1.6	1.6			1.6	9.8
25	1.6			1.6						1.6	1.6	1.6			1.6	9.8
304	1.8		1.4	1.1						1.7		2.5	1.1			9.6
305	1.8		1.4	1.1						1.7		2.5	1.1			9.6
363	9.0															9.0
364	9.0															9.0
94	3.4	0.7									2.0	0.7			2.0	8.7
95	3.4	0.7									2.0	0.7			2.0	8.7
96	3.4	0.7									2.0	0.7			2.0	8.7

Table 22. Adults' consumption rates of domestic fruit in the Harwell area (kg/y)

Observation number	Apple	Blackberry	Blackcurrant	Cherry	Damson	Fig	Gooseberry	Greengages	Peach	Pear	Plum	Raspberry	Redcurrants	Rhubarb	Strawberry	Total
97	3.4	0.7									2.0	0.7			2.0	8.7
100	3.4	0.7									2.0	0.7			2.0	8.7
101	3.4	0.7									2.0	0.7			2.0	8.7
321	2.3														6.0	8.3
322	2.3														6.0	8.3
245	7.9															7.9
246	7.9															7.9
255	6.8										0.5					7.3
68	3.8	1.0					1.3							1.3		7.3
69	3.8	1.0					1.3							1.3		7.3
70	3.8	1.0					1.3							1.3		7.3
71	3.8	1.0					1.3							1.3		7.3
318											3.0			2.3	1.9	7.2
319											3.0			2.3	1.9	7.2
367					2.3						2.3					4.5
368					2.3						2.3					4.5
1				0.7										2.3	1.4	4.3
2				0.7										2.3	1.4	4.3
82		0.8					1.5					1.1			0.4	3.8
83		0.8					1.5					1.1			0.4	3.8
84		0.8					1.5					1.1			0.4	3.8
85		0.8					1.5					1.1			0.4	3.8
310			0.2				1.7					0.9	0.2			3.1
311			0.2				1.7					0.9	0.2			3.1
125	2.3															2.3
126	2.3															2.3
243										1.4	0.9					2.3
244										1.4	0.9					2.3
309						0.8					1.4					2.2
316														1.8		1.8
317														1.8		1.8
183				1.5												1.5
184				1.5												1.5
185				1.5												1.5

Table 22. Adults' consumption rates of domestic fruit in the Harwell area (kg/y)

Observation number	Apple	Blackberry	Blackcurrant	Cherry	Damson	Fig	Gooseberry	Greengages	Peach	Pear	Plum	Raspberry	Redcurrants	Rhubarb	Strawberry	Total
80															1.1	1.1
81															1.1	1.1
250	0.7	0.3														1.0
251	0.7	0.3														1.0
252	0.7	0.3														1.0
253	0.7	0.3														1.0
34			0.8													0.8
35			0.8													0.8
36			0.8													0.8
39			0.8													0.8
40			0.8													0.8
237	0.5											0.1				0.6
238	0.5											0.1				0.6
12												0.5				0.5
13												0.5				0.5
115															0.4	0.4
116															0.4	0.4
312												0.2				0.2
313												0.2				0.2
369															0.1	0.1
370															0.1	0.1
371															0.1	0.1

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 3 highest adult consumers is 62.9 kg/y

The observed 97.5th percentile rate based on 90 observations is 39.6 kg/y

Table 23. Adults' consumption rates of milk in the Harwell area (l/y)

Observation number	Milk from cow
88	**59.1**
89	**59.1**
90	**59.1**
91	**59.1**
255	**59.1**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of milk based on the 5 highest adult consumers is 59.1 l/y

The observed 97.5th percentile rate based on 5 observations is 59.1 l/y

Table 24. Adults' consumption rates of cattle meat in the Harwell area (kg/y)

Observation number	Beef
28	**64.8**
20	**58.5**
21	**58.5**
30	**45.4**
22	**42.3**
23	**42.3**
24	**42.3**
25	**42.3**
29	**35.4**
31	**23.6**
115	**23.3**
116	**23.3**
318	18.0
319	18.0
26	8.7
27	8.7
354	5.7
355	5.7
243	4.3
244	4.3
316	2.2
317	2.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of cattle meat based on the 12 highest adult consumers is 41.8 kg/y

The observed 97.5th percentile rate based on 22 observations is 61.5 kg/y

Table 25. Adults' consumption rates of pig meat in the Harwell area (kg/y)

Observation number	Pork
26	**49.4**
27	**49.4**
317	12.0
354	5.7
355	5.7

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of pig meat based on the 2 highest adult consumers is 49.4 kg/y

The observed 97.5th percentile rate based on 5 observations is 49.4 kg/y

Table 26. Adults' consumption rates of sheep meat in the Harwell area (kg/y)

Observation number	Lamb/mutton
20	**35.1**
21	**35.1**
28	**28.3**
30	**22.7**
22	**19.5**
23	**19.5**
24	**19.5**
25	**19.5**
31	**11.8**
26	8.7
27	8.7
115	7.0
116	7.0
344	5.7
345	5.7

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of sheep meat based on the 9 highest adult consumers is 23.4 kg/y

The observed 97.5th percentile rate based on 15 observations is 35.1 kg/y

Table 27. Adults' consumption rates of poultry in the Harwell area (kg/y)

Observation number	Chicken	Partridge	Pheasant	Pigeon	Total
317	**24.0**				**24.0**
255			**4.5**	**2.8**	**7.3**
64		**0.5**	**5.6**		**6.1**
65		**0.5**	**5.6**		**6.1**
66		**0.5**	**5.6**		**6.1**
67		**0.5**	**5.6**		**6.1**
26			**4.5**		**4.5**
363			**3.4**		**3.4**
364			**3.4**		**3.4**
291		**1.2**	**1.8**		**3.0**
292		**1.2**	**1.8**		**3.0**
92			**2.7**		**2.7**
93			**2.7**		**2.7**
318			2.4		2.4
319			2.4		2.4
340		0.8	1.1		1.9
341		0.8	1.1		1.9
12		1.8			1.8
13			1.8		1.8
234			1.1		1.1
235			1.1		1.1
293			1.1		1.1
294			1.1		1.1
28			0.9		0.9
68			0.7		0.7
69			0.7		0.7
70			0.7		0.7
71			0.7		0.7
250			0.7		0.7
251			0.7		0.7
252			0.7		0.7
253			0.7		0.7
82			0.5		0.5
83			0.5		0.5
84			0.5		0.5
85			0.5		0.5
321			0.5		0.5
322			0.5		0.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of poultry based on the 13 highest adult consumers is 6.0 kg/y (Taking the highest consumption rate and dividing by 3 would give a cut-off value for the critical group of 8.0 kg/y. However, in this case judgement has been used and the cut-off value has been set by dividing the second highest value, 7.3, by 3 giving a cut-off value of 2.43 kg/y)

The observed 97.5th percentile rate based on 38 observations is 8.5 kg/y

Table 28. Adults' consumption rates of eggs in the Harwell area (kg/y)

Observation number	Chicken egg	Duck egg	Total
1	**17.8**		**17.8**
2	**17.8**		**17.8**
3	**17.8**		**17.8**
12	**17.8**		**17.8**
13	**17.8**		**17.8**
19	**17.8**		**17.8**
26	**17.8**		**17.8**
27	**17.8**		**17.8**
29	**17.8**		**17.8**
307	**17.8**		**17.8**
308	**17.8**		**17.8**
348	**17.1**		**17.1**
349	**17.1**		**17.1**
344	**16.8**		**16.8**
345	**16.8**		**16.8**
14	**15.8**		**15.8**
15	**15.8**		**15.8**
115	**14.2**		**14.2**
116	**14.2**		**14.2**
340	**4.4**	**8.8**	**13.3**
341	**4.4**	**8.8**	**13.3**
363	**10.4**		**10.4**
364	**10.4**		**10.4**
94	**8.9**		**8.9**
95	**8.9**		**8.9**
291	**8.9**		**8.9**
292	**8.9**		**8.9**
354	**8.9**		**8.9**
355	**8.9**		**8.9**
243	**8.6**		**8.6**
244	**8.6**		**8.6**
316	**8.2**		**8.2**
317	**8.2**		**8.2**
96	**7.5**		**7.5**
97	**7.5**		**7.5**
100	**7.5**		**7.5**
101	**7.5**		**7.5**
120	**7.1**		**7.1**
121	**7.1**		**7.1**
77	**6.9**		**6.9**
78	**6.9**		**6.9**
79	**6.9**		**6.9**
80	**5.9**		**5.9**
81	**5.9**		**5.9**
338	3.8		3.8
339	3.8		3.8
293	3.6		3.6
294	3.6		3.6
312	0.2		0.2
313	0.2		0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of eggs based on the 44 highest adult consumers is 12.1 kg/y

The observed 97.5th percentile rate based on 50 observations is 17.8 kg/y

Table 29. Adults' consumption rates of wild/free foods in the Harwell area (kg/y)

Observation number	Blackberry	Bullus plum	Crab apple	Damson	Elderberry	Hazel nuts	Plums	Sloe	Total
12	**6.0**	**1.4**	**2.3**	**2.3**	**5.4**	**0.9**		**2.3**	**20.6**
13	**6.0**	**1.4**	**2.3**	**2.3**		**0.9**			**12.9**
56						5.4			5.4
57						5.4			5.4
183	4.5								4.5
184	4.5								4.5
185	4.5								4.5
186	4.5								4.5
309	3.6								3.6
316	3.6								3.6
317	3.6								3.6
363	3.3								3.3
364	3.3								3.3
14				2.5					2.5
15				2.5					2.5
19				2.5					2.5
323	2.2								2.2
324	2.2								2.2
80	1.8								1.8
81	1.8								1.8
92	1.1								1.1
93	1.1								1.1
302				1.1					1.1
303				1.1					1.1
338	1.1								1.1
339	1.1								1.1
365	0.5					0.5			1.0
366	0.5					0.5			1.0
255	0.9								0.9
354	0.9								0.9
355	0.9								0.9
312	0.7						0.2		0.8
313	0.7						0.2		0.8
243	0.7								0.7
244	0.7								0.7
239	0.6								0.6
240	0.6								0.6
241	0.6								0.6
242	0.6								0.6
369	0.4								0.4
370	0.4								0.4
371	0.4								0.4
344	0.2								0.2
345	0.2								0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of wild/free foods based on the 2 highest adult consumers is 16.7 kg/y

