Aboriginal Lifestyle Characterization

NWMO TR-2014-13 **June 2014**

Nava C. Garisto, Phil Shantz, Ryan Kovacs and Allison Janes

SENES Consultants

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NUCLEAR WASTE MANAGEMENT ORGANIZATION

SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Nuclear Waste Management Organization
22 St. Clair Avenue East, 6th Floor
Toronto, Ontario
M4T 2S3
Canada

Tel: 416-934-9814
Web: www.nwmo.ca

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Authored by:	Nava C. Garisto, Phil Shantz, Ryan Kovacs and Allison Janes		
Verified by:	Stacey Fernandes and Farrah Cooper		
Approved by:	Don Gorber		
Nuclear Waste Management Organization			
Reviewed by:	Jeremy Chen, Chantal Medri and Neale Hunt		
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ABSTRACT

Title: **Aboriginal Lifestyle Characterization**
Report No.: **NWMO TR-2014-13**
Author(s): Nava C. Garisto, Phil Shantz, Ryan Kovacs and Allison Janes
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Abstract
Canadian post-closure safety assessments of the used fuel deep geological repository concept have calculated doses to a hypothetical self-sufficient farming household living in the vicinity of the repository under temperate climate conditions. This receptor is a useful indicator because the assumed lifestyle is plausible and generally maximizes potential long-term impacts.

However, recognizing the long time scales, alternative exposure groups with other diets and lifestyles can also be considered in order to ensure the robustness of the safety assessment conclusions. To this end, a study was completed by Garisto *et al*. (2005) which identified alternative exposure groups. Key among these were lifestyles that would be based on a hunter/gatherer lifestyle rather than farming. In particular, diets and lifestyles were characterized for a boreal forest hunter/gatherer and an inland tundra hunter/gatherer.

In part, these reflect traditional aboriginal lifestyles. In 2012, the Assembly of First Nations (AFN) completed a review of the Garisto *et al*. (2005) characterizations and provided a set of recommendations for improvement (AFN, 2012).

It was also recognized that a Southern Canadian deciduous forest hunter/gatherer lifestyle was of interest since potential siting communities may be in the sedimentary rock settings of southern Ontario. Also global warming may cause the boundary between boreal forest and deciduous forest to move further north into locations currently considered boreal forest.

The current study provides a stylized description of boreal forest, inland tundra and southern Canadian deciduous forest self-sufficient hunter/gatherer diet and lifestyles. In particular, it expands the findings of the Garisto *et al*. (2005) study by:

- incorporating the recommendations of the AFN review (AFN, 2012);
- including additional up-to-date information available from literature;
- adding a new receptor group – the southern Canadian deciduous forest receptor;
- providing an expanded list of biota important to the lifestyles of the receptor groups; and,
- updating dietary calculations for consistency with the 2008 Canadian Standards Association (CSA) N288.1 standard (CSA, 2008).

ABBREVIATIONS

AECL	Atomic Energy of Canada Limited
AFN	Assembly of First Nations
BF	Boreal Forest Ecosystem
CSA	Canadian Standards Association
IT	Inland Tundra Ecosystem
NWMO	Nuclear Waste Management Organization
SCDF	Southern Canadian Deciduous Forest Ecosystem

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1. INTRODUCTION

1.1 BACKGROUND

Canadian post-closure safety assessments of the used fuel deep geological repository concept have calculated doses to a hypothetical self-sufficient farming household living in the vicinity of the repository under temperate climate conditions. This receptor is a useful indicator because the assumed lifestyle is plausible and generally maximizes potential long-term impacts.

However, recognizing the long time scales, alternative exposure groups with other diets and lifestyles can also be considered in order to ensure the robustness of the safety assessment conclusions.

1.2 PREVIOUS STUDIES

Previous studies completed on this topic include the Garisto *et al*. (2005) study "*Alternate Exposure Groups, Characteristics and Data for the Post-Closure Safety Assessment of a Deep Geological Repository*", which identified alternative exposure groups with diets and lifestyles that are not necessarily characterized by studies of modern farmer receptors. Key among these were lifestyles that would be based on a hunter/gatherer lifestyle rather than farming. In particular, diets and lifestyles were characterized for a boreal forest hunter/gatherer and an inland tundra hunter/gatherer.

In part, these reflect traditional aboriginal lifestyles. The boreal forest hunter gatherer is a possible alternative lifestyle that could be practiced in a Canadian Shield environment, a potential siting location for the repository. The inland tundra lifestyle also reflects a possible future evolution of conditions at the site during periglacial conditions.

Each of the exposure groups was characterized by a description of diet and activities, location and surroundings, exposure pathways, and rates and durations of exposures. In 2012, the Assembly of First Nations completed a review of the Garisto *et al*. (2005) lifestyle characterizations and provided a set of recommendations for improvement (AFN, 2012).

It was also recognized that a Southern Canadian deciduous forest hunter/gatherer lifestyle was of interest since potential siting communities may be in the sedimentary rock settings of southern Ontario. Also global warming may cause the boundary between boreal forest and deciduous forest to move further north into locations currently considered boreal forest.

1.3 SCOPE OF WORK

The current study provides a stylized description of boreal forest, inland tundra and southern Canadian deciduous forest self-sufficient hunter/gatherer diet and lifestyles. In particular, the current scope of work includes:

a) Updating the Garisto *et al*. (2005) Boreal Forest (BF) receptor characterization to include:
    a. new diet and caloric intake data available from literature;
    b. new lifestyle characterization data available from literature;
    c. developing a list of specific non-human biota of importance; and
    d. data from references recommended by the AFN review (AFN, 2012).

b) Updating the Garisto *et al*. (2005) Inland Tundra (IT) receptor characterization to include:
    a. new diet and caloric intake data available from literature;
    b. new lifestyle characterization data available from literature;
    c. developing a list of specific non-human biota of importance; and
    d. data from references recommended by the AFN review (AFN, 2012).

c) Characterization of a new Southern Canadian Deciduous Forest (SCDF) receptor group, including:
    a. diet and caloric intake data available from literature;
    b. lifestyle characterization data available from literature;
    c. developing a list of specific non-human biota of importance; and
    d. data from references recommended by the AFN review (AFN, 2012).

1.4 METHODOLOGY

Update of Existing Receptor Groups: Boreal Forest and Inland Tundra

In this report the BF and IT characterizations of Garisto *et al*. (2005) have been expanded to include additional information from literature and specific references recommended by the AFN review (AFN, 2012).

A search of available literature yielded 49 sources with potentially valuable data, 14 of which contained information directly relevant to this study. These 14 references have been added to the study's database and their information used to update dietary intakes as well as lifestyle parameter values, as applicable.

The AFN review (AFN, 2012) also outlined 4 references for consideration. These references have been incorporated into the current study as follows:

- **Effects on Aboriginals from the Great Lakes Environment (EAGLE) (1995)** was reviewed and the data included in the previous Garisto *et al*. (2005) study. Data from the EAGLE (1995) continues to be used in this study. EAGLE (2001) was also reviewed as part of the current study.
- **First Nations Regional Longitudinal Health Survey (RHS) (2005)** was reviewed for information on food consumption rates.
- **First Nations Food, Nutrition and Environment Study (FNFNES) (Chan et al. 2012)** was reviewed for information on food consumption rates. Food intake rates have been incorporated into the study's database and used to update dietary intakes and lifestyle parameters.
- **First Nations Environmental Contaminants Program (FNECP) (Ongoing)** was sought, though documentation was not readily available. Correspondance with the study's coordinator confirmed that individual First Nations communities retain ownership of their results.

Also, since completion of the Garisto *et al.* (2005) report, the Canadian Standards Association (CSA) has released an updated version of the N288.1 standard (CSA, 2008) which includes energy expenditures. In this study, the CSA N288.1 (2008) 90th percentile energy expenditures were used as daily caloric intake requirements (kcal).

There is no sufficient correlation between energy intake values from CSA (2008) and the hunter/gatherer lifestyle. However, some available data indicate that CSA (2008) values are conservative compared to First Nations diet surveys (Wolever 1997; Chan 2012; Sante Quebec 1998; deGonzague 1999).

Extrapolation of Present-Day Data to Far-Future

The current study – and the Garisto *et al.* (2005) work – use information on present-day Aboriginal Peoples' lifestyles in order to characterize the diet and lifestyles of potential far-future human receptors that have adopted a self-sufficient lifestyle. However, present-day societies in such a future would not necessarily return to an aboriginal pre-contact state but would likely move to a more revised form which includes some amount of present-day knowledge. It is important to recognize that aboriginal societies were not static entities prior to European contact.

Aboriginal civilizations were evolving prior to contact. If one postulates that if European contact would have occurred over 1,000 years later, the Northern Boreal Forest peoples may have started to adopt technologies such as agriculture on their own. Diamond (1999, p. 108) writes:

> "Once food production had arisen in one part of the continent, neighboring hunter-gathers could see the result and make conscious decisions. In some cases the hunter-gatherers adopted the neighbouring system of food production virtually as a complete package; in others they chose only certain elements of it; and in still others they rejected food production entirely and remained hunter-gathers."

Agriculture was key in that it allowed for less of a reliance on hunting and gathering and therefore was associated with increased populations and the densification of communities. Diamond (1999, p. 111) speculates on this:

> "In all parts of the world where adequate evidence is available, archaeologists find evidence of rising densities associated with the appearance of food production. Which was the cause and which was the result?"

In the case of the Boreal Forest Aboriginal Peoples, agricultural adoption would have been necessary for populations to grow and intensify. It is known that trapping areas were historically laid out in sufficient size so as to provide for a family grouping. Having too many families utilize the same area of land would have led to an exhaustion of resources in this lifestyle. The short growing season and less generous agricultural soils of the Boreal Forest may have precluded these Aboriginal Peoples from ever widely adopting agriculture but it may be wrong to assume that some adoption would not have occurred. Present day Ojibway and Cree communities in the Boreal Forest generally have little in the way of agriculture and gardening although traditional/country foods (particularly meat and fish) continue to be important staples. There are however examples where Boreal Forest Aboriginal Peoples have adopted some agriculture/gardening.[1]

[1] Personal communication between Phil Shantz and Frank T. an Elder from Whitesand First Nation. Frank is one of the few remaining First Nations peoples who lived fully on the land until the mid 1960's practicing a mixed economy lifestyle of trapping, hunting and fishing. "Frank indicated to me that he grew potatoes, turnips and onions at his trap cabin on the shores of Zigzag Lake" (2010).

In the end, these societies evolved in their lifestyles, customs and patterns over the thousands of years in which they occupied eastern North America, often in response to each other. This evolution would continue into a far-future scenario, and societies would likely retain the knowledge they have gained up to that point.

Therefore future lifestyles in these areas could differ from those practiced in the past. In this sense, the lifestyles characterized here may be considered as stylized, as lifestyles that are points in a continuum of possibilities, rather than as a specific end point.

Assumptions Surrounding Self Sufficiency

As mentioned above, the current study – and the Garisto *et al*. (2005) work – uses information on present-day Aboriginal Peoples' lifestyles in order to characterize the diet and lifestyles of potential far-future human receptors that have adopted a self-sufficient lifestyle. Self-sufficiency is desired because it maximizes the local consumption of food and materials, and therefore is conservative with respect to potential receptor exposure to radioactivity from the repository. It is therefore appropriate for safety assessment purposes.

However, a number of present-day studies on First Nations' diets indicate that store-bought food comprises a large portion of the total food intake. In order to characterize self-sufficient diets (which contain no store-bought food) using present-day diet information (which contain varying amounts of store-bought food), the store-bought fraction of the present-day diet was removed, and the remainder normalized to a given daily caloric intake. The normalized diet better represents a diet comprised of only local/traditional foods.

Characterization of the Southern Canadian Deciduous Forest Receptor Group

Similar to the BF and IT characterizations, a literature search was conducted for diet and lifestyle information specific to First Nations located in areas of southern Ontario, Quebec and parts of British Columbia. Results indicate that such information is scarce and not substantive enough to support the development of detailed dietary tables like those of the BF and IT receptor groups. Since literature-based dietary studies alone could not provide the necessary information, the following method was applied:

1. Incorporate all relevant SCDF information obtained from literature;
2. Investigate, in a quantitative or qualitative manner, the key differences between BF and SCDF lifestyles;
3. Use the BF diet and lifestyle data as a basis for SCDF characterization, but adjust the data to reflect the key differences from item 2 above.
4. Exclude BF data from locations with high intakes of caribou (diets of these northern locations are not adequately representative of SCDF locations).

A detailed discussion of the SCDF characterization is provided in Section 4.1.

Table Data

A blank entry in the data tables indicates an absence of data, while a zero entry indicates a very low value, essentially zero. Although some data entries may appear to be counterintuitive (e.g. women eat more caribou than men (Table 2.3)), all entries are as they appear in the source documents.

1.5 DOCUMENT OUTLINE

The document is structured as follows:

Section 1 describes the project, background, and methodology.
Section 2 briefly describes the BF receptor group and presents diet and lifestyle data.
Section 3 briefly describes the IT receptor group and presents diet and lifestyle data.
Section 4 briefly describes the SCDF receptor group and presents diet and lifestyle data.

2. BOREAL FOREST RECEPTOR GROUP

2.1 DESCRIPTION AND METHODOLOGY

This section outlines parameters which characterize a self-sufficient Boreal Forest Hunter/Gatherer exposure group. The key aspect of this group is that its diet is assumed to be entirely based on local wild game, fish and other traditional/country foods. This group is not intended to be restricted to aboriginals; it could represent any group now or in the future that chooses to live a lifestyle with a high local wild food component.

This characterization is based on information from present-day boreal forest aboriginal communities. However, present-day aboriginal communities are not generally self-sufficient and consume significant amounts of store-bought foods. The diet information from present-day aboriginal communities is therefore extrapolated to a self-sufficient Hunter/Gatherer. (A self-sufficient lifestyle is of most interest for safety assessment purposes as it is potentially more exposed to local contaminants than a lifestyle with significant store-bought food.)

The lifestyle of the self-sufficient Hunter/Gatherer was developed from an understanding of the lifestyle of present-day elders in aboriginal communities. This was chosen so that it was consistent with a self-sufficient diet in local country foods and with self-sufficient use of local resources. It therefore results in a generally more traditional or historical lifestyle than is currently practiced (Garisto *et al.* 2005).

Dietary parameters are outlined in Section 2.2 and lifestyle parameters are provided in Section 0. Appendix B provides ecological profiles for select species. Appendix C provides information on literature sources included in the updated BF calculations.

2.2 DIET

Table 2-1 summarizes information on present-day diet of aboriginal communities in BF areas. Data from literature tends to focus on the wild game portion of the diet. Dietary components are obtained from literature, but include only those foods where corresponding quantitative intake rates were available or could be reasonably derived. For example, Canada goose is a possible dietary component but without referenceable, quantitative, literature-based intake rates to support its consumption it has been excluded. Information pertaining to the Canada goose, and possibly other species, could be included in a future revision to this document if data become available from referenceable studies.

Table 2-3 provides food intake data normalized to the conservative (high) energy intakes of 4480 kcal/d for adults and 2879 kcal/d for children, corresponding to the 90^{th} percentile of current intake (CSA, 2008). Store Food is not included in the normalization, since the lifestyle is considered to be self-sufficient.

Table 2-4 provides a distribution of food components for the self-sufficient BF diet, based on normalization to conservative CSA (2008) energy intake.

Table 2-1: Food Intake Rates and Components from Literature, by Location [g/d]

Component	Location					
	Elliot Lake-1[a]		Elliot Lake -2[b]	Hatchet Lake[c]		
	Adult	Child	Adult	Adult	Female Adult	Child
Caribou				397.0	398.0	241.0
Deer	79.4*	20.5*	108.0*	13.1*	3.4*	0.8*
Moose	79.4*	20.5*	108.0*	13.1*	3.4*	0.8*
Muskrat				1.2	0.9	0.1
Rabbit				1.2	0.9	0.1
Beaver				0.9	0.3	0.1
Grouse	39.7**	10.3**			3.9	0.1
Duck	39.7**	10.3**		8.2	1.3	2.3
Fish	79.4	20.5	19.2	107.4	87.7	43.8
Berries (as blueberries)	147.9	131.5		3.3	3.7	8.5
Elk						
Wild Rice						
Labrador Tea						
Ptarmigan						
Partridge						
Wild Turkey						
Black Bear						
Lynx						
Potatoes (local grown)						
Crab-apples						
Nettle						
Nuts						
Roots						
Rose Hips						
Mint Leaves						
Mushrooms						
Eggs				0.9	1.4	0.0
Store Food	408.0***	115.0***	98.6***	1,381.0	1,471.0	1,460.0
Water (m^3/a)	0.6	0.3	0.5	1.2	1.2	0.6
Soil (g/a)	7.3	11.0				

* Elliot Lake, Hatchet Lake, Big Trout, Grassy Narrows and Whitedog: values are divided between moose and deer based on the original reference.
** Elliot Lake, Big Trout, Grassy Narrows and Whitedog: values are divided between ducks and grouse based on the original reference.
*** Store food in Elliot Lake refers to above and below ground vegetables.
In Hatchet Lake data, age groups are 2-10: child, 11-20: teens and 21- 60+: adult
"Adult" refers to both genders unless otherwise specified.
References:
[a]SENES, 1996
[b]Rio Algom 1995
[c]CanNorth, 2000

Table 2-1: Food Intake Rates and Components from Literature, by Location [g/d] (Continued)

Component	Location				
	Big Trout[a]	Grassy Narrows[a]	Whitedog[a]	Yukon[b]	
	NS	NS	NS	Adult	Adult (Female)
Caribou	18.4	12.2	22.7	15.3	16.6
Deer	14.8*	20.7*	6.9*	1.4	1.5
Moose	14.8*	20.7*	6.9*	171.7	130.8
Muskrat	7.7		0.0		
Rabbit	1.8	5.1	4.6	13.3	13.2
Beaver	17.9	8.8	19.0	16.4	18.4
Grouse	112.0**	2.3**	4.6**	2.0	
Duck	112.0**	2.3**	4.6**	0.7	0.4
Fish	205.3	24.0	19.0	32.2	33.6
Berries (as blueberries)				6.7	5.3
Elk					
Wild Rice					
Labrador Tea					
Ptarmigan					
Partridge					
Wild Turkey					
Black Bear					
Lynx					
Potatoes (local grown)					
Crab-apples					
Nettle					
Nuts					
Roots					
Rose Hips					
Mint Leaves					
Mushrooms					
Eggs					
Store Food				2,363.0	2237.5
Water (m^3/a)					
Soil (g/a)					

* Elliot Lake, Hatchet Lake, Big Trout, Grassy Narrows and Whitedog: values are divided between moose and deer based on the original reference.
** Elliot Lake, Big Trout, Grassy Narrows and Whitedog: values are divided between ducks and grouse based on the original reference.
NS - Not Specified
"Adult" refers to both genders unless otherwise specified.
References:
[a]SENES, 1994 [b]Receveur, 1998

Table 2-1: Food Intake Rates and Components from Literature, by Location [g/d] (Continued)

Component	Location		
	Fort Smith[a] (NWT)	Fort Chipewyan[a] (AB)	Yukon (Haines Junction)[b]
	Adult	Adult	Adult
Caribou			163.2
Deer			
Moose			280.5
Muskrat			
Rabbit			
Beaver			
Grouse			
Duck			
Fish	11.0	16.0	27.2
Berries (as blueberries)	7.0	4.0	2.8
Elk			
Wild Rice			
Labrador Tea			
Ptarmigan			
Partridge			
Wild Turkey			
Black Bear			
Lynx			
Potatoes (local grown)			
Crab-apples			
Nettle			
Nuts			
Roots			
Rose Hips			
Mint Leaves			
Mushrooms			
Eggs			
Store Food	2,082.0	2,035.0	
Water (m^3/a)			
Soil (g/a)			

NS - Not Specified
"Adult" refers to both genders unless otherwise specified.
References:
[a]Wein, 1991
[b]Wein, 1995

Table 2-1: Food Intake Rates and Components from Literature, by Location [g/d] (Continued)

Component	Location			
	Yukon (Teslin)[a]	Yukon (Whitehorse)[a]	Manitoba (Ecozone 1)[b]	Manitoba (Ecozone 2)[b]
	Adult	Adult	Adult	Adult
Caribou	25.5	35.7		
Deer			11.1	0.5
Moose	362.1	158.1	2.9	19.4
Muskrat				
Rabbit			4.2	0.9
Beaver				
Grouse				
Duck			8.5	
Fish	17.8	16.8	1.3	3.4
Berries (as blueberries)	3.7	4.6	0.0	1.5
Elk			8.6	0.8
Wild Rice				
Labrador Tea				
Ptarmigan				
Partridge				
Wild Turkey				
Black Bear				
Lynx				
Potatoes (local grown)				
Crab-apples				
Nettle				
Nuts				
Roots				
Rose Hips				
Mint Leaves				
Mushrooms				
Eggs				
Store Food			2,158.0	2,283.0
Water (m^3/a)				
Soil (g/a)				

"Adult" refers to both genders unless otherwise specified.

