Cefas

Radiological Habits Survey: Wylfa, 2004

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FIGURES

TABLES

ANNEXES

SUMMARY

This report presents the results of a survey conducted in 2004 into the habits and consumption patterns of people living, working and pursuing recreational activities in the vicinity of the Wylfa nuclear power station. The site generates electricity from twin Magnox reactors. The site is licensed to Magnox Electric Ltd for the purposes of installing and operating certain activities prescribed under the Nuclear Installations Act, 1965 (as amended). Under the Radioactive Substances Act, 1993 the company is authorised to discharge gaseous radioactive wastes via stacks to the atmosphere and liquid radioactive wastes via an outfall into the Irish Sea. The site also contains sources of direct radiation.

Potential exposure pathways related to the site are:

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

The survey investigated all of these pathways. Individuals from the local population were interviewed and the data obtained are presented and discussed. Data for 594 individuals were collected. Gamma dose rate measurements were taken to supplement those made in routine surveillance programmes.

In the marine environment, local foods were consumed, these were: fish, crustaceans and molluscs. No consumption of seaweed was identified. Seaweed from the Wylfa power station cooling water intake pipe was being collected and used as a fertiliser on a farm outside the survey area. The main activities potentially leading to external exposure included

commercial fishing, boat angling, shore angling, and walking. Observations for individuals handling fishing gear and sediment were made. Watersports such as rowing and canoeing were observed. Diving was very popular in the survey area.

In the terrestrial environment, up to 5 km from the site, the main activity was farming. There was a small-scale vineyard in the survey area, which produced wine and jam. This was sold exclusively from the vineyard. High consumption rates were found in the following groups of locally produced foods: potato and eggs. Other local foods consumed were green vegetables, other vegetables, root vegetables, domestic fruit, milk, cattle meat, pig meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey, wild fungi and fish (freshwater). Evidence of the consumption of groundwater was found. One household was using only well water, three households predominantly used water from a borehole although they had access to mains water and two households were using both spring and mains water. Livestock were drinking borehole, surface and well water.

External exposure may occur from direct radiation to those living near the site. Occupancy habits within 1 km of the site perimeter included those related to residential, work and recreational activities. The highest occupancies were associated with residences.

Transfer of radioactive contamination from the site into the surrounding area by wildlife was investigated but none was found.

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. Additionally, 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 aquatic, terrestrial and direct radiation 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 of the Wylfa 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); by legislation implementing the European Union (EU) Basic Safety Standards (BSS) Directive 96/29/Euratom (CEC, 1996); and by the Energy Act 2004 (EA 04) (UK Parliament, 2004). 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.

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

1.2 Radiological protection framework

UK policy on the control of radiation exposure has long been based on the Recommendations of ICRP which embody the principles of justification of practices, optimisation of protection and dose limitation. Radiological protection of the public is based on the concept of a critical group of individuals. This group is defined as those people who, because of where they live and their habits, receive the highest radiation dose due to the operations of a site. It follows that, if the dose to this group is acceptable when compared to relevant dose limits and constraints, other members of the public will receive lower doses, and overall protection 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 European Community legislation in the EU BSS Directive 96/29/Euratom. The public dose standards were incorporated into UK law in IRR 99. In order to implement the Directive in England and Wales, the Environment Agency was issued with a direction by the 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

Wylfa nuclear power station is operated and managed by British Nuclear Group and generates electricity from twin Magnox reactors. The site is located on the north coast of Anglesey approximately 2 km north-west of the village of Cemaes (see Figures 1 and 2).

Magnox Electric Ltd is licensed to operate the site under NIA 65. Under RSA 93 it is authorised to discharge gaseous radioactive wastes via stacks to the atmosphere and liquid radioactive wastes via an outfall into the Irish Sea. Details of the amounts of radioactive waste discharged in 2003 have been published (EA, EHS, FSA and SEPA, 2004). The site was fully operational whilst the survey fieldwork was being carried out.

2.2 Survey objectives

The Centre for Environment, Fisheries and Aquaculture Science (Cefas) undertook the survey in 2004 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 Wylfa site via aquatic, terrestrial and direct radiation pathways in order to permit realistic assessments of critical group doses.

The last aquatic habits survey conducted by Cefas in the Wylfa area was in 1988. Data from this survey are used for dose assessments for the Wylfa area (e.g. EA, EHS, FSA and SEPA, 2004). The last terrestrial habits survey was in 2000 (Joyce and Smedley, 2001) and the last direct radiation survey was in 1997 (Duckett and Smedley, 1997).

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 consumption rates of aquatic and terrestrial foods from within the survey areas
- The production, use and destination of local produce
- External exposure activities, including angling, commercial fishing (netting and potting), bait digging and mollusc collection along the intertidal shoreline
- Occupancy in and on water in the survey area including boating, diving and swimming
- The consumption and use of groundwater at farms in the terrestrial survey area
- The extent of occupancy within 1 km of the site perimeter
- The extent of any unusual practices, which may be relevant, such as the use of seaweed as a fertiliser or livestock feed and the transfer of contamination off-site by wildlife

2.3 Survey areas

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

The aquatic survey area, shown in Figure 1, covered the coastline between Carmel Head to the west of the site and Point Lynas to the east. Fisheries up to 6 km from the coastline were included. The same area was used in the 1988 survey and was based on hydrographic survey information. The area is relevant to the effect of liquid discharges from the site. Those pathways relevant to the combined effect of gaseous and liquid discharges are also discussed in aquatic sections.

The terrestrial survey area, shown in Figure 2, was defined as the circle to a radius of 5 km from the site centre (NGR SH 350 939) to encompass the main areas of potential deposition from gaseous discharges. The same area was used in the 2000 survey. Activities relating to springs and groundwater in this area were investigated in the 2004 survey. Watercourses

and areas potentially containing contamination only from washout of gaseous discharges are discussed in the terrestrial sections of this report.

For direct radiation, the survey area, also shown in Figure 2, was defined as the area within 1 km of the licensed site perimeter. The 1997 direct radiation survey also covered this area.

2.4 Conduct of the survey

The fieldwork component of the survey was carried out between 29th June and 9th July 2004, by a survey team of four 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. Prior to the start of the fieldwork, discussions were held between the survey team, Magnox Electric Ltd, the Environment Agency, the Food Standards Agency and the Health and Safety Executive. These discussions provided an outline of the main aims of the survey and highlighted areas or items, which required special attention or effort by the team. On 5th July a meeting was held between the survey team and a representative of Magnox Electric Ltd at the Wylfa 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, diving 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 seafood, their handling rates of intertidal sediments and commercial fishing gear, their occupancy rates relevant to external exposure and occupancy rates in and on water. Any general information of possible use to the survey was also obtained. Using the information 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, mollusc collectors, boat owners, anglers, farmers, beekeepers and people living and/or working close to the site.

The survey did not involve the whole population in the vicinity of Wylfa, but targeted subsets or groups, chosen in order to identify the potentially most exposed individuals. However, it is possible that even within a subset or group there may be people we did not interview at the time of the survey. Therefore, 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. 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. Overall, although the number of potential interviewees was estimated to be 2700, information was obtained for a significantly smaller number than this. In particular, it should be noted that the survey did not include Magnox Electric Ltd employees or contractors while working on site. Dose standards applicable to them whilst at work are different to those for members of the public.

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 significant quantities 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 diving 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. occupancy rates in and on water for club members). In Annex 1 and 2 such individuals only have data for the pathways of primary interest.

Thirty-six person-days were spent investigating the survey areas and interviewing individuals who were relevant to the survey. Observations for 594 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, the data were examined and any notably high rates were double-checked where possible by way of a follow-up phone call. In rare cases where follow up phone calls are not possible (e.g. mollusc collectors who wish to remain anonymous) the data has to be accepted at face value. The raw data were entered into a habits survey database where each individual for whom information was obtained was given a unique identifier (the observation number) to assist in maintaining data quality.

During the interviews, people could not always provide consumption rates in kilograms per year for food or litres per year for milk. In these cases, interviewees were asked to provide the information in a different format. For example, some estimated the size and number of items, e.g. eggs consumed per year, whereas others gave the number of plants in a crop or the length and number of rows in which the crop was grown. 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 subsequent 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). Consumption rates less than 0.05 kg/y 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 report, the following procedures have been employed:

- Experienced scientific staff were used for fieldwork and data assessment. They had been trained in the techniques of interviewing and obtaining data for all pathways 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.
- Where possible, interviewees were contacted again to confirm the results of the initial interview if, when final consumption or occupancy rates were calculated, observations were found to be high in relation to our experience of other surveys, taking into account local factors.
- Data were manipulated in a database using a consistent set of conversion factors.
- Data were stored in a database in order to minimise transcription and other errors.
- Draft reports and data tables were formally reviewed by an experienced consultant in radiological protection.
- 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.

The 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 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 gaseous discharges.

3.2 Data analysis

The main output of the study is the statement of individuals' consumption, handling and occupancy rates given in Annexes 1 and 2. These can be used by those undertaking radiological assessments of the effects of the operation of the Wylfa 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 the Ministry of Agriculture, Fisheries and Food (MAFF) (now part of Defra) and the Food Standards Agency (Byrom *et al.,* 1995 and FSA, 2002), and these are referred to as generic rates in this report. 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 of 3 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 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 covered all coastline and intertidal areas between Carmel Head and Point Lynas (Figure 1) and fisheries up to 6 km from the coast.

Carmel Head to Cemaes

Carmel Head is a rocky outcrop situated approximately 5 km west of Wylfa power station and Hen Borth is a small cove, approximately 3 km to west of the site. One individual was interviewed who collected crabs (*Cancer pagurus*) and winkles (*Littorina littorea*) from the rocks at both these locations. Intertidal activities in general were limited at these and other sections of coastline because of limited road access and a precipitous rocky descent. The Anglesey Coastal Path provided access here and along the coastline to areas which otherwise would have been difficult to reach.

Cemlyn Nature Reserve was a popular area for bird watchers. Birds on the lagoon were viewed from the tide-washed shingle spit. The area was also popular with walkers and dog walkers. There was good access by road and a car park at each end of the nature reserve. During the survey four anglers were observed fishing from Cemlyn Bay, one person was interviewed who collected winkles from the rocks and one person was noted to be bait digging in this area. A hobby fisherman and a commercial fisherman were noted to be potting for lobsters (*Homarus gammarus*) and crabs.

West of Wylfa Head near Cestyll is Porth-y-pistyll, a small cove with a sandy beach (known locally as Cestyll Beach). It was reported that this area was infrequently used, although two families who live in the direct radiation area spent time on the beach. One of these families was also noted to be swimming and canoeing in Porth-y-pistyll cove. One individual was interviewed who collected mussels (*Mytilus edulis*) and it was reported that other individuals

had been seen collecting winkles from this cove. Access to the section of coastline around Wylfa power station was difficult due to steep rocks and an intermittent high wall with a fence. Anglers were observed in this area on two occasions heading to Porth Wnal.

Wylfa Head is a precipitous rocky headland approximately 0.5 km north-east of Wylfa power station. The Porth Wnal inlet was abundant with bass (*Dicentrarchus labrax*), which were attracted to the warm water discharged from the power station's outfall. Bass are abundant in this area in summer and autumn. Rod and line anglers were observed fishing for bass from the rocks on the west and the east sides of the inlet. Porth yr Ogof is a sandy cove located to the east of Wylfa Head and was accessible only by foot. At the time of the survey no one was observed there.

Cemaes to Amlwch

Cemaes is a small tourist village approximately 2 km east of Wylfa Head. It has a large sandy bay at low tide and a rocky shoreline. When the beach was exposed, it was popular with walkers and dog walkers. Two people were interviewed who swam in the sea at Cemaes. A commercial fisherman reported that bait digging occurred in Cemaes Bay, but it was not observed during the survey. There was a small harbour with a public slipway and approximately five sailboats and 20 fishing boats were seen moored or at anchor. One family was interviewed who collected and consumed mussels from Cemaes pier. A commercial fisherman was noted to be potting for common prawns (*Palaemon serratus*) and lobsters.

Bull Bay is a village west of Amlwch with a small sandy beach and a rugged rocky coastline. It was popular with walkers, dog walkers and children playing on the beach. Approximately 10 small fishing boats were at anchor or tied to the quay and small boats were frequently observed being launched from the slipway. A hobby fisherman was noted potting for lobster and crab and rod and line anglers were fishing from the rocks. A local rowing club launched their boats at Bull Bay and rowed along the coast throughout the survey area.

Amlwch to Point Lynas

The rocky coastline around the town of Amlwch was mainly accessible by footpath. Commercial fishing boats (mainly potting for lobsters, common prawns, crabs and whelks (*Buccinum undatum*)), charter boats and sailboats were moored at Amlwch Harbour. Charter boats were used for both sea angling and dive trips. The aquatic survey area was popular with divers due to the many shipwrecks. As well as local divers, people regularly came to the area from Holyhead and further afield. It was reported that bait diggers had been seen at low tide in Amlwch Harbour however they were not observed during the survey. Several rod and line anglers were interviewed on the pier at Amlwch and it was reported that anglers also fished from the rocks in this area.

The section of coastline from Amlwch to Point Lynas was extremely rocky with steep cliffs leading down to the sea. Porth Eilian was a small sand and pebble beach with a public slipway on the western side of Point Lynas headland. At the time of the survey no one was observed using the beach or launching craft.

The western side of Point Lynas was very precipitous and from the cliffs there was no access to the sea. The cliff top was popular with walkers, however their times were not recorded, as it was not a tide washed area. Angling from the rocks was fairly popular with some anglers on the north and east shores of Point Lynas. Several members of a canoe club were observed just offshore.

4.2 Commercial fisheries

Commercial fishing activity in the survey area was limited. The majority of the commercial boats fishing around Anglesey were berthed in Holyhead Harbour but for the most part did not fish to the east of Carmel Head. Eleven boats, all less than 10 metres in length, were noted to be working on a regular basis in separate areas between Carmel Head and Hell's Mouth, at Cemlyn Bay, Cemaes Bay and between Cemaes Bay and Point Lynas. One of these was

moored at Holyhead Harbour, one launched off the beach at Porth-Yr-Afon (approximately 5 km north of Holyhead), one was moored at Bull Bay and eight were berthed at Amlwch Harbour. The main fishing effort was shellfish potting for crabs, lobsters, whelks and common prawns. Some of the fishermen said they occasionally used trammel nets or rods to catch bass, pollack (*Pollachius pollachius*) and codling (*Gadus morhua*) to sell to wholesalers, for their families' consumption and to provide fish bait for their lobster pots.

4.3 Angling and hobby fishing

The coastline was very rocky and for the most part inaccessible so angling was limited to particular areas. Wylfa Head was the most popular location, particularly for bass angling from the rocks. People were also observed at Amlwch pier, Cemlyn Bay, Bull Bay and Point Lynas. A sea-angling club based at Amlwch had approximately 10 members who were regularly fishing in the survey area. Boat angling was also popular in the area. Boats could be launched from three slipways, and people were frequently observed launching boats from Bull Bay and Cemaes Bay but no one was observed launching from Porth Eilian. Approximately 20 angling boats were observed during the survey moored at Cemaes Bay and approximately 10 boats were observed moored at Bull Bay. Two boats based at Amlwch Harbour were identified that provided chartered angling trips.

The most abundant fish species caught by anglers in the area during the summer were bass, mackerel (*Scomber scombrus*), pollack, plaice (*Pleuronectes platessa*), flounder (*Platichthys flesus*), dab (*Limanda limanda*), Dover sole (*Solea solea*), grey mullet (*Chelon labrosus*), herring (*Clupea harengus*) and dogfish (*Scyliorhinus canicula*). During the winter the predominant species were cod and whiting (*Merlangius merlangus*). Although some individuals consumed all of these species, the majority of anglers consumed bass, pollack and mackerel.

Five individuals interviewed were hobby potting on a recreational basis with a few pots for crabs, lobsters and whelks (the maximum number of crustaceans permitted to be landed for an unregistered fisherman was 5 lobsters and 25 crabs per day). In all cases catches were used for their own and their families' consumption.

Molluscs collected and caught non-commercially in the survey area included winkles from the intertidal rocky areas at Cemlyn Bay, Hen Borth and Carmel Head and mussels from Cestyll Beach, Cemaes Pier and Bull Bay.

4.4 Wholesalers and retailers

Shellfish from the area was being sold to three main wholesalers, two in Anglesey and one in Caernarfon. The bulk of the lobster and common prawns were exported to Spain and whelks were exported to Korea. One fisherman was selling crab and lobster locally to hotels, restaurants or pubs and one fisherman was selling bass to a wholesaler, which were transported to Manchester. The small amount of pollack and codling landed generally went to Grimsby or Fleetwood for sale.

