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Radiological Habits Survey: Sellafield, 2003

ENVIRONMENT AGENCY

FOOD STANDARDS AGENCY

HSE
Health & Safety Executive

2004

Environment Report RL04/04

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2004

Peer reviewed by B. D. Smith

The work described in this report was carried out under contract to the Environment Agency, the Food Standards Agency and the Health and Safety Executive.
CEFAS contracts C1659, RB103 and C1666 respectively.
EA Project PO070206680, FSA Project RP0183 and HSE Project NS/X/374

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SUMMARY

This report presents the results of a survey conducted in 2003 into the habits and consumption patterns of people living, working and pursuing recreational activities in the vicinity of British Nuclear Fuels plc's Sellafield works. The site operations include fuel element storage, reprocessing and decommissioning of some nuclear facilities. Under the Nuclear Installations Act 1965, British Nuclear Fuels plc is licensed to operate the Sellafield site and United Kingdom Atomic Energy Authority is licensed to operate the Windscale site, which includes Atomic Energy Authority Technology facilities. Under the Radioactive Substances Act, 1993 British Nuclear Fuels plc and United Kingdom Atomic Energy Authority are authorised to discharge gaseous radioactive wastes via stacks to the atmosphere. British Nuclear Fuels plc is authorised to discharge liquid radioactive wastes via pipelines into the Irish Sea and United Kingdom Atomic Energy Authority has an inter site transfer authorisation to discharge liquid wastes via the British Nuclear Fuels plc pipelines.

Potential exposure pathways related to the site include:

- consumption of locally sourced terrestrial and marine foods
- consumption of groundwater
- occupancy of buildings and the surrounding areas relating to direct radiation
- occupancy of intertidal areas
- occupancy on or in marine water
- handling fishing gear and sediment
- consumption and/or use of seaweed

The survey investigated all of these pathways. Individuals from the local population were interviewed and the data obtained are presented and discussed. Data for 649 individuals were collected. Gamma dose rate measurements were taken to supplement those made in routine surveillance programmes.

High consumption rates were found in the following groups of locally produced foods: fish, crustaceans, molluscs, green vegetables, other vegetables, root vegetables, potato, milk, cattle meat, sheep meat and venison. Other local foods consumed were marine plants and algae, wildfowl, domestic fruit, poultry, eggs, wild/free foods, rabbits/hares, honey, wild fungi and fish (freshwater).

Evidence of the consumption of groundwater was found. Several farms were not connected to the mains water supply and were using spring water instead. A few individuals at Braystones were collecting spring water as their sole supply from a pipe coming out of the dunes.

Occupancy habits within 1 km of the site perimeter included those related to residential, work and recreational activities. In the marine environment, the main activities included angling, bait digging and dog walking. Watersports such as kitesurfing, windsurfing and kayaking were observed. Diving was also taking place in the survey area. Rock climbing was reported to be popular at St Bees Head and beachcombing occurred on three different beaches. Observations for individuals handling fishing gear and sediment were made.

The data from the survey are presented in full for each individual in order to assist in assessments of the additive effects of exposures from multiple pathways. The information recorded during interviews was processed in two different ways to identify high rates appropriate to the various aquatic and terrestrial pathways. One method estimated a representative figure for each pathway by selecting a group at the upper end of the distribution of observations. The other chose the 97.5 percentile rate from the distribution.

Comparisons are made with the results from previous surveys.

Suggestions are made for changes to environmental monitoring programmes on the basis of the information collected during the survey.

1 INTRODUCTION

The public may be exposed to radiation as a result of the operations at the Sellafield 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 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) and by legislation implementing the European Union (EU) Basic Safety Standards (BSS) Directive 96/29/Euratom (CEC, 1996). This Directive takes account of 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 consultation, including 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 for Environment, Food and Rural Affairs (Defra) in 2000 and the Welsh Assembly in 2002. These draft Guidance 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.

Operation of nuclear sites anywhere in the UK can only take place if they are licensed under the Nuclear Installations Act 1965 (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 is provided for.

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 EC legislation in the EU BSS Directive 96/29/Euratom. The public dose standards were incorporated into UK law in the IRR 99. In order to implement the Directive in England and Wales, the Environment Agency was issued with a direction by the Department of the Environment, Transport and the Regions (DETR) (now part of Defra) in 2000 (DETR, 2000). 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 dose received from any new source does not exceed 0.3 mSv a year;

- the dose received from any single site does not exceed 0.5 mSv a year.

Guidance on the principles underlying prospective assessments (i.e. assessments of potential future doses) has been provided by a group of UK public bodies (EA, SEPA, DoENI, NRPB and FSA, 2002). Where relevant, this guidance may also be applied to retrospective assessments (i.e. assessments of doses already received). A recent discussion paper (Camplin *et al.,* 2002) has considered different ways in which data collected from habits surveys similar to this study may be used to carry out integrated (i.e. combined pathway) dose assessments.

2 THE SURVEY

2.1 Site activity

Sellafield is owned by British Nuclear Fuels plc (BNFL). Operations and facilities include fuel element storage, Magnox and oxide fuel reprocessing plants, mixed oxide fuel manufacture, a Magnox nuclear power station (Calder Hall) and decommissioning of some nuclear facilities. The Calder Hall Magnox nuclear power station ceased operation on 31st March 2003. United Kingdom Atomic Energy Authority (UKAEA) owns and operates the Windscale part of the site, which includes Atomic Energy Authority (AEA) Technology facilities. The site is located approximately 12 km south-east of the town of Whitehaven and 2.5 km north of Seascale (see Figure 1).

Under NIA 65, BNFL is licensed to operate the Sellafield part of the site and UKAEA is licensed to operate the Windscale part of the site. Under RSA 93, BNFL and UKAEA are authorised to discharge gaseous radioactive wastes via stacks to the atmosphere, BNFL is authorised to discharge liquid radioactive wastes via pipelines into the Irish Sea and UKAEA has an inter site transfer authorisation to discharge liquid wastes via BNFL pipelines. Details of the amounts of radioactive waste discharged in 2002 can be found in the publication "Radioactivity in Food and the Environment, 2002", (EA, EHS, FSA and SEPA, 2003). The site was fully operational whilst the survey fieldwork was being carried out. The Magnox and oxide fuel reprocessing plants were running normally and decommissioning was underway in many areas including Calder Hall.

The Sealine Recovery Project was underway to remove three disused pipelines from Sellafield Beach and the seabed. The pipelines were being cut up, put into containers underwater and then taken to the BNFL Drigg solid waste disposal site (www.bnfl.com/sellafield). No additional work was done to investigate pathways relating to the Sealine Recovery Project. However, the normal activities involving beach use such as beachcombing, angling and shellfish collecting were investigated.

2.2 Survey objectives

The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) undertook the survey in 2003 on behalf of the Environment Agency, the Food Standards Agency, and the Health and Safety Executive. The aim of the survey was to obtain integrated habits data related to public radiation exposure from the Sellafield site via aquatic, terrestrial and direct radiation pathways in order to permit realistic assessments of critical group doses.

The last full aquatic and terrestrial habits surveys conducted by CEFAS in the Sellafield area were in 1998 (Tipple *et al*., 1999 and Smith *et al*., 1999 respectively). Annual reviews of the aquatic habits of the Sellafield Coastal Community have also been undertaken. Data from surveys are used for dose assessments for the Sellafield area (e.g. EA, EHS, FSA and SEPA, 2003). Direct radiation surveys were conducted by CEFAS in 1995 for the Calder Hall site and in 1996 for the rest of the Sellafield site.

Fieldwork was undertaken in order to obtain site specific habits survey data. These data were used to establish exposure pathways for the local population and the characteristics of those most exposed. General habits survey information for the area was also obtained.

Investigations were carried out to ascertain the following:

- The production, use and destination of local produce
- The consumption rates of aquatic and terrestrial foods from the survey areas

  The consumption of groundwater with particular reference to beach seepage
- The extent of occupancy within 1 km of the site perimeter
- External exposure activities, including angling, commercial fishing (netting and potting), bait digging and mollusc collection along the intertidal shoreline
- Exposure to debris from decommissioned pipelines through beachcombing
- Occupancy in and on water in the survey area
- Exposure to contaminated seagull guano when rock climbing

- The extent of any unusual practices, which may be relevant, such as the use of seaweed as a fertiliser or livestock feed, the use of sea-washed turf and the transfer of contamination by wildlife

2.3 Survey areas

Three main survey areas were defined to encompass the dominant activities expected for aquatic, terrestrial and direct radiation pathways respectively. Water courses and areas potentially containing contamination from gaseous washout alone are discussed in the terrestrial sections of this report. Those containing contamination from liquid discharges or both gaseous and liquid discharges are discussed in the aquatic sections.

The aquatic survey area (Figure 1) covered the coastline and estuaries from Parton in the north to Tarn Bay in the south and included fisheries up to 11 km from the coastline. This same area was used in the 1998 survey and was based on hydrographic survey information. Unlike the 1998 survey, consumption of seafood from outside the survey area was not included.

The terrestrial survey area, shown in Figure 2, was defined as the circle to a radius of 5 km from the site centre (NGR NY 029 038) to encompass the main areas of potential deposition from gaseous discharges. The same area was surveyed in the 1998 survey.

For direct radiation, the survey area also shown in Figure 2 was defined as the area within 1 km of the combined perimeter of the Sellafield and Windscale sites. The 1995/96 direct radiation surveys also covered the area within 1km of the combined perimeter.

2.4 Conduct of the survey

The fieldwork component of the survey was carried out between 7th September and 18th September 2003, by a survey team of three people, according to techniques described by Leonard *et al.* (1982).

A programme of work was sent to the Environment Agency, the Food Standards Agency, and the Health and Safety Executive before the survey for comment. Pre-survey discussions between one of the survey team, BNFL, the Environment Agency, the Food Standards Agency and the Health and Safety Executive were held prior to the start of the fieldwork. These discussions provided an outline of the main aims of the survey and highlighted areas or items, which required special attention or effort by the team. On 8th September a meeting was held between the survey team, BNFL and UKAEA at the Sellafield site. This served to provide details about site operations, including waste disposal, and information about potential pathways and activities in the area. Further information was sought about wildlife studies and pest control measures in and immediately around the site. Animals could be vectors for transporting radioactive materials off-site and are also potential food items for some individuals.

People with a local knowledge of the survey area were contacted for information on any aspects relevant to the various exposure pathways. These included the Environment Agency, local councils, the Tourist Information Centre, beekeeping representatives, local climbing clubs, wildfowling club representatives, diving clubs, angling clubs, commercial fishermen, local Defra fisheries and field officers and the local Sea Fisheries Committee.

During the survey, individuals who were identified as having the potential to be exposed to radioactivity from the site were contacted and interviewed. Interviews were used to establish individuals' consumption rates of locally grown terrestrial foods and locally caught seafoods, their handling rates of intertidal sediments, commercial fishing gear and their occupancy rates relevant to external exposure. Any general information of possible use to the survey was also

obtained. Using the information gained in the interviews, a list of occupations and activities was built up to produce a picture of potential exposure pathways. This then enabled emphasis to be placed on those individuals who were likely to be the most exposed and included commercial fishermen, boat owners, anglers, allotment holders, beekeepers and farmers.

The survey did not involve the whole population in the vicinity of Sellafield, but targeted subsets in order to identify the potentially most exposed individuals. Therefore, although the number of people in the terrestrial survey area was estimated to be 3500, information was obtained for a significantly smaller number than this. To aid interpretation, the number of people interviewed in each group as a percentage of what we estimate to be complete coverage for that group has been calculated. It is possible that there may be people in each group that we did not identify at the time of the survey. The results are summarised in Table 1. The 'groups' are described and quantified, and the number of people interviewed given as percentages of the totals. It should be noted that for certain groups, such as anglers and divers, 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 to estimate the number of individuals from the number of clubs for example. These cases are explained in Table 1.

The aquatic, terrestrial and direct radiation elements of the survey primarily targeted pathways relevant to those elements, for example people in the terrestrial survey were initially questioned because it was known that they grew a lot of terrestrial foodstuffs. However, where possible, every interviewee was asked about pathways in each of the three areas. During interviews with representatives from clubs such as angling clubs, it was not possible to collect data for all pathways (such as consumption of local foods) for each member. In these cases, data were limited to those relating to the primary reason for the interview e.g. intertidal occupancy for angling club members. Such individuals only have data for the pathway of interest in Annex 1.

Approximately 30 person-days were spent interviewing and observations for 649 individuals were recorded. During the survey, gamma dose rate measurements were taken to aid assessment of external exposure pathways.

3 METHODS FOR DATA ANALYSIS

3.1 Data recording

Data collected during the field work were recorded in logbooks. On return to the laboratory, these data were examined and any notably high rates were double-checked where possible by way of a follow-up phone call. These 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. The database converted these data into consumption rates (kg/y for food and l/y for milk) using a variety of conversion factors. These included produce weights (Hessayon, 1990 and 1997 and Good Housekeeping, 1994), edible fraction data researched by CEFAS and information supplied by the Meat and Livestock Commission. 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 tables.

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 to appear slightly erroneous ($\pm$ 0.1). The exception is for consumption rates less than 0.05 kg/y, which are presented to two decimal places, in order to avoid them appearing as 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 reports, 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 which were relevant to the survey being conducted. Where individuals offered information during interview which was unusual, they were questioned further in order to double check the validity of their claims.
- Interviewees were contacted again to confirm the results of the initial interview if, when final consumption rates were calculated, observations were found to be high in relation to our experience of other surveys, taking into account local factors.
- Data were stored in a database in order to minimise transcription and other errors.
- Draft reports and data tables were formally reviewed by senior CEFAS staff.
- 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.

These habits data are structured into groups of activities 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, for example, are grouped as 'crustaceans'. For external exposure over intertidal sediments, occupancy over a common substrate, (for example, sand) 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, ingestion 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. These age groups are from 0 to 1.0 y of age (called 3 months old); more than 1.0 y to 2.0 y (called 1 year old); more than 2.0 y to 7.0 y (called 5 year old); more than 7.0 y to 12.0 y (called 10 year old); more than 12.0 y to 17.0 y (called 15 year old). Individuals over 17 are treated as adults. These age groupings are consistent with those used in ICRP 72 (1996). 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 the atmospheric plume(s).

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 by those undertaking radiological assessments of the effects of the operation of the Sellafield site – taking into account the concentration and/or dose rate distributions in space and time relevant to the assessment. It is only with the outcome of such an assessment that the critical group can strictly be defined as those most exposed.

In addition to providing these data in the Annexes, we have also analysed them to provide estimates of rates of occupancy, handling and consumption which can be regarded as typical of those most exposed prior to a formal assessment being undertaken. Two approaches are used.

Firstly, the 97.5 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 percentile rates based on national statistics have been derived by MAFF and FSA (Byrom *et al.,* 1995 and FSA, 2002), and these are referred to as generic rates in this report. Secondly, 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 three 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. In this report, the term critical group rate is used to

represent the data derived by the 'cut-off' method for ease of presentation. A separate critical group rate was calculated for each food group or activity identified in the survey.

In exceptional cases the 'cut-off' method can result in only one member of the high rate group. In this case, judgement is used as to whether to include other individuals within the group.

In previous aquatic surveys (those undertaken prior to 2002) a factor of 1.5, instead of 3, was used to define the cut-off value for intertidal occupancy and handling. However, it is now considered appropriate that the same factor as for consumption is used. The factor reflects variations in the doses likely to be received due to natural variations in the interactions of radiations with tissues caused by, for example, differences in anatomy.

For ingestion pathways, high rates for children have been calculated from the survey data. However because few child consumers were identified during the survey, shown in Table 1, the rates should be viewed with caution. For assessment purposes, an alternative, theoretical approach may be taken which involves scaling the critical group rates for adults by ratios. These ratios are given in Annex 3 and have been calculated using generic 97.5 percentile consumption rates.

Selection of 97.5 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.

For the purposes of assessing total dose integrated across all pathways, the data from the survey can be further analysed to take into account the degree of overlap of each pathway. This is discussed further in Section 7 and data to undertake a total dose assessment are provided in Annex 4.

4 AQUATIC RADIATION PATHWAYS

4.1 Aquatic survey area

The aquatic survey area covered all intertidal areas between Parton and Tarn Bay, including estuaries (Figure 1).

Parton to Whitehaven

Parton is a seaside village approximately 2 km north of Whitehaven with a small sandy bay and rocky shoreline. It had a compound for boats belonging to members of a local angling club and a slipway for launching. Little activity was observed in this area during the survey. Fishing activities included boat angling in Parton Bay, part-time potting for crabs (*Cancer pagurus*) and lobsters (*Homarus gammarus*) and the collection of winkles (*Littorina littorea*) from the rocky areas. Water sports activities such as kayaking were reported to occur here. South of Parton is Whitehaven North Beach, a popular area for dog walking and water sports such as windsurfing.

Whitehaven to St Bees Head

The north and west piers of Whitehaven Harbour were popular with rod and line anglers and at low tide bait diggers and dog walkers were observed on the outer harbour beach. It was reported that small local boats and larger non-local freighters were often seen beached on the sands for boat maintenance at low tide in the outer harbour, although this was not observed during the survey. Whitehaven Inner Harbour is a permanent sea water area behind lock gates. It was used by most of the commercial fishing vessels, charter boats and non-commercial boats in the area. There was a 155-berth marina for angling and leisure craft from which members of the Whitehaven Boat Club sailed regularly. Little activity was noted on Whitehaven South Beach, although the survey team interviewed individuals who frequently fished and collected molluscs here and at Saltom Bay approximately 2 km south of Whitehaven. Beachcombing was noted on the beaches in the Whitehaven area.

St Bees Head to Seascale

St Bees Head is a rocky headland approximately 5 km south-west of Whitehaven. Most of the cliffs are Royal Society for the Protection of Birds (RSPB) designated nature reserves for colonies of cliff-nesting seabirds. St Bees Head was accessible by foot along the Cumbria Coastal Way and by road to the lighthouse at north head. Rock climbing was reported to occur at St Bees Head all year round except during the nesting season when climbers are banned. There were three designated climbing areas, one of which (Apiary Wall) was popular with many climbers. It was reported that climbers could be seen here on summer evenings and weekends when conditions were favourable. St Bees Head was also a popular area for diving activities particularly for novice divers.

The seaside resort of St Bees has public access to the beach at Seacote and further south at Seamill. The beach is approximately 2 km in extent with a pebble and sand substrate and a large tidal range. It was very popular with shore and rock anglers, walkers, dog walkers and families relaxing. Water sports such as kite-surfing, windsurfing and kayaking were commonplace due to the prevailing south-westerly winds; six kite-surfers and four windsurfers were observed on one day during the survey at Seamill and four kayakers were observed at Seacote. The beach at Seacote had a concrete slipway for the launching of boats and jet skis. Seaweed was collected from Seamill Beach for use as a fertiliser on vegetable gardens.

The coastline further south to Coulderton and Nethertown is predominantly shingle and rock with patches of sand. Winkles were collected from the rocky areas. During the survey there was not a great deal of activity noted at Coulderton with only an occasional dog walker observed. Anglers and baitdiggers were interviewed at Nethertown.

Braystones, another shingle, rock and sand beach was popular with shore anglers, winkle collectors and bait diggers. Beachcombing was reported to be a popular activity along this beach particularly in the winter when rough conditions wash debris ashore. One farmer removed sand from this beach to fill in walls on his farm.

At the time of the survey BNFL had commenced work on the Sealine Recovery Project and redundant pipelines were scheduled for removal from Sellafield Beach. A BNFL sign restricted public access north of Sellafield Station along the Cumbria Coastal Way. The beach was accessible via a bridge at Sellafield Railway Station. The restricted access could have affected the number of people using the beach. Although little activity was observed, people were noted shore angling, using a push net to collect shrimps for bait, bait digging and dog walking in this area.

Seascale to the Irt Estuary

The seaside resort of Seascale is approximately 15 km south-east of St Bees Head. It was popular with tourists and locals because of the large stretch of sandy beach, easy access and good car parking facilities. Several activities were observed on the sand such as walking, dog walking, children playing and shore angling. Seaweed was collected from Seascale and Drigg Beach for use as a fertiliser on vegetable gardens. Boat angling was very popular from Seascale, as there was a secure small boat compound that housed approximately 20 boats.

The 2 km sandy beach between Seascale and Drigg was accessible by foot from the villages at either end or from the footpath, which ran along the north side of the BNFL Drigg site fence. However, nobody was observed using this footpath during the survey. The Cumbria Coastal Way followed this stretch of beach.

Drigg Beach was popular with shore anglers, bait diggers and dog walkers. The beach was predominantly sandy with patches of shingle. Local farmers frequently removed trailer loads of sand and shingle from the beach to repair farm lanes and tracks. There were two rocky outcrops; Drigg Barn Scar which was a popular angling location when exposed at low water and Kokoarrah Scar which could be reached on foot or quad bike. Lobsters could be taken by hand from both rocky outcrops. Above the high tide line from Drigg down to the River Irt were sand dunes, which gave way to slightly marshy grazing land. The Lake District National

Park boundary crossed from the village of Holmrook to Kokoarrah Scar, with land to the south of this line being part of the National Park.

The Irt Estuary to Tarn Bay

The Irt Estuary is approximately 5 km south-east of Seascale. The salt marsh on both banks of the estuary was used for wildfowling and one farmer periodically grazed cattle on the east bank. Wildfowling was also taking place at Saltcoats Marsh. The River Mite flows from the north-east past Ravenglass, which is a busy tourist village with parking and access to the beach.

Ravenglass Estuary is a large area of mainly sand and mud which incorporates the channels of the Rivers Irt, Mite and Esk. There was a relatively large amount of observed and reported activity going on. Walkers and dog walkers frequently used the area and people in Ravenglass village, whose houses backed onto the beach, used it as an extension to their gardens. Bird life was abundant on the mudflats in the estuary and the area was popular with bird watchers. Water based activities included sailing and canoeing. Approximately 10 boats were moored in the estuary; most of these were pleasure craft or boats used for rod and line fishing although two commercial potting fishermen were based there. Local consumers frequently collected mussels (*Mytilus edulis*) and cockles (*Cerastoderma edule*) together with a few wild oysters (*Ostrea edulis*) although no commercial collection was taking place during the survey. It was reported that mussels had been gathered commercially under permit of the Muncaster Estate in January 2003.

The River Esk flows from the north-east, under Eskmeals Viaduct and out to the Irish Sea. Anglers were observed fishing in the River Esk and were also digging for worms and collecting peeler crabs for bait in Ravenglass Estuary. Wildfowling was noted on the salt marsh at Newbiggin Marsh. Eskmeals, a long sandy beach stretching from the River Esk to Tarn Bay, was mostly off limits to members of the public as it was used by the Ministry of Defence. The only parts that were accessible were the northern most part of the beach near

Eskmeals Viaduct and the southern most kilometre at Tarn Bay. This beach was popular with dog walkers, walkers and baitdiggers.

4.2 Commercial fisheries

Seven boats less than 10 metres in length, operating from Whitehaven, Seascale and Ravenglass, were noted working commercially in the survey area potting for crabs and lobsters, trawling, and set netting for whitefish. The main commercial fishery was potting for crabs and lobsters with all but one of the boats operating on a full time basis. The main fishing areas were off-shore of Ravenglass Estuary, Seascale, Braystones, St Bees Head and Parton. Potting was seasonal, generally commencing in April or May and finishing with the onset of rough weather around the end of September. With the exception of some local sales of crabs and lobsters either directly from the fishermen to the public, local restaurants/hotels or a butcher in Seascale, the majority was sold to buyers in France and Spain. In the autumn and winter, when the weather was favourable, commercial fishing targeted fish species mainly using set nets, with the main winter species being cod (*Gadus morhua*) and whiting (*Merlangius merlangus*). A small amount of *Nephrops* (*Nephrops norvegicus*) was caught from a small patch of muddy ground 10 km offshore of Braystones by one boat using a trawl net. The fishermen said they sold their fish and *Nephrops* catches locally to personal customers and only if they had exceptionally large catches, did they sell to a local wholesaler. One fisherman, working out of Ravenglass Estuary, occasionally trawled for shrimps. As his catches of this species were small, he retained them for his family's consumption.

