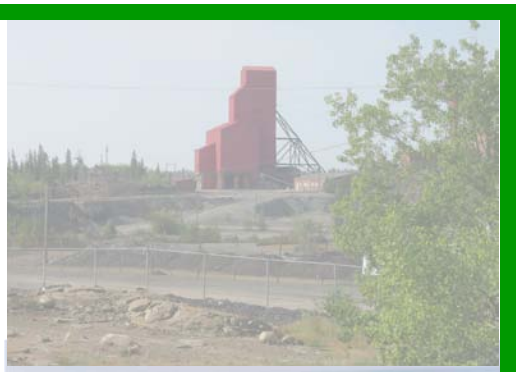
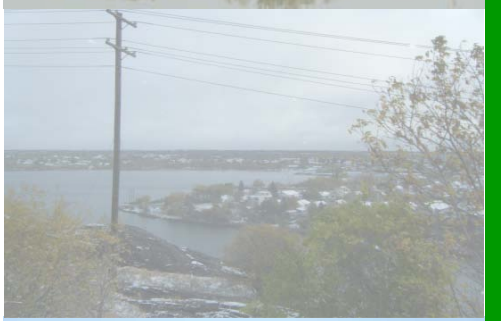


APPENDIX K

MARKET BASKET ESTIMATED DAILY INTAKE (EDI)



APPENDIX K:

MARKET BASKET ESTIMATED DAILY INTAKE

Table of Contents

List of Tables

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APPENDIX K: MARKET BASKET ESTIMATED DAILY INTAKE (EDI_{MB})

EXECUTIVE SUMMARY

Food represents a critical pathway of exposure to the chemicals of concern (COC) for the residents of the Flin Flon Area. Foods consumed and purchased from grocery stores, supermarkets, butchers, *etc.,* are considered background sources of exposure and contribute to an individuals' total level of exposure to COC. The exposures to COC through the consumption of store-bought foods is termed the market basket estimated daily intake or EDI. As part of the Human Health Risk Assessment (HHRA), a literature review was conducted to obtain published data on the concentrations of COC in store-bought foods (*i.e.,* supermarket or market basket food items).

Available food data were grouped into several separate categories (*i.e.,* fish and shellfish, milk and dairy products, *etc*). The different food categories used for the Flin Flon HHRA exposure model are described in this report.

The report identifies all the potential sources of information reviewed on the concentration of the COC in each of the different food categories. The data selected as the most appropriate for use in the Flin Flon HHRA are identified. Preference was given to recent, reliable, Canadian data.

When raw data was available, the mean concentration and 95% Upper Confidence Limit on the Mean (UCLM) was calculated. These values were then used to calculate the EDI for the market basket component of the HHRA exposure model. For cadmium, the EDI *via* the consumption of foods as recommended by the CCME within the derivation of the human health cadmium soil quality guideline was used within the HHRA. Values were provided for each of the five age classes on a µg/day basis and were adjusted based on the Health Canada (2006) recommended body weights used within the HHRA. For selenium, the results of the Dabeka (1994) Total Diet Study were used because it was the only complete source of Canadian data. Although the raw data from this study were not obtained, the CCME (2007) Scientific Supporting Document for the derivation of the Canadian Soil Quality Guideline for Selenium contained the average concentrations for each of the 135 food composites. These composites were organized into the 11 food categories used in the current assessment. The average concentration for each food category was used to represent the EPC in the HHRA.

The data presented in this report are used to support the Flin Flon HHRA.

K-1.0 INTRODUCTION

A literature review was conducted for food concentrations of the COC for use in the Flin Flon-area HHRA (Flin Flon HHRA). These COC are: arsenic (As), cadmium (Cd), copper (Cu), mercury (Hg), lead (Pb), and selenium (Se). The purpose of the literature review was to identify the most appropriate food data to characterize Flin Flon area residents' background exposure to store-bought foods. In Canada, most supermarkets foods are distributed across North America and are generally not specific to any given location. Thus, food purchased in Flin Flon should resemble the food purchased in other cities in Canada. An exception is the locally grown fruit and vegetables that are seasonally available in Flin Flon. In order to incorporate data on levels of COC in Flin Flon-specific produce into the HHRA, locally-grown residential and commercial gardens were sampled for a variety of fruits and vegetables. Local blueberries were also sampled and analyzed for COC. The results of that survey are provided separately in the Fish and Berry report (refer to Appendix E).

K-2.0 DEVELOPMENT OF THE EDI

The purpose of the current market basket review was three-fold: i) identify the key food item categories making up the diet of Flin Flon residents; ii) determine the EDI rates for each food category; and, iii) determine the range of COC concentrations in each food category. The information generated from this phase of the study was incorporated into the exposure pathway model of the HHRA as the market basket EDI for each COC.

K-2.1 Criteria for Selection of Databases

In order to determine the most appropriate data to use in the Flin Flon HHRA, the following criteria were used:

- Food concentration data were Canadian-specific (if Canadian data were unavailable, the literature search extended to international studies, preferably American);
- Food was purchased from a supermarket or other public point-of-purchase (*e.g.*, bakery, butcher);
- Food was prepared and/or cooked for normal consumption;
- Data were reported with adequate summary statistics (raw data, or at a minimum, the sample number, mean concentration and range); and,
- The method detection limits were adequately low to detect the metal in most of the food items.

When selecting the most appropriate food concentration dataset, there are additional issues to consider for each COC. These issues are outlined for each COC in the following sections.

K-2.2 Background on Food Categories

Estimates of Canadian's food intake are readily available with food grouped into categories of similar food items. The food data available were grouped into separate categories based on the categories outlined in Richardson (1997):

- Fish and shellfish;
- Milk and dairy products;
- Meat, poultry and eggs (excluding organ meats);
- Cereals and grains;
- Root vegetables;

- Other vegetables;
- Fruit and fruit juices;
- Fats and oils;
- Nuts;
- Sugars and sweets;
- Alcoholic beverages; and,
- Non-alcoholic beverages.

We recommend the use of the categorization approach in Richardson (1997) because:

- Fish COC concentrations can be significantly different compared to other meat items (*i.e.*, As);
- Fish consumption for Canadians is significantly lower than other meats when non-eaters are taken into account;
- The Flin Flon HHRA Market basket EDI (EDI_{MB}) calculation were based on the Richardson (1997) intake rates; and,
- Recent Health Canada guidelines (Health Canada, 2004a) recommends the use of Richardson (1997) intake rates.

A few changes of note were made to the Richardson (1997) groupings to allow for more appropriate use within the HHRA. These were:

- Organ meats were removed from the meat, poultry and eggs category (see below);
- Nuts and seeds were removed from the fats and oils category and included as an additional new category; and,
- Many new food items were added to the grouping (*e.g.*, butter, hamburger).

For a complete list of food categories identified for the Flin Flon HHRA, refer to Appendix K1 of this Appendix.

Organ meats were excluded from the meat, poultry and eggs category because the inclusion of this data was causing an unacceptable uncertainty in the estimated 95% upper confidence limit (UCL) on the mean COC concentration for the category. In particular, the copper concentration in organ meats was causing an unacceptable skewing of the data. For example, the standard deviations (SD) for copper in the meat, poultry and eggs category without and with the organ meats were 12,256 and 413 ng/g wet weight (ww), respectively (Table K-1). Depending on the metal, the magnitude of the change in the UCLM was variable. In all cases the SD was reduced by removing the organ meats from the meat, poultry and eggs category (Table K-1).

Table K-1 95% UCLM COC Concentration for the Meat, Poultry and Eggs Food Category, with and without Organ Meats (ng/g wet weight)

Meat, Poultry and Eggs Food Category	***Arsenic***	***Cadmium***	***Copper***	***Lead***	***Mercury***	***Selenium***
With organ meats	33.6 (77.6)	-	7,261.7 (12,256.1)	7.7 (4.5)	1.15 (0.7)	-
Without organ meats	15.2 (14.9)	-	1060.2 (412.7)	6.6 (4.2)	1.06 (0.6)	-

Note: Standard deviations are in brackets ( ).

In addition, the method selected to predict food intake assumed that each food item within the category was weighted equally. However, organ meat consumption is not comparable to that of other meats, poultry and eggs (Richardson, 2005 pers. comm. on compendium data). In fact, only 3% of respondents reported consumption of organ meats. It was hypothesized that the removal of organ meats, while reducing the uncertainty in the meat, poultry and eggs category, did not inappropriately lower the EDI_{MB} for the metals. In order to test this hypothesis, the intake of two metals with the highest concentrations in organ meats were modeled using organ specific intake rates on a per capita basis (meat non-eaters were included). It was found that the removal of organ meats, while reducing the uncertainty in the meat, poultry and eggs category, did not significantly lower the EDI_{MB}. Consumption of organ meats accounted for 0.1 and 0.2% of the total EDI_{MB} for copper and arsenic, respectively. Therefore, organ meats were not included in the derivation of the EDI_{MB} for the Flin Flon HHRA.

Nuts and seeds were removed from the oils and fats category and included as a separate category. Nuts and seeds were included in the EDI_{MB} calculation using separate intake rate data for nuts and seeds (Richardson, 1997).

Many new items have been added to the roster of food items tested in the Canadian Total Diet Study. To accommodate these new items, many of these items have been added to the categories established by Richardson (1997). Appendix K1 provides a list of the original items included in each category and the additional items added. Depending on the source of the data, the list of food items included in the category will vary. Appendix K provides a complete list of all the data included for each COC.

K-2.3 Selection of the Databases

The databases selected for use in the Flin Flon EDI_{MB} are summarized in Table K-2 (refer to Appendix K2 for the complete datasets).