4.5 Wildfowl

The aquatic survey area was predominantly rocky cliffs and sandy bays. The survey team did not find areas suitable for wildfowling such as salt marshes or estuaries, or any evidence of wildfowling.

4.6 Other Pathways

The consumption and use of seaweed was investigated. No one was found to be consuming seaweed. Seaweed was extracted from the cooling water intake pipe at Wylfa power station, which was sent to a local company who made it into compost. The compost was used as a

fertilizer on an organic farm outside the survey area. There was no other evidence of seaweed collection and use in the survey area.

4.7 Internal exposure

Consumption data for locally caught aquatic foodstuffs are presented in Tables 3 to 5 for adults and in Tables 6 to 8 for children. 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. No adult or child consumers of marine plants and algae or wildfowl were observed. For purposes of comparison, the data are summarised in Table 9 for adults and Tables 10 to 11 for children (15 year olds and 10 year olds respectively). No children in the 10 year old age group were noted to be consuming molluscs and no children in the 5 year old, 1 year old and 3 month old age groups were noted to be consuming any locally caught seafood. The summary tables also include mean rates and 97.5 percentile rates based on national data (referred to as 'generic' data in this report).

Adult consumption rates

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

The predominant species of fish consumed by adults were bass, pollack and mackerel, together with smaller quantities of cod, lesser spotted dogfish, plaice, whiting, Dover sole, dab, herring, flounder, grey mullet and salmon. A critical group of 21 individuals was identified with a maximum consumption rate of 51 kg/y and a mean of 22 kg/y. The observed 97.5 percentile rate based on 85 observations was 25 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 40% bass, 30% pollack, 10% mackerel and 20% 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 and exclude observations for 'mixed fish'.

The predominant species of crustaceans consumed by adults were lobsters and crabs. A critical group of six individuals was identified with a maximum consumption rate of 10 kg/y and a mean of 6.5 kg/y. The observed 97.5 percentile rate based on 38 observations was 7.4 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 55% lobsters and 45% crabs.

The predominant species of molluscs consumed by adults were whelks, mussels and winkles. A critical group of six individuals was identified with a maximum consumption rate of 5.5 kg/y and a mean of 1.5 kg/y. It should be noted that it was considered appropriate to base the cut-off rate for this group on the second highest observed rate. The observed 97.5 percentile rate based on 10 observations was 4.5 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 were 65% whelks, 25% mussels and 15% winkles. Figures have been rounded to the nearest 5% which in this case has resulted in a total of 105%.

Children's consumption rates

15 year old age group

For fish, a critical group of three individuals was identified with a maximum consumption rate of 21 kg/y and a mean of 19 kg/y. The observed 97.5 percentile rate based on eight observations was 20 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 7.2 kg/y and a mean of 4.3 kg/y. The observed 97.5 percentile rate based on three observations was 7.0 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 consumption rate of 0.20 kg/y. The observed 97.5 percentile is not applicable for one observation. 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.

10 year old age group

For fish, a critical group of one individual was identified with a consumption rate of 6.9 kg/y. It should be noted that it was considered appropriate not to include the lower consumption rate in the critical group (see section 3.2). The observed 97.5 percentile is not applicable for one observation. 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 one individual was identified with a consumption rate of 6.0 kg/y. The observed 97.5 percentile is not applicable for one observation. 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.

4.8 External exposure

Intertidal occupancy

Table 13 shows the intertidal occupancy data recorded during the survey. The four types of intertidal substrate in the survey area, where public occupancy was identified, were mud and stone, rock, sand, and sand and stone.

The only occupancy rate recorded over mud and stone was 26 h/y for a bait digger.

The maximum occupancy rate recorded over rock was 380 h/y for an angler. Seven other anglers had occupancy rates within a factor of three of this giving a mean occupancy for this group of 220 h/y.

The maximum occupancy rate recorded over sand was 370 h/y for three dog walkers. Six other individuals (anglers, a beach warden and dog walkers) had occupancy rates within a factor of three of this giving a mean occupancy for this group of 260 h/y.

The maximum occupancy rate recorded over sand and stone was 420 h/y for two nature reserve wardens. Three other individuals (an angler, a shore worker and a shellfish collector/walker) had occupancy rates within a factor of three of this. This gives a mean occupancy for this group of 290 h/y.

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 times higher than that for effective dose. There is also a contribution to effective dose due to skin exposure (ICRP, 1991).

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

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

Table 14 shows the times spent handling fishing gear and intertidal sediment recorded during the survey.

The maximum fishing gear handling rate recorded was 810 h/y for a commercial lobster potter. Eleven other commercial lobster potters had gear handling rates that came within a factor of three of this. This gives a mean handling rate for this group of 580 h/y.

The maximum sediment handling rate recorded was 26 h/y for a bait digger. A shellfish collector had a handling rate within a factor of three of this. This gives a mean handling rate for this group of 18 h/y.

Gamma dose rate measurements

Representative gamma dose rate measurements at 1 m above the substrate were taken over sand, and sand and stones where high occupancy rates were observed. These measurements (shown in Table 15) ranged from 0.058 μGy/h to 0.073 μGy/h over sand and 0.057 μGy/h over sand and stone. Measurements were also taken over seaweed and stones, and sand and mud. 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 pathways are generally considered to be minor in comparison with other exposure pathways such as the ingestion of foods produced in the vicinity of a nuclear site. However, in order to allow for their assessment, relevant data have been collected. Occupancy rates for activities taking place in or on seawater around Wylfa are shown in Table 16. The observations include six children. No further manipulation of the data (for example, calculating critical group rates) has been carried out. It should be noted that a lot of the data was gained through interviews with representatives from dive clubs, water sports clubs, etc. providing generic figures for their members. In particular, one club provided 200 observations for divers.

Activities in the water

Activities taking place in the water around Wylfa included diving and swimming. Two hundred and thirteen observations were recorded and the people with the highest occupancy rates were two divers with 130 h/y.

Activities on the water

Activities taking place on the water around Wylfa included commercial fishing, hobby fishing, sea angling, boating to and from dive sites, canoeing, rowing and sailing. Two hundred and ninety seven observations were recorded. The highest occupancy rate was 1200 h/y for a charter boat skipper and for three commercial fishermen.

5 TERRESTRIAL RADIATION PATHWAYS

5.1 Terrestrial survey area

The terrestrial survey area covered all land and watercourses within 5 km of the site centre (NGR SH 350 939) as shown in Figure 2.

The area around the Wylfa power station was predominantly agricultural. There were several villages within the survey area; Cemaes, Tregele and Llanfechell to the east and south-east, Mynydd Mechell to the south and Llanfairynghornwy to the south-west.

Thirty-eight working farms were located in the area. Of these two were dairy farms, two produced beef, three produced sheep, 24 farms produced both beef and sheep and seven farms were both dairy and livestock. No pig farms were identified. Several farmers grew crops such as barley, oats, potatoes, turnips for winter feed and forage crops for silage and hay.

Livestock was predominantly sold on Anglesey to meat markets, an abattoir and a butcher as well as further afield. Only the butcher was located within the survey area. Milk was sold to Milk Link and Glanbia for national distribution; some of the milk was used in the production of mozzarella cheese. One farmer sold excess barley to other farmers in the area for feed.

Many farmers and their families were noted to be consuming beef, lamb and milk from their own farms. Five farmers kept several chickens for the consumption eggs. Chicken meat was not consumed. One farmer and his family kept pigs purely for their own consumption. One farmer and his family were consuming their own potatoes.

There was a small-scale vineyard of approximately 15 acres in the survey area, growing grapes for wine and loganberries, gooseberries and raspberries for jam. Approximately 600

bottles of wine were produced per year and the wine and jam were sold exclusively from the vineyard.

No allotments were located in the area although several households growing a range of fruit and vegetables in their gardens were located and interviewed. Seven households kept chickens in their gardens purely for egg production, two households sold excess eggs to local customers and to family and friends. Chicken meat was not consumed. One household consumed eggs from ducks and geese kept in their gardens. One household kept a sow and piglets in their garden, consuming the pork they produced and giving excess to family and friends.

One beekeeper was identified in the survey area with five hives near Llanrhyddlad. The average production of honey per hive was 18 kg/y. The beekeeper and his family consumed honey from his hives and excess was given to other family and friends.

The consumption of wild foods was commonplace and included blackberries, sloes, damsons and mushrooms. At least 11 households consumed game from within the survey area; this included pheasant, rabbit and duck. One private game shoot on farmland with approximately 10 local members was identified in the survey area. The main species shot were pheasant (*Phasianus colchicus*), teal (*Anas crecca*) and snipe (*Gallinago Gallinago*).

Freshwater angling in the area appeared to be limited to a privately owned trout lake. Specific consumption rates were unobtainable. However, the secretary of the club said that it had 20 members who visited the lake approximately 100 times in a season with a bag limit of eight fish per member although the full quota was rarely taken. There were several streams in the area, which were investigated but the survey team could not find any evidence of angling.

One household was using well water as their sole domestic supply, three households were predominantly using a borehole although they did have mains water and two households were using spring and mains water. Livestock were identified drinking borehole, spring or surface water at 22 farms in the survey area.

The transfer of contamination from Wylfa by wildlife was investigated. At the site meeting, Magnox Electric Ltd staff were asked if they were aware of wildlife that could act as vectors for the transfer of radioactivity off site. Rabbits were common around the site although they were not a problem on site because there were no grassy areas. There was not a culling programme in place for rabbits on site. Pigeons were numerous and were controlled by a hawker. Pigeons have been monitored by the site on an ad hoc bases but nothing has been found. Farmers control foxes in the area.

5.2 Wholesalers and retailers

Retailers were interviewed in order to find out whether they were selling produce from within the survey area. They included greengrocers, bakers, butchers, a delicatessen, a market and a farm shop in Amlwch and Cemaes. Approximately 11 retail outlets were visited or contacted. One butcher in Amlwch was selling local beef from two farms in the area. No other retailers were found to be selling local produce.

5.3 Internal exposure

Consumption data for locally produced foodstuffs potentially affected by gaseous discharges are presented in Tables 17 to 32 for adults and Tables 33 to 45 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 9 for adults and in Tables 10 to 12 for children (15 year olds, 10 year olds, 5 year olds respectively). No children in the 1 year old or 3 month old age groups

were noted to be consuming locally produced foods potentially affected by gaseous discharges.

In order to provide information relevant to surveillance and assessments studies, the consumption rate data collected during the survey were analysed to indicate which food types most commonly contributed to each food group. The data are summarised in Table 46. Those food types shown in bold and labelled with an asterisk were sampled as part of the 2003 Food Standards Agency monitoring programme (EA, EHS, FSA and SEPA, 2004).

Adult consumption rates

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

No critical group mean consumption rates were found to be greater than the generic 97.5 percentile consumption rates. However 10 critical group mean consumption rates exceeded the generic mean consumption rates. These were for green vegetables, other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat, pig meat, eggs and honey. Two observed 97.5 percentile consumption rates exceeded the generic 97.5 percentile consumption rates. These were for potato and eggs.

Children's consumption rates

15 year old age group

Twelve children in this age group were identified to be eating locally produced food. Consumption was identified in the following 10 food groups: green vegetables, domestic fruit, milk, cattle meat, pig meat, sheep meat, poultry, eggs, wild/free foods and wild fungi. No consumption was identified for the following food groups: other vegetables, root vegetables, potato, rabbits/hares, honey, venison, freshwater fish and local cereals. The critical group mean consumption rate exceeded the generic 97.5 percentile consumption rate for cattle meat. A further four critical group mean consumption rates exceeded the generic mean consumption rates. These were for milk, pig meat, sheep meat and eggs. No observed 97.5 percentile consumption rates exceed the generic 97.5 percentile consumption rates.

10 year old age group

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

5 year old age group

Five children in this age group were identified as eating locally produced food. Consumption 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, freshwater fish 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.

6 DIRECT RADIATION PATHWAYS

6.1 Direct radiation survey area

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

The perimeter fence to the north and north-west of the site backed on to the rocky foreshore. Access was limited but anglers were observed walking around the foreshore and angling on the rocks from the west side of Porth Wnal. The cooling water outfall was located in the Porth Wnal inlet, this area was very popular for bass fishing in summer and autumn due to the warm water from the outfall.

From the north-east to south-east of the site the land was partly used as Wylfa nature trail with marked footpaths leading to Wylfa Head. The nature trail was owned by the power station and open to the public. Access was through the Visitors Centre or the car park to the east of the site. Adjacent to the east side of the power station was the National Grid operations and to the south of the site were the Visitors Centre and the Wylfa Sports and Social Club.

There were two sandy bays in the 1 km area, Porth yr Ogof to the east and Porth-y-pistyll to the south-west of the site; both were accessible to the public.

6.2 Residential activities

The direct radiation survey area was sparsely populated with 17 residences, two of which were not occupied, one was a holiday home (unoccupied at the time of the survey) and one was a farm. Two houses were within the 0 – 0.25 km zone, two houses were in the 0.25 – 0.5 km zone and 13 houses were spread out over the 0.5 – 1.0 km zone. Interviews were conducted with 11 of the households and included six families with children.

6.3 Leisure activities

The Wylfa Visitors Centre had received between 28 - 29,000 visitors in the 12 months leading up to the survey. The centre had a classroom that was frequently used by parties of school children. The Wylfa nature trail was open to the public and was also used for school projects. The Wylfa Sports and Social Club was an active club with approximately 75 associate members (not employed by Magnox Electric Ltd). Groups that met on a regular basis at the social club included a clay pigeon shooting club, a golf club and a theatre group.

Angling was popular from the rocks around Wylfa Head, particularly near the station cooling water outfall which attracted large numbers of bass. The two sandy bays in the area were accessible by footpaths but not by car. No one was observed on these bays however two local families spent time walking along the beach and they reported that the area was infrequently used.

6.4 Commercial activities

Commercial activities within the direct radiation survey area included farming, National Grid operations and commercial fishing. One farm was located within the area and farmed part of the area to the south and south-west, another farmer lived outside the area but farmed the area around Wylfa Head, to the east and south-east of the site. Workers at the National Grid building (not employed by Magnox Electric Ltd) included one permanent employee and several engineers who carried out maintenance work for short periods of time. Employees and contractors of the Wylfa site were not included in the survey. Fishermen were noted to be potting for crab and lobster within the 1 km survey area.

6.5 Occupancy rates

Table 47 presents indoor, outdoor and total occupancy data for adults and children and includes distances from the licensed site perimeter fence where these occupancies took place. An analysis of the data by distance zones and occupancy rates is shown in Table 48.

0 - 0.25 km from the site perimeter fence

Occupancy data were collected for twenty-nine individuals in the 0.0 to 0.25 km zone. The observations were mainly residents, farmers, workers at the National Grid and anglers. A resident had the highest occupancy rate of 8100 h/y.

0.25 – 0.5 km from the site perimeter fence

Occupancy data were collected for eleven people in the 0.25 to 0.5 km zone. The observations were for a family living in the area and a shellfish collector. A resident had the highest total occupancy rate of 8400 h/y.

0.5 – 1.0 km from the site perimeter fence

Occupancy data were collected for thirty-two people in the 0.5 to 1.0 km zone. The majority of observations were for residents. A resident had the highest total occupancy rate of 8400 h/y.

6.6 Gamma dose rate measurements

Table 49 presents gamma dose rate measurements in the Wylfa direct radiation survey area. Representative gamma dose rate measurements were taken both inside and outside a selection of residences and at outdoor background locations outside the area. It should be noted that the measurements have not been adjusted for natural background dose rates.

In the 1 km zone the outdoor measurements, which were taken approximately 5 to 10 metres from the nearest buildings, ranged from 0.066 to 0.082 μGy/h. All the outdoor measurements were taken over grass. Indoor measurements ranged from 0.063 to 0.120 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 readings over grass taken outside the direct radiation survey area ranged from 0.082 – 0.083 μGy/h. At the time of the survey, the outdoor measurements were within range of the background measurements.

Comprehensive studies of background radiation have been carried out on a national scale by the National Radiological Protection Board (since 1st April the Radiation Protection Division of the Health Protection Agency), the most recent of these being a review conducted during 1999 (Hughes, 1999). The results from these could be used for comparison.

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 50. 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 profile for Wylfa is shown in Annex 4. 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

The survey investigated the three potential sources of public radiation exposure from the Wylfa site, which were:

- Discharges of liquid radioactive waste to the Irish Sea
- Discharges of gaseous radioactive waste to the atmosphere
- Sources of direct radiation

Data were collected for 594 individuals including commercial fishermen, anglers, mollusc collectors, people pursuing water sports, farmers, gardeners and people spending time within 1 km of the site. These people were targeted because their habits and where they live may cause them to be exposed to radioactivity from the site. However, it should be noted that the most exposed people can only be defined with the outcome of a dose assessment.