The observed 97.5th percentile rate based on 44 observations is 12.3 kg/y

Table 30. Adults' consumption rates of rabbits/hares in the Harwell area (kg/y)

Observation number	Hare	Rabbit	Rabbit liver	Total
318		**3.0**		**3.0**
319		**3.0**		**3.0**
26		**2.7**		**2.7**
27		**2.7**		**2.7**
82	**1.1**			**1.1**
83	**1.1**			**1.1**
84	**1.1**			**1.1**
85	**1.1**			**1.1**
64	**0.8**	**0.2**		**1.0**
65	**0.8**	**0.2**		**1.0**
66	**0.8**	**0.2**		**1.0**
67	**0.8**	**0.2**		**1.0**
255		0.9		0.9
12			0.5	0.5
13			0.5	0.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of rabbits/hares based on the 12 highest adult consumers is 1.6 kg/y

The observed 97.5th percentile rate based on 15 observations is 3.0 kg/y

Table 31. Adults' consumption rates of honey in the Harwell area (kg/y)

Observation number	Honey
355	**10.9**
56	**9.1**
57	**9.1**
58	**9.1**
59	**9.1**
60	**9.1**
61	**9.1**
62	**9.1**
63	**9.1**
348	2.5
349	2.5
363	0.6
364	0.6
92	0.5
93	0.5
312	0.5
354	0.5
365	0.3
366	0.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of honey based on the 9 highest adult consumers is 9.3 kg/y

The observed 97.5th percentile rate based on 19 observations is 10.1 kg/y

Table 32. Adults' consumption rates of wild fungi in the Harwell area (kg/y)

Observation number	Mixed fungi	Mushrooms	Total
12	**3.4**		**3.4**
13	**3.4**		**3.4**
239		**2.3**	**2.3**
240		**2.3**	**2.3**
241		**2.3**	**2.3**
242		**2.3**	**2.3**
2		**1.8**	**1.8**
183		**1.5**	**1.5**
184		**1.5**	**1.5**
185		**1.5**	**1.5**
20		0.8	0.8
21		0.8	0.8
243		0.3	0.3
244		0.3	0.3
307		0.2	0.2
308		0.2	0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of wild fungi based on the 10 highest adult consumers is 2.2 kg/y

The observed 97.5th percentile rate based on 16 observations is 3.4 kg/y

Table 33. Adults' consumption rates of venison in the Harwell area (kg/y)

Observation number	Venison
92	**5.0**
93	**5.0**
64	1.4
65	1.4
66	1.4
67	1.4
293	1.2
294	1.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of venison based on the 2 highest adult consumers is 5.0 kg/y

The observed 97.5th percentile rate based on 8 observations is 5.0 kg/y

Table 34. Adults' consumption rates of freshwater fish (lake & stream) in the Harwell area (kg/y)

Observation number	Brown trout	Rainbow trout	Total
298		**5.9**	**5.9**
299		**5.9**	**5.9**
234		**4.0**	**4.0**
235		**4.0**	**4.0**
239	0.7		0.7
240	0.7		0.7
241	0.7		0.7
242	0.7		0.7

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of freshwater fish (lake & stream) based on the 4 highest adult consumers is 4.9 kg/y

The observed 97.5th percentile rate based on 8 observations is 5.9 kg/y

Table 35. Children's consumption rates of green vegetables in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Asparagus	Broccoli	Brussel sprout	Cabbage	Calabrese	Cauliflower	Courgettes	Cucumber	Leaf beet	Lettuce	Marrow	Spinach	Total
236	**12**			**8.2**	**13.2**			**2.6**			**2.2**	**2.5**		**28.6**
117	**13**			**6.2**	**5.8**		**3.9**	**5.0**						**21.0**
320	**12**						**0.2**	**6.7**			**0.5**	**6.7**	**1.7**	**15.7**
86	**15**				**4.3**		**2.3**	**1.1**		**0.4**		**6.0**		**14.0**
87	**12**				**4.3**		**2.3**	**1.1**		**0.4**		**6.0**		**14.0**
38	12				2.8				0.6		1.7			5.1
325	16	1.0	0.3	0.7	0.3	0.3					1.7			4.3
306	14							2.3						2.3
295	14							1.5			0.6			2.1
296	13							1.5			0.6			2.1
32	13	1.5												1.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 5 highest 15-year-old age group consumers is 18.7 kg/y

The observed 97.5th percentile rate based on 11 observations is 26.7 kg/y

10-year-old age group

Observation number	Age	Asparagus	Brussel sprout	Cabbage	Cauliflower	Courgettes	Cucumber	Lettuce	Total
118	**10**		**6.2**	**5.8**	**3.9**	**5.0**			**21.0**
119	**8**		**6.2**	**5.8**	**3.9**	**5.0**			**21.0**
37	8			2.8			0.6	1.7	5.1
99	9		0.6	2.8	0.6			0.8	4.9
314	11					2.5			2.5
297	10					1.5		0.6	2.1
33	11	1.5							1.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 2 highest 10-year-old age group consumers is 21.0 kg/y

The observed 97.5th percentile rate based on 7 observations is 21.0 kg/y

Table 35. Children's consumption rates of green vegetables in the Harwell area (kg/y)

5-year-old age group

Observation number	Age	Brussel sprout	Cabbage	Cauliflower	Lettuce	Total
98	**3**	**0.3**	**1.4**	**0.3**	**0.4**	**2.4**

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 2.4 kg/y

The observed 97.5th percentile rate is not applicable for 1 observation

1-year-old age group

Observation number	Age	Cauliflower	Courgettes	Total
315	**1**		**1.0**	**1.0**
11	**1**	**0.5**		**0.5**

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 0.7 kg/y

The observed 97.5th percentile rate based on 2 observations is 1.0 kg/y

Table 36. Children's consumption rates of other vegetables in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Broad bean	Chilli pepper	French bean	Pepper	Pumpkin	Runner bean	Squash	Sweetcorn	Tomato	Total
236	**12**			**1.3**			**13.1**			**5.1**	**19.4**
320	**12**		**0.7**	**4.8**		**1.0**	**9.1**	**0.2**		**0.7**	**16.4**
325	**16**	**1.7**		**0.3**	**0.5**	**1.0**	**2.5**	**1.0**	**1.0**	**7.5**	**15.5**
117	**13**	**3.1**					**9.3**				**12.4**
38	12	0.8					2.3		0.8	1.2	5.0
86	15	0.8					0.8			1.5	3.0
87	12	0.8					0.8			1.5	3.0
306	14			0.2		0.2	1.3		0.3		2.1
129	16						1.8				1.8
130	14						1.8				1.8
131	14						1.8				1.8
295	14	0.9									0.9
296	13	0.9									0.9

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 4 highest 15-year-old age group consumers is 15.9 kg/y

The observed 97.5th percentile rate based on 13 observations is 18.5 kg/y

10-year-old age group

Observation number	Age	Broad bean	Pea	Pepper	Runner bean	Sweetcorn	Tomato	Total
118	**10**	**3.1**			**9.3**			**12.4**
119	**8**	**3.1**			**9.3**			**12.4**
45	**11**		**3.4**		**4.3**			**7.7**
46	**9**		**3.4**		**4.3**			**7.7**
37	**8**	**0.8**			**2.3**	**0.8**	**1.2**	**5.0**
99	9	1.3		0.4	1.0		0.5	3.3
297	10	0.9						0.9
247	7						0.2	0.2
314	11				0.2			0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 5 highest 10-year-old age group consumers is 9.1 kg/y

The observed 97.5th percentile rate based on 9 observations is 12.4 kg/y

Table 36. Children's consumption rates of other vegetables in the Harwell area (kg/y)

5-year-old age group

Observation number	Age	Broad bean	Pea	Pepper	Runner bean	Tomato	Total
47	**3**		**1.7**		**2.1**		**3.9**
98	**3**	**0.7**		**0.2**	**0.5**	**0.3**	**1.6**
248	5					0.2	0.2

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 2.7 kg/y

The observed 97.5th percentile rate based on 3 observations is 3.7 kg/y

1-year-old age group

Observation number	Age	Pea	Runner bean	Total
11	**1**	**0.1**	**0.7**	**0.8**
315	1		0.1	0.1

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the single highest 1-year-old age group consumer is 0.8 kg/y

The observed 97.5th percentile rate based on 2 observations is 0.8 kg/y

Table 37. Children's consumption rates of root vegetables in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Beetroot	Carrot	Celeriac	Garlic	Kohl rabi	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Total
236	**12**	**8.9**	**4.9**				**8.1**					**1.4**		**23.3**
117	**13**		**2.1**				**4.6**	**4.5**					**6.2**	**17.4**
325	**16**		**3.3**	**1.0**			**1.0**	**3.3**	**1.7**	**0.3**	**0.7**			**11.3**
86	**15**	**1.9**	**1.1**			**0.4**		**3.8**			**1.1**			**8.3**
87	**12**	**1.9**	**1.1**			**0.4**		**3.8**			**1.1**			**8.3**
320	12	1.7	0.7		0.1			0.7						3.1
38	12		1.1					1.9						3.0
295	14		1.4					0.4						1.7
296	13		1.4					0.4						1.7

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 5 highest 15-year-old age group consumers is 13.7 kg/y

The observed 97.5th percentile rate based on 9 observations is 22.1 kg/y

10-year-old age group

Observation number	Age	Carrot	Garlic	Leek	Onion	Swede	Total
118	**10**	**2.1**		**4.6**	**4.5**	**6.2**	**17.4**
119	**8**	**2.1**		**4.6**	**4.5**	**6.2**	**17.4**
45	11	1.1			2.3		3.4
46	9	1.1			2.3		3.4
37	8	1.1			1.9		3.0
99	9			1.5	1.0		2.5
297	10	1.4			0.4		1.7
314	11		0.4				0.4