References:

[a]Wein, 1995

[b]Chan *et al*., 2012: Ecozone 1: Prairies/Plains; Ecozone 2: Plains/Boreal-Plains

Table 2-1: Food Intake Rates and Components from Literature, by Location [g/d] (Continued)

Component	Location			
	Manitoba (Ecozone 3)[a]	Manitoba (Ecozone 4)[a]	Moose Factory[b]	Moosonee[b]
	Adult	Adult	NS	NS
Caribou		91.9	20.8	10.9
Deer				
Moose	30.4	35.8	46.0	24.1
Muskrat			0.8	0.6
Rabbit			6.5	2.4
Beaver			6.1	4.6
Grouse			2.8	1.0
Duck			57.0	24.2
Fish	1.1	20.2	65.6	18.6
Berries (as blueberries)	3.2	6.1		
Elk		0.8		
Wild Rice	5.6			
Labrador Tea	0.3			
Ptarmigan		0.6	1.2	0.5
Partridge				
Wild Turkey				
Black Bear			0.4	0.2
Lynx				
Potatoes (local grown)				
Crab-apples				
Nettle				
Nuts				
Roots				
Rose Hips				
Mint Leaves				
Mushrooms				
Eggs				
Store Food	1,962.0	1,933		
Water (m^3/a)				
Soil (g/a)				

NS - Not Specified
"Adult" refers to both genders unless otherwise specified.
References:
[a]Chan *et al*., 2012: Ecozone 3: Boreal/Shield; Ecozone 4: Shield/Taiga
[b]Berkes *et al*., 1994

Table 2-1: Food Intake Rates and Components from Literature, by Location [g/d] (Continued)

Component	Location			
	New Post[a]	Fort Albany[a]	Kashechewan[a]	Attawapiskat[a]
	NS	NS	NS	NS
Caribou	93.6	14.1	45.5	23.6
Deer				
Moose	207.5	31.3	100.8	52.4
Muskrat	3.6	0.1	1.6	1.3
Rabbit	24.0	1.3	14.8	6.3
Beaver	26.1	0.6	11.7	9.1
Grouse	10.3	0.5	6.3	2.7
Duck	19.7	41.2	211.7	138.0
Fish	14.5	6.3	34.7	116.3
Berries (as blueberries)				
Elk				
Wild Rice				
Labrador Tea				
Ptarmigan	4.5	0.2	2.8	1.2
Partridge				
Wild Turkey				
Black Bear	1.7	0.3	0.8	0.4
Lynx				
Potatoes (local grown)				
Crab-apples				
Nettle				
Nuts				
Roots				
Rose Hips				
Mint Leaves				
Mushrooms				
Eggs				
Store Food				
Water (m^3/a)				
Soil (g/a)				

NS - Not Specified

References:

[a]Berkes *et al*., 1994

Table 2-1: Food Intake Rates and Components from Literature, by Location [g/d] (Continued)

Component	Location				
	Peawanuck[a]	Fort Severn[a]	Pinehouse, Sask[b]	Average of Manitoba First Nations[c]	
	NS	NS	NS	Adult (Female)	Adult (Male)
Caribou	70.5	185.5	1.5	1.0	0.7
Deer			1.9	3.2	4.5
Moose	156.3	411.2	47.8	4.6	12.1
Muskrat	1.0	7.3	7.3	0.2	1.0
Rabbit	17.3	18.8	31.9	0.6	1.8
Beaver	6.9	52.9	9.1	0.0	1.1
Grouse	7.4	8.0	4.3	0.2	0.8
Duck	212.2	235.8	22.4	3.4	15.6
Fish	121.4	61.1	186.8	7.1	17.9
Berries (as blueberries)			12.3	10.2	9.6
Elk				0.6	2.7
Wild Rice				2.2	1.0
Labrador Tea				0.0	0.0
Ptarmigan	3.3	3.6	0.1		
Partridge				0.1	0.4
Wild Turkey				0.0	0.1
Black Bear	1.3	3.4	27.8		
Lynx			0.5	0.0	0.0
Potatoes (local grown)			12.3		
Crab-apples				0.1	1.0
Nettle				0.0	0.0
Nuts				0.0	0.3
Roots				0.0	0.0
Rose Hips				0.0	0.0
Mint Leaves				0.0	0.0
Mushrooms				0.0	0.0
Eggs				0.1	0.3
Store Food					
Water (m^3/a)					
Soil (g/a)					

NS - Not Specified

References:

[a]Berkes *et al.*, 1994

[b]Tobias and Kay, 1994

[c]Chan *et al.*, 2012

Table 2-2: Energy Yield for Dietary Components [kcal/kg]

a) Country/Traditional Foods

Component	Value (Kcal/kg) [a]	Considered as
Caribou	1671	cooked, roasted
Deer	1576	cooked, roasted
Deer	1871	ground, cooked
Moose	1341	cooked, roasted
Muskrat	2341	cooked, roasted
Rabbit	1729	wild, cooked
Rabbit	2059	composite of cuts, cooked
Beaver	2118	cooked, roasted
Grouse [b]	1529	roasted
Duck	3371	meat and skin, cooked
Fish	1721	whitefish, mixed species
	1439	trout, mixed species
(species as per Hatchet lake questionnaire)	1194	walleye, cooked
	1129	northern Pike, cooked
	1194	white sucker
Berries	572	blueberries
Elk [c]	1370	Cooked, roasted (yield from 1lb raw meat)
Wild Rice	1038	Cooked
Tea	8	Brewed
Ptarmigan [c]	1280	
Store food, vegetables [d]	1190	plant
Store Food, composite	419 - 3817	
Milk	699	human, mature, fluid
Water	0	-
Soil	0	-
Partridge	2107	Meat only, roasted
Wild Turkey	1700	assumed equal to store-bought turkey
Black Bear [c]	1630	
Lynx	2341	Assumed equal to muskrat
Potatoes	931	baked, with skin
Crab-apples	764	-
Nettle	270	raw, fresh
Nuts	6484	average of walnut & hazelnut, raw, shelled
Roots	449	assumed equal to small carrot
Rose Hips	1	as tea
Mint Leaves	1	fresh
Mushrooms	214	Raw, white mushroom
Seagull Eggs	1560	assumed equal to chicken's eggs

[a] Ref: http://www.caloriecount.com unless otherwise noted
[b] Ref: http://www.annecollins.com/calories/calories-game-birds.htm
[c] Ref.: ADF&G, 2013
[d] Ref: OPG, 2002

Table 2-2: Energy Yield for Dietary Components [kcal/kg] (Continued)

b) Store-Bought Food (Composite)

Component	Value (Kcal/kg)	Considered as
Alternates (legumes)	1733	soybean, mature, cooked
Bannock	3453	flour or meal
Canned/bottled beverages	419	cola
Dairy	500	milk
Eggs	2000	whole, cooked
Fats and oils	884	sunflower oil
Fruit	520	apples
Mixed dishes	1041	prepared pasta
Presweetened grain	3659	enriched cornmeal
Store meats	2566	beef, all grades, cooked
Sweets	3817	candies, caramels
Unsweetened grain	2237	crude corn
Vegetables	579	potato

Ref: http://www.calorie-count.com

Table 2-3: Food Intake Requirements Based on Normalized Energy Intakes (Adult: 4480 kcal/d; Child: 2879 kcal/d), by Component, by Location [g/d]

Component	Location					
	Elliot Lake-1		Elliot Lake-2	Hatchet Lake		
	Adult	Child	Adult	Adult	Adult (Female)	Child
Caribou				1,983.9	2,174.0	1,439.4
Deer	557.3	270.4	1,347.8	65.5	18.3	4.6
Moose	557.3	270.4	1,347.8	65.5	18.3	4.6
Muskrat				5.8	4.9	0.5
Rabbit				6.4	5.3	0.5
Beaver				4.5	1.8	0.8
Grouse	278.7	135.4			21.3	0.6
Duck	278.7	135.4		41.0	7.3	13.4
Fish	608.2	295.1	261.5	585.7	522.8	285.4
Berries (as blueberries)	1,038.1	1,734.2		16.5	20.2	50.7
Elk						
Wild Rice						
Labrador Tea						
Ptarmigan						
Partridge						
Wild Turkey						
Black Bear						
Lynx						
Potatoes (local grown)						
Crab-apples						
Nettle						
Nuts						
Roots						
Rose Hips						
Mint Leaves						
Mushrooms						
Eggs				0.0	0.0	0.0
Total	**3318.2**	**2,840.8**	**2,957.1**	**2,774.8**	**2,794.2**	**1,800.7**

In Hatchet Lake data, age groups are 2-10: child, 11-20: teens and 21- 60+: adult
"Adult" refers to both genders unless otherwise specified.

Table 2-3: Food Intake Requirements Based on Normalized Energy Intakes (Adult: 4480 kcal/d; Child: 2879 kcal/d), by Location [g/d] (Continued)

Component	Location				
	Big Trout	Grassy Narrows	Whitedog	Yukon	
	NS	NS	NS	Adult	Adult (Female)
Caribou	83.8	344.1	639.6	181.6	228.1
Deer	67.2	583.2	194.4	17.1	21.3
Moose	67.2	583.2	194.4	2,041.3	1,801.8
Muskrat	35.1				
Rabbit	8.9	155.3	141.5	171.6	197.4
Beaver	81.5	248.9	534.8	195.4	253.2
Grouse	510.1	63.4	129.6	24.0	
Duck	510.1	63.4	129.6	8.7	6.2
Fish	1,020.5	738.2	584.2	418.4	504.4
Berries (as blueberries)				80.1	72.6
Elk					
Wild Rice					
Labrador Tea					
Ptarmigan					
Partridge					
Wild Turkey					
Black Bear					
Lynx					
Potatoes (local grown)					
Crab-apples					
Nettle					
Nuts					
Roots					
Rose Hips					
Mint Leaves					
Mushrooms					
Eggs					
Total	**2,384.4**	**2,779.8**	**2,548.1**	**3,138.2**	**3,084.9**

NS - Not Specified
"Adult" refers to both genders unless otherwise specified.

Table 2-3: Food Intake Requirements Based on Normalized Energy Intakes (Adult: 4480 kcal/d; Child: 2879 kcal/d), by Location [g/d] (Continued)

Component	Location		
	Fort Smith (NWT) Adult	Fort Chipewyan (AB) Adult	Yukon (Haines Junction) Adult
Caribou			1,059.6
Deer			
Moose			1,821.2
Muskrat			
Rabbit			
Beaver			
Grouse			
Duck			
Fish	2,684.3	3,055.3	192.5
Berries (as blueberries)	1,565.2	699.9	17.9
Elk			
Wild Rice			
Labrador Tea			
Ptarmigan			
Partridge			
Wild Turkey			
Black Bear			
Lynx			
Potatoes (local grown)			
Crab-apples			
Nettle			
Nuts			
Roots			
Rose Hips			
Mint Leaves			
Mushrooms			
Eggs			
Total	**4,249.5**	**3,755.2**	**3,091.2**

"Adult" refers to both genders unless otherwise specified.

Table 2-3: Food Intake Requirements Based on Normalized Energy Intakes (Adult: 4480 kcal/d; Child: 2879 kcal/d), by Location [g/d] (Continued)

Component	Location			
	Yukon (Teslin) Adult	Yukon (Whitehorse) Adult	Manitoba (Ecozone 1) Adult	Manitoba (Ecozone 2) Adult
Caribou	205.4	535.3		
Deer			672.7	61.8
Moose	2,916.4	2,370.6	175.0	2,438.9
Muskrat				
Rabbit			276.8	128.8
Beaver				
Grouse				
Duck			514.1	
Fish	156.2	274.8	86.2	467.7
Berries (as blueberries)	29.6	69.0	0.6	182.8
Elk			520.2	94.5
Wild Rice				
Labrador Tea				
Ptarmigan				
Partridge				
Wild Turkey				
Black Bear				
Lynx				
Potatoes (local grown)				
Crab-apples				
Nettle				
Nuts				
Roots				
Rose Hips				
Mint Leaves				
Mushrooms				
Eggs				
Total	**3,307.6**	**3,249.6**	**2,245.7**	**3,374.5**

"Adult" refers to both genders unless otherwise specified.
Ecozone 1: Prairies/Plains; Ecozone 2: Plains/Boreal-Plains

Table 2-3: Food Intake Requirements Based on Normalized Energy Intakes (Adult: 4480 kcal/d; Child: 2879 kcal/d), by Location [g/d] (Continued)

Component	Location			
	Manitoba (Ecozone 3) Adult	Manitoba (Ecozone 4) Adult	Moose Factory NS	Moosonee NS
Caribou		1,743.2	222.5	274.1
Deer				
Moose	2,728.9	678.1	493.1	607.5
Muskrat			9.0	16.1
Rabbit			76.0	65.8
Beaver			65.1	116.6
Grouse			29.9	25.9
Duck			610.2	611.0
Fish	103.0	418.4	767.2	512.2
Berries (as blueberries)	284.8	115.7		
Elk		14.2		
Wild Rice	500.5			
Labrador Tea	26.1			
Ptarmigan		11.0	13.2	11.5
Partridge				
Wild Turkey				
Black Bear			0.0	0.0
Lynx				
Potatoes (local grown)				
Crab-apples				
Nettle				
Nuts				
Roots				
Rose Hips				
Mint Leaves				
Mushrooms				
Eggs				
Total	**3,643.3**	**2,980.6**	**2,286.1**	**2,240.7**

NS - Not Specified
"Adult" refers to both genders unless otherwise specified.
Ecozone 3: Boreal/Shield; Ecozone 4: Shield/Taiga

Table 2-3: Food Intake Requirements Based on Normalized Energy Intakes (Adult: 4480 kcal/d; Child: 2879 kcal/d), by Location [g/d] (Continued)

Component	Location			
	New Post	Fort Albany	Kashechewan	Attawapiskat
	NS	NS	NS	NS
Caribou	638.2	289.0	194.5	134.8
Deer				
Moose	1,414.6	640.5	431.1	298.8
Muskrat	24.6	1.6	6.9	7.2
Rabbit	177.8	28.4	68.7	38.9
Beaver	178.2	11.3	50.1	52.1
Grouse	70.0	11.2	27.1	15.3
Duck	134.6	844.2	905.1	787.3
Fish	108.1	140.4	161.8	724.0
Berries (as blueberries)				
Elk				
Wild Rice				
Labrador Tea				
Ptarmigan	31.0	4.9	12.0	6.8
Partridge				
Wild Turkey				
Black Bear	0.0	0.0	0.0	0.0
Lynx				
Potatoes (local grown)				
Crab-apples				
Nettle				
Nuts				
Roots				
Rose Hips				
Mint Leaves				
Mushrooms				
Eggs				
Total	**2,777.1**	**1,971.4**	**1,857.4**	**2,065.2**

NS - Not Specified

Table 2-3: Food Intake Requirements Based on Normalized Energy Intakes (Adult: 4480 kcal/d; Child: 2879 kcal/d), by Location [g/d] (Continued)

Component	Location			Average of Manitoba First Nations	
	Peawanuck	Fort Severn	Pinehouse, Sask		
	NS	NS	NS	Adult (Female)	Adult (Male)
Caribou	245.3	430.6	12.9	98.2	23.7
Deer			15.6	308.7	164.0
Moose	543.7	954.5	402.0	445.2	438.0
Muskrat	3.3	17.0	61.0	19.5	36.1
Rabbit	65.4	47.4	291.1	59.2	71.0
Beaver	24.1	122.7	76.8	4.2	41.6
Grouse	25.7	18.6	36.3	14.6	28.6
Duck	738.2	547.3	187.8	332.0	564.4
Fish	461.1	154.8	1,712.6	749.5	709.8
Berries (as blueberries)			103.3	995.4	347.3
Elk				61.9	96.3
Wild Rice				215.0	37.0
Labrador Tea				3.2	0.2
Ptarmigan	11.4	8.3	0.8		
Partridge				0.0	0.0
Wild Turkey				0.0	0.0
Black Bear	0.0	0.0	0.0		
Lynx			0.0	0.0	0.0
Potatoes (local grown)			0.0		
Crab-apples				0.0	0.0
Nettle				0.0	
Nuts				0.0	0.0
Roots				0.0	0.0
Rose Hips				0.6	0.1
Mint Leaves				0.3	0.8
Mushrooms					0.0
Eggs				0.0	0.0
Total	**2,118.2**	**2,301.3**	**2,900.2**	**3,307.6**	**2,558.9**

NS - Not Specified

Table 2-4: Food Intake Distribution for All Diet Components [g/d]

Component	Adult			Child*		
	Min	Median	Max	Min	Median	Max
Caribou	12.9	259.7	2,174.0	1,439.4	1,439.4	1,439.4
Deer	15.6	115.6	1,347.8	4.6	676.2	1,347.8
Moose	18.3	583.2	2,916.4	4.6	676.2	1,347.8
Muskrat	1.6	12.6	61.0	0.5	0.5	0.5
Rabbit	5.3	69.9	291.1	0.5	0.5	0.5
Beaver	1.8	71.0	534.8	0.8	0.8	0.8
Grouse	11.2	27.1	510.1	0.6	0.6	0.6
Duck	6.2	421.1	905.1	13.4	13.4	13.4
Fish**	86.2	504.4	3,055.3	261.5	273.4	285.4
berries (as blueberries)	0.6	103.3	1,565.2	50.7	50.7	50.7
Elk	14.2	94.5	520.2			
wild rice	37.0	215.0	500.5			
Labrador Tea	0.2	3.2	26.1			
Ptarmigan	0.8	11.2	31.0			
Partridge	0.0	0.0	0.0			
Wild Turkey	0.0	0.0	0.0			
Black Bear	0.0	0.0	0.0			
Lynx	0.0	0.0	0.0			
Potatoes (local grown & harvested)	0.0	0.0	0.0			
Crab-apples	0.0	0.0	0.0			
Nettle	0.0	0.0	0.0			
Nuts	0.0	0.0	0.0			
Roots	0.0	0.0	0.0			
Rose Hips	0.1	0.4	0.6			
Mint Leaves	0.3	0.6	0.8			
Mushrooms	0.0	0.0	0.0			
Eggs	0.0	0.0	0.0			

*Values for child receptors are limited to two locations; values for caribou, muskrat, rabbit, beaver, grouse, duck, and berries are available for only one location.

** Fish species have a wide range in size, lifespan and food sources; however, in this study all fish species are aggregated due to a lack of data. A future revision to this document could consider alternate representations if more data become available.

The diet information for a self-sufficient hunter/gatherer summarized in the tables above is an estimate. However, results are limited in that they are extrapolated from diet survey data which has inherent gaps and is from non-self-sufficient diets.

2.3 LIFESTYLE

Lifestyle parameters for the BF receptor group are provided in Table 2-5. As previously noted, the lifestyle maximizes use of local resources, and is therefore a more traditional or historical lifestyle than is currently practiced. For comparison, results for a self-sufficient farmer are also listed, as presented in Garisto *et al.* (2005), unless otherwise stated. Garisto *et al*. (2005) mentions that where available, these parameters were obtained from recent studies conducted for the Environmental Assessment (EA) of the consolidation and management of historic waste in Port Hope (PHAI 2004a,b; 2005a,b). Where data were not available and the assumption made sense, lifestyle parameter values were assumed to be the same as or similar to the parameter values used for the self-sufficient farmer (AECL 1994).

Parameters relevant to type of dwelling were based on typical BF historical dwellings, or Wigwams. Such structures were used by the main First Nations in the BF, such as the Cree and Ojibway. Teepees were mostly used in Plains or fringe Boreal/Plain residences.