Table K-2 Summary of Databases Selected for Use in the Development of the EDI_{MB}

COC	*Location*	*Date*	*Description*	*Reference*
As	Six Canadian cities	1985 and 1988	Canadian Total Diet Study[a]: Total As analyzed in supermarket foods	Dabeka *et al*., 1993
Cd	Six Canadian cities	1985 to 1988	Canadian Total Diet Study[a]: Total Cd analyzed in supermarket foods	Dabeka and McKenzie, 1992; 1995; CCME, 1996
Cu	Eight Canadian cities	1993 to 1999 and 2000	Canadian Total Diet Study[a]: Total Cu analyzed in supermarket foods	Health Canada, 2004b; Dabeka and McKenzie, 2005 pers. comm.
Hg	Two Canadian cities	1998 to 2000	Canadian Total Diet Study[a]: Total Hg analyzed in supermarket foods; CFIA data: Total Hg in Canadian retail fish	Dabeka *et al*., 2003; Health Canada, 2007
Pb	Canada	2000	Canadian Total Diet Study[a]: Total Pb analyzed in supermarket foods	Dabeka and McKenzie, 2005 pers. comm.
Se	Canada (Toronto)	1992	Total Diet Study Total Se analyzed in supermarket foods	Dabeka, 1994; CCME, 2007

[a] All non-detected food concentrations were assumed by the authors to be the full detection limit.

It is important to note that the following tables reflect the concentrations of COC in food that are readily available or in the published literature. The authors of the data applied different assumptions to data with values below the detection limit (*i.e.*, non-detects), when averaging either the food item concentration or the food category (*e.g.*, non-detects equal zero

concentration, ½ the detection limit, or the detection limit itself). For the purposes of applying the food concentrations to the EDI_{MB}, the raw data was obtained, when available, and the non-detects were assumed to be half the detection limit and the 95% UCLM on the mean of the food categories was calculated. The data used in the derivation of the EDI_{MB} are summarized in Appendices K2.

K-3.0 RESULTS

K-3.1 Arsenic

Arsenic is commonly detected in most foods; however, the chemical forms differ and concentrations may vary considerably by food type. For example, much of the arsenic in fish is present in a highly complexed, non-bioavailable form, or as organoarsenicals (*e.g.*, arsenobetaine, arsenocholine) that are rapidly excreted from the body. Inorganic arsenic, specifically the soluble inorganic As(III) and As(V) species, are the most bioavailable and are the arsenic species of most interest and concern in any HHRA including the Flin Flon HHRA

Based on limited data, the percentage of inorganic arsenic in various foods has been reported to typically range from 0 to 1% in saltwater fish, 5% in vegetables, 10 to 15% in freshwater fish, 15% in potatoes and fruits, 73% in apple juice, 35 to 43% in rice, 49 to 69% in cereals, flour and breads, 15 to 41% in poultry, and as much as 75 to 100% in milk, dairy products, and meats (Weiler, 1987; MOE, 1987). For a typical mixed diet, approximately 20 to 40% of the estimated daily dietary intake of arsenic is inorganic (Borum and Abernathy, 1994; Yost *et al.,* 1998). Inorganic forms predominate in meat and poultry, dairy products and rice.

Selection of Food Database

There were a number of Canadian market basket surveys available for arsenic (JWEL, 2004; Dabeka *et al.,* 1993; MOE, 1987; Smith, 1971) (Table K-1). Some of the market basket studies analyzed total arsenic (*e.g*., DNHW, 1983; Dabeka *et al.,* 1993; JWEL, 2004), while others analyzed both total and inorganic forms (MOE, 1987).

The database selected for use in the Flin Flon HHRA was the Dabeka *et al*. (1993) Canadian Total Diet Study (TDS) because it fulfilled all of the selection criteria and was found to be the most appropriate for arsenic. In this survey, food was sampled from supermarkets in six Canadian cities and prepared as for normal consumption by Canadians (Dabeka *et al*., 1993). Raw data and summary statistics were available and the detection limits were appropriate, ranging from 0.3 to 1.1 ng/g ww. Unfortunately, arsenic was not analyzed in the Canadian TDS data for the period 1993 to 1999, and 2000 due to limited government resources (Dabeka, 2005 pers. comm.). Therefore, the available data are greater than 10 years old.

The more recent Port Colborne database (*i.e*., JWEL, 2004) was not selected because they had inappropriately high detection limits (*i.e*., arsenic was non-detectable in 97% of food samples; detection limit was ~50 ng/g dw (~10 ng/g ww for vegetables[1]); resulting in highly uncertain estimates of food concentrations. For that analyses, non-detectable arsenic concentrations were assumed to be equal to half the detection limit (JWEL, 2004), an assumption that is typically conservative. This may explain why the mean concentrations for the food categories in the JWEL (2004) data are consistently higher than those in the Dabeka *et al*. (1993) study. The

[1] Calculated for illustrative purposed only, and assumes an 80% moisture content for vegetables.

MOE (1987) and DNHW (1983) databases were not selected because they did not sample an adequate variety of foods. For example, the MOE (1987) study sampled only apple juice in the fruit and fruit products category, and the DNHW (1983) studied only marine fish and meat products. The MOE (1987) study will be used to provide assumptions of the inorganic arsenic content of the Dabeka *et al*. (1993) food data. The Smith (1971) database was not used because the data and summary statistics were not readily available and the data is likely no longer reflective of current arsenic food concentrations.

The available information on the concentration of arsenic in major food categories is presented in Table K-3. However, only data from Dabeka *et al*. (1993) were used to calculate the EDI for arsenic for the Flin Flon HHRA.

Table K-3 Typical Total Arsenic Concentrations in Canadian Foods

Food Type	*Location*	*Description*	*Concentration*[Φ]	*Reference*
Fish and Seafood				
Fish and shellfish	Port Colborne	186 food samples* [+]	mean: 1,600	JWEL, 2004
Fish and shellfish	6 Canadian cities between 1985 and 1988	total arsenic in samples collected	mean: 1,662.46 max: 4,830.0	Dabeka *et al*., 1993[b]
Marine fish	Canada	marine fish sold for human consumption	range: 400 to 118,000	DNHW, 1983
Fish (saltwater)	Ontario	total arsenic concentrations and % inorganic	1,100 to 4,000 (1% inorganic) average: 2,550	MOE, 1987[a]
Fish (freshwater)	Ontario	total arsenic concentrations and % inorganic	140 (15% inorganic)	MOE, 1987[a]
Shrimp	Ontario	total arsenic concentrations and % inorganic	650 (16% inorganic)	MOE, 1987[a]
Meat / Poultry Products				
Meat, poultry and eggs	Port Colborne	186 food samples	mean: 30.6 max: 43	JWEL, 2004
Meat and poultry	Canada, between 1985 and 1988	total arsenic in samples collected	mean: 24.3 max: 536.0	Dabeka *et al*., 1993[b]
Meat and poultry	Canada	sold for human consumption	range: non-detect to 440	DNHW, 1983
Red meat	Ontario	total arsenic concentrations and % inorganic	13 to 26 (100% inorganic)	MOE, 1987[a]
Poultry	Ontario	total arsenic concentrations and % inorganic	21 to 23 (41% inorganic)	MOE, 1987[a]
Meats	Canada, Ottawa-Hull area	food purchased	50	Smith, 1971
Milk and Dairy Products				
Milk and milk Products	Port Colborne	186 food samples	mean: 21 max: 24	JWEL, 2004
Vanilla ice cream	Ontario	total arsenic concentrations and % inorganic	16 (26% inorganic)	MOE, 1987[a]
Milk and dairy products	6 Canadian cities, between 1985 and 1988	total arsenic in samples collected	mean: 3.8 max: 26.0	Dabeka *et al*., 1993[b]
Dairy	Canada, Ottawa-Hull area	food purchased	200	Smith, 1971
Rice				
Cooked rice	Ontario	total arsenic concentrations and % inorganic	230 to 240 (43% inorganic)	MOE, 1987[a]
Rice cereal, dry	6 Canadian cities, between 1985 and 1988	total arsenic in samples collected	mean: 284.1 max: 365	Dabeka *et al*., 1993[b]

Table K-3 Typical Total Arsenic Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration[φ]***	***Reference***
Cereals, Grains and Baked Goods				
Cereals, grains and baked goods	Port Colborne	186 food samples	mean: 18.5 max: 28	JWEL, 2004
Cereals and baked goods	6 Canadian cities, between 1985 and 1988	total arsenic in samples collected	mean: 24.5 max: 365	Dabeka *et al*., 1993[b]
Cereals	Ontario	total arsenic concentrations and % inorganic	230 to 300 (49% inorganic)	MOE, 1987[a]
Bread	Ontario	total arsenic concentrations and % inorganic	mean: 24 (50% inorganic)	MOE, 1987[a]
Pastry flour	Ontario	total arsenic concentrations and % inorganic	11 (69% inorganic)	MOE, 1987[a]
Cereals	Canada; Ottawa-Hull area	food purchased	50	Smith, 1971
Fruits and Fruit Juices				
Fruits and fruit juices	Port Colborne	186 food samples	mean: 14.9 max: 37	JWEL, 2004
Fruit and fruit juices	6 Canadian cities, between 1985 and 1988	total arsenic in samples collected	mean: 4.5 max: 37	Dabeka *et al*., 1993[b]
Apple juice	Ontario	total arsenic concentrations and % inorganic	12 (73% inorganic)	MOE, 1987[a]
Garden fruits	Canada, Ottawa-Hull area	food purchased	20	Smith, 1971
Fruits	Canada, Ottawa-Hull area	food purchased	<100	Smith, 1971
Root Vegetables				
Potatoes	Port Colborne	186 food samples	mean: 18.5	JWEL, 2004
Root vegetables	6 Canadian cities, between 1985 and 1988	total arsenic in samples collected	mean: 7.8	Dabeka *et al*., 1993[b]
Root vegetables	Canada, Ottawa-Hull area	food purchased	<20	Smith, 1971
Potatoes	Canada, Ottawa-Hull area	food purchased	<100	Smith, 1971
Other Vegetables				
Other vegetables	Port Colborne	186 food samples	mean: 1.16 max: 2.7	JWEL, 2004
Vegetables	6 Canadian cities, between 1985 and 1988	total arsenic in samples collected	mean: 7.0 max: 84.0	Dabeka *et al*., 1993[b]
Leafy vegetables	Canada, Ottawa-Hull area	food purchased	<100	Smith, 1971
Legumes	Canada, Ottawa-Hull area	food purchased	<20	Smith, 1971
Fats and Oils				
Fats, oils, nuts and Seeds	Port Colborne	186 food samples	mean: 38.5 max: 54	JWEL, 2004
Fats and oils	6 Canadian cities, between 1985 and 1988	total arsenic in samples collected	mean: 19.0 max: 57.0	Dabeka *et al*., 1993[b]
Sugars and Sweets				
Sugars and sweets	Port Colborne	186 food samples	mean: 35.7 max: 48	JWEL, 2004
Sugar and candies	6 Canadian cities, between 1985 and 1988	total arsenic in samples collected	mean: 10.9 max: 105	Dabeka *et al*., 1993[b]