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 2 highest 10-year-old age group consumers is 17.4 kg/y

The observed 97.5th percentile rate based on 8 observations is 17.4 kg/y

Table 37. Children's consumption rates of root vegetables in the Harwell area (kg/y)

5-year-old age group

Observation number	Age	Carrot	Leek	Onion	Total
47	**3**	**0.6**		**1.1**	**1.7**
98	**3**		**0.7**	**0.5**	**1.2**

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 1.5 kg/y

The observed 97.5th percentile rate based on 2 observations is 1.7 kg/y

1-year-old age group

Observation number	Age	Carrot	Leek	Parsnip	Total
11	**1**	**0.7**	**0.6**	**0.3**	**1.6**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the only 1-year-old age group consumer is 1.6 kg/y

The observed 97.5th percentile rate is not applicable for 1 observation

Table 38. Children's consumption rates of potato in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Potato
86	**15**	**45.7**
87	**12**	**38.1**
129	**16**	**30.5**
130	**14**	**30.5**
131	**14**	**30.5**
236	**12**	**17.5**
325	16	13.3
117	13	10.4
306	14	9.3
38	12	8.5
320	12	1.7

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of potato based on the 6 highest 15-year-old age group consumers is 32.1 kg/y
The observed 97.5th percentile rate based on 11 observations is 43.8 kg/y

10-year-old age group

Observation number	Age	Potato
99	**9**	**12.1**
118	**10**	**10.4**
119	**8**	**10.4**
45	**11**	**9.2**
46	**9**	**9.2**
37	**8**	**8.5**
314	11	2.5

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of potato based on the 6 highest 10-year-old age group consumers is 10.0 kg/y
The observed 97.5th percentile rate based on 7 observations is 11.9 kg/y

5-year-old age group

Observation number	Age	Potato
98	**3**	**6.1**
47	**3**	**4.6**

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 5.3 kg/y
The observed 97.5th percentile rate based on 2 observations is 6.0 kg/y

1-year-old age group

Observation number	Age	Potato
11	**1**	**2.7**
315	**1**	**1.0**

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 1.9 kg/y
The observed 97.5th percentile rate based on 2 observations is 2.7 kg/y

Table 39. Children's consumption rates of domestic fruit in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Apple	Blackberry	Blackcurrant	Cherry	Gooseberry	Greengages	Peach	Pear	Plum	Raspberry	Redcurrants	Rhubarb	Strawberry	Total
325	**16**	**10.0**					**1.7**	**1.0**	**1.7**	**3.3**	**1.7**				**19.3**
295	**14**	**10.0**	**2.0**						**0.9**	**4.0**			**0.5**		**17.4**
296	**13**	**10.0**	**2.0**						**0.9**	**4.0**			**0.5**		**17.4**
32	**13**	**2.9**			**2.9**				**2.9**	**2.9**	**2.9**			**2.9**	**17.3**
236	**12**	**4.5**		**0.5**							**1.8**			**3.4**	**10.2**
306	**14**	**1.8**		**1.4**	**1.1**				**1.7**		**2.5**	**1.1**			**9.6**
320	**12**									**3.0**			**2.3**	**1.9**	**7.2**
86	15		0.8			1.5					1.1			0.4	3.8
87	12		0.8			1.5					1.1			0.4	3.8
117	13													0.4	0.4
38	12			0.4											0.4

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 7 highest 15-year-old age group consumers is 14.1 kg/y

The observed 97.5th percentile rate based on 11 observations is 18.8 kg/y

10-year-old age group

Observation number	Age	Apple	Blackberry	Blackcurrant	Cherry	Pear	Plum	Raspberry	Rhubarb	Strawberry	Total
297	**10**	**10.0**	**2.0**			**0.9**	**4.0**		**0.5**		**17.4**
33	**11**	**2.9**			**2.9**	**2.9**	**2.9**	**2.9**		**2.9**	**17.3**
99	9	1.7	0.3				1.0	0.3		1.0	4.4
247	7	3.9									3.9
118	10									0.4	0.4
119	8									0.4	0.4
37	8			0.4							0.4
314	11							0.1			0.1

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 2 highest 10-year-old age group consumers is 17.4 kg/y

The observed 97.5th percentile rate based on 8 observations is 17.4 kg/y

Table 39. Children's consumption rates of domestic fruit in the Harwell area (kg/y)

5-year-old age group

Observation number	Age	Apple	Blackberry	Plum	Raspberry	Strawberry	Total
248	**5**	**3.9**					**3.9**
98	**3**	**0.8**	**0.2**	**0.5**	**0.2**	**0.5**	**2.2**

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 3.1 kg/y

The observed 97.5th percentile rate based on 2 observations is 3.9 kg/y

1-year-old age group

Observation number	Age	Cherry	Raspberry	Strawberry	Total
11	**1**	**0.5**		**0.5**	**0.9**
315	1		0.03		0.03

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the single highest 1-year-old age group consumer is 0.9 kg/y

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

Table 40. Children's consumption rates of cattle meat in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Beef
320	**12**	**18.0**
32	**13**	**11.8**
117	**13**	**11.7**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of cattle meat based on the 3 highest 15-year-old age group consumers is 13.8 kg/y

The observed 97.5th percentile rate based on 3 observations is 17.7 kg/y

10-year-old age group

Observation number	Age	Beef
33	**11**	**11.8**
118	**10**	**11.7**
119	**8**	**11.7**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of cattle meat based on the 3 highest 10-year-old age group consumers is 11.7 kg/y

The observed 97.5th percentile rate based on 3 observations is 11.8 kg/y

Table 41. Children's consumption rates of sheep meat in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Lamb/mutton
32	**13**	**5.9**
117	**13**	**3.5**

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 4.7 kg/y

The observed 97.5th percentile rate based on 2 observations is 5.8 kg/y

10-year-old age group

Observation number	Age	Lamb/mutton
33	**11**	**5.9**
118	**10**	**3.5**
119	**8**	**3.5**

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 4.3 kg/y

The observed 97.5th percentile rate based on 3 observations is 5.8 kg/y

Table 42. Children's consumption rates of poultry in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Pheasant
320	**12**	**2.4**
295	**14**	**1.1**
296	**13**	**1.1**
236	12	0.5
86	15	0.5
87	12	0.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of poultry based on the 3 highest 15-year-old age group consumers is 1.5 kg/y

The observed 97.5th percentile rate based on 6 observations is 2.2 kg/y

10-year-old age group

Observation number	Age	Pheasant
297	**10**	**1.1**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of poultry based on the only 10-year-old age group consumer is 1.1 kg/y

The observed 97.5th percentile rate is not applicable for 1 observation

Table 43. Children's consumption rates of eggs in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Chicken egg
16	**16**	**15.8**
17	**14**	**15.8**
117	**13**	**14.2**
295	14	3.6
296	13	3.6

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of eggs based on the 3 highest 15-year-old age group consumers is 15.3 kg/y

The observed 97.5th percentile rate based on 5 observations is 15.8 kg/y

10-year-old age group

Observation number	Age	Chicken egg
118	**10**	**14.2**
119	**8**	**14.2**
122	**10**	**7.1**
123	**9**	**7.1**
124	**8**	**7.1**
99	9	3.7
297	10	3.6
314	11	0.1

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 10.0 kg/y

The observed 97.5th percentile rate based on 8 observations is 14.2 kg/y

Table 43. Children's consumption rates of eggs in the Harwell area (kg/y)

5-year-old age group

Observation number	Age	Chicken egg
18	**4**	**7.9**
98	3	1.9

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of eggs based on the single highest 5-year-old age group consumer is 7.9 kg/y
The observed 97.5th percentile rate based on 2 observations is 7.8 kg/y

1-year-old age group

Observation number	Age	Chicken egg
315	**1**	**0.05**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of eggs based on the only 1-year-old age group consumer is 0.05 kg/y
The observed 97.5th percentile rate is not applicable for 1 observation

Table 44. Children's consumption rates of wild/free foods in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Blackberry	Damson	Total
16	**16**		**2.5**	**2.5**
17	**14**		**2.5**	**2.5**
325	**16**	**2.2**		**2.2**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of wild/free foods based on the 3 highest 15-year-old age group consumers is 2.4 kg/y
The observed 97.5th percentile rate based on 3 observations is 2.5 kg/y

10-year-old age group

Observation number	Age	Blackberry	Plums	Total
314	**11**	**0.3**	**0.1**	**0.4**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of wild/free foods based on the only 10-year-old age group consumer is 0.4 kg/y
The observed 97.5th percentile rate is not applicable for 1 observation

5-year-old age group

Observation number	Age	Damson	Total
18	**4**	**1.3**	**1.3**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of wild/free foods based on the only 5-year-old age group consumer is 1.3 kg/y
The observed 97.5th percentile rate is not applicable for 1 observation

Table 44. Children's consumption rates of wild/free foods in the Harwell area (kg/y)

1-year-old age group

Observation number	Age	Blackberry	Plums	Total
315	**1**	**0.1**	**0.03**	**0.2**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of wild/free foods based on the only 1-year-old age group consumer is 0.2 kg/y

The observed 97.5th percentile rate is not applicable for 1 observation

Table 45. Children's consumption rates of rabbits/hares in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Hare	Rabbit	Total
320	**12**		**3.0**	**3.0**
86	**15**	**1.1**		**1.1**
87	**12**	**1.1**		**1.1**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of rabbits/hares based on the 3 highest 15-year-old age group consumers is 1.7 kg/y

The observed 97.5th percentile rate based on 3 observations is 2.9 kg/y

Table 46. Children's consumption rates of venison in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Venison
295	**14**	**1.2**
296	**13**	**1.2**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of venison based on the 2 highest 15-year-old age group consumers is 1.2 kg/y