Table 2-5: Lifestyle Parameters – Boreal Forest

Parameter	Units	Farmer	Boreal Forest Hunter/Gatherer	Reference / Comments
Water source	-	Well/Lake/ River	Lake/ River	-
Total water demand per person	m^3/a	130	6-10	Water was never difficult to come by in the boreal forest. Water was used for cooking foods and boiling medicines. Also used in ceremonies such as sweat lodges (steam for rocks) and of course bathing. Water was also used to keep hides soft for making drums and clothing, for keeping plant/tree material wet and malleable for craft/tool constructions such as black ash baskets. It is estimated that an average household consisting of two adults and 2-6 children, would use: Cooking: 12-16 L/d, Medicines: 2 L/d, Food preparation: 4-8 L/d, Ceremonies: 4-6 L/d, Bathing: 0 (swimming in lakes or creeks in spring/summer/fall), Hides / Tools / Clothing usage: 40- 80 L/d (Garisto *et al*. 2005). This implies a total water demand per person of 6-10 m^3/a. Overall, the estimated consumption is believed to be less than that of the farmer, which includes water for domestic use, drinking water for livestock, irrigation.
Drinking water demand	L/d	2.3	Ln (1.32, 1.65, 0.48, 3.6)	Lognormal, GM=1.32 (adult), GSD=1.65, 0.48-3.6 bounds from Richardson, 1997 3.1(Hatchet Lake) 1.4-1.6 (Elliot Lake) 2.3 L/d for Farmer (CSA, 2008)
Food storage for winter	-	Yes	Yes	

Table 2-5: Lifestyle Parameters – Boreal Forest (Continued)

Parameter	Units	Farmer	Boreal Forest Hunter/Gatherer	Reference / Comments
Total energy need (adult)	kcal/d	Max: 4116	Max: 4480	CSA N288.1 (2008) required energy intake for adults (90th percentile energy expenditure)
Food energy fraction obtained from traditional/wild foods:				
Plants	-	-	0-0.2	Based on Table 2-4: grouped maximum and minimum values.
Milk	-	-	-	Not Applicable.
Meat	-	-	0.14-0.95	Based on Table 2-4: grouped maximum and minimum values.
Birds and eggs	-	-	0-0.69	Based on Table 2-4: grouped maximum and minimum values.
Fish	-	0.01	0.03-0.91	Based on Table 2-4: grouped maximum and minimum values. (Farmer: Garisto *et al*., 2005)
Food energy fraction obtained from agriculture/domestic foods:				
Plants	-	0.32	-	(Farmer: Garisto *et al*. 2005)
Milk	-	0.36	-	(Farmer: Garisto *et al*. 2005)
Meat	-	0.26	-	(Farmer: Garisto *et al*. 2005)
Birds and eggs	-	0.05	-	(Farmer: Garisto *et al*. 2005)
Fraction of food obtained locally (including hunting, gathering, and agriculture):				
Plants	-	1.0	1.0	Self-sufficient exposure group
Milk	-	1.0	-	Not part of diet
Meat	-	1.0	1.0	Self-sufficient exposure group
Birds and eggs	-	1.0	1.0	Self-sufficient exposure group
Fish	-	1.0	1.0	Self-sufficient exposure group
Soil Ingestion rate	kg/a	0.04	0.007-0.04	The lower limit is from Table 2-1, the upper limit is from the value for a farmer (AECL 1994).
People per household	-	3	4-8	A typical wigwam could hold approximately eight people. Number of dwellers would depend on size of family. Dwelling is used for both sleeping and cooking (Garisto *et al*., 2005).
Building lifetime	a	50	6-10	The birch bark and willow branches do not decay over the life time of the wigwams. Wear and tear on wigwams would see a replacement of the entire structure every six to ten years (Garisto *et al*., 2005).
Building height	m	2.4	2.0	Typical Ojibway dwelling is called a Wigwam and is dome shaped.

Table 2-5: Lifestyle Parameters – Boreal Forest (Continued)

Parameter	Units	Farmer	Boreal Forest Hunter/Gatherer	Reference / Comments
Building width	m	9.7	3.0	3 m diameter
Building length	m	9.8	3.0	3 m diameter
Building volume	m^3	228	6-7	Dome shaped
Building material	-	-	Wood & bark	Typically constructed from birch bark, willow saplings and juniper bark. Birch bark is waterproof, and the willow is flexible and strong. Floors covered with spruce or balsam boughs. The boughs would keep the floor dry and their scent and oils are considered medicinal (Garisto *et al*., 2005).
Tree age when harvested for building material	a	100	Birch used for bark: 40-70 Willow saplings: 5-8	The wigwam was built using willow poles as the frame and the birch tree for the bark. The birch tree was not killed if the birch bark was harvested correctly. (Conservative Assumption) The willow saplings were most likely between 5 and 8 year of age and the birch trees from which the bark was harvested were most likely between 40 and 70 years. The diameter of the tree needed to be large enough to harvest larger pieces of bark from them.
Building occupancy factor	-	0.8	Male: 0.5-0.6 Female: 0.7-0.8	Much of the woodland culture was based on hunting, food preparation and gathering. There was limited time for arts and games.
Building wake plume entrainment factor	-	2	2	The entrainment constant is an empirical parameter that has a value between 0.5 and 2.0. It is often not obvious how to choose the cross-sectional area for use in deriving a vertical dispersion parameter, since releases from most nuclear sites are affected by several different buildings. To ensure that the air concentrations are not underestimated, the cross sectional area of the building should be taken as the area (perpendicular to the wind direction) of the largest single building affecting the plume. (CSA 2008)

Table 2-5: Lifestyle Parameters – Boreal Forest (Continued)

Parameter	Units	Farmer	Boreal Forest Hunter/Gatherer	Reference / Comments
Probability of being located downwind from energy fires (fraction of outside time that a person is exposed to fire smoke)	-	0.25	0.25 – 0.75	In a camp setting, housing units would be dispersed throughout a village – it is therefore inevitable that all residents would be impacted by energy fires. In some circumstances, families tend to move away from central camp during certain times of the year to travel to trade or travel to hunt and trap. If there is only one family unit in an area it is presumable that the fire will not always be upwind from the camp/family unit; therefore, 25% would be a good conservative lower estimate (Garisto *et al*. 2005).
Fraction of time exposed to indoor smoke	-	-	Male: 0.05-0.6 Female: 0.14-0.8	Based on estimates of time spent indoors/outdoors, from Garisto *et al.* 2005. See Appendix A.
Building air infiltration rate	hr^{-1}	0.35	2-4	Wigwam dwellings of the Boreal forest would likely have been less sealed and would have had higher air infiltration rates. For context, a value of 0.35/hr implies a well-sealed dwelling. A value of 1 is typical for most homes.
Inhalation Rate	m^3/d	-	Adult: 23.0 Child: 21.5	CSA N288.1 (2008) [annual values divided by 365 d/a]
Outdoor or ground exposure factor	-	0.2	Male: 0.4-0.5 Female: 0.2-0.3	Activities would include fishing, trapping, hunting, wood gathering, food preparation (gutting, cleaning, skinning), repairing community structures, travel by canoe or foot.
Water immersion occupancy factor	-	0.02	0.02	Expected to be low. Assumed same value as farmer
Fuel source	-	-	Wood	Birch bark was often used as fire starter; ‘old man’s beard’ or ‘tree moss’ was also used. Animal fat was used for candles.
Peat burning probability (as fuel)	-	1%	0%	-
Energy consumption per household	MJ/a	$1.1x10^5$	$5.8x10^4$ – $1.2x10^5$	Estimated 1 cord firewood consumed per week (for a household size of 4). Based on 1015 kg (2,240 lb) of wood (spruce) per cord (Kuhns, 2013).

Table 2-5: Lifestyle Parameters – Boreal Forest (Continued)

Parameter	Units	Farmer	Boreal Forest Hunter/Gatherer	Reference / Comments
Frequency of agricultural and land clearing fires	a^{-1}	1	0.1	First Nations would burn fires in the springtime to promote growth of specific plants and to retard growth of others. Fires would be applied periodically to beaver traplines to create more pioneer tree species (such as birch and poplar which the beaver prefers).
Frequency of forest fires	a^{-1}	0.02	0.0125 – 0.009	It is estimated that fire frequency for BF regions is every 80 to 110 years as the BF is a large disturbance based ecosystem (Kimmins, 1997).
Probability of irrigation	-	0.02-0.9	0	Not Applicable
Irrigation period	a	100	-	Not Applicable
Probability of using fresh lake sediments on fields	-	0.01	0	Not Applicable.
Dredged sediment thickness	m	0.3	-	Not Applicable.
Cropping frequency	a^{-1}	0-1	0	Not Applicable.
Cropping period, non-irrigated fields	a	50	-	Not Applicable.
Cropping soil contaminant loss fraction	-	0.05	0.05	It is realistic to assume some loss of radionuclides due to the cropping cycle. A low rate is conservative for the purpose of assessing dose due to soil exposure. Nutrient cycling in nutrient efficient farms provides a conservative lower bound on the loss of about 5% of the nutrient inventory of the crop. (CSA 2008)
Fish holdup time (Time between catching and eating fish)	d	0.5-60	0.3-60	Assumed. The shorter period accounts for fish being caught in the morning and consumed for lunch or dinner. The longer period accounts for outdoor drying of fish.

Table 2-5: Lifestyle Parameters – Boreal Forest (Continued)

Parameter	Units	Farmer	Boreal Forest Hunter/Gatherer	Reference / Comments
Plant holdup time (Time between plant absorbing the nuclide and being eaten by man)	d	1	0.01 - 270	Plants could have been consumed relatively soon after harvesting (immediately in some cases) or stored for later consumption using preservation techniques such as drying. For example, blueberries would have been harvested and dried for consumption during winter months. When a particular plant was once again available (in season), remaining dried rations (if any) would likely have been replaced by the new harvest. Therefore, a range of 0.01 d (immediate consumption) to 270 d (9 month preservation and storage) is assumed.
Animal holdup time (Time between animal being hunted, and being eaten by man)	d	1 milk/ bird 5 meat	0.1 - 270	Similar to plant holdup time, animals could have been consumed relatively quickly after being hunted (allowing for preparation), or, stored for later consumption using preservation techniques such as drying. A range of 0.1 d (immediate consumption allowing for preparation) to 270 d (9 month preservation and storage) is assumed.
Animal drinking water holdup time (Time between water being consumed by animal, and of animal being eaten by man)	d	0 milk/bird 4 meat	0.1 - 270	Similar to the farmer receptor, it is assumed that animals obtain water immediately from lakes, rivers, and other available surface water. As a result, the time between an animal consuming water and being harvested could be very small, and as such, is assumed to be zero. Animal drinking water holdup time is therefore equal to animal holdup time.
Animal air holdup time (Time between air inhaled by animal, and of animal then eaten by man)	d	0 milk/bird 4 meat	0.1 - 270	The time between air being inhaled by an animal and the animal being harvested is essentially zero. Animal air inhalation holdup time is therefore equal to animal holdup time.

Table 2-5: Lifestyle Parameters – Boreal Forest (Continued)

Parameter	Units	Farmer	Boreal Forest Hunter/Gatherer	Reference / Comments
Animal soil holdup time (Time between soil being consumed by animal, and of animal then eaten by man)	d	0 milk/bird 4 meat	0.1 - 270	Similar to animal drinking water holdup time, the time between an animal consuming soil and being harvested could be very small, and as such, is assumed to be zero. Animal soil holdup time is therefore equal to animal holdup time.
Food exposure time (Duration that plants consumed by animal or people are exposed to possible contamination)	d	100 plant/bird 50 milk/meat	100 plant/bird 50 milk/meat	Reasonable
Man's water holdup time (Time between removing water from source and its consumption by man	d	0	0	Water is not generally stored.
Inorganic building material holdup time (Time between inorganic material (sand, clay, rock) being removed from ground and placed into the building)	d	30	-	Not Relevant
Wood building material holdup time (Time between wood being harvested from woodlot and place into building occupied by man)	d	180	0	Wood used for building materials would have been used quickly after harvesting. Wood was not typically dried before use, though dry deadwood would have been harvested preferentially.

2.4 NON-HUMAN BIOTA AND ECOLOGICAL PROFILES

Table 2-6 presents a list of select species of particular importance to the BF lifestyle for purposes other than food (e.g. medicinal properties, building materials, preservation, ceremonial use, etc.).

Information in Table 2-6 has been obtained from a compilation by Marles *et al*. (2008) which examines plant usage by Aboriginal Peoples in the Canadian BF. It should be noted that although Marles *et al.* (2008) provides a great deal of useful information, the study focuses entirely on the usage of plants and fungi.

Table 2-6 is based on the usage categories identified by Marles *et al*. (2008). Where plants are identified as having multiple uses the species has been recorded in all applicable categories.

Marles *et al*. (2008) encompasses over 200 species of plants. Table 2-6 presents only select species to illustrate each of the main usage categories. For a detailed list of species the reader is directed to the original work by Marles *et al*. (2008).

Table 2-6: Important Non-Human Biota – Boreal Forest
(Marles et al., 2008)

Usage Category	Species and Descriptions (where available)
Ritual / Ceremonial Uses	• Tinder Fungus (*Fomes fomentarius*) [Dried and used for smudging instead of sweet-grass] • Diamond Willow Fungus (*Trametes suaveolens*) [dried and burned as an incense and smoke bath] • Pasture Sage (*Artemisia frigid*) [burned as an incense and smoke bath] • Beaked Hazelnut (Corylus cornuta) [used in relation to children entering teething age] • Red Osier Dogwood (*Cornus sericea*) [Dried bark burned in a mix for prayer; used to make the frame for dream-catcher charms] • Willow (*Salix bebbiana*) [used as an offering in ceremonies following successful bear hunts] • Valerian (*Valeriana dioica*) [used along with willow fungus and ceremony to create a luck charm] • Sparrow's Egg Lady's Slipper (*Cypripedium paserimum*) [used as a charm for love] • Sweet-grass (*Hierochloe odoratra*) [used as an incense and for smoke bath purification; used as a charm for administering blessings] • Tobacco (*Nicotiana rustica*) [offerings, and sacrifices (burning)]*

Note: A future revision of this document could expand on this list if more data become available.

* Winter (2000)

Table 2-6: Important Non-Human Biota – Boreal Forest (Continued)
(Marles et al., 2008)

Usage Category	Species and Descriptions (where available)
Technological Uses / Building Materials	• Tinder Fungus (*Fomes fomentarius*) [used as tinder for pipes and fires; used as a toy (ball) for children as it is nearly spherical; used to repel mosquitoes] • Old Man's Beard Lichen (*Usnea hirta*) [used as fire starting kindling] • Feather Moss (*Pleurozium schreberi*) [used as stuffing/wadding; soaked and used in cooking to boil foods wrapped inside] • Peat Moss (*Sphagnum fuscum*) [used for its absorbent padding properties as a wound dressing, diapers, cleaning material] • Juniper (*Juniperus communis*) [young berry-cones used to make dye] • Balsam Fir (*Abies balsamea*) [wood used for canoe frames and paddles; boughs used to create temporary shelters; needles used as fire starting material] • Tamarack (Larix laricina) [wood used to make toboggans, snowshoe frames, drum frames, and canoe paddles; roots peeled and used to stitch birch bark canoes (spruce more commonly); burned to smoke fish and hides] • Black Spruce (Picea mariana) [boughs burned to repel mosquitos; used to build traps; boiled and used to wash hunter's scents off of traps; young cones boiled to create a red dye; numerous other uses are documented] • Paper Birch (*Betula papyrifera*) [bark used to create numerous materials and tools including canoes, vessels, sleds, dwelling covers, food platters, cups, etc.; also used as a fire starting material]
Medicinal Uses	• Fly Agaric (*Amanita muscaria*) [boiled with other plants for eye drops to treat sore eyes] • Diamond Willow Fungus (*Trametes suaveolens*) [burned and smoke inhaled to treat headaches; crumbled into ear to treat ear aches] • Northern Perfume Lichen (*Evernia mesomorpha*) [decoction of lichen from birch trees used as an eye treatment for snow blindness] • Horsetail (*Equisetum arvense*) [decoctions used as a diuretic; burned on skin to treat sores; rhizome boiled and used to treat skin diseases] • Shield Fern (Dryopteris carthusiana) [boiled and used to treat kidney pain, skin diseases and other ailments] • Juniper (*Juniperus communis*) [young berry-cones boiled to make a diuretic remedy; smoked to treat asthma; inner bark soaked and used as wound treatment; debarked stems boiled to treat diarrhea and chest pain from infection; dried powdered leaves used to treat skin disorders] • White Cedar (*Thuja occidentalis*) [leaves are used in a variety of mixtures to treat ailments including bladder and kidney pain, pneumonia, or wounds] • Balsam Fir (*Abies balsamea*) [bark boiled and drunk to treat colds and influenza; sap steamed to treat asthma; dried bark used as part of a poultice for wounds and arthritis; numerous other uses are documented] • Tamarack (*Larix laricina*) [inner bark used to treat burns, sores, frostbite, and wounds; inner bark boiled to create a wash treatment for eyes and ears; inner bark tea drunk to treat a variety of conditions from depression to heart ailments] • Black Spruce (*Picea mariana*) [pitch and gum used to treat wounds, cysts, rashes, and skin infections; also eaten to treat heart ailments] • Tobacco (Nicotiana rustica) [see discussion that follows for details on Tobacco]

Tobacco

The topic of tobacco usage by Aboriginal Peoples of Canada and the United States often arises, and therefore warrants some discussion. Tobacco falls under the *Nicotiana* genus of plants, members of which are indigenous to America, Australia, South West Africa, and the South Pacific. The topic of tobacco usage by Aboriginal Peoples is covered in different ways and for different time periods by a number of authors. Information obtained from Marles et al. (2008), Duer and Turner (2005), and Winter (2000) is discussed below.

Marles et al. (2008) notes that for Aboriginal People of the Canadian BF, the habits of smoking (and chewing) plant materials for nonmedicinal purposes was not part of precontact Cree or Chipewyan cultures. The discussions in Marles et al. (2008) make a distinction that tobacco would have been introduced as opposed to being found naturally in these environments (presumably due to its habitat range). Discussions in Duer and Turner (2005) indicate though that Aboriginal communities along the West Coast of Canada (e.g. the Haida and Tlingit) did use and cultivate tobacco.

Winter (2000) states that all North American aboriginal peoples, including those of the arctic, used tobacoo as part of their religious or cultural traditions. As an example, Winter (2000) notes that “by 1700 CE tobacco was traded throughout the Arctic, along with tin for making pipes, iron and copper kettles…”, however this clearly indicates post-contact influence. To understand tobacco usage in pre-contact times (i.e. when there was clearly no influence from European colonists or related trade) archeobotanical and archeological studies are required.

Winter (2000) presents archaeobotanical and archaeological information on tobacco specimens found at several North American sites. Findings indicate that the earliest evidence of tobacco usage corresponds to the Middle Woodland period (1-500 CE), where the distribution of archeological specimens is heavily concentrated in the areas of the Mississipi, Missouri, and Illinois Rivers. Winter (2000) also notes that by the Late Woodland period (500-1000 CE), evidence of tobacco usage is more common for the same river area, but also ranging from the plains to the Atlantic Ocean, with tobacco evidence being found commonly and in abundance in southern Ontario sites during the later portion of the Late Woodland period (post-800 CE).

For areas north of the Southern Canadian Deciduous Forest ecozone, Winter (2000) mentions that in pre-contact times members of communities in northeastern Canada received tobacco through trade with southern communities (e.g. the Montagnais-Naskapi obtained via trade with the Huron and Iroquois). The northern communities still used tobacco for traditional purposes, regardless of the fact that it could not be grown in their environments. However, usage (and the extent of usage) depends on the timeframe being considered.

Overall, this information suggests that there is good evidence that Aboriginal People of the Southern Canadian Deciduous Forest used tobacco for traditional purposes during Pre-Contact times. Aboriginal People of the Boreal Forest and Inland Tundra ecozones are also very likely to have used tobacco for traditional purposes, though tobacco would have been obtained through trade or other means. For these reasons tobacco has been added to the the important non-human biota tables for all three ecozones. *Nicotiana rustica* is the species of tobacco most likely used in these ecozones during pre-contact times, based on the information in Winter (2000).

3. INLAND TUNDRA RECEPTOR GROUP

3.1 DESCRIPTION AND METHODOLOGY

This section outlines parameters which characterize a self-sufficient Inland Tundra Hunter/Gatherer exposure group. The key aspect of this group is that its diet is entirely based on local wild game, fish and other traditional/country foods that would be found in inland tundra areas (rather than along coastal areas). This group is primarily intended to illustrate the possible repository impact in a distant future when the area around a repository has evolved into an inland tundra region as part of the normal glaciation cycle.

This characterization is based on recent information on present-day inland tundra aboriginal communities. However, present-day aboriginal communities are not generally self-sufficient and consume significant amounts of store-bought foods. The diet information from present-day communities is therefore extrapolated to a self-sufficient Hunter/Gatherer. (A self-sufficient lifestyle is of most interest for safety assessment purposes as it is potentially more exposed to local contaminants than a lifestyle with significant store-bought food.)

The lifestyle of the self-sufficient Hunter/Gatherer was developed from an understanding of the lifestyle of present-day elders in aboriginal communities. This was chosen so that it was consistent with a self-sufficient diet in local country foods and with self-sufficient use of local resources. It therefore results in a more traditional or historical lifestyle than is currently practiced (Garisto *et al*. 2005).

Dietary parameters are outlined in Section 3.2 and lifestyle parameters are provided in Section 3.3. Appendix B provides ecological profiles for select species. Appendix C provides information on literature sources included in the updated IT calculations.

3.2 DIET

Table 3-1 summarizes information on present-day diet of aboriginal communities in IT areas. Data from literature tends to focus on the wild game portion of the diet. Dietary components are obtained from literature, but include only those foods where corresponding quantitative intake rates were available or could be reasonably derived.

Table 3-3 provides food intake data normalized to the conservative (high) energy intakes of 4480 kcal/d for adults and 2879 kcal/d for children, corresponding to the 90^{th} percentile of current intake (CSA, 2008). Store Food is not included in the normalization, since the lifestyle is considered to be self-sufficient.

Table 3-4 provides a distribution of food components for the self-sufficient IT diet, based on normalization to conservative CSA (2008) energy intake.

It is important to note that 1984 harvest data from Baker Lake have been excluded from the estimates presented in the tables below. These data have been excluded because values for moose, caribou, and fish - typically the primary sources of meat (see Table 3-1, Baker Lake 1975 and 1984-1985) - are absent, causing results to be skewed (bias) toward fox, wolf, and grizzly bear.