Table K-3 Typical Total Arsenic Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*$^{\Phi}$**	***Reference***
Sugar products	Canada, Ottawa-Hull area	food purchased	80	Smith, 1971
Miscellaneous				
Miscellaneous	6 Canadian cities, between 1985 and 1988	total arsenic in samples collected	mean: 12.5 max: 41.0	Dabeka *et al*., 1993[b]
Beverages				
Alcoholic beverages	Port Colborne	186 food samples	mean: 6.9	JWEL, 2004
Non-alcoholic beverages	Port Colborne	186 food samples	mean: 9.7	JWEL, 2004
Beverages	6 Canadian cities, between 1985 and 1988	total arsenic in samples collected	mean: 3.0 max: 9.0	Dabeka *et al*., 1993[b]
Tea	Ontario	total arsenic concentrations and % inorganic	35 (26% inorganic)	MOE, 1987[a]
Drinks	Canada, Ottawa-Hull area	food purchased	20	Smith, 1971

$^{\Phi}$ All food concentrations are expressed in units of ng/g wet weight, unless otherwise stated.

* includes replicates and duplicates

$^{+}$ 97% of all food data is below the MDL (50 ng/g dw). All food items analyzed as dry weight and then converted to wet weight using moisture content (measured by laboratory). Samples detected at, or below, the MDL were assumed to be ½ the detection limit.

[a] Food samples in this study were comprised of one homogenized sample, analyzed in duplicate or triplicate, except for saltwater fish and apple juice. Percent inorganic arsenic was calculated by dividing measured average inorganic concentration in foods by the average measured total arsenic concentration.

[b] All food samples in this study were prepared as for normal consumption and then homogenized.

K-3.2 Cadmium

Food is considered the primary source of cadmium exposure in the general public (Health Canada, 1986; ATSDR, 1999a). Average daily cadmium ingestion rates are documented in the range of 0.007 to 0.034 mg/day (Health Canada, 1986; Dabeka *et al*., 1987), while a slightly higher range of 0.010 to 0.040 mg/day is detected in the U.S. (Gartrell *et al*., 1986; Podrebarac, 1984; U.S. EPA, 1985; Health Canada, 1986).

Various cadmium concentrations have been detected in different foods (Health Canada, 1986). An average concentration of 0.05 mg cadmium/kg (wet-weight basis) is reported for most foods (Fleischer *et al*., 1974; Nordberg, 1974; Health Canada, 1986), however concentrations as high as 0.2, 1.6 and 21.0 mg/kg have been found in brown crabmeat, beef kidneys and livers, respectively (Chau *et al*., 1970; Health Canada, 1986). This is not unexpected as cadmium is known to accumulate in the liver and kidneys of vertebrates (ATSDR, 1999a).

Caution is recommended when interpreting cadmium concentration results derived from atomic absorption spectrophotometry. Several authors (Riihimaki, 1972; Friberg *et al*., 1974; Nordberg, 1974) have mentioned that some of these cadmium concentration results are much higher than the true value due to sodium interference (Health Canada, 1986).

Selection of Food Database

Canadian market basket data are available for cadmium (Dabeka and McKenzie, 1992; 1995). Dabeka and McKenzie (1992) analyzed the cadmium concentrations in 105 food composites that were collected in 1985 as part the Canadian health Protection Branch's ongoing total diet program. The food samples, purchased at the retail level in the Ottawa region, were prepared

for regular consumption before being combined into composites. Atomic absorption spectrophotometer was used to analyze cadmium concentrations in the food samples.

Dabeka and McKenzie (1995) analyzed the cadmium concentrations in food samples collected at the retail level from Halifax, Montreal, Toronto, Winnipeg and Vancouver. The food samples were prepared for regular consumption, homogenized into 113 composites and then subdivided into eight broader food categories. Cadmium concentrations were determined using atomic absorption spectrometry.

Within the derivation of the Canadian Soil Quality Guideline for inorganic cadmium, the CCME used the results of the Dabeka and McKenzie (1992; 1995) Total Diet Study to derive daily cadmium intake rates for the general population (CCME, 1996). These values were used in the current assessment to represent the EDI from the consumption of market basket foods (Table K-4).

Table K-4 Estimated Daily Cadmium Intake from Food for the Canadian General Population (CCME, 1996)

Age Class	***Estimated Daily Intake from Market Basket Foods (µg/kg/day)***
Infant[a]	0.58
Toddler	0.58
Child	0.46
Teen	0.26
Adult	0.18

[a] An EDI_{MB} was not provided for the infant. As a conservative measure, the EDI_{MB} recommended for the toddler was used for the infant.

K-3.3 Copper

Copper is an essential micronutrient and is found in all foods (ATSDR, 2004). Typical food items that are high in copper include shellfish, organ meats (*e.g.*, liver and kidney), legumes, and nuts (Dabeka and McKenzie, 1995; ATSDR, 2004; Dabeka and McKenzie, 2005, pers. comm.).

Selection of Food Database

Canadian market basket data available for copper are summarized in Table K-5 (Health Canada, 2004b; JWEL, 2004; Dabeka and McKenzie, 2005 pers. comm.). There was good agreement among the results for the Canadian Total Diet Study (CTDS) (Dabeka and McKenzie, 2005 pers. comm.; Health Canada, 2004b).

The copper levels for organ meats were significantly higher than the rest of the meat and poultry samples in all studies. For example, the mean copper concentrations for the meat category with and without the organ meats for three different studies were: 10,911 and 1,342 ng/g in the 2000 CTDS; 3,496 and 1,006 ng/g in the 1993 to 1999 CTDS; and, 21,935 and 685 ng/g in the Port Colborne study (refer to Section K-2.1 for further discussion on organ meats).

The databases selected for use in the Flin Flon HHRA were the consecutive years (1993 to 2000) of the Canadian Total Diet Studies (Health Canada, 2004b; Dabeka and McKenzie, 2005 pers. comm.) because they fulfilled all of the selection criteria and were the most appropriate for copper. The datasets were combined to increase the Canadian coverage (eight cities) and the statistical robustness of the data.

Table K-5 Typical Total Copper Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*** [φ]	***Reference***
Fish and Seafood				
Fish and shellfish	Canada	unpublished data from the 2000 TDS	992.4[a]	Dabeka and McKenzie, 2005 pers. comm.
Fish and shellfish	8 Canadian cities, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	137 food items collected	mean: 811.68 max: 1,972.4	Health Canada, 2004b
Fish and shellfish	Port Colborne	186 food samples (includes replicates and duplicates)	mean: 240[a]	JWEL, 2004
Meat / Poultry Products				
Meat, poultry and eggs	Canada	unpublished data from the 2000 TDS	10,910.6 [a,b]	Dabeka and McKenzie, 2005 pers. comm.
Meat, poultry and eggs	8 Canadian cities, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	137 food items collected	mean: 3,495.75 max: 33,372.87 (organ meats)	Health Canada, 2004b
Meat, poultry and eggs	Port Colborne	186 food samples (includes replicates and duplicates)	mean: 21 935[a] max: 170,000 (organ meats)	JWEL, 2004
Meat, fish and poultry	Canada, Ottawa-Hull area in 1969	foods purchased	1,490	Méranger and Smith, 1972
Meat, fish and poultry	Canada, Winnipeg area in 1972	foods purchased	1,130	Kirkpatrick and Coffin, 1977
Milk and Dairy Products				
Dairy	Canada	unpublished data from the 2000 TDS	221.0[a]	Dabeka and McKenzie, 2005 pers. comm.
Milk and milk products	8 Canadian cities, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	137 food items collected	mean: 200.93 max: 843.13	Health Canada, 2004b
Milk and milk Products	Port Colborne	186 food samples (includes replicates and duplicates)	mean: 179[a] max: 230	JWEL, 2004
Milk and dairy	Canada, Ottawa-Hull area in 1969	foods purchased	170	Méranger and Smith, 1972
Milk and dairy	Canada, Winnipeg area in 1972	foods purchased	190	Kirkpatrick and Coffin, 1977
Infant Formula				
Infant formula	Canada	unpublished data from the 2000 TDS	783.5[a]	Dabeka and McKenzie, 2005 pers. comm.
Infant formula	Canada	137 food items	mean: 789.76 max: 817.44	Health Canada, 2004b
Cereals, Grains and Baked Goods				

