



Radiological Habits Survey: Devonport, 2004



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Radiological Habits Survey: Devonport, 2004

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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 Devonport Dockyard, Plymouth. The overall site consists of two parts, the Naval Base and Devonport Royal Dockyard. The Naval Base site (HMNB) is managed by the Ministry of Defence (MOD) and is under the control of the Naval Base Commander. Devonport Royal Dockyard is that part of the site owned and operated by Devonport Royal Dockyard Limited (known as DML). The DML site is licensed under the Nuclear Installations Act, 1965. The Environment Agency is responsible for regulating the disposal of radioactive waste from nuclear sites in England and Wales under the Radioactive Substances Act 1993 (RSA 93).

MOD is exempt from the Act, but it is Government Policy that MOD establishments should be controlled under the same terms and conditions by administrative means. In addition to compliance with the requirements of the Certificates of Approval, MOD also operates within the terms of other relevant statutory provisions e.g. Health and Safety at Work Act etc 1974.

Discharges of liquid, gaseous and solid radioactive wastes are made by DML under an authorisation granted by the Environment Agency under RSA93 and by HMNB under Approvals. Liquid radioactive wastes are discharged by DML into the Hamoaze and also into the dockyard sewer system. The latter discharge flows to Camels Head Sewage Treatment Plant (CHSTP) for processing, and the liquid component is then discharged into the Hamoaze. Authorised gaseous wastes from DML are discharged to the local environment.

Potential exposure pathways related to site include:

- consumption of locally sourced aquatic and terrestrial foods
- occupancy of intertidal areas
- handling fishing gear and sediment
- occupancy on and in water in the aquatic survey area

- 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
- occupancy in close proximity to the liquid or dried sewage sludge at Camels Head Sewage Treatment Plant
- disposal of the dried sewage sludge component

The survey investigated all of these pathways. Individuals from the local population were interviewed and the data obtained are presented and discussed. Data for 1863 individuals were collected. Gamma dose rate measurements were taken to supplement those made in routine surveillance programmes.

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

In the marine environment, the main activities potentially leading to external exposure included boat dwelling, commercial fishing, boat and shore angling, general boating, swimming and diving. The main handling pathways related to fishing gear and intertidal sediments.

Seaweed was identified being used as a fertiliser on an allotment plot in the terrestrial survey area. No farms were identified using seaweed as fertiliser or feed for animals.

At CHSTP, some employees spent time in close proximity to liquid or dried sewage sludge. The latter was then distributed to farms for field dressing.

In the terrestrial environment, up to 5 km from the site, the main activities included farming and allotment maintenance. It was noted that livestock at some farms consumed ground and spring water. Transfer of radioactive contamination from the site into the surrounding area by animals was investigated but none was found.

Within 1 km of the site perimeter, the main occupancies related to residents, schools, a college and employment. The highest occupancies were related to residences.

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 the previous aquatic survey; no previous terrestrial or direct radiation surveys have been undertaken.

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 DML and MOD at Devonport Dockyard. Potential exposure pathways are from discharges of liquid or gaseous radioactive wastes into the local environment, or from radiation emanating directly from the site. This report provides information about activities carried out by members of the public which may influence their radiation exposure. The study has been funded by the Environment Agency, the Food Standards Agency and the Health and Safety Executive in order to support their respective roles in protecting the public from the effects of radiation.

1.1 Regulatory framework

The Environment Agency regulates discharges of waste under the Radioactive Substances Act 1993 (RSA 93) (UK Parliament, 1993) as amended by the Environment Act 1995 (EA 95) (UK Parliament, 1995a) and by legislation implementing the European Union (EU) Basic Safety Standards (BSS) Directive 96/29/Euratom (CEC, 1996). This Directive takes account of Recommendations of the International Commission on Radiological Protection (ICRP), particularly ICRP 60 (ICRP, 1991). Authorisations under RSA 93 are issued by the Environment Agency after wide-ranging consultation, including the Food Standards Agency. As well as being a Statutory Consultee, the Food Standards Agency has responsibilities for ensuring that any radioactivity present in food does not compromise food safety and that authorised discharges of radioactivity do not result in unacceptable doses to consumers via the food chain. The Food Standards Agency also ensures that public radiation exposure via the food chain is within EU accepted limits. Consultation papers on Statutory Guidance to the Environment Agency on the regulation of radioactive waste discharges were issued by the Department for Environment, Food and Rural Affairs (Defra) in 2000 and the Welsh Assembly in 2002. These draft guidance documents include, *inter alia*, affirmation that protection of the critical groups of the public is the appropriate radiological protection methodology to use. This report provides information to support assessments of critical groups.

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

1.2 Radiological protection framework

UK policy on the control of radiation exposure has long been based on the Recommendations of ICRP which embody the principles of justification of practices, optimisation of protection and dose limitation. Radiological protection of the public is based on the concept of a critical group of individuals. This group is defined as those people who, because of where they live and their habits, receive the highest radiation dose due to the operations of a site. It follows that, if the dose to this group is acceptable when compared to relevant dose limits and constraints, other members of the public will receive lower doses, and overall protection is provided for.

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

DML refits naval vessels including nuclear submarines and refuels the latter. It will also be decommissioning three obsolete nuclear submarines in the near future. HMNB provides berths for naval shipping. The docks are located at Devonport, west Plymouth fronting the Hamoaze (see Figures 1 and 2).

DML is licensed to operate the site under NIA 65, and under RSA 93 it is authorised to discharge gaseous and liquid radioactive wastes. HMNB discharges liquid radioactive waste from the docks under administrative agreement. The gaseous radioactive wastes are discharged via stacks to the atmosphere and the majority of liquid radioactive wastes are discharged to the Hamoaze. A small amount of liquid wastes arising from DML's laundry and hygiene facilities enter the dock sewer and travel with the general sewage to CHSTP for the separation of the solid and liquid components. The solid matter is processed for agricultural use and the liquid component is discharged into the Hamoaze. Details of the discharges made by DML and HMNB are reported in the Radioactivity in Food and the Environment series of reports (EA, EHS, FSA and SEPA, 2004).

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 from the DML and HMNB sites in Devonport 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 Devonport area was in 1992. The data from this survey are currently being used for dose assessments for the Devonport area (e.g. EA, EHS, FSA and SEPA, 2004). No previous terrestrial or direct radiation habits surveys have been conducted around the site by CEFAS.

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 over intertidal substrates including boat dwelling, angling, bait digging, mollusc collection and other recreational activities
- External exposure due to handling commercial fishing gear and sediment
- Activities taking place on and in water in the survey area, including boat dwelling, commercial fishing, diving, boat angling and other recreational activities
- The types, seasonality of and extent of consumption of wild foods in the area
- The consumption and use of groundwater at farms in the terrestrial survey area
- Occupancy in close proximity to liquid and dried sewage sludge from CHSTP
- Uses of stream and groundwater
- 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 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 waters and intertidal shorelines north of a line between Cawsand, on the Cornish coast, through Plymouth Breakwater and onto the Devon coast, directly east of the breakwater. The area extended as far as the tidal limits of the rivers. The same area was used in the 1992 survey. Activities taking place at CHSTP were also investigated because some liquid discharges flow via the dockyard sewer to the plant.

The terrestrial survey area, shown in Figure 2, was defined as the circle to a radius of 5 km from the site centre (NGR SX 445 565), to encompass the main areas of potential deposition from gaseous discharges. Activities relating to springs and groundwater in this area were also investigated.

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

2.4 Conduct of the survey

The fieldwork component of the survey was carried out between 5th and 18th May 2004, by a survey team of four personnel, 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, DML, 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 10th May a meeting was held between the survey team, DML staff and a MOD representative at the 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 areas were contacted for information on any aspects relevant to the various exposure pathways. These included Defra fisheries officers, the Devon and Cornwall Sea Fisheries Committee, a wildfowling club representative, seafood retailers, local councils, the Devonport Beekeepers Association secretary and the Plymouth Tourist Information Centre.

A meeting was held on 11th May with representatives from CHSTP to discuss potential exposure pathways relating to the liquid and dried sewage sludge. The times spent by employees in close proximity to these materials were sought. Enquiries were also made into the final use and location of the dried sewage sludge.

During the survey, individuals who were identified as having the potential to be exposed to radioactivity from the site were contacted and interviewed. Interviews were used to establish individuals' consumption rates of locally grown terrestrial foods and locally caught seafoods, their handling rates of intertidal sediments and commercial fishing gear, their occupancy rates relevant to intertidal exposure and direct radiation and their 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 boat owners/dwellers, divers, anglers, mollusc collectors, bait-diggers, allotment tenants, beekeepers, farmers and individuals living and/or working close to the site. These could possibly be DML and HMNB staff when not at work.

The survey did not involve the whole population in the vicinity of Devonport, 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 150,000, information was obtained for a significantly smaller number than this. In particular, it should be noted that the survey did not include DML or HMNB workers and contractors while working on the sites. Dose standards applicable to them whilst at work are different to those for members of the public. However, if for example they resided in the direct radiation survey area and were encountered during the survey their time at home would have been included in the observations.

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 businesses, the college and schools based within the direct radiation survey area, it was not possible to collect data for all pathways (such as consumption of local foods) for each employee or student. In these cases, data were limited to those relating to the primary reason for the interview (i.e. occupancy rates within 1 km of the site perimeter). In Annexes 1 and 2, such individuals only have data for the pathways of primary interest.

Forty-seven person-days were spent investigating the survey areas and interviewing individuals who were relevant to the survey. Observations for 1857 individuals were recorded.

During the survey, some gamma dose rate measurements were taken to aid assessment of external exposure pathways.

3 METHODS FOR DATA ANALYSIS

3.1 Data recording

Data collected during the fieldwork were recorded in logbooks. On return to the laboratory, the data were examined and any notably high rates were double-checked where possible by way of a follow-up phone call. In rare cases where follow up phone calls 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 (± 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 Devonport 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 the 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 (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 in 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, as shown in Table 1, 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 area, which is shown in Figure 1, comprised all coastal and intertidal areas north of a line between Cawsand, on the Cornish coast, through Plymouth Breakwater and onto the Devon coast.

Plymouth Sound

Plymouth Sound is a deep inlet of the English Channel approximately five kilometres across at the widest point. Plymouth Breakwater was considered to be the southern limit for the aquatic survey area. Both east and west shores are predominantly rock and where vehicle access was good were often used by anglers. The northern shore, which extended from Devil's Point to The Hoe, is also rock. This shoreline is a popular recreational area for families, as pools of seawater are left at low water, in which children frequently paddled and played. The most popular locations for shore angling included Mount Batten Point Breakwater on the east shore, Cremyll waterfront on the west shore and around The Hoe on the north shore. In adverse weather conditions boat anglers also fished in Plymouth Sound rather than go further afield in rough seas. A small ferry operated between Cremyll and Stonehouse all year round. A minimal amount of commercial fishing was carried out in this area of water with crab and lobster pots occasionally being set in Jennycliffe Bay and ray nets being set at Plymouth Breakwater. Plymouth Sound was generally a busy area for sailing and boating and the Mount Batten Water Sports Centre catered for large numbers of individuals who were enthusiasts of other water sports such as wind surfing and jet skiing.

Plym Estuary

The Plym Estuary enters Plymouth Sound from the north-east between The Hoe and Mount Batten Point. Although most of the intertidal area is mud or mud and sand, there is a small

area of sandy beach just north-east of the A379 road bridge where adults and children were frequently seen relaxing. A few small boats were observed moored to a pontoon but no owners were seen in attendance.

Hamoaze

North of Cremyll, Plymouth Sound leads into The Hamoaze which extended to the Tamar Bridge. Devonport dockyards are located on the east shore. Public access is limited to the industrialised area south of the docks, where angling was possible from the quayside and an area of foreshore to the south of the Tamar Bridge around Riverside. Here numerous small boats were moored in the river or over the mud near the Tamar River Sailing Club. On the western side there are two large shallow areas of water: St John's Lake and Millbrook Lake. At low water, large areas of sand and mud are exposed which contained beds of cockles (*Cerastoderma edule*). Located on the northern shore of Millbrook Lake are Millbrook Quay and Southdown Marina where numerous private boats are berthed, some of which were occupied as dwellings. Another quay is located at the Torpoint Ballast Pond which is again used to berth numerous yachts. The owner of this quay lived and worked here on board his own large boat moored over the mud. A boatyard in Torpoint is also a busy mooring and contained further boat dwellers. Torpoint Ferry operates between the town and Plymouth 24 hours per day all year. Further north the Lynher Estuary enters The Hamoaze from the west. Wearde Quay is located at this confluence and was visited frequently by anglers. Cockles and mussels (*Mytilus edulis*) were observed on the foreshore but nobody was seen collecting them during the survey. Another houseboat was moored here at the quayside. Regular bait digging was observed on Torpoint Beach and close to the Tamar Bridge on the east shore.

Lynher Estuary

The intertidal areas are mainly mud or a mixture of sand and mud with little activity being observed. The occasional angler was observed where cars had reasonable access to the

shore. A large boatyard is located at St Germans where several individuals keep and maintain boats. Maintenance is carried out in the yard above the high water mark.

Native oysters (*Ostrea edulis*) used to be commercially dredged in the Lynher estuary but the oyster population had dwindled to a point where it was no longer viable. Eels (*Anguilla anguilla*) were now the only species fished for commercially.

Tamar and Tavy Estuaries

The Tamar and Tavy estuaries enter the Hamoaze from the north. Ferries operated from Calstock on the upper Tamar Estuary to Cotehele Quay and Ferry Farm (Bere Alston) from April to September. One individual was noted to live on his boat all year moored offshore on the Tamar Estuary. As salmon fishing ceased in 2003, the only commercial fishing taking place on these estuaries was again for eels. A local wildfowling club had the shooting rights over a small piece of salt marsh located on the east shore of the Tamar.

4.2 Commercial fisheries

Commercial fishing activity in the survey area was very limited. The survey team located a commercial eel fisherman who informed them that he was now the only commercial fisherman working regularly inside Plymouth Breakwater. He said that on occasions some commercial fishermen deployed nets for thornback rays (*Raja clavata*) near the breakwater and a small amount of potting for crabs (*Cancer pagurus*) and lobsters (*Homarus gammarus*) took place. This information was supported by a Defra Fisheries Officer, who added that Defra, the Environment Agency, the Sea Fisheries Committee, the Port of Plymouth and the Ministry of Defence imposed so many regulations relating to fishing inside Plymouth Breakwater, that large scale commercial fishing was impossible. Use of nets for fish species, other than eel fyke nets, was prohibited north of a line between Devil's Point and Wilderness Point. Up to six potting fishermen worked sporadically inside the survey area, but their total time would not even equate to one boat fishing full time. Oyster fishing had been trialled again recently in the

Lynher River but it had not been commercially viable. Although not observed during the survey, the team were informed that cockles and winkles (*Littorina littorea*) were occasionally collected illegally from the beaches offshore of Millbrook and Torpoint respectively on a commercial basis.

Up until 2004, licensed salmon netting had been taking place on the Tamar, Lynher and Tavy estuaries with 261 salmon recorded as being caught in 2003. However, the fishermen involved had volunteered to sell their licenses in the interest of stock conservation to the North Atlantic Salmon Foundation, Defra and private enterprise, for a period of ten years.

4.3 Angling and hobby fishing

Angling from the shore was popular in the survey area. Preferred locations were Torpoint and Wearde Quay beaches on the Cornish side and West Hoe, Devil's Point and Mount Batten Breakwater on the Devon side. Most boat angling took place outside the survey area around Rame Head and over the offshore reefs and wrecks, unless rough conditions prevailed when they fished in the sheltered waters of the Sound. The species caught most frequently were bass (*Dicentrarchus labrax*), flounder (*Platichthys flesus*), whiting (*Merlangius merlangus*), cod (*Gadus morhua*), pollack (*Pollachius pollachius*), thornback ray, conger eel (*Conger conger*), lesser spotted dogfish (*Scyliorhinus canicula*) and mackerel (*Scomber scombrus*). Small quantities of grey gurnard (*Eutrigla gurnardus*), grey mullet (*Chelon labrosus*), plaice (*Pleuronectes platessa*), turbot (*Scophthalmus rhombus*) and sea trout (*Salmo trutta*) were also caught. The majority of the anglers who were interviewed did not consume all of these species, and the main species eaten were pollack, bass, thornback ray, mackerel, cod and flounder. It should be noted that as the survey area was a nursery ground for young bass, boat anglers were not permitted to retain this species. This regulation did not apply to shore anglers.

In addition to angling, hobby fishermen were allowed to use pots (five being the maximum permitted per person) for crabs and lobsters. Two hobby fishermen were interviewed who

said that between them they caught approximately 200 edible sized crabs and the occasional lobster during the course of a season. These were shared between family members.

Sport divers were interviewed and one of them said that he collected a small number of scallops (*Pecten maximus*) and lobsters for his own consumption from the Hamoaze area. Although scallops were not generally indigenous to this type of location they were probably the result of commercial offshore scallop fishermen sorting out the undersized samples and discarding them here on return to port. Two people were interviewed who used hand nets to catch small quantities of brown shrimps (*Crangon crangon*) and common prawns (*Palaemon serratus*) in shallow water during the summer months.

4.4 Wholesalers and retailers

Fish wholesalers in Plymouth were contacted and all confirmed that their fish and shellfish supplies were caught further offshore than the aquatic survey area extended.

4.5 Wildfowl

Wildfowling was very limited in the survey area. One club had the shooting rights over a small piece of salt marsh on the Tamar Estuary between Weir Quay and Thorn Point as well as several other locations outside the survey area. The club had a membership of 100 individuals and two visits of 2 hours duration to this location per year would be usual for the keener members (about half the club). A club representative said that only a small number of mallard (*Anas platyrhynchos*) and teal (*Anas crecca*) were shot per season at this location. Another individual was interviewed who did 20 h/y wildfowling at Insworke located on St John's Lake.

4.6 Other pathways

One person was identified who regularly used seaweed as a fertiliser on an allotment plot in the terrestrial survey area. It was estimated that approximately 12 large sacs of seaweed

were used annually from Riverside in the aquatic survey area. No farms were identified using seaweed as fertiliser or feed.

4.7 Internal exposure

Consumption data for locally caught aquatic foodstuffs are presented in Tables 3 to 6 for adults and Table 7 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. No adult consumers of marine plants and algae were noted and no child consumers of crustaceans, molluscs, marine plants and algae or wildfowl were noted. Also no children in the 1 year old or 3 month old age groups were noted to be consuming any locally caught seafood. For purposes of comparison, the data are summarised, in Table 8 for adults, and Tables 9 to 11 for children (15 year olds, 10 year olds and 5 year olds respectively). The summary tables also include mean rates and 97.5 percentile rates based on national data (referred to as 'generic' data in this report). No generic data are available for the 5 year old age group.

Adult consumption rates

The people consuming the greatest quantities of foods from the aquatic survey area were anglers, hobby fishermen, wildfowlers, a diver and the families of these people.

The predominant species of fish consumed by adults were bass, cod, flounder, mackerel, pollack and thornback ray together with smaller quantities of whiting, grey gurnard, grey mullet, lesser spotted dogfish, plaice, sea trout and turbot. A critical group of eight individuals was identified with a maximum consumption rate of 60 kg/y and a mean of 32 kg/y. The observed 97.5 percentile rate based on 96 observations was 33 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 25% pollack, 20% bass, 15% cod, 15% flounder, 15% thornback ray and 10% mackerel. These

percentages, rounded to the nearest 5%, are based on the total amount of fish consumed by this group, excluding non-specific 'mixed fish'.

The species of crustaceans consumed by adults were crabs, common prawns, brown shrimps and lobsters. A critical group of 12 individuals was identified with a maximum consumption rate of 11 kg/y and a mean of 3.5 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 14 observations was 8.6 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 65% crabs, 15% common prawns, 15% brown shrimps and 5% lobsters.

Only one adult was noted to be consuming molluscs. He consumed scallops at a rate of 1.7 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 species of wildfowl consumed by adults were mallard and teal. A critical group of four individuals was identified with maximum and mean consumption rates of 1.1 kg/y. The observed 97.5 percentile rate based on nine observations was also 1.1 kg/y. No generic data are available for this food group.

Children's consumption rates

15 year old age group

For fish, a critical group of two individuals was identified with a maximum consumption rate of 16 kg/y and a mean of 14 kg/y. The observed 97.5 percentile rate based on nine observations was 15 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.

10 year old age group

For fish, a critical group of two individuals was identified with a maximum consumption rate of 10 kg/y and a mean of 7.0 kg/y. The observed 97.5 percentile rate based on six observations was 9.4 kg/y. This compares with the generic mean and 97.5 percentile consumption rates for fish of 6.0 kg/y and 20 kg/y respectively.

5 year old age group

For fish, one child consumed at a rate of 10 kg/y and no other children in this age group came within the threshold rate. The observed 97.5 percentile rate based on five observations was 9.4 kg/y.

4.8 External exposure

Intertidal occupancy

Table 12 shows the intertidal occupancy data recorded during the survey. The five types of intertidal substrate in the survey area, where public occupancy was identified, were mud, mud, sand and shale, rock, salt marsh and sand and stones. In addition, the table contains data for houseboat dwelling occupancy rates, the values being when the boats were in contact with the substrate at low tide. It should be noted that dependent on the material with which the hull is constructed and its thickness, its shielding effect will differ from boat to boat.