Table 3-1: Food Intake Rates and Components from Literature, by Location [g/d]

Component	Location				
	1975	Baker Lake[a] 1983-84	1984-85	Yukon First Nations[b] 2003	
	NS	NS	NS	Adult (Female)	Adult (Male)
Caribou	534.8	729.8	659.0		
Moose					
Polar Bear		0.0	1.3		
Muskox		3.5	1.3		
Wolf		2.5	2.9		
Arctic Fox		4.1	17.9		
Red Fox		0.0	0.0		
Rabbit	0.1				
Swan		0.0	0.1		
Goose	1.1	1.4	1.7		
Ptarmigan		0.3	0.3		
Fish	335.8	9.0	5.6	62.0	80.0
Berries					
Total	871.9	751.3	690.0	62.0	80.0

NS – Not Specified

Component	Location					
	NWT Dene & Metis[b] 2003		NWT Inuit[b] 2003		Old Crow, Yukon FN[c] 2011	1992
	Adult (Female)	Adult (Male)	Adult (Female)	Adult (Male)	Adult (Female)	Adult
Caribou					64.5	96.1
Moose						48.5
Polar Bear						
Muskox						
Wolf						
Arctic Fox						
Red Fox						
Rabbit						
Swan						
Goose						
Ptarmigan						
Fish	57.1	52.3	65.1	75.1		9.2
Berries						12.9
Total	57.1	52.3	65.1	75.1	64.5	166.6

"Adult" refers to both genders unless otherwise specified

References:

[a]Beak, 1989

[b]INAC, 2003

[c]Schuster *et al*., 2011

Table 3-2: Energy Yield for Dietary Components [kcal/kg]

Component	Value (Kcal/kg)	Food Type
Caribou	1671	caribou, cooked, roasted
Moose	1341	cooked, roasted
Polar Bear	2588	bear, cooked, simmered
Muskox	2376	bison, cooked, pan-broiled
Wolf	1772	veal, ribs, separable lean only, cooked, roasted
Arctic Fox	1772	veal, ribs, separable lean only, cooked, roasted
Red Fox	1772	veal, ribs, separable lean only, cooked, roasted
Rabbit	1729	rabbit, wild, cooked
Swan	3048	goose
Goose	3048	goose, meat and skin, cooked, roasted
Ptarmigan	1280[a]	
Lake trout	1439	trout, mixed species
Other fish	1721	whitefish, mixed species
Fish	1509	
Berries	572	blueberries

Ref: http://www.calorie-count.com
[a] Ref.: ADF&G, 2013

Table 3-3: Food Intake Requirements based on 4480 kcal/d Normalized Energy Intake, by Component, by Location [g/d]

Component	Location				
	1975	Baker Lake 1983-84	1984-85	Yukon First Nations 2003	
	NS	NS	NS	Adult (Female)	Adult (Male)
Caribou	1,706.8	2,596.9	2,548.7		
Moose					
Polar Bear		0	5.0		
Muskox		12.5	5.2		
Wolf		8.7	11.1		
Arctic Fox		14.7	69.1		
Red Fox		0	0.1		
Rabbit	0.4				
Swan		0	0.3		
Goose	3.4	5.1	6.4		
Ptarmigan		0.9	1.1		
Fish	1,071.7	31.9	21.7	2,967.9	2,967.9
Berries					
Total	2,782.3	2,674.1	2,668.7	2,967.9	2,967.9

NS – Not Specified

Table 3-3: Food Intake Requirements Based on 4480 kcal/d Normalized Energy Intake, by Component, by Location [g/d] (Continued)

Component	Location					
	NWT Dene & Metis 2003		NWT Inuit 2003		Old Crow, Yukon FN 2011	1992
	Adult (Female)	Adult (Male)	Adult (Female)	Adult (Male)	Adult (Female)	Adult
Caribou					164.5	1,744.1
Moose						879.8
Polar Bear						
Muskox						
Wolf						
Arctic Fox						
Red Fox						
Rabbit						
Swan						
Goose						
Ptarmigan						
Fish	2,967.9	2,967.9	2,967.9	2,967.9		167.4
Berries						233.9
Total	2,967.9	2,967.9	2,967.9	2,967.9	164.5*	3,025.1

* Portion of diet that is caribou only. Remaining diet will be derived from “all other foods”. Since the exact breakdown of “all other foods” is not known, the dietary intake (g/d) of its components cannot be calculated.
"Adult" refers to both genders unless otherwise specified

Table 3-4: Food Intake Distribution for All Diet Components [g/d]

Component	Normalized Diet (g/d)		
	Min	Median	Max
Caribou	164.5	1,744.1	2,600.2
Moose	879.8	879.8	879.8
Polar Bear	0.0	2.5	5.0
Muskox	5.2	8.8	12.5
Wolf	8.8	9.9	11.1
Arctic Fox	14.7	41.9	69.1
Red Fox	0.0	0.0	0.1
Rabbit	0.4	0.4	0.4
Swan	0.0	0.2	0.3
Goose	3.4	5.1	6.4
Ptarmigan	0.9	1.0	1.1
Fish**	21.7	99.7*	2,967.9
Berries	233.9	233.9	233.9

*Derivation of median fish intake values does not include Yukon/NWT Dene & Metis/Inuit 2003 data since these locations are bias toward 100% fish consumption due to lack of data for other diet components.

** Fish species have a wide range in size, lifespan and food sources; however, in this study all fish species are aggregated due to a lack of data. A future revision to this document could consider alternate representations if more data become available.

The diet information for a self-sufficient hunter/gatherer summarized in the tables above is an estimate. However, results are limited in that they are extrapolated from diet survey data which has inherent gaps and is from non-self-sufficient diets.

3.3 LIFESTYLE

Lifestyle parameters for the IT receptor group are provided in Table 3-5. For comparison, results for a self-sufficient farmer are also listed, as presented in Garisto *et al.* (2005), unless otherwise stated. Garisto *et al.* (2005) mentions that where available, these parameters were obtained from recent studies conducted for the Environmental Assessment (EA) of the consolidation and management of historic waste in Port Hope (PHAI 2004a,b; 2005a,b). Where data were not available and the assumption made sense, lifestyle parameter values were assumed to be the same as or similar to the parameter values used for the self-sufficient farmer (AECL 1994).

Table 3-5: Lifestyle Parameters – Inland Tundra

Parameter	Units	Farmer	Inland Tundra Hunter/ Gatherer	Reference/ Comments
Water source	-	Well/Lake/ River	Lake/ River	-
Total water demand per person	m^3/a	130	6-10	Assumed same as Boreal Forest Hunter/Gatherer.
Drinking water demand	L/d	2.3	1.9	2.3 L/d for Farmer (CSA, 2008).
Food storage for winter	-	-	Yes	Assumed.
Total energy need	Kcal/d	Max: 4116	Max: 4880	CSA (2008) required energy intake for adults (90^{th} percentile energy expenditure).
Food energy fraction obtained from:				
Plants	-	0.32	0.03	Based on Table 3-4: grouped maximum and minimum values for plants.
Milk	-	0.36	0	Not Applicable.
Meat	-	0.26	0.06-0.99	Based on Table 3-4: grouped maximum and minimum values for meat.
Birds and eggs	-	0.05	0.002-0.005	Based on Table 3-4: grouped maximum and minimum values for birds and eggs.
Fish	-	0.01	0.01-1	Based on Table 3-4: grouped maximum and minimum values for fish.
Fraction of food obtained locally:				
Plants (e.g., berries)	-	1.0	1.0	Self-sufficient exposure group.
Milk	-	1.0	-	Not Applicable.

Table 3-5: Lifestyle Parameters – Inland Tundra (Garisto *et al*. 2005) (Continued)

Parameter	Units	Farmer	Inland Tundra Hunter/ Gatherer	Reference/ Comments
Meat	-	1.0	0.33	For the IT receptor group, the primary source of meat is caribou, which is characterized by a large home range. This implies that caribou are only seasonally available in any one location. As such a value of 0.33 may be appropriate. However, it is important to consider that Aboriginal Peoples that relied on caribou would have adapted to the large range of their food source, adopting a lifestyle of frequent movement ensuring they were never too far from food.
Birds and eggs	-	1.0	1.0	Self-sufficient exposure group.
Fish	-	1.0	1.0	Self-sufficient exposure group.
Soil Ingestion rate	kg/a	0.04	0.007-0.04	Assumed same as Boreal Forest Hunter/Gatherer
People per household	-	3	5.5	Average family size (Beak 1989).
Household lifetime	a	50	0.4 - 2	For semi-permanent structures incorporating sod and/or stone, it is estimated that portions would be replaced as maintenance occurs, resulting in a 2 year period over which the entire structure would eventually be remade. For more temporary shelters (e.g. skin tents), it is estimated that these would be moved seasonally (every 3 to 6 months) based on food availability, although the materials may not be replaced every move.
Building height	m	2.4	2	Assumed same approximate size as Boreal Forest.
Building width	m	9.7	3	Assumed same approximate size as Boreal Forest.
Building volume	m^3	228	6-7	Assumed same approximate size as Boreal Forest.

Table 3-5: Lifestyle Parameters – Inland Tundra (Garisto *et al*. 2005) (Continued)

Parameter	Units	Farmer	Inland Tundra Hunter/ Gatherer	Reference/ Comments
Building material		Wood or Clay/stone	Soil/stone	Skin tents were used for shelter in summer. The snowhouse (igloo) was used in winter, but the Inuit also constructed homes of sod, stone and whale-bone.
Building occupancy factor	-	0.8	Male: 0.5-0.6 Female: 0.7-0.8	Assumed same as Boreal Forest Hunter/ Gatherer.
Building wake plume entrainment factor	-	2	2	The entrainment constant is an empirical parameter that has a value between 0.5 and 2.0. It is often not obvious how to choose the cross-sectional area for use in deriving a vertical dispersion parameter, since releases from most nuclear sites are affected by several different buildings. To ensure that the air concentrations are not underestimated, the cross sectional area of the building should be taken as the area (perpendicular to the wind direction) of the largest single building affecting the plume. (CSA 2008).
Probability of being located downwind from energy fires	-	0.25	0.25 – 0.75	Assumed same as Boreal Forest Hunter/ Gatherer.
Fraction of time exposed to indoor smoke	-	-	Male: 0.05-0.6 Female: 0.14-0.8	Based on estimates of time spent indoors/outdoors from Garisto *et al.* 2005. See Appendix A.
Building air infiltration rate	hr^{-1}	0.35	2 - 4	Assumed same as BF.
Inhalation Rate	m^3/d	-	Adult: 23.0 Child: 21.5	CSA N288.1 (2008) [annual values divided by 365 d/a].
Outdoor or ground exposure factor	-	0.2	0.5-1	Generally, shelters were floorless; indicating, there could be up to 100% ground exposure, However, considerable portions of time in winter could be spent on ice (assumed 50%). (Garisto *et al*. 2005).

Table 3-5: Lifestyle Parameters – Inland Tundra (Garisto *et al*. 2005) (Continued)

Parameter	Units	Farmer	Inland Tundra Hunter/ Gatherer	Reference/ Comments
Water immersion occupancy factor	-	0.02	< 0.02	Expected to be low given the proposed climate. Assumed less than the conservative farmer assumption.
Fuel source	-	-	Moss/Wood /Ground Plants	In pre-contact times, caribou fat was used for stone lamps and snowhouses were often without heat. Cooking was outside on fires of moss and willow.
Peat burning probability (as fuel)	-	1%	0%	Assumed.
Energy consumption per household	MJ/a	1.1×10^5	8.7×10^3	Large trees would be scarce, and would not be able to provide a constant source of fuel wood. Fires would rely on smaller species such as dwarf willow, juniper or arctic heather. Therefore, assumed to be approximately 15% of BF due to limited fuel wood supply.
Frequency of agricultural fires	a^{-1}	1	0	No agricultural practices.
Frequency of forest fires	a^{-1}	0.02	0	Assumed.
Probability of irrigation	-	0.02-0.9	0	Not Relevant.
Irrigation period	a	100	-	Not Relevant.
Probability of using fresh lake sediments on fields	-	0.01	-	Not Relevant.
Dredged sediment thickness	m	0.3	-	Not Relevant.
Cropping frequency	a^{-1}	0-1	0	Not Relevant.
Cropping period, non-irrigated fields	a	50	-	Not Relevant.

Table 3-5: Lifestyle Parameters – Inland Tundra (Garisto *et al*. 2005) (Continued)

Parameter	Units	Farmer	Inland Tundra Hunter/ Gatherer	Reference/ Comments
Cropping soil contaminant loss fraction	-	0.05	0.05	It is realistic to assume some loss of radionuclides due to the cropping cycle. A low rate is conservative for the purpose of assessing dose due to soil exposure. Nutrient cycling in nutrient efficient farms provides a conservative lower bound on the loss of about 5% of the nutrient inventory of the crop. (CSA 2008).
Fish holdup time (Time between catching and eating fish)	d	0.5- 60	0.3-60	Assumed. The shorter period accounts for fish being caught in the morning and consumed for lunch or dinner. The longer period accounts for outdoor drying of fish.
Plant holdup time (Time between plant absorbing the nuclide and being eaten by man)	d	1	0.01 - 270	Similar to BF, plants could have been consumed relatively soon after harvesting (immediately in some cases) or stored for later consumption using preservation techniques such as drying. The BF range of 0.01 d (immediate consumption) to 270 d (9 month preservation and storage) is therefore assumed to be applicable.

Table 3-5: Lifestyle Parameters – Inland Tundra (Garisto *et al*. 2005) (Continued)

Parameter	Units	Farmer	Inland Tundra Hunter/ Gatherer	Reference/ Comments
Animal holdup time (Time between animal being hunted, and being eaten by man)	d	1 milk/ bird 5 meat	0.1 - 270	Similar to plant holdup time, animals could have been consumed relatively quickly after being hunted (allowing for preparation), or, stored for later consumption using preservation techniques such as drying. Larger animals may have required longer preparation time, though it is also likely that a group of hunters would hunt and prepare a large animal and thus share the effort required. The BF range of 0.1 d (immediate consumption allowing for preparation) to 270 d (9 month preservation and storage) is therefore assumed to be applicable.
Animal drinking water holdup time (Time between water being consumed by animal, and of animal being eaten by man)	d	0 milk/bird 4 meat	0.1 - 270	Assumed same as BF.
Animal air holdup time (Time between air inhaled by animal, and of animal then eaten by man)	d	0 milk/bird 4 meat	0.1 - 270	Assumed same as BF.
Animal soil holdup time (Time between soil being consumed by animal, and of animal then eaten by man)	d	0 milk/bird 4 meat	0.1 - 270	Assumed same as BF.
Food exposure time	d	100 plant/bird 50 milk/meat	100 plant/bird 50 milk/meat	Assumed same as farmer.
Man's water holdup time	d	0	0	Water is not generally stored.

Table 3-5: Lifestyle Parameters – Inland Tundra (Garisto *et al*. 2005) (Continued)

Parameter	Units	Farmer	Inland Tundra Hunter/ Gatherer	Reference/ Comments
Inorganic building material holdup time	d	30	-	Not Relevant.
Wood building material holdup time	d	180	-	Not Relevant.
Tree age when harvested for building material	a	100	-	Not Relevant.

Ref: Garisto *et al*. (2005)

3.4 NON-HUMAN BIOTA AND ECOLOGICAL PROFILES

Table 3-6 presents a list of select species of particular importance to the IT lifestyle for purposes other than food (e.g. medicinal properties, building materials, etc.).

Information in Table 3-6 has been obtained from a study by Davis and Banack (2012) which investigates traditional plant usage by Aboriginal Peoples in Nunavut. A search of related literature indicates that information on Aboriginal traditional medicinal/ceremonial plant use in tundra regions is scarce.

Table 3-6 is based on the usage categories identified by Davis and Banack (2012), excluding general consumption. Where plants are identified as having multiple uses the species has been recorded in all applicable categories.

Table 3-6: Important Non-Human Biota – Inland Tundra
(Davis and Banack, 2012)

Usage Category	Species and Descriptions (where available)
Ritual / Ceremonial Uses	• Tobacco (*Nicotiana rustica*) [offerings, and sacrifices (burning)]*
Materials	• *(Arctostaphyles spp*.) [smoked] • Arctic Heather *(Cassiope tetragona)* [tinder, fuel, insect repellent] • Cottongrass *(Eriophorum scheuchzeri)* [wick for lamps, along with animal fat/oil; soot for tattoos] • Sphagnum moss *(Sphagnum spp.)* [absorbent: bandages, diapers, etc; insulation; sled-runners] • Sod *(various)* [sod-house construction]
Medicinal Uses	• Common Yarrow *(Achillea nigrescens)* [prepared as a tea, incense or bath and used to treat reproductive problems] • *(Arctostaphyles spp*.) [prepared as a tea or oil infusion and used to treat urinary tract infections] • Dwarf Birch *(Betula glandulosa)* [leaf buds prepared as an oil infusion and used to prevent frostbite] • Elegant Indian Paintbrush *(Castilleja elegans)* [brewed as a tea and used to treat 'contradictory thoughts'] • Common Horsetail *(Equisetum arvense)* [whole plant prepared as a tea or maceration and used to treat urinary tract infections] • Mountain Sorrel *(Oxyria digyna)* [prepared as a poultice to treat chest illness] • Shrubby Cinquefoil *(Potentilla fructicosa)* [Leaves and petals prepared as a tea and used to treat sore throat and heart problems] • Willow (various) *(Salix spp.)* [inner bark chewed and used to treat pain, headache and toothache] • Moss Campion *(Silene acaulis)* [used to treat anxiety]

Note: A future revision of this document could expand on this list if more data become available.
*Winter (2000)

See Section 2.4 for further discussions on tobacco usage.

4. SOUTHERN CANADIAN DECIDUOUS FOREST RECEPTOR GROUP

4.1 DESCRIPTION AND METHODOLOGY

This section outlines parameters which characterize a self-sufficient southern Canadian deciduous forest Hunter/Gatherer/Farmer exposure group. The key aspect of this group, as discussed below, is that its diet is derived primarily from agriculture, with farmed produce and livestock accounting for 80% of daily energy requirements. The remaining 20% is distributed among local wild game, fish, and other traditional/country foods.

As discussed in Section 1.4, this characterization is based on information from present-day aboriginal communities located within the southern Canadian deciduous forest. However, there are a number of limitations associated with this, namely: that present-day aboriginal communities are not generally self-sufficient and consume significant amounts of store-bought foods; and that there is a paucity of dietary intake data for SCDF First Nations communities in the literature. As a result, diet information for present-day SCDF communities is supplemented with BF diet information, and extrapolated to a self-sufficient Hunter/Gatherer/Farmer.

Dietary parameters are outlined in Section 4.2 and lifestyle parameters are provided in Section 4.3. Appendix B provides ecological profiles for select species. Appendix C provides information on literature sources included in the updated SCDF calculations.

Comparison to Boreal Forest

There is no dividing line that designates one side of central/eastern Canada between the northern boreal forest and the southern Canadian deciduous forest Aboriginal Peoples. However, traditional knowledge, archaeological investigations and historical research does provide evidence that can help delineate some of the distinguishing characteristics of these two broad categorizations.

As discussed in Section 1.4, it is important to recognize that Aboriginal societies were not static entities prior to European contact. But for the purposes of this study it is perhaps most important to understand what these societies were like immediately prior to contact.

This is not as simple as it seems, as the First Nations composition of today in Central and Southern Ontario and Quebec is different than at the time of European contact, and has changed significantly with the associated political, social and economic events (e.g., fur trade, French and English wars, American expansionism). However, the First Nations from Southern and Central Ontario, Southern Quebec and what is now bordering US states did possess many similar characteristics that are useful in the context of this study. Therefore, the broad characterization of the Aboriginal Peoples of the Southern Canadian Deciduous Forest does envelop this wider area.

The use of the terms “Boreal Forest” and “Southern Canadian Deciduous Forest” implies that the lifestyles and characteristics of these people are associated with these forest types. However, it is the underlying factors of climate (e.g. temperatures, rainfall), geology, glacial features and soils that give rise to these distinct forest types. In turn, Aboriginal Peoples developed their lifestyles and societies around these climatic realities, geography and ecological surroundings. Prior to contact, one of the key distinguishing characteristics between Boreal Forest Aboriginal Peoples and Southern Canadian Deciduous peoples was that it was only in southern Ontario and Quebec that climate and soils amenable to agriculture existed (Dean,

1994). This was perhaps the single most defining differing characteristic between these two peoples.

Wright (1994) notes that all of the cultivated plants used by Native peoples in Southern Canada were domesticated from the south (primarily Mesoamerica) and gradually moved north. He postulated that corn entered the Windsor and Niagara areas around 500 A.D. and beans around 1400 A.D.

The Canadian Encyclopedia (Bishop, 2012) has delineated the Aboriginal Peoples of Central and Southern Ontario, Southern Quebec, northern Ohio and New York at the time of contact into two agricultural groups, with the Huron, Petun, Neutral, Six Nations, Erie and Wenro as farmers and the Ojibway and Algonquins as hunter gatherers. The major crops grown were corn, beans and squash but tobacco and sunflowers were also grown.