Table K-5 Typical Total Copper Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*** [φ]	***Reference***
Cereal and grain products	Canada	unpublished data from the 2000 TDS	1,367.0[a]	Dabeka and McKenzie, 2005 pers. comm.
Cereals, grains and baked goods	8 Canadian cities, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	137 food items collected	mean: 1,300.04 max: 4,574.87	Health Canada, 2004b
Cereals, grains and baked goods	Port Colborne	186 food samples (includes replicates and duplicates)	mean: 1,006 [a] max: 1,700	JWEL, 2004
Cereals	Canada, Ottawa-Hull area in 1969	foods purchased	2,790	Méranger and Smith, 1972
Cereals	Canada, Winnipeg area in 1972	foods purchased	2,260	Kirkpatrick and Coffin, 1977
Fruits and Fruit Juices				
Fruit and fruit products	Canada	unpublished data from the 2000 TDS	814.2[a]	Dabeka and McKenzie, 2005 pers. comm.
Fruit and fruit products	8 Canadian cities, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	137 food items collected	mean: 911.28 max: 5,305.59	Health Canada, 2004b
Fruits and fruit juices	Port Colborne	186 food samples (includes replicates and duplicates)	mean: 687[a] max: 3,100 (dried fruits)	JWEL, 2004
Garden fruits	Canada, Ottawa-Hull area in 1969	foods purchased	900	Méranger and Smith, 1972
Garden fruits	Canada, Winnipeg area in 1972	foods purchased	810	Kirkpatrick and Coffin, 1977
Fruits	Canada, Ottawa-Hull area in 1969	foods purchased	520	Méranger and Smith, 1972
Fruits	Canada, Winnipeg area in 1972	foods purchased	540	Kirkpatrick and Coffin, 1977
Root Vegetables				
Root vegetables	Canada	unpublished data from the 2000 TDS	774.3[a]	Dabeka and McKenzie, 2005 pers. comm.
Root vegetables	8 Canadian cities, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	137 food items collected	mean: 839.74 max: 2,650.79	Health Canada, 2004b
Potatoes	Port Colborne	186 food samples (includes replicates and duplicates)	mean: 675[a]	JWEL, 2004
Potatoes	Canada, Ottawa-Hull area in 1969	foods purchased	2,530	Méranger and Smith, 1972
Potatoes	Canada, Winnipeg area in 1972	foods purchased	1,180	Kirkpatrick and Coffin, 1977

Table K-5 Typical Total Copper Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*** [φ]	***Reference***
Root vegetables	Canada, Ottawa-Hull area in 1969	foods purchased	880	Méranger and Smith, 1972
Root vegetables	Canada, Winnipeg area in 1972	foods purchased	680	Kirkpatrick and Coffin, 1977
Other Vegetables				
Other vegetables	Canada	unpublished data from the 2000 TDS	782.8[a]	Dabeka and McKenzie, 2005 pers. comm.
Other vegetables	8 Canadian cities, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	137 food items collected	mean: 836.84 max: 3,715.39	Health Canada, 2004b
Other vegetables	Port Colborne	186 food samples (includes replicates and duplicates)	mean: 1,259[a] max: 4,300	JWEL, 2004
Leafy vegetables	Canada, Ottawa-Hull area in 1969	foods purchased	840	Méranger and Smith, 1972
Leafy vegetables	Canada, Winnipeg area in 1972	foods purchased	920	Kirkpatrick and Coffin, 1977
Legumes	Canada, Ottawa-Hull area in 1969	foods purchased	1,480	Méranger and Smith, 1972
Legumes	Canada, Winnipeg area in 1972	foods purchased	1,170	Kirkpatrick and Coffin, 1977
Mixed Foods or Miscellaneous				
Miscellaneous (including soup)	8 Canadian cities, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	137 food items collected	mean: 1,528.76 max: 15,344.29 (seeds shelled)	Health Canada, 2004b
Soups	Canada, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	foods collected	256. [a]	Health Canada, 2004b
Fats and Oils				
Fats, oils and peanuts	Canada	unpublished data from the 2000 TDS	1,276.3[a]	Dabeka and McKenzie, 2005 pers. comm.
Fats, oils and peanuts	8 Canadian cities, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	137 food items collected	mean: 2,044.04 max: 5,911.07	Health Canada, 2004b
Fats, oils, nuts and seeds	Port Colborne	186 food samples (includes replicates and duplicates)	mean: 2,514[a] max: 9,800 (nuts and seeds)	JWEL, 2004
Fats and oils	Canada, Ottawa-Hull area in 1969	foods purchased	1,890	Méranger and Smith, 1972
Fats and oils	Canada, Winnipeg area in 1972	foods purchased	1,560	Kirkpatrick and Coffin, 1977

Table K-5 Typical Total Copper Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*** [φ]	***Reference***
Sugars and Sweets				
Sugar, candy and desserts	Canada	unpublished data from the 2000 TDS	727.4[a]	Dabeka and McKenzie, 2005 pers. comm.
Sugar, candy and desserts	8 Canadian cities, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	137 food items collected	mean: 647.06 max: 2,896.88	Health Canada, 2004b
Sugars and sweets	Port Colborne	186 food samples (includes replicates and duplicates)	mean: 487 [a] max: 1,400	JWEL, 2004
Sugars	Canada, Ottawa-Hull area in 1969	foods purchased	2,360	Méranger and Smith, 1972
Sugars	Canada, Winnipeg area in 1972	foods purchased	1,450	Kirkpatrick and Coffin, 1977
Beverages				
Non-alcoholic drinks	Canada	unpublished data from the 2000 TDS	56.1[a]	Dabeka and McKenzie, 2005 pers. comm.
Non-alcoholic drinks	8 Canadian cities, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	137 food items collected	mean: 108.00 max: 193.32	Health Canada, 2004b
Non-alcoholic beverages	Port Colborne	186 food samples (includes replicates and duplicates)	mean: 35.4[a]	JWEL, 2004
Alcoholic drinks	Canada	unpublished data from the 2000 TDS	66.2[a]	Dabeka and McKenzie, 2005 pers. comm.
Non-alcoholic drinks	8 Canadian cities, Toronto, Montreal, Halifax, Winnipeg, Vancouver, Ottawa, Whitehorse and Calgary between 1993 and 1999	137 food items collected	mean: 88.5 max: 134.28	Health Canada, 2004b

Table K-5 Typical Total Copper Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*** [Φ]	***Reference***
Alcoholic beverages	Port Colborne	186 food samples (includes replicates and duplicates)	mean: 27.3[a]	JWEL, 2004
Drinks	Canada, Ottawa-Hull area in 1969	foods purchased	270	Méranger and Smith, 1972
Drinks	Canada, Winnipeg area in 1972	foods purchased	170	Kirkpatrick and Coffin, 1977

Φ All food concentrations are expressed in units of ng/g wet weight, unless otherwise stated.

a Calculated from raw data in original study.

b High levels in the year 2000 data for meat, poultry and eggs can be largely attributed to the extremely high copper concentrations reported for organ meats. Organ meats were included in previous years' studies, but the average concentration in organ meats between 1993 and 1999 was 4-fold lower than the 2000 value. Values for meat, poultry and eggs, excluding organ meats, are 1,006 and 1,342 ng/g for 1993 to 1999 and 2000, respectively.

c All food concentrations are expressed in units of ng/g wet weight, unless otherwise stated.

K-3.4 Mercury

Canadians may be exposed to mercury *via* several food sources as it does not degrade in the environment and can accumulate in living organisms (Health Canada, 2007). Mercury exists in three distinct forms; 1) elemental mercury; 2) inorganic mercury; and, 3) organic or methyl-mercury, the most toxic form.

While traces of mercury are present in all foods, the highest concentrations of mercury are found in fish, particularly in salt and freshwater predatory fish (Health Canada, 2007). Several total diet studies conducted in Canada and other parts of the world have shown that for the average population, fish are the main source of dietary mercury intake (Dabeka *et al*., 2003; Health Canada, 2007). In contrast to the high capacity of mercury to bioaccumulate in fish, mercury uptake in plants from soil is minimal, leading to low mercury concentrations in fruits and vegetables (European Commission, 2003; Health Canada, 2007). After fish, Dabeka *et al*. (2003) revealed that mushrooms have the highest concentrations of mercury as they are known to uptake mercury from the soil quite readily.

Selection of Food Database

Canadian market basket data available for mercury are available in Table K-6 (Meranger and Smith, 1972; Kirkpatrick and Coffin, 1977; Dabek *et al.*, 2003; FDA, 2007; Health Canada, 2007).

The Dabeka *et al*. (2003) dataset was selected for use in the Flin Flon HHRA because it fulfilled all of the selection criteria and was found to be the most appropriate for mercury. Data from the Health Canada (2007) HHRA of Mercury in Fish and Health Benefits of Fish Consumption Report were combined with Dabeka *et al*. (2003) to increase the Canadian coverage and the statistical robustness of the fish and seafood data. Several databases were not used because the method detection limits were not adequately low to detect the metal in most food items (Méranger and Smith, 1972; Kirkpatrick and Coffin, 1977).