The observed 97.5th percentile rate based on 2 observations is 1.2 kg/y

10-year-old age group

Observation number	Age	Venison
297	**10**	**1.2**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of venison based on the only 10-year-old age group consumer is 1.2 kg/y

The observed 97.5th percentile rate is not applicable for 1 observation

Table 47. Children's consumption rates of freshwater fish (lake & stream) in the Harwell area (kg/y)

15-year-old age group

Observation number	Age	Rainbow trout
236	**12**	**2.0**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of freshwater fish (lake & stream) based on the only 15-year-old age group consumer is 2.0 kg/y
The observed 97.5th percentile rate is not applicable for 1 observation

10-year-old age group

Observation number	Age	Rainbow trout
300	**7**	**5.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of freshwater fish (lake & stream) based on the only 10-year-old age group consumer is 5.9 kg/y
The observed 97.5th percentile rate is not applicable for 1 observation

5-year-old age group

Observation number	Age	Rainbow trout
301	**2**	**5.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of freshwater fish (lake & stream) based on the only 5-year-old age group consumer is 5.9 kg/y
The observed 97.5th percentile rate is not applicable for 1 observation

Table 48. Percentage contribution each food type makes to its terrestrial food group for adults

Green vegetables	
Cabbage	31.63 %
Brussel sprout	16.00 %
Lettuce	12.97 %
Marrow	10.97 %
Courgettes	9.95 %
Cauliflower	7.81 %
Broccoli	6.45 %
Spinach	1.26 %
Cucumber	1.14 %
Calabrese	0.97 %
Artichoke	0.43 %
Asparagus	0.34 %
Leaf beet	0.10 %

Other vegetables	
Runner bean	40.32 %
Tomato	23.45 %
Broad bean	13.56 %
Pea	8.77 %
French bean	7.46 %
Sweetcorn	4.12 %
Pumpkin	1.41 %
Pepper	0.61 %
Squash	0.18 %
Chilli pepper	0.12 %

Root vegetables	
Onion	35.21 %
Carrot	20.12 %
Beetroot	17.11 %
Leek	12.91 %
Swede	5.95 %
Shallot	3.24 %
Parsnip	2.38 %
Artichoke	1.45 %
Spring onion	0.74 %
Garlic	0.56 %
Celeriac	0.16 %
Kohl rabi	0.12 %
Radish	0.05 %

Potato	
Potato	100.00 %

Domestic fruit	
Apple	46.47 %
Plum	11.56 %
Strawberry	8.56 %
Raspberry	8.50 %
Pear	7.01 %
Cherry	4.37 %
Blackcurrant	3.02 %
Gooseberry	3.01 %
Rhubarb	2.19 %
Blackberry	1.91 %
Greengages	1.45 %
Redcurrants	1.11 %
Damson	0.53 %
Peach	0.23 %
Fig	0.09 %

Milk	
Milk from cow	100.00 %

Cattle meat	
Beef	100.00 %

Pig meat	
Pork	100.00 %

Sheep meat	
Lamb	100.00 %

Poultry	
Pheasant	66.96 %
Chicken	23.15 %
Partridge	7.23 %
Pigeon	2.66 %

Eggs	
Chicken egg	96.79 %
Duck egg	3.21 %

Wild/free foods	
Blackberry	61.88 %
Damson	12.63 %
Hazel nuts	12.04 %
Elderberry	4.78 %
Crab apple	3.99 %
Bullus plum	2.39 %
Sloe	1.99 %
Plums	0.29 %

Rabbits/hares	
Rabbit	61.19 %
Hare	34.61 %
Rabbit liver	4.21 %

Honey	
Honey	100.00 %

Wild fungi	
Mushrooms	72.63 %
Mixed fungi	27.37 %

Venison	
Venison	100.00 %

Freshwater fish (lake & stream)	
Rainbow trout	87.42 %
Brown trout	12.58 %

Notes

Food types in emboldened italics were monitored by FSA in 2006 (EA, EHS, FSA and SEPA, 2007).
Percentages are based on the consumption of all adults in the survey consuming that particular food group.

Table 49. Occupancy rates in the Harwell direct radiation survey area for adults and children (h/y)

Observation Number	Sex	Age (years)	Indoor occupancy	Outdoor occupancy	Total occupancy
0 to 0.25 km zone					
247	M	7	7480	644	8124
248	F	5	7480	644	8124
331	M	71	7872	52	7924
408	F	44	7774	150	7924
356	M	39	3948	3936	7884
357	F	36	3948	3936	7884
358	M	14	7650	234	7884
359	M	13	7650	234	7884
360	M	5	6424	1460	7884
361	M	31	3948	3936	7884
75	F	73	7668	52	7720
76	M	80	7668	52	7720
330	M	48	7618	98	7716
318	F	39	7209	484	7693
423	F	36	6964	660	7624
426	F	2	6964	660	7624
427	F	2	6964	660	7624
326	M	54	6702	636	7338
254	F	U	6500	700	7200
320	M	12	6703	484	7187
410	M	24	7024	150	7174
413	F	52	6924	150	7074
332	F	40	6579	495	7074
327	F	46	6846	88	6934
425	M	13	6094	660	6754
246	F	U	5980	644	6624
245	M	U	5324	550	5874
319	M	40	5366	484	5850
328	F	14	5575	44	5619
424	M	38	5304	220	5524
411	M	17	5274	150	5424
409	M	44	4974	200	5174
329	M	19	4900	44	4944
74	M	22	3677	260	3937
72	M	24	3025	260	3285
73	M	26	3025	260	3285
435	M	U	2350		2350
362	F	17		2304	2304
269	M	U	2160		2160
270	M	U	1080	1080	2160
271	F	U	2160		2160
272	F	U	2160		2160
434	M	U	1998		1998
277	M	U	1955		1955
278	M	U	1955		1955
279	M	U	1955		1955
280	M	U	1955		1955
281	M	U	1955		1955
282	F	U	1955		1955
283	F	U	1955		1955
284	F	U	1955		1955
285	F	U	1955		1955
286	F	U	1955		1955
259	M	U	1932		1932
260	M	U	1932		1932
261	M	U	1932		1932
262	M	U	1932		1932
263	M	U	1932		1932

Table 49. Occupancy rates in the Harwell direct radiation survey area for adults and children (h/y)

Observation Number	Sex	Age (years)	Indoor occupancy	Outdoor occupancy	Total occupancy
264	F	U	1932		1932
265	F	U	1932		1932
266	F	U	1932		1932
267	F	U	1932		1932
268	F	U	1932		1932
380	M	U	1824	48	1872
381	F	U	1824	48	1872
382	F	U	1824	48	1872
383	F	U	1824	48	1872
384	F	U	1824	48	1872
385	F	U	1824	48	1872
386	F	U	1824	48	1872
387	F	U	1824	48	1872
388	F	U	1824	48	1872
389	F	U	1824	48	1872
390	F	U	1824	48	1872
391	F	U	1824	48	1872
392	F	U	1824	48	1872
393	F	U	1824	48	1872
394	F	U	1824	48	1872
395	F	U	1824	48	1872
396	F	U	1824	48	1872
397	F	U	1824	48	1872
398	F	U	1824	48	1872
399	F	U	1824	48	1872
400	F	U	1824	48	1872
401	F	U	1824	48	1872
402	F	U	1824	48	1872
403	F	U	1824	48	1872
404	F	U	1824	48	1872
405	F	U	1824	48	1872
406	F	U	1824	48	1872
407	F	U	1824	48	1872
350	M	U	1633	59	1692
351	M	U	1692		1692
352	M	U	1692		1692
432	F	U	1645		1645
433	F	U	1645		1645
414	F	U	1645		1645
375	U	U	1440	48	1488
376	U	U	1440	48	1488
377	U	U	1440	48	1488
378	U	U	1440	48	1488
353	F	U	1410		1410
419	M	U	1410		1410
420	F	U	1410		1410
287	M	U	1196		1196
288	M	U	1196		1196
289	F	U	1196		1196
290	F	U	1196		1196
415	M	U	1152		1152
416	M	U	1152		1152
421	F	U	987		987
417	F	U	940		940
418	F	U	940		940
273	M	U	920		920
274	M	U	920		920
275	F	U	920		920
276	F	U	920		920

Table 49. Occupancy rates in the Harwell direct radiation survey area for adults and children (h/y)

Observation Number	Sex	Age (years)	Indoor occupancy	Outdoor occupancy	Total occupancy
422	F	U	893		893
249	F	U		819	819
373	U	U	720	48	768
374	U	U	720	48	768
379	U	U	552	48	600
>0.25 to 0.5 km zone					
339	M	57	6244	404	6648
338	F	54	3844	404	4248
436	F	U	1645	235	1880
437	F	U	1645	235	1880
438	F	U	1645	235	1880
439	F	U	1645	235	1880
440	F	U	1645	235	1880
441	F	U	1645	235	1880
442	F	U	1645	235	1880
443	F	U	1645	235	1880
444	F	U	1645	235	1880
445	F	U	1645	235	1880
446	F	U	1645	235	1880
447	F	U	1645	235	1880
448	F	U	1645	235	1880
449	F	U	1645	235	1880
450	F	U	1645	235	1880
>0.5 to 1 km zone					
372	F	87	8552	52	8604
317	M	62	6874	1246	8120
316	F	60	7540	356	7896
244	M	U	7174	550	7724
428	F	47	6974	700	7674
368	F	60	6937	735	7672
309	F	70	6652	966	7618
256	F	35	6780	822	7602
258	F	1	6780	822	7602
243	F	U	6674	700	7374
344	F	53	5218	2058	7276
345	M	63	6399	730	7129
333	F	42	6600	156	6756
367	M	62	5864	730	6594
186	M	U	6093	483	6576
431	M	16	6264	200	6464
335	F	9	5907	156	6063
336	F	8	5907	156	6063
337	F	4	5907	156	6063
334	M	34	5832	156	5988
429	M	47	5674	100	5774
342	F	54	5370	390	5760
343	M	63	5510	130	5640
257	M	27	4244	984	5227
412	M	U	4874	150	5024
154	F	U	1500	200	1700
155	F	U	1500	200	1700
156	F	U	1500	200	1700
157	F	U	1500	200	1700
158	F	U	1500	200	1700
159	F	U	1500	200	1700
160	M	U	1500	200	1700
164	M	U	1380	230	1610
162	F	U	1400		1400
134	M	5	936	332	1268