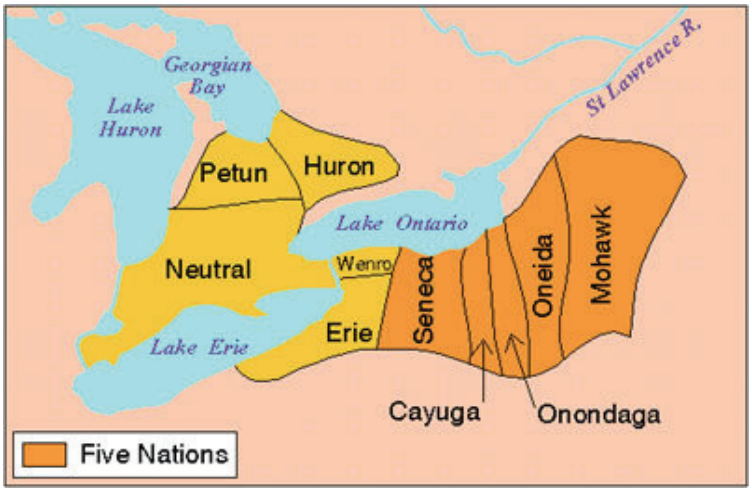

Figure 4-1: Native People – Eastern Farmers (Bishop, 2012)

Figure 4-2: Native People – Eastern Hunters (Bishop, 2012)

Both Boreal Forest Aboriginal Peoples and Southern Canadian Deciduous Aboriginal Peoples hunted and fished. The relative composition of their diets likely reflected the species made available to them by their surroundings, and by the technologies employed in their capture. For the Boreal Forest peoples, the animals and fish hunted and caught prior to Contact may be largely the same species that Aboriginal Peoples use today. Exceptions may arise based on the declining or expanding ranges of certain species, or based on modern preferences, but it is likely that important species such as moose, beaver, grouse, walleye, pike, trout, etc. have persisted.

Historically, Aboriginal People of the Southern Canadian Deciduous Forest likely ate animals and fish similar to Aboriginal Peoples in the Great Lakes St. Lawrence Forest (the forest of central Ontario and the major forest type between the deciduous and boreal forests) (Dean, 1994). In Southern Canada there have likely been more significant changes owing to alteration of the landscape for settlement, agriculture and urbanization. The major mammal populations of pre-contact time likely varied significantly from the present. For example, the ranges of moose and caribou at one time extended into southern Ontario, and deer were likely not as ubiquitous as the present day. Other species like wild turkey were utilized prior to contact and existed through the early centuries of contact but were exterminated in the late nineteenth century and have only now been actively re-introduced.

The Aboriginal People of Northern Ontario (i.e. Boreal Forest) are sometimes broadly referred to as Algonquins and in this sense encompassing what we might consider to be the territories of Algonquins, Ojibway and Cree today. Wright (1994, p.36) indicates that only on the extreme southern range of these peoples did they adopt agriculture in any way.

> "Certain of the eastern Algonquins adopted corn agriculture from their Iroquoian-speaking neighbours, but only in a limited fashion. They planted in the spring, abandoned the crop during the summer, and harvested whatever had survived the ravages of raccoons, birds and insects, in the fall."

Dean (1994, p.19) describes how in Ontario northern and southern Aboriginal Peoples lived differently.

> "To the Amerindians, wherever they lived, and Europeans alike, the dominating feature of the landscape was the forest. For those who lived in the Boreal Forest, game animals and fish were far from numerous and the winters long and often extremely cold. Nevertheless, there was sufficient food and shelter for the adept …. Southern Ontario in 1600, on the other hand, especially in the summer, was undoubtedly a hospitable place. Climatically somewhat like the present, comparatively long summers of pleasant weather cheered the spirit and were suitable for many crops native to the region. Extensive tracts of easily workable sandy loams originating from glacial action could be readily cleared of forest cover for both settlement and agriculture. Moreover game animals, birds, and fish were widely available."

Wright (1994, p.22) articulated that the southern region of Ontario (an area roughly south of the Severn River and extending to include all the Ottawa Valley) always supported a far greater population than areas to the north. Trigger (1994, p.41) indicates that in mid-sixteenth century an estimated 65,000 Huron, Petun and Neutral (Iroquoian speaking peoples) (later forming the Huron Confederacy) people inhabited Southern Ontario.

The population of the northern boreal forest would have been much less dense. Bishop (1994) estimated that the population of Algonquin speaking peoples (Algonquin, Ojibway and Cree) of northern Ontario may have numbered around 8,000.

Trigger (1994, p.42-43) comments on the lifestyles of the Iroquoian Culture of southern Ontario (which represented most of the population of the Southern Canadian Deciduous Forest):

> "The Ontario Iroquoian groups each had distinctive traits but they shared a general pattern of life already well established by the beginning of the sixteenth century. They lived in villages that were located near light, easily worked soil and sometimes numbered 1,500 or more inhabitants. **The cultivation by women of corn, beans and squash produced up to 80 percent of the food that was eaten.** Apart from the dog, the Iroquoians kept no domestic animals. As they did not practice crop rotation, their fields had a declining fertility. The increasing distance that villages had to go to obtain firewood compelled them to relocate their villages every ten to thirty years. "

The high percentage of maize in pre-contact sites is documented in literature, particularly in recent work on the Mantle site (2013) - a largely pre-contact site in southern Ontario - by Williamson and Birch, which discusses findings that 62% of the diet being maize alone. The 80% agriculture assumption (based on Trigger (1994)) produces a dietary distribution where corn accounts for 61% of the daily caloric intake. There is good agreement between these values (61% versus 62%), which suggests that the 80% agriculture assumption (and proportion of corn) is reasonable.

Archaeological evidence also demonstrates that the St. Lawrence Iroquoians lived similarly, with built villages with as many as forty longhouses which could have housed 2,000 people (Wright, 1994).

The sizes of groupings varied between the Cree and Ojibway but were significantly smaller than the Southern Canada Deciduous peoples. Bishop (1994) indicated that for the Ojibway, summer villages of 100 persons were common and were more sedentary than the Cree, which had much larger ranges and smaller encampments. The more disperse nature of the Cree was likely a result of less dense food sources requiring them to maintain small populations and be nomadic and therefore not over exploit food resources in any one particular area.

It is important to note the use of a wide diversity of native plants. It is estimated that approximately 400 different species of native plants were used in Ontario (Yarnell, 1964). Plants would have been used for food products (i.e. berries), medicines, fuel, tools and shelter.

In summary, the major distinguishing characteristics between the Boreal Forest Aboriginal Peoples and the Southern Canadian Deciduous people would have been the following:

- SCDF peoples relied on agriculture for a substantial portion of their diet and particularly corn, squash and beans. This may have represented up to 80% of their diet.
- BF peoples had essentially no agriculture and remained a hunter-gatherer society. The corollary of this is that BF peoples would have had a larger percentage of their diet comprised of meat.
- SCDF peoples concentrated in larger villages for longer periods of the year and for many years (if not decades). BF peoples lived generally in family groupings although there may have been larger seasonal encampments.

- Population of the BF peoples was significantly less dense per square kilometer than that of the SCDF peoples.
- SCDF peoples generally lived in large villages while BF peoples would have lived in much smaller villages and/or in nomadic family groupings.

4.2 DIET

Table 4-1 summarizes information on present-day diet of aboriginal communities in SCDF areas. As discussed in Sections 1.4 and 4.1, data from literature are limited; for extrapolation to be possible, SCDF data (obtained from literature) is combined with BF data.

A distinguishing factor for the SCDF receptor group is the use of agricultural practices to produce farmed plants and animals, comprising up to 80% of daily energy requirements. For simplicity, Table 4-1 shows only the SCDF food intake data obtained from literature; to view the supplementary BF food intake data, the reader is directed to Table 2-1.

Table 4-3 provides food intake data normalized to a conservative (high) energy intake of 4480 kcal/d, corresponding to the 90th percentile of current intake (CSA, 2008). Store Food is not included in the normalization, since the lifestyle is considered to be self-sufficient. As discussed in Section 4.1, it is assumed that 80% of daily energy requirements are obtained from agriculturally raised crops. The relative proportions different crops are assumed to be equal to those of the Garisto *et al*. (2005) modern farmer receptor (Garisto *et al*. 2005; Table 6.1 and Table C.2), with the following substitutions:

1. All energy obtained from grain (Garisto *et al*. 2005), has been substituted with corn;
2. All energy obtained from vegetables (Garisto *et al*. 2005), has been substituted with squash;
3. All energy obtained from potatoes (Garisto *et al.* 2005), has been substituted with beans.

Table 4-5 provides a distribution of food components for the self-sufficient SCDF diet, based on normalization to conservative CSA (2008) energy intake.

Ecological profiles for select non-human biota are provided in Appendix B.

Table 4-1: Food Intake Rates and Components from Literature, by Location [g/d]

Component	Location				
	Kanawake (NY)[a]	Nuxalk (BC)[b]			Southern Quebec[c]
	Adult	Adult	NS	Teen	Adult
Caribou					
Deer			2.4*		
Moose			2.4*		
Muskrat					
Rabbit					
Beaver					
Grouse					
Duck			2.4*		
Fish	64.4	71.8	128.1	17.0	23.0
Berries (as blueberries)			12.6		
Elk					
Wild Rice					
Labrador Tea					
Ptarmigan					
Partridge					
Wild Turkey					
Black Bear					
Lynx					
Potatoes (local grown)					
Crab-apples					
Nettle					
Nuts					
Roots			0.3		
Rose Hips					
Mint Leaves					
Mushrooms					
Eggs					
Store Food					
Water (m^3/a)					
Soil (g/a)					

* Nuxalk: values are divided between moose, deer, and fish based on grouping from the original reference.
NS – Not Specified
"Adult" refers to both genders unless otherwise specified
References:
[a]Chan *et al*., 1999
[b]Kuhnlein, 1984
[c]Mos *et al*., 2004

Table 4-2: Energy Yield for Dietary Components [kcal/kg]

a) Country/Traditional Foods

Component	Value (Kcal/kg)	as
Caribou	1671	cooked, roasted
Deer	1576	cooked, roasted
Deer	1871	ground, cooked
Moose	1341	cooked, roasted
Muskrat	2341	cooked, roasted
Rabbit	1729	wild, cooked
Rabbit	2059	composite of cuts, cooked
Beaver	2118	cooked, roasted
Grouse [b]	1529	roasted
Duck	3371	meat and skin, cooked
Fish	1721	whitefish, mixed species
	1439	trout, mixed species
(species as per Hatchet lake questionnaire)	1194	walleye, cooked
	1129	northern Pike, cooked
	1194	white sucker
Berries	572	blueberries
Elk [c]	1370	Cooked, roasted (yield from 1lb raw meat)
Wild Rice	1038	Cooked
Tea	8	Brewed
Ptarmigan [c]	1280	
Store food, vegetables [d]	1190	plant
Store Food, composite	419 - 3817	
Water	0	-
Soil	0	-
Partridge	2107	Meat only, roasted
Wild Turkey	1700	assumed equal to store-bought turkey
Black Bear [c]	1630	
Lynx	2341	Assumed equal to muskrat
Potatoes	931	baked, with skin
Crab-apples	764	-
Nettle	270	raw, fresh
Nuts	6484	average of walnut & hazelnut, raw, shelled
Roots	449	assumed equal to small carrot
Rose Hips	1	as tea
Mint Leaves	1	fresh
Mushrooms	214	Raw, white mushroom
Seagull Eggs	1560	assumed equal to chicken's eggs

[a] Ref: http://www.calorie-count.com unless otherwise noted
[b] Ref: http://www.annecollins.com/calories/calories-game-birds.htm
[c] Ref: ADF&G, 2013
[d] Ref: OPG, 2002

Table 4-2: Energy Yield for Dietary Components [kcal/kg] (Continued)

b) Farmed Foods

Component	Value (Kcal/kg)	Considered as
Agriculture - Grain (Corn)	839	corn on the cob
Agriculture - Vegetables (squash)	561	acorn squash, baked
Agriculture - (Beans)	840	Kidney beans, canned, not cooked

Ref: http://www.calorie-count.com

Table 4-3: Food Intake Requirements Based on 4480 kcal/d Normalized Energy Intake, by Component, by Location [g/d] (Diet of Hunted/Gathered Foods and Traditional Agriculture)

(Hunted/Gathered components; assuming that hunted/gathered food accounts for 20% of diet, agriculturally-obtained food accounts for 80% of diet)

Component	Location				
	Kanawake (NY)	Nuxalk (BC)			Southern Quebec
	Adult	Adult	NS	Teen	Adult
Caribou					
Deer			10.3*		
Moose			10.3*		
Muskrat					
Rabbit					
Beaver					
Grouse					
Duck			10.3*		
Fish	671.1**	671.1**	598.5	671.1**	671.1**
Berries (as blueberries)			54.0		
Elk					
Wild Rice					
Labrador Tea					
Ptarmigan					
Partridge					
Wild Turkey					
Black Bear					
Lynx					
Potatoes (local grown)					
Crab-apples					
Nettle					
Nuts					
Roots			0		
Rose Hips					
Mint Leaves					
Mushrooms					
Eggs					

* Nuxalk: values are divided between moose, deer, and fish based on grouping from the original reference.

** Original reference includes only fish intake values for these locations. Since fish is the only non-agricultural food item, when normalized, the proportion of fish becomes 20% of the total dietary intake which produces the same value for many locations.

NS – Not Specified

"Adult" refers to both genders unless otherwise specified

“Teen” age group from original reference.

Table 4-3: Food Intake Requirements Based on 4480 kcal/d Normalized Energy Intake, by Component, by Location [g/d] (Diet of Hunted/Gathered Foods and Traditional Agriculture) (Continued)

(Hunted/Gathered components; assuming that hunted/gathered food accounts for 20% of diet, agriculturally-obtained food accounts for 80% of diet)

Component	Location				
	Elliot Lake-1		Elliot Lake -2	Big Trout	Grassy Narrows
	Adult	Child	Adult	NS	NS
Caribou				16.8	68.8
Deer	111.5	84.1	269.6	13.4	116.6
Moose	111.5	84.1	269.6	13.4	116.6
Muskrat				7.0	
Rabbit				1.8	31.1
Beaver				16.3	49.8
Grouse	55.7	42.2		102.0	12.7
Duck	55.7	42.2		102.0	12.7
Fish	121.6	91.8	52.3	204.1	147.6
Berries (as blueberries)	207.6	539.7			
Elk					
Wild Rice					
Labrador Tea					
ptarmigan					
Partridge					
Wild Turkey					
Black Bear					
Lynx					
Potatoes (local grown)					
Crab-apples					
Nettle					
Nuts					
Roots					
Rose Hips					
Mint Leaves					
Mushrooms					
Eggs					
Hunter/Gatherer Subtotal	**663.6**	**884.1**	**591.4**	**476.9**	**556.0**

NS – Not Specified
"Adult" refers to both genders unless otherwise specified

Table 4-3: Food Intake Requirements Based on 4480 kcal/d Normalized Energy Intake, by Component, by Location [g/d] (Diet of Hunted/Gathered Foods and Traditional Agriculture) (Continued)

(Hunted/Gathered components; assuming that hunted/gathered food accounts for 20% of diet, agriculturally-obtained food accounts for 80% of diet)

Component	Location			
	Whitedog	Yukon		Fort Smith (NWT)
	NS	Adult	Adult (Female)	Adult
Caribou	127.9	36.3	45.6	
Deer	38.9	3.4	4.3	
Moose	38.9	408.3	360.4	
Muskrat				
Rabbit	28.3	34.3	39.5	
Beaver	107.0	39.1	50.6	
Grouse	25.9	4.8		
Duck	25.9	1.7	1.2	
Fish	116.8	83.7	100.9	536.9
Berries (as blueberries)		16.0	14.5	313.0
Elk				
Wild Rice				
Labrador Tea				
Ptarmigan				
Partridge				
Wild Turkey				
Black Bear				
Lynx				
Potatoes (local grown)				
Crab-apples				
Nettle				
Nuts				
Roots				
Rose Hips				
Mint Leaves				
Mushrooms				
Eggs				
Hunter/Gatherer Subtotal	**509.6**	**627.6**	**617.0**	**849.9**

NS – Not Specified
"Adult" refers to both genders unless otherwise specified

Table 4-3: Food Intake Requirements Based on 4480 kcal/d Normalized Energy Intake, by Component, by Location [g/d] (Diet of Hunted/Gathered Foods and Traditional Agriculture) (Continued)

(Hunted/Gathered components; assuming that hunted/gathered food accounts for 20% of diet, agriculturally-obtained food accounts for 80% of diet)

Component	Location			
	Fort Chipewyan (AB)	Yukon (Teslin)	Yukon (Whitehorse)	Manitoba (Ecozone 1)
	Adult	Adult	Adult	Adult
Caribou		41.1	107.1	
Deer				134.5
Moose		583.3	474.1	35.0
Muskrat				
Rabbit				55.4
Beaver				
Grouse				
Duck				102.8
Fish	611.1	31.2	55.0	17.2
Berries (as blueberries)	140.0	5.9	13.8	0.1
Elk				104.0
Wild Rice				
Labrador Tea				
Ptarmigan				
Partridge				
Wild Turkey				
Black Bear				
Lynx				
Potatoes (local grown)				
Crab-apples				
Nettle				
Nuts				
Roots				
Rose Hips				
Mint Leaves				
Mushrooms				
Eggs				
Hunter/Gatherer Subtotal	**751.0**	**661.5**	**649.9**	**449.1**

"Adult" refers to both genders unless otherwise specified
Ecozone 1: Prairies/Plains;

Table 4-3: Food Intake Requirements Based on 4480 kcal/d Normalized Energy Intake, by Component, by Location [g/d] (Diet of Hunted/Gathered Foods and Traditional Agriculture) (Continued)

(Hunted/Gathered components; assuming that hunted/gathered food accounts for 20% of diet, agriculturally-obtained food accounts for 80% of diet)

Component	Location			
	Manitoba (Ecozone 2)	Manitoba (Ecozone 3)	Moose Factory	Moosonee
	Adult	Adult	NS	NS
Caribou			44.5	54.8
Deer	12.4			
Moose	487.8	545.8	98.6	121.5
Muskrat			1.8	3.2
Rabbit	25.8		15.2	13.2
Beaver			13.0	23.3
Grouse			6.0	5.2
Duck			122.0	122.2
Fish	93.5	20.6	153.4	102.4
Berries (as blueberries)	36.6	57.0		
Elk	18.9			
Wild Rice		100.1		
Labrador Tea		5.2		
Ptarmigan			2.6	2.3
Partridge				
Wild Turkey				
Black Bear			0.0	0.0
Lynx				
Potatoes (local grown)				
Crab-apples				
Nettle				
Nuts				
Roots				
Rose Hips				
Mint Leaves				
Mushrooms				
Eggs				
Hunter/Gatherer Subtotal	**674.9**	**728.7**	**457.2**	**448.1**

NS – Not Specified
"Adult" refers to both genders unless otherwise specified
Ecozone 2: Plains/Boreal-Plains; Ecozone 3: Boreal/Shield;

Table 4-3: Food Intake Requirements Based on 4480 kcal/d Normalized Energy Intake, by Component, by Location [g/d] (Diet of Hunted/Gathered Foods and Traditional Agriculture) (Continued)

(Hunted/Gathered components; assuming that hunted/gathered food accounts for 20% of diet, agriculturally-obtained food accounts for 80% of diet)

	Location			
Component	**Fort Albany**	**Kashechewan**	**Attawapiskat**	**Peawanuck**
	NS	**NS**	**NS**	**NS**
Caribou	57.8	38.9	27.0	49.1
Deer				
Moose	128.1	86.2	59.8	108.7
Muskrat	0.3	1.4	1.4	0.7
Rabbit	5.7	13.7	7.8	13.1
Beaver	2.3	10.0	10.4	4.8
Grouse	2.2	5.4	3.1	5.1
Duck	168.8	181.0	157.5	147.6
Fish	28.1	32.4	144.8	92.2
Berries (as blueberries)				
Elk				
Wild Rice				
Labrador Tea				
Ptarmigan	1.0	2.4	1.4	2.3
Partridge				
Wild Turkey				
Black Bear	0.0	0.0	0.0	0.0
Lynx				
Potatoes (local grown)				
Crab-apples				
Nettle				
Nuts				
Roots				
Rose Hips				
Mint Leaves				
Mushrooms				
Eggs				
Hunter/Gatherer Subtotal	**394.3**	**371.5**	**413.0**	**423.6**

NS – Not Specified

Table 4-3: Food Intake Requirements based on 4480 kcal/d Normalized Energy Intake, by Component, by Location [g/d] (Diet of Hunted/Gathered Foods and Traditional Agriculture) (Continued)

(Hunted/Gathered components; assuming that hunted/gathered food accounts for 20% of diet, agriculturally-obtained food accounts for 80% of diet)