Table K-6 Typical Total Mercury Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*** [φ]	***Reference***
Fish and Seafood				
Fish	U.S.	top 10 types of fish consumed by the U.S general population[a]	20 to 206	U.S. EPA, 1996e; ATSDR, 1999b
Fish and seafood	Canada	fish and seafood species collected at the importers' or domestic processing plants[b]	0 to 230	Health Canada, 2007
Fish and seafood	U.S. 1999 to 2000	NHANES dietary study[c]	9 to 1,327	U.S. EPA, 1997; Mahaffey *et al*., 2004
Fish and fish products	Whitehorse and Ottawa 1998 to 2000	135 food composites	67	Dabeka *et al*., 2003
Fish and fish products	U.S. 1991 to 2005	total diet study	19 to 163	FDA, 2007
Meat / Poultry Products				
Meat, fish and Poultry	Winnipeg area, 1972	foods purchased	29	Kirkpatrick and Coffin, 1977
Meat, fish and Poultry	Hull-Ottawa region, 1969	foods purchased	<10	Méranger and Smith, 1972
Meat and meat products	Whitehorse and Ottawa 1998 to 2000	135 food composites	1.2	Dabeka *et al*., 2003
Poultry and poultry products	White Horse and Ottawa 1998 to 2000	135 food composites)	1.4	Dabeka *et al*., 2003
Poultry and poultry products	U.S. 1991 to 2005	annual total diet study	0 to 1	FDA, 2007
Beef and beef products	U.S. 1991 to 2005	annual total diet study	0 to 1	FDA, 2007
Milk and Dairy Products				
Milk and dairy products	Winnipeg area, 1972	foods purchased	<1	Kirkpatrick and Coffin, 1977
Milk and dairy products	Hull-Ottawa region, 1969	foods purchased	<10	Méranger and Smith, 1972
Dairy products	Whitehorse and Ottawa 1998 to 2000	135 food composites	0.7	Dabeka *et al*., 2003
Dairy products	U.S. 1991 to 2005	annual total diet study	0	FDA, 2007
Infant formula	Whitehorse and Ottawa 1998 to 2000	135 food composites	0.23	Dabeka *et al*., 2003
Cereals, Grains and Baked Goods				
Rice and rice products	U.S. 1991 to 2005	annual total diet study	0	FDA, 2007
Cereals	Winnipeg area, 1972	foods purchased	1	Kirkpatrick and Coffin, 1977
Cereals	Hull-Ottawa region, 1969	foods purchased	<20	Méranger and Smith, 1972
Cereal and cereal products	Whitehorse and Ottawa 1998 to 2000	135 food composites	0.34	Dabeka *et al*., 2003
Cereals, grains and bread	U.S. 1991 to 2005	annual total diet study	0	FDA, 2007
Fruits and Fruit Juices				
Garden fruits	Winnipeg area, 1972	foods purchased	1	Kirkpatrick and Coffin, 1977
Garden fruits	Hull-Ottawa region, 1969	foods purchased	<10	Méranger and Smith, 1972
Fruits	Winnipeg area, 1972	foods purchased	<1	Kirkpatrick and Coffin, 1977
Fruits	Hull-Ottawa region, 1969	foods purchased	<10	Méranger and Smith, 1972
Fruit and fruit products	Whitehorse and Ottawa 1998 to 2000	135 food composites	0.16	Dabeka *et al*., 2003
Fruit and fruit products	U.S.	annual total diet study	0	FDA, 2007

Table K-6 Typical Total Mercury Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*** [φ]	***Reference***
Root Vegetables				
Potatoes	Winnipeg area, 1972	foods purchased	2	Kirkpatrick and Coffin, 1977
Potatoes	Hull-Ottawa region, 1969	foods purchased	<10	Méranger and Smith, 1972
Root vegetables	Winnipeg area, 1972	foods purchased	1	Kirkpatrick and Coffin, 1977
Root vegetables	Hull-Ottawa region, 1969	foods purchased	<10	Méranger and Smith, 1972
Other Vegetables				
Leafy vegetables	Winnipeg area, 1972	foods purchased	2	Kirkpatrick and Coffin, 1977
Leafy vegetables	Hull-Ottawa region, 1969	foods purchased	<10	Méranger and Smith, 1972
Vegetables and vegetable products	Whitehorse and Ottawa 1998 to 2000	135 food composites	0.68	Dabeka *et al*., 2003
Legumes	Winnipeg area, 1972	foods purchased	1	Kirkpatrick and Coffin, 1977
Legumes	Hull-Ottawa region, 1969	foods purchased	<10	Méranger and Smith, 1972
Vegetables	U.S. 1991 to 2005	annual total diet study	0	FDA, 2007
Fats and Oils				
Oils and Fats	Winnipeg area, 1972	foods purchased	1	Kirkpatrick and Coffin, 1977
Oils and Fats	Hull-Ottawa region, 1969	foods purchased	<10	Méranger and Smith, 1972
Fats and Oils	Whitehorse and Ottawa 1998 to 2000	135 food composites	0.32	Dabeka *et al*., 2003
Sugars and Sweets				
sugars	Winnipeg area, 1972	foods purchased	<1	Kirkpatrick and Coffin, 1977
Sugars and adjuncts	Hull-Ottawa region, 1969	foods purchased	<10	Méranger and Smith, 1972
Beverages				
Drinks	Winnipeg area, 1972	foods purchased	<1	Kirkpatrick and Coffin, 1977
Drinks	Hull-Ottawa region, 1969	foods purchased	<10	Méranger and Smith, 1972
Beverages	Whitehorse and Ottawa	135 food composites	0.06	Dabeka *et al*., 2003
Drinks	U.S. 1991 to 2005	annual total diet study	0	FDA, 2007
Other				
Miscellaneous	Whitehorse and Ottawa 1998 to 2000	foods purchased	0.32	Dabeka *et al*., 2003
Miscellaneous	U.S. 1991 to 2005	annual total diet study	0	FDA, 2007
Soups	Whitehorse and Ottawa 1998 to 2000	135 food composites	0.14	Dabeka *et al*., 2003
Soups	U.S. 1991 to 2005	annual total diet study	0	FDA, 2007

Table K-6 Typical Total Mercury Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*** [Φ]	***Reference***
Baby foods	Whitehorse and Ottawa 1998 to 2000	135 food composites	0.20	Dabeka *et al*., 2003
Foods to be cooked in packages	Whitehorse and Ottawa 1998 to 2000	135 food composites	0.40	Dabeka *et al*., 2003
Fast food	Whitehorse and Ottawa 1998 to 2000	135 food composites	1.5	Dabeka *et al*., 2003
Fast food	U.S. 1991 to 2005	annual total diet study	0 to 3	FDA, 2007

[Φ] All food concentrations are expressed in units of ng/g wet weight, unless otherwise stated.

[a] Tuna, Shrimp, Pollack, Salmon, Cod, Catfish, Clam, Flounder (Flatfish), Crab and Scallop

[b] Fish and seafood species collected include: Amberjacks, Barracouta, Basa, Bullhead (Brown), Capelin, Carp, Catfish, Arctic Char, Clam, Cockle, Cod, Crab, Crawfish Drum, Eel, Flounder, Haddock, Hake, Herring, Jack, Kamaboko, Kingfish, Longcod, Lobster, Mackerel, Mahi Mahi, Maria, Monkfish, Mullet, Mussel, Octopus, Oyster, Perch, Periwinkle, Plaice, Pollock, Prawn, Pumpkinseed, Quahog, Rockfish, Salmon, Scallop, Sea Cucumber, Sea Urchin, Shrimp, Skate, Smelt, Snapper, Sole, Sturgeon, Tilefish, Trout, Tuna, Turbot, Whelk, Whitefish

[c] Fish species reportedly consumed by women subjects of the NHANES 1999 to 2000: Shark, Swordfish, Porgy, Walleye, Bass, Northern Pike, Halibut, Snapper, Lobster, Tuna, Skate, Catfish, Pollock, Trout, Brown Trout, Sea bass, Croaker, Cod, Crab, Perch, Pompano, Sardines, Smelt, Carp, Flounder, Haddock, Mackerel, Crab, Shrimp, Scallops, Whiting,Salmon, Octopus, Squid, Clams, Oysters, Herring, Mullet.

K-3.5 Lead

Due to it past commercial use patterns, lead is found in most food items (ATSDR, 1999c). As a result of the phasing out of leaded gasoline sales in the early 1980s, and the virtual elimination of the use of lead-soldered cans for food storage, lead concentrations in environmental media and food are generally much lower today than in the 1970s and 1980s (ATSDR, 1999c).

Selection of Food Database

There were a number of Canadian datasets available for lead, all conducted as part of the Canadian Total Diet Study (CTDS) (Dabeka and McKenzie, 1992; 1995; Health Canada, 2004b; Dabeka and McKenzie, 2005 pers. comm.). Data from these surveys are summarized in Table K-7. The databases selected for use in the Flin Flon HHRA were Dabeka and McKenzie (2005, pers. comm.) because it fulfills all of the selection criteria and was found to be the most appropriate for lead.

The CTDS lead results for 1993 through to 1999 (Health Canada, 2004b) could not be used because the accuracy of the data at near-detection limit measurements was poor due to the accidental contamination of the samples (Dabeka, 2005 pers. comm.). The older Total Diet Study results were also not used because lead concentrations in environmental media and biological tissues/fluids are generally much lower today than in the 1970s and 1980s (ATSDR, 1999c). In addition, older Canadian diet studies (and presumably other studies in which lead was measured in various media) used analytical techniques that may not have been sensitive enough for the prescribed purpose.

Table K-7 Typical Lead Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*** [Φ]	***Reference***
Fish and Seafood				
Fish and shellfish	Canada	mean of 4 food composites	mean: 3.0	Dabeka and McKenzie, 2005 pers. comm.
Fish and shellfish	8 Canadian cities sampled in 1993 to 1999	137 food items	mean: 10.68 max: 20.69	Health Canada, 2004a