The maximum occupancy rate recorded over mud was 610 h/y for an individual carrying out boat maintenance. One other individual (a bait digger) had an occupancy rate within a factor of three of this giving a mean rate of 460 h/y.

The maximum occupancy rate recorded over mud, sand and shale was 1300 h/y for an angler/bait digger. Three other people, also angling and/or bait digging, had occupancy rates within a factor of three of this giving a mean occupancy for this group of 980 h/y.

The maximum occupancy rate recorded over rock was 150 h/y for an angler. Seven other occupancy rates (anglers and sunbathers) came within a factor of three of this, giving a mean rate for this group of 80 h/y.

The maximum occupancy rate recorded over salt marsh was 4.0 h/y for a wildfowler. No other occupancy rates were recorded over this substrate.

The maximum occupancy rate recorded over sand and stones was 370 h/y for a dog walker. Two other occupancy rates (anglers) came within a factor of three of this, giving a mean occupancy rate for this group of 270 h/y.

The maximum occupancy rate recorded for houseboat dwelling, when the boat was on substrate as opposed to floating, was 6800 h/y. Thirteen other houseboat dwellers had occupancy rates within a factor of three of this giving a mean occupancy for this group of 4100 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 13 shows the fishing gear and intertidal sediment handling rates recorded during the survey.

An eel fisherman operating Fyke nets represented the critical group for handling fishing gear as no other individuals had rates within a factor of three. His handling time was 780 h/y.

The maximum handling rate recorded for sediment was 1000 h/y for a bait digger. One other individual carrying out boat maintenance had a handling rate within a factor of three of this, giving a mean rate for this group of 810 h/y.

Gamma dose rate measurements

Representative gamma dose rate measurements at 1 m above the substrate were taken at locations where high occupancy rates were observed. These measurements (Table 14) ranged from 0.069 $\mu\text{Gy/h}$ over mud at Southdown Marina to 0.093 $\mu\text{Gy/h}$ over mud, sand and shale at Torpoint. The average UK natural background dose rates are 0.05 and 0.07 $\mu\text{Gy/h}$ over sand and mud/salt marsh respectively. A value of 0.06 $\mu\text{Gy/h}$ is expected for all other substrate types.

Exposure to liquid and dried sewage sludge

Exposure pathways relating to wet and dried sewage sludge were investigated at CHSTP as it receives some liquid discharges from the DML and HMNB. Activities taking place in the sewer between the entry point of the liquid discharges and the sewage works were not considered.

During the sewage treatment process the thicker sewage sludge sinks to the bottom of the settlement tanks. The liquid component, following ultra-violet light treatment, is discharged into the Hamoaze. The sludge component is treated with lime to neutralise it and is transferred to a centrifuging plant for further liquid removal. Following this process, it is despatched directly to farms in Devon and Cornwall from the plant in enclosed 10 tonnes capacity trailers. At farms it was spread on fields for fertiliser. No farms in the terrestrial survey area were noted to be using this product.

Employees at CHSTP spend time in close proximity (within 10 metres) to the liquid or dried sewage sludge during procedures such as removal of large debris and gravel, unblocking pipes, sampling sewage sludge or servicing machinery. Table 15 shows the employees' occupancy rates in close proximity to the liquid and dried sewage sludge. The highest occupancy rate near liquid sewage sludge was 1400 h/y for two employees. The highest occupancy rate near dried sewage sludge was 180 h/y for the same two employees. No data has been collected for pathways related to other aspects of sewage disposal or treatment, such as people working in the sewers between the Devonport site and CHSTP.

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 consumption of foods produced or caught in the vicinity of a nuclear site. However, in order to allow for their assessment, relevant data have been collected. Occupancy rates in or on seawater around Devonport are shown in Table 16. The observations include 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 water sports clubs, ferry managers etc. providing generic figures for their members and employees.

Activities in the water

Observations of activities taking place in water around Devonport included swimming, diving and spear fishing. The person with the highest occupancy rate in water was a commercial diver carrying out maintenance on yacht moorings for 310 h/y. Some water sport instructors and swimmers also had times in excess of 200 h/y.

Activities on the water

Activities taking place on the water around Devonport were numerous, as there were several water sports, yachting, rowing and boating clubs in the survey area. Also, there were ferries, river cruises, boat dwellers, boat anglers and one commercial fisherman. In addition, there were other commercial fishermen, not working in the area but constantly travelling to and from quays further up the estuaries.

The persons with the highest occupancy rates on water were boat dwellers, when their vessels were floating, with a maximum time of 4000 h/y. However, an eel fisherman who was also a boat dweller had a total time of 7500 h/y.

5 TERRESTRIAL RADIATION PATHWAYS

5.1 Terrestrial survey area

The terrestrial survey area covered all land within 5 km of the site centre (NGR SX 445 565) as shown in Figure 2. The sector from the north east to the south east of the site is highly urbanised, being made up of various suburbs of Plymouth. Saltash and Torpoint are small towns located to the north west and south west of the site respectively. The rest of the survey area is mainly farmland and estuaries. It is bisected by the River Tamar, Hamoaze and the Sound from north to south and by the Lynher River to the west. At low tide there are large mud flats on the banks of these watercourses.

Data was collected for 16 working farms within 5 km of the site. Farming taking place included livestock (beef, lamb, turkeys, geese and chickens), arable (barley, wheat, oats, rapeseed, corn, grass, potatoes, peas, fruit and vegetables), dairy and chicken eggs. Beef and lamb were sold to markets at Liskard, Camborne, Tavistock, Exeter and Halworthy or to two abattoirs located outside the survey area. Poultry was sold from a farm to local customers at Christmas. Some arable crops, such as grass, barley, oats and corn, were kept by farmers for use as winter-feed. Fruit, barley and wheat were sold to national wholesalers. Vegetables were sold directly to customers, shops or wholesalers, all within the survey area. Milk was sold to Milk Link for national distribution. Eggs were sold either to a national wholesaler or directly to local customers.

Although all properties visited were supplied with mains water, six of the farms used their own supplies of either spring, well or borehole water.

Locally produced beef, lamb, poultry, eggs, milk and vegetables were consumed by some of the farming families.

Two farmers kept poultry (chickens, ducks, geese and guinea fowl) mainly for their families' consumption. These families also consumed chicken eggs. Game, including rabbits, deer, pheasants and woodcock, was shot on farmland in the survey area for consumption.

Private gardens were noted in the survey area, but efforts were concentrated on the unusually large number (for an inner city area) of allotment plots since this is where the highest concentration of local fruit and vegetable producers could be found. There were 20 separate allotment sites (highlighted in Figure 2) within 5 km of the site. Eighteen were owned and run by Plymouth County Council, one by the Saltash County Council and one was privately run. The total number of allotment plots being rented within 5 km of the site centre was approximately 600. A great variety of fruit and vegetables were grown at the allotment sites, often over 30 species. Species included mange tout, Florence fennel, globe and Jerusalem artichokes, Chinese radish, chilli peppers, aubergine, pak choi, boysenberries and jostaberries. Observation number 1122 used seaweed from Riverside near St. Budeaux as a fertiliser on his allotment plot.

Ten beekeepers were identified in the survey area, six of which were producing honey at the time. The productive beekeepers kept between two and seven hives each and production was approximately 20 kg/y per hive. Honey was consumed by beekeepers and their families as well as being given to friends and sold to private customers. One beekeeper owned a shop where he sold most of his honey.

The consumption of wild foods was limited to blackberries, which were consumed by many people, and a small amount of elderberries. One person was found to be consuming rabbit; and two people were consuming venison.

Freshwater angling was not identified in the survey area, as the watercourses were tidal.

The transfer of contamination from the DML site by wildlife was investigated. At the site meeting, DML staff were asked if they were aware of wildlife that could act as vectors for the

transfer of radioactivity off site. The area around the site was a heavily populated suburb and the DML staff were not aware of any wildlife being present on the site except for seagulls. For this reason they do not have a culling or sampling programme in place at present.

5.2 Wholesalers and retailers

Retailers, including greengrocers, butchers and convenience stores in the survey area were interviewed in order to find out whether they were selling produce from the survey area. It was not possible to visit every shop because the survey area was heavily urbanised. Therefore efforts were concentrated on the more-likely outlets in out-lying small towns such as Saltash and Torpoint, as well as Plymouth centre and other shops seen en route.

Fifteen retail outlets and 1 fruit and vegetable market were visited, of which three retail outlets were selling local produce. One butcher's shop sold Cornish pasties, which contained locally grown vegetables. Two retailers sold local fruit and vegetables, and one of these also sold local eggs and honey.

5.3 Internal exposure

Consumption data for locally produced foodstuffs potentially affected by gaseous discharges are presented in Tables 17 to 31 for adults and Tables 32 to 42 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 8 for adults, and Tables 9 to 11 for children (15 year olds, 10 year olds and 5 year olds respectively). No children in the 1 year old or 3 month old age groups were noted to be consuming locally 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 43. 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 15 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey, wild fungi and venison. No consumption of pig meat or local cereals was identified.

When compared with the generic 97.5 percentile consumption rates, the critical group mean consumption rate was greater for green vegetables, other vegetables, root vegetables and cattle meat. A further seven critical group mean consumption rates exceeded the generic mean consumption rates. These were for potato, domestic fruit, milk, sheep meat, eggs, wild/free foods and honey. Six observed 97.5 percentile consumption rates exceeded the generic 97.5 percentile consumption rates. These were for green vegetables, other vegetables and root vegetables, milk, cattle meat and honey.

Children's consumption rates

15 year old age group

Twenty-three children in this age group were identified to be eating locally produced foods. Consumption was identified in the following nine food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, cattle meat, sheep meat, poultry and wild/free foods. No consumption was identified for the following food groups: milk, pig meat, eggs, rabbits/hares, honey, wild fungi, venison and local cereals.

Two critical group mean consumption rates, for other vegetables and cattle meat, exceeded the generic 97.5 percentile consumption rates. The critical group mean consumption rates for a further two food groups; green vegetables and root vegetables, were higher than their respective generic mean consumption rates. Three observed 97.5 percentile consumption rates exceeded the generic 97.5 percentile consumption rates. These were for other vegetables, root vegetables and cattle meat.

10 year old age group

Fifteen 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, cattle meat, sheep meat, poultry, eggs and honey. No consumption was identified for the following food groups: milk, pig meat, wild/free foods, rabbits/hares, wild fungi, venison and local cereals.

Three critical group mean consumption rates, for cattle meat, sheep meat and honey, exceeded the generic 97.5 percentile consumption rates. The critical group mean consumption rates for a further four food groups; green vegetables, other vegetables, root vegetables and eggs, were higher than the generic mean consumption rate. Two observed 97.5 percentile consumption rates exceeded the generic 97.5 percentile consumption rates. These were for root vegetables and sheep meat.

5 year old age group

Seventeen 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, cattle meat, sheep meat, eggs, wild/free foods and honey. No consumption was identified for the following food groups: milk, pig meat, poultry, rabbits/hares, wild fungi, venison and local cereals. No generic 97.5 percentile

or generic mean consumption rates have been determined for this age group so no comparisons with the corresponding observed rates are possible.

6 DIRECT RADIATION PATHWAYS

6.1 Direct radiation survey area

The direct radiation survey area covered all land within 1 km of the DML nuclear licensed site perimeter (Figure 2). HMNB was not considered to be part of the licensed site area.

To the north of the site is Weston Mill Lake, an expanse of water that opens into the Hamoaze. The lake has a jetty to berth naval warships. Further north, the survey area includes part of the densely populated residential area Barne Barton, with many low rise flats. Between the flats and Weston Mill Lake is a strip of land, currently under development. To the north-east of the site is CHSTP and small sections of the densely populated suburbs of St Budeaux, Weston Mill and North Prospect. A school is located in the Weston Mill area.

To the immediate east of the DML licensed site are the buildings of HMS Drake and two recreation grounds within HMNB. A busy main road runs the length of the site, with residential houses, a shop and a nursery school situated on the eastern side of the road. Further east is the very densely populated residential area of Keyham; this includes a college, two primary schools, three recreation grounds, a park, allotments and a train station. To the south-east of the site is the residential area of Devonport with a school, a college, many shops, a park and a train station.

The area to the south of the DML site predominantly covers HMNB. South of the dockyard is sparsely populated with a few low-rise flats. The area includes Moon Cove (a large slipway with boats moored on the mud), the Torpoint ferry crossings and part of the residential area Morice Town.

To the west of the site the Hamoaze dominates the area. It also includes part of the shoreline of Torpoint; the ferry crossing, Gravesend Point, Thanckes Lake, Yonderberry Point and Cove Head. This part of the survey area only included a few residences at Gravesend Point.

6.2 Residential activities

As the survey area is densely populated and time did not allow for coverage of the entire area, the survey targeted particular residences that were closest to the site. Properties selected for the survey were the flats on Furze Park and Talbot Gardens in Barne Barton, and houses along Saltash Road at the closest point to the east of the site. Interviews were conducted with 42 households.

6.3 Leisure activities

Leisure activities in the vicinity of the site were limited. There are two recreation grounds to the east of the site and two parks, one to the east and one to the south-east. Children who attended a nursery school on Saltash Road regularly used the adjacent recreation ground. Their times playing at the recreation ground were considered in addition to their times in the school. The Hamoaze was a popular area for sailing and boat angling with many people passing through the direct radiation survey area.

6.4 Commercial and educational activities

The survey targeted commercial and educational buildings nearest to the site. DML and HMNB employees and people contracted by these establishments were not included in the survey unless they also resided in the survey area, when their times at home would be included. Commercial activities included two businesses located in units on HMNB and shops located on Saltash Road and Keyham Road. This busy parade of shops included a bridal shop, a pub, a take away food establishment, a café and a glazing business. Generic occupancy rates were obtained for staff and pupils from two primary schools, a nursery school and a college of further education. The college had approximately 5500 full and part time students with varying occupancy rates. It was difficult for the college to provide information for this number of students therefore a representative number of 100 students has been used.

6.5 Occupancy rates

Table 44 presents indoor, outdoor and total occupancy data for adults and children and includes distances from the site perimeter fence where these occupancies took place. An analysis of the data by distance zones and occupancy rates is shown in Table 45. Non-HMNB people working on the adjoining naval dockyard in units leased from HMNB are marked by an asterisk in Table 44.

0 - 0.25 km from the site perimeter fence

Occupancy data were collected for 459 individuals in the 0 to 0.25 km zone. The majority of observations in this zone were for staff and children attending a college and a nursery school both to the east of the site, although the highest total occupancies were for people living on Saltash Road. The highest total occupancy rate was for a retired elderly resident with 8500 h/y. For work related activities, the highest occupancies were 1900 h/y for shop workers (mostly spent indoors).

0.25 – 0.5 km from the site perimeter fence

Occupancy data were collected for 353 people in the 0.25 to 0.5 km zone. The majority of observations in this zone were again staff and children attending a primary school to the east of the site although the highest total occupancy was for a resident with 8700 h/y. For work related activities, the highest occupancies were 1900 h/y for shop workers (mostly spent indoors).

0.5 – 1.0 km from the site perimeter fence

Occupancy data were collected for 221 people in the 0.5 to 1.0 km zone. As was the case with the closer zones the majority of observations were teachers and children attending a primary school although the highest total occupancies were for two residents with 8600 h/y.

For work related activities, the highest occupancies were 2000 h/y for eight employees based in units on HMNB (all spent indoors); none of these eight were DML or HMNB employees or contractors.

6.6 Gamma dose rate measurements

Table 46 presents gamma dose rate measurements in the Devonport direct radiation survey area. Representative gamma dose rate measurements were taken both inside and outside a selection of residences and a school, and at outdoor background locations outside the area. It should be noted that the measurements have not been adjusted for natural background dose rates.

The outdoor measurements, which were taken approximately 2 to 20 metres from the nearest buildings, ranged from 0.063 to 0.095 $\mu\text{Gy/h}$. Outdoor measurements were taken over grass and concrete. The indoor measurements ranged from 0.052 to 0.108 $\mu\text{Gy/h}$. Background gamma dose rate measurements were taken over grass between 3 and 8 km from the site and ranged from 0.082 to 0.101 $\mu\text{Gy/h}$. These gamma dose rate measurements show no significant difference between those taken around the Devonport site and the background measurements taken further afield.

Comprehensive studies of background radiation have been carried out on a national scale by the National Radiological Protection Board (since 1st April 2005 renamed as the Radiation Protection Division after merging with 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 47. These are based on information in Annex 1 and are derived irrespective of the magnitude of the rate observed for each pathway.

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

The National Dose Assessments Working Group (NDAWG) has considered methods for calculating total dose from consumption and occupancy data provided by habits surveys. The relevant adult profiles for Devonport are 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

During the survey, team members interviewed the majority of commercial fishermen and farmers in the survey area. In addition anglers, houseboat dwellers, divers, swimmers and other water sport enthusiasts, wildfowlers, allotment holders, bee keepers, game shooters (people shooting pheasants, rabbits, pigeons etc), people collecting wild/free foods and wild fungi and people living and carrying out activities near the DML site were identified and interviewed. All consumption rates recorded in this report include only locally produced or caught foods.

Exposure pathways were investigated for 1857 individuals. The survey found that exposure of the public to radiation from the dockyard site at Devonport were present from the following pathways:

- Discharges of liquid radioactive waste from DML and HMNB to the Hamoaze and Camels Head Sewage Treatment Plant
- Discharges of gaseous radioactive waste from DML to the atmosphere

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

- 32 kg/y for fish
- 3.5 kg/y for crustaceans
- 1.7 kg/y for molluscs
- 1.1 kg/y for wildfowl

The predominant aquatic species consumed by the respective critical groups were bass, cod, flounder, mackerel, pollack, thornback ray, common prawns, brown shrimps, crabs, lobsters and scallops. The species of wildfowl consumed were mallard and teal. No consumption of

marine plants and algae was found, although one individual was noted to use seaweed for fertiliser.

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

- 4100 h/y for boat dwelling over exposed substrate
- 980 h/y for mud, sand and shale
- 460 h/y for mud
- 270 h/y for sand and stones
- 80 h/y for rock
- 4 h/y for salt marsh

The critical group rate for handling fishing gear was 780 h/y and that for handling of sediment was 810 h/y.

The highest time spent in close proximity to the liquid sewage sludge was 1400 h/y and the highest time spent in close proximity to the dried sewage sludge was 180 h/y.

The highest occupancy rate for time spent in water was 310 h/y and the highest occupancy rate for time spent on water was 7500 h/y.

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

- 54 kg/y for green vegetables
- 61 kg/y for other vegetables
- 71 kg/y for root vegetables
- 88 kg/y for potato
- 44 kg/y for domestic fruit
- 190 l/y for milk
- 50 kg/y for cattle meat
- 13 kg/y for sheep meat

- 3.7 kg/y for poultry
- 10 kg/y for eggs
- 8.9 kg/y for wild/free foods
- 0.90 kg/y for rabbits/hares
- 7.6 kg/y for honey
- 0.11 kg/y for wild fungi
- 10 kg/y for venison

No consumption of pig meat or local cereals was identified. Consumption of foodstuffs by children was also recorded. Combinations of food groups (both aquatic and terrestrial) consumed at critical group rates, 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.

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

- 8500 h/y for the 0 to 0.25 km zone
- 8700 h/y for the 0.25 to 0.5 km zone
- 8600 h/y for the 0.5 to 1.0 km zone

In each zone, the highest occupancy rates were due to residency.

8.2 Comparisons with previous surveys

No previous terrestrial or direct radiation surveys have been carried out by CEFAS, therefore comparisons for these exposure pathways cannot be made. However, comparisons can be made with the previous aquatic survey of 1992, in which the same survey area was used. In 1992, a critical group consumption rate for salmonids of 14 kg/y for 12 individuals was derived. In 2004, however, licensed salmon netting had ceased and in consequence no salmon were noted to be consumed during this survey.

The critical group consumption rate for non-salmonid fish has increased from 13 kg/y in 1992 to 32 kg/y in 2004. In 1992 the maximum consumption rate observed was 18 kg/y and eight individuals formed the critical group. In the 2004 survey, the maximum consumption rate observed was 60 kg/y and eight individuals were included in the critical group.

The main species of fish consumed by the critical group in the 1992 aquatic survey were flounder, dab, bass, whiting and grey mullet. In 2004, the main species were flounder, bass, mackerel, pollack, thornback ray and cod.

The critical group consumption rate for crustaceans has decreased from 5.0 kg/y in 1992 to 3.5 kg/y in 2004. In 1992 the maximum consumption rate observed was 6.1 kg/y and four people were included in the critical group. In the 2004 survey, the maximum consumption rate observed was 11 kg/y and 12 people were included in the critical group.

The main species of crustaceans consumed by the critical group in the 1992 aquatic survey was crab. In 2004, the main species were crab, common prawn and brown shrimp.

No molluscs were noted to be consumed in the 1992 survey. The 2004 survey identified one individual who consumed scallops at a rate of 1.7 kg/y.