Component	Location		
	Pinehouse, Saskatchewan	Average of Manitoba First Nations	
	NS	Adult (Female)	Adult (Male)
Caribou	2.6	19.6	4.7
Deer	3.1	61.7	32.8
Moose	80.4	89.0	87.6
Muskrat	12.2	3.9	7.2
Rabbit	58.2	11.8	14.2
Beaver	15.4	0.8	8.3
Grouse	7.3	2.9	5.7
Duck	37.6	66.4	112.9
Fish	342.5	149.9	142.0
Berries (as blueberries)	20.7	199.1	69.5
Elk		12.4	19.3
Wild Rice		43.0	7.4
Labrador Tea		0.6	0.0
Ptarmigan	0.2		
Partridge		0.0	0.0
Wild Turkey		0.0	0.0
Black Bear	0.0		
Lynx	0.0	0.0	0.0
Potatoes (local grown)	0.0		
Crab-apples		0.0	0.0
Nettle		0.0	
Nuts		0.0	0.0
Roots		0.0	0.0
Rose Hips		0.1	0.0
Mint Leaves		0.1	0.2
Mushrooms			0.0
Eggs		0.0	0.0
Hunter/Gatherer Subtotal	**580.0**	**661.5**	**511.8**

NS – Not Specified

Table 4-4: Food Intake Requirements Based on 4480 kcal/d Normalized Energy Intake, by Component [g/d] (Diet of Hunted/Gathered Foods and Traditional Agricutlure)

(Traditional agriculture components; for all locations; assuming that hunted/gathered food accounts for 20% of diet, traditional agriculturally-obtained food accounts for 80% of diet)

Agriculture – Corn	3,275.8
Agriculture - Vegetables (squash)	738
Agriculture – Beans	501.4
Agriculture Subtotal	**4,515.2**

Table 4-5: Food Intake Distribution for All Diet Components (Diet of Hunted/Gathered Foods and Traditional Agriculture) [g/d]

(Hunted/Gathered and Traditional Agriculture components; assuming that hunted/gathered food accounts for 20% of diet, traditional agriculturally-obtained food accounts for 80% of diet)

Component	Adult			Child*
	Min	Median	Max	-
Caribou	4.3	71.5	213.7	
Deer	5.4	56.6	464.6	145.0
Moose	13.8	147.7	782.3	112.8
Muskrat	0.7	5.9	28.6	
Rabbit	3.4	27.9	110.3	
Beaver	1.8	30.1	226.5	
Grouse	3.4	8.5	156.0	64.5
Duck	4.1	344.0	610.3	142.1
Fish**	23.0	176.0	896.0	122.6
Berries (as blueberries)	0.1	25.9	179.2	308.9
Elk	17.0	26.1	142.5	
Wild Rice	7.7	44.6	103.9	
Labrador Tea	0.0	0.0	0.0	
Ptarmigan	0.2	2.9	3.4	
Partridge	0.0	0.0	0.0	
Wild Turkey	0.0	0.0	0.0	
Black Bear	0.0	0.0	0.0	
Lynx	0.0	0.0	0.0	
Potatoes (local grown)	0.0	0.0	0.0	
Crab-apples	0.0	0.0	0.0	
Nettle	0.0	0.0	0.0	
Nuts	0.0	0.0	0.0	
Roots	0.0	0.0	0.0	
Rose Hips	0.0	0.0	0.0	
Mint Leaves	0.0	0.0	0.0	
Mushrooms	0.0	0.0	0.0	
Eggs	0.0	0.0	0.0	
Agriculture - Corn	2,748.9	2,748.9	2,748.9	2,748.9
Agriculture - Vegetables (squash)	414.0	414.0	414.0	414.0
Agriculture - Beans	421.1	421.1	421.1	421.1

*Child values available for one location only (Elliot Lake), minimum, median and maximum not applicable.

** Fish species have a wide range in size, lifespan and food sources; however, in this study all fish species are aggregated due to a lack of data. A future revision to this document could consider alternate representations if more data become available.

4.2.1 Agriculture and Domestication of Livestock

This section discusses an alternative case, where the SCDF receptor group includes not only farming of plant produce beyond traditional agriculture, but domestication of livestock (sheep/cow, poultry and eggs, and possibly rabbit) as well.

The information presented in Section 4.2, above, assumes that agriculture includes only the plants traditionally farmed by Aboriginal Peoples of the SCDF in the past. However, as discussed in Section 1.4, societies in such a future would not necessarily return to an aboriginal pre-contact state but would likely move to a more revised form which includes some amount of present-day knowledge. An important example is the domestication and use of livestock. One can speculate that although domestication of livestock was not generally observed in past pre-contact aboriginal societies, domestication of livestock is now widely known, and in a far-future scenario, societies would likely retain this knowledge.

Table 4-6 presents the food intake requirements (based on a normalized intake of 4480 kcal/d) for a SCDF receptor with both farmed produce and raised livestock. Table 4-7 outlines the food intake distribution that occurs if domesticated livestock are included in agricultural practices.

Table 4-6: Food Intake Requirements Based on 4480 kcal/d Normalized Energy Intake, by Component [g/d] (Diet of Agriculture and Domesticated and Hunted/Gathered Food)

(Agriculture and domesticated components only; for all locations; assuming that hunted/gathered food accounts for 20% of diet, agriculture and domesticated food accounts for 80% of diet)

Agriculture - Milk Products	733.0
Agriculture - Domestic Meat (sheep, cow)	265.6
Agriculture - Poultry	54.6
Agriculture - Eggs	82.9
Agriculture - Corn	2,079.9
Agriculture - Vegetables (squash)	468.6
Agriculture - Beans	318.3
Agriculture - Domestic Meat (Rabbit)	0.9
Agriculture Subtotal	**4,003.8**

Table 4-7: Food Intake Distribution for Hunted/Gathered Components (Diet of Agriculture and Domesticated and Hunted/Gathered Food) [g/d]

(Hunted/Gathered components only; *assuming that hunted/gathered food accounts for 20% of diet, agriculture and domesticated food accounts for 80% of diet)*

Component	Adult			Child*
	Min	Median	Max	-
Caribou	3	43	128	0
Deer	3	33	270	84
Moose	10	110	583	84
Muskrat	0	3	12	0
Rabbit	2	15	58	0
Beaver	1	14	107	0
Grouse	2	6	102	42
Duck	1	102	181	42
Fish	17	132	671	92
Berries (as blueberries)	0	45	313	540
Elk	12	19	104	
Wild Rice	7	43	100	
Labrador Tea	0	1	5	
Ptarmigan	0	2	3	
Partridge	0	0	0	
Wild Turkey	0	0	0	
Black Bear	0	0	0	
Lynx	0	0	0	
Potatoes (local grown & harvested)	0	0	0	
Crab-apples	0	0	0	
Nettle	0	0	0	
Nuts	0	0	0	
Roots	0	0	0	
Rose Hips	0	0	0	
Mint Leaves	0	0	0	
Mushrooms	0	0	0	
Eggs	0	0	0	

*Child values available for one location only (Elliot Lake), minimum, median and maximum not applicable.

4.3 LIFESTYLE

Lifestyle parameters for the SCDF receptor group are provided in Table 4-8. As previously noted, the lifestyle maximizes use of local resources, and is therefore a more traditional or historical lifestyle than is currently practiced. For comparison, results for a self-sufficient farmer are also listed, as presented in Garisto *et al.* (2005), unless otherwise stated. Garisto *et al.* (2005) mentions that where available, these parameters were obtained from recent studies conducted for the Environmental Assessment (EA) of the consolidation and management of historic waste in Port Hope (PHAI 2004a,b; 2005a,b). Where data were not available and the assumption made sense, lifestyle parameter values were assumed to be the same as or similar to the parameter values used for the self-sufficient farmer (AECL 1994).

Parameters relevant to type of dwelling were based on typical SCDF historical dwellings, or Longhouses. Such structures were used by the main First Nations in the SCDF, such as the Huron.

Table 4-8: Lifestyle Parameters – Southern Canadian Deciduous Forest Receptor Group

Parameter	Units	Farmer	Southern Canadian Deciduous Forest Hunter/Gatherer/Farmer	Reference / Comments
Water source	-	-	Lake/ River	
Total water demand per person	m^3/a	130	50-70	Water was used for cooking foods and boiling medicines. Also used in ceremonies and bathing. Water was also used to keep hides soft for making drums and clothing, for keeping plant/tree material wet and malleable for craft/tool constructions such as black ash baskets. It is estimated that an average household consisting of two adults and 2-6 children, would use: Cooking: 12-16 L/d, Medicines: 2 L/d, Food preparation: 4-8 L/d, Ceremonies: 4-6 L/d, Bathing: 0 (swimming in lakes or creeks in spring/summer/fall), Hides / Tools / Clothing usage: 40- 80 L/d. This implies a total water demand per person of 6-10 m^3/a. However, water demand is also impacted (increased) due to farming practices. Crops such as corn, beans and squash are relatively tolerant of dry conditions but would require occasional watering during the summer season. Another important factor for aboriginal lifestyles prior to contact with settlers is the lack of metal vessels for cooking. Food would likely have been roasted more often. Once the fur trade began, cooking vessels would have been among the first items acquired. When accounting for these factors, an estimated value of 50-70 m^3 per year is believed to be reasonable for the SCDF receptor group.

Table 4-8: Lifestyle Parameters – Southern Canadian Deciduous Forest Receptor Group (Continued)

Parameter	Units	Farmer	Southern Canadian Deciduous Forest Hunter/Gatherer/Farmer	Reference / Comments
Drinking water demand	L/d	2.3	Ln (1.32, 1.65, 0.48, 3.6)	Lognormal, GM=1.32, GSD=1.65, 0.48-3.6 bounds from Richardson (1997). 3.1 (Hatchet Lake), 1.4-1.6 (Elliot Lake), 2.3 L/d for farmer (CSA, 2008)
Food storage for winter	-	-	Yes	-
Total energy need (adult)	kcal/d	Max: 4116	Max: 4480	CSA (2008) required energy intake for adults (90^{th} percentile energy expenditure)
Food energy fraction obtained from traditional/wild:				
Plants	-	-	0-0.07	Table 4-4: grouped maximum and minimum values.
Milk	-	-	-	Not Applicable.
Meat	-	-	0.01-0.19	Table 4-4: grouped maximum and minimum values.
Birds and eggs	-	-	0-0.14	Table 4-4: grouped maximum and minimum values.
Fish	-	0.01	0.01-0.2	Table 4-4: grouped maximum and minimum values.
Food energy fraction obtained from agriculture:				
Plants	-	1.0	0.8	Trigger (1994); see Section 4.1 discussions.
Milk	-	0.36	-	Farmer: Garisto *et al.* 2005.
Meat	-	0.26	-	Farmer: Garisto *et al.* 2005.
Birds and eggs	-	0.05	-	Farmer: Garisto *et al.* 2005.
Soil Ingestion rate	kg/a	0.04	0.007-0.04	The lower limit is from Table 4-1; the upper limit is from the value for a farmer.
People per household	-	3	50	Archaeological evidence is that the St. Lawrence Iroquoians built villages with as many as forty longhouses and which could have housed 2,000 people (Wright, 1994).
Building lifetime	a	50	10-30	Villages were relocated approximately every 10 to 30 years due to the gradual depletion of firewood and soil nutrients (crop rotation was not practiced leading to gradual declines in soil fertility) (Trigger 1994).

Table 4-8: Lifestyle Parameters – Southern Canadian Deciduous Forest Receptor Group (Continued)

Parameter	Units	Farmer	Southern Canadian Deciduous Forest Hunter/Gatherer/Farmer	Reference / Comments
Building height	m	2.4	6-9	Typical dwellings include for example, the Huron longhouse (Ste. Marie 2013) (New York State Museum 2012).
Building width	m	9.7	6-9	Typical dwellings include for example, the Huron longhouse (Ste. Marie 2013) (New York State Museum 2012).
Building length	m	9.8	55 to 67	New York State Museum (2012)
Building volume	m^3	228	up to 2412	Rectangular, long.
Building material		-	Wood & bark	Longhouse framework consistent of wooden poles dug into the ground, covered with sheets of bark, held in place by a netting of flexible poles or by lashings made of woven strips of bark fibres. Trees such as basswood are noted building materials (New York State Museum 2012), though other tree species characteristic of the local area were likely used.
Tree age when harvested for building material	a	100	Birch used for bark: 40-70 Poles and lashes: < 20	Longhouses were made of poles bent over to form an arbor, which was then covered with bark and saplings.
Building occupancy factor	-	0.8	Male: 0.54-0.64 Female: 0.74-0.84	Much of the available time was based on farming, hunting, food preparation and gathering of food and firewood. Traditionally, men would have spent more time away hunting, whereas women would have spent more time residing within buildings or the village. Assumed similar to BF, but increased by 1 hour to account for the influence of increased food availability due to farming (overall less time spent outdoors hunting).

Table 4-8: Lifestyle Parameters – Southern Canadian Deciduous Forest Receptor Group (Continued)

Parameter	Units	Farmer	Southern Canadian Deciduous Forest Hunter/Gatherer/Farmer	Reference / Comments
Building wake plume entrainment factor	-	2	2	The entrainment constant is an empirical parameter that has a value between 0.5 and 2.0. It is often not obvious how to choose the cross-sectional area for use in deriving a vertical dispersion parameter, since releases from most nuclear sites are affected by several different buildings. To ensure that the air concentrations are not underestimated, the cross sectional area of the building should be taken as the area (perpendicular to the wind direction) of the largest single building affecting the plume. (CSA 2008) Moreover, for buildings that are at least three times wider than they are high, the width ceases to be a relevant length scale for mixing in the building wake. In this case, the cross-sectional area should be limited to the square of the building height (h^2). (CSA 2008)
Probability of being located downwind from energy fires (fraction of outside time that a person is exposed to fire smoke)	-	0.25	0.25 – 0.5	Because villages and longhouses were both larger and denser than those of the boreal forest, it is likely that individuals would have inevitably been more downwind or in the path of smoke.
Fraction of time exposed to indoor smoke	-	-	Male: 0.05-0.6 Female: 0.14-0.8	Based on estimates of time spent indoors/outdoors from Garisto *et al.* 2005. See Appendix A.
Building air infiltration rate	hr^{-1}	0.35	2-5	For perspective, a value of 0.35 (farmer) implies a well sealed dwelling. A value of 1 is typical for most modern homes. In comparison, large longhouse dwellings could have had higher air infiltration rates induced by the air consumed by numerous family fires within the building.

Table 4-8: Lifestyle Parameters – Southern Canadian Deciduous Forest Receptor Group (Continued)

Parameter	Units	Farmer	Southern Canadian Deciduous Forest Hunter/Gatherer/Farmer	Reference / Comments
Inhalation Rate	m^3/d	-	Adult: 23.0 Child: 21.5	CSA N288.1 (2008) [annual values divided by 365 d/a]
Outdoor or ground exposure factor	-	0.2	Male: 0.36-0.46 Female: 0.16-0.26	Southern Canadian Aboriginal Peoples may have been more exposed to soil through the clearing of land for agriculture and when working these areas. Conversely, most of the boreal ecosystem was not cleared (ground and tree cover remained).
Water immersion occupancy factor	-	0.02	0.02	Assumed same as farmer
Fuel source	-	-	Wood	Birch bark was often used as fire starter and/or 'old man's bear' or 'tree moss' was also used. Animal fat was used for candles.
Peat burning probability (as fuel)	-	1%	0%	Not used.
Energy consumption per household	MJ/a	1.1×10^5	4.9×10^5	Estimated 1 cord firewood consumed per week, for a fire serving 8 people (2 families; 4 people per family). This is assuming that at least 2 families share an indoor fire in a longhouse. Assuming 50 people per longhouse household gives a value of 6.25 cords of firewood consumed per week. Weight-per-cord is derived as an average of representative available species (maple, spruce, white pine, red oak, white oak, and poplar) yielding 1,357.3 kg (dry) per cord using values from Kuhns (2013). Based on AECL (1994) 1.1 MJ/kg firewood, this gives a value of 4.9×10^5 MJ/year.

Table 4-8: Lifestyle Parameters – Southern Canadian Deciduous Forest Receptor Group (Continued)

Parameter	Units	Farmer	Southern Canadian Deciduous Forest Hunter/Gatherer/Farmer	Reference / Comments
Frequency of agricultural and land clearing fires	a^{-1}	1	0.3	First Nations would burn fires in the springtime to promote growth of specific plants and to retard growth of others. Fires would be applied periodically to beaver traplines to create more pioneer tree species (such as birch and poplar which the beaver prefers). For southern deciduous lifestyles, a greater frequency is likely (in comparison to BF lifestyles), since some of the land utilized for agriculture would have likely been cleared or partially cleared using fires.
Frequency of forest fires	a^{-1}	0.02	0.004 – 0.003	Fire frequency in southern Canada is approximately 1/3 that of boreal forest systems, due to the older average age of forests compared to boreal (Kimmins, 1997).
Probability of irrigation	-	0.02-0.9	0.5	In the southern Canadian deciduous forest it is likely that irrigation was partially used for agriculture. Crops such as corn, beans and squash are relatively tolerant of dry conditions but would require occasional watering during the summer season.
Irrigation period	a	100	50	Assume a few to several times per season.
Probability of using fresh lake sediments on fields	-	0.01	0	No evidence of this.
Dredged sediment thickness	m	0.3	-	No evidence of this.
Cropping frequency	a^{-1}	0-1	0-1	Assumed up to 1 crop per growing season. Potentially less, accounting for failed crops.
Cropping period, non-irrigated fields	a	50	10-30	Based on village/household lifetime. Villages would likely relocate after approximately 10-30 years due in part to declining soil fertility (Trigger 1994).

Table 4-8: Lifestyle Parameters – Southern Canadian Deciduous Forest Receptor Group (Continued)

Parameter	Units	Farmer	Southern Canadian Deciduous Forest Hunter/Gatherer/Farmer	Reference / Comments
Cropping soil contaminant loss fraction	-	0.05	0.05	It is realistic to assume some loss of radionuclides due to the cropping cycle. A low rate is conservative for the purpose of assessing dose due to soil exposure. Nutrient cycling in nutrient efficient farms provides a conservative lower bound on the loss of about 5% of the nutrient inventory of the crop. (CSA 2008)
Fish holdup time (Time between catching and eating fish)	d	0.5- 60	0.3- 60	Assumed. The shorter period accounts for fish being caught in the morning and consumed for lunch or dinner. The longer period accounts for outdoor drying of fish.
Plant holdup time (Time between plant absorbing the nuclide and being eaten by man)	d	1	0.01 - 270	Similar to BF, plants could have been consumed relatively soon after harvesting (immediately in some cases) or stored for later consumption using preservation techniques such as drying. The BF range of 0.01 d (immediate consumption) to 270 d (9 month preservation and storage) is therefore assumed to be applicable.
Animal holdup time (Time between animal being hunted, and being eaten by man)	d	1 milk/ bird 5 meat	0.1 - 270	Similar to plant holdup time, animals could have been consumed relatively quickly after being hunted (allowing for preparation), or, stored for later consumption using preservation techniques such as drying. Larger animals may have required longer preparation time, though it is also likely that a group of hunters would hunt and prepare a large animal and thus share the effort required. The BF range of 0.1 d (immediate consumption allowing for preparation) to 270 d (9 month preservation and storage) is therefore assumed to be applicable.

Table 4-8: Lifestyle Parameters – Southern Canadian Deciduous Forest Receptor Group (Continued)

Parameter	Units	Farmer	Southern Canadian Deciduous Forest Hunter/Gatherer/Farmer	Reference / Comments
Animal drinking water holdup time (Time between water being consumed by animal, and of animal being eaten by man)	d	0 milk/bird 4 meat	0.1 - 270	Assumed same as BF.
Animal air holdup time (Time between air inhaled by animal, and of animal then eaten by man)	d	0 milk/bird 4 meat	0.1 - 270	Assumed same as BF.
Animal soil holdup time (Time between soil being consumed by animal, and of animal then eaten by man)	d	0 milk/bird 4 meat	0.1 - 270	Assumed same as BF.
Food exposure time (Duration that plants consumed by animal or people are exposed to possible contamination)	d	100 plant/bird 50 milk/meat	100 plant/bird 50 milk/meat	Reasonable
Man's water holdup time (Time between removing water from source and its consumption by man	d	0	0	Reasonable

Table 4-8: Lifestyle Parameters – Southern Canadian Deciduous Forest Receptor Group (Continued)

Parameter	Units	Farmer	Southern Canadian Deciduous Forest Hunter/Gatherer/Farmer	Reference / Comments
Inorganic building material holdup time (Time between inorganic material (sand, clay, rock) being removed from ground and placed into the building)	d	30	-	Not Relevant.
Wood building material holdup time (Time between wood being harvested from woodlot and place into building occupied by man)	d	180	0	Similar to the BF, where wood used for building materials would have been used quickly after harvesting. Wood was not typically dried before use, though dry deadwood would have been harvested preferentially. Aboriginal communities of the SCDF were generally larger than those of the BF, with high wood consumption rates. Eventually, local wood resources would be depleted causing a community to move. It is also believed that Aboriginal Peoples of the SCDF used more sophisticated tree harvesting techniques such as tree girdling.

Note: Water demand for a farmer includes (i) water for domestic purposes (drinking, cooking, bathing, laundry, etc.), (ii) drinking water for domestic animals, (iii) irrigation of the gardens and (iv) irrigation of the forage fields.