Table 49. Occupancy rates in the Harwell direct radiation survey area for adults and children (h/y)

Observation Number	Sex	Age (years)	Indoor occupancy	Outdoor occupancy	Total occupancy
135	M	5	936	332	1268
136	M	5	936	332	1268
137	M	5	936	332	1268
138	M	5	936	332	1268
139	F	5	936	332	1268
140	F	5	936	332	1268
141	F	5	936	332	1268
142	F	5	936	332	1268
143	F	5	936	332	1268
144	M	10	985	283	1268
145	M	10	985	283	1268
146	M	10	985	283	1268
147	M	10	985	283	1268
148	M	10	985	283	1268
149	F	10	985	283	1268
150	F	10	985	283	1268
151	F	10	985	283	1268
152	F	10	985	283	1268
153	F	10	985	283	1268
430	F	19	988	60	1048
161	F	U	700	100	800
346	F	35		730	730
163	F	U	700		700
167	F	U	440	120	560
168	F	U	440	120	560
169	F	U	440	120	560
170	F	U	440	120	560
171	F	U	440	120	560
172	F	U	440	120	560
173	F	U	440	120	560
174	F	U	440	120	560
175	F	U	440	120	560
176	F	U	440	120	560
177	F	U	440	120	560
178	F	U	440	120	560
179	F	U	440	120	560
347	F	35		442	442
165	F	U	400		400
166	F	U	400		400
180	F	U	195		195
181	F	U	195		195
182	F	U	195		195

Notes
U = Unknown

Table 50. Analysis of occupancy rates in the Harwell direct radiation survey area

0 to 0.25 km zone	
Number of hours	Number of observations
8000 to 8760	2
7000 to 8000	21
6000 to 7000	3
5000 to 6000	6
4000 to 5000	1
3000 to 4000	3
2000 to 3000	6
1000 to 2000	68
0 to 1000	12
0 to 8760	**122**

>0.25 to 0.5 km zone	
Number of hours	Number of observations
8000 to 8760	0
7000 to 8000	0
6000 to 7000	1
5000 to 6000	0
4000 to 5000	1
3000 to 4000	0
2000 to 3000	0
1000 to 2000	15
0 to 1000	0
0 to 8760	**17**

>0.5 to 1 km zone	
Number of hours	Number of observations
8000 to 8760	2
7000 to 8000	10
6000 to 7000	7
5000 to 6000	6
4000 to 5000	0
3000 to 4000	0
2000 to 3000	0
1000 to 2000	30
0 to 1000	22
0 to 8760	**77**

Notes

Only representative samples of generic level data are included in this analysis.

Table 51. Gamma dose rate measurements for the Harwell direct radiation survey (µGy/h)

Location	Outdoor substrate	Gamma dose rate at 1 metre[a]	Indoor substrate	Gamma dose rate at 1 metre[a]
Business 1	Grass	0.069		NM
Business 2	Grass	0.073	Concrete	0.076
Residence 1	Grass	0.076		NM
Residence 2	Grass	0.081	Wood	0.106
Business 3	Grass	0.069	Concrete	0.082
School 1	Grass	0.066	Wood	0.062
Business 4	Grass	0.068	Concrete	0.062
Residence 3	Grass	0.057	Wood	0.065
Residence 4	Grass	0.073	Concrete	0.096
Residence 5	Grass	0.072	Concrete	0.108
Residence 6	Grass	0.083	Concrete	0.111
Residence 7	Grass	0.077		NM
Residence 8	Grass	0.077		NM
Residence 9	Grass	0.083	Concrete	0.103
Residence 10	Grass	0.075	Concrete	0.093
Residence 11	Grass	0.085		NM
Residence 12	Grass	0.077	Wood	0.105
Residence 13	Grass	0.088	Concrete	0.116
Residence 14	Grass	0.073	Concrete	0.096
Residence 15	Grass	0.075	Concrete	0.098
Residence 16	Grass	0.072	Concrete	0.101
Residence 17	Grass	0.077	Concrete	0.095
Residence 18	Grass	0.065		NM
School 2	Grass	0.066	Concrete	0.068
Residence 19		NM	Wood	0.082
Residence 20	Grass	0.070	Concrete	0.088

	Substrate	Gamma dose rate at 1 metre
Background 1	Grass	0.070
Background 2	Grass	0.067
Background 3	Grass	0.074
Background 4	Grass	0.065

Notes

NM = Not measured

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

Table 52. Combinations of adult pathways for use in dose assessments in the Harwell area

Combination number	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in water	Occupancy on water	Indoor occupancy	Outdoor occupancy
1			*	*	*	*	*					*	*	*	*		*								
2							*		*		*						*								
3									*	*	*	*	*		*										
4			*	*	*	*	*		*		*		*												
5			*	*	*	*	*						*	*		*									
6			*	*	*	*						*			*			*							
7			*	*	*	*	*							*										*	*
8			*	*	*	*	*	*				*		*	*										
9												*		*		*		*							
10		*																			*	*	*		
11	*	*																		*					
12			*	*	*	*	*					*							*						
13														*			*		*						
14				*			*		*				*	*			*							*	*
15			*	*	*		*					*	*					*							
16				*			*		*	*		*	*	*										*	*
17			*	*	*	*	*		*			*			*									*	*
18							*				*		*	*										*	*
19			*	*		*	*		*	*			*	*		*									
20				*			*					*	*	*		*									

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; green vegetables, other vegetables, root vegetables, potato, domestic fruit, poultry, eggs, wild/free foods, rabbits/hares and wild fungi.

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
1	M	30			11.3	5.9	6.5	10.9	4.3						**17.8**														
2	F	29			11.3	5.9	6.5	10.9	4.3						**17.8**				**1.8**										
3	F	55			11.3	4.5	6.5	10.9							**17.8**														
4	M	U			11.3	4.5	6.5	10.9																					
5	M	U			11.3	4.5	6.5	10.9																					
6	M	U			11.3	4.5	6.5	10.9																					
7	M	U			11.3	4.5	6.5	10.9																					
8	F	U			11.3	4.5	6.5	10.9																					
9	F	U			11.3	4.5	6.5	10.9																					
10	F	U			11.3	4.5	6.5	10.9																					
12	M	62			12.7	5.7	1.6	1.4	0.5					1.8	**17.8**	**20.6**	0.5		**3.4**										
13	F	59			12.7	5.7	1.6	1.4	0.5					1.8	**17.8**	**12.9**	0.5		**3.4**										
14	F	37													**15.8**	2.5													
15	M	40													**15.8**	2.5													
19	F	U													**17.8**	2.5													
20	F	51							24.0		**58.5**		**35.1**						0.8										
21	F	51									**58.5**		**35.1**						0.8										
22	F	19							9.8		**42.3**		**19.5**																
23	M	45							9.8		**42.3**		**19.5**																
24	F	45							9.8		**42.3**		**19.5**																
25	M	21							9.8		**42.3**		**19.5**																
26	M	55									8.7	**49.4**	8.7	**4.5**	**17.8**		**2.7**												

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
27	F	55									8.7	**49.4**	8.7		**17.8**		**2.7**												
28	M	22									**64.8**		**28.3**	0.9															
29	M	24									**35.4**				**17.8**														
30	M	40			1.5				**101.6**		**45.4**		**22.7**																
31	F	40			1.5				17.3		**23.6**		**11.8**																
34	M	49			10.1	10.0	6.0	16.9	0.8																				
35	F	48			10.1	10.0	6.0	16.9	0.8																				
36	M	18			10.1	10.0	6.0	16.9	0.8																				
39	M	U			10.1	10.0	6.0	16.9	0.8																				
40	F	U			10.1	10.0	6.0	16.9	0.8																				
41	M	65			**31.7**	**25.0**	**33.4**	**29.9**																					
42	F	65			**31.7**	**25.0**	**33.4**	**29.9**																					
43	F	30				15.4	6.8	18.4																					
44	M	31				15.4	6.8	18.4																					
48	M	65			**48.6**	14.7	**25.9**	**50.8**																					
49	F	64			**48.6**	14.7	**25.9**	**50.8**																					
50	F	U			**48.6**	14.7	**25.9**	**50.8**																					
51	M	U			**48.6**	14.7	**25.9**	**50.8**																					
52	M	U				6.8	14.3	**50.8**																					
53	M	U				6.8	14.3	**50.8**																					
54	F	U				6.8	14.3	**50.8**																					
55	F	U				6.8	14.3	**50.8**																					

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
56	M	68			**71.0**	**46.6**	**30.3**	**85.7**	**43.5**							5.4		**9.1**											
57	F	68			**80.1**	**46.6**	**30.3**	**85.7**	**43.5**							5.4		**9.1**											
58	M	U																**9.1**											
59	M	U																**9.1**											
60	M	U																**9.1**											
61	F	U																**9.1**											
62	F	U																**9.1**											
63	F	U																**9.1**											
64	M	66			**49.1**	**16.6**	**51.3**	**83.8**						**6.1**			**1.0**			1.4									
65	F	66			**40.1**	**16.6**	**51.3**	**83.8**						**6.1**			**1.0**			1.4									
66	F	40			**40.1**	**16.6**	**51.3**	**83.8**						**6.1**			**1.0**			1.4									
67	M	40			**40.1**	**16.6**	**51.3**	**83.8**						**6.1**			**1.0**			1.4									
68	M	54			1.3	**27.1**	**17.5**	**50.8**	7.3					0.7															
69	F	52			1.3	**27.1**	**17.5**	**50.8**	7.3					0.7															
70	F	U			1.3	**27.1**	**17.5**	**50.8**	7.3					0.7															
71	M	U			1.3	**27.1**	**17.5**	**50.8**	7.3					0.7															
72	M	24			10.9		**32.7**	**43.5**	21.8																			3025	260
73	M	26																										3025	260
74	M	22																										3677	260
75	F	73																										7668	52
76	M	80																										7668	52
77	F	50			**29.9**	14.4	**21.2**	**33.9**							**6.9**														