Table K-7 Typical Lead Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*** [φ]	***Reference***
Fish	5 Canadian cities sampled in 1986 to 1988	113 composites of 39 foods	mean: 19.3 max: 72.8	Dabeka and McKenzie, 1995
Fish	Canada, Ottawa/Hull region, Ottawa/Hull area	2 x 105 food composites sampled	mean: 21.2	Dabeka and McKenzie, 1992
Meat / Poultry Products				
Meat, poultry and eggs	Canada sampled in 2000	mean of 14 food composites	mean: 5.2	Dabeka and McKenzie, 2005 pers. comm.
Meat, poultry and eggs	8 Canadian cities sampled in 1993 to 1999	137 food items	mean: 13.11 max: 35.33	Health Canada, 2004a
Meat and poultry	5 Canadian cities sampled in 1986 to 1988	113 composites of 39 foods	mean: 20.2 max: 523.4	Dabeka and McKenzie, 1995
Canned luncheon meat	5 Canadian cities sampled in 1986 to 1988	---	mean: 163	Dabeka and McKenzie, 1995
Meat and poultry	Canada, Ottawa/Hull region in 1985	2 x 105 food composites sampled	mean: 18.5	Dabeka and McKenzie, 1992
Milk and Dairy Products				
Milk and milk products	Canada	mean of 12 food composites	mean: 2.8	Dabeka and McKenzie, 2005 pers. comm.
Milk and milk products	8 Canadian cities	137 food items	mean: 4.87 max: 14.22	Health Canada, 2004a
Milk and milk products	5 Canadian cities sampled in 1986 to 1988	113 composites of 39 foods	mean: 7.7 max: 44.7	Dabeka and McKenzie, 1995
Milk and Dairy Products	Canada, Ottawa/Hull region in 1985	2 x 105 food composites sampled	mean: 6.58	Dabeka and McKenzie, 1992
Infant formula	Canada	mean of 2 food composites	mean: 1.6	Dabeka and McKenzie, 2005 pers. comm.
Infant formula	Canada	137 food items	mean: 3.7 max: 4.99	Health Canada, 2004a
Infant formula (ready-to-use)	Canada	49 samples	mean: 1.58 max: 6.08	Dabeka, 1989
Infant formula (concentrated)	Canada	50 samples	mean: 3.67 max: 75.3	Dabeka, 1989
Infant formula (powdered)	Canada	64 samples	mean: 12.56 max: 57.3	Dabeka, 1989
Evaporated milk (lead-free solder)	Canada	8 samples	mean: 2.83 max: 5.17	Dabeka, 1989
Evaporated milk (lead-soldered)	Canada	13 samples	mean: 94.9 max: 300	Dabeka, 1989
Cereals, Grains and Baked Goods				
Cereal/grain products and baked goods	Canada	mean of 21 food composites	mean: 7.5	Dabeka and McKenzie, 2005 pers. comm.
Cereals, grains and baked goods	8 Canadian cities	137 food items	mean: 11.94 max: 33.51	Health Canada, 2004a
Bakery goods and cereals	5 Canadian cities sampled in 1986 to 1988	113 composites of 39 foods	mean: 13.7 max: 66.4	Dabeka and McKenzie, 1995
Bakery goods and cereals	Canada, Ottawa/Hull region in 1985	2 x 105 food composites sampled	mean: 23.5	Dabeka and McKenzie, 1992

Table K-7 Typical Lead Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*** [φ]	***Reference***
Fruits and Fruit Juices				
Fruit and fruit products	Canada	mean of 20 food composites	mean: 6.9	Dabeka and McKenzie, 2005 pers. comm.
Fruit and fruit Products	8 Canadian cities	137 food items	mean: 11.10 max: 63.97	Health Canada, 2004a
Fruits and fruit juice	5 Canadian cities sampled in 1986 to 1988	113 composites of 39 foods	mean: 44.4 max: 372.7	Dabeka and McKenzie, 1995
Canned and raw cherries	5 Canadian cities sampled in 1986 to 1988	--	mean: 203	Dabeka and McKenzie, 1995
Canned citrus	5 Canadian cities sampled in 1986 to 1988	--	mean: 126	Dabeka and McKenzie, 1995
Fruits and fruit juices	Canada, Ottawa/Hull region in 1985	2 x 105 food composites sampled	mean: 60.7	Dabeka and McKenzie, 1992
Root Vegetables				
Root vegetables	Canada	mean of 6 food composites	mean: 5.6	Dabeka and McKenzie, 2005 pers. comm.
Root vegetables	8 Canadian cities	137 food items	mean: 5.46 max: 9.41	Health Canada, 2004a
Other Vegetables				
Other vegetables	Canada	mean of 15 food composites	mean: 4.7	Dabeka and McKenzie, 2005 pers. comm.
Other vegetables	8 Canadian cities	137 food items	mean: 9.38 max: 35.65	Health Canada, 2004a
Vegetables	5 Canadian cites sampled in 1986 to 1988	113 composites of 39 foods	mean: 24.4 max: 331.7	Dabeka and McKenzie, 1995
Canned beans	5 Canadian studies sampled in 1986 to 1988	--	mean: 158	Dabeka and McKenzie, 1995
Vegetables	Canada, Ottawa/Hull region in 198	2 x 105 food composites sampled	mean: 29.3	Dabeka and McKenzie, 1992
Fats and Oils				
Fats, oils and peanut butter	Canada	mean of 4 food composites	4.6	Dabeka and McKenzie, 2005 pers. comm.
Fats, oils and peanuts	8 Canadian cities	137 food items	mean: 18.20 max: 23.88	Health Canada, 2004a
Fats and oils	5 Canadian cities sampled in 1986 to 1988	113 composites of 39 foods	mean: 9.6 max: 19.7	Dabeka and McKenzie, 1995
Fats and Oils	Canada, Ottawa/Hull region	2 x 105 food composites sampled in 1985 in Ottawa/Hull area	mean: 8.1	Dabeka and McKenzie, 1992
Sugars and Sweets				
Sugar, candy and desserts	Canada	mean of 9 food composites	mean: 18.0	Dabeka and McKenzie, 2005 pers. comm.
Sugar, candy and desserts	8 Canadian cities	137 food items	mean: 8.17 max: 17.72	Health Canada, 2004a
Sugar and candies	5 Canadian cites sampled in 1986 to 1988	113 composites of 39 foods	mean: 18.3 max: 111.6	Dabeka and McKenzie, 1995
Sugar and candies	Canada, Ottawa/Hull region in 1985	2 x 105 food composites sampled	mean: 32.8	Dabeka and McKenzie, 1992
Beverages				
Non-alcoholic drinks	Canada	mean of 4 food composites	mean: 1.5	Dabeka and McKenzie, 2005 pers. comm.

Table K-7 Typical Lead Concentrations in Canadian Foods				
Food Type	***Location***	***Description***	***Concentration*** [Φ]	***Reference***
Alcoholic drinks	Canada	mean of 2 food composites	mean: 9.0	Dabeka and McKenzie, 2005 pers. comm.
Non-alcoholic drinks	8 Canadian cities	137 food items	mean: 1.64 max: 2.83	Health Canada, 2004a
Alcoholic drinks	8 Canadian cities	137 food items	mean: 15.51 max: 29.46	Health Canada, 2004a
Beverages	5 Canadian cites sampled in 1986 to 1988	113 composites of 39 foods	mean: 9.9 max: 88.8	Dabeka and McKenzie, 1995
Beverages	Canada, Ottawa/Hull region in 1985	2 x 105 food composites sampled	mean: 47.4	Dabeka and McKenzie, 1992
Other				
Miscellaneous	8 Canadian cities	137 food items	mean: 55.37 max: 704.48 (Frozen beef dinner)	Health Canada, 2004a
Miscellaneous	5 Canadian cites sampled in 1986 to 1988	113 composites of 39 foods	mean: 41.7 max: 178.9	Dabeka and McKenzie, 1995
Soups	5 Canadian cities sampled in 1986 to 1988	113 composites of 39 foods	mean: 15.5 max: 48.7	Dabeka and McKenzie, 1995
Soups	Canada, Ottawa/Hull region in 1985	2 x 105 food composites sampled	mean: 26.3	Dabeka and McKenzie, 1992

Φ All food concentrations are expressed in units of ng/g wet weight, unless otherwise stated.
[a] All food concentrations are expressed in units of ng/g wet weight, unless otherwise stated.

K-3.6 Selenium

The most important pathway for selenium exposure to the general public is food, followed by water, then air (ATSDR, 2003). Selenium is a micronutrient and is found in many food items. Selenium supplements are also available and commonly used by a portion of the general population. These supplements generally contain 10 to 25 µg Se/tablet as inorganic selenium or selenomethionine, although some tablets with up to 200 µg/tablet are available (Goodman *et al*., 1990). In general, fish and seafood, and meats contain the highest concentrations of selenium, cereals have intermediate levels, and fruits and vegetables generally contain the lowest levels (ATSDR, 2003). Brazil nuts are reported to contain very high levels of selenium since they grow in the foothills of the Andes Mountains, where the soils are high in selenium (Secor and Lisk, 1989).

Selection of Food Database

The results of the Dabeka (1994) Total Diet Study were used in the Flon Flon HHRA because it was the only complete source of Canadian data. In July of 1992, commercial foods were purchased in retail outlets in Toronto. This included the collection of 135 food composites, including infant formulae composites. These samples were prepared for typical consumption and analyzed in triplicates by cyclic and pseudocyclic INNA instrumental neutron activation analysis (CCME, 2007). Although the raw data from this study were not obtained, the CCME (2007) Scientific Supporting Document for the derivation of the Canadian Soil Quality Guideline for Selenium contained the average concentrations for each of the 135 food composites. These composites were organized into the 11 food categories used in the current assessment. The average concentration for each food category was used to represent the EPC in the HHRA (Table K-8).