All consumption rates recorded in this report include only locally produced or caught foods.

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

- 22 kg/y for fish
- 6.5 kg/y for crustaceans
- 1.5 kg/y for molluscs

The predominant aquatic species consumed by the respective groups were bass, pollack and mackerel; lobsters and crabs; whelks, mussels and winkles.

Wildfowling and seaweed consumption were not identified in the survey area. The use of local seaweed as a fertiliser on a farm outside the area was noted.

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

- 26 h/y for mud and stone
- 220 h/y for rock
- 260 h/y for sand
- 290 h/y for sand and stone

The critical group rate for handling fishing gear was 580 h/y and for handling sediment was 18 h/y.

The maximum occupancy rate in water was 130 h/y and the maximum occupancy rate for time spent on water was 1200 h/y.

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

- 27 kg/y for green vegetables
- 21 kg/y for other vegetables
- 21 kg/y for root vegetables
- 100 kg/y for potato
- 29 kg/y for domestic fruit
- 140 l/y for milk
- 38 kg/y for cattle meat
- 17 kg/y for pig meat
- 8.0 kg/y for sheep meat
- 1.6 kg/y for poultry
- 18 kg/y for eggs
- 5.6 kg/y for wild/free foods
- 1.4 kg/y for rabbits/hares
- 4.5 kg/y for honey
- 0.91 kg/y for wild fungi
- 0.18 kg/y for fish (freshwater)

No consumption of venison 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, together with external pathway exposures, may be achieved from the data for individuals in Annexes 1 and 2. Rates for individuals making up the critical groups are presented in bold type.

Evidence of consumption of groundwater included one household using spring water as their sole domestic supply and five households using boreholes and spring water alongside mains water.

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

- 8100 h/y for the 0 to 0.25 km zone
- 8400 h/y for the 0.25 to 0.5 km zone
- 8400 h/y for the 0.5 to 1.0 km zone

In all three zones, the highest occupancy rates were for residents.

8.2 Comparisons with previous surveys

The results from this survey can be compared with results from the last aquatic, terrestrial and direct radiation habits surveys undertaken at Wylfa in 1988, 2000 and 1997 respectively. The same areas were used in this survey as the previous surveys.

In 1988, the critical group mean consumption rate for fish was 94 kg/y for a group of eight people, and the maximum consumption rate was 170 kg/y. The main species of fish consumed by the critical group were cod, saithe, pollack, herring, mackerel, plaice and sole. In 2004, the critical group consumption rate decreased significantly to 22 kg/y, the maximum consumption rate also decreased significantly to 51 kg/y, but the number in the critical group increased to 21. The main species consumed were bass, pollack, and mackerel.

In 1988, the critical group mean consumption rate for crustaceans was 23 kg/y, the maximum consumption rate was 37 kg/y and the number of people in the critical group was 14. In 2004, the critical group consumption rate decreased to 6.5 kg/y, the maximum consumption rate also decreased to 10 kg/y and the number in the critical group decreased to six. In 1998 and 2004, the main species of crustaceans consumed by the critical group were crab and lobster.

In 1988, the critical group mean consumption rate for molluscs was 1.8 kg/y, the maximum consumption rate was 2.3 kg/y and the number of people in the critical group was seven. The main species of molluscs consumed by the critical group were winkles and whelks. In 2004, the critical group consumption rate was similar at 1.5 kg/y, though the maximum consumption rate increased to 5.5 kg/y and the critical group was six. The main species consumed were whelks, winkles and additionally mussels.

The consumption of wildfowl or seaweed was not considered in 1988 and was not noted in 2004.

For occupancy of intertidal substrates recorded in 1988 and 2004, the two that can be compared are rock and sand.

For external pathways it should be noted that the methodology for determining the critical group has changed since the 1988 survey so care is needed when comparing results. In the following paragraphs, the critical group rates from the 1988 survey have been recalculated using the current method and the rates in brackets were calculated using the original method.

The 1988 critical group mean intertidal occupancy rates over rock using the 2004 methodology was 1600 h/y for two anglers (2400 h/y for one angler), the maximum rate being 2400 h/y. The 2004 critical group mean intertidal occupancy rates over rock was much less at 220 h/y for eight anglers, the maximum rate being 380 h/y.

The 1988 critical group mean intertidal occupancy rates over sand using the 2004 methodology was 310 h/y for four dog walkers and a beachcomber (370 h/y for two dog walkers and a beachcomber), with a maximum rate of 400 h/y. The 2004 critical group mean intertidal occupancy rates over sand was 260 h/y for six dog walkers, one beach warden and two anglers, the maximum rate being 370 h/y.

In 1988, the critical group mean handling rate for commercial fishing gear using the 2004 methodology was 770 h/y for seven fishermen (1100 h/y for two fishermen), with a maximum handling rate of 1200 h/y. The 2004 critical group mean handling rate for commercial fishing gear was 580 h/y for 12 fishermen, the maximum rate being 810 h/y.

In 1988, the critical group mean handling rate for sediment was 37 h/y for five bait diggers and one diver (75 h/y for one baitdigger). The 2004 critical group mean handling rate for sediment was 18 h/y for a baitdigger and a shellfish collector, the maximum handling rate being 26 h/y.

A comparison of occupancy rates in and on water cannot be made because this pathway was not investigated in the 1988 survey.

For terrestrial food groups, the critical group mean consumption rates (kg/y and l/y) in the 2004 survey are tabulated below, together with those of the 2000 survey for ease of comparison:

	2000	2004
• Green vegetables	26	27
• Other vegetables	98	21
• Root vegetables	36	21
• Potato	110	100
• Domestic fruit	110	29
• Milk	190	140
• Cattle meat	47	38

• Pig meat	10	17
• Sheep meat	12	8.0
• Poultry	23	1.6
• Eggs	27	18
• Wild/free foods	8.9	5.6
• Rabbits/hares	2.5	1.4
• Honey	14	4.5
• Wild fungi	5.1	0.91
• Venison	0	0
• Fish (freshwater)	*	0.18

* The critical group mean consumption rate for fish (freshwater and marine, affected by gaseous and liquid discharge) in the 2000 terrestrial survey was 7.4 kg/y and cannot be compared with fish (freshwater, affected only by gaseous discharge) for 2004.

Consumption rates had increased in 2004 in the following food groups: green vegetables and pig meat, though apart from pig meat, only slightly. Consumption rates had decreased in 2004 in the following food groups: other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey and wild fungi. Several of the reductions are large. Venison was not consumed in either 2000 or 2004.

A comparison of the 1997 and 2004 direct radiation survey results shows that in 1997 the highest recorded occupancy rate was 8500 h/y for a person who lived and worked in the 0.5 – 1.0 km zone. In the 2004 survey the highest occupancy rate was 8400 h/y for a child living in the 0.25 – 0.5 km zone.

Commercial activities noted in 1997 and still being carried out in 2004 were farming, commercial fishing and the National Grid operations. Leisure activities in both surveys included angling, walking and activities at Wylfa sports and social club. The National Coastal Watch, noted in 1997 was no longer operational in 2004.

Gamma dose rate measurements for 10 residences in 2004 can be compared with gamma dose rate measurements taken at similar locations in 1997. These were for one farm and seven residences (houses one, two, five, six, seven, nine and 10 in Table 49). Gamma dose measurements in 1997 ranged from 0.078 to 0.090 μGy/h indoors and from 0.078 to 0.082 μGy/h outdoors. Gamma dose measurements in 2004 ranged from 0.063 to 0.121 μGy/h indoors and from 0.066 to 0.082 μGy/h outdoors.

8.3 Suggestions for environmental monitoring

The 2003 monitoring programmes operated by the Environment Agency and the Food Standards Agency included the following samples and measurements (EA, EHS, FSA and SEPA, 2004):

Aquatic surveillance

- Plaice from the pipeline area
- Crabs from the pipeline area
- Lobsters from the pipeline area
- Winkles from Cemaes Bay
- *Fucus vesiculosus* from Cemaes Bay
- Seaweed from Cemaes Bay
- Sediment from Cemaes and Cemlyn Bay
- Seawater from Cemaes and Cemlyn Bay
- Gamma dose rate measurements over sand, and rock and sand at Cemaes Bay and pebbles, and pebbles and rock at Cemlyn Bay.

Terrestrial surveillance

- Milk
- Apples
- Barley
- Beetroot

- Blackberries
- Broad beans
- Honey
- Onions
- Potato
- Freshwater

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.

(1) EA monitoring

- Gamma dose rate measurements could be introduced at Bull Bay (NGR SH 426 943) as this was a popular area for intertidal activities.
- Groundwater was consumed at several households. This could be added to the monitoring programme.
- Seaweed from the intake pipe was made into compost and used as fertilizer on a farm on Anglesey. A sample of the fertilizer could be introduced.

(2) FSA monitoring

- Monitoring of bass from the area around the station discharge outfall could be introduced, as it was a commonly consumed species from this location and was consumed at rates above the generic mean rates.
- Whelks were consumed at rates above the generic mean rates and commercial collection was identified in the aquatic area. Whelks from the vicinity of the aquatic discharge could be introduced if samples were obtainable.
- Individuals were collecting and consuming mussels from the survey area. A sample of mussels could be introduced from the nearest location to the site.
- Consumption rates of pig meat have increased since 2000 and were above the generic mean rates. A sample of pig meat could be added to the monitoring programme.

- Broad beans could be replaced by runner beans in the other vegetables group because they were more commonly consumed.
- Courgettes could be introduced as they are commonly consumed and the green vegetable group is not currently monitored.
- Grapes from the vineyard within the terrestrial survey area could be introduced, as this pathway has not been previously considered.

9 ACKNOWLEDGEMENTS

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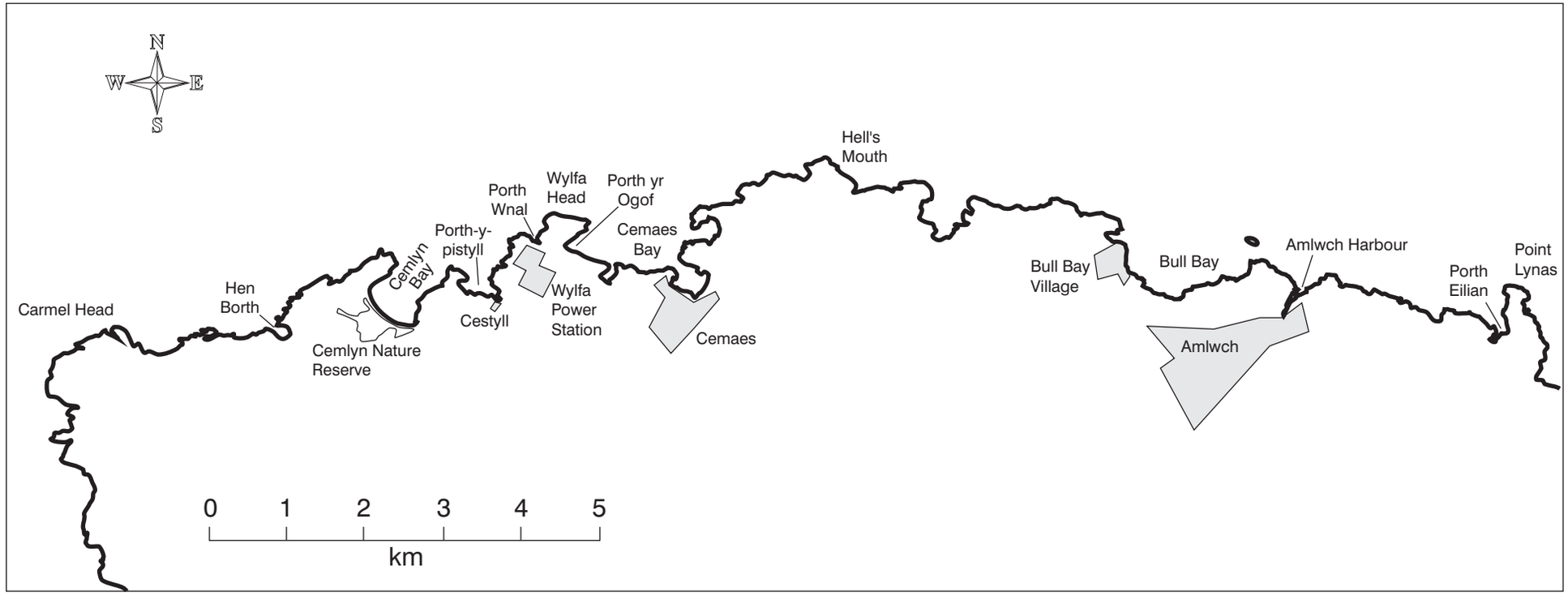
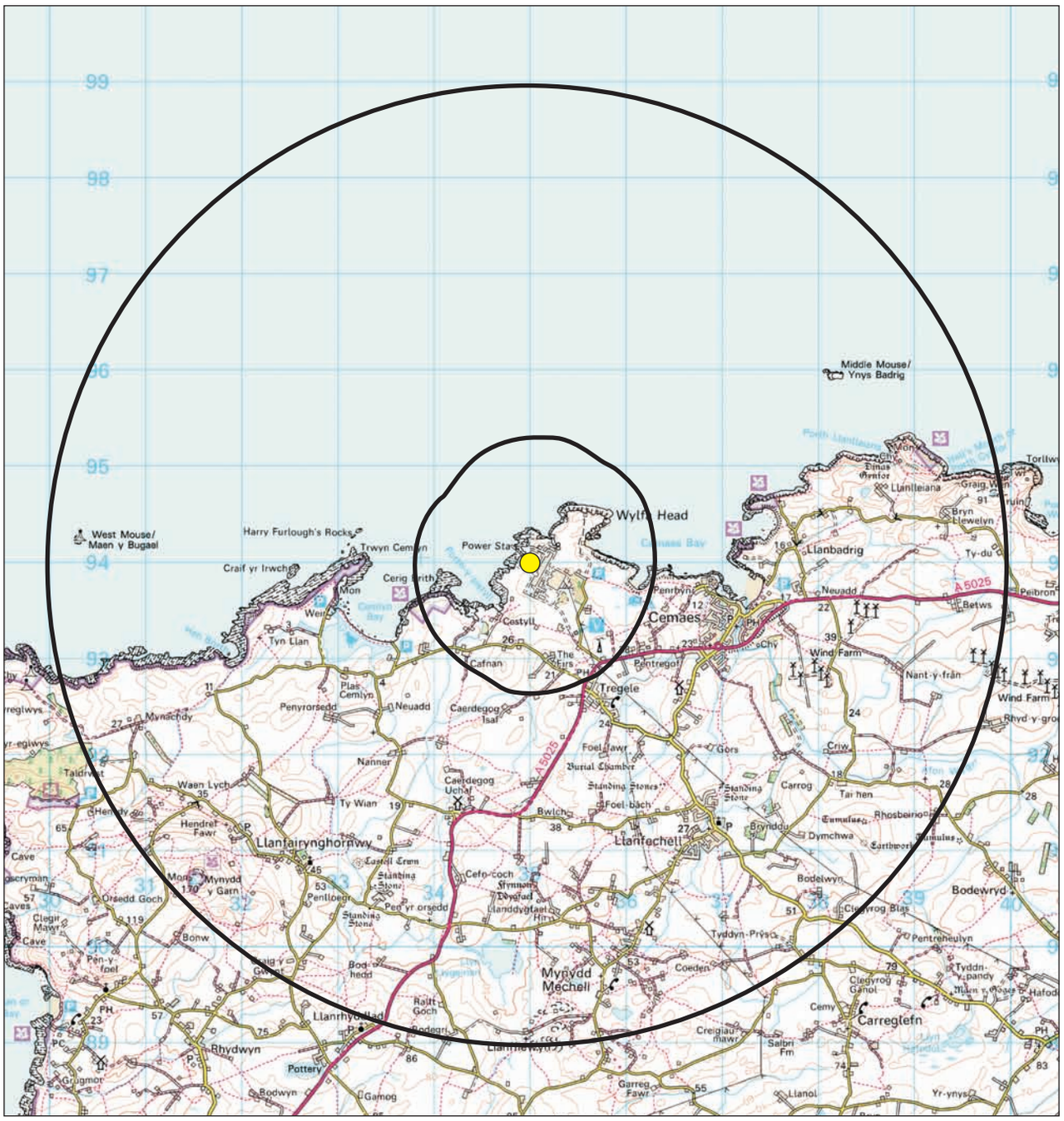