Winkles were the only mollusc species collected commercially in the survey area. The main beaches for this activity were Bootle and Drigg. These were sold to a shellfish wholesaler in Glasgow for export, mainly to France and Spain. In January 2003, large quantities of mussels were removed from the Ravenglass Estuary, under permit of the Muncaster Estate. The mussels were transported to the Wash in East Anglia where they were re-laid in cleaner seawater for 3 months then cleansed and dredged for public consumption.

Commercial salmon fishing in the survey area was no longer taking place.

4.3 Angling and hobby fishing

Angling was very popular in the survey area with shore angling taking place from all the local beaches and piers. Members of several sea-angling clubs were interviewed. Boat angling was also practised from Whitehaven Harbour and coastal locations where launching and landing boats could be accomplished without too much difficulty. Seascale and Parton were the two favoured locations as both had enclosed lock-up compounds where angling boats could be kept secure. There were approximately 20 and five boats respectively at these locations which appeared to be in regular use. The launching of angling boats was also noted at Ravenglass and three angling boats were moored in the estuary.

The most abundant fish species caught by anglers in the area during the summer months were plaice (*Pleuronectes platessa*), pollack (*Pollachius pollachius*), dab (*Limanda limanda*), Dover sole (*Solea solea*), flounder (*Platichthys flesus*), bass (*Dicentrarchus labrax*), thornback ray (*Raja clavata*), dogfish (*Scyliorhinus canicula*), grey mullet (*Chelon labrosus*), mackerel (*Scomber scombrus*) and salmon (*Salmo salar*). The latter were caught from the Rivers Irt, Esk, Mite, Ehen and Calder. During the winter the predominant species were cod and whiting. Although some individuals consumed all of these species, the most frequently consumed species by the majority of anglers were cod, plaice, bass, Dover sole, thornback ray and mackerel.

Some individuals interviewed were fishing on a small-scale recreational basis in the survey area with a few pots (the maximum number permitted for an unregistered fisherman was 5) or nets. Catches were used for personal consumption and supplying friends and neighbours. Other individuals collected crabs and lobsters using hand held ‘crabbing hooks’ at low tide amongst the rocks at Kokoarrah Scar, Drigg Barn Scar, Parton and Coulderton.

Molluscs collected and caught non-commercially in the survey area included winkles, limpets (*Patella vulgata*), cockles, mussels and whelks (*Buccinum undatum*). Individuals collected winkles and limpets for their own consumption from the intertidal rocky areas at Drigg Barn Scar, Braystones, Nethertown, Coulderton, St Bees Head, Saltom Bay and Parton. Mussels and cockles were collected regularly at Ravenglass. Whelks were caught in season as a by-catch in pots with some being eaten locally by a few individuals.

4.4 Seafood wholesalers and retailers

The fish wholesaler for the area said that fish from the survey area represented a very small percentage of his annual turnover. He said that he infrequently bought small amounts of fish from local fishermen and some of the *Nephrops* would have been caught from the within the area, but exact proportions would have been impossible to quantify.

Retailers were visited and only one shop sold any locally caught seafood products, which were dressed crabs. Another wet fish shop, whose owner was also a registered fisherman, would have usually sold local fish. However, this was not the case in 2003 because the owner had been unwell for several months and had not fished.

4.5 Wildfowl

There was a wildfowling club in the area with approximately 12 members shooting on Newbiggin Marsh. The main species shot were mallard (*Anas platyrhynchos*), teal (*Anas crecca*) and widgeon (*Anas penelope*). Two other wildfowlers were identified shooting mallard on Saltcoats Marsh. Wildfowl tended to be consumed by both wildfowlers and members of their families.

4.6 Other pathways

Two people were identified who consumed small quantities of *Porphyra* collected from the Braystones area, north of Sellafield.

Four people were identified who regularly used seaweed collected from Drigg, Seamills, and Seascale beaches as a fertiliser on their vegetable gardens. The results of their vegetable consumption are discussed below. No farms were identified using seaweed as fertiliser or feed.

There were no observations of sea-washed turf being used in the area.

Two farmers were identified removing sand from two beaches in the survey area. A farmer was removing a trailer load of sand and shingle from Drigg Beach to repair farm lanes and tracks and this was reported to be a regular activity. Another farmer was noted removing smaller quantities of sand from Braystones Beach to fill in walls on his farm.

4.7 Internal exposure

Consumption data for locally caught aquatic foodstuffs are presented in Tables 3 to 7 for adults. Table 8 gives additional information on the adult consumption rates for vegetables grown in land where seaweed has been used as a fertiliser. Consumption data for locally caught aquatic foodstuffs are presented in Tables 9 to 12 for children. The data do not include consumption of fish or shellfish landed at Whitehaven as the catch invariably comes from outside the survey area. The tables include the mean consumption rates of the critical groups together with the observed 97.5 percentile rates calculated as described in Section 3.2. For purposes of comparison, the data are summarised in Table 13 for adults and Tables 14 to 16 for children (15 year olds, 10 year olds and 5 year olds respectively). No children in the 1 year old or 3 month old age groups were noted to be consuming locally caught seafood or wildfowl. No child consumers of marine plants and algae were observed. The summary

tables also include mean rates and 97.5 percentile rates based on national data (referred to as 'generic' data in this report). No generic data are available for the 5 year old age group.

Adult consumption rates

The people consuming the greatest quantities of food from the aquatic survey area were boat and shore anglers, commercial fishermen and wildfowlers.

The predominant species of fish consumed by adults were cod, plaice, mackerel, and thornback ray, along with smaller quantities of salmon, bass, haddock (*Melanogrammus aeglefinus*), pollack, lemon sole (*Microstomus kitt*), squid (*Loligo forbesi*), Dover sole, flounder, sea trout (*Salmo trutta*), turbot (*Scophthalmus maximus*), and whiting. A critical group of 31 individuals was identified with a maximum consumption rate of 74 kg/y and a mean of 41 kg/y. The observed 97.5 percentile rate based on 146 observations was 57 kg/y. This compares with the adult generic mean and 97.5 percentile consumption rates for fish of 15 kg/y and 40 kg/y respectively. The percentage breakdown of species eaten by the critical group was 60% cod, 20% plaice, 10% thornback ray and 10% other species as named in Table 3. These percentages, rounded to the nearest 5%, are based on the total amount of fish consumed by this group.

The predominant species of crustaceans consumed by adults was crabs with smaller quantities of lobsters, brown shrimps and *Nephrops*. A critical group of 10 individuals was identified with a maximum consumption rate of 48 kg/y and a mean of 27 kg/y. The observed 97.5 percentile rate based on 57 observations was 39 kg/y. This compares with the adult generic mean and 97.5 percentile consumption rates for crustaceans of 3.5 kg/y and 10 kg/y respectively. The percentage breakdown of species eaten by the critical group, rounded to the nearest 5%, was 75% crabs, 10% lobsters, 10% brown shrimps and 5% *Nephrops*.

The predominant species of molluscs consumed by adults were mussels, winkles and cockles with smaller quantities of whelks and limpets. A critical group of nine individuals was

identified with a maximum consumption rate of 53 kg/y and a mean of 34 kg/y. The observed 97.5 percentile rate based on 38 observations was 43 kg/y. This compares with the adult generic mean and 97.5 percentile consumption rates for molluscs of 3.5 kg/y and 10 kg/y respectively. The percentage breakdown of species eaten by the critical group, rounded to the nearest 5%, were 35% winkles, 30% mussels, 25% cockles and 5% whelks.

Two individuals eating 0.10 kg/y of *Porphyra* were observed. No generic data are available for this food group.

The species of wildfowl consumed by adults were duck and goose. A critical group of six individuals was identified with a maximum consumption of 2.6 kg/y and a mean of 1.9 kg/y. The observed 97.5 percentile rate based on six observations was 2.6 kg/y. No generic data are available for this food group. The percentage breakdown of species eaten by the critical group, rounded to the nearest 5%, was 85% duck and 15% goose.

Children's consumption rates

15 year old age group

For fish, a critical group of four individuals was identified with a maximum consumption rate of 18 kg/y and a mean of 11 kg/y. The observed 97.5 percentile rate based on 11 observations was 16 kg/y. This compares with the generic mean and 97.5 percentile consumption rates for fish of 6.5 kg/y and 20 kg/y respectively.

For crustaceans, a critical group of three individuals was identified with a maximum consumption rate of 1.1 kg/y and a mean of 1.0 kg/y. The observed 97.5 percentile rate based on three observations was 1.1 kg/y. This compares with the generic mean and 97.5 percentile consumption rates for crustaceans of 2.5 kg/y and 6.0 kg/y respectively.

For molluscs, a critical group of one individual was identified with a maximum consumption rate of 16 kg/y. The observed 97.5 percentile is not applicable for one observation.

For wildfowl, a critical group of three individuals was identified with a maximum consumption rate of 2.6 kg/y and a mean of 2.2 kg/y. The observed 97.5 percentile rate based on three observations was 2.6 kg/y. No generic data are available for this group.

10 year old age group

For fish, a critical group of four individuals was identified with a maximum consumption rate of 14 kg/y and a mean of 9.9 kg/y. The observed 97.5 percentile rate based on seven observations was 13 kg/y. This compares with the generic mean and 97.5 percentile consumption rates for fish of 6.0 kg/y and 20 kg/y respectively.

For crustaceans, a critical group of two individuals was identified with a maximum consumption rate of 12 kg/y and a mean of 11 kg/y. The observed 97.5 percentile rate based on two observations was 12 kg/y. This compares with the generic mean and 97.5 percentile consumption rates for crustaceans of 2.5 kg/y and 7.0 kg/y respectively.

For molluscs, a critical group of one individual was identified with a maximum consumption rate of 19 kg/y. The observed 97.5 percentile is not applicable for one observation.

For wildfowl, a critical group of one individual was identified with a maximum consumption rate of 2.6 kg/y. The observed 97.5 percentile is not applicable for one observation.

5 year old age group

For fish, a critical group of six individuals was identified with a maximum consumption rate of 14 kg/y and a mean of 10 kg/y. The observed 97.5 percentile rate based on eight

observations was 14 kg/y. No generic consumption rates have been derived for this age group.

For crustaceans, a critical group of four individuals was identified with a maximum consumption rate of 12 kg/y and a mean of 9.0 kg/y. The observed 97.5 percentile rate based on four observations was 12 kg/y. No generic consumption rates have been derived for this age group.

For molluscs, a critical group of three individuals was identified with a maximum consumption rate of 19 kg/y and a mean of 16 kg/y. The observed 97.5 percentile rate based on three observations was 19 kg/y. No generic consumption rates have been derived for this age group.

For wildfowl, a critical group of one individual was identified with a maximum consumption rate of 2.6 kg/y. The observed 97.5 percentile is not applicable for one observation.

4.8 External exposure

Intertidal occupancy

Table 18 shows the intertidal occupancy data recorded during the survey. The six types of intertidal substrate in the survey area, where public occupancy was identified, were coal and sand, rock, salt marsh, sand, sand and mud, and sand and stones.

The maximum occupancy time recorded over coal and sand was 180 h/y for two dog walkers. Two other dog walkers' occupancy rates came within a factor of three of this, giving a mean time for this group of 160 h/y.

The maximum occupancy time recorded over rock was 30 h/y for two anglers. No other individuals occupancy rates came within a factor of three of this. This gives a mean time for this group of 30 h/y.

The maximum occupancy time recorded over salt marsh was 400 h/y by a marsh warden. No other individuals occupancy time came within a factor of three of this.

The maximum occupancy time recorded over sand was 890 h/y for an individual who spent time dog walking, shellfish collecting, bait digging and angling. Nineteen other individuals (anglers, bait diggers and dog walkers) had occupancy rates within a factor of three of this giving a mean time for this group of 500 h/y.

The maximum occupancy time recorded over sand and mud was 1600 h/y for an individual who was shellfish collecting and angling. Thirteen other individuals (bait diggers, anglers, dog walkers and shellfish collectors) had occupancy rates within a factor of three of this. This gives a mean occupancy time for this group of 870 h/y.

The maximum occupancy time recorded over sand and stones was 1100 h/y for an individual who was dog walking. The occupancy time of one angler came within a factor of three; this gives a mean occupancy time of 860 h/y.

Rock climbing at St Bees Head was not observed at the time of the survey however a keen climber was interviewed. His total occupancy time at the three identified climbing areas was 120 h/y. Approximately 70 h/y were spent climbing at the popular Apiary Wall where it is possible to climb all year round. It was estimated that the keenest climbers would climb here for a maximum of 100 h/y, this area had less bird activity than the other two areas. Approximately 42 h/y were spent at St Bees north main crag; this is a nesting area but is not a popular site for climbing. It was reported that most climbers would avoid areas covered in seagull guano. The third climbing area was at St Bees south crag, where approximately 7.0 h/y were spent. This area is unpopular with climbers and is also a nesting area.

The Environment Agency specifically wanted beachcombing investigated. This occurred on Braystones Beach, Drigg Beach and in the Whitehaven area. Two people had an occupancy time of 180 h/y throughout the winter months on Braystones Beach and reported that people in the area were frequently seen beachcombing. One person had an occupancy time of 50 h/y along Drigg Beach and one person had an occupancy time of 64 h/y on the beaches in the Whitehaven area. None of these rates were sufficient to include these occupancies in the critical groups.

Handling

Handling sediment, while bait digging or mollusc collecting, or handling commercial fishing gear, which has become entrained with fine sediment particles, can give rise to skin exposure from beta radiation. This needs consideration even though the annual dose limit for skin is a factor of 50 rates higher than that for effective dose. There is also a contribution to effective dose due to skin exposure (ICRP, 1991).

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

Table 19 shows the rates spent handling fishing gear and intertidal sediment recorded during the survey.

The maximum fishing gear handling time recorded was 1000 h/y for two commercial lobster potters. Six other commercial fishermen (mainly other lobster potters) had gear handling rates that came within a factor of three of this. This gives a mean handling time for this group of 730 h/y.

The maximum sediment handling time recorded was 1500 h/y for two shellfish collectors. One other shellfish collector and two bait diggers had handling rates within a factor of three of this. This gives a mean handling time for this group of 1000 h/y.

Gamma dose rate measurements

Representative gamma dose rate measurements at 1 m above the substrate were taken at locations where high occupancy rates were observed. These measurements (shown in Table 20) ranged from 0.060 to 0.083 μGy/h over sand and up to 0.159 μGy/h over mud. Measurements were also taken over coal and sand and sand and stone. Natural levels of around 0.05 and 0.07 μGy/h are expected over sand and mud respectively. A value of 0.06 μGy/h is expected for all other substrate types.

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 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 allow for their assessment, relevant data have been collected. Occupancy rates for activities taking place in or on the water around Sellafield are shown in Table 21. It includes two children undertaking activities on the water.

Activities in the water

Activities taking place in the water around Sellafield included diving, push netting, swimming, kitesurfing, kayaking, and windsurfing. Thirty-four observations were recorded and the people with the highest occupancy rates were 10 kayakers with 100 h/y.

Activities on the water

Activities taking place on the water around Sellafield included general boating, commercial fishing, sea angling and canoeing. One hundred and thirty-eight observations were recorded. The person with the highest occupancy time was a commercial fisherman with 1400 h/y. It should be noted that some of the data for diving, sea angling and boating was gained through interviews with representatives from relevant clubs who gave generic data for their members.

5 TERRESTRIAL RADIATION PATHWAYS

5.1 Terrestrial survey area

The terrestrial survey area covered all land within 5 km of the site centre (NGR NY 029 038) as shown in Figure 2.

The area around the Sellafield site was predominantly farm land. Several villages were within the survey area, Beckermet and Haile to the north, Gosforth and Wellington to the east and the coastal village of Seascale to the south. The River Ehen flowed from the north-west along the western boundary of the site, and the River Calder flowed from the fells in the north-east through the middle of the Sellafield site. Both rivers converged at the Calder Viaduct and flowed into the Irish Sea. The BNFL Drigg solid waste disposal site overlapped the survey area to the south.

Interviews were conducted at 34 working farms in the area. Of these six were dairy farms, two produced beef, three produced sheep, 10 farms produced both beef and sheep and 13 farms were both dairy and livestock. Three of the farms also produced poultry and five also produced chicken eggs, though production was all on a small scale. No pig farms were identified. Several farmers grew crops such as barley, wheat, turnips, maize, silage and hay for winter feed.

Livestock was mostly sold to local meat markets at Carlisle, Cockermouth and Ulverston as well as to abattoirs in Clitheroe and Preston. These abattoirs and meat markets were all outside the survey area. Beef was also sold privately to a farmer in Berwick (Northumberland) and occasionally sold to a local butcher in Egremont. Most of the milk from the area was sold to dairies outside the area belonging to Dairy Crest, Dairy Farmers of Britain, First Milk and Scottish Milk. There was only one dairy in the area and it was selling milk directly to milkmen, shops and hotels in the area. Chickens and chicken eggs were sold mainly to local customers, family and friends. One farmer kept a small number of turkeys and

another kept a small number of geese to sell to family and friends. Three farmers were producing potatoes to be sold as door trade and through wholesale merchants who were located outside the survey area. One farmer sometimes sold excess barley to other farmers in the area.

Consumption of locally reared meat was identified in the survey area, 10 farmers and their families consumed beef and 10 consumed lamb from their own farms. Most of the dairy farmers and their families consumed milk from their own farms. Five farmers and their families consumed chickens, two consumed turkeys and two consumed geese all from their own farms. Seventeen farmers consumed chicken eggs from their own or neighbouring farms. No other people were identified consuming local farm products. Several private gardens with a range of fruit and vegetables were noted. Three households consumed eggs from chickens kept in their gardens and two of these sold excess eggs to family and friends. One household consumed turkeys that were kept in their garden. The nearest allotments were located in Egremont 2 km outside the survey area therefore were not considered.

Four beekeepers were identified in the survey area. A total of 11 hives were noted, six in the Gosforth area, two in Wellington and three at a farm near Beckermet. The average production of honey per hive was 14 kg per year. All beekeepers consumed honey from their hives and excess was sold privately or given to family and friends.

The consumption of wild foods was commonplace and included blackberries, rowanberries, mushrooms, sloes, damsons and wild plums. Wild fungi were collected from many of the farms although many people interviewed said that this year had been particularly bad because of the lack of rain. At least 15 households consumed game; this included venison, pheasant, pigeon, rabbit, duck, hare and woodcock.

Freshwater angling was predominantly for salmon and trout on the River Calder and the River Ehen. Three local freshwater angling clubs were contacted. One club with approximately 250 members had the lease to fish from Egremont to the Ehen Estuary and the other two

clubs, with approximately 70 members in total, had the lease to fish along the River Calder just north of the site. Catches and consumption of salmon and trout were reported to have been very low over the last few years due to the lack of rain. Four farmers and their families consumed brown trout and salmon caught on the River Ehen and the River Calder.

Five farms located on the fells, north-east of the site, were using spring water as their sole domestic supply. One other farm located 0.25 km south-west of the site was using spring water as well as mains water. Livestock were identified drinking spring and surface water at 11 farms in the survey area, with livestock from one farm known to drink from a small lake just over 1 km north-west of the site perimeter fence. People in a few holiday homes to the south of Braystones Station were reported to be drinking spring water from a pipe coming out of the dunes as they had no mains water supply. The homes to the north of the station were put on mains water supply in 2001; prior to this people were using spring water from the dunes or from a well. There are still houses in Braystones that have spring water channelled to their homes from culverts under the railway tracks, however, this was not reported as being used as drinking water. There were a few houses north of the station that were not on mains water but no one was available for interview to investigate further.

The transfer of contamination from Sellafield by wildlife was investigated. BNFL told us that, following the discovery of contaminated pigeons in Seascale in 1998, they have been trying to minimise such unusual pathways by the prevention of wildlife access, removal of potential habitat and (as a last resort) culling. In addition, using Environment Agency methodology, BNFL have identified potential pathways. Following the assessment of doses for these pathways, there will be a decision on any additional monitoring. The consumption of potentially contaminated wildlife was investigated during the survey but none was found.

The Environment Agency has monitored sediments that accumulate in road drains in Seascale since 1998 (EA, EHS, FSA and SEPA, 2003). Observations were made for contract workers who cleaned the road drains in Seascale to assess exposure pathways relating to the sediment. The contract workers cleaned the drains annually but there was no contact with

the sediment as it was removed by suction hose. The waste sediment was transported directly to a waste disposal site near Workington.

5.2 Terrestrial food wholesalers and retailers

Retailers were interviewed in order to find out whether they were selling produce from within the survey area. They included greengrocers, butchers and convenience stores, in Whitehaven, Cleator Moor, Egremont, Gosforth and Seascale. Approximately 18 retail outlets were visited or contacted via telephone. One butcher in Cleator Moor was selling local beef and lamb from a farm in Beckermet and a bakery in Seascale was selling local milk from a dairy within the 5 km area. No other retailers were found to be selling local produce.

5.3 Internal exposure

Consumption data for locally produced terrestrial foodstuffs are presented in Tables 22 to 37 for adults and Tables 38 to 51 for children. These tables include the mean consumption rates of the critical groups together with the observed 97.5 percentile rates calculated as described in Section 3.2. For purposes of comparison, the data are summarised in Table 13 for adults and in Tables 14 to 17 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 locally produced terrestrial foods.

In order to provide information relevant to surveillance and assessments studies, the consumption rate data collected during the survey were analysed to indicate which food types most commonly contributed to each food group. These data are summarised in Table 52. Those food types shown in bold and labelled with an asterisk were sampled as part of the 2002 Food Standards Agency monitoring programme (EA, EHS, FSA and SEPA, 2003).

Adult consumption rates

Consumption of terrestrial foods was identified in the following 16 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey, wild fungi, venison and freshwater fish. No consumption of pig meat, or local cereals was identified.

When compared with the generic 97.5 percentile consumption rates, the critical group mean consumption rates were greater for milk and cattle meat. A further eight critical group mean consumption rates exceeded the generic mean consumption rates. These were for green vegetables, other vegetables, root vegetables, potato, domestic fruit, sheep meat, eggs and honey. Seven observed 97.5 percentile consumption rates exceeded the generic 97.5 percentile consumption rates. These were for green vegetables, other vegetables, root vegetables, potato, milk, cattle meat and sheep meat.

Children's consumption rates

15 year old age group

Fourteen children in this age group were identified to be eating locally produced terrestrial food. Consumption of terrestrial foods was identified in the following 14 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat, sheep meat, poultry, eggs, wild/free foods, honey, wild fungi and freshwater fish. No consumption was identified for the following food groups: pig meat, rabbits/hares, venison and local cereals. The critical group mean consumption rates exceeded the generic 97.5 percentile consumption rates for root vegetables and cattle meat. A further five critical group mean consumption rates exceeded the generic mean consumption rates. These were for green vegetables, other vegetables, milk, eggs and wild/free foods. Four observed 97.5 percentile consumption rates exceeded the generic 97.5 percentile consumption rates. These were for green vegetables, root vegetables, milk and cattle meat.