No wildfowl were noted to be consumed in the 1992 survey. The 2004 survey identified four individuals who consumed mallard and teal at a rate of 1.1 kg/y.

For external pathways it should be noted that the methodology for determining the critical group has changed since the previous survey so care is needed when comparing results. In the following paragraphs, the critical group rates from the 1992 survey have been recalculated using the current method. For houseboat dwelling, occupancy over sand and stones, occupancy over mud, sand and shale and handling sediment, the critical group rates remained unchanged when calculated by either method. For occupancy over mud and

handling commercial fishing gear the rates in brackets in the following paragraphs were calculated using the former method.

Occupancy rates for houseboat dwellers have increased. In the 1992 survey the highest rate was 2500 h/y and the critical group rate was 2100 h/y for nine individuals. In 2004, the maximum rate was 6800 h/y and the critical group rate was 4100 h/y for 14 people. This increase was mainly due to retired people spending more time on their moored craft.

Occupancy rates over mud, sand and shale have increased from 260 h/y for one individual in 1992 to 980 h/y for four individuals in 2004, with the maximum rate being 1300 h/y. This increase was because anglers and bait diggers were noted to be spending more time over mud, sand and shale substrate.

Occupancy rates over mud have decreased from 860 h/y for 10 salmon fishermen (1200 h/y for four fishermen using the previous method) in 1992 to 460 h/y for two individuals repairing boats and bait digging in 2004. The maximum rate was 1400 h/y in 1992 and 610 h/y in 2004. This decrease was because salmon fishing had ceased. It should be noted that there was evidence during the 1992 survey that illegal commercial bait digging was taking place over mud substrates although no direct interviews were obtained. Therefore, based on CEFAS observations and experience with this activity at other sites, the 1992 report recommended that an occupancy time of 2000 h/y over mud be adopted for assessment purposes.

Occupancy rates over sand and stones have increased from 100 h/y in 1992 for two salmon fishermen to 270 h/y in 2004 for three individuals, two anglers and a dog walker. The maximum rate was 100 h/y in 1992 and 370 h/y in 2004.

Occupancies over rock and salt marsh were noted in 2004 but not in 1992. Comparisons are therefore not possible.

The 1992 survey identified a critical group handling rate for commercial fishing gear of 1100 h/y for seven fishermen (1600 h/y for three fishermen using the earlier method) and a maximum handling rate of 1800 h/y. The 2004 survey gave a critical group handling rate of 780 h/y for one fisherman.

The 1992 survey identified a critical group handling rate for sediment of 310 h/y for two people (a fisherman and a bait digger) and a maximum handling rate of 320 h/y. However, for assessment purposes a critical group rate of 2000 h/y was conservatively proposed for the same rationale as for occupancy over mud. The 2004 survey gave a critical group handling rate of 810 h/y for two people (a boat repairer and a bait digger) and a maximum rate of 1000 h/y.

The 2004 survey identified occupancies in and on water. However, these were not considered in the 1992 survey, so no comparisons can be made.

Three gamma dose rate measurements from 2004 can be compared with gamma dose rate measurements taken at similar locations in 1992 (Camplin, 1993).

	1992 ($\mu\text{Gy/h}$)	2004 ($\mu\text{Gy/h}$)
• Torpoint Ferry	0.074 over mud	0.093 over mud, sand and shale
• Torpoint south	0.078 over mud	0.093 over mud, sand and shale
• Wearde Quay	0.074 over mud/sand	0.085 over mud, sand and shale

A possible explanation for this apparent increase might be natural radiation from the shale component of the substrate.

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

- Dogfish from Plymouth Sound
- Crabs from Plymouth Sound
- Mussels from the River Lynher
- *Fucus vesiculosus* from Kinterbury
- Mud from Kinterbury
- Sediment from Torpoint (south) and Lopwell
- Seawater from Torpoint (south) and Millbrook Lake
- Gamma dose rate measurements over mud at Kinterbury and Lopwell, over shale at Torpoint (south), over shale, mud and slate at Torpoint (south) and over mud, rock and stones at Lopwell

Terrestrial surveillance

- Blackberries
- Courgettes
- Grass

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

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

- Removing dogfish and adding thornback rays and/or flounders which are eaten more frequently and reside in the aquatic survey area for longer periods.

- Adding winkles from the Torpoint foreshore because these were commercially collected on occasions.
- Adding cockles from the Southdown foreshore because these were commercially collected on occasions.
- Adding a brown shrimp or common prawn sample from the Lynher Estuary because these were consumed by some individuals.
- Carrying out in-situ gamma spectrometric analyses at a selection of locations in order to identify which radionuclides are causing the elevated gamma dose rates.
- Adding dried sewage sludge in the form dispatched to farms.

Although consumed by one individual, scallops have not been suggested because they only occur sparsely and a sample would be very difficult to obtain.

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

- Adding honey because it is consumed by many individuals.
- Adding potatoes which is a major crop in the area.
- Adding strawberries as a representative fruit which is eaten in large quantities.
- Adding cabbages as a representative vegetable which is the predominantly eaten green vegetable.

9 ACKNOWLEDGEMENTS

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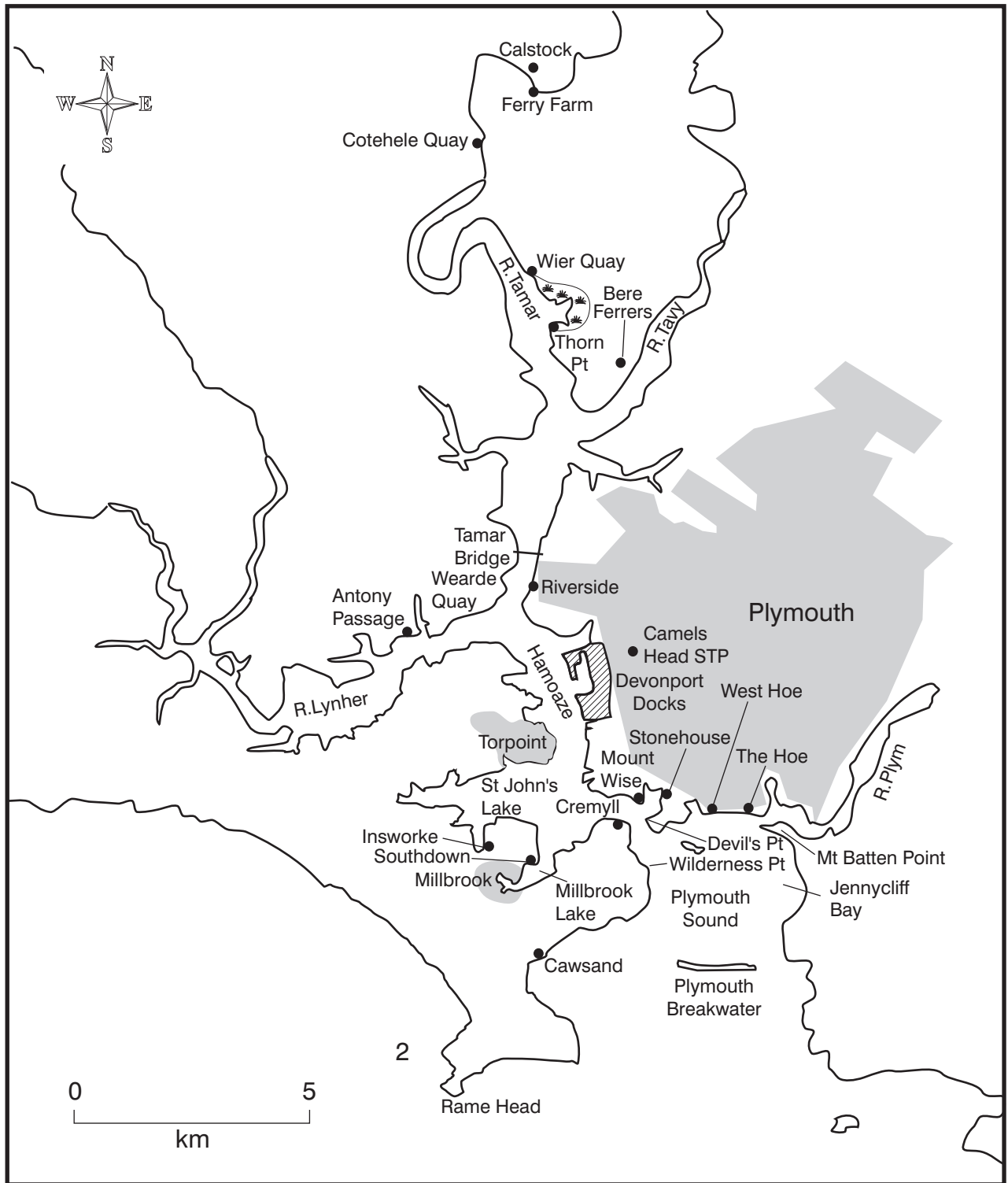
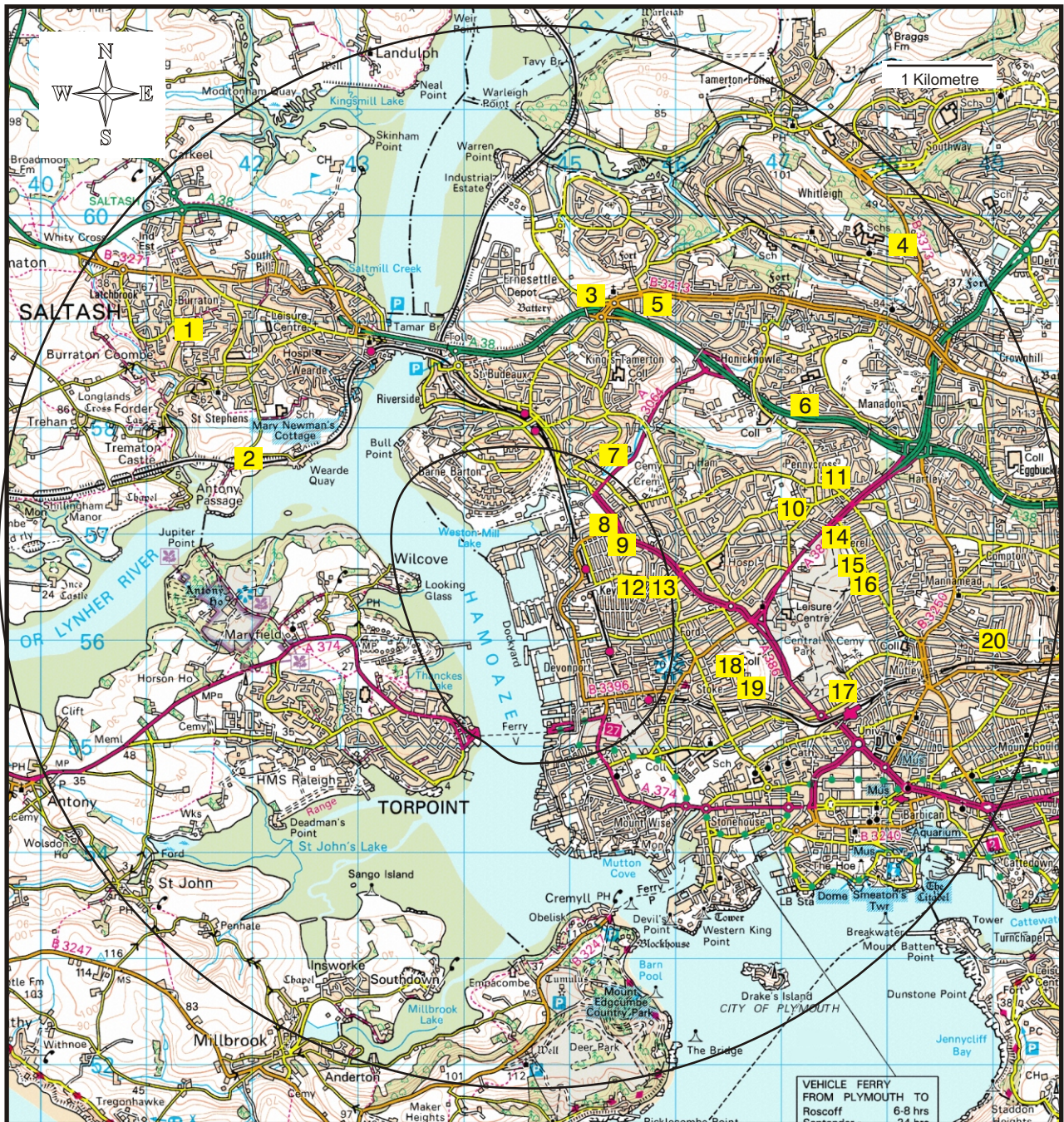


Figure1. The Devonport aquatic survey area



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

- | | |
|---|--|
| 1 = Fairmead Road Allotments | 11 = Hermon Terrace, Outland Road Allotments |
| 2 = Wearde Road Allotments | 12 = North Prospect, Parkside Allotments |
| 3 = Bakers Field, Ernesettle Lane Allotments | 13 = Henderson Place, Wolseley Road Allotment |
| 4 = Kendel Place, Crownhill Allotments | 14 = Peverell Park Allotments |
| 5 = West Park Terrace, West Park Allotments | 15 = Central Park Allotments |
| 6 = Chaucer Way, Honicknowle Allotments | 16 = Barne Park Allotments |
| 7 = Elliott Street, Weston Mill Allotments | 17 = Swarthmore Allotments |
| 8 = Frys & May Field, Keyham Allotments | 18 = Rowdens, Stoke Allotments |
| 9 = Ocean Street, Keyham Allotments | 19 = Penlee, Stoke Allotments |
| 10 = Fosters Field, Beacon Park Allotments | 20 = Lower Compton, Compton Allotments |

Table 1. Survey coverage

Group	Criteria	Estimate of complete coverage	Number for whom data obtained	Coverage	Notes
ALL PATHWAYS					
All potential people in Devonport aquatic, terrestrial and direct radiation survey areas	Number of people resident in terrestrial survey area (excluding those in the direct radiation survey area)	133,000 [^]	428	*	Not all people resident in the 5 km area were interviewed. The survey targeted individuals who were potentially the most exposed (Section 2.4), mostly producers of local food (farmers and small holders)
	Number of people who consume food from the terrestrial area (excluding those who live in the terrestrial or direct radiation survey area)	U	35	U	9 of the 35 people actually do live in the direct radiation survey area but no direct radiation data was available so they have been included in this category
	Number of people resident in the direct radiation survey area	15,000	95		
	Number of people employed or educated in the direct radiation survey area, but who do not live in the direct radiation survey area	U	938	U	Excluding employees and contractors of DML and MOD. Most of this data was gained through generic interviews. Personal addresses were not recorded so it is possible that some of them did live in the survey areas.
	Data obtained for people affected by aquatic discharge living outside the 5 km area	U but more than 2000	335	U	Excluding people exposed to aquatic discharges through employment only
	Number of people exposed to aquatic discharges through employment	50	32	****	Includes Camels Head STP employees and Ferry workers
	Approximate total for aquatic, terrestrial and direct radiation survey areas	U but more than 150,000	1863 ^{^^}	U	
AQUATIC PATHWAYS					
Commercial fishermen	Number of full-time commercial fishermen actively fishing in survey area	1	1	*****	
Hobby fishermen	Number of people in survey area seen in action, spoken to or heard of during survey	6	3	***	
Boat anglers	Number seen or heard of during survey	50	6	*	

Table 1. Survey coverage

Group	Criteria	Estimate of complete coverage	Number for whom data obtained	Coverage	Notes
Shore anglers	Anglers who fish in survey area on a regular basis (once a month or more)	100	24	**	Some of these anglers fish from man-made structures such as piers and quays
Boat dwellers	Number of full-time boat dwellers in survey area	25	17	****	
Regular local sport divers	Members of clubs in survey area and people seen in action or spoken to during the survey	50	28	****	Interview with club representatives provided generic data for keenest members
Commercial divers	Number of people in survey area seen in action, spoken to or heard of during survey	1	1	*****	
Bait diggers	Number of people in survey area seen in action, spoken to or heard of during survey	50	22	***	
Other beach users	Number of people in survey area seen in action, spoken to or heard of during survey	U	53	U	Mainly walkers, dog walkers and swimmers
Water sports participants (excl. diving)	Members of clubs in survey area and people seen in action or spoken to during the survey	U	160	U	Interview with a sailing club representative provided generic data for 140 members
Wildfowlers	Members of a club in survey area	100	52	***	Interview with a club representative provided generic data for keenest members
Camels Head Sewage Treatment Works employees	Number of people who work with the sewage sludge or sewage cake bio-solids from Camels Head Sewage Treatment Works	4	4	*****	
Ferry workers	Number of people who work on ferry boats in the survey area	50	28	***	Interviews with employers provided generic data for employees

Table 1. Survey coverage

Group	Criteria	Estimate of complete coverage	Number for whom data obtained	Coverage	Notes
TERRESTRIAL PATHWAYS^{^^^}					
Farms	Number of farmers and their family members consuming farm produce from the survey area	55	44	****	Estimate of 20 farms in the area, of which 16 farmers were interviewed
Allotment holders	Number of people consuming allotment produce from the survey area	1800	296	*	Estimate of 600 allotment plots, of which 88 allotment plot holders were interviewed
Bee keepers	Number of people consuming honey from survey area	U	18	U	Estimate of 10 beekeepers in the area, of which 6 were interviewed
DIRECT RADIATION PATHWAYS					
Residences	Number of residents in the survey area	15,000	95	*	37 households were interviewed
Businesses	Number of people predominantly based in survey area	U	35	U	Most data are generic, provided from interviews with managers or personnel staff from 7 businesses
Schools, nursery schools and colleges	Number of staff and pupils in survey area	U	899	U	All data are generic, provided from interviews with personnel staff from 1 nursery school, 2 primary schools and 1 college
BREAKDOWN OF AGE GROUPS					
Adults	Individuals over 17	U	1173	U	
15 year old	More than 12.0 year old to 17.0 year old	U	58	U	
10 year old	More than 7.0 year old to 12.0 year old	U	357	U	
5 year old	More than 2.0 year old to 7.0 year old	U	268	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	0	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 in the lower section some individuals, for example someone who lives and works in the direct radiation survey area will be counted twice, whereas others, such as people only consuming foods from their garden, will not be counted at all.