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
78	M	50			**29.9**	14.4	**21.2**	**33.9**							**6.9**														
79	F	26			**29.9**	14.4	**21.2**	**33.9**							**6.9**														
80	M	48			26.7	**22.0**	6.3	**50.8**	1.1						**5.9**	1.8													
81	F	45			26.7	**22.0**	6.3	**50.8**	1.1						**5.9**	1.8													
82	M	47			14.0	3.0	8.3	**50.8**	3.8					0.5			**1.1**												
83	F	47			14.0	3.0	8.3	**50.8**	3.8					0.5			**1.1**												
84	F	67			14.0	3.0	8.3	**50.8**	3.8					0.5			**1.1**												
85	M	17			14.0	3.0	8.3	**50.8**	3.8					0.5			**1.1**												
88	M	51								**59.1**																			
89	F	50								**59.1**																			
90	M	25								**59.1**																			
91	F	23								**59.1**																			
92	F	50												**2.7**		1.1		0.5		**5.0**									
93	M	50												**2.7**		1.1		0.5		**5.0**									
94	M	55			9.7	6.6	5.0	24.3	8.7						**8.9**														
95	F	55			9.7	6.6	5.0	24.3	8.7						**8.9**														
96	M	32			9.7	6.6	5.0	24.3	8.7						**7.5**														
97	F	31			9.7	6.6	5.0	24.3	8.7						**7.5**														
100	M	U			9.7	6.6	5.0	24.3	8.7						**7.5**														
101	F	U			9.7	6.6	5.0	24.3	8.7						**7.5**														
102	M	60																				**250**							
103	M	19																				**250**							

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
104	M	45																				**780**							
105	M	43																				**780**							
106	M	41																				81							
107	M	43																				81							
108	M	35																				**198**							
109	F	35																				**198**							
112	M	44																				**475**							
113	M	46																				**475**							
114	F	45																				**475**							
115	M	40			**42.0**	**24.9**	**34.8**	20.8	0.4		**23.3**		7.0		**14.2**														
116	F	38			**42.0**	**24.9**	**34.8**	20.8	0.4		**23.3**		7.0		**14.2**														
120	M	U													**7.1**														
121	F	U													**7.1**														
125	M	U							2.3																				
126	F	U							2.3																				
127	M	U				1.8		**30.5**																					
128	F	U				1.8		**30.5**																					
132	F	U			10.9	**18.7**	**26.4**	**44.2**																					
133	M	U			10.9	**18.7**	**26.4**	**44.2**																					
154	F	U																										1500	200
155	F	U																										1500	200
156	F	U																										1500	200

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
157	F	U																										1500	200
158	F	U																										1500	200
159	F	U																										1500	200
160	M	U																										1500	200
161	F	U																										700	100
162	F	U																										1400	
163	F	U																										700	
164	M	U																										1380	230
165	F	U																										400	
166	F	U																										400	
167	F	U																										440	120
168	F	U																										440	120
169	F	U																										440	120
170	F	U																										440	120
171	F	U																										440	120
172	F	U																										440	120
173	F	U																										440	120
174	F	U																										440	120
175	F	U																										440	120
176	F	U																										440	120
177	F	U																										440	120
178	F	U																										440	120

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
179	F	U																										440	120
180	F	U																										195	
181	F	U																										195	
182	F	U																										195	
183	F	U							1.5							4.5			**1.5**										
184	M	U							1.5							4.5			**1.5**										
185	M	U							1.5							4.5			**1.5**										
186	M	U			4.1	**17.2**		25.4	16.3							4.5												6093	483
187	M	U																									450		
188	F	U																									450		
189	M	U																									240		
190	F	U																									240		
193	M	U																				**234**							
196	M	U																				108							
197	M	U																				18							
198	M	U																				**390**							
199	M	U																								39	117		
200	M	U																								39	117		
201	M	U																								39	117		
209	M	U		**1.2**																			**12**			39	117		
210	F	U		**1.2**																									
213	F	U																				**240**							

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
214	M	U																				120							
215	M	U																									4874		
216	F	U																									4874		
217	M	U																									400		
218	M	U																				**273**							
219	M	U																				50							
220	M	U																				**390**							
221	M	U																				**390**							
222	M	U																				**440**							
223	M	U																				**240**							
224	M	U																				**312**							
225	M	U																				**297**							
226	M	U	**1.1**	**1.0**																		**297**							
227	M	U																				**234**							
228	M	U																				**312**							
229	M	U																				**312**							
230	M	U																				**273**							
233	M	U																				84							
234	M	U			**57.2**	**38.9**	**46.5**	**34.9**	20.5					1.1							**4.0**								
235	F	U			**57.2**	**38.9**	**46.5**	**34.9**	20.5					1.1							**4.0**								
237	M	U			8.1	**36.1**	**24.3**	**36.9**	0.6																				
238	F	U			8.1	**36.1**	**24.3**	**36.9**	0.6																				

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
239	M	U														0.6			**2.3**		0.7								
240	F	U														0.6			**2.3**		0.7								
241	M	U														0.6			**2.3**		0.7								
242	F	U														0.6			**2.3**		0.7								
243	F	U				5.4			2.3		4.3				**8.6**	0.7			0.3									6674	700
244	M	U				5.4			2.3		4.3				**8.6**	0.7			0.3									7174	550
245	M	U				0.4			7.9																			5324	550
246	F	U				0.4			7.9																			5980	644
249	F	U																											819
250	F	U							1.0					0.7															
251	M	U							1.0					0.7															
252	M	U							1.0					0.7															
253	M	U							1.0					0.7															
254	F	U																										6500	700
255	F	U			2.4	3.6	5.9	18.1	7.3	**59.1**				**7.3**		0.9	0.9												
256	F	35																										6780	822
257	M	27																										4244	984
259	M	U																										1932	
260	M	U																										1932	
261	M	U																										1932	
262	M	U																										1932	
263	M	U																										1932	

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
264	F	U																										1932	
265	F	U																										1932	
266	F	U																										1932	
267	F	U																										1932	
268	F	U																										1932	
269	M	U																										2160	
270	M	U																										1080	1080
271	F	U																										2160	
272	F	U																										2160	
273	M	U																										920	
274	M	U																										920	
275	F	U																										920	
276	F	U																										920	
277	M	U																										1955	
278	M	U																										1955	
279	M	U																										1955	
280	M	U																										1955	
281	M	U																										1955	
282	F	U																										1955	
283	F	U																										1955	
284	F	U																										1955	
285	F	U																										1955	

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
286	F	U																										1955	
287	M	U																										1196	
288	M	U																										1196	
289	F	U																										1196	
290	F	U																										1196	
291	M	U												**3.0**	**8.9**														
292	F	U												**3.0**	**8.9**														
293	M	44			2.1	0.9	1.7		17.4					1.1	3.6					1.2									
294	F	44			2.1	0.9	1.7		17.4					1.1	3.6					1.2									
298	M	42																			**5.9**								
299	F	40																			**5.9**								
302	F	40			4.6	4.2		18.7	19.2							1.1													
303	M	40			4.6	4.2		18.7	19.2							1.1													
304	M	21			2.3	2.1		9.3	9.6																				
305	F	19			2.3	2.1		9.3	9.6																				
307	F	U			5.2	4.5	9.1		22.7						**17.8**				0.2										
308	M	U			5.2	4.5	9.1		22.7						**17.8**				0.2										
309	F	70			9.8	**47.2**	**21.1**	7.3	2.2							3.6												6652	966
310	F	73			23.2	**39.6**	13.0	**49.1**	3.1																				
311	M	78			23.2	**39.6**	13.0	**49.1**	3.1																				
312	F	33			4.9	0.3	0.8	5.0	0.2						0.2	0.8		0.5											
313	M	40			4.9	0.3	0.8	5.0	0.2						0.2	0.8													

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
316	F	60				5.4			1.8		2.2				**8.2**	3.6												7540	356
317	M	62				5.4			1.8		2.2	12.0		**24.0**	**8.2**	3.6												6874	1246
318	F	39			15.7	**23.7**	3.1	1.7	7.2		18.0			2.4			**3.0**											7209	484
319	M	40			15.7	**23.7**	3.1	1.7	7.2		18.0			2.4			**3.0**											5366	484
321	F	58			8.4	12.0	10.2	**34.4**	8.3					0.5															
322	M	62			8.4	12.0	10.2	**34.4**	8.3					0.5															
323	M	62			4.3	15.5	11.3	13.3	19.3							2.2													
324	F	59			4.3	15.5	11.3	13.3	19.3							2.2													
326	M	54																										6702	636
327	F	46																										6846	88
329	M	19																										4900	44
330	M	48				15.1																						7618	98
331	M	71				15.1																						7872	52
332	F	40																										6579	495
333	F	42																										6600	156
334	M	34																										5832	156
338	F	54				10.8									3.8	1.1												3844	404
339	M	57				10.8									3.8	1.1												6244	404
340	F	U												1.9	**13.3**														
341	M	U												1.9	**13.3**														
342	F	54																										5370	390
343	M	63																										5510	130

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
344	F	53							12.0				5.7		**16.8**	0.2												5218	2058
345	M	63							12.0				5.7		**16.8**	0.2												6399	730
346	F	35																											730
347	F	35																											442
348	M	U													**17.1**			2.5											
349	F	U													**17.1**			2.5											
350	M	U																										1633	59
351	M	U																										1692	
352	M	U																										1692	
353	F	U																										1410	
354	M	91			7.3	14.5		**50.8**	26.2		5.7	5.7			**8.9**	0.9		0.5											
355	F	80			7.3	14.5		**50.8**	26.2		5.7	5.7			**8.9**	0.9		**10.9**											
356	M	39																										3948	3936
357	F	36																										3948	3936
361	M	31																										3948	3936
362	F	17																											2304
363	M	61				9.0			9.0					**3.4**	**10.4**	3.3		0.6											
364	F	57				9.0			9.0					**3.4**	**10.4**	3.3		0.6											
365	M	U							16.0							1.0		0.3											
366	F	U							16.0							1.0		0.3											
367	M	62				2.3		2.3	4.5																			5864	730
368	F	60				2.3		2.3	4.5																			6937	735