10 year old age group

Seven children in this age group were identified as eating locally produced food. Consumption of terrestrial foods was identified in the following 10 food groups: potato, domestic fruit, milk, cattle meat, sheep meat, poultry, eggs, wild/free foods, wild fungi and freshwater fish. No consumption was identified for the following food groups: green vegetables, other vegetables, root vegetables, pig meat, rabbits/hares, honey, venison and local cereals. Only for cattle meat did the critical group mean consumption rate exceed the generic 97.5 percentile consumption rate. For two further food groups, milk and eggs, the critical mean consumption rates were higher than the generic mean consumption rates. Only for milk and cattle meat were the observed 97.5 percentile consumption rates greater than the generic 97.5 percentile consumption rates.

5 year old age group

Six children in this age group were identified as eating locally produced food. Consumption of terrestrial foods was identified in the following 10 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat, sheep meat, eggs and wild/free foods. No consumption was identified for the following food groups: pig meat, poultry, rabbits/hares, honey, wild fungi, venison and local cereals. No generic 97.5 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

One child in this age group was identified to be eating locally produced food. Consumption of terrestrial foods was identified in the following two food groups: milk and cattle meat. No consumption was identified for the following food groups: green vegetables, other vegetables root vegetables, potato, domestic fruit, pig meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey, wild fungi, venison and local cereals. Again, no generic 97.5 percentile

or generic mean consumption rates have been determined for this age group, therefore no comparisons with the observed corresponding rates could be made.

6 DIRECT RADIATION PATHWAYS

6.1 Direct radiation survey area

The direct radiation survey area covered all land within 1 km of the Sellafield site perimeter fence, as shown in Figure 2.

To the north of the site was Sellafield Visitors Centre, Yottenfews Farm and Sella Park House, each of these is owned and run by BNFL. A Tourist Information Centre was based inside the Visitors Centre. The River Calder flowed from the north through the middle of the site and joined the Irish Sea at the Calder Viaduct. A track ran along the eastern perimeter of the site, following the Calder Hall fence, and joined the road to Seascale to the south-east. The east and south of the survey area was predominantly farmland. The Fellside Combined Heat and Power Plant was located to the east and the Seascale golf course was adjacent to the southern part of the site boundary.

To the south-west was a shingle and sand beach and the River Ehen flowed parallel to the coast, between dunes and the site boundary, out to the Irish Sea. The beach was accessible across a bridge near Sellafield Station. At the time of the survey, BNFL had commenced work on the Sealine Recovery Project and redundant pipelines were scheduled for removal from Sellafield Beach. A BNFL sign restricted public access north of Sellafield Station along the Cumbria Coastal Way. Sellafield Station was located to the west of the site, and in following the coastline, the railway track ran past the south-west site boundary. To the north-west and west, the survey area was predominantly agricultural land.

6.2 Residential activities

The direct radiation survey area was sparsely populated with 25 residences, three of which were not occupied. Eight of the residences were farms, three of which were within 0.25 km of the site perimeter fence. Thirteen houses were located to the north of the site near

Calderbridge and four were located to the east and west of the site. Interviews were conducted with 17 of the households, and the community was found to be predominantly middle aged and included six families with children.

6.3 Leisure activities

The Sellafield Visitors Centre received in excess of 118,000 visitors between July 2002 and August 2003. Parties of school children frequently visited the gardens at Yottenfews Farm for nature studies.

At the time of the survey the public were permitted access to the River Calder where it passes through the site, but because it is difficult to reach very few people are known to spend time in this area. A local angling club once had the fishing rights for this stretch of the river but it is no longer fished in order to conserve fish stocks. We identified two angling clubs that fished the River Calder upstream of the site boundary and one angling club that fished the River Ehen.

The Seascale golf course 4th tee and 11th green are adjacent to the Calder Hall side of the site. Extensive earth banking shields the green. No activities were observed on the track by Calder Hall. Activities such as walking and dog walking occurred along the beach to the west of the site. Several people were noted shore angling as well as baitdigging and push netting for shrimps as bait.

6.4 Commercial activities

Commercial activities within the direct radiation survey area included farming, railway operations and Environment Agency monitoring. Eight farms were located within 1 km of the site; most of the farmland was owned and leased by BNFL. Livestock grazed the area immediately to the east of the perimeter fence. Situated to the west of the site were Sellafield Railway Station, a manned signal box and the railway track that followed the coast. Staff from

the Environment Agency carried out monitoring in and around the Sellafield site. This included two fisheries officers who spent time on the River Calder including within the site, two environment management people who spent time on or near the site (film badges were worn when on site) and one monitoring and data assistant.

The Sellafield Visitors Centre, Yottenfews Farm, Sella Park House and Fellside Combined Heat and Power Plant are all owned by BNFL or by contractors of BNFL. Employees working there were not considered for the purpose of this survey.

6.5 Occupancy rates

Table 53 presents indoor, outdoor and total occupancy data for adults and includes distances from the site perimeter fence where these occupancies took place. An analysis of the data by distance zones and occupancy rates is shown in Table 54.

0 - 0.25 km from the site perimeter fence

Twenty-four individuals were identified as spending time in the 0.0 to 0.25 km zone. The observations were mainly farmers, their families and the stationmasters at Sellafield Station. A farmer had the highest occupancy time of 8400 h/y.

0.25 – 0.5 km from the site perimeter fence

Thirty-two people were identified as spending time in the 0.25 to 0.5 km zone. The observations were for two farms, three residences and several bait diggers, shore anglers and dog walkers. A farm worker who lived and worked in the zone had the highest total occupancy time of 8400 h/y.

0.5 – 1.0 km from the site perimeter fence

Twenty-seven people were identified as spending time in the 0.5 to 1.0 km zone. The majority of observations were for residences and a couple of farms. A farmer had the highest total occupancy time of 8200 h/y.

6.6 Gamma dose rate measurements

Table 55 presents gamma dose rate measurements in the Sellafield direct radiation survey area. Representative gamma dose rate measurements were taken both inside and outside a selection of residences and at background locations outside the area. It should be noted that the measurements have not been adjusted for natural background dose rates.

Outdoor measurements, which were taken approximately 5 to 10 metres from the nearest buildings, ranged from 0.078 to 0.100 µGy/h. All the outdoor measurements were taken over grass except over grass and gravel at the signal box. Indoor measurements ranged from 0.087 to 0.140 µGy/h and were for the most part higher than the outdoor measurements. This is more likely to be due to natural radioactivity in the building materials than to any artificial sources.

Background gamma dose rate measurements taken over grass at 3.5 to 6.3 km from the site perimeter fence were found to range from 0.079 and 0.092 µGy/h.

Comprehensive studies of background radiation have been carried out on a national scale by the National Radiological Protection Board (NRPB), the most recent of these being a review conducted during 1999 (Hughes, 1999). The results from these could be used for comparison.

Table 56 presents gamma dose rate measurements made around the outside of the site perimeter fence 1 metre above the ground and 1 metre from the fence. Nine locations were

over grass, two were over tarmac, one was over mud and one was over stone chips. The measurements ranged from 0.067 (over tarmac) to 0.126 (over grass) μGy/h. The highest reading was found east of the site near Calder Hall.

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 57. These are based on information in Annex 1 and are derived irrespective of the magnitude of the rate observed for each pathway.

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.

The National Dose Assessments Working Group (NDAWG) has considered methods for calculating total dose from consumption and occupancy data provided by habits surveys. The relevant adult profiles for Sellafield are shown in Annex 4. Child profiles can be calculated by applying the ratios shown in Annex 3. Further discussion of the use of these data in assessments is given in Radioactivity in Food and the Environment, 2003 (EA, EHS, FSA and SEPA, 2004).

8 CONCLUSIONS AND SUGGESTIONS

8.1 Survey findings

During the survey, team members interviewed the majority of commercial fishermen and farmers in the survey area. In addition anglers, wildfowlers, rough shooters (people shooting rabbits, pigeons etc), beekeepers, amateur gardeners, people collecting wild/free foods and wild fungi, people pursuing watersports and intertidal activities were identified and interviewed. All consumption rates recorded in this report include only locally produced or caught foods.

Exposure pathways were investigated for 649 individuals. The survey found that pathways relating to each of the three potential sources of exposure from the Sellafield site were present:

- Discharges of liquid radioactive waste to the Irish Sea
- Discharges of gaseous radioactive waste to the atmosphere
- Direct radiation emitted from the site

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

- 41 kg/y for fish
- 27 kg/y for crustaceans
- 34 kg/y for molluscs
- 0.10 kg/y for marine plants and algae
- 1.9 kg/y for wildfowl

The predominant aquatic species consumed were cod, plaice, mackerel, thornback ray, crabs, lobsters, *Nephrops*, mussels, winkles and cockles. The species of wildfowl consumed were goose and duck.

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

- 160 h/y for coal and sand
- 30 h/y for rock
- 400 h/y for salt marsh
- 500 h/y for sand
- 870 h/y for sand and mud
- 860 h/y for sand and stones

The highest occupancy time for rock climbing at St Bees Head was 120 h/y. Beachcombing occurred on three beaches in the area; the highest occupancy time for was 180 h/y.

The critical group rate for handling fishing gear was 730 h/y and for handling sediment was 1000 h/y.

The maximum occupancy rate in water was 110 h/y for a group of kayakers. The maximum occupancy rate for time spent on water was 1400 h/y for a commercial fisherman. Other watersports in and on water included kitesurfing, windsurfing, diving, sailing and canoeing.

The adult critical group rates for the separate local terrestrial consumption pathways were:

- 36 kg/y for green vegetables
- 38 kg/y for other vegetables
- 31 kg/y for root vegetables
- 110 kg/y for potato
- 32 kg/y for domestic fruit

- 260 l/y for milk
- 46 kg/y for cattle meat
- 24 kg/y for sheep meat
- 6.6 kg/y for poultry
- 13 kg/y for eggs
- 3.4 kg/y for wild/free foods
- 2.4 kg/y for rabbits/hares
- 5.0 kg/y for honey
- 2.1 kg/y for wild fungi
- 23 kg/y for venison
- 0.20 kg/y for fish (freshwater)

No consumption of pig meat or local cereals was identified. Consumption of foodstuffs by children was also recorded. Combinations of food groups (both aquatic and terrestrial) consumed at critical group rates by individuals, together with their external pathway exposures, are presented in bold type in Annexes 1 and 2.

Evidence of consumption of groundwater included several farms using spring water and a few individuals at Braystones collecting spring water as their sole supply of water from a pipe coming out of the dunes.

For occupancy rates of members of the public within 1 km of the Sellafield site perimeter fence, the highest rates (indoors plus outdoors) were:

- 8400 h/y for the 0 to 0.25 km zone
- 8400 h/y for the 0.25 to 0.5 km zone
- 8200 h/y for the 0.5 to 1.0 km zone

In two of the zones, the highest occupancy rates were for farmers and in the other zone for a farm worker.

8.2 Comparisons with previous surveys

The results from this survey can be compared with results from the last surveys undertaken at Sellafield. The previous full aquatic and terrestrial surveys were carried out concurrently in 1998 and the previous direct radiation surveys were carried out in 1995 for the Calder Hall side of the site and in 1996 for the rest of the site. The most recent aquatic habits review was in 2002 and data from this are included in the following comparisons. However, it should be noted that the review was not a full habits survey and only targeted known Sellafield Coastal Community critical group members.

In 1998, 2002 and 2003, the critical group mean consumption rates for fish were 45, 51 and 41 kg/y respectively, the maximum consumption rates were 91, 93 and 74 kg/y respectively and the number of people in the critical group were 13, 20 and 31 respectively. In 1998, the main species of fish consumed by the critical group were cod (50%), plaice (25%), and other species (25%) comprising mackerel, whiting, bass and Dover sole. In 2002, the main species were cod (40%) and other species (60%) comprising plaice, thornback ray and mackerel. In 2003, the main species were cod (60%), plaice (20%), thornback ray (10%) and other species (10%).

In 1998, 2002 and 2003, the critical group mean consumption rates for crustaceans were 28, 16 and 27 kg/y respectively, the maximum consumption rates were 42, 35 and 48 kg/y respectively and the number of people in the critical group were eight, 14 and 10 respectively. In 1998, the main species of crustaceans consumed by the critical group were crabs (85%) and lobsters (15%). In 2002, the main species were crabs (50%), lobsters (30%) and *Nephrops* (20%). In 2003, the main species were crabs (75%), lobsters (10%), brown shrimps (10%), and *Nephrops* (5%).

In 1998, 2002 and 2003, the critical group mean consumption rates for molluscs were 15, 29 and 34 kg/y respectively, the maximum consumption rates were 23, 45 and 53 kg/y respectively and the number of people in the critical group were four, four and nine

respectively. In 1998, the main species of molluscs consumed in the critical group were winkles (30%), cockles (25%), whelks (20%), mussels (15%) and limpets (10%). In 2002, the main species were winkles (60%) and mussels (40%). In 2003, the main species were winkles (35%), mussels (30%), cockles (25%), and whelks (5%).

In 1998, consumption of razor fish (*Ensis arcuatus*) and sea mice (*Aphrodite aculeata*) were noted. However no consumption was identified in 2002 or 2003.

Comparison of consumption rates for the marine plants and algae and wildfowl food groups can not be drawn, because in 1998 and 2002 consumption of these food groups was not recorded.

The most important intertidal substrates recorded in 1998, 2002 and 2003 that can be compared are sand and mud, and salt marsh.

It should be noted that the methodology for determining the critical group has been altered since the 1998 survey so care is needed when comparing results. However, where the critical group rates for 2003 would have been different using the 1998 methodology, a comment is made in the comparisons.

In 1998, 2002 and 2003, the critical group mean intertidal occupancy rates for sand and mud were 1100, 1200 and 870 h/y respectively. The maximum rates were 1400, 1700 and 1600 h/y respectively and the number of people in the critical group were 11, four and 14 respectively. Using the 1998 methodology, the critical group rate for 2003 would have been 1500 h/y for three people shellfish collecting, angling and bait digging.

In 1998, 2002 and 2003 the critical group mean intertidal occupancy rates for salt marsh were 130, 26 and 400 h/y respectively. The maximum rates were 130, 26 and 400 h/y respectively and the number of people in the critical group was one (a nature warden), two (wildfowlers) and one (a marsh warden) respectively.

In 1998, 2002 and 2003, the critical group mean handling rate for commercial fishing gear was 1200, 500 and 730 h/y respectively, the maximum handling rates were 1500, 950 and 1000 h/y respectively and the number of people in the critical group were two, eight and eight respectively.

In 1998, 2002 and 2003, the critical group mean handling rate for sediment was 950, 880 and 1000 h/y respectively, the maximum handling rates were 1000, 1100 and 1500 h/y respectively and the number of people in the critical group were three, five and five respectively.

No comparison of occupancy rates in and on water can be made with previous surveys because this pathway was not investigated in 1998 and 2002.

For terrestrial food groups, the critical group mean consumption rates (kg/y and l/y) in the 2003 survey are tabulated below, together with those of the 1998 survey for ease of comparison:

	1998	2003
• Green vegetables	31	36
• Other vegetables	29	38
• Root vegetables	44	31
• Potato	180	110
• Domestic fruit	32	32
• Milk	250	260
• Cattle meat	32	46
• Pig meat	6.8	0
• Sheep meat	14	24
• Poultry	24	6.6
• Eggs	13	13
• Wild/free foods	4.8	3.4

• Rabbits/hares	0	2.4
• Honey	10	5.0
• Wild fungi	1.4	2.1
• Venison	0	23
• Fish (freshwater)	0	0.20

Consumption rates had decreased in 2003 in the following food groups: root vegetables, potato, pig meat (nil in 2003), poultry, wild/free foods and honey. Consumption rates had increased in 2003 in the following food groups: green vegetables, other vegetables, milk, cattle meat, sheep meat, rabbits/hares (nil in 1998), wild fungi, venison and fish (freshwater) (both nil in 1998). Consumption rates of domestic fruit and eggs remained the same.

A comparison of the 1995/6 and 2003 direct radiation results shows that the highest occupancy rates are still recorded for farmers who live and work within 1 km of the site. In 1995/6 the highest recorded occupancy rate was 8600 h/y for three farmers, one in the 0 – 0.25 km zone and one the 0.25 – 0.5 km zone. In the 2003 survey the highest occupancy time was 8400 h/y for a farmer and a farm worker in the 0 – 0.25 km zone and 0.25 – 0.5 km zone respectively.

Activities present in 1995/6 still being carried out in 2003 included work by the Environment Agency (previously identified as National Rivers Authority staff), the manning of Sellafield Station, golf at the Seascale golf links and bait digging and shore angling on Sellafield Beach. Activities no longer taking place in 2003 included a commercial supplier housed in Sellafield Station buildings and the Sellafield Area Sports and Recreation Association (SASRA), whose members have not fished the River Calder within the Sellafield site in the last five years.

Gamma dose rate measurements for five residences in 2003 can be compared with gamma dose rate measurements taken at similar locations in 1995/6. These were for three farms and two residences (farms 1, 2 and 4 and houses 1 and 3 in Table 55). Gamma dose

measurements, indoors and outdoors, in 1995/6 ranged from 0.090 to 0.118 μGy/h and in 2003 from 0.089 to 0.123 μGy/h.

Gamma dose rate measurements at five locations around the site perimeter fence in 2003 could be compared with those taken in 1995/6. Measurements at these locations on the western side of the site ranged from 0.002 to 0.015 μGy/h higher in 2003 than measurements in 1996. On the eastern side (Calder Hall) of the site, measurements at two locations were respectively 0.034 and 0.297 μGy/h higher in 1995 than measurements in 2003. It should be noted that at the time of the 1995 survey all four reactors of the Calder Hall power station were on line while at the time of the 2003 survey the reactors had ceased operation.

8.3 Suggestions for environmental monitoring

The 2002 monitoring programmes operated by the Environment Agency and the Food Standards Agency included the following samples and measurements (EA, EHS, FSA and SEPA, 2003):

Aquatic surveillance

- Cod
- Plaice
- Bass
- Mullet
- Pollack
- Sea trout
- Salmon
- Brown trout
- Rainbow trout
- Crabs
- Lobsters
- Surface water
- Winkles
- Mussels
- Limpets
- Whelks
- Cockles
- Shrimps
- Sea mouse
- *Fucus vesiculosus*
- *Porphyra*
- *Rhodymenia spp.*

- Sediment from Whitehaven Outer Harbour, St Bees, River Calder, Sellafield, pipeline on foreshore, Ehen Spit, Seascale, Drigg Stream, Ravenglass, River Mite Estuary and Newbiggin.
- Gamma dose rate measurements over intertidal areas at Parton, Whitehaven, Saltom Bay, St Bees, Nethertown, Braystones, Sellafield, Ehen Spit, River Calder, Seascale, Drigg Barn Scar, Muncaster Bridge, Ravenglass, Newbiggin/Eskmeals and Tarn Bay

Terrestrial surveillance

- Milk
- Apples
- Barley
- Blackberries
- Bovine
- Broad beans
- Cabbages
- Carrots
- Cauliflower
- Eggs
- Elderberries
- Honey
- Leeks
- Ovine
- Potato
- Runner beans
- Sloe berries
- Swede
- Turnips

It should be noted that the suggestions put forward in this section for consideration are based solely on the findings of this survey. They are not the outcome of any form of assessment.

For the aquatic monitoring programme, consideration should be given to the following:

- This survey did not identify the consumption of mullet, which is currently monitored. Thornback ray could replace mullet because this species is more commonly consumed.
- Although salmon was not consumed in high amounts it was consumed by many people therefore it is suggested that salmon should be sampled from the River Ehen.
- Consumption of *Nephrops* and shrimps was identified therefore it is suggested that *Nephrops* should be sampled from Braystones and shrimps should be sampled from Ravenglass.

- Consumption of wildfowl was identified. One-off samples of duck and goose could be obtained for re-assurance purposes.
- Gamma dose rate measurements could be introduced at Drigg on sand as many observations were noted on the beach and farmers were removing large quantities of sand.

For the terrestrial monitoring programme, consideration could be given to the following:

- Monitoring of broad beans in the other vegetables group could be changed to monitoring tomatoes as they were eaten in the greatest quantities in that group.
- Monitoring of cauliflower in the green vegetables group could be changed to monitoring Brussels sprouts as they were eaten in greater quantities.
- Monitoring of swede in the root vegetables group could be changed to onions as they were eaten in greater quantities.
- Monitoring of elderberries could be changed for wild damsons as they were eaten in larger quantities.
- Monitoring of pheasants could be introduced as they were commonly consumed within the poultry group.
- The consumption of rabbit was identified; a one-off sample of rabbit could be obtained for re-assurance purposes.
- Consumption of venison was identified; a one-off sample could be obtained for re-assurance purposes.
- Groundwater consumption was identified at several farms in the survey area and at Braystones, a biannual sample could be obtained.

9 ACKNOWLEDGEMENTS

Gratitude is expressed to representatives of local authorities and associations and members of the public who offered helpful advice and information during the survey. This survey was undertaken on behalf of the Environment Agency, the Food Standards Agency and the Health and Safety Executive. The project officers for these organisations gave considerable help during the planning of the survey and the drafting of the report.