Figure 1. The Wylfa aquatic survey area



● Wylfa site centre

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

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 Wylfa aquatic, terrestrial and direct radiation survey areas	Number of people resident in terrestrial survey area (excluding those in the direct radiation survey area)	2700^	141^^	*	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). Includes data for 12 people who consumed terrestrial foods but lived outside 5 km.
	Number of people resident in the direct radiation survey area	60	44	****	Including 3 people that also work in the direct radiation survey area
	Number of people employed but not resident in the direct radiation survey area	20	15	****	Excluding employees and contractors of Magnox Electric Ltd and people living in the direct radiation survey area
	Number of people using the aquatic area	Unknown but more than 600	394^^	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 3300	594^^	U	
AQUATIC PATHWAYS					
Commercial fishermen	Number of commercial fishermen actively fishing in survey area	20	14	****	
Boat anglers and hobby fishermen	Number seen or heard of during survey	100	30	**	Interview with 1 boat angling club representative provided generic data for 11 people
Shore anglers and other beach users	Number seen in action or spoken to during survey	U	117	U	
Baitdiggers	Number seen in action, spoken to or heard of during survey	U	2	U	
Divers	Members of clubs in survey area or people spoken to during survey	U	205	U	Interview with a club representative provided generic data for 200 people
Watersports enthusiasts	Members of clubs in survey area and people seen in action or spoken to during survey period	100	37	**	Interview with a rowing club and a canoeing club representative provided generic data for 36 people

Table 1. Survey coverage

Group	Criteria	Estimate of complete coverage	Number for whom positive data was obtained	Coverage for positive observations	Notes
TERRESTRIAL PATHWAYS^^^					
Farms	Number of farmers and their family members in the survey area	100	88	*****	Estimate of 40 farms in the area, of which 38 farmers were interviewed
Bee keepers	Number of people consuming honey in survey area	U	2	U	Estimate of 1 beekeeper in the area, who was interviewed
DIRECT RADIATION PATHWAYS					
Occupancy of area	Number with occupancies > 100 hours (excluding site employees)	90	70	****	
Residences	Number of residents in the survey area	60	44	****	Estimate of 15 occupied houses and farms in the area, 11 occupants of which were interviewed
Employees	Number of people predominantly based in survey area (>500 hours)	10	5	***	Including 3 people who live in the direct radiation area, excluding 13 people who work < 500 hours, site employees and contractors
BREAKDOWN OF AGE GROUPS					
Adults	Individuals over 17	U	533	U	
15 year old	More than 12.0 year old to 17.0 year old	U	31	U	
10 year old	More than 7.0 year old to 12.0 year old	U	17	U	
5 year old	More than 2.0 year old to 7.0 year old	U	11	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

* = >0-20% ** = 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 (freshwater)	Brown trout, rainbow trout, perch, pike, salmon (river), eels
Crustaceans	Brown crab, spider crab, crawfish, lobster, *Nephrops*, squat lobster, prawn, shrimp
Molluscs	Cockles, limpets, mussels, oysters, queens, scallops, razor shell, whelks, winkles

Notes:
* Although squid and cuttlefish are molluscs, radiologically they are more akin to fish
† Including offal

Table 3. Adults' consumption rates of fish in the Wylfa area (kg/y)

Observation number	Bass	Cod	Dab	Dover sole	Flounder	Grey mullet	Herring	Lesser spotted dogfish	Mackerel	Mixed fish	Plaice	Pollack	Salmon	Whiting	Total
359	**12.8**								**5.5**			**22.5**		**10.3**	**51.2**
94			**2.7**	**11.2**			**1.3**		**4.4**		**7.9**				**27.5**
519	**2.6**							**18.1**			**1.8**			**3.1**	**25.6**
376		**18.0**									**6.0**				**24.0**
471-472	**23.6**														**23.6**
458-459												**22.1**			**22.1**
460-461												**22.1**			**22.1**
462-463										**20.8**					**20.8**
446									**18.8**						**18.8**
380-383										**17.7**					**17.7**
465-466	**17.7**														**17.7**
473-474	**17.7**														**17.7**
358	4.5								1.1			7.9		2.1	15.5
523-524	10.3								5.0						15.4
482-485										11.3					11.3
469-470	10.7														10.7
353-356	4.3	3.0												2.6	9.8
48	3.8	6.0													9.8
53	3.8	6.0													9.8
394-395	3.8	2.7												0.5	7.0
369-372		3.7												3.2	7.0
95			0.7	2.8			0.3		1.1		2.0				6.9
117-118	2.3				1.0				2.2		1.0				6.5
349-352	5.3														5.3
143-145		5.0													5.0
520									2.5					2.3	4.8
509-510	3.7														3.7
364		3.6													3.6
366-367		3.6													3.6
377-379	3.6														3.6
454									3.5						3.5

Table 3. Adults' consumption rates of fish in the Wylfa area (kg/y)

Observation number	Bass	Cod	Dab	Dover sole	Flounder	Grey mullet	Herring	Lesser spotted dogfish	Mackerel	Mixed fish	Plaice	Pollack	Salmon	Whiting	Total
85									0.4			2.5			2.8
400-401									2.8						2.8
556-557	1.4								1.1						2.5
1		0.9							0.9					0.5	2.3
489-490	1.0					0.2			0.4			0.6			2.2
107-109	1.9														1.9
413									1.8						1.8
84									1.6						1.6
495-498													1.0		1.0
398-399	0.5					0.4									1.0
518									0.5						0.5
563-565											0.3				0.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of fish based on the 21 highest adult consumers is 22.2 kg/y

The observed 97.5 percentile rate based on 85 observations is 25.4 kg/y

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

Observation number	Crab	Lobster	Common prawn	Total
94	**3.6**	**6.5**		**10.0**
462	**2.7**	**4.4**		**7.2**
463	**2.7**	**4.4**		**7.2**
95	**2.1**	**3.9**		**6.0**
446	**4.3**			**4.3**
376	**2.8**	**1.3**		**4.1**
364		3.2		3.2
366		3.2		3.2
367		3.2		3.2
143	0.8	1.4		2.2
144	0.8	1.4		2.2
145	0.8	1.4		2.2
117	1.1	0.6	0.4	2.1
118	1.1	0.6	0.4	2.1
84	0.7	1.3		2.0
15	0.5	0.9		1.3
17	0.5	0.9		1.3
18	0.5	0.9		1.3
1	0.7			0.7
65	0.7			0.7
66	0.7			0.7
390		0.6		0.6
391		0.6		0.6
134	0.6			0.6
136	0.6			0.6
2		0.4		0.4
502	0.4			0.4
503	0.4			0.4
489	0.1	0.2		0.3
490	0.1	0.2		0.3
83	0.2			0.2
550	0.2			0.2
551	0.2			0.2
563	0.2			0.2
564	0.2			0.2
565	0.2			0.2
500	0.1			0.1
501	0.1			0.1

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of crustaceans based on the 6 highest adult consumers is 6.5 kg/y

The observed 97.5 percentile rate based on 38 observations is 7.4 kg/y

Table 5. Adults' consumption rates of molluscs in the Wylfa area (kg/y)

Observation number	Mussel	Whelk	Winkle	Total
462		**5.5**		**5.5**
1	**1.0**			**1.0**
2	**1.0**			**1.0**
15			**0.4**	**0.4**
16			**0.4**	**0.4**
22			**0.4**	**0.4**
134			0.2	0.2
136			0.2	0.2
117	0.2			0.2
118	0.2			0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of molluscs based on the 6 highest adult consumers is 1.5 kg/y (Taking the highest consumption rate of 5.5 k/y and dividing by 3 would give a cut-off value of 1.8 kg/y for the critical group. However, judgement has been used and in this case the cut off value has been based on the second highest observed rate.)

The observed 97.5 percentile rate based on 10 observations is 4.5 kg/y

Table 6. Children's consumption rates of fish in the Wylfa area (kg/y)

15 year old age group

Observation number	Age	Bass	Dab	Dover sole	Herring	Mackerel	Mixed fish	Plaice	Salmon	Total
464	**15**						**20.8**			**20.8**
467	**16**	**17.7**								**17.7**
468	**15**	**17.7**								**17.7**
455	16					3.5				3.5
456	14					3.5				3.5
457	14					3.5				3.5
119	16					2.2				2.2
499	14								1.0	1.0

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of fish based on the 3 highest 15 year old consumers is 18.7 kg/y
The observed 97.5 percentile rate based on 8 observations is 20.2 kg/y

10 year old age group

Observation number	Age	Bass	Dab	Dover sole	Herring	Mackerel	Mixed fish	Plaice	Salmon	Total
96	**10**		**0.7**	**2.8**	**0.3**	**1.1**		**2.0**		**6.9**
517	10					0.5				0.5

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of fish based on the only 10 year old consumer is 6.9 kg/y
The observed 97.5 percentile rate based on 2 observations is 6.7 kg/y

Table 7. Children's consumption rates of crustaceans in the Wylfa area (kg/y)

15 year old age group

Observation number	Age	Crab	Lobster	Total
464	**15**	**2.7**	**4.4**	**7.2**
362	**15**		**2.8**	**2.8**
363	**12**		**2.8**	**2.8**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of crustaceans based on the 3 highest 15 year old consumers is 4.3 kg/y
The observed 97.5 percentile rate based on 3 observations is 7.0 kg/y

10 year old age group

Observation number	Age	Crab	Lobster	Total
96	**10**	**2.1**	**3.9**	**6.0**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of crustaceans based on the only 10 year old consumer is 6.0 kg/y
The observed 97.5 percentile is not applicable for 1 observation

Table 8. Children's consumption rates of molluscs in the Wylfa area (kg/y)

15 year old age group

Observation number	Age	Mussel
119	**16**	**0.2**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of molluscs based on the only 15 year old consumer is 0.2 kg/y
The observed 97.5 percentile is not applicable for 1 observation

Table 9. Summary of adults' consumption rates in the Wylfa 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	85	21	51.2	17.7	22.2	25.4	15.0	40.0
Crustaceans	38	6	10.0	4.1	6.5	7.4	3.5	10.0
Molluscs	10	6	5.5	0.4	1.5	4.5	3.5	10.0
Green vegetables	30	12	44.4	16.3	26.7	44.4	15.0	45.0
Other vegetables	36	13	25.3	10.2	20.7	25.3	20.0	50.0
Root vegetables	31	17	31.8	13.6	21.0	31.8	10.0	40.0
Potato	40	13	131.0	50.0	104.3	131.0	50.0	120.0
Domestic fruit	53	13	38.0	13.6	28.6	35.8	20.0	75.0
Milk	27	27	212.8	73.9	140.3	193.1	95.0	240.0
Cattle meat	6	4	37.8	37.8	37.8	37.8	15.0	45.0
Pig meat	2	2	16.9	16.9	16.9	16.9	15.0	40.0
Sheep meat	39	24	17.0	5.7	8.0	17.0	8.0	25.0
Poultry	23	8	3.6	1.2	1.6	2.4	10.0	30.0
Eggs	44	25	33.5	11.9	18.4	26.0	8.5	25.0
Wild/free foods	41	7	9.5	3.4	5.6	9.5	7.0	25.0
Rabbits/hares	8	4	1.8	0.9	1.4	1.8	6.0	15.0
Honey	2	2	4.5	4.5	4.5	4.5	2.5	9.5
Wild fungi	39	27	1.8	0.7	0.9	1.2	3.0	10.0
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Fish (freshwater)	3	3	0.2	0.2	0.2	0.2	15.0	40.0

ND = not determined
NC = not consumed

Table 10. Summary of 15 year old children's consumption rates in the Wylfa 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	3	20.8	17.7	18.7	20.2	6.5	20.0
Crustaceans	3	3	7.2	2.8	4.3	7.0	2.5	6.0
Molluscs	1	1	0.2	0.2	0.2	NA	2.5	6.0
Green vegetables	2	2	4.3	4.3	4.3	4.3	9.0	25.0
Other vegetables	NC	NC	NC	NC	NC	NC	10.0	30.0
Root vegetables	NC	NC	NC	NC	NC	NC	7.5	20.0
Potato	NC	NC	NC	NC	NC	NC	60.0	130.0
Domestic fruit	3	1	11.4	11.4	11.4	10.9	15.0	50.0
Milk	4	4	145.2	103.7	126.1	143.9	110.0	260.0
Cattle meat	1	1	37.8	37.8	37.8	NA	15.0	35.0
Pig meat	3	3	16.9	16.9	16.9	16.9	10.0	30.0
Sheep meat	6	4	9.4	7.9	9.0	9.4	5.5	15.0
Poultry	1	1	0.5	0.5	0.5	NA	6.5	20.0
Eggs	5	4	26.0	13.6	16.7	24.8	7.0	25.0
Wild/free foods	2	2	0.2	0.2	0.2	0.2	3.0	13.0
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	NC	NC	NC	NC	NC	NC	2.0	5.0
Wild fungi	2	2	0.5	0.5	0.5	0.5	2.0	5.5
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Fish (freshwater)	NC	NC	NC	NC	NC	NC	6.5	20.0

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

Table 11. Summary of 10 year old children's consumption rates in the Wylfa 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	2	1	6.9	6.9	6.9	6.7	6.0	20.0
Crustaceans	1	1	6.0	6.0	6.0	NA	2.5	7.0
Molluscs	NC	NC	NC	NC	NC	NC	2.5	7.0
Green vegetables	1	1	6.8	6.8	6.8	NA	6.0	20.0
Other vegetables	1	1	6.9	6.9	6.9	NA	8.0	25.0
Root vegetables	1	1	11.5	11.5	11.5	NA	6.0	20.0
Potato	1	1	10.9	10.9	10.9	NA	45.0	85.0
Domestic fruit	1	1	0.3	0.3	0.3	NA	15.0	50.0
Milk	2	2	127.8	103.7	115.7	127.1	110.0	240.0
Cattle meat	NC	NC	NC	NC	NC	NC	15.0	30.0
Pig meat	1	1	16.9	16.9	16.9	NA	8.5	25.0
Sheep meat	1	1	9.4	9.4	9.4	NA	4.0	10.0
Poultry	NC	NC	NC	NC	NC	NC	5.5	15.0
Eggs	3	2	13.6	5.9	9.7	13.2	6.5	20.0
Wild/free foods	2	1	1.7	1.7	1.7	1.7	3.0	11.0
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	NC	NC	NC	NC	NC	NC	2.0	7.5
Wild fungi	NC	NC	NC	NC	NC	NC	1.5	4.5
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Fish (freshwater)	NC	NC	NC	NC	NC	NC	6.0	20.0

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

Table 12. Summary of 5 year old children's consumption rates in the Wylfa 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	1	1	6.8	6.8	6.8	NA	ND	ND
Other vegetables	1	1	6.9	6.9	6.9	NA	ND	ND
Root vegetables	1	1	11.5	11.5	11.5	NA	ND	ND
Potato	2	1	10.9	10.9	10.9	10.7	ND	ND
Domestic fruit	1	1	0.3	0.3	0.3	NA	ND	ND
Milk	2	2	127.8	127.8	127.8	127.8	ND	ND
Cattle meat	1	1	2.5	2.5	2.5	NA	ND	ND
Pig meat	NC	NC	NC	NC	NC	NC	ND	ND
Sheep meat	1	1	2.9	2.9	2.9	NA	ND	ND
Poultry	NC	NC	NC	NC	NC	NC	ND	ND
Eggs	1	1	5.9	5.9	5.9	NA	ND	ND
Wild/free foods	4	2	1.8	1.7	1.8	1.8	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
Fish (freshwater)	NC	NC	NC	NC	NC	NC	ND	ND

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

Table 13. Intertidal occupancy rates in the Wylfa area (h/y)

Observation number	Location	Activity	Mud and stone	Rock	Sand	Sand and stone
48	**Local beaches**	**Bait digging**/angling	**26**	45	45	
519	**Amlwch**	**Angling**		**384**		
471-472	**Wylfa Head**	**Angling**		**242**		
117	**Local beaches**	**Angling**		**208**		**208**
349	**Wylfa Head**	**Angling**		**198**		
351	**Wylfa Head**	**Angling**		**198**		
380-381	**Bull Bay**	**Angling**		**156**		
465-466	Wylfa Head	Angling		120		
469	Wylfa Head	Angling		120		
377-378	Wylfa Head	Angling		108		
353	Wylfa Head	Angling		100		
356	Wylfa Head	Angling		100		
394	Bull Bay/Cemlyn Bay	Angling/bait digging		96	6	
395	Bull Bay	Angling		96		
520	Local beaches	Angling		96		
107-108	Local beaches	Angling		81		
94	Bull Bay	Working on the shore		60		
398-399	Point Lynas	Angling		60		
400-401	Point Lynas	Angling		28		
447-449	Point Lynas	Angling		28		
98-102	Bull Bay	Angling		20		
526-527	Local beaches	Angling		15		
509	Wylfa Head	Angling		12		
517-518	Local beaches	Angling		8		
486-488	**Cemaes Bay**	**Dog walking**			**365**	
369	**Local beaches**	**Angling**			**300**	
371	**Local beaches**	**Angling**			**300**	
396	**Cemaes Bay**	**Beach warden**			**220**	
513-515	**Cemaes Bay**/Cemlyn Bay	**Dog walking**			**152**	23
47	Cestyll Beach	Playing			100	
49	Cestyll Beach	Playing			100	
55	Cestyll Beach	Playing			100	
57	Cestyll Beach	Playing			100	
373-374	Cemlyn Bay	Walking			52	
384-389	Bull Bay	Walking			52	
397	Cemaes Bay	Beach warden			44	
46	Cestyll Beach	Playing			40	
50-52	Cestyll Beach	Playing			40	