^{^^^} - 15 shops, 1 market and 2 nurseries 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, kohlrabi, leek, onion, parsnip, radish, shallot, spring onion, swede, turnip
Potato	
Domestic fruit	Apple, apricot, blackberry, blackcurrant, boysenberry, cherry, damson, fig, gooseberry, grapes, greengages, huckleberry, loganberry, melon, nectarines, peach, pear, plum, 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, wild apple
Honey	
Wild Fungi	Mushrooms
Rabbits/Hare	Hare, rabbit
Venison †	
Fish (sea)	Bass, brill, cod, common ling, dab, Dover sole, flounder, gurnard, haddock, hake, herring, lemon sole, mackerel, monkfish, mullet, plaice, pollack, witch saithe, salmon, sea trout, squid*, cuttlefish*, rays, turbot, whitebait, whiting
Fish (fresh water)	Brown trout, rainbow trout, perch, pike, salmon (river), eels
Crustaceans	Brown crab, spider crab, crawfish, lobster, <i>Nephrops</i> , squat lobster, prawn, shrimp
Molluscs	Cockles, limpets, mussels, oysters, queens, scallops, razor shell, whelks, winkles

Notes:

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

† Including offal

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

Observation number	Bass	Cod	Flounder	Grey gurnard	Grey mullet	Lesser spotted dogfish	Mackerel	Mixed fish	Plaice	Pollack	Sea trout	Thornback ray	Turbot	Whiting	Total
30								59.6							59.6
253-254	5.8						10.8			21.9					38.5
220, 226-229	5.9	5.9	5.9									5.9			23.6
430-431	1.1				1.7	1.5	0.1			11.6					16.1
270							9.7								9.7
1137								9.5							9.5
1162	1.0		0.3					4.5				2.6			8.5
406-408	1.8		1.8							2.4				2.2	8.3
1168-1170	1.8				5.0			1.5							8.3
469, 512-515	2.3						5.5								7.8
182, 202							2.1			5.6					7.7
1154-1157	7.5														7.5
192								6.8							6.8
1122-1124	3.8		2.7												6.5
1163-1164										5.9					5.9
31-32								4.5							4.5
328								4.5							4.5
413-416	0.5				3.5	0.4	0.1								4.5
290-291										2.1				1.9	4.0
450-451, 454													3.7		3.7
1090	0.6			0.2	1.0		1.7								3.5
131			0.6			0.5			0.6	0.8		0.9			3.5
520-521								3.4							3.4
1151-1152	1.7		0.6				1.0								3.3
292-293										1.4				1.3	2.7
1167										1.7	0.8				2.5
189-190			1.1						1.1						2.3
384-387														2.3	2.3
522								2.3							2.3
409	0.5						1.2			0.4					2.2
1148	1.9														1.9
295,298,299	1.9														1.9
1165-1166										1.5					1.5
324-325,327								1.5							1.5
329-334								1.5							1.5

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

Observation number	Bass	Cod	Flounder	Grey gurnard	Grey mullet	Lesser spotted dogfish	Mackerel	Mixed fish	Plaice	Pollack	Sea trout	Thornback ray	Turbot	Whiting	Total
286, 294							1.1								1.1
198-199	1.1														1.1
28	1.0														1.0
417-418							0.8								0.8
1158-1159							0.7								0.7
421-425							0.7								0.7
125, 130	0.5														0.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of fish based on the 8 highest adult consumers is 31.8 kg/y

The observed 97.5 percentile rate based on 96 observations is 32.9 kg/y

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

Observation number	Brown shrimp	Common prawn	Crab	Lobster	Total
1168	5.7	5.6			11.3
372			2.7	0.3	3.0
373			2.7	0.3	3.0
374			2.7	0.3	3.0
375			2.7	0.3	3.0
377			2.7		2.7
378			2.7		2.7
379			2.7		2.7
380			2.7		2.7
381			2.7		2.7
382			2.7		2.7
1137				1.7	1.7
31	0.3				0.3
32	0.3				0.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of crustaceans based on the 12 highest adult consumers is 3.5 kg/y (Taking the highest consumption rate of 11.3 k/y and dividing by 3 would give a cut-off value of 3.8 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 14 observations is 8.6 kg/y

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

Observation number	Scallop
1137	1.7

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of molluscs based on the only adult consumer is 1.7 kg/y

The observed 97.5 percentile is not applicable for 1 observation

Table 6. Adults' consumption rates of wildfowl in the Devonport area (kg/y)

Observation number	Duck
383	1.1
475	1.1
476	1.1
477	1.1
469	0.3
512	0.3
513	0.3
514	0.3
515	0.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of wildfowl based on the 4 highest adult consumers is 1.1 kg/y

The observed 97.5 percentile rate based on 9 observations is 1.1 kg/y

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

15 year old age group

Observation number	Age	Bass	Flounder	Grey gurnard	Grey mullet	Lesser spotted dogfish	Mackerel	Mixed fish	Pollack	Turbot	Whiting	Total
432	14	1.1			1.7	1.5	0.1		11.6			16.1
428	16						12.1					12.1
453	14									3.7		3.7
410	14	0.5					1.2		0.4			2.2
429	16						2.1					2.1
301	16	1.9										1.9
419	16						0.8					0.8
420	14						0.8					0.8
1160	12						0.5					0.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of fish based on the 2 highest 15 year old age group consumers is 14.1 kg/y

The observed 97.5 percentile rate based on 9 observations is 15.3 kg/y

10 year old age group

Observation number	Age	Bass	Flounder	Grey gurnard	Grey mullet	Lesser spotted dogfish	Mackerel	Mixed fish	Pollack	Turbot	Whiting	Total
433	7	1.1			1.7	1.5	0.1		5.8			10.2
452	10									3.7		3.7
296	10								1.4		1.3	2.7
303	10	1.9										1.9
1091	8	0.3		0.1	0.5		0.8					1.8
1153	9	0.9	0.3				0.5					1.6

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of fish based on the 2 highest 10 year old age group consumers is 7.0 kg/y

The observed 97.5 percentile rate based on 6 observations is 9.4 kg/y

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

5 year old age group

Observation number	Age	Bass	Flounder	Grey gurnard	Grey mullet	Lesser spotted dogfish	Mackerel	Mixed fish	Pollack	Turbot	Whiting	Total
434	5	1.1			1.7	1.5	0.1		5.8			10.2
326	6							1.5				1.5
426	6						0.7					0.7
427	3						0.7					0.7
1161	6						0.2					0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of fish based on the 4 highest 5 year old age group consumers is 3.3 kg/y

The observed 97.5 percentile rate based on 5 observations is 9.4 kg/y

Table 8. Summary of adults' consumption rates in the Devonport 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	96	8	59.6	23.6	31.8	32.9	15.0	40.0
Crustaceans	14	12	11.3	1.7	3.5	8.6	3.5	10.0
Molluscs	1	1	1.7	1.7	1.7	NA	3.5	10.0
Wildfowl	9	4	1.1	1.1	1.1	1.1	ND	ND
Green vegetables	247	25	105.4	38.0	54.1	65.0	15.0	45.0
Other vegetables	269	37	139.5	46.8	60.6	67.7	20.0	50.0
Root vegetables	262	17	165.0	57.6	71.2	59.8	10.0	40.0
Potato	248	39	165.6	57.3	87.9	107.9	50.0	120.0
Domestic fruit	230	26	93.4	31.7	44.5	44.7	20.0	75.0
Milk	8	8	276.6	146.0	195.0	276.6	95.0	240.0
Cattle meat	8	8	63.1	47.3	49.6	63.1	15.0	45.0
Pig meat	NC	NC	NC	NC	NC	NC	15.0	40.0
Sheep meat	8	4	14.1	11.3	12.7	14.1	8.0	25.0
Poultry	8	6	5.7	2.3	3.7	5.7	10.0	30.0
Eggs	6	6	13.8	7.4	10.0	13.8	8.5	25.0
Wild/free foods	41	3	15.9	5.4	8.9	5.4	7.0	25.0
Rabbits/hares	1	1	0.9	0.9	0.9	NA	6.0	15.0
Honey	18	11	11.3	4.5	7.6	11.3	2.5	9.5
Wild fungi	2	2	0.1	0.1	0.1	0.1	3.0	10.0
Venison	2	2	10.0	10.0	10.0	10.0	ND	ND

ND = not determined

NC = not consumed

NA = not applicable

Table 9. Summary of 15 year old children's consumption rates in the Devonport 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	9	2	16.1	12.1	14.1	15.3	6.5	20.0
Crustaceans	NC	NC	NC	NC	NC	NC	2.5	6.0
Molluscs	NC	NC	NC	NC	NC	NC	2.5	6.0
Green vegetables	19	12	20.2	7.0	13.4	18.6	9.0	25.0
Other vegetables	19	5	53.3	22.1	36.0	53.3	10.0	30.0
Root vegetables	17	13	22.9	8.1	15.3	22.9	7.5	20.0
Potato	20	11	39.0	14.2	24.1	39.0	60.0	130.0
Domestic fruit	17	7	12.4	4.2	7.0	11.5	15.0	50.0
Milk	NC	NC	NC	NC	NC	NC	110.0	260.0
Cattle meat	2	2	37.8	37.8	37.8	37.8	15.0	35.0
Pig meat	NC	NC	NC	NC	NC	NC	10.0	30.0
Sheep meat	2	2	4.5	4.5	4.5	4.5	5.5	15.0
Poultry	2	2	2.3	2.3	2.3	2.3	6.5	20.0
Eggs	NC	NC	NC	NC	NC	NC	7.0	25.0
Wild/free foods	3	3	1.1	0.3	0.6	1.1	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	NC	NC	NC	NC	NC	NC	2.0	5.5
Venison	NC	NC	NC	NC	NC	NC	ND	ND

ND = not determined

NC = not consumed

Table 10. Summary of 10 year old children's consumption rates in the Devonport 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	6	2	10.2	3.7	7.0	9.4	6.0	20.0
Crustaceans	NC	NC	NC	NC	NC	NC	2.5	7.0
Molluscs	NC	NC	NC	NC	NC	NC	2.5	7.0
Green vegetables	9	3	20.2	17.1	18.1	19.5	6.0	20.0
Other vegetables	9	6	22.6	9.2	13.0	20.6	8.0	25.0
Root vegetables	10	5	22.8	12.4	16.7	21.5	6.0	20.0
Potato	10	5	33.8	13.7	19.8	31.3	45.0	85.0
Domestic fruit	10	3	10.8	5.5	9.0	10.8	15.0	50.0
Milk	NC	NC	NC	NC	NC	NC	110.0	240.0
Cattle meat	1	1	37.8	37.8	37.8	NA	15.0	30.0
Pig meat	NC	NC	NC	NC	NC	NC	8.5	25.0
Sheep meat	3	2	14.1	14.1	14.1	14.1	4.0	10.0
Poultry	1	1	2.3	2.3	2.3	NA	5.5	15.0
Eggs	2	2	8.9	8.9	8.9	8.9	6.5	20.0
Wild/free foods	NC	NC	NC	NC	NC	NC	3.0	11.0
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	1	1	7.8	7.8	7.8	NA	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

ND = not determined

NC = not consumed

NA = not applicable

Table 11. Summary of 5 year old children's consumption rates in the Devonport 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	5	1	10.2	10.2	10.2	9.4	ND	ND
Crustaceans	NC	NC	NC	NC	NC	NC	ND	ND
Molluscs	NC	NC	NC	NC	NC	NC	ND	ND
Green vegetables	13	3	23.6	10.6	18.1	22.6	ND	ND
Other vegetables	13	8	11.8	4.0	7.0	11.7	ND	ND
Root vegetables	13	6	23.1	8.6	12.8	19.9	ND	ND
Potato	14	2	35.0	15.3	25.1	28.6	ND	ND
Domestic fruit	13	3	9.2	3.3	5.7	7.8	ND	ND
Milk	NC	NC	NC	NC	NC	NC	ND	ND
Cattle meat	2	2	31.5	31.5	31.5	31.5	ND	ND
Pig meat	NC	NC	NC	NC	NC	NC	ND	ND
Sheep meat	2	2	1.9	1.9	1.9	1.9	ND	ND
Poultry	NC	NC	NC	NC	NC	NC	ND	ND
Eggs	2	2	6.9	6.9	6.9	6.9	ND	ND
Wild/free foods	4	4	0.5	0.2	0.3	0.5	ND	ND
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	2	2	0.9	0.9	0.9	0.9	ND	ND
Wild fungi	NC	NC	NC	NC	NC	NC	ND	ND
Venison	NC	NC	NC	NC	NC	NC	ND	ND

ND = not determined

NC = not consumed

Table 12. Intertidal occupancy rates in the Devonport area (h/y)

Observation number	Location	Activity	Mud	Mud, sand and shale	Rock	Salt marsh	Sand and stones	Boat dwelling
187	Huggin's Boatyard (Torpoint)	Boat maintenance,boat dwelling	612					6770
275-276	Wearde Quay	Boat dwelling						5475
370	Southdown Marina	Boat dwelling						4996
323	Millbrook Quay	Boat dwelling						4808
188	Huggin's Boatyard (Torpoint)	Boat dwelling						4115
486-487	Balast Pond (Torpoint)	Boat dwelling						3860
489	Balast Pond (Torpoint)	Boat dwelling						3474
321-322	Millbrook Quay	Boat dwelling						3472
339	Southdown Marina	Boat dwelling						2912
189-190	Huggin's Boatyard (Torpoint)	Boat dwelling						2350
178	Huggin's Boatyard (Torpoint)	Boat dwelling						2020
488	Balast Pond (Torpoint)	Boat dwelling						1930
368	Southdown Marina	Boat dwelling						1717
28	Torpoint Beach/Wilcove Beach	Angling/bait digging		1300				
29	Torpoint Beach	Bait digging		1000				
220	Wearde Beach/local beaches	Angling/bait digging		806				
228	Local beaches/Wearde Beach	Angling/bait digging		806				
324	Local beaches/Torpoint Beach	Angling/bait digging		390				
327	Local beaches/Torpoint Beach	Angling/bait digging		390				
329	Local beaches/Torpoint Beach	Angling/bait digging		390				
331	Local beaches/Torpoint Beach	Angling/bait digging		390				
333	Local beaches/Torpoint Beach	Angling/bait digging		390				
192	Torpoint Beach	Angling		347				
280	Torpoint Beach	Bait digging		286				
406	R. Tamar/Torpoint Beach	Angling/bait digging	310	260				
198	Torpoint Beach	Angling/bait digging		260				
290	Local beaches	Angling		234				
292	Local beaches	Angling		234				
129	Torpoint Beach	Bait digging		208				
195	Southdown/Torpoint Beach	Angling/bait digging		195				
196	Southdown/Torpoint Beach	Angling/bait digging		195				
133	Torpoint Beach	Angling/bait digging		104			18	
135	Torpoint Beach	Angling/bait digging		104			18	

Table 12. Intertidal occupancy rates in the Devonport area (h/y)

Observation number	Location	Activity	Mud	Mud, sand and shale	Rock	Salt marsh	Sand and stones	Boat dwelling
128	Torpoint Beach	Bait digging		104				
31	Torpoint Beach	Walking		78				
283	Torpoint Beach	Playing		44				
287-289	Torpoint Beach	Playing		44				
281	Torpoint Beach	Bait digging		30				
351	Mount Wise	Dog walking		12				
428	Torpoint	Angling/bait digging		8	150			
405	Millbrook	Bait digging		4				
335	Millbrook Quay	Dog walking					365	
384	Lynher River	Angling					225	
386	Lynher River	Angling					225	
136	Torpoint Beach	Dog walking					104	
137	Torpoint Beach	Dog walking					104	
1024-1032	Various	Water sports preparation					98	
253-254	Plymouth Sound	Angling			78		78	
1200-1203	Saltram Beach	Sunbathing					36	
1338	Local beaches	Water sports preparation					26	
1339	Local beaches	Water sports preparation					26	
1205	Mount Batten Beach	Sunbathing					24	
1204	Mount Batten Beach	Sunbathing					14	
1194	Saltram Beach	Sunbathing					10	
1195	Saltram Beach	Sunbathing					10	
1196-1199	Saltram Beach	Playing					10	
125	R Tavy/R Tamar and R Tavy	Walking/bait digging	20				2	
469	Bere Ferrers peninsula	Wildfowling				4		
295	Plymouth Sound	Angling			100			
443-444	West Hoe	Sunbathing			60			
450-451	West Hoe, Jennycliff, Cawsand	Sunbathing			60			
435	West Hoe	Sunbathing			30			
429	Local beaches	Angling			18			
130	R Tavy near Warleigh Burton Farm	Walking	20					
132	R Tavy near Warleigh Burton Farm	Walking	20					
134	R Tavy near Warleigh Burton Farm	Walking	20					

Table 12. Intertidal occupancy rates in the Devonport area (h/y)

Observation number	Location	Activity	Mud	Mud, sand and shale	Rock	Salt marsh	Sand and stones	Boat dwelling
383	Marsh wall at Insworke	Wildfowling	20					
1148	Antony Passage	Working on the shore	20					
13	Hancock's Creek (Lynher)	Boat maintenance	14					

Notes

Emboldened observations are the critical group members

The critical group intertidal occupancy rate over mud based on 2 observations is 461 h/y

The observed 97.5 percentile rate based on 9 observations for mud is 551 h/y

The critical group intertidal occupancy rate over mud, sand and shale based on 4 observations is 978 h/y

The observed 97.5 percentile rate based on 30 observations for mud, sand and shale is 1082 h/y

The critical group intertidal occupancy rate over rock based on 8 observations is 80 h/y

The observed 97.5 percentile rate based on 10 observations for rock is 138 h/y

The critical group intertidal occupancy rate over salt marsh based on 1 observation is 4 h/y

The observed 97.5 percentile is not applicable for 1 observation over salt marsh

The critical group intertidal occupancy rate over sand and stones based on 3 observations is 271 h/y

The observed 97.5 percentile rate based on 33 observations for sand and stones is 253 h/y

The critical group intertidal occupancy rate for houseboat dwelling based on 14 observations is 4099 h/y

The observed 97.5 percentile rate based on 17 observations for houseboat dwelling is 6252 h/y

Table 13. Handling rates of fishing gear and sediment in the Devonport area (h/y)

Observation number	Location	Activity	Fishing gear	Sediment
29	Torpoint Beach	Bait digging		1000
216	All estuaries in survey area	Net handling	780	
187	Huggin's Boatyard (Torpoint)	Boat maintenance		612
406	R. Tamar bank n. of St.Budeuax Wharf and Torpoint	Bait digging		310
28	Torpoint Beach	Bait digging		300
280	Torpoint Beach	Bait digging		286
129	Torpoint Beach	Bait digging		208
1168	Lynher River	Net handling	120	
128	Torpoint Beach	Bait digging		104
133	Torpoint Beach	Bait digging		104
135	Torpoint Beach	Bait digging		104
220	Wearde Beach	Bait digging		104
228	Wearde Beach	Bait digging		104
198	Torpoint Beach	Bait digging		52
195	Southdown	Bait digging		39
196	Southdown	Bait digging		39
372	Inside the breakwater	Gear handling	39	
374	Inside the breakwater	Gear handling	39	
281	Torpoint Beach	Bait digging		30
324	Torpoint Beach	Bait digging		30
327	Torpoint Beach	Bait digging		30
329	Torpoint Beach	Bait digging		30
331	Torpoint Beach	Bait digging		30
333	Torpoint Beach	Bait digging		30
428	Torpoint Beach	Bait digging		8
405	Millbrook	Bait digging		4
125	R Tamar and R Tavy	Bait digging		2

Notes

Emboldened observations are the critical group members

The critical group fishing gear handling time based on 1 observation is 780 h/y

The observed 97.5 percentile rate based on 4 observations for fishing gear is 730 h/y

The critical group sediment handling time based on 2 observations is 806 h/y

The observed 97.5 percentile rate based on 25 observations for sediment is 767 h/y

Table 14. Gamma dose rate measurements over intertidal substrates in the Devonport area (micro Gy/h)

Location	NGR	Substrate	Gamma dose rate at 1 metre
Torpoint - bait area	SX 441 547	Mud, sand and shale	0.093
Torpoint - boat area	SX 441 546	Mud and sand	0.093
Torpoint - Huggin's Boatyard	SX 431 548	Mud	0.071
Wearde Quay - angling	SX 427 577	Mud, sand and shale	0.085
Wearde Quay - houseboat	SX 425 576	Mud, sand and shale	0.075
Millbrook Quay - posn 1	SX 432 523	Mud, sand and shale	0.079
Millbrook Quay - posn 2	SX 433 523	Mud	0.076
Southdown Marina	SX 437 527	Mud	0.069
Warleigh Barton Farm	SX 459 622	Mud	0.092
Warleigh Barton Farm	SX 459 622	Mud and shale	0.089
Under the Tamar Bridge	SX 437 588	Mud	0.070

Table 15. Rates for occupancy in close proximity to liquid or dried sewage sludge (h/y)

Observation number	Activity	Occupancy in close proximity (<10m) to the liquid sewage sludge	Occupancy in close proximity (<10m) to the dried sewage sludge
183 -184	Debris removal, cleaning filters, unblocking pumps/pipes, sampling	1430	180
185 - 186	Debris removal, cleaning filters, unblocking pumps/pipes, sampling	176	22

Notes

No data have been collected for pathways related to other aspects of sewage disposal or treatment, such as people working in the sewers between the Devonport site and Camels Head STP.