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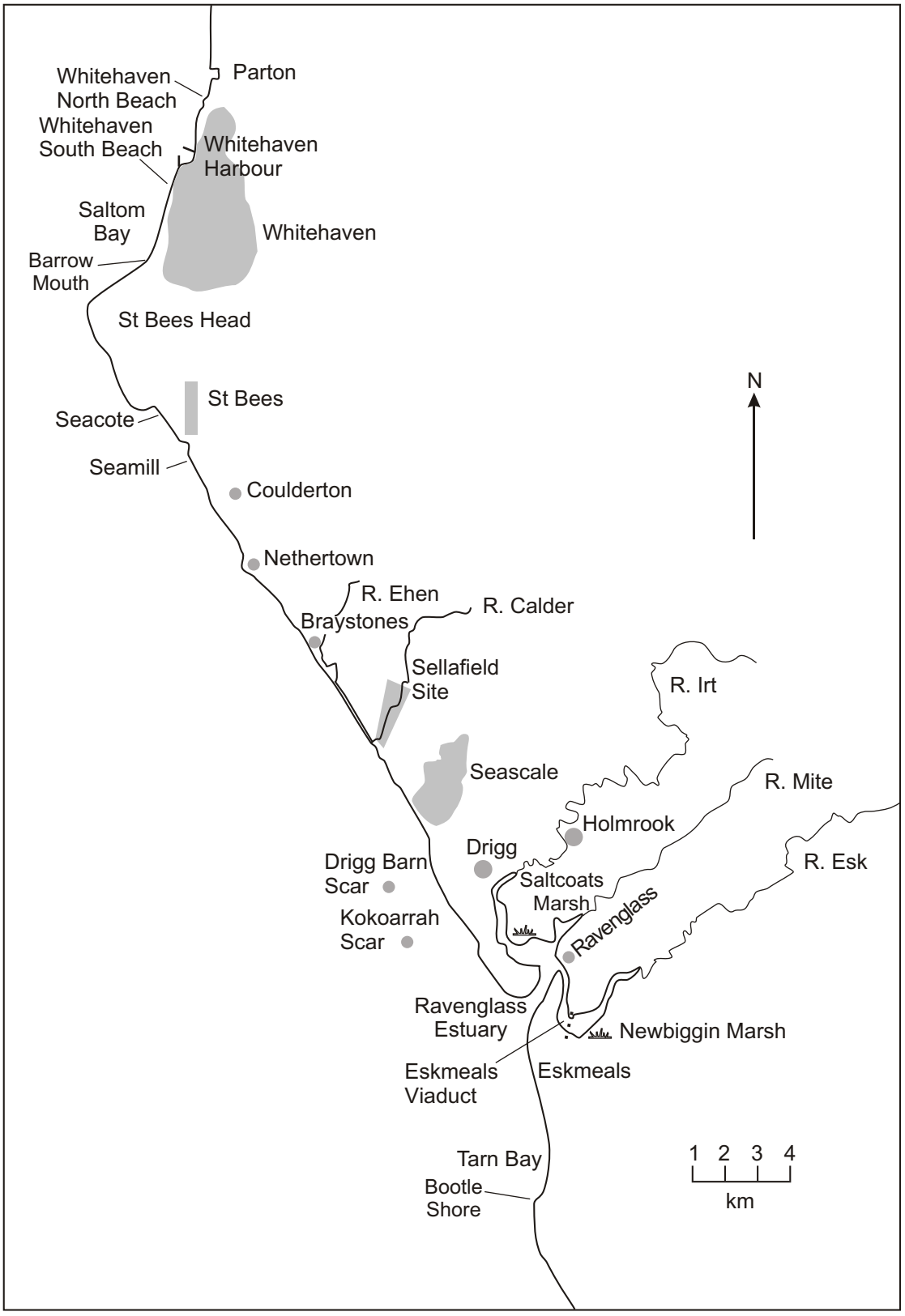

Figure 1. The Sellafield aquatic survey area

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

Key

○ = Sellafield site centre

Table 1. Survey coverage

Group	Criteria	Estimate of complete coverage	Number for whom positive data was obtained	Coverage for positive observations	Notes
ALL PATHWAYS					
All potential people in Sellafield aquatic, terrestrial and direct radiation survey areas	Number of people resident in terrestrial survey area (excluding those in the direct radiation survey area)	3500^	213^^	*	Not all people resident in the 5 km area were interviewed. The survey targeted individuals who were potentially the most exposed (Section 2.4), mostly producers of local food (farmers and small holders)
	Number of people resident in the direct radiation survey area	70	47	****	
	Number of people employed but not resident in the direct radiation survey area	10	5	***	Excluding employees and contractors of BNFL and UKAEA, and farm workers living in the direct radiation survey area
	Number of people using the aquatic area	Unknown but more than 650	389^^	U	Data obtained for people living outside the 5 km area affected by aquatic discharge
	Approximate total for aquatic, terrestrial and direct radiation survey areas	Unknown but more than 4200	649^^	U	
AQUATIC PATHWAYS					
Commercial fishermen	Number of commercial fishermen actively fishing in survey area	11	11	*****	
Boat anglers and hobby fishermen	Number seen or heard of during survey	50	18	**	
Shore anglers and other beach users	Number seen in action or spoken to during survey	Unknown but at least 220	220	U	Interview with angling club representatives provided generic data
Bait diggers	Number seen in action, spoken to or heard of during survey	100	73	****	Interview with 2 angling club representatives provided generic data
Wildfowlers	Number of club members licensed to shoot in survey area	20	3	*	
Divers	Members of clubs in survey area or people spoken to during survey	40	15	**	Interview with a club representative provided generic data
Watersports enthusiasts	Members of clubs in survey area and people seen in action or spoken to during survey period	200	107	***	Interview with a sailing club and a kayaking club representative provided generic data

Table 1. Survey coverage

TERRESTRIAL PATHWAYS^^^					
Farms	Number of farmers and their family members in the survey area	150	128	*****	Estimate of 40 farms in the area, of which 34 farmers were interviewed
Bee keepers	Number of people consuming honey in survey area	U	9	U	Estimate of 4 beekeepers in the area, all of which were interviewed
DIRECT RADIATION PATHWAYS					
Occupancy of area	Number with occupancies > 100 hours (excluding site employees)	85	65	****	
Residences	Number of residents in the survey area	70	47	****	Estimate of 25 houses and farms in the area, 17 occupants of which were interviewed
Employees	Number of people predominantly based in survey area	20	10	*****	Including farm workers who live in the direct radiation area. Environment Agency workers also spend time but are not based in the survey area
BREAKDOWN OF AGE GROUPS					
Adults	Individuals over 17	U	570	U	
15 year old	More than 12.0 year old to 17.0 year old	U	29	U	
10 year old	More than 7.0 year old to 12.0 year old	U	23	U	
5 year old	More than 2.0 year old to 7.0 year old	U	25	U	
1 year old	More than 1.0 year old to 2.0 year old	U	1	U	
3 months old	From 0 to 1.0 year old	U	1	U	

Notes

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

^^ - The number of people for whom data was obtained for each pathway listed below, will not necessarily equal the approximate total. This is because some individuals, for example someone who fishes from a boat and the shore and digs their own bait, will be counted three times, whereas others, such as the families of fishermen, will not be counted at all.

^^^ - 18 shops and 1 dairy were visited during the survey

U - Unknown

Coverage

* = 1-20% **= 20 - 40% ***= 40 - 60% ****= 60-80% *****=80-100%

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
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, pumpkin, raspberry, redcurrants, rhubarb, rowanberry, strawberry, tayberry, whitecurrant
Milk	Milk, butter, cream, cheese, yoghurt, goats 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 (fresh water)	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. Adult consumption rates of fish in the Sellafield area (kg/y)

Observation number	Bass	Cod	Dover sole	Flounder	Haddock	Lemon sole	Mackerel	Mixed fish	Plaice	Pollack	Salmon	Sea trout	Squid*	Thornback ray	Turbot	Whiting	Total
16		**55.7**					**18.6**										**74.3**
140		**59.0**															**59.0**
142		**59.0**															**59.0**
283-284								**56.7**									**56.7**
136	**17.7**						**17.7**				**17.7**						**53.1**
276		**26.5**							**26.5**								**53.1**
20-21		**24.3**												**24.3**			**48.6**
143		**46.3**															**46.3**
1-2								**44.2**									**44.2**
22-24		**22.1**							**22.1**								**44.2**
260-261		**22.1**							**22.1**								**44.2**
48								**35.4**									**35.4**
263								**35.4**									**35.4**
278		**17.7**							**17.7**								**35.4**
19		**16.2**												**16.2**			**32.4**
10-11		**9.5**					**9.5**			**9.5**	**0.9**						**29.5**
279		**3.8**	**0.2**		**19.7**				**2.8**				**3.0**				**29.4**
178-179								**28.4**									**28.4**
280		**14.3**					**1.7**		**1.1**				**3.0**	**8.2**			**28.2**
3-4		**27.2**															**27.2**
35		**9.8**				**9.2**			**6.5**								**25.5**
17		**18.6**					**6.2**										**24.8**
144		23.6															23.6
285-286								23.6									23.6
129		18.0					5.3										23.3
12-14								17.9									17.9
117		7.5							10.0								17.5
9								16.3									16.3
288-289		15.0															15.0
193-194								13.6									13.6
164				5.9			1.2		5.9								13.0
465-466		2.6	3.4						4.2	2.5							12.7
110-111		11.8															11.8
113	0.7	10.7													0.5		11.8
118	0.7	10.7													0.5		11.8

Table 3. Adult consumption rates of fish in the Sellafield area (kg/y)

Observation number	Bass	Cod	Dover sole	Flounder	Haddock	Lemon sole	Mackerel	Mixed fish	Plaice	Pollack	Salmon	Sea trout	Squid*	Thornback ray	Turbot	Whiting	Total
251		5.9					5.9										11.8
253		5.9					5.9										11.8
653-654		5.9							5.9								11.8
404-405	1.6	9.9															11.5
254		5.9				1.4			4.1								11.3
196								10.9									10.9
145-146								9.5									9.5
176-177	0.5	6.0									2.4						9.0
190	4.0	3.7															7.7
198-200	4.0	3.7															7.7
36						4.5			3.2								7.7
224								6.8									6.8
229								6.8									6.8
406-407		6.2															6.2
410-412		6.2															6.2
157		2.0					0.6		3.4								6.1
220		6.0															6.0
222-223		6.0															6.0
78-80		2.7			2.7												5.4
160-163		4.1		0.5					0.5								5.0
119	0.4	1.8				0.6			0.8	1.1							4.7
121-124	0.4	1.8				0.6			0.8	1.1							4.7
400		0.5									2.1	1.6				0.3	4.4
402-403		0.5									2.1	1.6				0.3	4.4
152-153	2.1								2.0								4.1
115									2.0							2.0	4.1
255		4.1															4.1
257-259		4.1															4.1
120								4.0									4.0
130								4.0									4.0
256											3.9						3.9
262											3.9						3.9
197	1.6	2.2															3.8
201	1.6	2.2															3.8
204		1.3							2.0								3.3

Table 3. Adult consumption rates of fish in the Sellafield area (kg/y)

Observation number	Bass	Cod	Dover sole	Flounder	Haddock	Lemon sole	Mackerel	Mixed fish	Plaice	Pollack	Salmon	Sea trout	Squid*	Thornback ray	Turbot	Whiting	Total
206-211		1.3							2.0								3.3
350-353											2.9	0.3					3.3
141							0.8									2.1	2.9
155							0.8									2.1	2.9
95		2.7															2.7
158-159								2.7									2.7
138-139	1.1	1.5															2.6
173-174											2.4						2.4
333-335											2.4						2.4
357							2.2										2.2
69-70		1.4															1.4
321-323											0.9						0.9
326-328											0.9						0.9
250											0.8						0.8
252											0.8						0.8
109									0.6								0.6
294-296											0.6						0.6

Notes

Emboldened observations are the critical group consumers

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

The critical group mean consumption rate of fish based on the 31 highest adult consumers is 41.3 kg/y

The observed 97.5 percentile rate based on 146 observations is 56.7 kg/y

Table 4. Adult consumption rates of crustaceans in the Sellafield area (kg/y)

Observation number	Brown shrimp	Crab	Lobster	*Nephrops*	Total
1-2	**0.6**	**47.2**			**47.7**
22-24		**20.6**	**6.2**		**26.8**
16		**19.4**			**19.4**
3-4	**10.2**	**6.7**	**2.3**		**19.2**
48		**4.5**	**2.1**	**11.8**	**18.4**
20		**11.8**	**3.3**	**2.3**	**17.3**
653-654		5.9	5.9		11.8
116-117		2.0	9.8		11.8
19		5.9	3.3	2.3	11.4
21		5.9	3.3	2.3	11.4
17		9.7			9.7
280	0.4	3.6	2.0	3.6	9.6
260-261			8.5		8.5
114		7.4			7.4
279	0.4	1.8	0.4	3.6	6.1
283-284			0.9	5.1	6.0
35-36		5.1	0.7		5.8
467-468		1.3	1.1		2.4
29		2.2			2.2
466			2.1		2.1
276		1.3	0.8		2.1
278		1.3	0.8		2.1
119		1.4	0.5		1.9
121-122		1.4	0.5		1.9
263		1.3	0.5		1.8
265		1.3	0.5		1.8
40		1.4	0.2		1.6
129		1.0	0.4		1.4
164		1.0	0.4		1.4
255		0.9	0.4		1.3
257-259		0.9	0.4		1.3
465		1.3			1.3
254		0.9	0.4		1.2
224			1.1		1.1
229			1.1		1.1
469		0.5	0.5		1.1
136		1.0			1.0
115		0.5		0.5	1.0
103		0.2	0.4		0.5
9		0.4			0.4
12		0.3			0.3
182		0.3			0.3
281-282		0.3			0.3

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of crustaceans based on the 10 highest adult consumers is 27.0 kg/y

The observed 97.5 percentile rate based on 57 observations is 39.4 kg/y

Table 5. Adult consumption rates of molluscs in the Sellafield area (kg/y)

Observation number	Cockle	Limpet	Mussel	Whelk	Winkle	Total
269	**16.0**		**32.6**		**4.4**	**53.1**
9	**6.5**		**16.0**		**20.0**	**42.6**
3-4	**12.4**				**24.8**	**37.1**
1-2	**14.7**		**9.1**		**11.6**	**35.4**
273	**1.4**		**21.8**		**1.3**	**24.5**
12			**10.1**		**9.9**	**20.0**
48			**4.7**	**11.8**	**1.5**	**17.9**
29		0.7			11.5	12.2
16-17	4.5		2.3		2.2	9.0
178-180	5.3					5.3
183	5.3					5.3
186-189	5.3					5.3
136	3.4		0.5			3.9
283-284				2.5	0.1	2.6
113					1.6	1.6
118					1.6	1.6
141	0.05		0.4		0.8	1.2
119					1.1	1.1
121-123					1.1	1.1
19-21			0.5			0.5
155	0.05		0.4			0.4
429-430			0.3		0.1	0.4
143-144			0.2			0.2

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of molluscs based on the 9 highest adult consumers is 33.7 kg/y

The observed 97.5 percentile rate based on 38 observations is 43.4 kg/y

Table 6. Adult consumption rates of marine plants and algae in the Sellafield area (kg/y)

Observation number	*Porphyra*
279	**0.1**
280	**0.1**

Notes

Emboldened observations are the critical group consumers
The critical group mean consumption rate of marine plants and algae based on the 2 highest adult consumers is 0.1 kg/y
The observed 97.5 percentile rate based on 2 observations is 0.1 kg/y

Table 7. Adult comsumption rates of wildfowl in the Sellafield area (kg/y)

Observation number	Duck	Goose	Total
653	**2.6**		**2.6**
654	**2.6**		**2.6**
659	**2.6**		**2.6**
634	**0.7**	**0.6**	**1.2**
635	**0.7**	**0.6**	**1.2**
636	**0.7**	**0.6**	**1.2**

Notes

Emboldened observations are the critical group consumers
The critical group mean consumption rate of wildfowl based on the 6 highest adult consumers is 1.9 kg/y
The observed 97.5 percentile rate based on 6 observations is 2.6 kg/y

Table 8. Adult consumption rates of vegetables grown on land where seaweed has been used as a fertiliser (kg/y)

Observation number	Beetroot	Brussels sprout	Cabbage	Cauliflower	Leek	Leef beet	Onion	Pea	Potato	Runner bean	Turnip
40	4.5						18.0		19.0	13.5	
S1		1.1	15.0	1.3	1.1		12.5		10.2		
S2		1.1	15.0	1.3	1.1		12.5		10.2		
S3	7.5		5.1		1.2		22.0	6.8	17.5		5.4
S4	7.5		5.1		1.2		22.0	6.8	17.5		5.4
S5	22.7					2.3	10.5		27.2		
S6						2.3	10.5		27.2		

Notes

This information is not included in Annex 1 data for vegetables because the source of exposure is liquid discharges and not gaseous discharge

Table 9. Children's consumption rates of fish in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Bass	Cod	Lemon sole	Mixed fish	Plaice	Pollack	Salmon	Sea trout	Whiting	Total
15	**15**				**17.9**						**17.9**
147	**15**				**9.5**						**9.5**
148	**12**				**9.5**						**9.5**
230	**12**				**6.8**						**6.8**
131	16				4.0						4.0
132	15				4.0						4.0
324	14							0.9			0.9
329	12							0.9			0.9
657	16		0.5			0.5					0.9
298	15							0.6			0.6
297	13							0.6			0.6

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of fish based on the 4 highest 15 year old consumers is 10.9 kg/y

The observed 97.5 percentile rate based on 11 observations is 15.8 kg/y

10 year old age group

Observation number	Age	Bass	Cod	Lemon sole	Mixed fish	Plaice	Pollack	Salmon	Sea trout	Whiting	Total
5	**7**		**13.6**								**13.6**
655	**8**		**5.9**			**5.9**					**11.8**
149	**8**				**9.5**						**9.5**
126	**9**	**0.4**	**1.8**	**0.6**		**0.8**	**1.1**				**4.7**
154	8	2.1				2.0					4.1
408	8		3.7								3.7
325	10							0.9			0.9

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of fish based on the 4 highest 10 year old consumers is 9.9 kg/y

The observed 97.5 percentile rate based on 7 observations is 13.3 kg/y

Table 9. Children's consumption rates of fish in the Sellafield area (kg/y)

5 year old age group

Observation number	Age	Bass	Cod	Lemon sole	Mixed fish	Plaice	Pollack	Salmon	Sea trout	Whiting	Total
6	**6**		**13.6**								**13.6**
7	**4**		**13.6**								**13.6**
656	**6**		**5.9**			**5.9**					**11.8**
287	**4**				**11.8**						**11.8**
8	**2**		**6.8**								**6.8**
125	**4**	**0.4**	**1.8**	**0.6**		**0.8**	**1.1**				**4.7**
401	5		0.5					1.0	1.6	0.3	3.3
409	6		2.5								2.5

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of fish based on the 6 highest 5 year old consumers is 10.4 kg/y

The observed 97.5 percentile rate based on 8 observations is 13.6 kg/y

Table 10. Children's consumption rates of crustaceans in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Brown shrimp	Crab	Lobster	Total
230	**12**			**1.1**	**1.1**
657	**16**		**0.5**	**0.5**	**0.9**
658	**13**		**0.5**	**0.5**	**0.9**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of crustaceans based on the 3 highest 15 year old consumers is 1.0 kg/y
The observed 97.5 percentile rate based on 3 observations is 1.1 kg/y

10 year old age group

Observation number	Age	Brown shrimp	Crab	Lobster	Total
655	**8**		**5.9**	**5.9**	**11.8**
5	**7**	**5.1**	**3.4**	**1.2**	**9.6**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of crustaceans based on the 2 highest 10 year old consumers is 10.7 kg/y
The observed 97.5 percentile rate based on 2 observations is 11.7 kg/y

5 year old age group

Observation number	Age	Brown shrimp	Crab	Lobster	Total
656	**6**		**5.9**	**5.9**	**11.8**
6	**6**	**5.1**	**3.4**	**1.2**	**9.6**
7	**4**	**5.1**	**3.4**	**1.2**	**9.6**
8	**2**	**2.5**	**1.7**	**0.6**	**4.8**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of crustaceans based on the 4 highest 5 year old consumers is 9.0 kg/y
The observed 97.5 percentile rate based on 4 observations is 11.6 kg/y

Table 11. Children's consumption rates of molluscs in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Cockle	Mussel	Winkle	Total
272	**15**	**5.3**	**10.9**		**16.2**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of molluscs based on the highest 15 year old consumer is 16.2 kg/y
The observed 97.5 percentile is not applicable for 1 observation

10 year old age group

Observation number	Age	Cockle	Mussel	Winkle	Total
5	**7**	**6.2**		**12.4**	**18.6**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of molluscs based on the highest 10 year old consumer is 18.6 kg/y
The observed 97.5 percentile is not applicable for 1 observation

5 year old age group

Observation number	Age	Cockle	Mussel	Winkle	Total
6	**6**	**6.2**		**12.4**	**18.6**
7	**4**	**6.2**		**12.4**	**18.6**
8	**2**	**3.1**		**6.2**	**9.3**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of molluscs based on the 3 highest 5 year old consumers is 15.5 kg/y
The observed 97.5 percentile rate based on 3 observations is 18.6 kg/y

Table 12. Children's consumption rates of wildfowl in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Duck	Goose	Total
657	**16**	**2.6**		**2.6**
658	**13**	**2.6**		**2.6**
637	**14**	**0.7**	**0.6**	**1.2**

Notes

Emboldened observations are the critical group consumers
The critical group mean consumption rate of wildfowl based on the 3 highest 15 year old consumers is 2.2 kg/y
The observed 97.5 percentile rate based on 3 observations is 2.6 kg/y

10 year old age group

Observation number	Age	Duck	Goose	Total
655	**8**	**2.6**		**2.6**

Notes

Emboldened observations are the critical group consumers
The critical group mean consumption rate of wildfowl based on the highest 10 year old consumer is 2.6 kg/y
The observed 97.5 percentile is not applicable for 1 observation

5 year old age group

Observation number	Age	Duck	Goose	Total
656	**6**	**2.6**		**2.6**

Notes

Emboldened observations are the critical group consumers
The critical group mean consumption rate of wildfowl based on the highest 5 year old consumer is 2.6 kg/y
The observed 97.5 percentile is not applicable for 1 observation

Table 13. Summary of adult's consumption rates in the Sellafield area (kg/y or l/y)

Food group	Number of observations	No. higher rate consumers	Observed maximum critical group consumption rate	Observed minimum critical group consumption rate	Observed mean critical group consumption rate	Observed 97.5 %ile consumption rate	Generic mean consumption rate	Generic 97.5 %ile consumption rate
Fish	146	31	74.3	24.8	41.3	56.7	15.0	40.0
Crustaceans	57	10	47.7	17.3	27.0	39.4	3.5	10.0
Molluscs	38	9	53.1	17.9	33.7	43.4	3.5	10.0
Marine plants/algae	2	2	0.1	0.1	0.1	0.1	ND	ND
Wildfowl	6	6	2.6	1.2	1.9	2.6	ND	ND
Green vegetables	30	14	55.6	25.7	35.8	55.6	15.0	45.0
Other vegetables	47	9	66.7	23.5	38.4	64.7	20.0	50.0
Root vegetables	43	21	56.1	21.6	30.9	55.5	10.0	40.0
Potato	61	36	165.6	55.6	109.4	165.6	50.0	120.0
Domestic fruit	57	13	48.0	21.2	32.1	45.1	20.0	75.0
Milk	60	35	414.9	155.6	260.0	414.9	95.0	240.0
Cattle meat	28	28	70.8	31.2	46.3	70.8	15.0	45.0
Pig meat	NC	NC	NC	NC	NC	NC	15.0	40.0
Sheep meat	29	6	35.4	12.7	23.6	35.4	8.0	25.0
Poultry	57	24	9.8	4.7	6.6	9.3	10.0	30.0
Eggs	79	58	20.8	7.1	13.1	20.8	8.5	25.0
Wild/free foods	73	13	5.4	2.0	3.4	5.4	7.0	25.0
Rabbits/hares	5	5	3.0	1.5	2.4	3.0	6.0	15.0
Honey	9	4	6.8	3.2	5.0	6.8	2.5	9.5
Wild fungi	34	9	4.0	1.4	2.1	4.0	3.0	10.0
Venison	5	3	22.7	22.7	22.7	22.7	ND	ND
Fish (freshwater)	10	10	0.2	0.2	0.2	0.2	15.0	40.0

ND = not determined
NC = not consumed

Table 14. Summary of 15 year old children's consumption rates in the Sellafield area (kg/y or l/y)

Food group	Number of observations	No. higher rate consumers	Observed maximum critical group consumption rate	Observed minimum critical group consumption rate	Observed mean critical group consumption rate	Observed 97.5 %ile consumption rate	Generic mean consumption rate	Generic 97.5 %ile consumption rate
Fish	11	4	17.9	6.8	10.9	15.8	6.5	20.0
Crustaceans	3	3	1.1	0.9	1.0	1.1	2.5	6.0
Molluscs	1	1	16.2	16.2	16.2	NA	2.5	6.0
Wildfowl	3	3	2.6	1.2	2.2	2.6	ND	ND
Green vegetables	2	2	25.9	9.6	17.8	25.5	9.0	25.0
Other vegetables	2	2	23.5	3.2	13.3	23.0	10.0	30.0
Root vegetables	5	3	29.0	15.9	22.8	28.4	7.5	20.0
Potato	7	4	55.6	42.5	50.9	55.6	60.0	130.0
Domestic fruit	6	3	27.4	2.9	12.4	24.8	15.0	50.0
Milk	10	7	311.1	103.7	175.3	294.5	110.0	260.0
Cattle meat	3	3	47.3	37.8	41.0	46.8	15.0	35.0
Pig meat	NC	NC	NC	NC	NC	NC	10.0	30.0
Sheep meat	3	3	3.8	1.2	2.1	3.6	5.5	15.0
Poultry	6	3	1.4	1.3	1.3	1.4	6.5	20.0
Eggs	8	4	14.2	5.9	8.6	13.0	7.0	25.0
Wild/free foods	9	2	5.4	1.5	3.5	4.7	3.0	13.0
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	1	1	0.6	0.6	0.6	NA	2.0	5.0
Wild fungi	6	3	1.5	0.5	0.8	1.4	2.0	5.5
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Fish (freshwater)	2	2	0.2	0.2	0.2	0.2	6.5	20.0