Table 13. Intertidal occupancy rates in the Wylfa area (h/y)

Observation number	Location	Activity	Mud and stone	Rock	Sand	Sand and stone
54	Cestyll Beach	Playing			40	
56	Cestyll Beach	Playing			40	
84	Cemaes Bay	Walking			33	
119	Cemaes Bay	Walking			30	
110-111	Point Lynas/Cemlyn Bay	Walking			18	18
511-512	**Cemlyn Bay**	**Nature reserve warden**				**420**
85	**Local beaches**	**Working on the shore**				**240**
1	**Cestyll Beach/Local beaches**	**Shellfish collecting/walking**				**162**
112-116	Local beaches	Walking				91
24	Cemaes Bay/Cemlyn Bay	Walking				72
26-30	Cemaes Bay/Cemlyn Bay	Walking				72
67-68	Cemlyn Bay	Walking				72
96-97	Bull Bay	Playing				60
2	Local beaches	Walking				52
516	Cemlyn Bay	Dog walking				48
62-64	Porth-y-pistyll/Hen Borth	Walking				44
79	Bull Bay	Playing				40
80-82	Bull Bay	Playing				40
522	Local beaches	Dog walking				39
59-60	Cemlyn Bay	Walking				30
86-92	Local beaches	Working on the shore				20
69-70	Cemlyn Bay	Walking				13
134	Carmel Head/Hen Borth	Shellfish collecting				9
103-106	Cemlyn Bay	Angling				8
15	Cemlyn Bay	Shellfish collecting				6
71	Cemlyn Bay	Walking				5

Notes

Emboldened observations are the critical group members

The critical group intertidal occupancy rate over mud and stones based on 1 observation is 26 h/y

The observed 97.5 percentile rate is not applicable for 1 observation

The critical group intertidal occupancy rate over rock based on 8 observations is 223 h/y

The observed 97.5 percentile rate based on 39 observations for rock is 249 h/y

The critical group intertidal occupancy rate over sand based on 9 observations is 263 h/y

The observed 97.5 percentile rate based on 34 observations for sand is 365 h/y

The critical group intertidal occupancy rate over sand and stones based on 5 observations is 290 h/y

The observed 97.5 percentile rate based on 50 observations for sand and stones is 380 h/y

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

Observation number	Location	Activity	Fishing gear	Sediment
361	**Carmel Head to Hell's Mouth**	**Gear handling**	**808**	
360	**Carmel Head to Hell's Mouth**	**Gear handling**	**718**	
375	**Carmel Head to Hell's Mouth**	**Gear handling**	**660**	
376	**Carmel Head to Hell's Mouth**	**Gear handling**	**660**	
147	**Carmel Head to Hell's Mouth**	**Gear handling**	**609**	
148	**Carmel Head to Hell's Mouth**	**Gear handling**	**609**	
143	**Carmel Head to Hell's Mouth**	**Gear handling**	**583**	
146	**Carmel Head to Hell's Mouth**	**Gear handling**	**583**	
364	**Carmel Head to Wylfa Head**	**Gear handling**	**495**	
368	**Carmel Head to Wylfa Head**	**Gear handling**	**488**	
357	**Carmel Head to Hell's Mouth**	**Gear handling**	**416**	
83	**Various**	**Gear handling**	**270**	
365	Carmel Head to Hell's Mouth	Gear handling	260	
94	Bull Bay	Gear handling	180	
15	Cemlyn Bay	Gear handling/shellfish collecting	120	6
17	Cemlyn Bay	Gear handling	120	
21	Cemlyn Bay	Gear handling	120	
390	Cemaes Bay to Point Lynas	Gear handling	47	
48	**Local beaches**	**Bait digging**		**26**
134	**Carmel Head/Hen Borth**	**Shellfish collecting**		**9**
1	Cestyll Beach	Shellfish collecting		6
394	Cemlyn Bay	Bait digging		6

Notes

Emboldened observations are the critical group members

The critical group fishing gear handling rate based on 12 observations is 575 h/y

The observed 97.5 percentile rate based on 18 observations for fishing gear is 770 h/y

The critical group sediment handling rate based on 2 observations is 18 h/y

The observed 97.5 percentile rate based on 5 observations for sediment is 24 h/y

Table 15. Gamma dose rate measurements over intertidal substrates in the Wylfa area (µGy/h)

Location	NGR	Substrate	Gamma dose rate at 1 metre
Cemlyn Bay	SH 335 932	Sand and stone	0.0568
Cemlyn Bay	SH 335 932	Sand and mud	0.0500
Cemaes Bay	SH 374 937	Sand	0.0579
Bull Bay	SH 427 944	Seaweed and stone	0.1092
Porth Eilian	SH 478 930	Sand	0.0729

Table 16. Occupancy rates in and on water in the Wylfa area (h/y)

Observation number	Location	Activity	In water	On water
392-393	Carmel Head to Point Lynas	Diving/working on a charter boat	130	690
149-348	Local wrecks and coastline	Diving/boating	100	750
46	Cestyll Beach	Swimming/canoeing	30	30
50-52	Cestyll Beach	Swimming/canoeing	30	30
54	Cestyll Beach	Swimming/canoeing	30	30
56*	Cestyll Beach	Swimming/canoeing	30	30
454, 455*, 456*	Various	Diving/boating	20	95
119*	Cemaes Bay	Swimming	12	
84	Cemaes Bay	Swimming	6	
361	Carmel Head to Hell's Mouth	Commercial fishing		1248
446	Cemaes Bay to Point Lynas	Charter boat skipper		1248
375-376	Carmel Head to Hell's Mouth	Commercial fishing		1242
360	Carmel Head to Hell's Mouth	Commercial fishing		1140
143	Carmel Head to Hell's Mouth	Commercial fishing		1130
146	Carmel Head to Hell's Mouth	Commercial fishing		1130
147-148	Carmel Head to Hell's Mouth	Commercial fishing		1080
413	Carmel Head to Point Lynas	Charter boat skipper		928
368	Carmel Head to Wylfa Head	Commercial fishing		682
364	Carmel Head to Wylfa Head	Commercial fishing		594
357	Carmel Head to Hell's Mouth	Commercial fishing		468
390	Cemaes Bay to Point Lynas	Commercial fishing		468
458-459	Bull Bay	Sea angling		429
365	Carmel Head to Hell's Mouth	Commercial fishing		416
462	Bull Bay	Hobby fishing		336
463-464*	Bull Bay	Sea angling		336
434	Carmel Head to Point Lynas	Canoeing		312
482-483	Bull Bay	Sea angling		280
83	Various	Commercial fishing		270
117	Cemaes Bay	Sea angling		240
94	Bull Bay	Hobby fishing		180
380-381	Bull Bay	Sea angling		156
15	Cemlyn Bay	Hobby fishing		120
17	Cemlyn Bay	Hobby fishing		120
21	Cemlyn Bay	Hobby fishing		120
414-433	Point Lynas	Canoeing		120
523	Various	Sea angling		117
521	Various	Rowing		104
579-593	Various	Rowing		104
594-595	Various	Sailing		100
525	Various	Sea angling		54
369	Bull Bay	Sea angling		48
371	Bull Bay	Sea angling		48
402-412	Carmel Head to Point Lynas	Sea angling		30
526-527*	Bull Bay	Boating		11

* Observation numbers 56, 119, 455, 456, 464 and 527 are for a 15 year old, a 16 year old, a 16 year old, a 14 year old, a 15 year old and a 12 year old respectively

Table 17. Adults' consumption rates of green vegetables in the Wylfa area (kg/y)

Observation number	Artichoke (globe)	Asparagus	Broccoli	Brussel sprout	Cabbage	Cauliflower	Courgettes	Cucumber	Herbs	Lettuce	Marrow	Rocket	Spinach	Total
501							**16.6**	**8.5**	**0.5**	**4.5**	**10.8**	**0.9**	**2.7**	**44.4**
500							**16.6**	**8.5**	**0.5**	**4.5**	**10.8**	**0.9**	**2.7**	**44.4**
481					**21.3**					**5.2**				**26.5**
556	**2.3**		**4.8**	**2.9**	**4.7**	**2.9**	**2.8**			**1.9**			**2.2**	**24.6**
557	**2.3**		**4.8**	**2.9**	**4.7**	**2.9**	**2.8**			**1.9**			**2.2**	**24.6**
560	**2.3**		**4.8**	**2.9**	**4.7**	**2.9**	**2.8**			**1.9**			**2.2**	**24.6**
558	**2.3**		**4.8**	**2.9**	**4.7**	**2.9**	**2.8**			**1.9**			**2.2**	**24.6**
559	**2.3**		**4.8**	**2.9**	**4.7**	**2.9**	**2.8**			**1.9**			**2.2**	**24.6**
561	**2.3**		**4.8**	**2.9**	**4.7**	**2.9**	**2.8**			**1.9**			**2.2**	**24.6**
562	**2.3**		**4.8**	**2.9**	**4.7**	**2.9**	**2.8**			**1.9**			**2.2**	**24.6**
139							**5.4**						**10.9**	**16.3**
140							**5.4**						**10.9**	**16.3**
570				0.9	5.7	2.7	1.8			2.4				13.6
571				0.9	5.7	2.7	1.8			2.4				13.6
132								5.4					1.8	7.3
133								5.4					1.8	7.3
126							6.9							6.9
127							6.9							6.9
477							1.8			2.5				4.3
478							1.8			2.5				4.3
546		1.3	0.5							2.5				4.3
547		1.3	0.5							2.5				4.3
574				0.2	1.4	0.7	0.5			0.6				3.4
575				0.2	1.4	0.7	0.5			0.6				3.4
576				0.2	1.4	0.7	0.5			0.6				3.4
577				0.2	1.4	0.7	0.5			0.6				3.4
120								3.4						3.4
121								3.4						3.4
438										0.3	1.6			1.9
439										0.3	1.6			1.9

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 12 highest adult consumers is 26.7 kg/y

The observed 97.5 percentile rate based on 30 observations is 44.4 kg/y

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

Observation number	Broad bean	Chilli pepper	French bean	Mangetout	Pea	Pepper	Runner bean	Squash	Sweetcorn	Tomato	Total
500-501					**2.7**				**1.0**	**21.6**	**25.3**
562	**4.2**		**1.4**	**2.5**	**2.4**	**1.3**	**10.5**	**0.2**	**0.3**	**1.6**	**24.4**
556-561	**4.2**		**1.4**	**2.5**	**2.4**	**1.3**	**10.5**	**0.2**	**0.3**	**1.6**	**24.4**
570-571	**3.6**	**0.6**	**0.7**	**3.6**		**1.2**	**2.7**		**0.7**	**0.7**	**13.9**
546-547			**3.0**							**7.2**	**10.2**
120-121										7.9	7.9
126-127	4.5				2.7						7.3
139-140	5.7										5.7
72-76							5.4				5.4
132-133										5.4	5.4
574-577	0.9	0.1	0.2	0.9		0.3	0.7		0.2	0.2	3.5
65-66					3.4						3.4
438-439	0.8				0.4					2.2	3.4
117-118										1.1	1.1

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 13 highest adult consumers is 20.7 kg/y

The observed 97.5 percentile rate based on 36 observations is 25.3 kg/y

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

Observation number	Artichoke (Jerusalem)	Beetroot	Carrot	Celeriac	Celery	Garlic	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
139		**5.7**					**12.5**	**13.6**							**31.8**
140		**5.7**					**12.5**	**13.6**							**31.8**
493			**4.5**						**3.6**			**2.0**	**13.6**	**5.4**	**29.1**
494			**4.5**						**3.6**			**2.0**	**13.6**	**5.4**	**29.1**
570		**2.7**	**4.5**			**0.5**	**2.5**	**6.1**	**1.4**		**4.5**	**0.8**			**22.9**
571		**2.7**	**4.5**			**0.5**	**2.5**	**6.1**	**1.4**		**4.5**	**0.8**			**22.9**
500	**10.9**							**10.8**		**0.5**					**22.2**
501	**10.9**							**10.8**		**0.5**					**22.2**
556		**1.4**		**1.0**	**1.7**	**0.2**	**1.4**	**4.2**		**0.6**	**1.2**	**0.6**	**4.4**		**16.8**
560		**1.4**		**1.0**	**1.7**	**0.2**	**1.4**	**4.2**		**0.6**	**1.2**	**0.6**	**4.4**		**16.8**
557		**1.4**		**1.0**	**1.7**	**0.2**	**1.4**	**4.2**		**0.6**	**1.2**	**0.6**	**4.4**		**16.8**
559		**1.4**		**1.0**	**1.7**	**0.2**	**1.4**	**4.2**		**0.6**	**1.2**	**0.6**	**4.4**		**16.8**
561		**1.4**		**1.0**	**1.7**	**0.2**	**1.4**	**4.2**		**0.6**	**1.2**	**0.6**	**4.4**		**16.8**
562		**1.4**		**1.0**	**1.7**	**0.2**	**1.4**	**4.2**		**0.6**	**1.2**	**0.6**	**4.4**		**16.8**
558		**1.4**		**1.0**	**1.7**	**0.2**	**1.4**	**4.2**		**0.6**	**1.2**	**0.6**	**4.4**		**16.8**
141								**13.6**							**13.6**
142								**13.6**							**13.6**
126		2.9					6.0								8.9
127		2.9					6.0								8.9
132							6.5								6.5
133							6.5								6.5
574		0.7	1.1			0.1	0.6	1.5	0.4		1.1	0.2			5.7
575		0.7	1.1			0.1	0.6	1.5	0.4		1.1	0.2			5.7
576		0.7	1.1			0.1	0.6	1.5	0.4		1.1	0.2			5.7
577		0.7	1.1			0.1	0.6	1.5	0.4		1.1	0.2			5.7
65		1.4	1.1							1.4					3.9
66		1.4	1.1							1.4					3.9
33		1.4	1.4												2.7
34		1.4	1.4												2.7
438								2.6							2.6
439								2.6							2.6

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 17 highest adult consumers is 21.0 kg/y

The observed 97.5 percentile rate based on 31 observations is 31.8 kg/y

Table 20. Adults' consumption rates of potato in the Wylfa area (kg/y)

Observation number	Potato
33	**131.0**
34	**131.0**
122	**117.9**
123	**117.9**
124	**117.9**
125	**117.9**
128	**117.9**
129	**117.9**
130	**117.9**
131	**117.9**
500	**50.1**
501	**50.1**
481	**50.0**
493	36.4
494	36.4
126	34.0
127	34.0
570	21.8
571	21.8
438	16.4
439	16.4
139	14.7
140	14.7
556	13.4
557	13.4
558	13.4
559	13.4
560	13.4
561	13.4
562	13.4
132	10.9
133	10.9
574	5.5
575	5.5
576	5.5
577	5.5
65	4.5
66	4.5
58	0.9
59	0.9

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of potato based on the 13 highest adult consumers is 104.3 kg/y

The observed 97.5 percentile rate based on 40 observations is 131.0 kg/y

Table 21. Adults' consumption rates of domestic fruit in the Wylfa area (kg/y)