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

Observation number	Location	Activity	In water	On water
216	Weir Quay/Tamar, Lhyner and Tavy estuaries	Boat dwelling (afloat)/eel netting		7482
178	Huggin's Boatyard	Boat dwelling (tide in)		4040
486-487	Torpoint Beach	Boat dwelling (tide in)		3860
489	Torpoint Beach	Boat dwelling (tide in)		3474
323	Millbrook Quay	Boat dwelling (tide in)		3434
368	Southdown Marina	Boat dwelling (tide in)		3434
276	Wearde Quay/All estuaries in survey area	Diving, boating, boat dwelling (tide in)	312	2865
370	Southdown Marina	Boat dwelling (tide in)		2498
321-322	Millbrook Quay	Boat dwelling (tide in)		2480
488	Torpoint Beach	Boat dwelling (tide in)		1930
311-320	Torpoint to Plymouth	Torpoint ferry operations		1880
275	Wearde Quay	Boat dwelling (tide in)		1825
462-468	Plymouth Sound	Working on a boat		1818
307-310	Cremyll to Plymouth	Cremyll ferry operations		1500
339	Southdown Marina	Boat dwelling (tide in)		1456
187	Huggin's Boatyard	Boat dwelling (tide in)		1354
455-457	Plymouth Sound	Working on a boat		1136
188	Huggin's Boatyard	Boat dwelling (tide in)		823
458-461	Plymouth Sound	Working on a boat		568
189-190	Huggin's Boatyard	Boat dwelling (tide in)		470
220	Inside the breakwater	Boat angling		468
228	Inside the breakwater	Boat angling		468
1168	Lynher River	Angling/shrimp netting (in river)		444
1206-1207	All estuaries in survey area	Boating		250
404	R Tamar and R Tavy	Canoeing, boating		240
478	Plymouth Sound	Commercial fishing		240
1122	Inside the breakwater	Boat angling		208
1188-1193	River Plym	Jet skiing		208
411-412	Plymouth Sound	Boating		180
514	R Tamar	Boat angling		160
794-847	Plymouth Sound	Boating		154
182	Plymouth Sound	Boat angling		143
202	Plymouth Sound	Boat angling		143
1348-1349	Inside the breakwater	Water sports instructor	140	140
1208-1210	All estuaries in survey area	Boating		125

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

Observation number	Location	Activity	In water	On water
1137	Hamoaze and Drakes Island/Inside the breakwater	Diving, boating	30	84
848-1003	Plymouth Sound	Boating		78
281	All estuaries in survey area	Angling		63
1004-1023	Plymouth Sound	Boating		61
1138	Inside the breakwater	Boating		60
449	Plymouth Sound/West Hoe	Boating, swimming	60	52
372	Inside the breakwater	Boating		39
374	Inside the breakwater	Boating		39
1	Antony Passage	Water sports instructor	33	33
125	River Tavy near Warleigh Burton Farm	Boating		30
130	River Tavy near Warleigh Burton Farm	Boating		30
132	River Tavy near Warleigh Burton Farm	Boating		30
134	River Tavy near Warleigh Burton Farm	Boating		30
1139-1147	Inside the breakwater/Hamoaze and Drakes Island	Diving, boating	30	24
1204	Mount Batten Bay/Inside the breakwater	Swimming, boating	21	14
1340-1346	Breakwater Fort/Inside the breakwater	Diving, boating	24	12
1148	Lynher River/Inside the breakwater	Surfing, boating	20	9
1211	Inside the breakwater	Water sports instructor	280	
1347	Inside the breakwater	Water sports instructor	280	
441-442	West Hoe	Swimming	250	
437-439	West Hoe	Swimming	128	
1024-1032	Various	Diving	65	
445-448	West Hoe	Swimming	60	
452-454	West Hoe, Jennycliff, Cawsands	Swimming	60	
1338-1339	Inside the breakwater	Diving	52	
436	West Hoe	Swimming	30	
1149-1150	Lynher River	Swimming	30	
295	Plymouth Sound	Spear fishing	25	
1205	Mount Batten Bay/The Hoe	Swimming	6	
440	West Hoe	Swimming	4	
1196-1199	River Plym	Swimming	2	

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

Observation number	Arti-choke	Aspa-ragus	Broc-coli	Brussel sprout	Cabbage	Cala-brese	Cauli-flower	Chard	Courg-ette	Cucu-umber	Gherkin	Herbs	Kale	Leaf beet	Lettuce	Marrow	Pak choi	Rocket	Spinach	Total
524-525			28.1	17.1	22.8				13.2						11.3	13.0				105.4
272-274			5.4	13.7	10.2		8.2	1.5	9.1	2.3			7.3		9.5					67.0
1043-1045		0.9		7.3	11.4		5.4	2.0		6.0		0.1	16.0		7.5	6.3			2.1	65.0
266			6.1		10.6		6.8		23.0	8.5		0.9			3.0	1.8				60.8
156-157					37.4				7.4							1.8				46.6
46-47			9.4		30.5		5.8													45.6
1-3					22.7		22.7													45.4
1178-1179			22.4		18.3					0.9						0.9				42.5
286, 294			8.2		1.8		6.1		3.7						19.1				3.6	42.5
33-34									22.1	3.4					10.0				4.1	39.6
213				6.4			9.5						7.3		12.0				3.4	38.6
218-219			12.3	3.8	18.8		3.1													38.0
400-401					15.2		3.7	3.2					12.8							35.0
194			14.1	8.6	11.5															34.2
1090									14.7			0.3			1.6	14.4	1.0	2.2		34.1
1092-1093									14.7			0.3			1.6	14.4	1.0	2.2		34.1
510-511					30.8										1.7					32.5
172			0.8		4.6				8.2			0.8			9.0	4.5			2.0	29.9
191, 193			15.0						4.4	8.2									1.4	28.9
270-271			1.9	1.9			1.9	1.6	5.6	10.7					4.9					28.6
43-44			10.1		8.2		5.1		3.4											26.8
225				11.5	10.2		4.7													26.4
230-231				11.5	10.2		4.7													26.4
122-123					22.1										3.4				0.5	26.0
211,214,215				3.6				1.9	3.7	4.5					6.7	3.6			1.4	25.4
282,284,285			1.4	10.0	6.0		2.0			4.3				0.9	0.6					25.1
279			1.4	10.0	6.0		2.0			4.3				0.9	0.6					25.1
259,264			8.2		2.7				4.4	6.8		0.4			1.6					24.1
107		0.6			10.2		2.4						5.8		2.7				0.5	22.2
182			0.8	0.8	9.9		0.7		1.6			0.7			3.6	0.6			2.9	21.8
202-205			0.8	0.8	9.9		0.7		1.6			0.7			3.6	0.6			2.9	21.8
251-252				10.4	8.7										2.7					21.8
366-367							8.2								11.0			2.5		21.7
1062-1063	5.4	2.1	3.7		5.9						0.6		3.2							21.0
240					4.3		3.4		4.6						3.6				4.5	20.4
239,250			8.3	5.1	6.8															20.2
241-246			8.3	5.1	6.8															20.2
1187					8.5		10.5													19.0
117		0.2	6.7		5.5		3.4								2.7					18.5
267-269					3.5		2.3		7.7	2.8		0.3			1.0	0.6				18.2
1180-1183				1.7	9.1		5.6								1.1					17.6
206,212				2.3	3.6		2.3									9.0				17.2

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

Observation number	Arti-choke	Aspa-ragus	Broc-coli	Brussel sprout	Cabbage	Calabrese	Cauliflower	Chard	Courgette	Cucumber	Gherkin	Herbs	Kale	Leaf beet	Lettuce	Marrow	Pak choi	Rocket	Spinach	Total
520-522					13.7		0.9					0.02			0.4			1.7		16.7
160,163-167			2.2	2.2	10.2		1.1								0.6					16.4
265						4.1			9.2			0.5			2.4					16.1
1184-1186					2.0				4.9			0.3			4.5			2.0	2.3	16.0
376,396-398				5.5	5.1			0.8		2.0		0.1			2.4					15.9
277-278					5.1										10.0					15.1
508-509					4.6				1.8	1.7					6.8					14.9
1127-1128					4.3										0.9				8.2	13.3
120-121					11.1										1.7				0.2	13.0
6-8					6.5		6.5													13.0
1075-1076					2.3		5.6	2.4				0.2			2.3					12.8
221-223					12.8															12.8
35-42					12.4															12.4
103-106					12.3															12.3
473									3.7			0.1			2.3	3.6		2.3		11.9
1171-1173				2.7			2.2		0.7	0.7	0.5				0.5	4.3				11.7
498-501				2.7	3.7		4.5								0.6					11.5
474,490				4.8	6.4															11.2
470-472				8.5					1.1			0.2			1.2					10.9
126-127					8.5										2.0					10.5
257-258					2.1		1.7		2.3						1.8				2.3	10.2
369,371									7.4						2.6					10.0
507				5.5															4.1	9.5
158-159					4.3							0.2			2.5				2.6	9.5
10951096					4.6										2.3				2.6	9.4
1125-1126			1.1	0.7	3.0		0.6								2.0			1.5		8.9
526-528,530					8.8															8.8
1055-1056												0.1			3.5		5.0			8.6
1129-1131			1.0	2.3	5.1															8.4
217				2.7	2.6		2.0												0.3	7.6
1048-1049					5.1										2.5					7.6
1158-1159										3.4					4.0					7.4
494-497		1.6					1.0								2.3				2.6	7.4
155,161	0.9		0.7		3.3					1.4					0.3				0.3	7.0
14 - 15													6.7							6.7
207-209			2.2		1.8				1.8						0.6					6.5
1057-1058					3.0										1.5				1.7	6.2
491-493					6.1															6.1
113-116			0.6						5.0						0.1					5.7
197,200-201			5.6																	5.6
1064	1.4	0.7	0.9		1.5						0.2		0.8							5.4
144-145									1.1						4.0					5.1

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

Observation number	Arti-choke	Aspa-ragus	Broc-coli	Brussel sprout	Cabbage	Calabrese	Cauliflower	Chard	Courgette	Cucumber	Gherkin	Herbs	Kale	Leaf beet	Lettuce	Marrow	Pak choi	Rocket	Spinach	Total
175-176			0.8	1.1	2.0									0.2					0.6	4.8
253-254					4.1															4.1
1077					0.7		1.6	0.7				0.1		0.6						3.7
1080-1082					0.7		1.6	0.7				0.1		0.6						3.7
12, 20 - 23				1.8										1.8						3.6
504-506														3.6						3.6
1037																3.6				3.6
99 - 100														2.4						2.4
1033-1034									0.9	0.9										1.8
1085-1089					1.1									0.5						1.6
1038-1041														0.6					0.7	1.3
224, 234-237				0.5	0.4		0.3												0.04	1.3
297,300,302							0.7							0.2						0.9
304-306							0.7							0.2						0.9
101-102																			0.8	0.8
1122-1124												0.3								0.3
177, 179-181									0.2											0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 25 highest adult consumers is 54.1 kg/y

The observed 97.5 percentile rate based on 247 observations is 65.0 kg/y

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

Observation number	Aubergine	Broad bean	Chilli pepper	French bean	Mangetout	Pea	Pepper	Runner bean	Squash	Sweetcorn	Tomato	Total
33-34		43.2		8.1		27.0		61.2				139.5
16		34.4						49.5				83.9
510-511		5.1		6.1		5.1	3.7	15.3		1.4	40.5	77.1
108-109		24.6				12.2		36.7				73.4
1127-1128		13.7						40.8			10.8	65.3
117		12.3		9.7				32.6			6.5	61.1
221-223		26.2				6.5		22.0		1.4		56.1
172		24.5				0.4		24.5			6.1	55.5
110-112		27.3				6.8		20.4				54.5
1075-1076		30.5		5.4	3.4	4.5		10.2				54.0
158-159				8.6		10.8		20.4			13.5	53.3
259, 264	4.9	10.9	9.4	1.9				11.6	10.9	1.7		51.3
286, 294		4.2				7.9		30.6			8.2	50.9
1055-1056		4.5		3.4		0.7		22.7	7.5	2.8	9.1	50.6
369, 371		25.2		2.4				13.3			9.1	49.9
272 - 274		3.0		6.8				17.4	0.3	5.1	15.1	47.8
1043 - 1045		9.1				2.8		17.0			18.0	46.9
191, 193				3.0		3.6		16.3		5.5	18.3	46.8
197, 200-201		20.5		2.7				20.4		2.3		45.9
1178-1179		11.4		1.4		7.5		24.5	0.1	0.9		45.7
251 - 252		6.8				11.8		24.5				43.1
213		5.6				1.4		26.5		3.7	5.4	42.7
265		9.1		2.9				24.5		4.6		41.1
217		9.8		3.0		1.1		25.5		1.4		40.7
107		6.1		5.6				21.2			6.5	39.5
470 - 472		21.8				2.1		14.5				38.4
126 - 127						9.5		28.6				38.0
508 - 509		6.8		2.7				20.4		1.7	3.6	35.3
194						2.4					32.4	34.8
270 - 271		2.1					1.0	3.5		10.7	17.5	34.8
1037		4.6		3.6				13.6			12.7	34.5
1 - 3								22.7		11.3		34.0
46 - 47		22.8				11.3						34.0
277 - 278		18.2		2.7		11.5						32.4

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

Observation number	Aubergine	Broad bean	Chilli pepper	French bean	Mangetout	Pea	Pepper	Runner bean	Squash	Sweetcorn	Tomato	Total
266		0.7				1.6	5.9	5.7		3.2	14.4	31.4
211, 214-215		10.9				6.3		13.6				30.8
376, 396-398	0.2	1.8	0.5	4.5		5.4	0.5	14.7		1.4	1.1	30.1
1062-1063		4.1				3.8		17.0	0.6	0.9	2.7	29.2
520 - 522		3.4	0.5	5.4		2.3	1.2	6.8		1.0	8.1	28.6
232 - 233		6.4				5.4		16.3				28.1
206, 212		8.0				10.1	0.5	4.5			4.1	27.2
218 - 219		11.3				3.7		11.2		0.5		26.6
279, 282		5.6				5.0	0.2	11.3		1.4	2.7	26.2
284 - 285		5.6				5.0	0.2	11.3		1.4	2.7	26.2
507		5.5		4.3				16.3				26.1
1085-1089		8.2				2.4		14.7				25.3
1090				5.2	4.4	2.2	1.6	6.5		0.2	5.0	25.0
1092-1093				5.2	4.4	2.2	1.6	6.5		0.2	5.0	25.0
491 - 493		4.6						20.4				25.0
1048-1049		7.6				3.8		13.6				24.9
474, 490		4.8				4.7		14.3				23.8
14 - 15						9.5		14.3				23.7
400 - 401		9.1						13.6				22.7
35 - 42		4.9		1.4				16.3				22.7
253 - 254		4.6				4.6		12.2		1.2		22.6
182, 202-205		2.4		1.3		1.6		12.2		1.7	2.9	22.1
526, 530				5.2				13.1		3.9		22.1
527 - 528				5.2				13.1		3.9		22.1
1180-1183		3.4				8.4		10.2				22.1
103 - 106						3.0		18.4				21.4
1187		6.4				12.6						19.0
473		3.4		5.4		10.1						18.9
1125-1126		4.6						13.6				18.2
1129-1131						1.1		17.0				18.1
498 - 501		9.1				1.8		5.4		1.4		17.7
225, 230 - 231		3.8				1.9		11.4				17.1
494 - 497		3.4				3.4		10.2				17.0
1095-1096		3.4		2.7				10.2				16.3

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

Observation number	Aubergine	Broad bean	Chilli pepper	French bean	Mangetout	Pea	Pepper	Runner bean	Squash	Sweetcorn	Tomato	Total
160, 163 - 167		1.1				4.3		10.6		0.3		16.3
1077, 1080-1081		8.8		1.5	1.0	1.9		2.9				16.1
399								14.7				14.7
240		2.3		1.4		2.3		4.5		3.7		14.1
504 - 506				2.9				10.9				13.8
1184-1186			0.3	1.2		3.0	2.6			0.5	6.0	13.7
113 - 116		6.1		2.4		3.0				0.8		12.4
17 - 19		4.9						7.1				12.0
239, 241 - 246				3.0		2.5		4.5		1.9		11.8
250				3.0		2.5		4.5		1.9		11.8
155, 161		1.0						0.7		3.3	6.0	11.0
1057				1.8		2.3		6.8				10.9
1058				1.8		2.3		6.8				10.9
156 - 157						10.8						10.8
267 - 269		0.2				0.5	2.0	1.9		1.1	4.8	10.5
144 - 145		1.6						1.8		3.5	3.4	10.3
524 - 525										1.2	9.0	10.2
175 - 176		3.6				1.1		5.4				10.2
6 - 8								6.5		3.2		9.7
43 - 44		1.1		2.8				4.0		1.7		9.7
1033-1034				0.9		2.3		3.4		0.3	2.7	9.5
122 - 123		4.5						4.5				9.1
101 - 102						0.8		7.7				8.5
366 - 367								8.4				8.4
1064		1.0				1.0		4.3	0.2	0.2	0.7	7.3
257 - 258		1.1		0.7		1.1		2.3		1.8		7.1
224, 234-237		1.6		0.5		0.2		4.3		0.2		6.8
1171-1173		1.4									5.4	6.8
99-100						5.4						5.4
1038-1041		0.9		0.7		0.9		2.7				5.3
12, 20 -23								4.5				4.5
120 - 121		2.3						2.3				4.5
1122-1124						1.2		2.3				3.5
146 - 153		1.6						1.8				3.4

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

Observation number	Aubergine	Broad bean	Chilli pepper	French bean	Mangetout	Pea	Pepper	Runner bean	Squash	Sweetcorn	Tomato	Total
297, 300, 302								3.4				3.4
304 - 306								3.4				3.4
207 - 209						1.4		1.8				3.1
1158-1159				2.4								2.4
1053-1054										2.3		2.3
177, 179-181		0.7						0.7			0.2	1.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 37 highest adult consumers is 60.6 kg/y

The observed 97.5 percentile rate based on 269 observations is 67.7 kg/y

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

Observation number	Jerusalem artichoke	Beetroot	Carrot	Celeriac	Celery	Chinese radish	Fennel	Garlic	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
34		13.4	53.5					4.3		48.1	16.0		9.5		20.2		165.0
33		13.4	53.5					4.3		48.1	16.0		9.5				144.8
107		5.7	14.0					1.6	3.5	8.1	2.8		0.9		31.8		68.5
108-109		12.2								42.1	9.7						64.0
400-401		9.0	9.0							16.2			1.6		13.6	10.8	60.2
270-271		2.5	8.8					0.6	0.5	35.0			5.6		2.4	4.2	59.4
510-511		10.1	10.1						2.5	8.1	2.0		3.6	1.1	15.3	6.1	59.0
197, 200-201		10.1	13.5							21.6			4.8			8.1	58.1
221-223									7.3	10.4	3.2				36.7		57.6
1127-1128		16.2	16.2							8.6	13.0						54.0
117		16.2	16.2					1.2		9.7			7.7				51.0
46-47		7.9	7.9							9.0	6.3		4.0			13.5	48.6
206, 212		2.0	31.8						2.3	11.0							47.1
251-252		9.1	2.0						6.1	19.4	4.1		5.4				46.1
1180-1183		3.4	10.1	2.4					1.7	8.1			2.4		10.2	4.1	42.3
1043-1045		5.6	2.8						5.6	4.5	2.3	2.7		0.8	17.0		41.3
272-274		2.1	6.8					0.1	3.0	9.1	2.3	1.2		1.2	9.8	2.1	37.7
474, 490		4.7	4.7							3.8	3.8				14.3	5.7	37.0
1090			6.5		2.6				13.0	8.6			3.1				33.7
1092-1093			6.5		2.6				13.0	8.6			3.1				33.7
156-157		3.6	3.6						7.2	14.4			3.8				32.6
126-127									4.7	26.5							31.2
1122-1124		4.7	4.7							3.2			3.8		14.3		30.8
1075		3.4	1.7						4.5	9.0	6.3					5.4	30.3
470-472			2.1						6.3	15.1	5.0	0.2	1.5				30.3
218-219		7.4	3.7					0.5	5.6	10.4	1.5						29.1
225, 230-231			9.5							5.0	2.5		3.4		8.6		28.9
1048-1049		3.8								12.0	6.0	1.5	5.3				28.6
1076		3.4	1.7						1.7	9.0	6.7					5.4	27.8
16		17.6								10.1							27.7
508-509		3.4	3.4							8.1			2.4		10.2		27.5
172								6.1	8.2	8.2			4.1				26.5
266		1.1	1.8					0.4	2.5	6.6			3.0		9.1	1.1	25.7
473		3.4	13.5						3.4	5.4							25.7
182, 202		0.8	2.4					1.1		16.5	2.8		1.6	0.2		0.2	25.6
1062-1063		7.2	5.6							4.1	4.3					4.3	25.5
213		4.5	7.7							5.3	6.5						23.9

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

Observation number	Jerusalem artichoke	Beetroot	Carrot	Celeriac	Celery	Chinese radish	Fennel	Garlic	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
366-367		6.8								16.5							23.3
1057-1058		2.3	4.5						2.3	1.8	1.8	0.9	1.6	1.0	6.8		22.9
253-254		1.5	3.0					0.4		12.2	2.4		3.2				22.8
103-106		1.5								17.0	2.4						21.0
1053-1054			13.5							7.2							20.7
369, 371		2.3								14.1	2.2	1.1	1.0				20.5
507		5.4								4.3	4.3					6.5	20.5
524-525			0.7						16.9	2.2							19.8
99-100		1.8	3.6							4.3		1.4	1.9	1.6		4.3	19.0
498-501		3.6	1.8						2.7	5.9	1.4		1.9	1.6			18.9
520-522		8.3								5.4	0.9		2.4		1.7		18.7
279, 282, 284-285		2.5	1.2					0.2		9.9	2.0	1.0			1.4	0.2	18.4
259, 264	10.9			1.9				1.9			2.9		0.6				18.2
14-15									9.5	7.6							17.0
491-493			9.0							1.7	3.6		1.7				15.9
1055-1056		2.3	1.1							11.0				0.5			14.9
494-497		6.8								4.1						4.1	14.9
1158-1159										14.4							14.4
526, 527-528, 530			2.2							4.3	1.3				6.5		14.3
191, 193		1.8	3.2							9.1							14.1
286, 294		1.7	2.3						1.8	6.8						0.9	13.5
1125-1126		2.3								7.2		1.2				2.7	13.3
160, 163-167		0.9								11.9							12.8
265								0.8		11.0		0.9					12.7
194													2.7		9.8		12.5
1085-1089		4.1								6.5						1.9	12.5
239, 241-246, 250		1.9	1.9						6.9		1.8						12.4
211, 214-215		1.8	1.8							4.3	1.4		1.3	0.8			11.4
376, 396-398		2.3				1.4	0.2	0.5	1.1	1.9	1.8	1.3	0.6				11.1
1184-1186			3.0						3.8	1.2	1.2	1.2		0.7			11.0
35-42		1.8								6.9						2.2	10.9
95-98										10.8							10.8
122-123									10.4								10.4
144-145		0.7	0.5							2.7	0.7		0.9		2.3	2.3	10.0
110-112		6.8								2.7							9.5