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

Table 15. Summary of 10 year old children's consumption rates in the Sellafield area (kg/y or l/y)

Food group	Number of observations	No. higher rate consumers	Observed maximum critical group consumption rate	Observed minimum critical group consumption rate	Observed mean critical group consumption rate	Observed 97.5 %ile consumption rate	Generic mean consumption rate	Generic 97.5 %ile consumption rate
Fish	7	4	13.6	4.7	9.9	13.3	6.0	20.0
Crustaceans	2	2	11.8	9.6	10.7	11.7	2.5	7.0
Molluscs	1	1	18.6	18.6	18.6	NA	2.5	7.0
Wildfowl	1	1	2.6	2.6	2.6	NA	ND	ND
Green vegetables	NC	NC	NC	NC	NC	NC	6.0	20.0
Other vegetables	NC	NC	NC	NC	NC	NC	8.0	25.0
Root vegetables	NC	NC	NC	NC	NC	NC	6.0	20.0
Potato	3	3	55.6	29.5	38.2	54.3	45.0	85.0
Domestic fruit	1	1	0.3	0.3	0.3	NA	15.0	50.0
Milk	4	4	311.1	103.7	168.5	299.5	110.0	240.0
Cattle meat	3	3	47.3	47.3	47.3	47.3	15.0	30.0
Pig meat	NC	NC	NC	NC	NC	NC	8.5	25.0
Sheep meat	2	2	1.4	1.4	1.4	1.4	4.0	10.0
Poultry	1	1	1.4	1.4	1.4	NA	5.5	15.0
Eggs	3	2	17.8	17.8	17.8	17.8	6.5	20.0
Wild/free foods	5	5	0.6	0.3	0.5	0.6	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	1	1	0.1	0.1	0.1	NA	1.5	4.5
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Fish (freshwater)	1	1	0.2	0.2	0.2	NA	6.0	20.0

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

Table 16. Summary of 5 year old children's consumption rates in the Sellafield area (kg/y or l/y)

Food group	Number of observations	No. higher rate consumers	Observed maximum critical group consumption rate	Observed minimum critical group consumption rate	Observed mean critical group consumption rate	Observed 97.5 %ile consumption rate	Generic mean consumption rate	Generic 97.5 %ile consumption rate
Fish	8	6	13.6	4.7	10.4	13.6	ND	ND
Crustaceans	4	4	11.8	4.8	9.0	11.6	ND	ND
Molluscs	3	3	18.6	9.3	15.5	18.6	ND	ND
Wildfowl	1	1	2.6	2.6	2.6	NA	ND	ND
Green vegetables	1	1	1.8	1.8	1.8	NA	ND	ND
Other vegetables	1	1	0.5	0.5	0.5	NA	ND	ND
Root vegetables	1	1	5.2	5.2	5.2	NA	ND	ND
Potato	1	1	36.0	36.0	36.0	NA	ND	ND
Domestic fruit	2	2	0.9	0.9	0.9	0.9	ND	ND
Milk	5	5	109.5	71.1	80.9	106.3	ND	ND
Cattle meat	2	2	21.0	21.0	21.0	21.0	ND	ND
Pig meat	NC	NC	NC	NC	NC	NC	ND	ND
Sheep meat	1	1	3.8	3.8	3.8	NA	ND	ND
Poultry	NC	NC	NC	NC	NC	NC	ND	ND
Eggs	2	2	7.4	3.7	5.6	7.3	ND	ND
Wild/free foods	2	2	0.8	0.2	0.5	0.7	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

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

Table 17. Summary of 1 year old children's consumption rates in the Sellafield area (kg/y or l/y)

Food group	Number of observations	No. higher rate consumers	Observed maximum critical group consumption rate	Observed minimum critical group consumption rate	Observed mean critical group consumption rate	Observed 97.5 %ile consumption rate	Generic mean consumption rate	Generic 97.5 %ile consumption rate
Fish	NC	NC	NC	NC	NC	NC	ND	ND
Crustaceans	NC	NC	NC	NC	NC	NC	ND	ND
Molluscs	NC	NC	NC	NC	NC	NC	ND	ND
Green vegetables	NC	NC	NC	NC	NC	NC	ND	ND
Other vegetables	NC	NC	NC	NC	NC	NC	ND	ND
Root vegetables	NC	NC	NC	NC	NC	NC	ND	ND
Potato	NC	NC	NC	NC	NC	NC	ND	ND
Domestic fruit	NC	NC	NC	NC	NC	NC	ND	ND
Milk	1	1	73.0	73.0	73.0	NA	ND	ND
Cattle meat	1	1	10.5	10.5	10.5	NA	ND	ND
Pig meat	NC	NC	NC	NC	NC	NC	ND	ND
Sheep meat	NC	NC	NC	NC	NC	NC	ND	ND
Poultry	NC	NC	NC	NC	NC	NC	ND	ND
Eggs	NC	NC	NC	NC	NC	NC	ND	ND
Wild/free foods	NC	NC	NC	NC	NC	NC	ND	ND
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	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

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

Table 18. Intertidal occupancy rates in the Sellafield area (h/y)

Observation number	Location	Activity	Coal and sand	Rock	Salt marsh	Sand	Sand and mud	Sand and stones
150-151	**Whitehaven Harbour Beach**	**Dog walking**	**183**					
355	**Whitehaven Harbour Beach**	**Dog walking**	**156**					
354	**Whitehaven Harbour Beach**	**Dog walking**	**104**					
152	Whitehaven Harbour/Local beaches	Bait digging/Angling	52				182	
190	**Ravenglass/Drigg/Local beaches**	**Bait digging/Angling**		**30**		**352**		
198	**Ravenglass/Drigg/Local beaches**	**Bait digging/Angling**		**30**		**352**		
135	**Eskmeals**	**Marsh warden**			**400**			
653	Saltcoats Marsh	Wildfowling			48			
659	Saltcoats Marsh	Wildfowling			48			
634	Newbiggin Marsh	Wildfowling			15			
113	**Braystones**	**Dog walking/ Shellfish collecting/ Bait digging/Angling**				**891**		
399	**Braystones**	**Dog walking**				**875**		
93-94	**Seascale**	**Dog walking**				**730**		
103	**Local beaches/Seascale**	**Playing on beach/ Dog walking**				**653**		
214-215	**Seascale**	**Dog walking**				**548**		
45	**Drigg Beach**	**Dog walking**				**520**		
254	**Seascale/Drigg/Local beaches**	**Dog walking/ Bait digging/Angling**				**442**		
43-44	**Drigg Beach**	**Dog walking**				**440**		
109	**Sellafield Beach**	**Angling/Bait digging**				**373**		
41-42	**Drigg Beach**	**Dog walking**				**365**		
118	**Braystones**	**Dog walking**				**365**		
356	**Whitehaven Beach**	**Dog walking**				**364**		
357	**Local beaches**	**Dog walking**				**364**		
129	**Eskmeals**	**Angling/Dog walking**				**316**		
364-365	St Bees Beach	Walking				273		
119	Nethertown/Local beaches	Angling/ Shellfish collecting/ Bait digging				231		
416	Seascale/Whitehaven	Walking/Angling				225		
95	Seascale	Dog walking/Playing on beach				214		
165-168	Ravenglass	Angling				210		
110	Nethertown/Local beaches	Dog walking/Angling/ Shellfish collecting/ Push netting for shrimps				195		

Table 18. Intertidal occupancy rates in the Sellafield area (h/y)

Observation number	Location	Activity	Coal and sand	Rock	Salt marsh	Sand	Sand and mud	Sand and stones
169-172	Ravenglass	Walking				182		
397-398	St Bees Beach	Walking				182		
128	Local beaches	Dog walking				156		
419-420	Seascale	Dog walking				150		
156-157	Local beaches	Angling				140		
362-363	Local beaches	Dog walking				130		
443-445	Sellafield/Seascale Beach	Walking				130		
176-177	Drigg	Angling/Bait digging				114		
104-105	Local beaches	Playing on beach				105		
394-395	St Bees Beach	Playing on beach				105		
111	Nethertown	Dog walking				104		
202-203	Drigg	Dog walking				104		
46-47	Drigg Beach	Walking				100		
415	Seascale	Walking				100		
106-108	Seascale	Walking				78		
417-418	Seascale	Walking				75		
164	Ravenglass/Drigg	Bird watching/Walking/ Dog walking				72		39
366-369	St Bees Beach	Walking				54		
127	Eskmeals	Bird watching				52		
173-175	Drigg	Dog walking				52		
359-361	Whitehaven Beach	Walking				52		
449	Seascale	Walking				52		
339	Drigg Beach	Walking				48		
452-455	St Bees Beach	Walking				48		
429-433	Drigg Beach	Walking				30		
141	Seascale/Drigg/Ravenglass	Shellfish collecting/ Bait digging/Angling				28		36
205	Drigg Beach	Dog walking				26		
49	Drigg	Dog walking				24		
181-182	Seascale	Playing on beach				24		
184-185	Seascale	Playing on beach				24		
212-213	Drigg	Walking				18		
370	St Bees/Seascale/Drigg	Water sports preparation				14		
422	Drigg Beach	Horse riding				8		
371	St Bees/Seascale/Drigg	Water sports preparation				7		

Table 18. Intertidal occupancy rates in the Sellafield area (h/y)

Observation number	Location	Activity	Coal and sand	Rock	Salt marsh	Sand	Sand and mud	Sand and stones
96-97	Seascale	Playing on beach				6		
314-317	Local beaches	Walking				5		
384-385	St Bees Beach	Water sports preparation				5		
98-102	Seascale	Playing on beach				4		
312-313	St Bees Beach	Walking				4		
334-335	St Bees Beach	Walking				2		
12	**Bootle Shore/Barrow Mouth/ Whitehaven**	**Shellfish collecting/Angling**					**1587**	
9	**Bootle Shore**	**Shellfish collecting**					**1500**	
140	**Drigg/Ravenglass/Sellafield/ Eskmeals**	**Bait digging/Angling**					**1326**	
191	**Local beaches**	**Bait digging/Angling**					**924**	
136	**Ravenglass Beach**	**Dog walking**					**910**	
195	**Local beaches**	**Bait digging/Angling**					**795**	
143	**Local beaches**	**Bait digging/Angling**					**728**	
32	**Drigg Beach**	**Bait digging**					**700**	
279	**Local beaches**	**Shellfish collecting**					**700**	
197	**Local beaches**	**Bait digging/Angling**					**624**	
224	**Local beaches**	**Bait digging/Angling**					**624**	
178	**Whitehaven Harbour/ Saltom Bay/St Bees**	**Bait digging/Angling**					**620**	**620**
145	**Local beaches**	**Bait digging/Angling**					**572**	
263	**Local beaches**	**Dog walking/Angling**					**547**	
192	Local beaches	Bait digging/Angling					468	
204	Whitehaven Harbour/ Whitehaven Beach	Bait digging/Angling					468	
579-611	Local beaches	Bait digging/Angling					430	280
274-275	Parton Beach	Dog walking					365	
48	Sellafield Beach/ Whitehaven	Bait digging/Angling/ Beachcombing					358	
255	Whitehaven Harbour/St Bees/Drigg	Bait digging/Angling					290	
134	Ravenglass	Dog walking					260	
16	Whitehaven Harbour	Bait digging					234	
18	Whitehaven Harbour	Bait digging					234	
612-633	Parton to Ravenglass	Bait digging/Angling					218	98
120	Drigg Beach	Bait digging/Angling					178	
133	Drigg Beach	Bait digging/Angling					178	

Table 18. Intertidal occupancy rates in the Sellafield area (h/y)

Observation number	Location	Activity	Coal and sand	Rock	Salt marsh	Sand	Sand and mud	Sand and stones
10	Drigg Beach	Bait digging/Angling					161	
220	Whitehaven Harbour	Bait digging					156	
470-471	Seascale/Drigg	Walking					156	
35	Ravenglass	Dog walking					152	
273	Local beaches	Walking					125	
571-578	Local beaches	Angling					80	80
11	Drigg Beach	Walking					63	
158	Whitehaven Harbour/St Bees Beach	Bait digging/Angling					26	208
138	Drigg Beach	Angling					24	
40	**Drigg Beach**	**Dog walking**						**1095**
353	Braystones	Beachcombing/Walking						286
406	Braystones/St Bees/Whitehaven	Angling						250
410	Braystones/St Bees/Whitehaven	Angling						250
90-92	Seascale	Dog walking						243
351	Braystones	Beachcombing						182
160-163	Local beaches	Angling						130
390	St Bees Beach	Dog walking						104
404-405	Drigg/Calderton/ St Bees/Whitehaven	Angling						100
137	Drigg Beach	Beachcombing						50
400-401	Nethertown to Braystones	Angling						20
388-389	St Bees Beach	Dog walking						18
386-387	St Bees Beach	Walking						12
358	Whitehaven Beach	Playing						10

Notes

Emboldened observations are the critical group members

The critical group mean intertidal occupancy over coal and sand based on 4 observations is 156 h/y

The observed 97.5 percentile rate based on 5 observations for coal and sand is 183 h/y

The critical group mean intertidal occupancy over rock based on 2 observations is 30 h/y

The observed 97.5 percentile rate based on 2 observations for rock is 30 h/y

The critical group mean intertidal occupancy over saltmarsh based on 1 observation is 400 h/y

The observed 97.5 percentile is not applicable for 1 observation

The critical group mean intertidal occupancy over sand based on 20 observations is 502 h/y

The observed 97.5 percentile rate based on 115 observations for sand is 730 h/y

The critical group mean intertidal occupancy over sand and mud based on 14 observations is 868 h/y

The observed 97.5 percentile rate based on 98 observations for sand and mud is 1155 h/y

The critical group mean intertidal occupancy over sand and stones based on 2 observations is 856 h/y

The observed 97.5 percentile rate based on 90 observations for sand and stones is 285 h/y

Table 19. Handling rates of fishing gear and sediment in the Sellafield area (h/y)

Observation number	Location	Activity	Fishing gear	Sediment
1	**Ravenglass**	**Gear handling**	**1000**	
3	**Ravenglass**	**Gear handling**	**1000**	
116	**Whitehaven**	**Gear handling**	**955**	
19	**St Bees Head**	**Gear handling**	**688**	
114	**St Bees Head**	**Gear handling**	**688**	
35	**Ravenglass**	**Gear handling**	**600**	
653	**Seascale**	**Gear handling**	**464**	
659	**Seascale**	**Gear handling**	**464**	
276-277	Seascale	Gear handling	324	
260	Whitehaven	Gear handling	240	
22	Parton	Gear handling	156	
37-38	Ravenglass	Gear handling	150	
9	**Bootle Shore**	**Shellfish collecting**		**1500**
12	**Bootle Shore**	**Shellfish collecting**		**1500**
32	**Drigg Beach**	**Bait digging**		**700**
279	**Local beaches**	**Shellfish collecting**		**700**
178	**Whitehaven Harbour**	**Bait digging**		**620**
140	Drigg/Eskmeals	Bait digging		416
192	Local beaches	Bait digging		260
16	Whitehaven Harbour	Bait digging		234
18	Whitehaven Harbour	Bait digging		234
197	Local beaches	Bait digging		208
191	Local beaches	Bait digging		198
113	Braystones	Bait digging/Shellfish collecting		162
220	Whitehaven Harbour	Bait digging		156
579-611	Local beaches	Bait digging		150
254	Drigg	Bait digging		130
195	Local beaches	Bait digging		120
612-633	Sellafield/Seascale/Drigg/Ravenglass	Bait digging		120
145	Local beaches	Bait digging		104
204	Whitehaven Harbour	Bait digging		104
224	Local beaches	Bait digging		104

Table 19. Handling rates of fishing gear and sediment in the Sellafield area (h/y)

Observation number	Location	Activity	Fishing gear	Sediment
48	Whitehaven Harbour	Bait digging		78
143	Local beaches	Bait digging		78
190	Drigg/Ravenglass	Bait digging		70
198	Drigg/Ravenglass	Bait digging		70
141	Drigg/Ravenglass/Seascale	Bait digging/Shellfish collecting		64
152	Whitehaven Harbour	Bait digging		52
255	Whitehaven Harbour	Bait digging		50
120	Drigg Beach	Bait digging		48
133	Drigg Beach	Bait digging		48
176-177	Drigg	Bait digging		30
158	Whitehaven Harbour	Bait digging		26
10	Drigg Beach	Bait digging		20
109	Sellafield Beach	Bait digging		13
119	Local beaches	Bait digging/Shellfish collecting		11
110	Unknown	Shellfish collecting		3

Notes

Emboldened observations are the critical group members

The critical group mean fishing gear handling time based on 8 observations is 732 h/y

The observed 97.5 percentile rate based on 14 observations for fishing gear is 1000 h/y

The critical group mean sediment handling time based on 5 observations is 1004 h/y

The observed 97.5 percentile rate based on 92 observations for sediment is 700 h/y

Table 20. Gamma dose rate measurements over intertidal substrates in the Sellafield area (micro Gy/h)

Location	NGR	Substrate	Gamma dose rate at 1 metre
Drigg Beach	SD 046 983	Sand	0.060
Seascale Beach	NY 035 009	Position 2 - Wet sand	0.073
Sellafield Beach	NY 020 031	Sand	0.077
Seascale Beach	NY 035 009	Position 1 - Dry sand	0.082
Braystones	NY 000 059	Sand	0.083
Salmongarth	SD 085 956	Mud	0.083
Whitehaven Harbour	NX 968 184	Coal and sand	0.094
Braystones	NX 999 058	Sand and stone	0.095
Ravenglass	SD 085 960	Mud	0.096
Parton Beach	NX 977 207	Coal and sand	0.131
Eskmeals	SD 087 942	Mud	0.159

Table 21. Occupancy rates in and on water in the Sellafield area (h/y)

Observation number	Location	Activity	In water	On water
234	St Bees/Whitehaven	Kayaking	104	
236-241	St Bees/Whitehaven	Kayaking	104	
245-246	St Bees/Whitehaven	Kayaking	104	
248	St Bees/Whitehaven	Kayaking	104	
384	St Bees	Kitesurfing	60	
370	St Bees/Seascale/Drigg	Kitesurfing	42	
371	Whitehaven to St Bees/ Seascale/Drigg	Diving/Boating/Kitesurfing	30	5
465	Various	Diving/Boating/Angling	20	135
467	Various	Diving/Boating	20	15
469	Various	Diving/Boating	20	15
391-393	St Bees/Parton	Kayaking	15	
141	Seascale	Swimming/Angling	12	40
372-383	St Bees	Diving/Boating	9	5
93	Seascale	Swimming	3	
110	Various	Shellfish collecting/ Push netting for shrimps/Angling	3	120
116	Whitehaven	Commercial fishing		1365
1	Ravenglass	Commercial fishing		1200
3	Ravenglass	Commercial fishing		1200
19	St Bees Head	Commercial fishing		825
114	St Bees Head	Commercial fishing		825
16	Whitehaven Harbour	Sea angling		632
18	Whitehaven Harbour	Sea angling		632
119	Various	Sea angling		624
260	Whitehaven	Boating		400
276-277	Seascale	Sea angling		385
10	Seascale	Sea angling		350
35	Ravenglass	Commercial fishing		270
288	Ravenglass	Sea angling		248
37-38	Ravenglass	Commercial fishing		223
195	Whitehaven	Sea angling		210
254	Various	Sea angling		175
143	Whitehaven	Sea angling		160
22	Parton	Sea angling		156
112	Various	Sea angling		120
279	Various	Commercial fishing		100
470-471	Seascale/Drigg/Ravenglass	Boating		80
169-170	Ravenglass	Canoeing/Boating		76
171*-172*	Ravenglass	Canoeing/Boating		76
255	Parton	Sea angling		75
251	St Bees Head	Sea angling		72
473-525	Whitehaven to Parton	Boating		66
48	Parton	Sea angling		60
263	Parton	Sea angling		60
136	Selker	Sea angling		45
538-570	Parton to St Bees	Boating		33
127	Ravenglass	Canoeing		24

* Observation numbers 171 and 172 are for a 6 year old boy and a 3 year old boy respectively

Table 22. Adult consumption rates of green vegetables in the Sellafield area (kg/y)

Observation number	Artichoke	Asparagus	Broccoli	Brussels sprout	Cabbage	Calabrese	Cauliflower	Chard	Courgettes	Cucumber	Herbs	Kale	Lettuce	Marrow	Spinach	Total
25 - 26				**22.8**	**27.4**									**5.4**		**55.6**
81 - 82				**6.8**	**13.6**	**5.6**	**2.8**		**2.4**	**5.1**	**0.2**		**2.2**		**2.5**	**41.1**
78 - 80				**4.8**	**29.5**		**3.6**			**1.0**			**2.1**			**41.1**
72				**14.6**			**5.4**		**1.5**	**2.7**			**3.2**			**27.4**
301 - 302	**2.2**	**1.1**			**21.9**			**1.6**								**26.8**
71				**14.6**			**5.4**			**2.7**			**3.2**			**25.9**
73 - 74				**14.6**			**5.4**			**2.7**			**3.2**			**25.9**
68				**5.1**	**20.6**											**25.7**
318 - 320					7.9					5.7						13.5
64 - 66			2.6	3.4								3.6				9.6
336 - 339				0.9			2.6						2.4			5.9
299 - 300									3.7		0.3					3.9
470 - 471					2.5						0.5					3.0
83 - 84									0.9							0.9

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of green vegetables based on the 14 highest adult consumers is 35.8 kg/y

The observed 97.5 percentile rate based on 30 observations is 55.6 kg/y

Table 23. Adult consumption rates of other vegetables in the Sellafield area (kg/y)

Observation number	Broad bean	Chilli pepper	French bean	Pea	Pepper	Runner bean	Squash	Sweetcorn	Tomato	Total
301-302	**15.8**	**0.5**	**3.2**	**2.3**	**2.4**		**0.4**	**2.2**	**40.0**	**66.7**
68	**10.2**		**2.7**	**10.1**		**13.6**			**16.3**	**53.0**
25-26									**32.4**	**32.4**
71-74			**5.1**	**5.2**		**5.1**			**8.1**	**23.5**
470-471				4.0					15.0	19.0
439-442									12.6	12.6
318-320									12.0	12.0
221				4.1		4.1				8.2
225-228				4.1		4.1				8.2
83-84						1.8			5.4	7.2
299-300						6.8				6.8
250					1.2				5.4	6.6
252					1.2				5.4	6.6
81-82				3.3					2.3	5.6
256					0.5				4.5	5.0
262					0.5				4.5	5.0
78-80			2.1						1.8	3.9
64-66	3.2									3.2
55-56									2.3	2.3
336-339				0.9		0.9				1.8
69-70			1.1							1.1

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of other vegetables based on the 9 highest adult consumers is 38.4 kg/y

The observed 97.5 percentile rate based on 47 observations is 64.7 kg/y

Table 24. Adult consumption rates of root vegetables in the Sellafield area (kg/y)