Observation number	Apple	Blackberry	Blackcurrant	Cherry	Damson	Fig	Gooseberry	Grapes	Peach	Plum	Pumpkin	Raspberry	Redcurrant	Rhubarb	Strawberry	Tayberry	Total
500-501	**6.8**				**9.1**						**3.9**			**4.6**	**13.6**		**38.0**
557-560	**5.8**		**1.5**				**2.6**		**5.1**			**4.4**	**3.5**	**2.4**	**3.1**	**2.6**	**30.9**
556	**5.8**		**1.5**				**2.6**		**5.1**			**4.4**	**3.5**	**2.4**	**3.1**	**2.6**	**30.9**
561-562	**5.8**		**1.5**				**2.6**		**5.1**			**4.4**	**3.5**	**2.4**	**3.1**	**2.6**	**30.9**
493-494	**2.3**					**4.5**		**6.8**	**8.0**						**4.8**		**26.3**
139-140														**2.3**	**11.3**		**13.6**
9-12	11.4																11.4
14	11.4																11.4
35-36	2.3									7.9							10.2
120-121	2.3		1.1	0.1						4.5			1.1				9.2
1-2	4.5																4.5
546-547			1.0									1.0			0.5		2.5
134-138	0.9						0.9										1.8
72-76			1.1							0.5							1.6
477-478		0.5	0.5				0.5										1.5
563-565										1.3							1.3
438-439							1.2										1.2
65-66	0.2														0.7		0.9
570-571															0.6		0.6
574-577															0.2		0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 13 highest adult consumers is 28.6 kg/y

The observed 97.5 percentile rate based on 53 observations is 35.8 kg/y

Table 22. Adults' consumption rates of milk in the Wylfa area (l/y)

Observation number	Milk
35	**212.8**
566	**182.5**
567	**182.5**
548	**181.5**
549	**181.5**
122	**172.9**
123	**172.9**
124	**172.9**
9	**145.2**
10	**145.2**
11	**145.2**
12	**145.2**
134	**136.9**
135	**136.9**
136	**136.9**
137	**136.9**
23	**127.8**
24	**127.8**
25	**127.8**
26	**127.8**
31	**127.8**
138	**103.7**
504	**103.7**
505	**103.7**
506	**103.7**
475	**73.9**
476	**73.9**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of milk based on the 27 highest adult consumers is 140.3 l/y

The observed 97.5 percentile rate based on 27 observations is 193.1 l/y

Table 23. Adults' consumption rates of cattle meat in the Wylfa area (kg/y)

Observation number	Beef
495	**37.8**
496	**37.8**
497	**37.8**
498	**37.8**
58	9.8
59	9.8

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of cattle meat based on the 4 highest adult consumers is 37.8 kg/y
The observed 97.5 percentile rate based on 6 observations is 37.8 kg/y

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

Observation number	Pork
440	**16.9**
441	**16.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of pig meat based on the 2 highest adult consumers is 16.9 kg/y
The observed 97.5 percentile rate based on 2 observations is 16.9 kg/y

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

Observation number	Lamb
35	**17.0**
36	**17.0**
58	**11.5**
59	**11.5**
440	**9.4**
441	**9.4**
495	**7.9**
496	**7.9**
497	**7.9**
498	**7.9**
435	**7.5**
436	**7.5**
437	**7.5**
1	**5.7**
2	**5.7**
33	**5.7**
34	**5.7**
502	**5.7**
503	**5.7**
563	**5.7**
564	**5.7**
565	**5.7**
568	**5.7**
569	**5.7**
134	4.5
135	4.5
136	4.5
137	4.5
138	4.5
15	3.8
16	3.8
17	3.8
18	3.8
19	3.8
20	3.8
21	3.8
22	3.8
477	2.8
478	2.8

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of sheep meat based on the 24 highest adult consumers is 8.0 kg/y

The observed 97.5 percentile rate based on 39 observations is 17.0 kg/y

Table 26. Adults' consumption rates of poultry in the Wylfa area (kg/y)

Observation number	Duck	Pheasant	Pigeon	Total
35	**0.9**	**2.7**		**3.6**
550		**1.4**		**1.4**
551		**1.4**		**1.4**
556		**1.4**		**1.4**
557		**1.4**		**1.4**
435	**1.2**			**1.2**
436	**1.2**			**1.2**
437	**1.2**			**1.2**
1		0.7		0.7
475		0.7		0.7
476		0.7		0.7
495		0.5		0.5
496		0.5		0.5
497		0.5		0.5
498		0.5		0.5
552		0.3		0.3
553		0.3		0.3
554		0.3		0.3
555		0.3		0.3
491			0.2	0.2
563		0.2		0.2
564		0.2		0.2
565		0.2		0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of poultry based on the 8 highest adult consumers is 1.6 kg/y

The observed 97.5 percentile rate based on 23 observations is 2.4 kg/y

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

Observation number	Chicken egg	Duck egg	Goose egg	Total
501	**33.5**			**33.5**
450	**26.0**			**26.0**
451	**26.0**			**26.0**
452	**26.0**			**26.0**
550	**20.8**			**20.8**
551	**20.8**			**20.8**
493	**10.4**	**5.9**	**4.4**	**20.7**
494	**10.4**	**5.9**	**4.4**	**20.7**
122	**18.0**			**18.0**
123	**18.0**			**18.0**
124	**18.0**			**18.0**
125	**18.0**			**18.0**
1	**17.8**			**17.8**
2	**17.8**			**17.8**
556	**17.8**			**17.8**
557	**17.8**			**17.8**
139	**14.8**			**14.8**
140	**14.8**			**14.8**
475	**14.8**			**14.8**
476	**14.8**			**14.8**
440	**13.6**			**13.6**
441	**13.6**			**13.6**
500	**11.9**			**11.9**
570	**11.9**			**11.9**
571	**11.9**			**11.9**
72	8.9			8.9
73	8.9			8.9
74	8.9			8.9
75	8.9			8.9
76	8.9			8.9
502	8.9			8.9
503	8.9			8.9
3	7.8			7.8
4	7.8			7.8
491	6.4			6.4
120	5.1			5.1
121	5.1			5.1
5	4.4			4.4
6	4.4			4.4
126	2.1			2.1
127	2.1			2.1
563	0.1			0.1
564	0.1			0.1
565	0.1			0.1

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of eggs based on the 25 highest adult consumers is 18.4 kg/y

The observed 97.5 percentile rate based on 44 observations is 26.0 kg/y

Table 28. Adults' consumption rates of wild/free foods in the Wylfa area (kg/y)

Observation number	Blackberry	Damson	Sloe	Total
120	**9.1**		**0.5**	**9.5**
121	**9.1**		**0.5**	**9.5**
75	**4.5**			**4.5**
481	**4.5**			**4.5**
578	**4.5**			**4.5**
35	**3.4**			**3.4**
36	**3.4**			**3.4**
563	2.7			2.7
564	2.7			2.7
565	2.7			2.7
1	2.3		0.2	2.5
2	2.3		0.2	2.5
58	1.8			1.8
59	1.8			1.8
61	1.7			1.7
62	1.7			1.7
126	0.7	0.9		1.6
127	0.7	0.9		1.6
123	0.9			0.9
570	0.9			0.9
550	0.7			0.7
551	0.7			0.7
9	0.6			0.6
10	0.6			0.6
14	0.6			0.6
15	0.5			0.5
16	0.5			0.5
17	0.5			0.5
18	0.5			0.5
19	0.5			0.5
20	0.5			0.5
21	0.5			0.5
22	0.5			0.5
134	0.4			0.4
135	0.4			0.4
136	0.4			0.4
137	0.4			0.4
138	0.4			0.4
23	0.2			0.2
24	0.2			0.2
25	0.2			0.2
26	0.2			0.2
31	0.2			0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of wild/free foods based on the 7 highest adult consumers is 5.6 kg/y

The observed 97.5 percentile rate based on 41 observations is 9.5 kg/y

Table 29. Adults' consumption rates of rabbits/hares in the Wylfa area (kg/y)

Observation number	Rabbit
132	**1.8**
133	**1.8**
35	**0.9**
491	**0.9**
552	0.1
553	0.1
554	0.1
555	0.1

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of rabbits/hares based on the 4 highest adult consumers is 1.4 kg/y
The observed 97.5 percentile rate based on 8 observations is 1.8 kg/y

Table 30. Adults' consumption rates of honey in the Wylfa area (kg/y)

Observation number	Honey
493	**4.5**
494	**4.5**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of honey based on the 2 highest adult consumers is 4.5 kg/y
The observed 97.5 percentile rate based on 2 observations is 4.5 kg/y

Table 31. Adults' consumption rates of wild fungi in the Wylfa area (kg/y)

Observation number	Mushrooms
481	**1.8**
120	**1.1**
121	**1.1**
134	**1.1**
135	**1.1**
136	**1.1**
137	**1.1**
138	**1.1**
563	**1.0**
564	**1.0**
565	**1.0**
1	**0.9**
2	**0.9**
122	**0.9**
126	**0.9**
127	**0.9**
35	**0.7**
550	**0.7**
551	**0.7**
15	**0.7**
16	**0.7**
17	**0.7**
18	**0.7**
19	**0.7**
20	**0.7**
21	**0.7**
22	**0.7**
477	0.5
478	0.5
132	0.5
133	0.5
548	0.5
549	0.5
578	0.3
9	0.2
10	0.2
14	0.2
58	0.1
59	0.1

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of wild fungi based on the 27 highest adult consumers is 0.9 kg/y
The observed 97.5 percentile rate based on 39 observations is 1.2 kg/y

Table 32. Adults' consumption rates of fish (freshwater) in the Wylfa area (kg/y)

Observation number	Rainbow trout
563	**0.2**
564	**0.2**
565	**0.2**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of fish (freshwater) based on the 3 highest adult consumers is 0.2 kg/y
The observed 97.5 percentile rate based on 3 observations is 0.2 kg/y

Table 33. Children's consumption rates of green vegetables in the Wylfa area (kg/y)

15 year old age group

Observation number	Age	Brussel sprout	Cabbage	Cauliflower	Courgettes	Lettuce	Total
479	**15**				**1.8**	**2.5**	**4.3**
480	**13**				**1.8**	**2.5**	**4.3**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of green vegetables based on the 2 highest 15 year old consumers is 4.3 kg/y
The observed 97.5 percentile rate based on 2 observations is 4.3 kg/y

10 year old age group

Observation number	Age	Brussel sprout	Cabbage	Cauliflower	Courgettes	Lettuce	Total
572	**8**	**0.5**	**2.9**	**1.4**	**0.9**	**1.2**	**6.8**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of green vegetables based on the only 10 year old consumer is 6.8 kg/y
The observed 97.5 percentile is not applicable for 1 observation

5 year old age group

Observation number	Age	Brussel sprout	Cabbage	Cauliflower	Courgettes	Lettuce	Total
573	**5**	**0.5**	**2.9**	**1.4**	**0.9**	**1.2**	**6.8**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of green vegetables based on the only 5 year old consumer is 6.8 kg/y
The observed 97.5 percentile is not applicable for 1 observation

Table 34. Children's consumption rates of other vegetables in the Wylfa area (kg/y)

10 year old age group

Observation number	Age	Broad bean	Chilli pepper	French bean	Mangetout	Pepper	Runner bean	Sweetcorn	Tomato	Total
572	**8**	**1.8**	**0.3**	**0.4**	**1.8**	**0.6**	**1.4**	**0.3**	**0.3**	**6.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of other vegetables based on the only 10 year old consumer is 6.9 kg/y
The observed 97.5 percentile is not applicable for 1 observation

5 year old age group

Observation number	Age	Broad bean	Chilli pepper	French bean	Mangetout	Pepper	Runner bean	Sweetcorn	Tomato	Total
573	**5**	**1.8**	**0.3**	**0.4**	**1.8**	**0.6**	**1.4**	**0.3**	**0.3**	**6.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of other vegetables based on the only 5 year old consumer is 6.9 kg/y
The observed 97.5 percentile is not applicable for 1 observation

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

10 year old age group

Observation number	Age	Beetroot	Carrot	Garlic	Leek	Onion	Parsnip	Shallot	Spring onion	Total
572	**8**	**1.4**	**2.3**	**0.2**	**1.2**	**3.0**	**0.7**	**2.2**	**0.4**	**11.5**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of root vegetables based on the only 10 year old consumer is 11.5 kg/y
The observed 97.5 percentile is not applicable for 1 observation

5 year old age group

Observation number	Age	Beetroot	Carrot	Garlic	Leek	Onion	Parsnip	Shallot	Spring onion	Total
573	**5**	**1.4**	**2.3**	**0.2**	**1.2**	**3.0**	**0.7**	**2.2**	**0.4**	**11.5**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of root vegetables based on the only 5 year old consumer is 11.5 kg/y
The observed 97.5 percentile is not applicable for 1 observation

Table 36. Children's consumption rates of potato in the Wylfa area (kg/y)

10 year old age group

Observation number	Age	Potato
572	**8**	**10.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of potato based on the only 10 year old consumer is 10.9 kg/y
The observed 97.5 percentile is not applicable for 1 observation

5 year old age group

Observation number	Age	Potato
573	**5**	**10.9**
60	4	0.9

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of potato based on the only 5 year old consumer is 10.9 kg/y
The observed 97.5 percentile rate based on 2 observations is 10.7 kg/y

Table 37. Children's consumption rates of domestic fruit in the Wylfa area (kg/y)

15 year old age group

Observation number	Age	Apple	Blackberry	Blackcurrant	Gooseberry	Strawberry	Total
13	**16**	**11.4**					**11.4**
479	15		0.5	0.5	0.5		1.5
480	13		0.5	0.5	0.5		1.5

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of domestic fruit based on the only 15 year old consumer is 11.4 kg/y
The observed 97.5 percentile rate based on 3 observations is 10.9 kg/y

10 year old age group

Observation number	Age	Apple	Blackberry	Blackcurrant	Gooseberry	Strawberry	Total
572	**8**					**0.3**	**0.3**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of domestic fruit based on the only 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	Gooseberry	Strawberry	Total
573	**5**					**0.3**	**0.3**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of domestic fruit based on the only 5 year old consumer is 0.3 kg/y
The observed 97.5 percentile is not applicable for 1 observation

Table 38. Children's consumption rates of milk in the Wylfa area (l/y)

15 year old age group

Observation number	Age	Milk
13	**16**	**145.2**
27	**16**	**127.8**
32	**16**	**127.8**
507	**16**	**103.7**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of milk based on the 4 highest 15 year old consumers is 126.1 l/y
The observed 97.5 percentile rate based on 4 observations is 143.9 l/y

10 year old age group

Observation number	Age	Milk
28	**9**	**127.8**
508	**11**	**103.7**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of milk based on the 2 highest 10 year old consumers is 115.7 l/y
The observed 97.5 percentile rate based on 2 observations is 127.1 l/y

5 year old age group

Observation number	Age	Milk
30	**3**	**127.8**
29	**2**	**127.8**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of milk based on the 2 highest 5 year old consumers is 127.8 l/y
The observed 97.5 percentile rate based on 2 observations is 127.8 l/y

Table 39. Children's consumption rates of cattle meat in the Wylfa area (kg/y)

15 year old age group

Observation number	Age	Beef
499	**14**	**37.8**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of cattle meat based on the only 15 year old consumer is 37.8 kg/y
The observed 97.5 percentile is not applicable for 1 observation

5 year old age group

Observation number	Age	Beef
60	**4**	**2.5**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of cattle meat based on the only 5 year old consumer is 2.5 kg/y
The observed 97.5 percentile is not applicable for 1 observation

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

15 year old age group

Observation number	Age	Pork
445	**14**	**16.9**
442	**13**	**16.9**
444	**13**	**16.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of pig meat based on the 3 highest 15 year old consumers is 16.9 kg/y
The observed 97.5 percentile rate based on 3 observations is 16.9 kg/y

10 year old age group

Observation number	Age	Pork
443	**10**	**16.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of pig meat based on the only 10 year old consumer is 16.9 kg/y
The observed 97.5 percentile is not applicable for 1 observation

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

15 year old age group

Observation number	Age	Lamb
445	**14**	**9.4**
442	**13**	**9.4**
444	**13**	**9.4**
499	**14**	**7.9**
479	15	2.8
480	13	2.8

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of sheep meat based on the 4 highest 15 year old consumers is 9.0 kg/y
The observed 97.5 percentile rate based on 6 observations is 9.4 kg/y

10 year old age group

Observation number	Age	Lamb
443	**10**	**9.4**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of sheep meat based on the only 10 year old consumer is 9.4 kg/y
The observed 97.5 percentile is not applicable for 1 observation

5 year old age group

Observation number	Age	Lamb
60	**4**	**2.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of sheep meat based on the highest 5 year old consumer is 2.9 kg/y
The observed 97.5 percentile is not applicable for 1 observation

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

15 year old age group

Observation number	Age	Pheasant
499	**14**	**0.5**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of poultry based on the only 15 year old consumer is 0.5 kg/y
The observed 97.5 percentile is not applicable for 1 observation

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

15 year old age group

Observation number	Age	Chicken egg
453	**14**	**26.0**
445	**14**	**13.6**
442	**13**	**13.6**
444	**13**	**13.6**
7	12	4.4