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

Observation number	Jerusalem artichoke	Beetroot	Carrot	Celeriac	Celery	Chinese radish	Fennel	Garlic	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
203-205		0.8	2.4					1.1			2.8		1.6	0.2		0.2	9.1
504-506		3.6								2.9		1.4		0.8			8.7
267-269		0.4	0.6					0.1	0.8	2.2			1.0		3.0	0.4	8.6
1077, 180-1082		1.0	0.5						0.5	2.6	2.1					1.5	8.1
12, 20-23		1.4	1.4							4.3	1.1						8.1
1037			4.5							3.6							8.1
1129-1131										8.1							8.1
240		1.4	0.9					0.6		2.3	1.4	0.5	0.7	0.2			7.9
155, 161		1.0						0.7		1.7		0.7				3.3	7.3
232-233								0.8		4.3			1.9				7.0
43-44		6.1											0.8				6.8
1064		1.8	1.4							1.0	1.1					1.1	6.4
207-209			0.9						0.9	1.8	1.1	0.4		0.4			5.4
120-121									5.2								5.2
1187										5.0							5.0
175-176			0.8							1.4	0.7	0.1	0.6			1.0	4.6
277-278										4.4							4.4
1038-1041		0.9	0.9							2.2		0.4					4.3
17-19		2.5								1.4							4.0
257-258		0.7	0.5					0.3		1.1	0.7	0.2	0.3	0.1			3.9
1178-1179			1.7						1.7								3.4
1095-1096										2.7							2.7
1171-1173			1.4						1.4								2.7
217										1.9							1.9
1033-1034			0.6							0.9	0.5						1.9
101-102											1.6						1.6
342-343			1.5														1.5
146-153		0.7															0.7
177, 179-181									0.2	0.2			0.1				0.6
224, 234-237										0.3							0.3
297, 300, 302		0.2															0.2
304-306		0.2															0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 17 highest adult consumers is 71.2 kg/y

The observed 97.5 percentile rate based on 262 observations is 59.8 kg/y

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

Observation number	Potato
1134-1136	165.6
33-34	132.0
524-525	109.2
118-119, 272-274	101.6
1053-1054	91.0
108-109	83.6
1-3, 9-10	82.9
99-100	76.4
251-252, 270-271	71.7
1178-1179	68.3
1127-1128	65.5
1187	63.7
369, 371	60.1
279, 282, 284,285	57.7
266	57.3
508-509	54.6
194	51.6
12, 20-23	50.8
366-367	50.8
213	50.5
110-112	48.6
191, 193	45.9
1048-1049	45.5
218-219	45.0
117	41.0
24-25	39.0
126-127	38.2
95-98	36.4
1062-1063	35.9
16	35.7
197, 200-201, 1180-1183	34.1
253-254	33.8
107, 277-278	32.8
46-47	31.9
1158-1159	30.3
473, 1090,1092,1093	27.3
221-223	26.2
122-123, 225, 230-231	25.5
217	25.3
376, 396-398	25.0
6-8	23.7
172	22.9
1129-1131, 1055-1056	22.7
211, 214-215,498-501	21.8
158-159	20.5
14-15, 267-269	19.1

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

Observation number	Potato
1125-1126	18.2
470-472	17.0
155, 161	16.7
259, 264	16.2
239, 241-246, 250	15.3
526-528, 530	14.2
491-493, 1171-1173	13.7
1075-1076	13.7
120-121	12.7
35-42	11.6
1043-1045	11.4
232-233	10.9
507	10.9
1122-1124	10.9
494-497	10.2
474, 490	9.6
400-401	9.1
1057-1058,1184-1186	9.1
144-145	9.1
1064	9.0
175-176	8.7
43-44	8.2
1033-1034,1095-1096	6.8
207-209, 286,294	6.8
17-19, 510-511	5.1
113-116,182,202-205	4.6
240, 342-343	4.5
224, 234-237	4.2
1077, 1080-1082	3.9
1038-1041	3.6
101-102	3.3
257-258	2.3
160, 163-167	1.0
177, 179-181	0.6

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of potato based on the 39 highest adult consumers is 87.9 kg/y

The observed 97.5 percentile rate based on 248 observations is 107.9 kg/y

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

Observation number	Apple	Black-berry	Black-currant	Blue-berry	Boysen-berry	Cherry	Goose-berry	Grape	Green-gages	Josta-berry	Logan-berry	Melon	Pear	Plum	Pumpkin	Rasp-berry	Red-currant	Rhubarb	Straw-berry	Tay-berry	White-currant	Total	
213			22.7				22.7									22.7	22.7	2.7				93.4	
194			30.6				22.1									4.1		14.5	1.4				72.6
172	1.2	2.4	0.6				4.1				16.3				12.2	20.4			4.1			61.4	
33-34			14.2							5.7						8.1			23.6	8.1		59.7	
101-102			10.2								16.7					1.4	16.3					44.7	
1178-1179			3.6				3.6									3.6		16.3	16.1			43.3	
46-47			8.5				6.1				11.9					8.5		2.3	6.0			43.3	
366-367		5.0					3.4				4.5					10.2		11.8	7.9			42.9	
474, 490			11.9				8.6				11.1					7.1		1.6				40.4	
286, 294		3.6	1.1								1.1					9.1		6.8	15.3			37.1	
217	3.4	11.3				2.7	2.3					0.9		2.3		4.5		3.5	5.7			36.5	
191, 193		3.2	15.9				4.9								1.6	1.4		2.8	6.0			35.6	
270-271	1.6	5.3			2.5					4.2						8.8	0.5	1.6	3.5	7.0		34.8	
16																		9.7	23.8			33.5	
211																4.5			27.2			31.7	
214-215																4.5			27.2			31.7	
1127-1128							6.1									8.1		3.5	6.8			24.5	
43-44		1.7					2.8									6.2	1.7	1.2	9.6			23.3	
259, 264		0.9	0.4												10.9	0.4		8.7	1.8			23.0	
221-223			2.7				0.5				2.7			4.1				5.5	6.1			21.7	
1090			2.3				2.0					0.7			2.3	9.8	1.8	0.5	2.3			21.7	
108-109			8.2															3.1	10.2			21.5	
1092-1093			2.3				1.6					0.7			2.3	9.8	1.8	0.5	2.3			21.3	
1043-1045			1.2								1.2				0.4	4.2		1.8	11.9			20.7	
197			3.4				1.7			3.4						7.6	1.1	0.6		2.3		20.0	
200-201			3.4				1.7			3.4						7.6	1.1	0.6		2.3		20.0	
225											3.7					4.8		3.8	5.6	1.9		19.6	
230-231											3.7					4.8		3.8	5.6	1.9		19.6	
156-157																		2.3	17.0			19.3	
491-493	0.5		5.7				4.1				8.0											18.2	
277-278																12.9			3.6			16.5	
1180-1183		2.0	1.4				1.0									0.2		1.4	10.2			16.2	
272-274											7.3	0.6			2.4			5.3				15.6	
1038-1041			4.5													2.7		0.5	1.0	6.4		15.0	
524-525	5.7												4.5	4.5								14.7	
1075-1076			1.4				1.0									0.2		1.2	10.7			14.5	
400-401	0.7	1.4					2.7											6.9	2.7			14.4	
107			5.4				2.7									2.7		3.5				14.3	
1187																1.0		8.1	4.3			13.3	
369, 371																		10.9	2.3			13.2	
526-528	2.3		3.4				0.4	0.2										0.5	5.7			12.4	

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

Observation number	Apple	Black-berry	Black-currant	Blue-berry	Boysen-berry	Cherry	Goose-berry	Grape	Green-gages	Josta-berry	Logan-berry	Melon	Pear	Plum	Pumpkin	Rasp-berry	Red-currant	Rhubarb	Straw-berry	Tay-berry	White-currant	Total
530	2.3		3.4				0.4	0.2										0.5	5.7			12.4
202-205	2.4	1.6	0.8				1.2							1.6		2.9		0.8	0.8			12.2
182	2.4	1.6	0.8				1.2							1.6		2.9		0.8	0.8			12.2
265			0.5				2.3									0.5				9.1		12.2
470-472			4.2				3.8									2.4				1.3		11.7
504-506	3.8										4.2					2.7		0.6				11.3
206, 212	0.5		1.5				0.9									1.1	0.7	0.2	5.4		0.7	11.0
1048-1049		8.0																3.1				11.0
218-219			0.7				0.1			3.0							0.3	3.0	3.7			10.9
14-15							2.5									1.1	1.1	5.8				10.5
251-252																		3.5	6.8			10.3
266	0.2		0.7				1.4				0.5			0.2		3.4	0.2	2.3	1.4			10.2
520-522			0.9											3.4			0.8	2.3	2.8			10.2
175-176			2.3				4.1									0.8		2.3	0.5			9.9
1184-1186												2.3			1.5			6.1				9.9
95-98																			9.5			9.5
1062-1063	0.5		0.5	0.5			0.5		0.5				0.5	0.5		2.5	0.5	2.3				8.5
396-398	0.7	0.2	0.2				0.5	0.2		0.2	0.7	0.2	0.7			0.5	0.1	3.6	0.6		0.1	8.3
376	0.7	0.2	0.2				0.5	0.2		0.2	0.7	0.2	0.7			0.5	0.1	3.6	0.6		0.1	8.3
155, 161	1.7		0.3				1.0									3.3	0.03	0.7	0.3			7.4
99-100			2.8				2.0										2.3					7.2
1095-1096			1.4														1.1	0.6	3.6			6.7
1158-1159							4.1											2.3				6.4
224	0.6	1.9				0.5	0.4					0.1		0.4		0.8		0.6	0.9			6.1
234-237	0.6	1.9				0.5	0.4					0.1		0.4		0.8		0.6	0.9			6.1
1171-1173			2.3				0.8											2.8				5.8
232-233																		5.2				5.2
118-119	5.0																					5.0
1122-1124							2.0												2.9			4.9
17-19																		1.4	3.4			4.8
110-112																		4.6				4.6
122-123	4.5																					4.5
1134-1136	3.6												0.9									4.5
1129-1131																			4.3			4.3
1077			0.4				0.3									0.1		0.3	3.1			4.2
1080-1082			0.4				0.3									0.1		0.3	3.1			4.2
498-501																		1.8	1.8			3.7
399																		3.6				3.6
1125-1126			1.4				0.8											1.4				3.6
508-509																			3.6			3.6
510-511																		3.5				3.5

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

Observation number	Apple	Black-berry	Black-currant	Blue-berry	Boysen-berry	Cherry	Goose-berry	Grape	Green-gages	Josta-berry	Logan-berry	Melon	Pear	Plum	Pumpkin	Rasp-berry	Red-currant	Rhubarb	Straw-berry	Tay-berry	White-currant	Total
267-269	0.1		0.2				0.5				0.2			0.1		1.1	0.1	0.8	0.5			3.4
160							0.6									0.2			2.2			3.0
163-167							0.6									0.2			2.2			3.0
297																		0.8	1.7			2.5
300																		0.8	1.7			2.5
302																		0.8	1.7			2.5
304-306																		0.8	1.7			2.5
158-159																		2.3				2.3
473																		2.3				2.3
120-121	2.3																					2.3
144-145			0.2				0.9										0.1	0.9				2.2
1064	0.1		0.1	0.1			0.1		0.1				0.1	0.1		0.6	0.1	0.6				2.1
207-209																			1.9			1.9
177							0.1				0.5				0.3	0.6			0.1			1.6
179-181							0.1				0.5				0.3	0.6			0.1			1.6
342-343			1.5																			1.5
343			1.5																			1.5
1033-1034	0.3																		1.0			1.4
494-497																		1.2				1.2
103-106																		1.0				1.0
1055-1056													0.3			0.2			0.5			1.0
12																		0.9				0.9
20-23																		0.9				0.9
352-253																		0.9				0.9
257-258			0.3														0.3					0.7
1057-1058	0.3																					0.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 26 highest adult consumers is 44.5 kg/y

The observed 97.5 percentile rate based on 230 observations is 44.7 kg/y

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

Observation number	Milk
1134-1136	276.6
12	146.0
20-23	146.0

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of milk based on the 8 highest adult consumers is 195.0 l/y

The observed 97.5 percentile rate based on 8 observations is 276.6 l/y

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

Observation number	Beef
125, 130	63.1
402-403	50.0
479-482	47.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of cattle meat based on the 8 highest adult consumers is 49.6 kg/y

The observed 97.5 percentile rate based on 8 observations is 63.1 kg/y

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

Observation number	Lamb
260-261	14.1
479-480	11.3
481-482	4.5
125, 130	3.8

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of sheep meat based on the 4 highest adult consumers is 12.7 kg/y

The observed 97.5 percentile rate based on 8 observations is 14.1 kg/y

Table 25. Adults' consumption rates of poultry in the Devonport area (kg/y)

Observation number	Chicken	Duck	Goose	Guinea fowl	Pheasant	Turkey	Woodcock	Total
125		2.3	1.1		2.3		0.1	5.7
130		2.3	1.1		2.3		0.1	5.7
402	2.3			0.8				3.0
403	2.3			0.8				3.0
481	0.8		0.9			0.7		2.3
482	0.8		0.9			0.7		2.3
122					0.5			0.5
123					0.5			0.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of poultry based on the 6 highest adult consumers is 3.7 kg/y

The observed 97.5 percentile rate based on 8 observations is 5.7 kg/y

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

Observation number	Chicken egg
125	13.8
130	13.8
260	8.9
261	8.9
402	7.4
403	7.4

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of eggs based on the 6 highest adult consumers is 10.0 kg/y

The observed 97.5 percentile rate based on 6 observations is 13.8 kg/y

Table 27. Adults' consumption rates of wild/free foods in the Devonport area (kg/y)

Observation number	Blackberry	Elderberry	Total
213	15.9		15.9
122-123	5.4		5.4
1187	3.6		3.6
120-121	2.7		2.7
206, 212, 240, 265	2.3		2.3
266	1.4		1.4
1134-1136	1.2		1.2
144-145, 257-258	1.1		1.1
369, 371, 520-522	1.1		1.1
125, 130	0.9		0.9
1062-1063	0.7		0.7
118-119, 267-269	0.5		0.5
1043-1045		0.5	0.5
527-528, 530	0.3		0.3
1057-1958	0.3		0.3
1064	0.2		0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of wild/free foods based on the 3 highest adult consumers is 8.9 kg/y

The observed 97.5 percentile rate based on 41 observations is 5.4 kg/y

Table 28. Adults' consumption rates of rabbits/hares in the Devonport area (kg/y)

Observation number	Rabbit
172	0.9

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of rabbits/hares based on the only adult consumer is 0.9 kg/y

The observed 97.5 percentile is not applicable for 1 observation

Table 29. Adults' consumption rates of honey in the Devonport area (kg/y)

Observation number	Honey
337-338	11.3
342-343, 345-348	7.8
336	5.4
349-350	4.5
340-341, 402-403	2.7
125, 130	1.8
265	0.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of honey based on the 11 highest adult consumers is 7.6 kg/y

The observed 97.5 percentile rate based on 18 observations is 11.3 kg/y

Table 30. Adults' consumption rates of wild fungi in the Devonport area (kg/y)

Observation number	Mushrooms
125	0.1
130	0.1

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of wild fungi based on the 2 highest adult consumers is 0.1 kg/y

The observed 97.5 percentile rate based on 2 observations is 0.1 kg/y

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

Observation number	Venison
125	10.0
130	10.0

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of venison based on the 2 highest adult consumers is 10.0 kg/y

The observed 97.5 percentile rate based on 2 observations is 10.0 kg/y

Table 32. Children's consumption rates of green vegetables in the Devonport area (kg/y)

15 year old age group

Observation number	Age	Artichoke	Broccoli	Brussel sprout	Cabbage	Cauliflower	Chard	Courgette	Cucumber	Gherkin	Herbs	Kale	Lettuce	Marrow	Pak choi	Rocket	Spinach	Total
249	14		8.3	5.1	6.8													20.2
523	16				13.7	0.9					0.02		0.4			1.7		16.7
168	16		2.2	2.2	10.2	1.1							0.6					16.4
170	14		2.2	2.2	10.2	1.1							0.6					16.4
169	15		2.2	2.2	10.2	1.1							0.6					16.4
171	13		2.2	2.2	10.2	1.1							0.6					16.4
502	15			2.7	3.7	4.5							0.6					11.5
503	13			2.7	3.7	4.5							0.6					11.5
173	16				4.3						0.2		2.5				2.6	9.5
174	14				4.3						0.2		2.5				2.6	9.5
529	14				8.8													8.8
162	12	0.9	0.7		3.3				1.4				0.3				0.3	7.0
1059	12				3.0								1.5				1.7	6.2
1160	12								2.6				3.0					5.6
256	12				4.1													4.1
1084	16				0.7	1.6	0.7				0.1		0.6					3.7
1083	13				0.7	1.6	0.7				0.1		0.6					3.7
1036	12							0.9	0.9									1.8
238	16			0.5	0.4	0.3											0.04	1.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 12 highest 15 year old consumers is 13.4 kg/y

The observed 97.5 percentile rate based on 19 observations is 18.6 kg/y

Table 32. Children's consumption rates of green vegetables in the Devonport area (kg/y)

10 year old age group

Observation number	Age	Artichoke	Broccoli	Brussel sprout	Cabbage	Cauliflower	Chard	Courgette	Cucumber	Gherkin	Herbs	Kale	Lettuce	Marrow	Pak choi	Rocket	Spinach	Total
248	11		8.3	5.1	6.8													20.2
1091	8							7.4			0.1		0.8	7.2	0.5	1.1		17.1
1094	7							7.4			0.1		0.8	7.2	0.5	1.1		17.1
210	8		2.2		1.8			1.8					0.6					6.5
1174	10			1.4		1.1		0.4	0.3	0.2			0.3	2.2				5.9
1175	7			1.4		1.1		0.4	0.3	0.2			0.3	2.2				5.9
255	7				4.1													4.1
1050	8				2.5								1.3					3.8
1035	10							0.9	0.9									1.8

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 3 highest 10 year old consumers is 18.1 kg/y

The observed 97.5 percentile rate based on 9 observations is 19.5 kg/y

5 year old age group

Observation number	Age	Artichoke	Broccoli	Brussel sprout	Cabbage	Cauliflower	Chard	Courgette	Cucumber	Gherkin	Herbs	Kale	Lettuce	Marrow	Pak choi	Rocket	Spinach	Total
1046	6			2.2	3.8	2.7	1.0		2.4		0.1	4.8	3.8	1.9			1.1	23.6
247	5		8.3	5.1	6.8													20.2
1047	2			0.7	1.9	1.4	0.5		1.2		0.03	1.6	1.9	0.9			0.5	10.6
1176	6			1.4		1.1		0.4	0.3	0.2			0.3	2.2				5.9
1060	5				1.5								0.8				0.9	3.1
1061	4				1.5								0.8				0.9	3.1
1177	3			0.7		0.6		0.2	0.2	0.1			0.1	1.1				2.9
1051	4				1.5								0.8					2.3
1161	6								0.6				1.0					1.6
1052	2				1.0								0.5					1.5
1078	3				0.2	0.4	0.2				0.02		0.2					0.9
1079	2				0.1	0.3	0.1				0.01		0.1					0.7
1042	2												0.2				0.2	0.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 3 highest 5 year old consumers is 18.1 kg/y

The observed 97.5 percentile rate based on 13 observations is 22.6 kg/y

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

15 year old age group

Observation number	Age	Broad bean	Chilli pepper	French bean	Mange-tout	Pea	Pepper	Runner bean	Sweetcorn	Tomato	Total
173	16			8.6		10.8		20.4		13.5	53.3
174	14			8.6		10.8		20.4		13.5	53.3
523	16	3.4	0.5	5.4		2.3	1.2	6.8	1.0	8.1	28.6
256	12	4.6				4.6		12.2	1.2		22.6
529	14			5.2				13.1	3.9		22.1
502	15	9.1				1.8		5.4	1.4		17.7
503	13	9.1				1.8		5.4	1.4		17.7
168	16	1.1				4.3		10.6	0.3		16.3
169	15	1.1				4.3		10.6	0.3		16.3
170	14	1.1				4.3		10.6	0.3		16.3
171	13	1.1				4.3		10.6	0.3		16.3
1084	16	8.8		1.5	1.0	1.9		2.9			16.1
1083	13	8.8		1.5	1.0	1.9		2.9			16.1
249	14			3.0		2.5		4.5	1.9		11.8
162	12	1.0						0.7	3.3	6.0	11.0
1059	12			1.8		2.3		6.8			10.9
1036	12			0.9		2.3		3.4	0.3	2.7	9.5
238	16	1.6		0.5		0.2		4.3	0.2		6.8
1160	12			1.8							1.8

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 5 highest 15 year old consumers is 36.0 kg/y

The observed 97.5 percentile rate based on 19 observations is 53.3 kg/y

10 year old age group

Observation number	Age	Broad bean	Chilli pepper	French bean	Mange-tout	Pea	Pepper	Runner bean	Sweetcorn	Tomato	Total
255	7	4.6				4.6		12.2	1.2		22.6
1091	8			2.6	2.2	1.1	0.8	3.3	0.1	2.5	12.5
1050	8	3.8				1.9		6.8			12.5
248	11			3.0		2.5		4.5	1.9		11.8
1035	10			0.9		2.3		3.4	0.3	2.7	9.5
1094	7			2.6	2.2	1.1	0.8		0.1	2.5	9.2
1174	10	0.7								2.7	3.4
1175	7	0.7								2.7	3.4
210	8					1.4		1.8			3.1

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 6 highest 10 year old consumers is 13.0 kg/y