Observation number	Beetroot	Carrot	Celeriac	Celery	Fennel	Garlic	Leek	Onion	Parsnip	Shallot	Swede	Sweet potato	Turnip	Total
25-26		**10.1**					**20.3**	**22.0**		**3.8**				**56.1**
301-302		**18.0**	**1.6**	**5.4**		**0.1**	**9.0**	**7.2**	**1.8**			**0.5**		**43.6**
470-471	**7.5**						**3.0**	**10.0**	**12.5**				**5.0**	**38.0**
64-66	**3.4**	**3.4**						**6.6**	**5.4**		**10.2**			**29.0**
81-82	**3.8**	**6.7**		**1.0**			**1.7**	**4.0**		**1.2**	**5.0**		**2.0**	**25.4**
78-80	**2.8**	**11.8**					**10.1**							**24.7**
71-74	**7.3**	**7.3**			**0.1**	**0.2**	**2.4**	**4.1**	**2.0**					**23.5**
425-426		**11.3**											**11.3**	**22.7**
68	**3.4**	**10.1**							**8.1**					**21.6**
336-339		10.4						1.8					5.2	17.4
429-430		3.8					0.8	7.6					3.8	15.9
432-433		3.8					0.8	7.6					3.8	15.9
318-320													7.9	7.9
434		1.2					0.2	2.5					1.2	5.2
221	4.1													4.1
225-228	4.1													4.1
39													3.4	3.4
49-50													3.4	3.4
83-84								2.3						2.3

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of root vegetables based on the 21 highest adult consumers is 30.9 kg/y

The observed 97.5 percentile rate based on 43 observations is 55.5 kg/y

Table 25. Adult consumption rates of potato in the Sellafield area (kg/y)

Observation number	Potato
25-26	**165.6**
51-52	**165.6**
301-302	**165.6**
456-458	**165.6**
427-428	**150.0**
336-339	**120.0**
68	**117.9**
78-80	**100.0**
231-233	**100.0**
318-320	**82.6**
221	**74.2**
225-228	**74.2**
321-323	**55.6**
326-328	**55.6**
429-430	50.0
432-433	50.0
64-66	42.5
425-426	34.0
314-315	29.5
470-471	20.0
434	16.5
71-74	14.6
28	8.5
30-31	8.5
299-300	4.6
83-84	4.5

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of potato based on the 36 highest adult consumers is 109.4 kg/y

The observed 97.5 percentile rate based on 61 observations is 165.6 kg/y

Table 26. Adult consumption rates of domestic fruit in the Sellafield area (kg/y)

Observation number	Apple	Blackberry	Blackcurrant	Blueberry	Damson	Gooseberry	Grapes	Greengages	Loganberry	Pear	Plum	Pumpkin	Raspberry	Redcurrants	Rhubarb	Strawberry	Total
470-471	**17.5**		**2.0**			**4.0**				**1.5**	**4.5**		**5.0**		**10.0**	**3.5**	**48.0**
68	**4.5**		**3.2**			**6.4**					**2.7**		**3.2**		**19.1**	**1.8**	**40.8**
299-300	**9.1**									**13.6**	**9.1**		**3.4**		**1.2**		**36.3**
427-428	**17.1**		**2.3**										**4.5**		**1.2**	**2.8**	**28.0**
71-74	**8.1**	**0.4**		**0.1**				**1.5**	**0.4**	**8.1**		**3.6**			**2.0**	**3.3**	**27.4**
301-302	**0.7**		**4.5**		**0.2**		**2.3**			**0.2**			**1.8**			**11.4**	**21.2**
81-82	3.1	3.1	1.6		2.1					2.1	1.5			0.5	0.4		14.5
39	9.1									0.9	0.8						10.7
49-50	9.1									0.9	0.8						10.7
78-80	2.3												2.7		4.2		9.2
429-430			3.0										1.5		1.5	0.8	6.8
432-433			3.0										1.5		1.5	0.8	6.8
83-84										1.8			2.3			1.4	5.4
51-52	3.4																3.4
336-339			0.7			0.4					1.3		0.6				3.0
305-308	0.1		2.4												0.3		2.9
310	0.1		2.4												0.3		2.9
434			1.0										0.5		0.5	0.2	2.2
456-458			1.2										0.8				2.0
55-58											1.4						1.4
69-70	0.7		0.2												0.5		1.4
221																1.1	1.1
225-228																1.1	1.1
250	0.5																0.5
252	0.5																0.5
290-291	0.3																0.3

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of domestic fruit based on the 13 highest adult consumers is 32.1 kg/y

The observed 97.5 percentile rate based on 57 observations is 45.1 kg/y

Table 27. Adult consumption rates of milk in the Sellafield area (l/y)

Observation number	Milk
351-353	**414.9**
39	**365.0**
49-50	**365.0**
290-291	**311.1**
425-426	**311.1**
28	**276.6**
30-31	**276.6**
341-343	**276.5**
305-308	**237.1**
310	**237.1**
336-339	**219.0**
350	**207.4**
437-438	**207.4**
344-345	**182.5**
294-296	**165.9**
452-453	**155.6**
456-458	138.3
303-304	136.9
446-449	121.7
83	103.7
314-315	103.7
429-430	103.7
432-433	103.7
421-423	91.0
231-233	86.7
264	73.0
266	73.0
434	34.2

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of milk based on the 35 highest adult consumers is 260.0 l/y

The observed 97.5 percentile rate based on 60 observations is 414.9 l/y

Table 28. Adult consumption rates of cattle meat in the Sellafield area (kg/y)

Observation number	Beef
39	**70.8**
50	**70.8**
231-233	**63.1**
83-86	**47.3**
290-291	**47.3**
314-315	**47.3**
425-426	**47.3**
264	**42.0**
266-267	**42.0**
221	**37.8**
225-228	**37.8**
294-296	**37.8**
59-60	**31.2**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of cattle meat based on the 28 highest adult consumers is 46.3 kg/y
The observed 97.5 percentile rate based on 28 observations is 70.8 kg/y

Table 29. Adult consumption rates of sheep meat in the Sellafield area (kg/y)

Observation number	Lamb	Mutton	Total
39	**35.4**		**35.4**
50	**35.4**		**35.4**
59-60	**22.6**		**22.6**
83-84	**12.7**		**12.7**
443-444	11.3		11.3
71-72		10.4	10.4
439-442	5.7		5.7
221	4.5		4.5
225-228	4.5		4.5
231-233	3.8		3.8
429-430	3.8		3.8
432-433	3.8		3.8
314-315	1.4		1.4
434	1.2		1.2

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of sheep meat based on the 6 highest adult consumers is 23.6 kg/y
The observed 97.5 percentile rate based on 29 observations is 35.4 kg/y

Table 30. Adult consumption rates of poultry in the Sellafield area (kg/y)

Observation number	Chicken	Duck	Goose	Pheasant	Pigeon	Turkey	Woodcock	Total
427-428	**9.8**							**9.8**
221	**1.5**		**3.5**			**3.5**		**8.5**
225-228	**1.5**		**3.5**			**3.5**		**8.5**
83		**2.7**		**3.4**			**0.9**	**7.0**
439-440				**4.5**	**1.7**			**6.2**
84		**2.7**		**3.4**				**6.1**
330-332				**3.0**	**3.1**			**6.1**
333-334		**1.4**		**4.5**				**5.9**
470-471		**1.5**		**1.5**		**2.5**		**5.5**
39						**5.3**		**5.3**
50						**5.3**		**5.3**
28	**0.5**			**4.5**				**5.0**
30	**0.5**			**4.5**				**5.0**
71-72	**3.8**	**0.5**		**0.5**				**4.7**
336-339				2.8				2.8
69-70				2.3				2.3
321-323				1.4				1.4
326-328				1.4				1.4
446-447				1.4				1.4
429-430	0.3	0.3	0.7					1.3
432-433	0.3	0.3	0.7					1.3
231-233				0.6				0.6
456-458				0.6				0.6
303-304	0.6							0.6
31	0.5							0.5
434	0.1	0.1	0.2					0.4
51-52				0.2				0.2
421-423				0.2				0.2

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of poultry based on the 24 highest adult consumers is 6.6 kg/y

The observed 97.5 percentile rate based on 57 observations is 9.3 kg/y

Table 31. Adult consumption rates of eggs in the Sellafield area (kg/y)

Observation number	Chicken egg	Duck egg	Total
33-34	**20.8**		**20.8**
78-80	**20.8**		**20.8**
303-304	**14.8**	**5.9**	**20.7**
51-54	**17.8**		**17.8**
68	**17.8**		**17.8**
83-84	**17.8**		**17.8**
216-219	**17.8**		**17.8**
314-315	**17.8**		**17.8**
443-444	**14.8**		**14.8**
71-74	**14.2**		**14.2**
336-339	**12.5**		**12.5**
28	**5.9**	**5.9**	**11.8**
30-31	**5.9**	**5.9**	**11.8**
69-70	**10.4**		**10.4**
39	**8.9**		**8.9**
49-50	**8.9**		**8.9**
76-77	**8.9**		**8.9**
81-82	**8.9**		**8.9**
440-442	**8.9**		**8.9**
350-353		**8.8**	**8.8**
27	**8.2**		**8.2**
221	**7.1**		**7.1**
225-228	**7.1**		**7.1**
294-296	**7.1**		**7.1**
61-63	6.9		6.9
312-313	5.9		5.9
429-430	5.9		5.9
432-433	5.9		5.9
301-302	4.4		4.4
318-319	3.0		3.0
320-323	3.0		3.0
326-328	2.0		2.0
434	2.0		2.0

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of eggs based on the 58 highest adult consumers is 13.1 kg/y

The observed 97.5 percentile rate based on 79 observations is 20.8 kg/y

Table 32. Adult consumption rates of wild/free foods in the Sellafield area (kg/y)

Observation number	Blackberry	Crab apple	Damson	Elderberry	Rowanberry	Sloe	Total
64-66	**5.4**						**5.4**
83-84	**1.8**		**2.3**			**0.5**	**4.5**
33-34	**2.7**						**2.7**
81-82		**1.0**		**1.5**			**2.5**
51-52	**2.3**						**2.3**
250	**2.0**						**2.0**
252	**2.0**						**2.0**
39	0.8					0.8	1.5
49-50	0.8					0.8	1.5
429-430	1.5						1.5
432-433	1.5						1.5
299-300	0.7				0.8		1.5
256	0.7		0.5				1.1
27	0.9						0.9
78-80	0.9						0.9
262	0.7						0.7
446-447	0.2					0.7	0.8
443-444	0.8						0.8
28	0.7						0.7
30-31	0.7						0.7
216-219	0.6						0.6
235	0.6						0.6
242	0.6						0.6
336-339	0.5						0.5
350-353	0.3					0.2	0.5
434	0.5						0.5
314-315	0.3		0.1				0.5
318-320	0.5						0.5
456-458	0.5						0.5
290-291	0.3						0.3
71-74		0.3					0.3
55-56			0.2				0.2
305-308	0.2						0.2
310	0.2						0.2
448-449	0.2						0.2

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of wild/free foods based on the 13 highest adult consumers is 3.4 kg/y

The observed 97.5 percentile rate based on 73 observations is 5.4 kg/y

Table 33. Adult consumption rates of rabbits/hares in the Sellafield area (kg/y)

Observation number	Hare	Rabbit	Total
330		**3.0**	**3.0**
331		**3.0**	**3.0**
332		**3.0**	**3.0**
333	**1.2**	**0.3**	**1.5**
334	**1.2**	**0.3**	**1.5**

Notes

Emboldened observations are the critical group consumers
The critical group mean consumption rate of rabbits/hares based on the 5 highest adult consumers is 2.4 kg/y
The observed 97.5 percentile rate based on 5 observations is 3.0 kg/y

Table 34. Adult consumption rates of honey in the Sellafield area (kg/y)

Observation number	Honey
299	**6.8**
300	**6.8**
470	**3.2**
471	**3.2**
472	0.9
463	0.7
464	0.7
429	0.6
430	0.6

Notes

Emboldened observations are the critical group consumers
The critical group mean consumption rate of honey based on the 4 highest adult consumers is 5.0 kg/y
The observed 97.5 percentile rate based on 9 observations is 6.8 kg/y

Table 35. Adult consumption rates of wild fungi in the Sellafield area (kg/y)

Observation number	Mushrooms
55-56	**4.0**
68	**1.8**
429-430	**1.5**
432-433	**1.5**
81-82	**1.4**
83-84	1.1
221	0.7
225-228	0.7
434	0.5
333-335	0.2
39	0.2
49-50	0.2
305-308	0.1
310	0.1
321-323	0.1
326-328	0.1

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of wild fungi based on the 9 highest adult consumers is 2.1 kg/y
The observed 97.5 percentile rate based on 34 observations is 4.0 kg/y

Table 36. Adult consumption rates of venison in the Sellafield area (kg/y)

Observation number	Venison
330	**22.7**
331	**22.7**
332	**22.7**
83	1.4
84	1.4

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of venison based on the 3 highest
3 highest adult consumers is 22.7 kg/y
The observed 97.5 percentile rate based on 5 observations is 22.7 kg/y

Table 37. Adult consumption rates of fish (freshwater) in the Sellafield area (kg/y)

Observation number	Brown trout
333	**0.2**
334	**0.2**
335	**0.2**
321	**0.2**
322	**0.2**
323	**0.2**
326	**0.2**
327	**0.2**
328	**0.2**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of fish (freshwater) based on the
9 highest adult consumers is 0.2 kg/y
The observed 97.5 percentile rate based on 9 observations is 0.2 kg/y

Table 38. Children's consumption rates of green vegetables in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Broccoli	Brussel sprout	Cauliflower	Cucumber	Kale	Lettuce	Total
75	**14**		**14.6**	**5.4**	**2.7**		**3.2**	**25.9**
67	**15**	**2.6**	**3.4**			**3.6**		**9.6**

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of green vegetables based on the 2 highest 15 year old consumers is 17.8 kg/y

The observed 97.5 percentile rate based on 2 observations is 25.5 kg/y

5 year old age group

Observation number	Age	Broccoli	Brussel sprout	Cauliflower	Cucumber	Kale	Lettuce	Total
340	**3**		**0.3**	**0.8**			**0.7**	**1.8**

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of green vegetables based on the highest 5 year old consumer is 1.8 kg/y

The observed 97.5 percentile is not applicable for 1 observation

Table 39. Children's consumption rates of other vegetables in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Broad bean	French bean	Pea	Runner bean	Tomato	Total
75	**14**		**5.1**	**5.2**	**5.1**	**8.1**	**23.5**
67	**15**	**3.2**					**3.2**

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of other vegetables based on the 2 highest 15 year old consumers is 13.3 kg/y

The observed 97.5 percentile rate based on 2 observations is 23.0 kg/y

5 year old age group

Observation number	Age	Broad bean	French bean	Pea	Runner bean	Tomato	Total
340	**3**			**0.3**	**0.3**		**0.5**

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of other vegetables based on the highest 5 year old consumer is 0.5 kg/y

The observed 97.5 percentile is not applicable for 1 observation

Table 40. Children's consumption rates of root vegetables in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Beetroot	Carrot	Fennel	Garlic	Leek	Onion	Parsnip	Swede	Turnip	Total
67	**15**	**3.4**	**3.4**				**6.6**	**5.4**	**10.2**		**29.0**
75	**14**	**7.3**	**7.3**	**0.1**	**0.2**	**2.4**	**4.1**	**2.0**			**23.5**
431	**15**		**3.8**			**0.8**	**7.6**			**3.8**	**15.9**
435	15		1.2			0.2	2.5			1.2	5.2
436	15		1.2			0.2	2.5			1.2	5.2

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of root vegetables based on the 3 highest 15 year old consumers is 22.8 kg/y

The observed 97.5 percentile rate based on 5 observations is 28.4 kg/y

5 year old age group

Observation number	Age	Beetroot	Carrot	Fennel	Garlic	Leek	Onion	Parsnip	Swede	Turnip	Total
340	**3**		**3.1**				**0.5**			**1.6**	**5.2**

Notes

Emboldened observations are the critical group consumers

The critical group mean consumption rate of root vegetables based on the highest 5 year old consumer is 5.2 kg/y

The observed 97.5 percentile is not applicable for 1 observation

Table 41. Children's consumption rates of potato in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Potato
324	**14**	**55.6**
329	**12**	**55.6**
431	**15**	**50.0**
67	**15**	**42.5**
435	15	16.5
436	15	16.5
75	14	14.6

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of potato based on the 4 highest 15 year old consumers is 50.9 kg/y
The observed 97.5 percentile rate based on 7 observations is 55.6 kg/y

10 year old age group

Observation number	Age	Potato
325	**10**	**55.6**
317	**8**	**29.5**
316	**7**	**29.5**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of potato based on the 3 highest 10 year old consumers is 38.2 kg/y
The observed 97.5 percentile rate based on 3 observations is 54.3 kg/y

5 year old age group

Observation number	Age	Potato
340	**3**	**36.0**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of potato based on the highest 5 year old consumer is 36.0 kg/y
The observed 97.5 percentile is not applicable for 1 observation

Table 42. Children's consumption rates of domestic fruit in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Apple	Blackberry	Blackcurrant	Blueberry	Gooseberry	Greengages	Loganberry	Pear	Plum	Pumpkin	Raspberry	Rhubarb	Strawberry	Total
75	**14**	**8.1**	**0.4**		**0.1**		**1.5**	**0.4**	**8.1**		**3.6**		**2.0**	**3.3**	**27.4**
431	**15**			**3.0**								**1.5**	**1.5**	**0.8**	**6.8**
309	**14**	**0.1**		**2.4**									**0.3**		**2.9**
435	15			1.0								0.5	0.5	0.2	2.2
436	15			1.0								0.5	0.5	0.2	2.2
292	14	0.3													0.3

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of domestic fruit based on the 3 highest 15 year old consumers is 12.4 kg/y
The observed 97.5 percentile rate based on 6 observations is 24.8 kg/y

10 year old age group

Observation number	Age	Apple	Blackberry	Blackcurrant	Blueberry	Gooseberry	Greengages	Loganberry	Pear	Plum	Pumpkin	Raspberry	Rhubarb	Strawberry	Total
293	**11**	**0.3**													**0.3**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of domestic fruit based on the highest 10 year old consumer is 0.3 kg/y
The observed 97.5 percentile is not applicable for 1 observation

5 year old age group

Observation number	Age	Apple	Blackberry	Blackcurrant	Blueberry	Gooseberry	Greengages	Loganberry	Pear	Plum	Pumpkin	Raspberry	Rhubarb	Strawberry	Total
311	**4**	**0.04**	**0.1**	**0.7**									**0.1**		**0.9**
340	**3**			**0.2**		**0.1**				**0.4**		**0.2**			**0.9**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of domestic fruit based on the 2 highest 5 year old consumers is 0.9 kg/y
The observed 97.5 percentile rate based on 2 observations is 0.9 kg/y

Table 43. Children's consumption rates of milk in the Sellafield area (l/y)

15 year old age group

Observation number	Age	Milk
292	**14**	**311.1**
309	**14**	**237.1**
298	**15**	**165.9**
297	**13**	**165.9**
450	**15**	**121.7**
451	**15**	**121.7**
431	**15**	**103.7**
424	16	91.0
435	15	34.2
436	15	34.2

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of milk based on the 7 highest 15 year old consumers is 175.3 l/y
The observed 97.5 percentile rate based on 10 observations is 294.5 l/y

10 year old age group

Observation number	Age	Milk
293	**11**	**311.1**
454	**9**	**155.6**
317	**8**	**103.7**
316	**7**	**103.7**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of milk based on the 4 highest 10 year old consumers is 168.5 l/y
The observed 97.5 percentile rate based on 4 observations is 299.5 l/y

5 year old age group

Observation number	Age	Milk
340	**3**	**109.5**
455	**4**	**77.8**
268	**5**	**73.0**
270	**3**	**73.0**
311	**4**	**71.1**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of milk based on the 5 highest 5 year old consumers is 80.9 l/y
The observed 97.5 percentile rate based on 5 observations is 106.3 l/y

1 year old age group

Observation number	Age	Milk
271	**1**	**73.0**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of milk based on the highest 1 year old consumer is 73.0 l/y
The observed 97.5 percentile is not applicable for 1 observation

Table 44. Children's consumption rates of cattle meat in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Beef
292	**14**	**47.3**
298	**15**	**37.8**
297	**13**	**37.8**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of cattle meat based on the 3 highest 15 year old consumers is 41.0 kg/y
The observed 97.5 percentile rate based on 3 observations is 46.8 kg/y

10 year old age group

Observation number	Age	Beef
293	**11**	**47.3**
317	**8**	**47.3**
316	**7**	**47.3**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of cattle meat based on the 3 highest 10 year old consumers is 47.3 kg/y
The observed 97.5 percentile rate based on 3 observations is 47.3 kg/y

5 year old age group

Observation number	Age	Beef
268	**5**	**21.0**
270	**3**	**21.0**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of cattle meat based on the 2 highest 5 year old consumers is 21.0 kg/y
The observed 97.5 percentile rate based on 2 observations is 21.0 kg/y

1 year old age group

Observation number	Age	Beef
271	**1**	**10.5**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of cattle meat based on the highest 1 year old consumer is 10.5 kg/y
The observed 97.5 percentile is not applicable for 1 observation

Table 45. Children's consumption rates of sheep meat in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Lamb
431	**15**	**3.8**
435	**15**	**1.2**
436	**15**	**1.2**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of sheep meat based on the 3 highest
15 year old consumers is 2.1 kg/y
The observed 97.5 percentile rate based on 3 observations is 3.6 kg/y

10 year old age group

Observation number	Age	Lamb
317	**8**	**1.4**
316	**7**	**1.4**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of sheep meat based on the 2 highest
10 year old consumers is 1.4 kg/y
The observed 97.5 percentile rate based on 2 observations is 1.4 kg/y

5 year old age group

Observation number	Age	Lamb
445	**4**	**3.8**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of sheep meat based on the highest
5 year old consumer is 3.8 kg/y
The observed 97.5 percentile is not applicable for 1 observation

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

15 year old age group

Observation number	Age	Chicken	Duck	Goose	Pheasant	Total
324	**14**				**1.4**	**1.4**
329	**12**				**1.4**	**1.4**
431	**15**	**0.3**	**0.3**	**0.7**		**1.3**
435	15	0.1	0.1	0.2		0.4
436	15	0.1	0.1	0.2		0.4
424	16				0.2	0.2

Notes

Emboldened observations are the critical group consumers
The critical group mean consumption rate of poultry based on the 3 highest
15 year old consumers is 1.3 kg/y
The observed 97.5 percentile rate based on 6 observations is 1.4 kg/y

10 year old age group

Observation number	Age	Chicken	Duck	Goose	Pheasant	Total
325	**10**				**1.4**	**1.4**

Notes

Emboldened observations are the critical group consumers
The critical group mean consumption rate of poultry based on the highest
10 year old consumer is 1.4 kg/y
The observed 97.5 percentile is not applicable for 1 observation

Table 47. Children's consumption rates of eggs in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Chicken egg
75	**14**	**14.2**
298	**15**	**7.1**
297	**13**	**7.1**
431	**15**	**5.9**
324	14	2.0
329	12	2.0
435	15	2.0
436	15	2.0

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of eggs based on the 4 highest 15 year old consumers is 8.6 kg/y
The observed 97.5 percentile rate based on 8 observations is 13.0 kg/y

10 year old age group

Observation number	Age	Chicken egg
317	**8**	**17.8**
316	**7**	**17.8**
325	10	2.0

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of eggs based on the 2 highest 10 year old consumers is 17.8 kg/y
The observed 97.5 percentile rate based on 3 observations is 17.8 kg/y