4.4 NON-HUMAN BIOTA AND ECOLOGICAL PROFILES

Table 4-9 presents a list of select species of particular importance to the SCDF lifestyle for purposes other than food (e.g. medicinal properties, building materials, preservation, ceremonial use, etc.).

Information in Table 4-9 has been obtained from a compilation by Yarnell (1964) which examines plants important to the lifestyle and culture of Aboriginal Peoples in the Great Lakes Region. It should be noted that although Yarnell (1964) provides a great deal of useful information, the study focuses entirely on the usage of plants. Also, descriptions of the uses of plants (how they are prepared, which parts, etc.) have a large variability in terms of detail.

Table 4-9 is based on the usage categories identified by Yarnell (1964). Where plants are identified as having multiple uses the species has been recorded in all applicable categories.

Yarnell (1964) encompasses over 300 species of plants. Table 4-9 presents only select species to illustrate each of the main usage categories. For a detailed list of species the reader is directed to the original work by Yarnell (1964).

Table 4-9: Important Non-Human Biota – Southern Canadian Deciduous Forest
(Yarnell, 1964)

Usage Category	Species and Descriptions (where available)
Food Spice/ Flavouring	• Spice Bush (*Lindera benzoin*) [root] • Wild Ginger (*Asarum canadense*) [root]
Medicinal Beverage	• Scouring Rush/Field Horsetail (*Equisetum arvense*) • Shield Fern/Crested Wood Fern (*Dyopteris cristata*) [root] • Bracken Fern (*Pteridium aquilinum*) [roots] • Hemlock (*Tsuga canadensis*) • White Pine (*Pinus strobus)* • Balsam Fir (*Abies balsamea)* • White Spruce (*Picea glauca)* • White Cedar (*Thuja occidentalis)* • Trillium (*Trillium grandiflora*) • Nettle (*Urtica gracilis*) • Smartweed (*Polygonum coccineum*) • Leatherwood (*Dirca palustris*) • St. Johns Wort (*Hypericum virginicum*) • Seneca Snakeroot (*Polygala senega*) • Goldenrod (*Solidago canadensis*)

Table 4-9: Important Non-Human Biota – Southern Canadian Deciduous Forest *(Yarnell, 1964)* **(Continued)**

Usage Category	Species and Descriptions (where available)
Other Medicinal Plants	• Spice Bush (*Lindera benzoin*) [root] • Wild Ginger (*Asarum canadense*) [root] • Giant Puffball (*Calvatia craniiformis*) • Clubmoss (*Lycoperdon subincarnatum*) • Ground Pine (*Lycopodium obscurum*) • Rattlesnake Fern (*Botrychium viginianum*) • Hemlock (*Tsuga canadensis*) • Black Spruce (*Picea mariana*) • Red/Norway Pine (*Pinus resinosa*) • Jack Pine (*Pinus banksiana*) • Juniper (*Juniperus communis*) • Red Cedar (*Juniperus viginiana*) • Rattlesnake Grass (*Glyceria canadensis*) [root] • Jack-in-the-pulpit (*Arisaema triphyllum*) • Wild Onion (*Allium stellatum*) • Wild Leek (*Allium tricoccum*) • Wild Lily (*Lilium canadense*) • False Solomon's Seal (*Smilacina racemosa*) [root] • Willow (*Salix gracilis*) • Butternut (*Juglans cinerea*) • Sweet/Black Birch (*Betula lenta*) [bark] • Beech (*Fagus grandiflora*) • Red Oak (*Quercus rubra*) • Tobacco (*Nicotiana rustica*)*
Ceremonial / Charms	• Sweet Flag (*Acorus calamus*) [used as 'fishing medicine' on nets] • Dragon Root (*Arisaema dracontium*) [ceremonial uses related to dreams] • Scouring Rush/Field Horsetail (*Equisetum arvense*) • Seneca Snakeroot (*Polygala senega*) • Wild Oats (Uvularia sessifolia) [used as part of a 'hunting medicine'] • Solomon's Seal (Polygonatum canaliculatum) [incense] • Sweet Fern (*Compotonia peregrina*) [incense] • Witch Hazel (Hamamelis virginiana) [used as ceremonial beads] • Wild Sarsaparilla (Aralia nudicaulis) [fish lure on nets] • Aster (Aster umbellatus) • Tobacco (*Nicotiana rustica*) [numerous uses as offerings, sacrifices (burning), etc.]*

Table 4-9: Important Non-Human Biota – Southern Canadian Deciduous Forest *(Yarnell, 1964)* **(Continued)**

Usage Category	Species and Descriptions (where available)
Smoking Materials	• Smartweed (*Polygonum coccineum*) [smoked to attract deer] • Shining Willow (Salix lucida) [bark] • Swamp Persicaria (Polygonum coccineum) [dried flowers smoked] • Hawthorn (Crataegus sp.) [bark] • Staghorn Sumac (Rhus typhina) [leaves smoked with tobacco] • Red Osier Dogwood (Cornus stolonifera) [bark] • Bearberry/Kinnikinnik [leaves] • Fragrant Goldenrod (Solidago graminiflora) [flowers] • Aster (Aster umbellatus) • Tobacco (*Nicotiana rustica*) [numerous uses as offerings,sacrifices (burning), etc.]*
Dye	• Hemlock (*Tsuga canadensis*) • Speckled Alder (*Almus rugosa*) [roots, bark] • Red Oak (*Quercus rubra*) • Witch Hazel (Hamamelis virginiana) • Staghorn Sumac (Rhus typhina) [leaves smoked with tobacco] • Butternut (*Juglans cinerea*) • Black Walnut (*Juglans nigra*) • Bloodroot (*Sanguinaria canadensis*) [used for dye and paint] • Blackeyed Susan (*Rudbeckia hirta*)
Building Materials & General Utility	• Leatherwood (*Dirca palustris*) • Black Spruce (*Picea mariana*) • Red/Norway Pine (*Pinus resinosa*) • Jack Pine (*Pinus banksiana*) • Juniper (*Juniperus communis*) [bark used for weaving maters and home building materials] • Red Cedar (*Juniperus viginiana*) • Beard Grass (*Andropogon gerardi*) [textile weaving material] • Sweet Flag (*Acorus calamus*) [used as thatch] • Balsam Fir (Abies basamea) [pitch used for sealing canoes] • Hemlock (*Tsuga canadensis*) [used as thatch] • Larch/Tamarack (*Laris laricina*) [roots used to sew canoes and bags] • White Pine (*Pinus strobus)* [pitch used for sealing canoes] • Eastern White Cedar (*Thuja occidentalis*) [wood used for canoe ribs, toboggans, spear handles; roots used to sew canoes; bark fibre used for rope, twine, nets, bags and mats] • Cattail (*Typha latifolia*) [leaves used for mats and thatching] • Black Willow (*Salix nigra*) [fibre used for bags, pouches, fish nets, and cord] • Shagbark Hickory (*Carya ovata*) [wood used for bows, arrows and building] • Paper Birch (*Betula papyrifera*) [bark used for canoes, buckets, kitchen utensils, storage containers, and house covers]

* Winter (2000)

See Section 2.4 for further discussions on tobacco usage.

5. CLOSING REMARKS

This document is based on currently available information, and any information becoming available in the future could be incorporated in a subsequent revision.

Interviews with First Nations Elders and resource users in each ecozone may be helpful to obtain addition insight on the information gathered and to further validate the information presented.

REFERENCES

Alaska Department of Fish and Game (ADF&G). 2013. Eating game meat. Retrieved from: http://www.adfg.alaska.gov/index.cfm?adfg=hunting.eating.

Aniskowicz, B.T. 1994. Hinterland Who's Who. Bird Fact Sheet: Ptarmigan. Environment Canada and Canadian Wildlife Federation. Catalogue number CW69-4/38-1994E. Retrieved from: http://www.hww.ca/en/species/mammals/polar-bear.html.

Arthur, S. 2008. Wildlife notebook series: Caribou. Alaska Department of Fish and Game. Retrieved from: http://www.adfg.alaska.gov/static/education/wns/caribou.pdf.

Assembly of First Nations (AFN). 2012. AFN Report on "Alternative exposure groups, characteristics and data for the post-closure safety assessment of a deep geological repository". Prepared for the Nuclear Waste Management Organization. Toronto, Canada.

Atomic Energy of Canada Limited (AECL). 1994. Environmental Impact Statement on the concept for disposal of Canada's nuclear fuel waste. Atomic Energy of Canada Limited Report, AECL-10711, COG-93-1. Pinawa, Canada.

Beak Consultants Limited (Beak). 1989. Kiggavic Uranium, Baker Lake Northwest Territories Canada, Supporting Document No. 10: Socio-Economic Impact Assessment. Prepared for Urangesellschaft Canada Limited. Brampton, Canada.

Berkes, F., P.J. George, R.J. Preston, A. Hughes, J. Turner and B.D. Cummins. 1994. Wildlife harvesting and sustainable regional native economy in the Hudson and James Bay lowland, Ontario. Arctic. Vol. 47. No. 4.

Beyer, W.N., E. Conner and S. Gerould. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. Vol. 58. Issue 2.

Bishop, C.A. 1994. Northern Algonquins 1550 – 1760, in Aboriginal Ontario – historical perspectives on the First Nations. Dundurn Press Limited. Toronto, Canada. .

Bishop, C.A. 2012. Aboriginal People: Eastern Woodlands. In the Canadian Encyclopedia.Historica Foundation. Retrieved from: http://www.thecanadianencyclopedia.com/en/article/aboriginal-people-eastern-woodlands/

Canadian Standards Association (CSA). 2008. Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operations of nuclear facilities. CSA Guideline N288.1-08. Toronto, Canada.

CanNorth. 2000. Hatchet Lake dietary survey, final report. Canada North Environmental Services Limited Partnership. Ottawa, Canada.

Carroll, J.P. 1993. Gray Partridge (Perdix perdix). In the birds of North America, No.58 (A. Poole and F.Gill,Eds.). Philadelphia: The Academy of Natural Sciences; Washington,

D.C.: The American Ornithologists' Union. Cornell Lab of Ornithology, All About Birds. Retrieved from: http://www.allaboutbirds.org/guide/Gray_Partridge/lifehistory.

Chan, H.M., M. Trifonopoulos, A. Ing, O. Receveur and E. Johnson. 1999. Consumption of freshwater fish in Kahnewake: risk and benefits. Environmental Research. Vol. 80. Part 2.

Chan, L., O. Receveur, D. Sharp, H. Schwartz, A. Ing, K. Fediuk, A. Black and C. Tikhonov. 2012. First Nations food, nutrition and environment study (FNFNES): results from Manitoba (2010). University of Northern British Columbia. Prince George, Canada.

Davis, J.D., and S.A. Banack. 2012. Ethnobotany of the Kiluhikturmiut Inuinnait of Kugluktuk, Nunavut, Canada. Society of Ethnogiology - Ethonobiology Letters: Research Communication. Vol. 3. 78-90.

Dean, W.G. 1994. The Ontario landscape, Circa A.D. 1600, in Aboriginal Ontario – historical perspectives on the First Nations. Dundurn Press Limited. Toronto, Canada.

DeGonzague, B., O. Receveur, D. Wedll and H. Kuhnlein. 1999. Dietary intake and body mass index of adults in 2 Ojibwe communities. Research. Vol. 99. No. 6.

Diamond, J. 1999. Guns, germs and steel: the fate of human societies. W.W. Norton & Company. New York, USA.

Duer, D., and Turner, N. 2005. Keeping It Living – Traditions of Plant Use and Cultivation on the Northwest Coast of North America. University of Washington Press. 13.

Eaton, S.W. 1992. Wild turkey (Meleagris gallopavo). In the Birds of North America, No. 22 (A. Poole, P. Stettenheim, and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C. Cornell Lab of Ornithology All About Birds. Retrieved from: http://www.allaboutbirds.org/guide/wild_turkey/lifehistory.

Eide, N.E., J.U. Jespen and P. Prestrud. 2004. Spatial organization of reproductive Arctic Foxes alopex lagopus: responses to changes in spatial and temporal availability of prey. Journal of Animal Ecology. Vol. 73.

Elder, S. 2005. "Ovibos moschatus" (On-line), Animal Diversity Web. Retrieved from: http://animaldiversity.ummz.umich.edu/accounts/Ovibos_moschatus/.

Environment Canada (EC). 2012. Federal contaminated sites action plan (FCSAP) - ecological risk assessment guidance - module C: standardization of wildlife receptor characteristics. Environmental Stewardship Branch, Environment Canada. Ottawa, Canada.

Environment Yukon (EY). 2007. Fact sheet for Arctic Ground Squirrel. Retrieved from: http://www.environmentyukon.gov.yk.ca/wildlifebiodiversity/mammals/agsquirrel.php.

Ferguson, S.H., M.K. Taylor, E.W. Born, A. Rosing-Asvid and F. Messier. 1999. Determinants of home range size for polar bears (ursus maritimus). Ecology Letters. Vol. 2.

Fox, D., and T. Murphy. 2002. "Lynx canadensis", animal diversity web. Retrieved from: http://animaldiversity.ummz.umich.edu/site/accounts/information/Lynx_canadensis.html

Garisto, N., Z. Eslami and F. Bhesania. 2005. Alternative exposure groups, characteristics and data for the post-closure safety assessment of a deep geological repository. Ontario Power Generation report 06819-REP-01200-10150-R00. Toronto, Canada.

Giesen, K.M, and C.E. Braun. 1992. Winter home range and habitat characteristics of White-Tailed Ptarmigan in Colorado. Wilson Bull. Vol. 104. Part 2.

Gray, D. 1990. Hinterland who's who. Mammal fact sheet: Muskox. Environment Canada and Canadian Wildlife Federation. Catalogue number CW69-4/51-1990E. Retrieved from http://www.hww.ca/en/species/mammals/muskox.html.

Hannon, S.J., P.K. Eason and K. Martin. 1998. Willow Ptarmigan (Lagopus lagopus). The birds of North America, Inc., Philadelphia, PA. Cornell Lab of Ornithology All About Birds. Retrieved from: http://www.allaboutbirds.org/guide/Willow_Ptarmigan/lifehistory.

Indian and Northern Affairs Canada (INAC). 2003. Canadian Arctic contaminants assessment report II: human health. North Contaminants Program. Ministry of Indian Affairs and Northern Development. Ottawa, Canada.

Kelly, B.P. 2005. Correction factor for Ringed Seal surveys in Northern Alaska. Juneau Center, School of Fisheries and Ocean Sciences, University of Alaska, Juneau, USA. Retrieved from http://www.arlis.org/docs/vol1/60385416.pdf

Kimmins, J.P. 1997. Forest ecology: a foundation for sustainable management. Second Edition. Prentice Hall, New Jersey, USA.

Kuhnlein, H.V. 1984. Traditional and contemporary Nuxalk foods. Nutrition Research. Vol. 4.

Kuhns, M. 2013. Heating with wood: species characteristics and volumes. Utah State University. Retrieved from: http://forestry.usu.edu/htm/forest-products/wood-heating/

Marles, R.J., C. Clavelle, L. Monteleone, N. Tays and D. Burns. 2008. Aboriginal plant use in Canada's northwest boreal forest. Natural Resources Canada. Canadian Forest Service. Edmonton, Canada.

McCullough, J. and K. Kirschbaum. 2001. "Meleagris gallopavo" (on-line), animal diversity web. Retrieved from: http://animaldiversity.ummz.umich.edu/site/accounts/information/Meleagris_gallopavo.html

Mitchell, C.D. 1994. Trumpeter Swan (Cygnus buccinator). In The Birds of North America, No. 105 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Pennsylvania, and The American Ornithologists' Union, Washington, D.C., USA.

Mos, L., J. Jack, D. Cullon, L. Montour, C. Alleyne and P. Ross. 2004. The Importance of marine foods to a near-urban First Nation community in coastal British Columbia,

Canada: toward a risk-benefit assessment. Journal of Toxicology and Environmental Health. Vol. 67. Part A.

Mowbray, T.B., C.R. Ely, J.S. Sedinger and R.E. Trost. 2002. Canada Goose (Branta canadensis). In the Birds of North America, No. 682 (A. Poole, Ed.). The Birds of North America Online, Ithaca, New York. Cornell Lab or Ornithology All About Birds. Retrieved from: http://www.allaboutbirds.org/guide/canada_goose/lifehistory

Mundy, K. 1991. Hinterland who's who. mammal fact sheet: Grizzly Bear. Environment Canada and Canadian Wildlife Federation. Catalogue number CW69-4/36-1991E. Retrieved from: http://www.hww.ca/en/species/mammals/grizzly-bear.html

NatureServe. 2013. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Retrieved from: http://www.natureserve.org/explorer

New York State Museum. 2012. A Mohawk Iroquois Village. Retrieved from: http://www.nysm.nysed.gov/IroquoisVillage/constructiontwo.html#f

Ontario Power Generation (OPG). 2002. Guideline for calculation of derived release limits for radionuclides in airborne and liquid effluents from Ontario Power Generation Nuclear facilities. Ontario Power Generation Report N-REP-03482-10000-R00. Toronto, Canada.

Oregon Department of Environmental Quality (ODEQ). 2004. Final post-trial burn risk assessment work plan for the Umatilla chemical agent disposal facility, Hermiston, Oregon; Appendix D - natural history of selected ecological receptors. Retrieved from: http://library.state.or.us/repository/2010/201008090901001/AppendixD.pdf.

Port Hope Area Initiative (PHAI). 2005a. Human health and safety considerations study for the Port Hope Project. Low Level Radioactive Waste Management Office, Natural Resources Canada. Report LLRWMO-03710-ENA-12006. Revision 0. Port Hope, Canada.

Port Hope Area Initiative (PHAI). 2005b. Port Hope Project human health and safety considerations environmental effects assessment report. Low Level Radioactive Waste Management Office, Natural Resources Canada. Report LLRWMO-03710-ENA-12009. Revision 0. Port Hope, Canada.

Port Hope Area Initiative (PHAI). 2004a. Socio-economic environment baseline characterization study for the Port Hope Project. Low Level Radioactive Waste Management Office, Natural Resources Canada. Report LLRWM-03740-ENA-12001.. Port Hope, Canada.

Port Hope Area Initiative (PHAI). 2004b. Socio-economic environment environmental effects assessment study report for the Port Hope Project. Low Level Radioactive Waste Management Office, Natural Resources Canada. Report LLRWM-03720-ENA-12002.. Port Hope, Canada.

Receveur, O., N. Kassi, H.M. Chan, P.R. Berti and H.V. Kuhnlein. 1998. Yukon First Nations' assessment of dietary benefit/risk. Centre for Indigenous Peoples' Nutrition and Environment. McGill University. Montreal, Canada.

Richardson, G.M. 1997. Compendium of Canadian human exposure factor for risk assessment. O'Connor Associates Environmental Inc. Ottawa, Canada.

Rio Algom Limited (Rio Algom). 1995. Environmental Impact Statement - decommissioning of the Quirke and panel waste management areas. Prepared by Rio Algom Limited, Elliot Lake Division. Elliot Lake, Canada.

Sainte-Marie Among the Huron (St. Marie). 2013. Historical information: the life of the Huron Wendat. Retrieved from: http://www.saintemarieamongthehurons.on.ca/sm/en/HistoricalInformation/TheLifeoftheWendat/index.htm

Sante Quebec. 1998. A dietary profile of the Cree, Sante Quebec health survey of the James Bay Cree 1991: food and nutrient intake. Ministere de la Sante et des Services Sociaux. Government of Quebec. Montreal, Canada.

Schindler, D. 2005. Determining Woodland Caribou home range and habitat use in Eastern Manitoba. Preliminary Analysis and Interim Report. Retrieved from: http://www.manitobamodelforest.net/publications/Determining%20Woodland%20Caribou%20Home%20Range%20and%20Habitat%20Use%20Apr%202005.pdf

Schmidt, J.L. and D.L. Gilbert. 1978. Big game of North America, ecology and management. Stackpole Books, Harrisburg, USA.

Schuster, R.C., M. Gamber, C. Dickson and H.M. Chan. 2011. Assessing risk of mercury exposure and nutritional benefits of consumption of caribou (Rangifer tarandus) in the Vuntut Gwitchin First Nation community of Old Crow, Yukon, Canada. Environmental Research. Vol. 111.

SENES Consultants Limited (SENES). 2000. Risk assessment for Pickering Nuclear Generating Station. Prepared for Ontario Power Generation. SENES Project Number 32977. Richmond Hill, Canada.

SENES Consultants Limited (SENES). 1996. Supporting document IV: environmental and pathways analysis for the Stanleigh Mine Decommissioning Project. Prepared for Rio Algom Limited. Richmond Hill, Canada.

SENES Consultants Limited (SENES). 1994. Consumption of fish and wildlife by Canadian Native People: a quantitative assessment from the published and unpublished literature. Prepared for Hazardous Waste Section, Environmental Health Directorate, Health and Welfare Canada. Richmond Hill, Canada.