Table K-8 Typical Selenium Concentrations in Canadian Foods			
Food Composite	***Concentration (µg/g)***	***Food Composite***	***Concentration (µg/g)***
Milk and Dairy		**Other Vegetables**	
Milk, Whole	0.015	Baked Beans	0.024
Milk, 2%	0.015	Beans	0.002
Milk, 1%	0.013	Broccoli	0.012
Milk, Skim	0.02	Cabbage	0.007
Evaporated Milk, Canned	0.029	Cauliflower	0.005
Cream, 10-12% bf	0.013	Celery	0.01
Ice Cream	0.033	Corn	0.014
Yogurt	0.014	Cucumbers	0.013
Cheese	0.124	Lettuce	0.004
Cheese, Cottage	0.059	Mushrooms, Canned	0.096
Cheese, Processed, Cheddar	0.123	Peas	0.027
Butter	0.025	Peas	0.011
Soups, Cream, Canned	0.009	Peppers	0.004
Average	0.038	Soups, Dehydrated	0.015
Meat, Poultry and Eggs		Tomatoes	0.003
		Tomato Juice, Canned	0.001
Beef, Steak	0.168	Tomatoes/Sauce Canned and Ketchup	0.028
Beef, Roast and Stewing	0.222	**Average**	0.016
Beef, Ground	0.138	**Root Vegetables**	
Pork, Fresh	0.307		
Pork, Cured	0.185	Beets	0.004
Veal	0.127	Carrots	0.014
Lamb	0.077	Onion	0.011
Cold Cuts and Luncheon Meats	0.207	Potatoes, Raw	0.007
Luncheon Meats, Canned	0.102	Potatoes, Baked	0.027
Wieners	0.102	Potatoes, Boiled, Skin on	0.011
Eggs	0.251	Potatoes, Boiled, Without Skin	0.008
Poultry, Chicken and Turkey	0.227	Potatoes, Chips	0.009
Soups, Meat, Canned	0.032	Rutabagas or Turnip	0.004
Meat, Poultry or Eggs	0.011	French Fries	0.046
Hamburger	0.242	**Average**	0.014
Chicken Burger	0.216	**Fruits and Juices**	
Hot Dog	0.26		
Chicken (Breaded, Fried)	0.198	Apple Juice, Canned, Unsweetened	0.001
Average	0.17	Applesauce, Canned, Sweetened	0.002
Fish and Shellfish		Apples, Raw	0.002
		Bananas	0.012
Fish, Marine, Fresh or Frozen	0.392	Blueberries	0.002
Fish, Fresh Water, Fesh or Frozen	0.133	Cherries	0.003
Fish, Canned	0.413	Citrus Fruit, Raw	0.003
Shellfish, Fresh or Frozen	0.391	Citrus Fruit, Frozen	0.001
Fish Burger	0.233	Citrus Fruit, Canned	0.011
Average	0.31	Grape Juice, Bottled	0.007
Cereals and Grains		Grapes	0.004
		Melons	0.002
Bread, White	0.41	Peaches	0.007
Bread, Whole Wheat	0.392	Pears	0.012
Bread, Rye	0.393	Pineapple, Canned	0.019

Table K-8 Typical Selenium Concentrations in Canadian Foods			
Food Composite	***Concentration (µg/g)***	***Food Composite***	***Concentration (µg/g)***
Cake	0.066	Plums, Dried and Canned Prunes	0.003
Cereals, Cooked Wheat	0.071	Raisins	0.005
Cereals, Corn	0.028	Raspberries	0.006
Cereals, Oatmeal	0.032	Strawberries	0.005
Cereals, Wheat and Bran	0.077	Fruit	0.12
Cookies	0.072	**Average**	0.011
Crackers	0.152	**Fats and Oils**	
Danish and Donuts	0.151		
Flour, Wheat	0.383	Cooking Fats and Salad Oils	0.012
Muffins	0.185	Margarine	0.011
Pancakes	0.132	**Average**	0.012
Pasta, Mixed Dishes	0.176	**Sugar and Sweets**	
Pasta, Plain	0.176		
Pie, Apple	0.056	Candy, Chocolate Bars	0.019
Pie, Other	0.056	Candy, Suckers	0.011
Rice	0.052	Gelatin Dessert	0.008
Rolls and English Muffins	0.394	Honey	0.004
Cereals	0.022	Jams	0.007
Popcorn (Microwave)	0.23	Puddings	0.013
Average	0.17	Sugar, White	0.006
Nuts and Seeds		Syrup	0.007
		Soft Drinks	0.002
Peanut Butter and Peanuts	0.035	Desserts	0.024
Seeds, Shelled	0.635	**Average**	0.010
Average	0.34	-	-
Formulae		-	-
		-	-
Formulae, Milk Base	0.015	-	-
Formulae, Soya Base	0.008	-	-
Average	0.012	-	-

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APPENDIX K1:

FOOD CATEGORIES USED IN THE DERIVATION OF THE EDI_{MB}

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APPENDIX K1: FOOD CATEGORIES USED IN THE DERIVATION OF THE EDI_{MB}

Composite food items included in food categories Φ*

ΦCategorization of food items are based on Richardson (1997); all additional items are highlighted

*Codes are primarily based on Dabeka and Mckenzie (1995). All items that have since been added to the Canadian total diet study are highlighted in grey and the new code is listed.

Dairy Products 1 Milk, whole 2 Milk, 2% 3 Milk, skim 4 Evaporated milk, canned 5 Cream 6 Ice cream, mixed 7 Yogurt, mixed 8 Cheese 9 Cottage cheese 10 Cheese, processed 11 Butter AA03 milk, 1%	**Fish/Shellfish** 24 Marine 25 Freshwater fish, cooked 26 Fish, canned 27 Shellfish
Other Vegetables 51 Corn, raw and canned, cooked 58 Cabbage, cooked and coleslaw 59 Celery 60 Peppers, green and red 61 Lettuce 62 Cauliflower, raw and cooked 63 Broccoli, raw and cooked 64 Beans, raw and canned, cooked 65 Peas, raw and canned, cooked 69 Tomatoes, raw and cooked 71 Tomatoes, canned, ketchup, sauce 72 Mushrooms, raw 73 Cucumber, raw, pickled 108 Baked beans MM01 popcorn LL09 Infant: Veg, peas	**Sugar and Candies** 95 Sugar 96 Syrup 97 Jams 98 Honey 99 Pudding, chocolate from powder 100 Candy, chocolate 101 Candy, other 111 Gelatin, dessert LL02 Infants: dessert
Fats and Oils 92 Cooking fats and salad oils 93 Margarine	**Nuts and Seeds** 94 Peanut butter and peanuts J10 Seeds, shelled

Bakery Goods and Cereals	**Meat, Poultry and Eggs**
32 White bread, all 33 Bread, whole wheat and rye 34 Bread rolls and biscuits 35 Wheat flour 36 Cake, white, yellow, chocolate 37 Cookies, all 38 Danish and donuts 39 Crackers 40 Waffles and pancakes 41 Cooked wheat cereal 42 Oatmeal cereal 43 Corn cereal 44 Wheat and bran cereals 45 Rice cereal, cooked 49 Pasta, canned 50 Pasta, plain, cooked 107 Bran muffins, plain LL01 Infant: Cereal mixed	12 Beef steak, cooked 13 Roast beef 14 Ground beef, cooked 15 Pork, cooked 16 Pork, cured 17 Veal, cooked 18 Lamb, cooked 19 Poultry, cooked 20 Eggs 22 Cold cuts, luncheon meats 23 Luncheon meat, canned 110 Wieners NN03 hamburger NN04 chicken burger NN05 hotdog NN06 chicken, nuggets CC03 Poultry pate LL08 Infant: Meat, poultry, eggs
Formula LL05 Formulae, milk-based LL05 Formulae, soya-based	**Root Vegetables** 52 Potatoes, raw 53 Potatoes, baked 54 Potatoes, boiled, skins 55 Potatoes, peeled, boiled 56 French fries 57 Potato chips 66 Carrots cooked 67 Onions, cooked 68 Turnips, rutabagas 112 Beets, raw and canned, cooked

Fruit and Fruit Juices

74 Citrus fruit, raw	75 Citrus fruit, canned
76 Citrus juice	77 Citrus juice, canned
78 Apples	79 Apple juice, canned
80 Apple sauce	81 Bananas
82 Grapes	83 Grape juice, bottled
84 Peaches, canned and raw	85 Pears, raw, canned
86 Plums, prunes, dried, canned	87 Cherries, raw and canned
88 Melons	89 Strawberries
90 Blueberries	91 Pineapple, canned
46 Apple pie	47 Pie, others, mix
109 Raisins	LL07 Infant: fruit, apple or peach

APPENDIX K2:

SUMMARY STATISTICS USED IN THE DERIVATION OF THE FLIN FLON MARKET BASKET EDI

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APPENDIX K2: SUMMARY STATISTICS USED IN THE DERIVATION OF THE FLIN FLON MARKET BASKET EDI

The following tables (K2-1 through K2-4) provide the summary statistics used in the derivation of the Flin Flon Market Basket EDI for certain COC.

Table K2-1 Summary Statistics for Arsenic used in the Derivation of the Flin Flon Market Basket EDI

Sample Statistics	*Dairy Products*	*Meat, Poultry and Eggs*	*Meat, Poultry and Eggs (without organ meats)*	*Fish/Shellfish*	*Bakery Goods and Cereals*	*Root Vegetables*	*Other Vegetables*	*Fruit and Fruit Juices*	*Fats and Oils*	*Nuts and Seeds*	*Sugar and Candies*
UCLM (ng/g)	**6.7**	**33.6**	**15.2**	**2071.7**	**28.1**	**10.2**	**22.1**	**6.7**	**26.7**	**21.4**	**22.6**
Recommendation 1	Data are Non-parametric (0.05)	Data are lognormal (0.05)	Data follow gamma distribution (0.05)	Data are normal (0.05)	Data are Non-parametric (0.05)	Assuming gamma distribution (0.05)	Data are Non-parametric (0.05)	Data follow gamma distribution (0.05)	Data are normal (0.05)	Data are normal (0.05)	Data are Non-parametric (0.05)
Recommendation 2	Use 97.5% Chebyshev (Mean, Sd) UCLM	Use H-UCLM	Use Approximate Gamma UCLM	Use Student's-t UCLM	Use 97.5% Chebyshev (Mean, Sd) UCLM	Use Approximate Gamma UCL	Use 97.5% Chebyshev (Mean, Sd) UCLM	Use Approximate Gamma UCLM	Use Student's-t UCLM	Use Student's-t UCLM	Use 97.5% Chebyshev (Mean, Sd) UCL
Number of Valid Samples	74.0	87.0	80.0	28.0	117.0	65.0	94.0	139.0	14.0	6.0	52.0
Number of Unique Samples	42.0	57.0	51.0	27.0	74.0	45.0	57.0	87.0	13.0	6.0	35.0
Minimum	0.1	0.7	0.7	77.0	0.1	0.1	0.1	0.1	0.6	6.6	1.3
Maximum	26.0	536.0	100.0	4,830.0	121.0	44.0	206.0	41.0	57.0	26.0	105.0
Mean	3.4	29.3	12.6	1,683.6	15.2	7.8	8.0	5.7	18.7	15.4	9.0
Median	1.5	8.9	8.8	1,360.0	9.0	5.2	3.4	3.8	16.5	14.0	4.4
Standard Deviation	4.6	77.6	14.9	1,205.9	22.4	8.4	21.9	6.8	16.9	7.4	15.8
Variance	20.8	6,026.6	222.7	1,454,187.7	501.1	71.1	481.6	46.3	285.2	54.4	248.7
Coefficient of Variation	1.3	2.7	1.2	0.7	1.5	1.1	2.7	1.2	0.9	0.5	1.8
Skewness	2.8	5.0	3.5	0.9	3.4	2.1	8.1	2.6	0.9	0.5	4.8