5 year old age group

Observation number	Age	Chicken egg
445	**4**	**7.4**
340	**3**	**3.7**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of eggs based on the 2 highest 5 year old consumers is 5.6 kg/y
The observed 97.5 percentile rate based on 2 observations is 7.3 kg/y

Table 48. Children's consumption rates of wild/free foods in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Blackberry	Crab apple	Damson	Total
67	**15**	**5.4**			**5.4**
431	**15**	**1.5**			**1.5**
435	15	0.5			0.5
436	15	0.5			0.5
292	14	0.3			0.3
75	14		0.3		0.3
309	14	0.2			0.2
450	15	0.2			0.2
451	15	0.2			0.2

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of wild/free foods based on the 2 highest 15 year old consumers is 3.5 kg/y
The observed 97.5 percentile rate based on 9 observations is 4.7 kg/y

10 year old age group

Observation number	Age	Blackberry	Crab apple	Damson	Total
243	**10**	**0.6**			**0.6**
244	**8**	**0.6**			**0.6**
317	**8**	**0.3**		**0.1**	**0.5**
316	**7**	**0.3**		**0.1**	**0.5**
293	**11**	**0.3**			**0.3**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of wild/free foods based on the 5 highest 10 year old consumers is 0.5 kg/y
The observed 97.5 percentile rate based on 5 observations is 0.6 kg/y

5 year old age group

Observation number	Age	Blackberry	Crab apple	Damson	Total
445	**4**	**0.8**			**0.8**
340	**3**	**0.2**			**0.2**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of wild/free foods based on the 2 highest 5 year old consumers is 0.5 kg/y
The observed 97.5 percentile rate based on 2 observations is 0.7 kg/y

Table 49. Children's consumption rates of honey in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Honey
431	**15**	**0.6**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of honey based on the highest 15 year old consumer is 0.6 kg/y
The observed 97.5 percentile is not applicable for 1 observation

Table 50. Children's consumption rates of wild fungi in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Mushrooms
431	**15**	**1.5**
435	**15**	**0.5**
436	**15**	**0.5**
309	14	0.1
324	14	0.1
329	12	0.1

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of fungi based on the 3 highest 15 year old consumers is 0.8 kg/y
The observed 97.5 percentile rate based on 6 observations is 1.4 kg/y

10 year old age group

Observation number	Age	Mushrooms
325	**10**	**0.1**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of fungi based on the highest 10 year old consumer is 0.1 kg/y
The observed 97.5 percentile is not applicable for 1 observation

Table 51. Children's consumption rates of fish (freshwater) in the Sellafield area (kg/y)

15 year old age group

Observation number	Age	Brown trout
324	**14**	**0.2**
329	**12**	**0.2**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of fish (freshwater) based on the 2 highest 15 year old consumers is 0.2 kg/y
The observed 97.5 percentile rate based on 2 observations is 0.2 kg/y

10 year old age group

Observation number	Age	Brown trout
325	**10**	**0.2**

Notes
Emboldened observations are the critical group consumers
The critical group mean consumption rate of fish (freshwater) based on the highest 10 year old consumer is 0.2 kg/y
The observed 97.5 percentile is not applicable for 1 observation

Table 52. Percentage contribution each food type makes to its terrestrial food group for adults

Green vegetables	
***Cabbage**	43.20 %
Brussels sprout	24.73 %
***Cauliflower**	7.97 %
Cucumber	6.73 %
Lettuce	5.46 %
Courgettes	2.54 %
Calabrese	1.82 %
Kale	1.79 %
Marrow	1.77 %
Broccoli	1.25 %
Spinach	0.83 %
Artichoke	0.71 %
Chard	0.52 %
Asparagus	0.36 %
Herbs	0.30 %
Other vegetables	
Tomato	58.41 %
***Runner bean**	12.36 %
Pea	12.18 %
***Broad bean**	8.43 %
French bean	6.27 %
Pepper	1.33 %
Sweetcorn	0.73 %
Chilli pepper	0.18 %
Squash	0.12 %
Root vegetables	
***Carrot**	27.83 %
Onion	19.76 %
***Leek**	13.17 %
***Turnip**	12.74 %
Beetroot	11.15 %
Parsnip	7.18 %
***Swede**	4.81 %
Celery	1.51 %
Shallot	1.17 %
Celeriac	0.38 %
Sweet potato	0.13 %
Garlic	0.11 %
Fennel	0.05 %

Domestic fruit	
***Apple**	29.36 %
Rhubarb	12.43 %
Pear	12.27 %
Strawberry	10.29 %
Raspberry	9.43 %
Blackcurrant	9.35 %
Plum	7.60 %
Gooseberry	2.63 %
Pumpkin	2.40 %
Blackberry	1.29 %
Greengages	0.97 %
Damson	0.77 %
Grapes	0.75 %
Loganberry	0.24 %
Redcurrants	0.17 %
Blueberry	0.06 %
Sheep meat	
***Lamb**	92 %
Mutton	8 %
Poultry	
Pheasant	39.60 %
Chicken	19.42 %
Turkey	16.77 %
Goose	10.56 %
Duck	6.76 %
Pigeon	6.43 %
Woodcock	0.46 %
Eggs	
***Chicken egg**	92.36 %
Duck egg	7.64 %
Wild/free foods	
***Blackberry**	77.69 %
Damson	6.75 %
***Sloe**	6.21 %
Crab apple	3.88 %
***Elderberry**	3.57 %
Rowanberry	1.89 %
Rabbits/hares	
Rabbit	80.12 %
Hare	19.88 %
Fish (freshwater)	
***Brown trout**	100.00 %

NOTES

Food types astrisked and emboldened were monitored by FSA in 2002 (EA, EHS, FSA and HSE, 2003)
Other foods monitored were barley, cattle meat, honey, milk and potato
Percentages are based on the consumption of all adults in the survey consuming that particular food group

Table 53. Occupancy rates in the Sellafield direct radiation survey area for adults and children (h/y)

Observation Number	Sex	Age (in years) (U if unknown)	Distance from site perimeter fence (km)	Indoor occupancy	Outdoor occupancy	Total occupancy
0 to 0.25 km zone						
294	M	43	0.20	6450	1975	8424
28	M	59	0.20	5158	3120	8278
30	F	61	0.20	6074	2190	8264
295	F	44	0.20	6762	1428	8190
31	F	30	0.20	5834	2190	8024
445	M	4	0.25	6535	860	7395
444	F	45	0.25	6418	860	7278
298	M	15	0.20	6227	832	7059
297	F	13	0.20	6383	520	6903
296	F	20	0.20	5788	520	6308
443	M	32	0.25	3300	910	4210
346	M	32	0.15	1732	81	1813
347	M	45	0.15	1732	81	1813
649-652	M	U	0.25		604	604
348-349	M	U	0.15	376	16	392
660-663	U	U	0.10		50	50
664	U	U	0.10		25	25
0.25 to 0.5 km zone						
452	M	41	0.50	6569	1807	8376
39	M	46	0.30	5345	2920	8265
52	F	56	0.40	7940	156	8096
33	M	55	0.50	5992	1920	7912
49	F	41	0.30	6373	1460	7833
453	F	41	0.50	6512	532	7044
454	M	9	0.50	6287	592	6879
455	M	4	0.50	6275	592	6867
51	M	59	0.40	4503	1825	6328
34	F	45	0.50	4961	876	5837
50	M	19	0.30	3806	730	4536
53	M	62	0.40		1560	1560
109	M	49	0.50		373	373
93	F	50	0.50		183	183
94	F	65	0.50		183	183
190	F	27	0.50		78	78
198	M	25	0.50		78	78
634	M	U	0.50		46	46
638-648	M	U	0.50		46	46
119	M	38	0.50		45	45
156	M	48	0.50		13	13
157	M	34	0.50		13	13
0.5 to 1.0 km zone						
290	M	43	1.00	4716	3500	8216
291	F	42	1.00	6060	2000	8060
460	F	41	0.90	7049	571	7620
55	M	65	0.95	5356	1938	7294
56	F	54	0.95	6002	1292	7294
461	F	14	0.90	6320	571	6891
462	F	11	0.90	6320	571	6891
292	M	14	1.00	6027	824	6851
293	F	11	1.00	5871	824	6695
84	F	52	0.60	5078	1500	6578
262	F	38	0.95	6161	104	6265
256	M	39	0.95	4955	1300	6255
459	M	41	0.90	5677	571	6248
250	M	59	0.95	4490	1430	5920

Table 53. Occupancy rates in the Sellafield direct radiation survey area for adults and children (h/y)

Observation Number	Sex	Age (in years) (U if unknown)	Distance from site perimeter fence (km)	Indoor occupancy	Outdoor occupancy	Total occupancy
69	M	37	0.60	4136	1612	5748
27	M	50	0.65	5101	608	5709
57	M	39	0.95	5029	672	5701
70	F	35	0.60	4060	1612	5672
247	F	52	0.95	5202	365	5567
249	M	48	0.95	5202	365	5567
252	F	56	0.95	4106	1430	5536
83	M	54	0.60	4028	1500	5528
58	F	35	0.95	4061	960	5021
25	M	U	0.70		1000	1000
87	F	U	0.60		913	913
88-89	F	U	0.60		506	506

Table 54. Analysis of occupancy rates in the Sellafield direct radiation survey area

0 to 0.25 km zone	
Number of hours per year	Number of observations
8000 to 8760	5
7000 to 8000	3
6000 to 7000	2
5000 to 6000	0
4000 to 5000	1
3000 to 4000	0
2000 to 3000	0
1000 to 2000	2
0 to 1000	11

0.25 to 0.5 km zone	
Number of hours per year	Number of observations
8000 to 8760	3
7000 to 8000	3
6000 to 7000	3
5000 to 6000	1
4000 to 5000	1
3000 to 4000	0
2000 to 3000	0
1000 to 2000	1
0 to 1000	20

0.5 to 1 km zone	
Number of hours per year	Number of observations
8000 to 8760	2
7000 to 8000	3
6000 to 7000	8
5000 to 6000	10
4000 to 5000	0
3000 to 4000	0
2000 to 3000	0
1000 to 2000	1
0 to 1000	3

Table 55. Gamma dose rate measurements for the Sellafield direct radiation survey (micro Gy/h)

Location	Distance (km)	NGR	Ground type	Gamma dose rate at 1 metre
Signal Box (inside)	0.15	NY 020 034	Wood	0.090
Signal Box (outside)	0.15	NY 020 034	Grass/gravel	0.078
Farm 1	0.20	NY 078 041	Indoors (concrete)	0.094
Farm 1	0.20	NY 078 041	Grass	0.092
Farm 2	0.20	NY 038 028	Indoors (concrete)	0.087
Farm 2	0.20	NY 038 028	Grass	0.087
Farm 3	0.25	NY 020 043	Indoors (concrete)	0.116
Farm 3	0.25	NY 020 043	Grass	0.091
Farm 4	0.30	NY 038 034	Indoors (concrete)	0.095
Farm 4	0.30	NY 038 034	Grass	0.090
Farm 5	0.40	NY 036 021	Indoors (stone)	0.097
Farm 5	0.40	NY 036 021	Grass	0.078
House 1	0.50	NY 041 033	Indoors (concrete)	0.097
House 1	0.50	NY 041 033	Grass	0.089
House 2	0.50	NY 022 051	Indoors (wood)	0.140
House 2	0.50	NY 022 051	Grass	0.082
House 3	0.60	NY 034 055	Indoors (concrete)	0.123
House 3	0.60	NY 034 055	Grass	0.091
Farm 6	0.60	NY 041 052	Indoors (concrete)	0.113
Farm 6	0.60	NY 041 052	Grass	0.086
House 4	0.65	NY 034 055	Indoors (concrete)	0.127
House 4	0.65	NY 034 055	Grass	0.100
House 5	0.95	NY 039 057	Indoors (concrete)	0.136
House 5	0.95	NY 039 057	Grass	0.087
Background 1 (Santon)	6.3	NY 099 017	Grass	0.079
Background 2 (Gosforth)	3.5	NY 070 047	Grass	0.092
Background 3 (Calder Bridge)	3.5	NY 050 079	Grass	0.079
Background 4 (Nethertown)	4.5	NX 990 076	Grass	0.081

Table 56. Gamma dose rate measurements around the Sellafield site perimeter fence (micro Gy/h)

Location	NGR	Substrate	Gamma dose rate at 1 metre
South west of the site			
River Ehen	NY 024 029	Tarmac	0.076
River Ehen	NY 023 030	Tarmac	0.067
West of the site			
Near the site main gate	NY 023 036	Grass	0.082
Near the site main gate	NY 023 037	Grass	0.088
High Sellafield	NY 023 041	Grass	0.104
Windscale site	NY 024 045	Grass	0.104
North of Windscale site	NY 025 046	Mud	0.086
North of the site			
North west corner	NY 027 049	Stone chips	0.079
East of the site			
North of Calder Gate	NY 034 042	Grass	0.088
North of Calder Gate	NY 034 040	Grass	0.126
North of Calder Gate	NY 034 039	Grass	0.12
North of Calder Gate	NY 035 037	Grass	0.116
North of Calder Gate	NY 035 034	Grass	0.088

Table 57. Examples of food groups eaten and external exposure combinations by adults for consideration for dose assessment purposes

Observation number	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	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						*	*		*	*						*		*														
21									*		*	*	*		*	*									*								
22	*								*					*	*				*		*												
23														*			*			*													
24	*													*			*		*		*				*								
25						*	*	*	*	*	*			*	*	*									*								
26	*										*				*	*										*							
27			*					*	*	*	*		*	*	*	*		*	*						*								
28													*		*	*									*							*	*
29	*	*																												*	*		
30						*	*	*	*	*				*				*						*							*		
31	*																				*			*		*			*				
32	*	*			*																						*	*					
33	*	*		*																				*						*		*	

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
1	M	50	U	**44.2**	**47.7**	**35.4**																									**1000**			1200		
2	F	U	U	**44.2**	**47.7**	**35.4**																														
3	M	U	U	**27.2**	**19.2**	**37.1**																									**1000**			1200		
4	M	U	U	**27.2**	**19.2**	**37.1**																														
9	M	45	U	16.3	0.4	**42.6**																					**1500**					**1500**				
10	M	69	6.0	**29.5**																							161					20		350		
11	F	66	6.0	**29.5**																							63									
12	M	18	U	17.9	0.3	**20.0**																					**1587**					**1500**				
13	M	18	U	17.9																																
14	F	U	U	17.9																																
16	M	U	U	**74.3**	**19.4**	9.0																					234					234		632		
17	F	U	U	**24.8**	9.7	9.0																														
18	M	63	U																								234					234		632		
19	M	U	U	**32.4**	11.4	0.5																									**688**			825		
20	F	U	U	**48.6**	**17.3**	0.5																														
21	F	U	U	**48.6**	11.4	0.5																														
22	M	U	U	**44.2**	**26.8**																										156			156		
23-24	F	U	U	**44.2**	**26.8**																															
25	M	U	1.3						**55.6**	**32.4**	**56.1**	**165.6**																								1000
26	F	U	1.3						**55.6**	**32.4**	**56.1**	**165.6**																								
27	M	50	0.7															**8.2**	0.9															5101	608
28	M	59	0.2									8.5		**276.6**			**5.0**	**11.8**	0.7															5158	3120
29	F	U	U		2.2	12.2																														
30	F	61	0.2									8.5		**276.6**			**5.0**	**11.8**	0.7															6074	2190
31	F	30	0.2									8.5		**276.6**			0.5	**11.8**	0.7															5834	2190
32	M	U	U																								**700**					**700**			
33	M	55	0.5															**20.8**	**2.7**															5992	1920
34	F	45	0.5															**20.8**	**2.7**															4961	876
35	M	U	U	**25.5**	5.8																						152				**600**			270		
36	F	U	U	7.7	5.8																															
37-38	M	U	U																												150			223		

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
39	M	46	0.3								3.4		10.7	**365.0**	**70.8**	**35.4**	**5.3**	**8.9**	1.5			0.2														5345	2920
40	M	U	U		1.6																							**1095**							
41	M	35	U																									**365**							
42	F	35	U																									**365**							
43	F	40	U																									**440**							
44	M	U	U																									**440**							
45	F	50	U																									**520**							
46-47	F	U	U																									100							
48	M	U	U	**35.4**	**18.4**	**17.9**																					358					78		60		
49	F	41	0.3								3.4		10.7	**365.0**				**8.9**	1.5			0.2							24							6373	1460
50	M	19	0.3								3.4		10.7	**365.0**	**70.8**	**35.4**	**5.3**	**8.9**	1.5			0.2														3806	730
51	M	59	0.4									**165.6**	3.4				0.2	**17.8**	**2.3**																4503	1825
52	F	56	0.4									**165.6**	3.4				0.2	**17.8**	**2.3**																7940	156
53	M	62	1.7															**17.8**																		1560
54	F	59	1.7															**17.8**																		
55	M	65	1.0							2.3			1.4						0.2			**4.0**													5356	1938
56	F	54	1.0							2.3			1.4						0.2			**4.0**													6002	1292
57	M	39	1.0										1.4																						5029	672
58	F	35	1.0										1.4																						4061	960
59	M	U	3.8												**31.2**	**22.6**																				
60	F	U	3.8												**31.2**	**22.6**																				
61	M	83	3.8															6.9																		
62-63	F	U	3.8															6.9																		
64	M	63	2.9						9.6	3.2	**29.0**	42.5							**5.4**																	
65	F	51	2.9						9.6	3.2	**29.0**	42.5							**5.4**																	
66	M	24	2.9						9.6	3.2	**29.0**	42.5							**5.4**																	
68	M	76	4.0						**25.7**	**53.0**	**21.6**	**117.9**	**40.8**					**17.8**				**1.8**														
69	M	37	0.6	1.4						1.1			1.4				2.3	**10.4**																	4136	1612
70	F	35	0.6	1.4						1.1			1.4				2.3	**10.4**																	4060	1612
71	M	66	2.8						**25.9**	**23.5**	**23.5**	14.6	**27.4**			10.4	**4.7**	**14.2**	0.3																	
72	F	62	2.8						**27.4**	**23.5**	**23.5**	14.6	**27.4**			10.4	**4.7**	**14.2**	0.3																	
73	F	45	7.5						**25.9**	**23.5**	**23.5**	14.6	**27.4**					**14.2**	0.3																	

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
74	M	40	7.5						**25.9**	**23.5**	**23.5**	14.6	**27.4**					**14.2**	0.3																		
76	M	U	3.3															**8.9**																		
77	F	U	3.3															**8.9**																		
78	M	52	4.0	5.4					**41.1**	3.9	**24.7**	**100.0**	9.2					**20.8**	0.9																		
79	F	54	4.0	5.4					**41.1**	3.9	**24.7**	**100.0**	9.2					**20.8**	0.9																		
80	M	29	4.0	5.4					**41.1**	3.9	**24.7**	**100.0**	9.2					**20.8**	0.9																		
81	M	56	4.0						**41.1**	5.6	**25.4**		14.5					**8.9**	**2.5**			**1.4**															
82	F	49	4.0						**41.1**	5.6	**25.4**		14.5					**8.9**	**2.5**			**1.4**															
83	M	54	0.6						0.9	7.2	2.3	4.5	5.4	103.7	**47.3**	**12.7**	**7.0**	**17.8**	**4.5**			1.1	1.4													4028	1500
84	F	52	0.6						0.9	7.2	2.3	4.5	5.4		**47.3**	**12.7**	**6.1**	**17.8**	**4.5**			1.1	1.4													5078	1500
85	M	27	U												**47.3**																					
86	F	25	U												**47.3**																					
87	F	U	U																																	913
88-89	F	U	U																																	506
90	M	U	1.3																										243							
91-92	F	U	1.3																										243							
93	F	50	3.3																									**730**					3			183
94	F	65	3.3																									**730**								183
95	F	64	3.3	2.7																								214								
98-99	M	U	U																									4								
100-101	F	U	U																									4								
103	M	45	1.3		0.5																							**653**								
106	M	32	3.3																									78								
107	F	29	3.3																									78								
109	M	49	6.0	0.6																								**373**				13				373
110	M	60	6.0	11.8																								195				3	3	120		
111	F	58	6.0	11.8																								104								
112	M	45	6.0																															120		
113	M	60	2.2	11.8		1.6																						**891**				162				
114	M	81	U		7.4																										**688**			825		
115	M	62	U	4.1	1.0																															
116	M	39	U		11.8																										**955**			1365		

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
117	F	39	U	17.5	11.8																															
118	F	61	2.2	11.8		1.6																						**365**								
119	M	38	6.0	4.7	1.9	1.1																						231				11		624		45
120	M	38	U	4.0																							178					48				
121	F	64	6.0	4.7	1.9	1.1																														
122	M	64	6.0	4.7	1.9	1.1																														
123	M	36	6.0	4.7		1.1																														
124	M	U	6.0	4.7																																
127	M	30	10.0																									52						24		
128	F	57	7.5																									156								
129	M	56	13.0	23.3	1.4																							**316**								
130	F	U	U	4.0																																
133	M	41	U																								178					48				
134	M	58	U																								260									
135	M	61	U																											**400**						
136	F	35	U	**53.1**	1.0	3.9																					**910**							45		
137	M	51	U																										50							
138	M	45	U	2.6																							24									
139	F	U	U	2.6																																
140	M	44	U	**59.0**																							**1326**					416				
141	M	65	3.3	2.9		1.2																						28	36			64	12	40		
142	F	39	U	**59.0**																																
143	M	68	U	**46.3**		0.2																					**728**					78		160		
144	F	U	U	23.6		0.2																														
145	M	39	U	9.5																							**572**					104				
146	F	U	U	9.5																																
150	F	U	U																						**183**											
151	M	U	U																						**183**											
152	M	40	U	4.1																					52		182					52				
153	F	40	U	4.1																																
155	F	62	3.3	2.9		0.4																														

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
156	M	48	6.0																									140								13
157	M	34	6.0	6.1																								140								13
158	M	27	U	2.7																							26		208			26				
159	F	25	U	2.7																																
160-163	M	U	21.0	5.0																									130							
164	M	57	7.5	13.0	1.4																							72	39							
165	M	47	80.0																									210								
169	M	43	7.5																									182					76			
170	F	37	7.5																									182					76			
173	M	31	6.0	2.4																								52								
174	F	31	6.0	2.4																								52								
176	F	38	10.0	9.0																								114				30				
177	M	41	10.0	9.0																								114				30				
178	M	37	U	**28.4**		5.3																					**620**		**620**			**620**				
179	F	U	U	**28.4**		5.3																														
180	F	U	U			5.3																														
181	M	47	4.5																									24								
182	F	45	4.5		0.3																							24								
183	M	U	U			5.3																														
186-189	M	U	U			5.3																														
190	F	27	3.3	7.7																						**30**		**352**				70				78
191	M	41	U																								**924**					198				
192	M	U	U																								468					260				
193	F	U	U	13.6																																
194	M	U	U	13.6																																
195	M	45	U																								**795**					120		210		
196	M	U	U	10.9																																
197	M	52	U	3.8																							**624**					208				
198	M	25	3.3	7.7																						**30**		**352**				70				78
199	F	52	3.3	7.7																																
200	M	49	3.3	7.7																																