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of eggs based on the 4 highest 15 year old consumers is 16.7 kg/y
The observed 97.5 percentile rate based on 5 observations is 24.8 kg/y

10 year old age group

Observation number	Age	Chicken egg
443	**10**	**13.6**
572	**8**	**5.9**
8	9	4.4

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of eggs based on the 2 highest 10 year old consumers is 9.7 kg/y
The observed 97.5 percentile rate based on 3 observations is 13.2 kg/y

5 year old age group

Observation number	Age	Chicken egg
573	**5**	**5.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of eggs based on the only 5 year old consumer is 5.9 kg/y
The observed 97.5 percentile is not applicable for 1 observation

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

15 year old age group

Observation number	Age	Blackberry
27	**16**	**0.2**
32	**16**	**0.2**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of wild/free foods 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	Blackberry
63	**7**	**1.7**
28	9	0.2

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of wild/free foods based on the only 10 year old consumer is 1.7 kg/y
The observed 97.5 percentile rate based on 2 observations is 1.7 kg/y

5 year old age group

Observation number	Age	Blackberry
60	**4**	**1.8**
64	**4**	**1.7**
30	3	0.2
29	2	0.2

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of wild/free foods based on the 2 highest 5 year old consumers is 1.8 kg/y
The observed 97.5 percentile rate based on 4 observations is 1.8 kg/y

Table 45. Children's consumption rates of wild fungi in the Wylfa area (kg/y)

15 year old age group

Observation number	Age	Mushrooms
479	**15**	**0.5**
480	**13**	**0.5**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of wild fungi based on the 2 highest 15 year old consumers is 0.5 kg/y
The observed 97.5 percentile rate based on 2 observations is 0.5 kg/y

Table 46. Percentage contribution each food type makes to its terrestrial food group for adults

Green vegetables	
Courgettes	20.8 %
Cabbage	17.1 %
Spinach	11.1 %
Lettuce	10.9 %
Cucumber	8.3 %
Broccoli	8.3 %
Cauliflower	6.8 %
Marrow	6.0 %
Brussel sprout	5.6 %
Artichoke	3.9 %
Asparagus	0.6 %
Rocket	0.4 %
Herbs	0.2 %
Other vegetables	
Runner bean	28.7 %
Tomato	27.5 %
***Broad bean**	16.5 %
Pea	9.4 %
Mangetout	7.4 %
French bean	4.7 %
Pepper	3.3 %
Sweetcorn	1.6 %
Chilli pepper	0.4 %
Squash	0.4 %
Root vegetables	
***Onion**	29.9 %
Leek	15.8 %
Swede	13.5 %
***Beetroot**	9.5 %
Carrot	6.4 %
Shallot	5.1 %
Artichoke	5.1 %
Celery	2.8 %
Parsnip	2.7 %
Spring onion	2.5 %
Turnip	2.5 %
Radish	1.9 %
Celeriac	1.7 %
Garlic	0.6 %

Domestic fruit	
***Apple**	27.0 %
Strawberry	16.5 %
Peach	10.1 %
Raspberry	6.3 %
Plum	6.1 %
Rhubarb	5.9 %
Redcurrants	5.2 %
Gooseberry	5.0 %
Blackcurrant	3.7 %
Damson	3.5 %
Tayberry	3.5 %
Grapes	2.6 %
Fig	1.8 %
Pumpkin	1.5 %
Blackberry	1.2 %
Cherry	0.04 %
Poultry	
Pheasant	74.9 %
Duck	23.9 %
Pigeon	1.2 %
Eggs	
Chicken egg	96.1 %
Duck egg	2.2 %
Goose egg	1.7 %
Rabbits/hares	
Rabbit	100.0 %
Wild/free foods	
***Blackberry**	95.5 %
Damson	2.6 %
Sloe	1.9 %
Fish (freshwater)	
Rainbow trout	100.0 %

Notes

Food types astrisked and emboldened were monitored by FSA in 2003 (EA, EHS, FSA and SEPA, 2004)
Other foods monitored were milk, barley, honey, and potato
Percentages are based on the consumption of all adults in the survey consuming that particular food group

Table 47. Occupancy rates in the Wylfa direct radiation survey area for adults and children (h/y)

Observation Number	Age (in years) (U if unknown)	Distance from site perimeter fence (km)	Indoor occupancy	Outdoor occupancy	Total occupancy
0 to 0.25 km zone					
38	40	0.25		1872	1872
533	U	0.05	1124	296	1420
37	65	0.25		365	365
534	U	0.05	180	180	360
535	U	0.05	180	180	360
536	U	0.05	180	180	360
537	U	0.05	180	180	360
538	U	0.05	180	180	360
539	U	0.05	180	180	360
540	U	0.05	180	180	360
541	U	0.05	180	180	360
542	U	0.05	180	180	360
543	U	0.05	180	180	360
544	U	0.05	180	180	360
545	U	0.05	180	180	360
471	32	0.25		252	252
472	33	0.25		252	252
349	45	0.25		208	208
351	35	0.25		208	208
465	45	0.25		130	130
466	45	0.25		130	130
469	39	0.25		130	130
377	55	0.25		118	118
378	30	0.25		118	118
353	29	0.25		110	110
356	28	0.25		110	110
509	50	0.25		12	12
0.25 to 0.5 km zone					
1	62	0.40		6	6
0.5 to 1.0 km zone					
73	63	0.60	8052	364	8416
75	63	0.60	7743	601	8344
72	56	0.60	7610	338	7948
65	76	0.70	7214	702	7916
40	30	0.65	7692	91	7783
42	1	0.65	7692	91	7783
66	63	0.70	7188	546	7734
41	2	0.65	7437	91	7528

Table 47. Occupancy rates in the Wylfa direct radiation survey area for adults and children (h/y)

Observation Number	Age (in years) (U if unknown)	Distance from site perimeter fence (km)	Indoor occupancy	Outdoor occupancy	Total occupancy
528	44	0.90	6281	1036	7317
529	32	0.90	6281	1036	7317
64	4	0.60	6884	221	7105
62	39	0.60	6759	338	7097
69	62	0.60	6699	183	6882
78	54	0.60	6552	192	6744
63	7	0.60	6242	364	6606
44	51	0.80	5929	416	6345
43	62	0.80	4017	2132	6149
68	12	0.60	5613	410	6023
532	9	0.90	5307	680	5987
71	37	0.60	5635	156	5791
530	15	0.90	5391	370	5761
531	11	0.90	5391	370	5761
39	48	0.65	5400	221	5621
61	33	0.60	5062	104	5166
74	19	0.60	4764	384	5148
77	56	0.60	5060	52	5112
45	25	0.80	4904	208	5112
76	33	0.60	4024	1040	5064
67	33	0.60	4301	390	4691
70	70	0.60	2545	639	3184
491	23	0.70	2616	160	2776
492	19	0.70	2616	160	2776

Table 48. Analysis of occupancy rates in the Wylfa direct radiation survey area

0 to 0.25 km zone	
Number of hours per year	Number of observations
8000 to 8760	1
7000 to 8000	1
6000 to 7000	0
5000 to 6000	0
4000 to 5000	0
3000 to 4000	0
2000 to 3000	0
1000 to 2000	2
0 to 1000	25

0.25 to 0.5 km zone	
Number of hours per year	Number of observations
8000 to 8760	4
7000 to 8000	0
6000 to 7000	0
5000 to 6000	2
4000 to 5000	3
3000 to 4000	1
2000 to 3000	0
1000 to 2000	0
0 to 1000	1

0.5 to 1 km zone	
Number of hours per year	Number of observations
8000 to 8760	2
7000 to 8000	10
6000 to 7000	6
5000 to 6000	10
4000 to 5000	1
3000 to 4000	1
2000 to 3000	2
1000 to 2000	0
0 to 1000	0

Table 49. Gamma dose rate measurements for the Wylfa direct radiation survey (μGy/h)

Location	Distance (km)	NGR	Ground type	Gamma dose rate at 1 metre
House 1	0.2	SH 355 939	Indoors - wood	0.0856
House 1	0.2	SH 355 939	Grass	0.0775
House 2	0.5	SH 349 931	Indoors - wood	0.0762
House 2	0.5	SH 349 931	Grass	0.0655
House 3	0.6	SH 347 930	Indoors - concrete	0.1023
House 3	0.6	SH 347 930	Grass	0.0771
House 4	0.6	SH 351 930	Indoors - concrete	0.1208
House 4	0.6	SH 351 930	Grass	0.0743
House 5	0.6	SH 352 929	Indoors - wood	0.0634
House 5	0.6	SH 352 929	Grass	0.0683
House 6	0.6	SH 352 930	Indoors - concrete	0.0843
House 6	0.6	SH 352 930	Grass	0.0782
House 7	0.7	SH 343 932	Indoors - concrete	0.0881
House 7	0.7	SH 343 932	Grass	0.0714
House 8	0.7	SH 358 932	Indoors - wood	0.0887
House 8	0.7	SH 358 932	Grass	0.0783
House 9	0.7	SH 352 930	Indoors - concrete	0.0837
House 9	0.7	SH 352 930	Grass	0.0782
House 10	0.8	SH 343 931	Indoors - wood	0.0826
House 10	0.8	SH 343 931	Grass	0.0733
House 11	0.9	SH 357 929	Inside caravan	0.0689
House 11	0.9	SH 357929	Grass	0.0821
Background 1	3.7	SH 330 902	Potato field	0.0833
Background 2	4.5	SH 398 943	Grass	0.0815
Background 3	5.2	SH 388 896	Grass	0.0832

Table 50. Examples of food groups eaten and external exposure combinations by adults for consideration for dose assessment puposes

Combination number	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Fish (freshwater)	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	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	*	*	*					*				*	*	*	*			*					*		*				*
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	*	*						*				*	*	*	*			*	*										
34				*	*	*	*	*						*	*														

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

Observation number	Sex	Age in years (U if unknown)	Distance of residence from site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Fish (freshwater)	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	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	62	1.8	2.3	0.7	**1.0**					4.5				**5.7**	0.7	**17.8**	2.5			**0.9**					**162**		6				6
2	F	59	1.8		0.4	**1.0**					4.5				**5.7**		**17.8**	2.5			**0.9**					52						
3	M	60	1.8														7.8															
4	F	52	1.8														7.8															
5	M	U	U														4.4															
6	F	U	U														4.4															
9	M	49	2.0								11.4	**145.2**						0.6			0.2											
10	F	49	2.0								11.4	**145.2**						0.6			0.2											
11	F	19	2.0								11.4	**145.2**																				
12	F	18	2.0								11.4	**145.2**																				
14	F	75	2.0								11.4							0.6			0.2											
15	M	52	2.0		1.3	**0.4**									3.8			0.5			**0.7**					6	120	6		120		
16	F	49	2.0			**0.4**									3.8			0.5			**0.7**											
17	M	26	2.0		1.3										3.8			0.5			**0.7**						120			120		
18	M	23	2.0		1.3										3.8			0.5			**0.7**											
19	M	18	2.0												3.8			0.5			**0.7**											
20	F	23	2.0												3.8			0.5			**0.7**											
21	M	77	2.0												3.8			0.5			**0.7**						120			120		
22	F	76	2.0			**0.4**									3.8			0.5			**0.7**											
23	M	56	3.0									**127.8**						0.2														
24	F	49	3.0									**127.8**						0.2								72						
25	M	33	3.0									**127.8**						0.2														
26	F	30	3.0									**127.8**						0.2								72						
31	M	20	3.0									**127.8**						0.2														
33	M	73	2.7						2.7	**131.0**					**5.7**																	
34	F	73	2.7						2.7	**131.0**					**5.7**																	
35	M	58	3.5								10.2	**212.8**			**17.0**	**3.6**		**3.4**	**0.9**		**0.7**											
36	F	81	3.5								10.2				**17.0**			**3.4**														
37	M	65	2.5																													365
38	F	40	2.5																													1872
39	M	48	0.7																												5400	221
40	F	30	0.7																												7692	91
43	M	62	0.8																												4017	2132
44	F	51	0.8																												5929	416
45	F	25	0.8																												4904	208
46	M	42																							40				30	30	3006	52
47	F	40																							100						5042	730

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

Observation number	Sex	Age in years (U if unknown)	Distance of residence from site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Fish (freshwater)	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	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
48	M	25	U	9.8																			**26**	45	45			**26**				
50	F	22																							40				30	30	7850	598
51	M	21																							40				30	30	7872	312
52	M	20																							40				30	30	3996	156
53	F	25	U	9.8																												
54	F	18																							40				30	30	4236	156
58	M	33	1.8							0.9			9.8		**11.5**			1.8			0.1											
59	F	U	1.8							0.9			9.8		**11.5**			1.8			0.1					30						
61	M	33	0.6															1.7												5062	104
62	F	39	0.6															1.7								44				6759	338
65	M	76	0.7		0.7			3.4	3.9	4.5	0.9																			7214	702
66	F	63	0.7		0.7			3.4	3.9	4.5	0.9																			7188	546
67	F	33	0.6																							72				4301	390
69	F	62	0.6																							13				6699	183
70	M	70	0.6																							13				2545	639
71	M	37	0.6																							5				5635	156
72	F	56	0.6					5.4			1.6						8.9													7610	338
73	M	63	0.6					5.4			1.6						8.9													8052	364
74	M	19	0.6					5.4			1.6						8.9													4764	384
75	F	63	0.6					5.4			1.6						8.9	**4.5**												7743	601
76	M	33	0.6					5.4			1.6						8.9													4024	1040
77	M	56	0.6																											5060	52
78	F	54	0.6																											6552	192
83	M	55	7.0		0.2																						**270**					
84	F	58	2.1	1.6	2.0																				33				6			
85	M	40	U	2.8																						**240**						
86-92	M	U	U																							20						
94	M	60	7.0	**27.5**	**10.0**																			60			180			180		
95	F	42	7.0	6.9	**6.0**																											
98	M	U	U																					20								
99	F	U	U																					20								
103	M	56	540.0																							8						
104-106	M	U	U																							8						
107	M	53	67.0	1.9																				81								
108	F	43	67.0	1.9																				81								
109	F	18	67.0	1.9																												
110	M	44	45.0																						18	18						

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

Observation number	Sex	Age in years (U if unknown)	Distance of residence from site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Fish (freshwater)	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	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
111	F	54	45.0																						18	18						
112	M	37	170.0																							91						
113	F	38	170.0																							91						
114	F	64	170.0																							91						
117	M	40	2.1	6.5	2.1	0.2		1.1																**208**		**208**				240		
118	F	39	2.1	6.5	2.1	0.2		1.1																								
120	F	54	3.5				3.4	7.9			9.2						5.1	**9.5**		0.5	**1.1**											
121	M	56	3.5				3.4	7.9			9.2						5.1	**9.5**		0.5	**1.1**											
122	M	54	3.5							**117.9**		**172.9**					**18.0**				**0.9**											
123	F	52	3.5							**117.9**		**172.9**					**18.0**	0.9														
124	M	31	3.5							**117.9**		**172.9**					**18.0**															
125	F	30	3.5							**117.9**							**18.0**															
126	M	68	4.0				6.9	7.3	8.9	34.0							2.1	1.6			**0.9**											
127	F	37	4.0				6.9	7.3	8.9	34.0							2.1	1.6			**0.9**											
128	F	65	5.5							**117.9**																						
129	M	62	5.5							**117.9**																						
130	F	U	5.5							**117.9**																						
131	M	U	5.5							**117.9**																						
132	M	72	2.2				7.3	5.4	6.5	10.9									**1.8**		0.5											
133	F	67	2.2				7.3	5.4	6.5	10.9									**1.8**		0.5											
134	M	51	4.1		0.6	0.2					1.8	**136.9**			4.5			0.4			**1.1**					9		**9**				
135	F	46	4.1								1.8	**136.9**			4.5			0.4			**1.1**											
136	F	28	4.1		0.6	0.2					1.8	**136.9**			4.5			0.4			**1.1**											
137	M	30	4.1								1.8	**136.9**			4.5			0.4			**1.1**											
138	F	76	4.1								1.8	**103.7**			4.5			0.4			**1.1**											
139	M	61	3.8				**16.3**	5.7	**31.8**	14.7	**13.6**						**14.8**															
140	F	59	3.8				**16.3**	5.7	**31.8**	14.7	**13.6**						**14.8**															
141	M	34	3.8						**13.6**																							
142	F	31	3.8						**13.6**																							
143	M	54	1.8	5.0	2.2																						**583**			1130		
144	M	25	1.8	5.0	2.2																											
145	F	56	1.8	5.0	2.2																											
146	M	18	1.8																								**583**			1130		
147	M	43	U																								**609**			1080		
148	M	35	U																								**609**			1080		
149-248	M	U	U																										100	750		
249-348	F	U	U																										100	750		