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
369	M	U			8.2	8.2	3.3	9.5	0.1							0.4													
370	F	U			8.2	8.2	3.3	9.5	0.1							0.4													
371	F	U			8.2	8.2	3.3	9.5	0.1							0.4													
372	F	87																										8552	52
373	U	U																										720	48
374	U	U																										720	48
375	U	U																										1440	48
376	U	U																										1440	48
377	U	U																										1440	48
378	U	U																										1440	48
379	U	U																										552	48
380	M	U																										1824	48
381	F	U																										1824	48
382	F	U																										1824	48
383	F	U																										1824	48
384	F	U																										1824	48
385	F	U																										1824	48
386	F	U																										1824	48
387	F	U																										1824	48
388	F	U																										1824	48
389	F	U																										1824	48
390	F	U																										1824	48

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
391	F	U																										1824	48
392	F	U																										1824	48
393	F	U																										1824	48
394	F	U																										1824	48
395	F	U																										1824	48
396	F	U																										1824	48
397	F	U																										1824	48
398	F	U																										1824	48
399	F	U																										1824	48
400	F	U																										1824	48
401	F	U																										1824	48
402	F	U																										1824	48
403	F	U																										1824	48
404	F	U																										1824	48
405	F	U																										1824	48
406	F	U																										1824	48
407	F	U																										1824	48
408	F	44																										7774	150
409	M	44																										4974	200
410	M	24																										7024	150
411	M	17																										5274	150
412	M	U																										4874	150

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
413	F	52																										6924	150
414	F	U																										1645	
415	M	U																										1152	
416	M	U																										1152	
417	F	U																										940	
418	F	U																										940	
419	M	U																										1410	
420	F	U																										1410	
421	F	U																										987	
422	F	U																										893	
423	F	36																										6964	660
424	M	38																										5304	220
428	F	47																										6974	700
429	M	47																										5674	100
430	F	19																										988	60
432	F	U																										1645	
433	F	U																										1645	
434	M	U																										1998	
435	M	U																										2350	
436	F	U																										1645	235
437	F	U																										1645	235
438	F	U																										1645	235

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
439	F	U																										1645	235
440	F	U																										1645	235
441	F	U																										1645	235
442	F	U																										1645	235
443	F	U																										1645	235
444	F	U																										1645	235
445	F	U																										1645	235
446	F	U																										1645	235
447	F	U																										1645	235
448	F	U																										1645	235
449	F	U																										1645	235
450	F	U																										1645	235
451	M	U																						130	156				
452	M	U																						130	156				
453	M	U																						130	156				

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 Harwell area

Observation number	Sex	Age (years)	Freshwater crustaceans	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Venison	Freshwater fish (lake & stream)	Riverbank occupancy over mud & gras	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
15-year-old age group																					
16	F	16										**15.8**	**2.5**								
17	M	14										**15.8**	**2.5**								
32	M	13		1.5				**17.3**	**11.8**	**5.9**											
38	F	12		5.1	5.0	3.0	8.5	0.4													
86	F	15		**14.0**	3.0	**8.3**	**45.7**	3.8			0.5			**1.1**							
87	M	12		**14.0**	3.0	**8.3**	**38.1**	3.8			0.5			**1.1**							
117	F	13		**21.0**	**12.4**	**17.4**	10.4	0.4	**11.7**	**3.5**		**14.2**									
129	F	16			1.8		**30.5**														
130	M	14			1.8		**30.5**														
131	M	14			1.8		**30.5**														
191	M	13															**360**				
204	M	12																51	117		
205	M	13																51	117		
206	M	14																51	117		
207	M	15																51	117		
208	M	16																51	117		
211	F	12	**1.2**																		
236	F	12		**28.6**	**19.4**	**23.3**	**17.5**	**10.2**			0.5					**2.0**					
295	F	14		2.1	0.9	1.7		**17.4**			**1.1**	3.6			**1.2**						

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

Observation number	Sex	Age (years)	Freshwater crustaceans	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Venison	Freshwater fish (lake & stream)	Riverbank occupancy over mud & gras	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
296	F	13		2.1	0.9	1.7		**17.4**			**1.1**	3.6			**1.2**						
306	F	14		2.3	2.1		9.3	**9.6**													
320	M	12		**15.7**	**16.4**	3.1	1.7	**7.2**	**18.0**		**2.4**			**3.0**						6703	484
325	F	16		4.3	**15.5**	**11.3**	13.3	**19.3**					**2.2**								
328	F	14																		5575	44
358	M	14																		7650	234
359	M	13																		7650	234
425	M	13																		6094	660
431	M	16																		6264	200
10-year-old age group																					
33	F	11		1.5				**17.3**	**11.8**	**5.9**											
37	M	8		5.1	**5.0**	3.0	**8.5**	0.4													
45	M	11			**7.7**	3.4	**9.2**														
46	M	9			**7.7**	3.4	**9.2**														
99	F	9		4.9	3.3	2.5	**12.1**	4.4				3.7									
110	M	9															**198**				
118	F	10		**21.0**	**12.4**	**17.4**	**10.4**	0.4	**11.7**	**3.5**		**14.2**									
119	M	8		**21.0**	**12.4**	**17.4**	**10.4**	0.4	**11.7**	**3.5**		**14.2**									
122	M	10										**7.1**									
123	M	9										**7.1**									

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

Observation number	Sex	Age (years)	Freshwater crustaceans	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Venison	Freshwater fish (lake & stream)	Riverbank occupancy over mud & gras	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
124	M	8										**7.1**									
144	M	10																		985	283
145	M	10																		985	283
146	M	10																		985	283
147	M	10																		985	283
148	M	10																		985	283
149	F	10																		985	283
150	F	10																		985	283
151	F	10																		985	283
152	F	10																		985	283
153	F	10																		985	283
192	M	11															**360**				
194	M	11															63				
195	M	11															63				
202	M	10																51	117		
203	M	11																51	117		
212	M	11	**1.2**															51	117		
231	M	11															**273**				
232	M	11															**273**				
247	M	7			0.2			3.9												7480	644

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

Observation number	Sex	Age (years)	Freshwater crustaceans	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Venison	Freshwater fish (lake & stream)	Riverbank occupancy over mud & gras	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
297	F	10		2.1	0.9	1.7		**17.4**			**1.1**	3.6			**1.2**						
300	F	7														**5.9**					
314	M	11		2.5	0.2	0.4	2.5	0.1				0.1	**0.4**								
335	F	9																		5907	156
336	F	8																		5907	156
5-year-old age group																					
18	M	4										**7.9**	**1.3**								
47	F	3			**3.9**	**1.7**	**4.6**														
98	M	3		**2.4**	**1.6**	**1.2**	**6.1**	**2.2**				1.9									
111	M	6															**198**				
134	M	5																		936	332
135	M	5																		936	332
136	M	5																		936	332
137	M	5																		936	332
138	M	5																		936	332
139	F	5																		936	332
140	F	5																		936	332
141	F	5																		936	332
142	F	5																		936	332
143	F	5																		936	332

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

Observation number	Sex	Age (years)	Freshwater crustaceans	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Venison	Freshwater fish (lake & stream)	Riverbank occupancy over mud & gras	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
248	F	5			0.2			**3.9**												7480	644
301	M	2														**5.9**					
337	F	4																		5907	156
360	M	5																		6424	1460
426	F	2																		6964	660
427	F	2																		6964	660
1-year-old age group																					
11	M	1		**0.5**	**0.8**	**1.6**	**2.7**	**0.9**													
258	F	1																		6780	822
315	F	1		**1.0**	0.1		**1.0**	0.03				**0.05**	**0.2**								

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	Other pathways possibly involved
1	At least 12 anglers reported that they had seen, or knew of, people poaching fish to consume from the River Thames. Fish were alledgedly caught by angling and laying lines at night. There were no confirmed observations of this noted during the survey.	Freshwater fish consumption from water affected by liquid discharges	Insufficient data to estimate a rate. Reports of up to 30 kg of fish at a time being taken. Believed to include pike, perch, carp, bream and possibly other species.	Riverbank ocupancy. No rates estimated.

Annex 4. Ratios for determining consumption and occupancy rates for children

Group	Ratio child/adult[a]	
	1-year-old	10-year-old
Fish[b]	0.050	0.200
Crustaceans[b]	0.050	0.250
Molluscs[b]	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[c]	0.110	0.490
Game[d]	0.140	0.500
Honey	0.789	0.789
Wild fungi	0.150	0.450
Freshwater fish[b]	0.050	0.250
Direct radiation	1.000	1.000
External exposure	0.030	0.500
Plume	1.000	1.000

Notes

[a]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 b and c, 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)

[b]Ratios were derived from Smith and Jones, (2003) which presented data for infants and children.

[c]Ratios were derived from FSA data for wild fruit and nuts for infants and 10-yr-old children.