Table K2-2	**Summary Statistics for Copper used in the Derivation of the Flin Flon Market Basket EDI**											
Sample Statistics	***Dairy Products***	***Meat, Poultry and Eggs***	***Meat, Poultry and Eggs (without organ meats)***	***Fish/ Shellfish***	***Bakery Goods and Cereals***	***Root Vegetables***	***Other Vegetables***	***Fruit and Fruit Juices***	***Fats and Oils***	***Nuts and Seeds***	***Sugar and Candies***	***Infant Formula***
UCLM (ng/g)	**357.0**	**7261.7**	**1060.2**	**1320.9**	**1788.3**	**1069.4**	**1238.9**	**1743.0**	**251.1**	**13990.1**	**1397.3**	**899.2**
Recommendation 1	Data are Non-parametric (0.05)	Data are Non-parametric (0.05)	Data follow gamma distribution (0.05)	Data are Non-parametric (0.05)	Data are Non-parametric (0.05)	Assuming gamma distribution (0.05)	Data are Non-parametric (0.05)	Data are Non-parametric (0.05)	Data follow gamma distribution (0.05)	Assuming gamma distribution (0.05)	Data are Non-parametric (0.05)	Data are Non-parametric (0.05)
Recommendation 2	Use 97.5% Chebyshev (Mean, Sd) UCLM	Use 95% Chebyshev (Mean, Sd) UCLM	Use Approximate Gamma UCLM	Use 95% Chebyshev (Mean, Sd) UCLM	Use 95% Chebyshev (Mean, Sd) UCLM	Use Approximate Gamma UCLM	Use 95% Chebyshev (Mean, Sd) UCLM	Use 95% Chebyshev (Mean, Sd) UCLM	Use Approximate Gamma UCLM	Use Approximate Gamma UCLM	Use 97.5% Chebyshev (Mean, Sd) UCLM	Use Student's-t UCLM or Modified-t UCLM
Number of Valid Samples	107.0	169.0	161.0	43.0	155.0	85.0	149.0	192.0	16.0	18.0	80.0	18.0
Number of Unique Samples	106.0	169.0	161.0	43.0	155.0	85.0	149.0	192.0	16.0	18.0	80.0	18.0
Minimum	20.4	316.9	316.9	288.6	303.6	157.5	138.1	43.5	1.3	4,570.3	23.5	547.5
Maximum	1,717.8	135,302.0	3331.7	2,869.9	8,642.9	5,414.7	6,950.0	38 571.4	640.3	23,887.5	4,593.5	1,622.1
Mean	204.4	3152.3	1,008.9	8,54.9	1,399.3	930.5	904.0	848.7	137.7	11,027.8	6,58.3	789.1
Median	91.2	965.2	947.8	604.2	1,084.3	707.7	572.7	470.3	93.2	10,109.4	224.5	723.8
Standard Deviation	252.8	1,2256.1	412.7	701.1	1,110.9	852.1	937.8	2842.8	165.7	5953.0	1,058.4	254.9
Variance	6.4E+04	1.5E+08	1.7E+05	4.9E+05	1.2E+06	7.3E+05	8.8E+05	8.1E+06	2.7E+04	3.5E+07	1.1E+06	6.5E+04
Coefficient of Variation	1.2	3.9	0.4	0.8	0.8	0.9	1.0	3.3	1.2	0.5	1.6	0.3
Skewness	2.8	8.4	2.0	1.5	2.9	2.7	3.0	12.4	2.1	0.5	2.3	2.4

Note: ProUCL disregarded zero values. Fats and Oils had two zero values.

Table K2-3 Summary Statistics for Mercury used in the Derivation of the Flin Flon Market Basket EDI

Summary Statistics	*Dairy Products*	*Meat, Poultry and Eggs*	*Meat, Poultry and Eggs (without organ meats)*	*Fish/Shellfish*	*Bakery Goods and Cereals*	*Root Vegetables*	*Other Vegetables*	*Fruit and Fruit Juices*	*Fats and Oils*	*Nuts and Seeds*	*Sugar and Candies*	*Infant Formula*
UCLM (ng/g)	**0.71**	**1.15**	**1.055**	**392.3**	**0.343**	**0.217**	**5.934**	**0.241**	**0.19**	**1**	**0.188**	**0.23**
Recommendation 1	Data are Non-parametric (0.05)	Data appear Gamma Distributed at 5% Significance Level	Data appear Gamma Distributed at 5% Significance Level	Data appear Lognormal at 5% Significance Level	Data appear Gamma Distributed at 5% Significance Level	Data Follow Appr. Gamma Distribution at 5% Significance Level	Data are Non-parametric (0.05)	Data are Non-parametric (0.05)	Too Few Observations To Calculate UCLs	Too Few Observations To Calculate UCLs	Data appear Gamma Distributed at 5% Significance Level	Too Few Observations To Calculate UCLs
Recommendation 2	Use 95% Chebyshev (Mean, Sd) UCLM	Use 95% Approximate Gamma UCLM	Use 95% Approximate Gamma UCLM	Use 95% H-UCLM	Use 95% Approximate Gamma UCLM	Use 95% Approximate Gamma UCLM	Use 99% Chebyshev (Mean, Sd) UCLM	Use 95% Chebyshev (Mean, Sd) UCLM	Used Max	Used Max	Use 95% Approximate Gamma UCLM	Used Max
Number of Valid Samples	24	36	34	143	36	17	32	50	--	--	18	--
Number of Unique Samples	20	26	24	69	28	16	24	34	--	--	14	--
Minimum	0.065	0.077	0.077	10	0.0365	0.0285	0.02	0.02	--	--	0.032	--
Maximum	1.8	2.3	2.3	1,820	1.8	0.58	16	0.7	--	--	0.32	--
Mean	0.324	0.894	0.821	289.7	0.263	0.139	0.82	0.133	--	--	0.143	--
Median	0.155	0.625	0.54	150	0.175	0.075	0.155	0.0575	--	--	0.12	--
Standard Deviation	0.433	0.692	0.637	347.8	0.311	0.161	2.907	0.174	--	--	0.0892	--
Coefficient of Variation	1.339	0.774	0.777	1.2	1.182	1.152	3.544	1.305	--	--	0.625	--
Skewness	2.366	0.622	0.723	2.089	3.687	2.002	4.994	2.287	--	--	0.778	--

Note: All original data is the mean for the food item reported by JWEL (2004). Non-detects = 1/2 dl

* The maximum value (shaded in grey) was used in the model when the 95% UCLM on the arithmetic mean was greater than the maximum value reported for the food group.

Table K2-4 Summary Statistics for Lead used in the Derivation of the Flin Flon Market Basket EDI

Summary Statistics	*Dairy Products*	*Meat, Poultry and Eggs*	*Meat, Poultry and Eggs (without organ meats)*	*Fish/Shellfish*	*Bakery Goods and Cereals*	*Root Vegetables*	*Other Vegetables*	*Fruit and Fruit Juices*	*Fats and Oils*	*Nuts and Seeds*	*Sugar and Candies*
UCLM (ng/g)	**6.0**	**7.2**	**6.6**	6.9*	**12.0**	**7.3**	**5.0**	**14.3**	0.4	13.5	**40.5**
Recommendation 1	Assuming gamma distribution (0.05)	Data follow gamma distribution (0.05)	Data follow gamma distribution (0.05)	Data follow gamma distribution (0.05)	Assuming gamma distribution (0.05)	Data are normal (0.05)	Data are normal (0.05)	Data are lognormal (0.05)	Too Few Observations To Calculate UCLM	Too Few Observations To Calculate UCLM	Data follow gamma distribution (0.05)
Recommendation 2	Use Approximate Gamma UCLM	Use Approximate Gamma UCLM	Use Approximate Gamma UCLM	Use Approximate Gamma UCLM	Use Approximate Gamma UCLM	Use Student's-t UCLM	Use Student's-t UCLM	Use 95% Chebyshev (MVUE) UCLM	Used Max	Used Max	Use Approximate Gamma UCLM
Number of Valid Samples	12.0	19.0	18.0	4.0	16.0	7.0	16.0	18.0	2.0	2.0	8.0
Number of Unique Samples	11.0	18.0	17.0	4.0	16.0	7.0	16.0	18.0	2.0	2.0	8.0
Minimum	0.2	0.7	0.7	1.4	1.8	2.1	1.0	1.0	0.4	1.9	0.6
Maximum	11.8	17.4	17.4	6.9	33.6	10.4	7.4	41.0	0.4	13.5	47.8
Mean	2.8	5.1	4.7	3.0	7.9	4.9	4.2	7.1	0.4	7.7	14.2
Median	0.9	3.5	3.5	1.8	4.7	3.6	4.1	3.1	--	--	5.0
Standard Deviation	3.9	4.5	4.2	2.7	8.5	3.3	1.8	10.5	--	--	18.0
Variance	15.3	20.6	17.7	7.1	71.9	10.9	3.2	110.0	--	--	323.1
Coefficient of Variation	1.4	0.9	0.9	0.9	1.1	0.7	0.4	1.5	--	--	1.3
Skewness	1.6	1.7	2.1	1.9	2.2	1.0	0.2	2.5	--	--	1.4

* The maximum value (shaded in grey) was used in the model when the 95% UCLM on the arithmetic mean was greater than the maximum value reported for the food group.