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
201	F	U	U	3.8																																
202	M	46	14.5																									104								
203	F	43	14.5																									104								
204	M	28	U	3.3																							468					104				
205	F	U	6.0																									26								
206-208	M	U	U	3.3																																
209-211	F	U	U	3.3																																
212	M	61	10.0																									18								
213	F	60	10.0																									18								
214	F	55	1.3																									**548**								
216	M	45	3.0															**17.8**	0.6																	
217	F	46	3.0															**17.8**	0.6																	
218	M	49	U															**17.8**	0.6																	
219	F	21	3.0															**17.8**	0.6																	
220	M	54	U	6.0																							156					156				
221	M	58	2.3							8.2	4.1	**74.2**	1.1		**37.8**	4.5	**8.5**	**7.1**				0.7																
222	F	U	U	6.0																																
223	M	U	U	6.0																																
224	M	36	U	6.8	1.1																						**624**					104				
225	F	50	2.3							8.2	4.1	**74.2**	1.1		**37.8**	4.5	**8.5**	**7.1**				0.7																
226	M	30	2.3							8.2	4.1	**74.2**	1.1		**37.8**	4.5	**8.5**	**7.1**				0.7																
227	M	28	2.3							8.2	4.1	**74.2**	1.1		**37.8**	4.5	**8.5**	**7.1**				0.7																
228	M	26	2.3							8.2	4.1	**74.2**	1.1		**37.8**	4.5	**8.5**	**7.1**				0.7																
229	F	35	U	6.8	1.1																															
231	M	U	2.5									**100.0**		86.7	**63.1**	3.8	0.6																			
232	F	U	2.5									**100.0**		86.7	**63.1**	3.8	0.6																			
233	M	U	2.5									**100.0**		86.7	**63.1**	3.8	0.6																			
234	M	45	U																														104			
235	M	37	2.4																0.6																	
236-240	M	U	U																														104			
241	F	U	U																														104			

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
242	F	37	2.4																0.6																	
245-246	F	U	U																														104			
247	F	52	1.0																																5202	365
248	F	U	U																														104			
249	M	48	1.0																																5202	365
250	M	59	1.0	0.8						6.6			0.5						**2.0**																4490	1430
251	M	U	U	11.8																														72		
252	F	56	1.0	0.8						6.6			0.5						**2.0**																4106	1430
253	F	U	U	11.8																																
254	M	U	1.4	11.3	1.2																							**442**				130		175		
255	M	52	U	4.1	1.3																						290					50		75		
256	M	39	1.0	3.9						5.0									1.1																4955	1300
257-258	F	U	U	4.1	1.3																															
259	M	U	U	4.1	1.3																															
260	M	66	U	**44.2**	8.5																											240			400		
261	F	65	U	**44.2**	8.5																															
262	F	38	1.0	3.9						5.0									0.7																6161	104
263	M	53	U	**35.4**	1.8																						**547**							60		
264	M	36	3.4											73.0	**42.0**																					
265	F	51	U		1.8																															
266	F	36	3.4											73.0	**42.0**																					
267	M	65	3.4												**42.0**																					
269	M	33	U			**53.1**																														
273	M	62	U			**24.5**																					125									
274	M	U	U																								365									
275	F	U	U																								365									
276	M	65	U	**53.1**	2.1																											324			385		
277	M	65	U																													324			385		
278	F	65	U	**35.4**	2.1																															
279	M	58	U	**29.4**	6.1		**0.9**																				**700**						**700**		100		
280	F	57	U	**28.2**	9.6		**0.9**																													
281	F	U	U		0.3																															

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
282	M	U	U		0.3																															
283	M	41	U	**56.7**	6.0	2.6																															
284	F	42	U	**56.7**	6.0	2.6																															
285-286	F	22	U	23.6																																
288	M	U	U	15.0																														248		
289	F	U	U	15.0																																
290	M	43	1.0										0.3	**311.1**	**47.3**				0.3																4716	3500
291	F	42	1.0										0.3	**311.1**	**47.3**				0.3																6060	2000
294	M	43	0.2	0.6										**165.9**	**37.8**			**7.1**																6450	1975
295	F	44	0.2	0.6										**165.9**	**37.8**			**7.1**																6762	1428
296	F	20	0.2	0.6										**165.9**	**37.8**			**7.1**																5788	520
299	M	67	4.3						3.9	6.8		4.6	**36.3**						1.5		**6.8**															
300	F	60	4.3						3.9	6.8		4.6	**36.3**						1.5		**6.8**															
301	M	57	1.6						**26.8**	**66.7**	**43.6**	**165.6**	**21.2**					4.4																	
302	F	55	1.6						**26.8**	**66.7**	**43.6**	**165.6**	**21.2**					4.4																	
303	F	65	3.3											136.9			0.6	**20.7**																	
304	M	72	3.3											136.9			0.6	**20.7**																	
305	M	68	2.8										2.9	**237.1**					0.2			0.1													
306	F	64	2.8										2.9	**237.1**					0.2			0.1													
307	M	38	2.8										2.9	**237.1**					0.2			0.1													
308	F	42	2.8										2.9	**237.1**					0.2			0.1													
310	M	41	2.8										2.9	**237.1**					0.2			0.1													
312	M	28	2.8															5.9										4							
313	F	24	2.8															5.9										4							
314	M	39	1.5									29.5		103.7	**47.3**	1.4		**17.8**	0.5									5							
315	F	29	1.5									29.5		103.7	**47.3**	1.4		**17.8**	0.5									5							
318	M	58	2.0						13.5	12.0	7.9	**82.6**						3.0	0.5																
319	F	51	2.0						13.5	12.0	7.9	**82.6**						3.0	0.5																
320	M	30	2.0						13.5	12.0	7.9	**82.6**						3.0	0.5																
321	M	71	2.8	0.9								**55.6**					1.4	2.0				0.1		**0.2**											

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
322	M	41	2.8	0.9								**55.6**					1.4	2.0				0.1		**0.2**												
323	F	42	2.8	0.9								**55.6**					1.4	2.0				0.1		**0.2**												
326	M	46	2.8	0.9								**55.6**					1.4	2.0				0.1		**0.2**												
327	F	45	2.8	0.9								**55.6**					1.4	2.0				0.1		**0.2**												
328	M	18	2.8	0.9								**55.6**					1.4	2.0				0.1		**0.2**												
330	M	42	2.9														**6.1**			**3.0**			**22.7**													
331	F	38	2.9														**6.1**			**3.0**			**22.7**													
332	M	18	2.9														**6.1**			**3.0**			**22.7**													
333	M	43	3.5	2.4													**5.9**			**1.5**		0.2		**0.2**												
334	M	70	3.5	2.4													**5.9**			**1.5**		0.2		**0.2**				2								
335	F	70	3.5	2.4																		0.2		**0.2**				2								
336	F	72	3.8						5.9	1.8	17.4	**120.0**	3.0	**219.0**			2.8	**12.5**	0.5																		
337	M	39	3.8						5.9	1.8	17.4	**120.0**	3.0	**219.0**			2.8	**12.5**	0.5																		
338	M	34	3.8						5.9	1.8	17.4	**120.0**	3.0	**219.0**			2.8	**12.5**	0.5																		
339	F	42	3.8						5.9	1.8	17.4	**120.0**	3.0	**219.0**			2.8	**12.5**	0.5									48									
341	M	73	1.8											**276.5**																					
342	F	66	1.8											**276.5**																					
343	F	26	1.8											**276.5**																					
344	M	48	2.8											**182.5**																					
345	F	42	2.8											**182.5**																					
346	M	32	13.5																																1732	81
347	M	45	3.5																																1732	81
348	M	U	16.5																																376	16
349	M	U	6.0																																376	16
350	F	78	2.0	3.3										**207.4**				**8.8**	0.5																	
351	M	46	2.0	3.3										**414.9**				**8.8**	0.5										182							
352	M	41	2.0	3.3										**414.9**				**8.8**	0.5																	
353	M	36	U	3.3										**414.9**				**8.8**	0.5										286							
354	M	46	13.5																						**104**											
355	M	65	13.5																						**156**											
356	M	54	13.5																									**364**								

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
357	M	53	13.5	2.2																								**364**								
359	M	30	13.5																									52								
362	M	36	12.8																									130								
364	M	64	9.0																									273								
365	F	62	9.0																									273								
366	F	58	13.5																									54								
370	M	35	13.5																									14					42			
371	M	34	13.5																									7					30	5		
372-376	M	U	U																														9	5		
377-383	F	U	U																														9	5		
384	M	29	U																									5					60			
385	M	45	U																									5					60			
386	F	34	U																										12							
388	M	25	U																										18							
389	F	25	U																										18							
390	F	55	13.5																										104							
391	M	32	13.5																														15			
392	M	47	U																														15			
393	M	30	U																														15			
394	F	38	13.5																									105								
397	M	31	13.5																									182								
398	F	27	13.5																									182								
399	M	U	2.8																									**875**								
400	M	51	4.5	4.4																									20							
402-403	F	U	4.5	4.4																																
404	M	45	U	11.5																									100							
405	F	46	U	11.5																									100							
406	M	38	13.5	6.2																									250							
407	F	32	13.5	6.2																																
410	M	52	13.5	6.2																									250							
411	F	54	13.5	6.2																																

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
412	M	75	13.5	6.2																																
415	M	35	3.3																									100								
416	M	22	6.0																									225								
417	F	19	6.0																									75								
419	F	25	1.3																									150								
420	M	28	1.3																									150								
421	M	49	2.6											91.0			0.2																			
422	F	41	2.6											91.0			0.2											8								
423	M	22	2.6											91.0			0.2																			
425	M	47	3.5								**22.7**	34.0		**311.1**	**47.3**																					
426	F	47	3.5								**22.7**	34.0		**311.1**	**47.3**																					
427	M	51	4.1									**150.0**	**28.0**				**9.8**																			
428	F	86	4.1									**150.0**	**28.0**				**9.8**																			
429	M	43	3.8			0.4					15.9	50.0	6.8	103.7		3.8	1.3	5.9	1.5		0.6	**1.5**						30								
430	F	48	3.8			0.4					15.9	50.0	6.8	103.7		3.8	1.3	5.9	1.5		0.6	**1.5**						30								
432	M	23	3.8								15.9	50.0	6.8	103.7		3.8	1.3	5.9	1.5			**1.5**						30								
433	M	26	3.8								15.9	50.0	6.8	103.7		3.8	1.3	5.9	1.5			**1.5**						30								
434	M	17	3.8								5.2	16.5	2.2	34.2		1.2	0.4	2.0	0.5			0.5														
437	M	61	1.8											**207.4**																					
438	F	60	1.8											**207.4**																					
439	M	60	3.3							12.6						5.7	**6.2**																			
440	M	52	3.3							12.6						5.7	**6.2**	**8.9**																		
441	F	55	3.3							12.6						5.7		**8.9**																		
442	F	88	3.3							12.6						5.7		**8.9**																		
443	M	32	0.3													11.3		**14.8**	0.8									130						3300	910
444	F	45	0.3													11.3		**14.8**	0.8									130						6418	860
446	M	53	3.1											121.7			1.4		0.8																
447	F	51	3.1											121.7			1.4		0.8																
448	M	25	3.1											121.7					0.2																
449	F	25	3.1											121.7					0.2									52							
452	M	41	0.5											**155.6**														48						6569	1807

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
453	F	41	0.5											**155.6**														48							6512	532
456	M	53	3.0									**165.6**	2.0	138.3			0.6		0.5																	
457	F	51	3.0									**165.6**	2.0	138.3			0.6		0.5																	
458	F	20	3.0									**165.6**	2.0	138.3			0.6		0.5																	
459	M	41	0.9																																5677	571
460	F	41	0.9																																7049	571
463	M	42	1.8																		0.7															
464	F	39	1.8																		0.7															
465	M	37	10.0	12.7	1.3																													20	135		
466	F	39	10.0	12.7	2.1																																
467	M	35	U		2.4																													20	15		
468	M	72	U		2.4																																
469	M	47	U		1.1																													20	15		
470	M	38	3.3						3.0	19.0	**38.0**	20.0	**48.0**				**5.5**				**3.2**							156						80		
471	F	39	3.3						3.0	19.0	**38.0**	20.0	**48.0**				**5.5**				**3.2**							156						80		
472	F	45	2.0																		0.9															
473-504	*M*	*U*	*U*																															*66*		
505-525	*U*	*U*	*U*																															*66*		
538-553	*M*	*U*	*U*																															*33*		
554-570	*U*	*U*	*U*																															*33*		
571	*U*	*U*	*U*																								*80*		*80*							
572-578	*M*	*U*	*U*																								*80*		*80*							
579-610	*M*	*U*	*U*																								*430*		*280*				*150*			
611	*U*	*U*	*U*																								*430*		*280*				*150*			
612	M	U	U	0.6																				**0.2**			218		98				120			
613-631	*M*	*U*	*U*																								*218*		*98*				*120*			
632-633	*U*	*U*	*U*																								*218*		*98*				*120*			
634	M	50	1.3					**1.2**																						15		15				46
635	F	49	1.3					**1.2**																												
636	F	17	1.3					**1.2**																												
638-648	*M*	*U*	*U*																																	*46*
649-652	*M*	*U*	*U*																																	*604*

Annex 1. Adult's consumption rates (kg/y or l/y) and occupancy rates (h/y) in the Sellafield area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Marine plants and algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intertidal occupancy over coal and sand	Intertidal occupancy over rock	Intertidal occupancy over sand and mud	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over salt marsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
653	M	U	1.3	11.8	11.8			**2.6**																							**48**	**464**					
654	F	U	3.0	11.8	11.8			**2.6**																													
659	M	U	U					**2.6**																							**48**	**464**					
660-663	*U*	*U*	*U*																																	*50*
664	*U*	*U*	*U*																																	*25*

Notes

Italicised observations indicate that data obtained was from a generic interview. Therefore data for pathways other than those given in the annex may be incomplete.

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

Observation number	Sex	Age in years	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Honey	Wild fungi	Fish (freshwater)	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
15 year old age group																										
148	M	12	U	**9.5**																						
184	M	12	4.5																			24				
230	M	12	U	**6.8**	**1.1**																					
329	F	12	2.8	0.9							**55.6**					**1.4**	2.0			0.1	**0.2**					
297	F	13	0.2	0.6									**165.9**	**37.8**			**7.1**								6383	520
358	M	13	10.0																				10			
363	M	13	12.8																			130				
658	F	13	3.0		**0.9**		**2.6**																			
75	F	14	7.5					**25.9**	**23.5**	**23.5**	14.6	**27.4**					**14.2**	0.3								
104	F	14	1.3																			105				
292	M	14	1.0									0.3	**311.1**	**47.3**				0.3							6027	824
309	F	14	2.8									**2.9**	**237.1**					0.2		0.1						
324	F	14	2.8	0.9							**55.6**					**1.4**	2.0			0.1	**0.2**					
461	F	14	0.9																						6320	571
637	M	14	1.3				**1.2**																			
15	M	15	U	**17.9**																						
67	M	15	2.9					**9.6**	**3.2**	**29.0**	**42.5**							**5.4**								
132	F	15	U	4.0																						
147	M	15	U	**9.5**																						
272	M	15	U			**16.2**																				
298	M	15	0.2	0.6									**165.9**	**37.8**			**7.1**								6227	832
431	F	15	3.8							**15.9**	**50.0**	**6.8**	**103.7**		**3.8**	**1.3**	**5.9**	**1.5**	**0.6**	**1.5**		30				
435	F	15	3.8							5.2	16.5	2.2	34.2		**1.2**	0.4	2.0	0.5		**0.5**						
436	F	15	3.8							5.2	16.5	2.2	34.2		**1.2**	0.4	2.0	0.5		**0.5**						
450	M	15	3.1										**121.7**					0.2								
451	F	15	3.1										**121.7**					0.2								
131	M	16	U	4.0																						

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

Observation number	Sex	Age in years	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Honey	Wild fungi	Fish (freshwater)	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
424	M	16	2.6										91.0			0.2										
657	F	16	3.0	0.9	**0.9**		**2.6**																			
10 year old age group																										
5	U	7	U	**13.6**	**9.6**	**18.6**																				
316	M	7	1.5								**29.5**		**103.7**	**47.3**	**1.4**		**17.8**	**0.5**				5				
395	M	7	13.5																			105				
97	F	8	3.3																			6				
149	F	8	U	**9.5**																						
154	M	8	U	4.1																						
167	M	8	80.0																			210				
244	F	8	2.4															**0.6**								
317	M	8	1.5								**29.5**		**103.7**	**47.3**	**1.4**		**17.8**	**0.5**				5				
408	F	8	13.5	3.7																						
655	M	8	3.0	**11.8**	**11.8**		**2.6**																			
126	M	9	6.0	**4.7**																						
185	F	9	4.5																			24				
361	M	9	13.5																			52				
369	M	9	13.5																			54				
454	M	9	0.5										**155.6**									48			6287	592
96	M	10	3.3																			6				
166	M	10	80.0																			210				
243	F	10	2.4															**0.6**								
325	M	10	2.8	0.9							**55.6**					**1.4**	2.0			**0.1**	**0.2**					
293	F	11	1.0									**0.3**	**311.1**	**47.3**				**0.3**							5871	824
367	F	11	13.5																			54				
462	F	11	0.9																						6320	571

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

Observation number	Sex	Age in years	Distance of residence from Sellafield site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Honey	Wild fungi	Fish (freshwater)	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
5 year old age group																										
8	U	2	U	**6.8**	**4.8**	**9.3**																				
102	F	2	U																			4				
172	M	3	7.5																			182		76		
175	F	3	6.0																			52				
215	M	3	7.5																			**548**				
270	F	3	3.4										**73.0**	**21.0**												
340	M	3	3.8					**1.8**	**0.5**	**5.2**	**36.0**	**0.9**	**109.5**				**3.7**	**0.2**								
418	M	3	6.0																			75				
7	U	4	U	**13.6**	**9.6**	**18.6**																				
105	F	4	1.3																			105				
125	F	4	6.0	**4.7**																						
287	M	4	U	**11.8**																						
311	M	4	2.8									**0.9**	**71.1**													
360	F	4	13.5																			52				
387	M	4	U																				12			
445	M	4	0.3												**3.8**		**7.4**	**0.8**				130			6535	860
455	M	4	0.5										**77.8**									48			6275	592
268	F	5	3.4										**73.0**	**21.0**												
401	F	5	4.5	3.3																			20			
6	U	6	U	**13.6**	**9.6**	**18.6**																				
168	M	6	80.0																			210				
171	M	6	7.5																			182		76		
368	M	6	13.5																			54				
409	F	6	13.5	2.5																						
656	M	6	3.0	**11.8**	**11.8**		**2.6**																			
1 year old age group																										
271	F	1	3.4										**73.0**	**10.5**												
3 month old age group																										
108	M	0.1	3.3																			78				

Annex 3. Ratios for determining consumption rates for children

Food group	Ratio child/adult[1]	
	1 yr old	10 yr old
Fish[2]	0.050	0.200
Crustaceans[2]	0.050	0.250
Molluscs[2]	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[3]	0.110	0.490
Game[4]	0.140	0.500
Honey	0.789	0.789
Wild fungi	0.150	0.450
Freshwater fish[2]	0.050	0.250
Direct radiation	1.000	1.000
External exposure	0.500	0.030
Plume	1.000	1.000

Notes

1. The age groups suggested for assessment in this table are those relating to dose coefficients representing 1 to 2 yr olds (labelled 1 yr old) and 7 to 12 yr olds (labelled 10 yr old). Excepting notes 2 and 3, ratios were derived from Byrom et al., 1995 for 1yr old (6 - 12 months) and 10 yr old children (10 - 11 yrs).
2. Ratios were derived from Smith and Jones, 2003 which presented data for infants and children.
3. Ratios were derived from FSA data for wild fruit and nuts for infants and 10 yr old children.
4. Game includes rabbits/hares and venison

Annex 4. Summary of Sellafield profiled habits data

Profile Name	Pathway Name	Crustaceans	Direct radiation	Eggs	Freshwater fish	Sea fish	Domestic fruit	Wild/free foods	Exposure over mud and sand	Exposure over salt marsh	Honey	Cattle meat	Game meat	Poultry	Sheep meat	Milk	Molluscs	Wild fungi	Occupancy in water	Occupancy on water	Plume (IN; 0-0.25km)	Plume (MID; 0.25-0.5km)	Plume (OUT; 0.5-1km)	Green vegetables	Other vegetables	Potato	Root vegetables
		kg	h	kg	kg	kg	kg	kg	h	h	kg	kg	kg	kg	kg	l	kg	kg	h	h	h	h	h	kg	kg	kg	kg
Crustaceans		27.0				43.4			60								17.3										
Direct radiation			8760	3.7		0.6	0.8	0.5	50			6.0	0.1	0.5	1.6	46.8		0.1		8	890	910	1660	0.8	1.0	7.2	1.0
Eggs			3170	13.1		0.6	4.8	0.8	10			10.9		1.9	3.1	92.0		0.2			1020	870	500	6.2	4.7	30.2	6.0
Freshwater fish				1.2	0.2	1.4			30				0.3	2.0				0.1								33.3	
Sea fish		11.6				41.3			210								6.5										
Domestic fruit				6.4			32.1	0.3	20		1.5			3.1	1.6			0.1						15.3	25.5	65.9	21.4
Wild/free foods			5390	10.0		0.1	3.7	3.4				7.3	0.2	1.0	2.0	8.0		0.4				2170	1810	8.7	3.7	36.0	10.9
Exposure over sand and mud		0.2	320			5.9			770								1.4					10					
Exposure over salt marsh		3.9				3.9				170			1.8														
Honey							42.1	0.7	80		5.0			2.8										3.5	12.9	12.3	19.0
Cattle meat			2820	5.2		0.1	1.4	0.5				46.3	0.1	2.4	6.4	113.9		0.2			820	460	1010	0.1	2.0	28.8	2.8
Game meat													25.7	6.1													
Poultry			2190	6.2		0.2	10.2	0.6	10		0.3	17.7	3.4	6.6	6.3	57.8		0.3			690	530	500	2.5	6.9	31.9	6.4
Sheep meat			5840	8.9			5.4	2.0				49.8	0.5	3.9	23.6	139.0		0.4				2130	2020	0.3	2.4	1.5	1.9
Milk			3250	4.8		0.4	1.7	0.4	20			12.7		0.9	2.0	260.0					1360	1030	470	0.7	0.2	16.4	3.6
Molluscs		17.0				23.6			400								33.7										
Wild fungi			1950	6.6			11.1	1.3	10		0.1			0.6	1.7	46.1	0.1	2.1					1620	12.0	7.6	35.3	15.1
Occupancy in water						11.8			200										3	120							
Occupancy on water		0.9	1750			8.1			170								0.2		1	232		10					
Plume pathways (inner area)			8760	10.8		0.2		0.4	30			14.2		1.3	2.8	165.9					7370					3.2	
Plume pathways (middle area)			8760	11.5			4.3	1.6	10			15.7		1.2	7.9	156.2		0.1				7140				36.8	1.1
Plume pathways (outer area)			8760	3.4		0.6	1.1	0.9				10.0	0.1	0.9	1.3	38.2		0.5					6310	0.1	2.3	0.5	0.2
Green vegetables			630	11.7		1.2	17.8	0.6						0.7	1.5			0.3					70	35.8	26.3	81.3	31.4
Other vegetables			970	9.3			21.4	0.1						1.0	2.3			0.2					110	32.8	38.4	93.2	35.0
Potato			730	6.4		0.6	5.5	0.3				10.5		2.4	0.9	43.1		0.2				400	30	10.5	9.6	109.4	11.4
Root vegetables			420	7.8		0.8	16.5	1.2	10		0.3	4.5		1.0	1.0	29.6		0.2					50	25.5	19.8	65.4	30.9

Notes

1. Mud and sand includes occupancy over coal and sand, sand, and sand and stones
2. Game meat includes venison and rabbits/hares
3. Plume times are the sums of individuals' indoor and outdoor times

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