[d]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 Harwell area

		Pathway Name																									
Profile Name	**Number of individuals**	Crustacea - Freshwater	Direct[a]	Eggs	Fish - lake & stream	Fish - river	Fruit - Domestic	Fruit and Nuts - Wild	Gamma ext - Sediment[b]	Honey	Meat - Cattle	Meat - Game[c]	Meat - Pig	Meat - Poultry	Meat - Sheep	Milk	Wild fungi	Occupancy in water	Occupancy on water	Plume (IN; 0-0.25km)[d]	Plume (MID; >0.25-0.5km)[d]	Plume (OUT; >0.5-1km)[d]	Sewage workers in proximity to sewage	Sewage workers in proximity to sewage sludge or cake	Vegetables - Green	Vegetables - Other Domestic	Vegetables - Potatoes	Vegetables - Root
Freshwater crustacean consumers	3	1.1				0.4			100									10	40								
Occupants for direct radiation	181		1	0.4			0.6	0.1			0.3		0.1	0.2	0.1					1740	220	910			0.3	1.1	0.5	0.3
Egg consumers	44		0.1	12.1			4.8	1.4		0.4	2.8	0.1	2.8	1.1	1		0.2					1030			8.4	6.4	12	4.9
Freshwater fish (lake & stream) consumers	4				4.9		10.2							0.5											28.6	19.4	17.5	23.3
Freshwater fish (river) consumers	1	1				1.1			300																			
Domestic fruit consumers	3						62.9	3.6		6	15.1				7.6										50.8	31.1	57.2	20.2
Wild fruit and nut consumers	2			17.8			0.5	16.7				0.5		1.8			3.4								12.7	5.7	1.4	1.6
Occupants for exposure - Sediment	16	0.1				0.1			420																			
Honey consumers	9			1			12.6	1.3		9.3	0.6		0.6												17.6	12	24.7	6.7
Cattle meat consumers	12			3.9			15.2				41.8			0.1	18.7		0.1								7.2	4.1	3.5	5.8
Game meat consumers	10		0.2	3.6			1.4	0.2		0.1	5.3	3.1	9.9	3.9	1.7					1350					20.1	11.4	33.9	21.1
Pig meat consumers	2			17.8							8.7	2.7	49.4	2.3	8.7													
Poultry meat consumers	13		0.1	5			2.1	1		0.2	0.8	1.8	4.7	6	0.7	4.5						620			13.2	7.2	27.2	16.2
Sheep meat consumers	9						20.2				46.6			0.1	23.4		0.2								0.3			
Milk consumers	5						1.5	0.2				0.2		1.5		59.1									0.5	0.7	3.6	1.2
Wild fungi consumers	10			5.3	0.3		1	4.9				0.1		0.4			2.2								3.7	1.7	1.4	1
Occupancy in water	4	0.3																40	120									
Occupancy on water	2																		4870									
Occupants for plume pathways (inner area)	26		1				2				1.4	0.2		0.2						6560					1.6	3	1.8	1.5
Occupants for plume pathways (mid area)	2		1	3.8				1.1													5450					10.8		
Occupants for plume pathways (outer area)	20		1	3.4			3	0.9			0.6		0.6	1.2	0.6							6900			0.7	4.5	1.9	1.1
Sewage workers in proximity to sewage	3																						130	160				
Sewage workers in proximity to sewage sludge or cake	3																						130	160				
Green vegetable consumers	19			2.6	0.4		6.8	0.6		1	2.5	0.5		1.4	0.7										45.6	23.1	51.7	34.8
Other domestic vegetable consumers	28		0.1	1.4	0.3		7.2	0.8		0.6	3	0.6		1.2	0.5					480		510			27.5	28.2	45.7	26.2
Potato consumers	44			1.1	0.2		6.2	0.4		0.7	0.3	0.3	0.3	0.7						70					23.3	18.8	49.7	21.5
Root vegetable consumers	29		0.1	1.7	0.3		6.3	0.5		0.6	1.6	0.3		1	0.5					110		260			32.1	24.3	48.2	30.6

Notes

[a]Direct radiation is expressed as a proportion of the group who are present within 1km of site

[b]Gamma ext - sediment includes occupancy over mud and grass

[c]Game meat includes rabbits/hares and venison

[d]Plume times are the sums of individuals' indoor and outdoor times

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
2	F	29			11.3	5.9	6.5	10.9	4.3						17.8				1.8										
8	F	U			11.3	4.5	6.5	10.9																					
9	F	U			11.3	4.5	6.5	10.9																					
10	F	U			11.3	4.5	6.5	10.9																					
14	F	37													15.8	2.5													
16	F	16													15.8	2.5													
19	F	U													17.8	2.5													
22	F	19							9.8		42.3		19.5																
31	F	40			1.5				17.3		23.6		11.8																
40	F	U			10.1	10.0	6.0	16.9	0.8																				
43	F	30				15.4	6.8	18.4																					
50	F	U			48.6	14.7	25.9	50.8																					
54	F	U				6.8	14.3	50.8																					
55	F	U				6.8	14.3	50.8																					
61	F	U																9.1											
62	F	U																9.1											
63	F	U																9.1											
66	F	40			40.1	16.6	51.3	83.8						6.1			1.0			1.4									
70	F	U			1.3	27.1	17.5	50.8	7.3					0.7															
79	F	26			29.9	14.4	21.2	33.9							6.9														
86	F	15			14.0	3.0	8.3	45.7	3.8					0.5			1.1												
91	F	23								59.1																			
92	F	50												2.7		1.1		0.5		5.0									
97	F	31			9.7	6.6	5.0	24.3	8.7						7.5														
101	F	U			9.7	6.6	5.0	24.3	8.7						7.5														
109	F	35																				198							
116	F	38			42.0	24.9	34.8	20.8	0.4		23.3		7.0		14.2														

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
121	F	U													7.1														
126	F	U							2.3																				
128	F	U				1.8		30.5																					
129	F	16				1.8		30.5																					
132	F	U			10.9	18.7	26.4	44.2																					
154	F	U																										1500	200
155	F	U																										1500	200
156	F	U																										1500	200
157	F	U																										1500	200
158	F	U																										1500	200
159	F	U																										1500	200
161	F	U																										700	100
162	F	U																										1400	
163	F	U																										700	
165	F	U																										400	
166	F	U																										400	
167	F	U																										440	120
168	F	U																										440	120
169	F	U																										440	120
170	F	U																										440	120
171	F	U																										440	120
172	F	U																										440	120
173	F	U																										440	120
174	F	U																										440	120
175	F	U																										440	120
176	F	U																										440	120
177	F	U																										440	120

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
178	F	U																										440	120
179	F	U																										440	120
180	F	U																										195	
181	F	U																										195	
182	F	U																										195	
183	F	U							1.5							4.5			1.5										
188	F	U																									450		
190	F	U																									240		
210	F	U		1.2																									
213	F	U																				240							
216	F	U																									4874		
235	F	U			57.2	38.9	46.5	34.9	20.5					1.1							4.0								
238	F	U			8.1	36.1	24.3	36.9	0.6																				
240	F	U														0.6			2.3		0.7								
242	F	U														0.6			2.3		0.7								
243	F	U				5.4			2.3		4.3				8.6	0.7			0.3									6674	700
246	F	U				0.4			7.9																			5980	644
249	F	U																											819
250	F	U							1.0					0.7															
254	F	U																										6500	700
255	F	U			2.4	3.6	5.9	18.1	7.3	59.1				7.3		0.9	0.9												
256	F	35																										6780	822
264	F	U																										1932	
265	F	U																										1932	
266	F	U																										1932	
267	F	U																										1932	
268	F	U																										1932	

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
271	F	U																										2160	
272	F	U																										2160	
275	F	U																										920	
276	F	U																										920	
282	F	U																										1955	
283	F	U																										1955	
284	F	U																										1955	
285	F	U																										1955	
286	F	U																										1955	
289	F	U																										1196	
290	F	U																										1196	
292	F	U												3.0	8.9														
294	F	44			2.1	0.9	1.7		17.4					1.1	3.6					1.2									
299	F	40																			5.9								
302	F	40			4.6	4.2		18.7	19.2							1.1													
305	F	19			2.3	2.1		9.3	9.6																				
307	F	U			5.2	4.5	9.1		22.7						17.8				0.2										
312	F	33			4.9	0.3	0.8	5.0	0.2						0.2	0.8		0.5											
318	F	39			15.7	23.7	3.1	1.7	7.2		18.0			2.4			3.0											7209	484
325	F	16			4.3	15.5	11.3	13.3	19.3							2.2													
332	F	40																										6579	495
333	F	42																										6600	156
340	F	U												1.9	13.3														
346	F	35																											730
347	F	35																											442
349	F	U													17.1			2.5											
353	F	U																										1410	

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
357	F	36																										3948	3936
362	F	17																											2304
366	F	U							16.0							1.0		0.3											
370	F	U			8.2	8.2	3.3	9.5	0.1							0.4													
371	F	U			8.2	8.2	3.3	9.5	0.1							0.4													
381	F	U																										1824	48
382	F	U																										1824	48
383	F	U																										1824	48
384	F	U																										1824	48
385	F	U																										1824	48
386	F	U																										1824	48
387	F	U																										1824	48
388	F	U																										1824	48
389	F	U																										1824	48
390	F	U																										1824	48
391	F	U																										1824	48
392	F	U																										1824	48
393	F	U																										1824	48
394	F	U																										1824	48
395	F	U																										1824	48
396	F	U																										1824	48
397	F	U																										1824	48
398	F	U																										1824	48
399	F	U																										1824	48
400	F	U																										1824	48
401	F	U																										1824	48
402	F	U																										1824	48

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
403	F	U																										1824	48
404	F	U																										1824	48
405	F	U																										1824	48
406	F	U																										1824	48
407	F	U																										1824	48
408	F	44																										7774	150
414	F	U																										1645	
417	F	U																										940	
418	F	U																										940	
420	F	U																										1410	
421	F	U																										987	
422	F	U																										893	
423	F	36																										6964	660
430	F	19																										988	60
432	F	U																										1645	
433	F	U																										1645	
436	F	U																										1645	235
437	F	U																										1645	235
438	F	U																										1645	235
439	F	U																										1645	235
440	F	U																										1645	235
441	F	U																										1645	235
442	F	U																										1645	235
443	F	U																										1645	235
444	F	U																										1645	235
445	F	U																										1645	235
446	F	U																										1645	235

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

Observation number	Sex	Age (years)	Freswater fish (river)	Freshwater crustaceans	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 (lake & stream)	Riverbank occupancy over mud & grass	Handling fishing gear	Occupancy in close proximity to sewage	Occupancy in close proximity to sewage sludge or sewage cake	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
447	F	U																										1645	235
448	F	U																										1645	235
449	F	U																										1645	235
450	F	U																										1645	235

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.

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