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

Observation number	Sex	Age in years (U if unknown)	Distance of residence from site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Fish (freshwater)	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	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
349	M	45	U	5.3																				**198**								208
350	F	45	U	5.3																												
351	M	35	U	5.3																				**198**								208
352	F	35	U	5.3																												
353	M	29	U	9.8																				100								110
354	F	29	U	9.8																												
355	F	28	U	9.8																												
356	M	28	U	9.8																				100								110
357	M	52	U																								**416**			468		
358	M	55	U	15.5																												
359	F	55	U	**51.2**																												
360	M	32	U																								**718**			1140		
361	M	54	9.9																								**808**			1248		
364	M	U	U	3.6	3.2																						**495**			594		
365	M	27	U																								260			416		
366	F	U	U	3.6	3.2																											
367	M	U	U	3.6	3.2																											
368	M	44	U																								**488**			682		
369	M	45	U	7.0																					**300**					48		
370	F	45	U	7.0																												
371	M	45	U	7.0																					**300**					48		
372	F	45	U	7.0																												
373	M	U	U																					52								
374	F	U	U																					52								
375	M	25	U																								**660**			1242		
376	M	27	U	**24.0**	**4.1**																						**660**			1242		
377	M	55	U	3.6																				108								118
378	M	30	U	3.6																				108								118
379	F	55	U	3.6																												
380	M	25	U	**17.7**																				**156**						156		
381	M	18	U	**17.7**																				**156**						156		
382	M	U	U	**17.7**																												
383	F	U	U	**17.7**																												
384	F	30	U																						52							
385	F	31	U																						52							
386	F	33	U																						52							
390	M	29	U		0.6																						47			468		

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

Observation number	Sex	Age in years (U if unknown)	Distance of residence from site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Fish (freshwater)	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	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
391	F	26	U		0.6																											
392	M	36	U																										130	690		
393	M	46	U																										130	690		
394	M	56	U	7.0																				96	6			6				
395	F	53	U	7.0																				96								
396	M	23	U																						**220**							
397	F	22	U																						44							
398	M	45	U	1.0																				60								
399	F	42	U	1.0																				60								
400	M	37	U	2.8																				28								
401	F	36	U	2.8																				28								
402-412	M	40	U																											30		
413	M	57	U	1.8																										928		
414-423	M	40	U																											120		
424-433	F	40	U																											120		
434	M	40	U																											312		
435	M	69	4.5												**7.5**	**1.2**																
436	F	57	4.5												**7.5**	**1.2**																
437	M	20	4.5												**7.5**	**1.2**																
438	M	70	4.7				1.9	3.4	2.6	16.4	1.2																					
439	M	30	4.7				1.9	3.4	2.6	16.4	1.2																					
440	M	46	4.3											**16.9**	**9.4**		**13.6**															
441	F	40	4.3											**16.9**	**9.4**		**13.6**															
446	M	47	U	**18.8**	**4.3**																									1248		
447	M	27	U																					28								
448	M	45	U																					28								
449	M	31	U																					28								
450	M	47	3.4														**26.0**															
451	F	46	3.4														**26.0**															
452	M	17	3.4														**26.0**															
454	M	32	U	3.5																									20	95		
458	M	50	U	**22.1**																										429		
459	F	51	U	**22.1**																										429		
460	F	U	U	**22.1**																												
461	M	U	U	**22.1**																												
462	M	45	U	**20.8**	**7.2**	**5.5**																								336		
463	F	44	U	**20.8**	**7.2**																									336		

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

Observation number	Sex	Age in years (U if unknown)	Distance of residence from site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Fish (freshwater)	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	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
465	M	45	U	**17.7**																				120								
466	F	45	U	**17.7**																				120								
469	M	39	U	10.7																				120								
470	F	39	U	10.7																												
471	M	32	U	**23.6**																				**242**								
472	M	33	U	**23.6**																				**242**								
473-474	F	U	U	**17.7**																												
475	F	45	3.3									**73.9**				0.7	**14.8**															
476	M	45	3.3									**73.9**				0.7	**14.8**															
477	M	40	4.3				4.3				1.5				2.8						0.5											
478	F	38	4.3				4.3				1.5				2.8						0.5											
481	F	65	5.1				**26.5**			**50.0**								**4.5**			**1.8**											
482	M	55	U	11.3																										280		
483	M	30	U	11.3																										280		
484	F	55	U	11.3																												
485	F	30	U	11.3																												
486	M	45	U																						**365**							
487	F	45	U																						**365**							
488	F	U	U																						**365**							
489	M	83	[redacted]	2.2	0.3																										6708	1344
490	F	61	[redacted]	2.2	0.3																										7034	706
491	M	23	0.7													0.2	6.4		**0.9**												2616	160
492	F	19	0.7																												2616	160
493	M	64	5.0						**29.1**	36.4	**26.3**						**20.7**			**4.5**												
494	F	57	5.0						**29.1**	36.4	**26.3**						**20.7**			**4.5**												
495	M	49	3.5	1.0									**37.8**		**7.9**	0.5																
496	F	44	3.5	1.0									**37.8**		**7.9**	0.5																
497	M	19	3.5	1.0									**37.8**		**7.9**	0.5																
498	M	20	3.5	1.0									**37.8**		**7.9**	0.5																
500	M	U	2.0		0.1		**44.4**	**25.3**	**22.2**	**50.1**	**38.0**						**11.9**															
501	F	U	2.0		0.1		**44.4**	**25.3**	**22.2**	**50.1**	**38.0**						**33.5**															
502	M	65	2.0		0.4										**5.7**		8.9															
503	F	64	2.0		0.4										**5.7**		8.9															
504	M	43	1.7									**103.7**																				
505	F	38	1.7									**103.7**																				
506	M	18	1.7									**103.7**																				
509	M	50	U	3.7																				12								12

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

Observation number	Sex	Age in years (U if unknown)	Distance of residence from site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Fish (freshwater)	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	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
510	F	48	U	3.7																												
511	M	26	U																							**420**						
512	F	26	U																							**420**						
513	F	42	U																						**152**	23						
516	M	53	U																							48						
518	M	46	U	0.5																				8								
519	M	53	U	**25.6**																				**384**								
520	M	36	U	4.8																				96								
521	M	U	U																											104		
523	M	62	U	15.4																										117		
524	F	61	U	15.4																												
525	F	31	U																											54		
526	M	45	U																					15						11		
528	M	44	0.9																												6281	1036
529	F	32	0.9																												6281	1036
533	M	U	U																												1124	296
534-545	M	U	U																												180	180
546	M	U	2.8				4.3	**10.2**			2.5																					
547	F	U	2.8				4.3	**10.2**			2.5																					
548	M	U	3.8									**181.5**									0.5											
549	F	U	3.8									**181.5**									0.5											
550	M	56	4.2		0.2											**1.4**	**20.8**	0.7			**0.7**											
551	F	52	4.2		0.2											**1.4**	**20.8**	0.7			**0.7**											
552	M	63	4.2													0.3			0.1													
553	F	48	4.2													0.3			0.1													
554	F	22	4.2													0.3			0.1													
555	F	23	4.2													0.3			0.1													
556	M	62	3.2	2.5			**24.6**	**24.4**	**16.8**	13.4	**30.9**					**1.4**	**17.8**															
557	F	56	3.2	2.5			**24.6**	**24.4**	**16.8**	13.4	**30.9**					**1.4**	**17.8**															
558	M	63	3.2				**24.6**	**24.4**	**16.8**	13.4	**30.9**																					
559	F	52	3.2				**24.6**	**24.4**	**16.8**	13.4	**30.9**																					
560	F	23	3.2				**24.6**	**24.4**	**16.8**	13.4	**30.9**																					
561	M	21	3.2				**24.6**	**24.4**	**16.8**	13.4	**30.9**																					
562	M	18	3.2				**24.6**	**24.4**	**16.8**	13.4	**30.9**																					
563	M	35	2.2	0.3	0.2						1.3				**5.7**	0.2	0.1	2.7			**1.0**	**0.2**										
564	F	25	2.2	0.3	0.2						1.3				**5.7**	0.2	0.1	2.7			**1.0**	**0.2**										
565	F	72	2.2	0.3	0.2						1.3				**5.7**	0.2	0.1	2.7			**1.0**	**0.2**										

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

Observation number	Sex	Age in years (U if unknown)	Distance of residence from site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Fish (freshwater)	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	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
566	M	55	2.2									**182.5**																				
567	F	53	2.2									**182.5**																				
568	M	57	2.6												**5.7**																	
569	F	56	2.6												**5.7**																	
570	M	36	2.4				13.6	**13.9**	**22.9**	21.8	0.6						**11.9**	0.9														
571	F	32	2.4				13.6	**13.9**	**22.9**	21.8	0.6						**11.9**															
574	M	74	U				3.4	3.5	5.7	5.5	0.2																					
575	F	74	U				3.4	3.5	5.7	5.5	0.2																					
576	M	63	U				3.4	3.5	5.7	5.5	0.2																					
577	F	63	U				3.4	3.5	5.7	5.5	0.2																					
578	M	50	1.7															**4.5**			0.3											
579-585	M	U	U																											104		
586-593	F	U	U																											104		
594	M	64	U																											100		
595	F	62	U																											100		

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

Observation number	Sex	Age in years	Distance of residence from site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Wild fungi	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Occupancy in water	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																										
7	F	12	U														4.4									
68	M	12	0.6																			72			5613	410
363	F	12	9.9		**2.8**																					
522	M	12	U																			39				
527	M	12	U																	15				11		
442	M	13	4.3											**16.9**	**9.4**		**13.6**									
444	M	13	4.3											**16.9**	**9.4**		**13.6**									
480	F	13	4.3				**4.3**				**1.5**				2.8				**0.5**							
515	F	13	U																		**152**	23				
57	F	14																			100				8252	100
79	F	14	7.0																			40				
101	M	14	U																	20						
445	F	14	4.3											**16.9**	**9.4**		**13.6**									
453	F	14	3.4														**26.0**									
456	M	14	U	3.5																			20	95		
457	M	14	U	3.5																						
499	M	14	3.5	1.0									**37.8**		**7.9**	**0.5**										
56	F	15																			40		30	30	5542	300
362	F	15	9.9		**2.8**																					
464	F	15	U	**20.8**	**7.2**																			336		
468	F	15	U	**17.7**																						
479	F	15	4.3				**4.3**				**1.5**				2.8				**0.5**							
530	M	15	0.9																						5391	370
13	M	16	2.0								**11.4**	**145.2**														
27	F	16	3.0									**127.8**						**0.2**				72				
32	F	16	3.0									**127.8**						**0.2**								
100	M	16	U																	20						
119	F	16	2.1	2.2		**0.2**															30		12			
455	M	16	U	3.5																			20	95		
467	M	16	U	**17.7**																						
507	M	16	1.7									**103.7**														

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

Observation number	Sex	Age in years	Distance of residence from site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Wild fungi	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence
10 year old age group																										
63	F	7	0.6															**1.7**				44			6242	364
115	F	7	170.0																			91				
514	F	8	U																		**152**	23				
572	M	8	2.4				**6.8**	**6.9**	**11.5**	**10.9**	**0.3**						**5.9**									
8	M	9	U														4.4									
28	F	9	3.0									**127.8**						**0.2**				72				
82	F	9	7.0																			40				
532	F	9	0.9																						5307	680
80	F	10	7.0																			40				
81	F	10	7.0																			40				
96	F	10	7.0	**6.9**	**6.0**																	60				
97	F	10	7.0																			60				
443	M	10	4.3											**16.9**	**9.4**		**13.6**									
517	M	10	U	**0.5**																8						
102	M	11	U																	20						
508	M	11	1.7									**103.7**														
531	M	11	0.9																						5391	370
5 year old age group																										
29	M	2	3.0									**127.8**						0.2				72				
41	F	2	0.7																						7437	91
49	M	2																			100				7850	598
30	M	3	3.0									**127.8**						0.2				72				
389	M	3	U																		52					
60	F	4	1.8							**0.9**			**2.5**		**2.9**			**1.8**				30				
64	F	4	0.6															**1.7**				44			6884	221
116	F	4	170.0																			91				
388	M	4	U																		52					
573	F	5	2.4				**6.8**	**6.9**	**11.5**	**10.9**	**0.3**						**5.9**									
387	M	6	U																		52					
1 year old age group																										
42	M	1	0.7																						7692	91
3 month old age group																										
55	F	0.1																			100				4236	156

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 Wylfa adults' profiled habits data

Profile Name	Number of individuals	Pathway Name	Crustacea	Direct[4]	Eggs	Fish - Fresh	Fish - Sea	Fruit - Domestic	Fruit and Nuts - Wild	Gamma ext - Sediment[1]	Honey	Meat - Cattle	Meat - Game[2]	Meat - Pig	Meat - Poultry	Meat - Sheep	Milk	Mollusca	Mushrooms	Occupancy In Water	Occupancy On Water	Plume (IN; 0-0.25km)[3]	Plume (MID; 0.25-0.5km)[3]	Plume (OUT; 0.5-1km)[3]	Vegetables - Green	Vegetables - Other Domestic	Vegetables - Potatoes	Vegetables - Root
			kg		kg	kg	kg	kg	kg	h	kg	kg	kg	kg	kg	kg	l	kg	kg	h	h	h	h	h	kg	kg	kg	kg
Crustacean consumers	6		6.5				19.8											0.9			557							
Occupants for direct radiation	60			1.00	1.1		2.3	0.2	0.2	10						0.1				3	3	426	567	2441		0.6	0.2	0.1
Egg consumers	25		0.1	0.04	18.4		0.3	9.1	0.3	9	0.4			1.3	0.3	1.2	26.7	0.1	0.2						7.9	5.5	29.8	9.8
Fresh fish consumers	3		0.2		0.1	0.2	0.3	1.3	2.7						0.2	5.7			1.0									
Sea fish consumers	21		1.6	0.19			22.2											0.3			215	36						
Domestic fruit consumers	13				11.7		0.4	28.6			0.7				0.2										22.6	17.9	22.8	21.8
Wild fruit and nut consumers	7			0.14	2.7			5.8	5.6				0.1		0.5	4.8	30.4		0.7				1192	4.8	3.0	7.1	
Occupants for exposure - Sediment	12		0.2	0.08	1.5		2.1	0.4	0.2	295					0.1	0.5		0.1	0.1		28		1			0.1		
Honey consumers	2				20.7			26.3			4.5																36.4	29.1
Cattle meat consumers	4						1.0					37.8			0.5	7.9												
Game meat consumers	4			0.25	1.6			2.6	0.9				1.4		1.0	4.2	53.2		0.4					694	3.6	2.7	5.4	3.3
Pig meat consumers	2				13.6									16.9		9.4												
Poultry meat consumers	8				9.6		0.6	9.0	0.6				0.1		1.6	4.9	26.6		0.3						6.2	6.1	3.4	4.2
Sheep meat consumers	24		0.1	0.04	3.4		0.3	1.4	1.0	10		7.1		1.4	0.4	8.0	8.9	0.1	0.2								11.0	0.2
Milk consumers	27				3.1			2.4	0.3	6					0.2	1.5	140.3		0.3								13.1	
Mollusc consumers	6		1.6	0.17	5.9		3.8	1.5	1.1	37					0.1	3.8		1.5	0.6		76		1					
Mushroom consumers	27		0.3	0.04	4.1		0.1	1.9	1.9	8					0.3	3.6	38.4	0.1	0.9		13				1.7	1.1	8.7	0.7
Occupants in water	202																			100	749							
Occupants on water	219		0.1				0.4													93	760							
Occupants for plume pathways (inner area)	2		0.3	1.00			2.2															7896						
Occupants for plume pathways (middle area)	6			1.00						50										25	25		5668					
Occupants for plume pathways (outer area)	22		0.1	1.00	2.0			0.5	0.4	7														6404		1.5	0.4	0.4
Green vegetable consumers	12				9.2		0.4	26.6	0.4						0.2				0.2						26.7	19.4	22.8	18.8
Other domestic vegetable consumers	13				8.1		0.4	22.9	0.1						0.2										22.8	20.7	18.3	16.0
Potato consumers	13				9.0			5.8	0.4							0.9	39.9		0.2						8.9	3.9	104.3	3.8
Root vegetable consumers	17				10.3		0.3	21.9	0.1		0.5				0.2										18.9	15.3	20.0	21.0

Notes

1. Gamma ext - Sediment includes occupancy over mud and stone, sand, and sand and stone
2. Game meat includes rabbits/hares
3. Plume times are the sums of individuals' indoor and outdoor times
4. Expressed as proportion of group who are present within 1km of site