The observed 97.5 percentile rate based on 9 observations is 20.6 kg/y

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

5 year old age group

Observation number	Age	Broad bean	Chilli pepper	French bean	Mange-tout	Pea	Pepper	Runner bean	Sweetcorn	Tomato	Total
247	5			3.0		2.5		4.5	1.9		11.8
1046	6	2.7				1.4				7.2	11.3
1051	4	2.3				1.1		4.1			7.5
1060	5			0.9		1.1		3.4			5.4
1061	4			0.9		1.1		3.4			5.4
1047	2	1.0				0.7				3.6	5.3
1052	2	1.5				0.8		2.7			5.0
1078	3	2.2		0.4	0.2	0.5		0.7			4.0
1176	6	0.7								2.7	3.4
1079	2	1.8		0.3	0.2	0.4		0.6			3.2
1177	3	0.3								1.4	1.7
1042	2	0.2		0.2		0.2		0.7			1.3
1161	6			0.6							0.6

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 8 highest 5 year old consumers is 7.0 kg/y

The observed 97.5 percentile rate based on 13 observations is 11.7 kg/y

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

15 year old age group

Observation number	Age	Beetroot	Carrot	Celery	Garlic	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
1059	12	2.3	4.5			2.3	1.8	1.8	0.9	1.6	1.0	6.8		22.9
256	12	1.5	3.0		0.4		12.2	2.4		3.2				22.8
503	13	3.6	1.8			2.7	5.9	1.4		1.9	1.6			18.9
502	15	3.6	1.8			2.7	5.9	1.4		1.9	1.6			18.9
523	16	8.3					5.4	0.9		2.4		1.7		18.7
529	14		2.2				4.3	1.3				6.5		14.3
168	16	0.9					11.9							12.8
169	15	0.9					11.9							12.8
170	14	0.9					11.9							12.8
171	13	0.9					11.9							12.8
249	14	1.9	1.9			6.9		1.8						12.4
1160	12						10.8							10.8
1084	16	1.0	0.5			0.5	2.6	2.1					1.5	8.1
1083	13	1.0				0.5	2.6	2.1					1.5	7.6
162	12	1.0			0.7		1.7		0.7				3.3	7.3
1036	12		0.6				0.9	0.5						1.9
238	16						0.3							0.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 13 highest 15 year old consumers is 15.3 kg/y

The observed 97.5 percentile rate based on 17 observations is 22.9 kg/y

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

10 year old age group

Observation number	Age	Beetroot	Carrot	Celery	Garlic	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
255	7	1.5	3.0		0.4		12.2	2.4		3.2				22.8
1091	8		3.2	1.3		6.5	4.3			1.5				16.9
1094	7		3.2	1.3		6.5	4.3			1.5				16.9
1050	8	1.9					6.0	3.0	0.8	2.7				14.3
248	11	1.9	1.9			6.9		1.8						12.4
210	8		0.9			0.9	1.8	1.1	0.4		0.4			5.4
1035	10		0.6				0.9	0.5						1.9
344	10		1.5											1.5
1174	10		0.7			0.7								1.4
1175	7		0.7			0.7								1.4

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 5 highest 10 year old consumers is 16.7 kg/y

The observed 97.5 percentile rate based on 10 observations is 21.5 kg/y

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

5 year old age group

Observation number	Age	Beetroot	Carrot	Celery	Garlic	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
1046	6	2.8	1.4			2.8	7.2	1.1	0.5		0.4	6.8		23.1
247	5	1.9	1.9			6.9		1.8						12.4
1060	5	1.1	2.3			1.1	0.9	0.9	0.5	0.8	0.5	3.4		11.5
1061	4	1.1	2.3			1.1	0.9	0.9	0.5	0.8	0.5	3.4		11.5
1047	2	1.4	0.7			1.4	3.6	0.6	0.5		0.2	1.7		10.1
1051	4	1.1					3.6	1.8	0.5	1.6				8.6
1052	2	0.8					2.4	1.2	0.3	1.1				5.7
1161	6						3.6							3.6
1078	3	0.2	0.1			0.1	0.6	0.5					0.4	2.0
1079	2	0.2	0.1			0.1	0.5	0.4					0.3	1.6
1176	6		0.7			0.7								1.4
1042	2	0.2	0.2				0.5		0.1					1.1
1177	3		0.3			0.3								0.7

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 6 highest 5 year old consumers is 12.8 kg/y

The observed 97.5 percentile rate based on 13 observations is 19.9 kg/y

Table 35. Children's consumption rates of potato in the Devonport area (kg/y)

15 year old age group

Observation number	Age	Potato
27	16	39.0
26	14	39.0
256	12	33.8
1160	12	22.7
502	15	21.8
503	13	21.8
173	16	20.5
174	14	20.5
162	12	16.7
249	14	15.3
529	14	14.2
1059	12	9.1
1036	12	6.8
238	16	4.2
1084	16	3.9
1083	13	3.9
168	16	1.0
169	15	1.0
170	14	1.0
171	13	1.0

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of potato based on the 11 highest 15 year old consumers is 24.1 kg/y

The observed 97.5 percentile rate based on 20 observations is 39.0 kg/y

10 year old age group

Observation number	Age	Potato
255	7	33.8
1050	8	22.8
248	11	15.3
1091	8	13.7
1094	7	13.7
1035	10	6.8
210	8	6.8
1174	10	5.5
1175	7	5.5
344	10	4.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of potato based on the 5 highest 10 year old consumers is 19.8 kg/y

The observed 97.5 percentile rate based on 10 observations is 31.3 kg/y

Table 35. Children's consumption rates of potato in the Devonport area (kg/y)

5 year old age group

Observation number	Age	Potato
11	2	35.0
247	5	15.3
1051	4	11.4
1161	6	7.6
1046	6	5.7
1176	6	5.5
1060	5	4.6
1061	4	4.6
1052	2	4.6
1047	2	2.8
1177	3	2.7
1078	3	1.0
1042	2	0.9
1079	2	0.8

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of potato based on the 2 highest 5 year old consumers is 25.1 kg/y

The observed 97.5 percentile rate based on 14 observations is 28.6 kg/y

Table 36. Children's consumption rates of domestic fruit in the Devonport area (kg/y)

15 year old age group

Observation number	Age	Apple	Black-berry	Black-currant	Cherry	Goose-berry	Grape	Melon	Plum	Pumpkin	Rasp-berry	Red-currant	Rhubarb	Straw-berry	Tay-berry	Total
529	14	2.3		3.4		0.4	0.2						0.5	5.7		12.4
523	16			0.9					3.4			0.8	2.3	2.8		10.2
162	12	1.7		0.3		1.0					3.3	0.03	0.7	0.3		7.4
238	16	0.6	1.9		0.5	0.4		0.1	0.4		0.8		0.6	0.9		6.1
1160	12					3.1							1.7			4.8
1084	16			0.4		0.3					0.1		0.3	3.1		4.2
1083	13			0.4		0.3					0.1		0.3	3.1		4.2
502	15												1.8	1.8		3.7
503	13												1.8	1.8		3.7
168	16					0.6					0.2			2.2		3.0
169	15					0.6					0.2			2.2		3.0
170	14					0.6					0.2			2.2		3.0
171	13					0.6					0.2			2.2		3.0
173	16												2.3			2.3
174	14												2.3			2.3
1036	12	0.3												1.0		1.4
1059	12	0.3														0.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 7 highest 15 year old consumers is 7.0 kg/y

The observed 97.5 percentile rate based on 17 observations is 11.5 kg/y

Table 36. Children's consumption rates of domestic fruit in the Devonport area (kg/y)

10 year old age group

Observation number	Age	Apple	Black-berry	Black-currant	Cherry	Goose-berry	Grapes	Melon	Plum	Pumpkin	Rasp-berry	Red-currant	Rhubarb	Straw-berry	Tay-berry	Total
1091	8			1.1		1.0		0.3		1.2	4.9	0.9	0.2	1.1		10.8
1094	7			1.1		0.8		0.3		1.2	4.9	0.9	0.2	1.1		10.6
1050	8		4.0										1.5			5.5
1174	10			1.1		0.4							1.4			2.9
1175	7			1.1		0.4							1.4			2.9
210	8													1.9		1.9
344	10			1.5												1.5
1035	10	0.3												1.0		1.4
354	11												0.9			0.9
355	9												0.9			0.9

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 3 highest 10 year old consumers is 9.0 kg/y

The observed 97.5 percentile rate based on 10 observations is 10.8 kg/y

5 year old age group

Observation number	Age	Apple	Black-berry	Black-currant	Cherry	Goose-berry	Grapes	Melon	Plum	Pumpkin	Rasp-berry	Red-currant	Rhubarb	Straw-berry	Tay-berry	Total
1046	6									0.2	2.1		0.9	6.0		9.2
1047	2									0.1	1.1		0.5	3.0		4.6
1051	4		2.4										0.9			3.3
1176	6			1.1		0.4							1.4			2.9
1042	2			0.6							0.7		0.1	0.2	0.8	2.4
1052	2		1.6										0.6			2.2
1177	3			0.6		0.2							0.7			1.5
1161	6					0.8							0.6			1.3
1078	3			0.1		0.1					0.02		0.1	0.8		1.0
154	5										0.9					0.9
1079	2			0.02		0.1					0.02		0.1	0.6		0.8
1060	5	0.2														0.2
1061	4	0.2														0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 3 highest 5 year old consumers is 5.7 kg/y

The observed 97.5 percentile rate based on 13 observations is 7.8 kg/y

Table 37. Children's consumption rates of cattle meat in the Devonport area (kg/y)

15 year old age group

Observation number	Age	Beef
483	16	37.8
484	14	37.8

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of cattle meat based on the 2 highest 15 year old consumers is 37.8 kg/y

The observed 97.5 percentile rate based on 2 observations is 37.8 kg/y

10 year old age group

Observation number	Age	Beef
485	10	37.8

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of cattle meat based on the only 10 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
132	6	31.5
134	5	31.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of cattle meat based on the 2 highest 5 year old consumers is 31.5 kg/y

The observed 97.5 percentile rate based on 2 observations is 31.5 kg/y

Table 38. Children's consumption rates of sheep meat in the Devonport area (kg/y)

15 year old age group

Observation number	Age	Lamb
483	16	4.5
484	14	4.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of sheep meat based on the 2 highest 15 year old consumers is 4.5 kg/y

The observed 97.5 percentile rate based on 2 observations is 4.5 kg/y

10 year old age group

Observation number	Age	Lamb
262	11	14.1
263	8	14.1
485	10	4.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of sheep meat based on the 2 highest 10 year old consumers is 14.1 kg/y

The observed 97.5 percentile rate based on 3 observations is 14.1 kg/y

5 year old age group

Observation number	Age	Lamb
132	6	1.9
134	5	1.9

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of sheep meat based on the 2 highest 5 year old consumers is 1.9 kg/y

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

Table 39. Children's consumption rates of poultry in the Devonport area (kg/y)

15 year old age group

Observation number	Age	Chicken	Goose	Turkey	Total
483	16	0.8	0.9	0.7	2.3
484	14	0.8	0.9	0.7	2.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of poultry based on the 2 highest 15 year old consumers is 2.3 kg/y

The observed 97.5 percentile rate based on 2 observations is 2.3 kg/y

10 year old age group

Observation number	Age	Chicken	Goose	Turkey	Total
485	10	0.8	0.9	0.7	2.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of poultry based on the only 10 year old consumer is 2.3 kg/y

The observed 97.5 percentile is not applicable for 1 observation

Table 40. Children's consumption rates of eggs in the Devonport area (kg/y)

10 year old age group

Observation number	Age	Chicken egg
262	11	8.9
263	8	8.9

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 8.9 kg/y

The observed 97.5 percentile rate based on 2 observations is 8.9 kg/y

5 year old age group

Observation number	Age	Chicken egg
132	6	6.9
134	5	6.9

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of eggs based on the 2 highest 5 year old consumers is 6.9 kg/y

The observed 97.5 percentile rate based on 2 observations is 6.9 kg/y

Table 41. Children's consumption rates of wild/free foods in the Devonport area (kg/y)

15 year old age group

Observation number	Age	Blackberry
523	16	1.1
529	14	0.3
1059	12	0.3

Notes

Emboldened observations are the critical group consumers
 The critical group consumption rate of wild/free foods based on the 3 highest 15 year old consumers is 0.6 kg/y
 (Taking the highest consumption rate of 1.1 k/y and dividing by 3 would give a cut-off value for the critical group of 0.4 k/y. However, judgement has been used and in this case the lower values of 0.3 k/y have been included in the critical group.)
 The observed 97.5 percentile rate based on 3 observations is 1.1 kg/y

5 year old age group

Observation number	Age	Blackberry
132	6	0.5
134	5	0.5
1060	5	0.2
1061	4	0.2

Notes

Emboldened observations are the critical group consumers
 The critical group consumption rate of wild/free foods based on the 4 highest 5 year old consumers is 0.3 kg/y
 The observed 97.5 percentile rate based on 4 observations is 0.5 kg/y

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

10 year old age group

Observation number	Age	Honey
344	10	7.8

Notes

Emboldened observations are the critical group consumers
 The critical group consumption rate of honey based on the only 10 year old consumer is 7.8 kg/y
 The observed 97.5 percentile is not applicable for 1 observation

5 year old age group

Observation number	Age	Honey
132	6	0.9
134	5	0.9

Notes

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

Table 43. Percentage contribution each food type makes to its terrestrial food group for adults

Domestic fruit		Green vegetables		Other vegetables		Wild/free foods	
Strawberry	25.9	Cabbage	34.9	Runner bean	45.6	*Blackberry	98.0
Rhubarb	15.5	Lettuce	11.1	Broad bean	22.4	Elderberry	2.0
Raspberry	13.6	Broccoli	9.9	Pea	11.4		
Blackcurrant	12.0	Brussel sprout	9.8	Tomato	9.7	Root vegetables	
Gooseberry	8.1	*Courgette	8.9	French bean	5.1		
Loganberry	6.6	Cauliflower	8.8	Sweetcorn	3.7	Onion	34.5
Apple	3.5	Cucumber	3.8	Pepper	0.6	Carrot	14.9
Blackberry	3.4	Marrow	3.7	Squash	0.6	Beetroot	12.9
Redcurrants	2.9	Kale	3.1	Mangetout	0.4	Swede	10.9
Tayberry	2.3	Spinach	2.8	Chilli pepper	0.4	Leek	7.6
Pumpkin	2.0	Chard	0.9	Aubergine	0.2	Parsnip	6.7
Plum	1.6	Rocket	0.7			Turnip	4.7
Jostaberry	1.2	Asparagus	0.4	Poultry		Shallot	4.5
Melon	0.5	Artichoke	0.3			Radish	0.9
Pear	0.5	Herbs	0.3	Chicken	26.0	Garlic	0.8
Cherry	0.2	Pak Choi	0.3	Pheasant	23.4	Spring onion	0.6
Boysenberry	0.2	Calabrese	0.1	Duck	19.5	Artichoke	0.4
Whitecurrant	0.1	Leaf beet	0.1	Goose	17.2	Celeriac	0.3
Grapes	0.05	Gherkin	0.1	Guinea fowl	6.9	Celery	0.2
Blueberry	0.03			Turkey	6.1	Chinese radish	0.1
Greengages	0.03			Woodcock	1.0	Fennel	0.01

Notes

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

Table 44. Occupancy rates in the Devonport 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					
1068	85	0.20	8527		8527
365	60	0.25	7894	365	8259
1069	54	0.10	7968	196	8164
363	9	0.25	7395	365	7760
364	7	0.25	7395	365	7760
1067	1	0.20	7618	120	7738
361	36	0.25	7252	260	7512
1066	35	0.20	7092	50	7142
1072	41	0.10	6125	224	6349
1071	47	0.10	6113	36	6149
1065	37	0.20	6040	50	6090
1073	16	0.10	5507	144	5651
1074	15	0.10	5507	144	5651
362	36	0.25	4067	913	4980
1070	55	0.10	4020	36	4056
1101	40	0.20	1860	60	1920
1102	21	0.20	1860	60	1920
1212-1220	U	0.10	1880		1880
1221-1223	U	0.10	1315	565	1880
1233-1234	2	0.10	1315	565	1880
1235-1236	3	0.10	1315	565	1880
1237-1238	4	0.10	1315	565	1880
1239-1241	5	0.10	1315	565	1880
1350-1430	U	0.20	1855	25	1880
1099	38	0.20	1203	45	1248
1100	63	0.20	1203	45	1248
1562	U	0.20	367	855	1222
1536-1561	U	0.20	1122	16	1138
1224-1225	2	0.10	634	188	822
1226-1227	3	0.10	634	188	822
1228-1229	4	0.10	634	188	822
1230-1232	5	0.10	634	188	822
1502-1535	U	0.20	667	8	675
1431-1500	U	0.20	631	8	639
1308-1311	4	0.10	390	195	585
1312-1315	5	0.10	390	195	585
1316-1319	6	0.10	390	195	585
1320-1323	7	0.10	390	195	585
1324-1327	8	0.10	390	195	585
1328-1331	9	0.10	390	195	585
1332-1334	10	0.10	390	195	585
1335-1337	11	0.10	390	195	585
1278-1281	4	0.10	195	260	455
1282-1285	5	0.10	195	260	455
1286-1289	6	0.10	195	260	455
1290-1293	7	0.10	195	260	455
1294-1297	8	0.10	195	260	455
1298-1301	9	0.10	195	260	455
1302-1304	10	0.10	195	260	455
1305-1307	11	0.10	195	260	455
1563-1662	U	0.20	442	8	450

Table 44. Occupancy rates in the Devonport 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					
1097	30	0.20	369	15	384
1098	16	0.20	369	15	384
1242-1250	2	0.10	165	47	212
1251-1259	3	0.10	165	47	212
1260-1268	4	0.10	165	47	212
1269-1277	5	0.10	165	47	212
0.25 to 0.5 km zone					
62	56	0.50	7880	828	8708
75	37	0.50	6932	1672	8604
56	38	0.50	7824	728	8552
69-70	45	0.50	7640	912	8552
63	67	0.50	7132	1368	8500
64	66	0.50	7132	1368	8500
89	48	0.50	7132	1368	8500
65-66	51	0.50	7434	988	8422
48-49	60	0.50	6672	1672	8344
59	45	0.50	7128	1216	8344
94	48	0.50	6976	1368	8344
354	11	0.50	7974	350	8324
138	28	0.40	8316		8316
139	33	0.40	8316		8316
353	35	0.50	8198	100	8298
355	9	0.50	7924	350	8274
99	62	0.40	7024	1216	8240
100	61	0.40	7024	1216	8240
86	41	0.50	6578	1596	8174
87	2	0.50	6578	1596	8174
78	35	0.50	6922	1216	8138
5	60	0.40	6509	1627	8136
50	58	0.50	6512	1520	8032
51	57	0.50	6512	1520	8032
4	31	0.40	6413	1603	8016
57	16	0.50	7252	728	7980
357	68	0.50	7735	175	7910
356	73	0.50	7545	350	7895
516	75	0.40	7792	40	7832
83	65	0.50	7112	608	7720
84	64	0.50	7112	608	7720
141	53	0.40	7616		7616
71	13	0.50	6363	1032	7395
72	11	0.50	6363	1032	7395
73	7	0.50	6363	1032	7395
76	7	0.50	6288	1107	7395
53	45	0.50	6964	361	7325
360	68	0.30	6680	644	7324
67	10	0.50	6266	1032	7298
68	7	0.50	6266	1032	7298
143	29	0.50	6372	624	6996
60	10	0.50	6197	782	6979
61	16	0.50	6197	782	6979
88	16	0.50	6054	908	6962

Table 44. Occupancy rates in the Devonport 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
0.25 to 0.5 km zone					
79	12	0.50	6093	868	6961
80	6	0.50	6093	868	6961
81	5	0.50	6093	868	6961
358	76	0.30	6652	308	6960
359	71	0.30	6652	308	6960
351	56	0.50	5943	1000	6943
58	46	0.50	6530	350	6880
54	9	0.50	6418	361	6779
55	8	0.50	6418	361	6779
82	51	0.50	5744	800	6544
85	43	0.50	5788	756	6544
517	52	0.50	6354	90	6444
352	35	0.50	6258	100	6358
77	38	0.50	6007	347	6354
142	38	0.50	5628	624	6252
92	16	0.50	5318	908	6226
93	13	0.50	5318	908	6226
519	26	0.50	6034	50	6084
52	31	0.50	5590	434	6024
74	39	0.50	4759	781	5540
140	24	0.40	5166	46	5212
45	22	0.40	3985	703	4688
90	17	0.50	3285		3285
91	18	0.50	3285		3285
1116	U	0.30	1872	48	1920
1117	28	0.40	1872	48	1920
1103	50	0.30	1776	48	1824
1104-1109	U	0.30	1776	48	1824
764-786	U	0.35	1619	39	1658
531-547	4	0.35	1004	312	1316
548-581	5	0.35	1004	312	1316
582-614	6	0.35	1004	312	1316
615-648	7	0.35	1004	312	1316
649-681	8	0.35	1004	312	1316
682-714	9	0.35	1004	312	1316
715-747	10	0.35	1004	312	1316
748-763	11	0.35	1004	312	1316
1113	21	0.30	1160	40	1200
1114-1115	U	0.30	1160	40	1200
1118	35	0.40	720	240	960
1119	28	0.40	720	240	960
1120	50	0.40	720	240	960
1121	41	0.40	720	240	960
1110-1112	U	0.30	672	240	912
787-793	U	0.35	117	117	234
0.5 to 1 km zone					
33	63	0.70	7092	1460	8552
34	60	0.70	7640	912	8552
1132	81	0.90	8366	30	8396
1133	77	0.90	8366	30	8396
159	44	0.80	7352	572	7924

Table 44. Occupancy rates in the Devonport 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
0.5 to 1 km zone					
173	16	0.80	6390	572	6962
174	14	0.80	6390	572	6962
158	44	0.80	5512	572	6084
213	68	0.90	5940		5940
388-393*	U	0.90	1974		1974
394-395*	U	1.00	1974		1974
1663-1688	4	0.60	1082	234	1316
1689-1713	5	0.60	1082	234	1316
1714-1738	6	0.60	1082	234	1316
1739-1764	7	0.60	1082	234	1316
1765-1791	8	0.60	1082	234	1316
1792-1816	9	0.60	1082	234	1316
1817-1841	10	0.60	1082	234	1316
1842-1866	11	0.60	1082	234	1316

Notes

* = working in units located on MOD dockyard

Table 45. Analysis of occupancy rates in the Devonport direct radiation survey area

0 to 0.25 km zone	
Number of hours per year	Number of observations
8000 to 8760	3
7000 to 8000	5
6000 to 7000	3
5000 to 6000	2
4000 to 5000	2
3000 to 4000	0
2000 to 3000	0
1000 to 2000	133
0 to 1000	311

0.25 to 0.5 km zone	
Number of hours per year	Number of observations
8000 to 8760	28
7000 to 8000	15
6000 to 7000	23
5000 to 6000	2
4000 to 5000	1
3000 to 4000	2
2000 to 3000	0
1000 to 2000	268
0 to 1000	14

0.5 to 1 km zone	
Number of hours per year	Number of observations
8000 to 8760	4
7000 to 8000	1
6000 to 7000	3
5000 to 6000	1
4000 to 5000	0
3000 to 4000	0
2000 to 3000	0
1000 to 2000	212
0 to 1000	0

Table 46. Gamma dose rate measurements for the Devonport direct radiation survey (micro Gy/h)

Location	Distance from perimeter (km)	NGR	Ground type	Gamma dose rate at 1 metre
House 1, Furze Park	0.50	SX 444 572	Indoor/concrete	0.064
House 1, Furze Park	0.50	SX 444 572	Outdoor/grass	0.086
House 2, Furze Park	0.50	SX 443 572	Indoor/concrete	NM
House 2, Furze Park	0.50	SX 443 572	Outdoor/grass	0.087
Flat 1, Talbot Gdns, 3rd floor	0.40	SX 445 573	Indoor/concrete	0.052
Flat 1, Talbot Gdns, 3rd floor	0.40	SX 445 573	Outdoor/concrete	0.063
Flat 2, Talbot Gdns, 3rd floor	0.40	SX 445 573	Indoor/concrete	0.055
Flat 2, Talbot Gdns, 3rd floor	0.40	SX 445 573	Outdoor/concrete	0.066
House 1, Saltash Road	0.10	SX 450 568	Indoor/wood	0.097
House 1, Saltash Road	0.10	SX 450 568	Outdoor/grass	0.085
House 2, Saltash Road	0.10	SX 451 566	Indoor/wood	0.108
House 2, Saltash Road	0.10	SX 451 566	Outdoor/grass	0.087
House 3, Saltash Road	0.10	SX 452 564	Indoor/concrete	0.068
House 3, Saltash Road	0.10	SX 452 564	Outdoor/concrete	NM
House 4, Saltash Road	0.10	SX 449563	Indoor/concrete	0.071
House 4, Saltash Road	0.10	SX 449563	Outdoor/concrete	0.083
Drake Primary School	0.35	SX 452 565	Indoor/concrete	0.094
Drake Primary School	0.35	SX 452 565	Outdoor/concrete	0.095
Background 1	3.00	SX 451 527	Grass	0.086
Background 2	5.30	SX 475 616	Grass	0.101
Background 3	4.80	SX 407 529	Grass	0.082
Background 4	8.00	SX 380 609	Grass	0.085

Table 47. Examples of food groups eaten and external exposure combinations by adults for consideration for dose assessment purposes

Combination number	Fish	Crustaceans	Molluscs	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy in houseboats	Intertidal occupancy over mud, sand and shale	Intertidal occupancy over mud	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over saltmarsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Occupancy in close proximity to liquid sewage sludge	Occupancy in close proximity to dried sewage sludge	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																																		*	*			

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

Observation number	Sex	Age in years (U if unknown)	Distance of residence from site (km) (U if unknown)	Fish	Crustaceans	Molluscs	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Inter-tidal occupancy in houseboats	Inter-tidal occupancy over mud, sand and shale	Inter-tidal occupancy over mud	Inter-tidal occupancy over rock	Inter-tidal occupancy over sand	Inter-tidal occupancy over sand and stones	Inter-tidal occupancy over saltmarsh	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Occupancy in close proximity to liquid sewage sludge	Occupancy in close proximity to diked sewage sludge	Indoor occupancy within 1 km of site perimeter fence	Outdoor occupancy within 1 km of site perimeter fence	
1	M	50	1.1					45.4	34.0		82.9																											
2	F	49	1.1					45.4	34.0		82.9																											
3	F	U	1.1					45.4	34.0		82.9																											
4	M	31	0.4																																	6413	1603	
5	M	60	0.4																																6509	1627		
6-8	M	U	1.1					13.0	9.7		23.7																											
9	M	45	3.8								82.9																											
10	F	42	3.8								82.9																											
12	M	46	5.0					3.6	4.5	8.1	50.8	0.9	146.0																									
13	M	62	4.8																						14													
14	M	56	3.2					6.7	23.7	17.0	19.1	10.5																										
15	F	69	3.2					6.7	23.7	17.0	19.1	10.5																										
16	M	67	3.2						83.9	27.7	35.7	33.5																										
17	F	35	16.0						12.0	4.0	5.1	4.8																										
18	F	39	16.0						12.0	4.0	5.1	4.8																										
19	M	34	16.0						12.0	4.0	5.1	4.8																										
20	F	46	5.0					3.6	4.5	8.1	50.8	0.9	146.0																									
21	M	74	5.0					3.6	4.5	8.1	50.8	0.9	146.0																									
22	F	73	5.0					3.6	4.5	8.1	50.8	0.9	146.0																									
23	F	U	5.0					3.6	4.5	8.1	50.8	0.9	146.0																									
24	M	48	3.9								39.0																											
25	F	47	3.9								39.0																											
28	M	64	U	1.0																																		
29	M	25	U																																			
30	F	24	U	59.6																																		
31	M	66	U	4.5	0.3																																	
32	F	65	U	4.5	0.3																																	
33	M	63	U																																			
34	F	60	U					39.6	139.5	144.8	132.0	59.7																								7092	1460	
35	M	77	4.0					12.4	22.7	10.9	11.6																											
36-37	M	35	4.0					12.4	22.7	10.9	11.6																											
38-42	F	35	4.0					12.4	22.7	10.9	11.6																											
43	M	55	2.4					26.8	9.7	6.8	8.2	23.3																										
44	F	56	2.4					26.8	9.7	6.8	8.2	23.3																										
45	F	22	0.4																																	3985	703	
46	M	54	U					45.6	34.0	48.6	31.9	43.3																										
47	F	53	U					45.6	34.0	48.6	31.9	43.3																										
48	M	60	0.5																																		6672	1672
49	F	60	0.5																																		6672	1672
50	M	58	0.5																																		6512	1520
51	F	57	0.5																																		6512	1520
52	M	31	0.5																																		5590	434
53	F	45	0.5																																		6964	361

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

Observation number	Sex (U if unknown)	Age in years	Distance of residence from site (km) (U if unknown)	Fish	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Honey	Intertidal occupancy in houseboats	Intertidal occupancy over mud, sand and shale	Intertidal occupancy over mud	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	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	
15 year old age group																										
79	M	12	0.5																					6093	868	
162	M	12	U		7.0	11.0	7.3	16.7	7.4																	
256	F	12	2.8		4.1	22.6	22.8	33.8																		
441	M	12	2.8																			250				
1036	M	12	U		1.8	9.5	1.9	6.8	1.4																	
1059	M	12	1.8		6.2	10.9	22.9	9.1	0.3					0.3												
1160	M	12	3.7	0.5	5.6	1.8	10.8	22.7	4.8																	
71	M	13	0.5																					6363	1032	
93	F	13	0.5																					5318	908	
171	M	13	U		16.4	16.3	12.8	1.0	3.0																	
188	M	13	2.0													4115							823			
503	F	13	U		11.5	17.7	18.9	21.8	3.7																	
1083	F	13	U		3.7	16.1	7.6	3.9	4.2																	
1150	M	13	U																			30				
26	F	14	3.9					39.0																		
170	M	14	U		16.4	16.3	12.8	1.0	3.0																	
174	M	14	0.8		9.5	53.3		20.5	2.3															6390	572	
249	F	14	4.0		20.2	11.8	12.4	15.3																		
410	M	14	U	2.2																						
420	M	14	U	0.8																						
432	F	14	U	16.1																						
442	M	14	2.8																			250				
453	F	14	U	3.7																		60				
484	F	14	5.3							37.8	4.5	2.3														
529	F	14	2.0		8.8	22.1	14.3	14.2	12.4					0.3												
1004-1005	M	14	U																				61			
1192	F	14	U																				208			
1190	M	15	U																				208			
1006-1007	F	14	U																				61			
135	M	15	U														104			18	104					
169	F	15	U		16.4	16.3	12.8	1.0	3.0																	
502	M	15	U		11.5	17.7	18.9	21.8	3.7																	
1008-1009	M	15	U																				61			
1010-1011	F	15	U																				61			
1074	F	15	0.1																					5507	144	
27	M	16	3.9					39.0																		
57	M	16	0.5																					7252	728	
61	M	16	0.5																					6197	782	
88	M	16	0.5																					6054	908	
92	M	16	0.5																					5318	908	
168	F	16	U		16.4	16.3	12.8	1.0	3.0																	
173	M	16	0.8		9.5	53.3		20.5	2.3															6390	572	
238	F	16	3.5		1.3	6.8	0.3	4.2	6.1																	
301	F	16	3.9	1.9																						
419	M	16	U	0.8																						
428	M	16	U	12.1													8		150		8					

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

Observation number	Sex (U if unknown)	Age in years	Distance of residence from site (km) (U if unknown)	Fish	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Honey	Intertidal occupancy in houseboats	Intertidal occupancy over mud, sand and shale	Intertidal occupancy over mud	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	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
15 year old age group																									
429	M	16	U	2.1															18						
483	M	16	5.3							37.8	4.5	2.3													
523	F	16	1.1		16.7	28.6	18.7		10.2					1.1											
1012-1013	M	16	U																				61		
1014-1015	F	16	U																				61		
1073	M	16	0.1																					5507	144
1084	F	16	U		3.7	16.1	8.1	3.9	4.2																
1098	F	16	U																					369	15
10 year old age group																									
68	F	7	0.5																					6266	1032
73	M	7	0.5																					6363	1032
76	M	7	0.5																					6288	1107
255	F	7	2.8		4.1	22.6	22.8	33.8																	
364	F	7	0.3																					7395	365
433	F	7	U	10.2																					
615-631	M	7	U																					1004	312
632-648	F	7	U																					1004	312
1094	F	7	U		17.1	9.2	16.9	13.7	10.6																
1175	F	7	U		5.9	3.4	1.4	5.5	2.9																
1209	M	7	U																				125		
1290-1291	M	7	U																					195	260
1292-1293	F	7	U																					195	260
1320-1321	M	7	U																					390	195
1322-1323	F	7	U																					390	195
1739-1751	M	7	U																					1082	234
1752-1764	F	7	U																					1082	234
55	F	8	0.5																					6418	361
210	M	8	U		6.5	3.1	5.4	6.8	1.9																
263	M	8	4.3								14.1		8.9												
289	M	8	U																						
445	M	8	U																						
649-665	M	8	U																					1004	312
666-681	F	8	U																					1004	312
1050	M	8	2.8		3.8	12.5	14.3	22.8	5.5																
1091	F	8	2.4	1.8	17.1	12.5	16.9	13.7	10.8																
1196	F	8	U																			10	2		
1197	M	8	U																			10	2		
1294-1295	M	8	U																					195	260
1296-1297	F	8	U																					195	260
1324-1325	M	8	U																					390	195
1326-1327	F	8	U																					390	195
1765-1776	M	8	U																					1082	234
1777-1791	F	8	U																					1082	234
54	M	9	0.5																					6418	361
288	M	9	U														44								
355	F	9	0.5						0.9															7924	350

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

Observation number	Sex (U if unknown)	Age in years	Distance of residence from site (km) (U if unknown)	Fish	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Honey	Intertidal occupancy in houseboats	Intertidal occupancy over mud, sand and shale	Intertidal occupancy over mud	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	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
10 year old age group																									
363	M	9	0.3																					7395	365
446	F	9	U																			60			
447	F	9	U																			60			
682-697	M	9	U																					1004	312
698-714	F	9	U																					1004	312
1153	F	9	U	1.6																					
1298-1299	M	9	U																					195	260
1300-1301	F	9	U																					195	260
1328-1329	M	9	U																					390	195
1330-1331	F	9	U																					390	195
1792-1804	M	9	U																					1082	234
1805-1816	F	9	U																					1082	234
60	F	10	0.5																					6197	782
67	M	10	0.5																					6266	1032
287	M	10	U														44								
296	M	10	U	2.7																					
303	M	10	3.9	1.9																					
344	F	10	3.5				1.5	4.5	1.5						7.8										
448	F	10	U																			60			
452	M	10	U	3.7																		60			
485	F	10	5.3							37.8	4.5	2.3													
715-731	M	10	U																					1004	312
732-747	F	10	U																					1004	312
1035	F	10	U		1.8	9.5	1.9	6.8	1.4																
1149	M	10	U																			30			
1174	F	10	U		5.9	3.4	1.4	5.5	2.9																
1302	M	10	U																						
1303-1304	F	10	U																					195	260
1332-1333	M	10	U																					390	195
1334	F	10	U																					390	195
1817-1829	M	10	U																					1082	234
1830-1841	F	10	U																					1082	234
72	F	11	0.5																					6363	1032
248	F	11	4.0		20.2	11.8	12.4	15.3																	
262	M	11	4.3								14.1		8.9												
283	M	11	U														44								
354	M	11	0.5						0.9															7974	350
449	F	11	U																			60	52		
748-755	M	11	U																					1004	312
756-763	F	11	U																					1004	312
1138	F	11	3.3																				60		
1305-1306	M	11	U																					195	260
1307	F	11	U																					195	260
1335	M	11	U																					390	195
1336-1337	F	11	U																					390	195
1842-1853	M	11	U																					1082	234

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

Observation number	Sex (U if unknown)	Age in years	Distance of residence from site (km) (U if unknown)	Fish	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Honey	Intertidal occupancy in houseboats	Intertidal occupancy over mud, sand and shale	Intertidal occupancy over mud	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	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
5 year old age group																									
548-563	M	5	U																					1004	312
564-581	F	5	U																					1004	312
1060	F	5	1.8		3.1	5.4	11.5	4.6	0.2					0.2											
1198	M	5	U																		10	2			
1230	M	5	U																					634	188
1231-1232	F	5	U																					634	188
1239	M	5	U																					1315	565
1240-1241	F	5	U																					1315	565
1269-1273	M	5	U																					165	47
1274-1277	F	5	U																					165	47
1282-1283	M	5	U																					195	260
1284-1285	F	5	U																					195	260
1312-1313	M	5	U																					390	195
1314-1315	F	5	U																					390	195
1689-1700	M	5	U																					1082	234
1701-1713	F	5	U																					1082	234
80	F	6	0.5																					6093	868
132	M	6	5.0							31.5	1.9		6.9	0.5	0.9			20					30		
326	M	6	U	1.5																					
426	M	6	U	0.7																					
438-439	F	6	2.8																						
582-598	M	6	U																			128			
599-614	F	6	U																					1004	312
1046	M	6	U		23.6	11.3	23.1	5.7	9.2															1004	312
1161	M	6	3.7	0.2	1.6	0.6	3.6	7.6	1.3																
1176	M	6	U		5.9	3.4	1.4	5.5	2.9																
1210	F	6	U																				125		
1286-1287	M	6	U																					195	260
1288-1289	F	6	U																					195	260
1316-1317	M	6	U																					390	195
1318-1319	F	6	U																					390	195
1714-1726	M	6	U																					1082	234
1727-1738	F	6	U																					1082	234
1 year old age group																									
1067	F	1	0.2																					7618	120

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 Devonport adult profiled habits data

Profile Name	Pathway Name	Crustacea	Direct ⁴	Eggs	Fish - Sea	Fruit - Domestic	Fruit and nuts - Wild	Gamma ext - Rock	Gamma ext - Sediment ¹	Honey	Meat - Cow	Meat - Game ²	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	h	h	kg	kg	kg	kg	kg	l	kg	kg	h	h	h	h	h	kg	kg	kg	kg	
Crustacea		3.5			1.5											0.1		13	41								
Direct			1.00			0.5														864	978	153	0.3	1.0	1.1	0.8	
Eggs				10.0	0.2		0.3		7	1.5	37.7	3.3	2.9	6.0					10								
Fish - Sea					31.8			20	221										117				1.0	5.6	8.4	5.7	
Fruit - Domestic			0.12		0.5	44.5	0.6															886	27.3	43.6	41.9	32.2	
Fruit and nuts - Wild			0.33			34.2	8.9						0.3									1980	30.2	20.3	33.8	14.9	
Gamma ext - Rock					12.3			71	22									4					1.2	6.4	9.7	6.5	
Gamma ext - Sediment									2264									28	2690								
Honey						0.3				7.6																0.8	0.3
Meat - Cow				5.3	0.1		0.2	5	1.1	49.6	2.5	2.8	4.9						8								
Meat - Game				13.8	0.5		0.9	21	1.8	63.1	10.0	5.7	3.8			0.1			30								
Meat - Poultry				7.1	0.2		0.3	7	1.5	50.3	3.3	3.7	2.8						10								
Meat - Sheep				4.4							23.7			12.7													
Milk						2.3	0.5								195.0								2.3	2.8	93.8	5.1	
Mollusca		1.7			9.5											1.7		30	84								
Mushrooms				13.8	0.5		0.9	21	1.8	63.1	10.0	5.7	3.8				0.1		30								
Occupancy IN water		1.6			1.2			391											200	496							
Occupancy ON water								1678											35	3883							
Plume (IN; 0-0.25km)			1.00																	6723							
Plume (MID; 0.25-0.5km)			1.00			0.3															7398						
Plume (OUT; 0.5-1km)			1.00			31.1	2.3															7692	19.5	61.2	50.8	47.7	
Vegetables - Green			0.12		0.1	26.8	0.7															922	54.1	43.8	59.3	35.6	
Vegetables - Other Domestic			0.11		0.1	20.4	0.1															841	25.0	60.6	43.4	38.6	
Vegetables - Potatoes			0.10		0.2	14.2	0.3								21.3							423	439	26.8	34.3	87.9	29.2
Vegetables - Root			0.12		0.6	24.0																1006	20.5	61.2	48.0	71.2	



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Amendments (1st September 2005) to Radiological Habits Survey: Devonport, 2004.

Page 7, 1st paragraph.

The DML site, which also contains sources of direct radiation, is licensed under the Nuclear Installations Act, 1965.

Amended to: The DML site is licensed under the Nuclear Installations Act, 1965.

Page 11, 1st paragraph.

The public may be exposed to radiation as a result of the operations of DML and the MOD at Devonport Dockyard either from discharges of liquid or gaseous radioactive wastes into the local environment, or from radiation emanating directly from the site.

Amended to: The public may be exposed to radiation as a result of the operations of DML and MOD at Devonport Dockyard. Potential exposure pathways are from discharges of liquid or gaseous radioactive wastes into the local environment, or from radiation emanating directly from the site.

Page 45, 3rd paragraph.

Sentence added: These gamma dose rate measurements show no significant difference between those taken around the Devonport site and the background measurements taken further afield.

Page 47, 2nd paragraph.

Exposure pathways were investigated for 1857 individuals. The survey found that pathways relating to each of the three potential sources of exposure from the dockyard site at Devonport were present:

- Discharges of liquid radioactive waste from DML and HMNB to the Hamoze and CHSTP
- Discharges of gaseous radioactive waste from DML to the atmosphere
- Direct radiation emitted from the DML site (sometimes called 'station shine')

Amended to: Exposure pathways were investigated for 1857 individuals. The survey found that exposure of the public to radiation from the dockyard site at Devonport were present from the following pathways:

- Discharges of liquid radioactive waste from DML and HMNB to the Hamoze and Camels Head Sewage Treatment Plant
- Discharges of gaseous radioactive waste from DML to the atmosphere