Slater, G.L. 2006. Trumpeter Swan (Cygnus buccinator): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Retrieved from: http://www.fs.fed.us/r2/projects/scp/assessments/trumpeterswan.pdf

Smith, J. 2002. "Canis lupus" (On-line), Animal Diversity Web. Retrieved from: http://animaldiversity.ummz.umich.edu/site/accounts/information/Canis_lupus.html

Stephenson, B. 2008. Wildlife notebook series: Lynx. Alaska Department of Fish and Game. Retrieved from: http://www.adfg.alaska.gov/static/education/wns/lynx.pdf

Stirling, I. 2002. Hinterland who's who. Mammal fact sheet: Polar Bear. Environment Canada and Canadian Wildlife Federation. Catalogue number CW69-4/18-2003E-HTML. Retrieved from: http://www.hww.ca/en/species/birds/ptarmigan.html.

Tobias, C. 2011. "Marmota monax" (on-line), animal diversity web. Retrieved from: http://animaldiversity.ummz.umich.edu/accounts/Marmota_monax/

Tobias, T.N. and J.J. Kay. 1994. The bush harvest in Pinehouse, Saskatchewan, Canada. Arctic. Vol. 47. No. 3.

Trigger, B.G. 1994. The original Iroquoians: Huron, Petun, and Neutral, in Aboriginal Ontario – historical perspectives on the First Nations. Dundurn Press Limited. Toronto, Canada.

United States Environmental Protection Agency (U.S. EPA). 1993. Wildlife exposure factors handbook: volume I. U.S. EPA Report U.S. EPA/600/R-93/187. Washington, D.C., USA.

van Zyll de Jong, C.G. 1991. Hinterland who's who. Mammal fact sheet: Woodchuck. Environment Canada and Canadian Wildlife Federation. Catalogue number CW69-4/20-1991E. Retrieved from:http://www.hww.ca/en/species/mammals/woodchuck.html.

Weeden, R.B. 2008. Wildlife notebook series: Ptarmigan. Alaska Department of Fish and Game (ADF&G). Revised by Paragi, T. Retrieved from: http://www.adfg.alaska.gov/static/education/wns/ptarmigan.pdf

Wein, E. and M. Freeman. 1995. Frequency of traditional food use by three Yukon First Nations living in four communities. Arctic. Vol. 48. No. 2. 61 – 171.

Wein, E.E., J.H. Sabry and F.T. Evers. 1991. Food consumption patterns and use of country foods by Native Canadians near Wood Buffalo National Park, Canada. Arctic. Vol. 44. No. 3.

Wheatley, M. 1994. Boreal beavers (Castor canadensis): home range, territoriality, food habits and genetics of a mid-continent population. Unpubl. Ph.D. Thesis, University of Manitoba: 350 pp. Retrieved from: http://www.wilds.mb.ca/taiga/tbspub40.html

Winter, J. 2000. Tobacco use by native North Americans: sacred smoke and silent killer. University of Oklahoma Press. Norman, USA.

Wolever, T., S. Hamad, J. Gittelsohn, A. Hanley, A. Logan, S. Harris and B. Zinman. 1997. Nutrient intake and food use in an Ojibwa-Cree community in Northern Ontario assessed by 24H dietary recall. Nutrition Research. Vol. 17. No. 4.

Wright, J.V. 1994. Before European contact, in Aboriginal Ontario – historical perspectives on the First Nations. Dundurn Press. Toronto, Canada.

Yarnell, R. 1964. Aboriginal relationships between culture and plant life in the upper Great Lakes region. Museum of Anthropology, Anthropological Papers No 23. University of Michigan. Arbor, USA.

APPENDIX A: ESTIMATES – FRACTION OF TME INDOORS/OUTDOORS
(Garisto et al., 2005)

Table A-1: Estimated Fraction of Time Indoors/Outdoors (from Garisto *et al.*, 2005)

Parameter	Winter		Summer	
	Indoor	Outdoor	Indoor	Outdoor
Male, after J. P. Gladu				
Fraction of time slept	0.4		0.3	
Fraction of time for subsistence activities	0.2	0.3	0.2	0.3
Fraction of time traveled		0.1		0.2
Total indoor	0.6	-	0.5	-
Total outdoor	-	0.4	-	0.5
Fraction of time that fire is on indoor	1	-	0.1	-
Fraction of time that a person is exposed to indoor fire (calculated)	0.6	-	0.05	-
Female, estimated				
Fraction of time slept	0.4		0.3	
Fraction of time for subsistence activities	0.4	0.2	0.4	0.3
Fraction of time traveled		0		0
Total indoor	0.8	-	0.7	-
Total outdoor	-	0.2	-	0.3
Fraction of time that fire is on indoor	1	-	0.2	-
Fraction of time that a person is exposed to indoor fire (calculated)	0.8	-	0.14	-

APPENDIX B: ECOLOGICAL PROFILES

Table B-1: Boreal Forest – Ecological Profile

	Fractional Composition of Diet																		Exposure Characteristics									
	Fish		Benthos		Small Mammals		Birds		Invertebrates		Amphibians and Reptiles		Aquatic Plants		Terr. Plants		Soil (g (dw)/d unless otherwise stated)		Sediment		Body Weight (g)		Food Intake (g-dw/d)		Water Intake (L/d)		Inhalation Rate (m^3/d)		Home Range (ha)	
Moose													0.2	1	0.8	1	2% of food ingestion rate	1	2% of food ingestion rate	1	400000	1	8000	1	20	1*	91	2	460 - 26200	1
White-tailed-Deer															1	1	2% of food ingestion rate	1	2% of food ingestion rate	1	75000	1	2250	1*	4.5	1*	23	2	30 - 2435	1
Caribou															1	3	0.03	4			135000	3	3784	2*	8.2	2*	27	2	200000	5
Beaver													0.1	2	0.9	2			0.01	2	24000	2	918	2*	1.7	2*	6.9	2	0.25 – 10.34	6
Muskrat	0.05	1	0.15	1									0.8	1							1000	1	70	1	0.1	1*	0.62	2	0.03 - 0.79	1
Arctic Ground Squirrel															1	7	3	4			800	8,9	56	2*	0.08	2*	0.46	2		
Groundhog															1	7	11	4			4000	7,10	211	2*	0.35	2*	1.7	2		
Black Bear	0.05	1			0.15	1									0.8	1					68000	1	2040	1*	4.08	1*			300 - 114700	1
Lynx					0.9†	11,12	0.1	11,12									13.4	4			10600	11,12	470	2*	0.83	2*	3.6	2		
Mink	0.3	1	0.25	1	0.24	1	0.01	1	0.1	1	0.1	1									820	1	115	1	0.0246	1*			40 - 1100	1
Weasel					0.7	1	0.25	1	0.025	1	0.025	1									89	1	9.79	1*	0.01157	1*			1 - 87	1
Otter	0.8	1	0.15	1	0.05	1															7500	1	225	1	0.6	1*			900 - 23100	1
Red Fox					0.4	1	0.2	1	0.25	1					0.15	1	2.8% of food ingestion rate	1			3800	1	342	1	0.342	1*			280 - 3420	1
Rabbit ** (E.Cottontail)															1	2	0.02	2			1200	2	79	2*	0.12	2*	0.64	2	3.1	2
Mallard Duck			0.4	1					0.05	1			0.5	1	0.05	1	2 - 3.3% of food ingestion rate	1	2 - 3.3% of food ingestion rate	1	1200	1	60	1*	0.072	1*	0.47	2	9.2 - 240	1
Lesser Scaup			0.9	1									0.1	1					0.02	4	707	1	49.5	1*	0.04949	1*	0.33	2	10 - 1710	1
Ruffed Grouse									0.15	1					0.85	1	0.02	2			552	1	33.1	1	0.03864	1*	0.23	2	1.0 - 180	1
Ptarmigan									0.1	9,13, 14,15					0.9	9,13, 14,15	4.2	4			620	9,14	42.6	2*	0.04	2*	0.3	2		
Loon	0.9	1	0.1	1																	5300	1	1007	1	0.159	1*			4.4 - 59	1
Wild Turkey									0.1	9,16,17					0.9	9,16,17	20	4			7400	9	214	2*	0.23	2*	1.9	2		
Partridge									0.02	9,18					0.98	9,18	3.2	4			400	9,18	32	2*	0.03	2*			82 - 672	9

† Lynx: Includes 0.1 contribution from caribou

* Based on allometric equations from the U.S. EPA, 1993

** From Garisto *et al.* (2005)

1. EC, 2012
2. U.S. EPA, 1993
3. Arthur, 2008
4. Beyer *et al.*, 1994
5. Schindler, 2005
6. Wheatley, 1994
7. van Zyll de Jong, 1991
8. EY, 2007
9. NatureServe, 2013
10. Tobias, 2011
11. Stephenson, 2008
12. Fox and Murphy, 2002
13. Aniskowicz, 1994
14. Hannon *et al.*, 1998
15. Weeden, 2008
16. McCullough and Kirschbaum, 2001
17. Eaton, 1992
18. Carroll, 1993

Table B-2: Inland Tundra – Ecological Profile

	Fractional Composition of Diet																		Exposure Characteristics									
	Fish		Benthos (including crustaceans)		Small Mammals		Birds		Invertebrates		Amphibians and Reptiles		Aquatic Plants		Terr. Plants		Soil (g (dw)/d unless otherwise stated)		Sediment		Body Weight (g)		Food Intake (g-dw/d)		Water Intake (L/d)		Inhalation Rate (m^3/d)		Home Range (ha)	
Moose													0.2	1	0.8	1	2% of food ingestion rate	1	2% of food ingestion rate	1	400000	1	8000	1	20	1*	91	2	460 - 26200	1
Musk ox															1	5	0.02	4			250000	5	6272	2*	14	2*	51	2	7000	6
Caribou															1	3	0.03	4			135000	3	3784	2*	8.2	2*	27	2	200000	7
Wolf**					0.78	2	0.22	2									0.01	2			43000	8	1481	2*	2.9	2*	11	2	13000-30000	9
Rabbit (Snowshoe Hare)															1	1	6.3% of food ingestion rate	1			1300	1	78	1	0.13	1*	0.64	2	1.6 - 10.2	1
Arctic Fox**					0.95	2	0.05	2									0.01	2			3750	10	200	2*	0.33	2*	2.2	2	500-6000	10
Red Fox					0.4	1	0.2	1	0.25	1					0.15	1	2.8% of food ingestion rate	1			3800	1	342	1	0.342	1*			280 - 3420	1
Grizzly Bear	0.08	11			0.05	11			0.02	11					0.85	11	0.02	2			225000	11	5752	2*	13	2*	35	2	20000-180000	11
Polar Bear					1	12											0.02	2			350000	12	8264	2*	19	2*	79	2	12550000	13
Harbour Seal**	1	2																	0.02	2	136000	14	3806	2*	8.2	2*	20	2	500	15
Mallard Duck			0.4	1					0.05	1			0.5	1	0.05	1	2 - 3.3% of food ingestion rate	1	2 - 3.3% of food ingestion rate	1	1200	1	60	1*	0.072	1*	0.47	2	9.2 - 240	1
Ruffed Grouse									0.15	1					0.85	1	0.02	2			552	1	33.1	1	0.03864	1*	0.23	2	1.0 - 180	1
Canada Goose															1	2,16	3.1	4			4000	2,14,16	143	2*	0.15	2*	0.9	2	290-2830	17
Swan (Trumpeter)													1	18					0.02	2	7000	19	206	2*	0.22	2*	1.8	2	1.5 to 100	20
Ptarmigan**															1	20	0.02	2			475	21	35.8	2*	0.036	2*	0.23	2	250	22
Partridge									0.02	23,24					0.98	23,24	3.2	4			400	23,24	32	2*	0.03	2*			82 - 672	23

* Based on allometric equations from the U.S. EPA, 1993

** From Garisto *et al.* (2005)

1. EC, 2012
2. U.S. EPA, 1993
3. Arthur, 2008
4. Beyer *et al.*, 1994
5. Gray, 1990
6. Elder, 2005
7. Schindler, 2005
8. Schmidt *and Gilber.*, 1978
9. Smith, 2002
10. Eide *et al.*, 2004
11. Mundy, 1991
12. Stirling, 2002
13. Ferguson *et al.*, 1999
14. NatureServe, 2013
15. Kelly, 2005
16. Mowbray *et al.*, 2002
17. ODEQ, 2004
18. Mitchell, 1994
19. Slater, 2006
20. SENES, 2000
21. Aniskowicz, 1994
22. Giesen and Braun, 1992
23. NatureServe, 2013
24. Carroll, 1993

Table B-3: Southern Canadian Deciduous Forest – Ecological Profile

	Fractional Composition of Diet																		Exposure Characteristics											
	Fish		Benthos (including crustaceans)		Small Mammals		Birds		Invertebrates		Amphibians and Reptiles		Aquatic Plants		Terr. Plants		Soil (g/d unless otherwise stated)		Sediment		Body Weight (g)		Food Intake (g-dw/d)		Water Intake (L/d)		Inhalation Rate (m^3/d)		Home Range (ha)	
Moose													0.2	1	0.8	1	2% of food ingestion rate	1	2% of food ingestion rate	1	400000	1	8000	1	20	1*	91	2	460 - 26200	1
White-tailed Deer															1	1	2% of food ingestion rate	1	2% of food ingestion rate	1	75000	1	2250	1*	4.5	1*	23	2	30 - 2435	1
Beaver													0.1	2	0.9	2			0.01	2	24000	2	918	2*	1.7	2*	6.9	2	0.25 – 10.34	8
Muskrat	0.05	1	0.15	1									0.8	1							1000	1	70	1	0.1	1*	0.62	2	0.03 - 0.79	1
Black Bear	0.05	1			0.15	1									0.8	1					68000	1	2040	1*	4.08	1*			300 - 114700	1
Lynx					0.9†	4,5	0.1	4,5									13.4	3			10600	4,5	470	2*	0.83	2*	3.6	2		
Rabbit** (E.Cottontail)															1	2	0.02	2			1200	2	79	2*	0.12	2*	0.64	2	3.1	2
Mallard Duck			0.4	1					0.05	1			0.5	1	0.05	1	2 - 3.3% of food ingestion rate	1	2 - 3.3% of food ingestion rate	1	1200	1	60	1*	0.072	1*	0.47	2	9.2 - 240	1
Ruffed Grouse									0.15	1					0.85	1	0.02	2			552	1	33.1	1	0.03864	1*	0.23	2	1.0 - 180	1
Loon	0.9	1	0.1	1																	5300	1	1007	1	0.159	1*			4.4 - 59	1
Swan (Trumpeter)													1	6					0.02	2	7000	6	206	2*	0.22	2*	1.8	2	1.5 to 100	7

† Lynx: Includes 0.1 contribution from caribou
* Based on allometric equations from the U.S. EPA, 1993
** From Garisto *et al.* (2005)

1. EC, 2012
2. U.S. EPA, 1993
3. Beyer *et al.* 1994
4. Stephenson, 2008
5. Fox and Murphy, 2002
6. SENES, 2000
7. Slater, 2006
8. Wheatley, 1999

APPENDIX C: LITERATURE REVIEW SUMMARIES

Reference Material Reviewed and Included in the Report:

Berkes, F., P.J. George, R.J. Preston, A. Hughes, J. Turner and B.D. Cummins. 1994. *Wildlife harvesting and sustainable regional native economy in the Hudson and James Bay Lowland, Ontario*. ARCTIC. Vol. 47, No. 4. pp 350-360. December.

The paper develops a methodology to investigate the quantitative importance and economic value of hunting and fishing for the Mushkegowuk region, Hudson and James Bay Lowland. Harvests of wildlife by the 6500 aboriginal residents of eight communities - Moose Factory, Moosonee, New Post, Fort Albany, Kashechewan, Attawapiskat, Peawanuck and Fort Severn - were estimated by means of a questionnaire study.

This study provides potentially useful information on harvest/hunting yeilds (in terms of mass [kg]) and on the populations of these communities, allowing for data to be interpreted on a per-capita basis. Data from this study will be examined and incorporated into the current study.

Chan, H.M., M. Trifonopoulos, A. Ing, O. Receveur and E. Johnson. 1997. *Consumption of freshwater fish in Kahnawake: risks and benefits*. Environmental Research Section A. Vol. 80. Pp S213 - S222.

This document summarizes a comprehensive study to address local concerns regarding health risks from exposure to contaminants associated with consumption of freshwater fish.

The study contains potentially useful information on freshwater fish consumption rates (grams per day) as well as a species list of fish. Data from this study will be examined and incorporated into the current study.

Chan, L., O. Receveur, D. Sharp, H. Schwartz, A. Ing, K. Fediuk, A. Black and C. Tikhonov. 2012. *First Nations food, nutrition and environment study (FNFNES): results from Manitoba (2010)*. Prince George: University of Northern British Columbia.

This study examines a wide range of health related topics (food consumption, lifestyle characterization, health assessment, drinking water analysis, hair anaylsis [for chemical residues], and surface water analysis) affecting aboriginal Canadians living on First Nations reserves across Manitoba.

This study contains potentially useful information on traditional food intake rates and energy intake rates, among other useful data (species lists and lifestyle information). Data from this study will be examined and incorporated into the current study.

This is one of the main studies recommended for inclusion by the Assembly of First Nations (in their review of the Garisto 2005 study).

Daveluy, C. and L. Bertrand. 1991. *A dietary profile of the Cree: report of the Sante Quebec Health survey of the James Bay Cree 1991 – food and nutrient intake*. Government of Quebec. Sante Quebec.

This study documents a large scale assessment and characterization of the dietary profiles of the Cree people of northern Quebec.

This study provides potentially useful information on mean and median intake of energy and nutrients (g/d or mg/d) for different age groups among community members. Data from this study will be examined and incorporated into the current study.

DeGonzague, B., O. Receveur, D. Wedll and H. Kuhnlein. 1999. *Dietary intake and body mass index of adults in 2 Ojibwe communities*. Research. Vol 99, No. 6. Pp 710 – 716.

This study describes and compares dietary intake and prevalence of overweight in a sample of adults in 2 Ojibwe comminities in Minnessota and Wisconsin. Data were acquired through interviews, a twenty-four-hour recall of food consumption, and a sociocultural questionnaire.

The study provides energy intake rates in kcal per day and food intake rates in grams per day; however, the study does not distinguish between food and energy obtained from traditional foods and that obtained from market (store-bought) foods. Data from this study will be examined and incorporated into the current study.

Doyle, J.R., J.M. Blais and P.A. White. 2012. *A survey of the traditional food consumption that may contribute to enhanced soil ingestion in a Canadian First Nation community*. Science of the Total Environment. Vol. 424. pp 104-109. March.

This study assesses and documents the self-sufficient activities and food consumption practiced by a First Nation Community living in a wilderness community in Canada to allow for a comparison with previous qualitative assessments of aboriginal populations and a quantitative mass balance tracer element study of the community conducted concurrently.

Quantitative information is limited to frequency of use, in terms of percentage of meals that or diet that contains traditional food. A list of species most commonly hunted or fished is provided. The species list from this study will be examined and incorporated into the current study.

Harper, B.L., A. Harding, T. Waterhous and S. Harris. 2007. *Traditional tribal subsistence exposure scenario and risk assessment guidance manual.* Prepared for the United States Environmental Protection Agency. August.

This document provides guidance for risk assessors when deriving a study methodology and scenarios for risk assessment of tribal or aboriginal receptors.

The document provides some useful information on energy intakes and food intakes (grams/day) for self-sufficient communities, or communities with diets characterised by very high percentages of traditional foods. Data from this study will be examined and incorporated into the current study.

Indian and Northern Affairs Canada (INAC). 2003. *Northern contaminants program – Canadian Arctic contaminants assessment report Part II human health*. Ottawa.

This document describes a study by Indian and Northern Affairs Canada of contaminants and their effects on human health for First Nations (Yukon), Metis, and Inuit peoples in the arctic.

This study contains potentially useful information on traditional food intake rates and energy intake rates, among other useful data (species lists and lifestyle information). Data from this study will be examined and incorporated into the current study.

Kuhnlein, H. 1984. *Traditional and contemporary Nuxalk foods*. Nutrition Research. Vol. 4. Pp 789 - 809.

This paper presents information collected on the consumption of traditional and contemporary foods at the Nuxalk First Nation. Information was collected through interviews with community members and using 24-hr recalls.

The study contains a potentially useful list of frequently harvested traditional foods, as well as some data on intake rates. Data from this study will be examined and incorporated into the current study.

Mos, L., J. Jack, D. Cullon, L. Montour, C. Alleyne and P. Ross. 2004. *The importance of marine foods to a near-urban First Nation community in coastal British Columbia, Canada: toward a risk-benefit assessment*. Journal of Toxicology and Environmental Health, Part A. Vol. 670. Pp 791 - 808.

This study presents the results of a survey conducted to document the relative importance of traditional foods in the diet of the Sencoten people, as a basis for the future assesment of exposure to, and risk associated with, environmental contaminants (persistant organic pollutants [POPs]) in such a diet.

The study contains a potentially useful list of frequently harvested traditional foods, as well as some data on intake rates (expressed as annual average intakes). Data from this study will be examined and incorporated into the current study.

Schuster, R., M. Gamberg, C. Dickson and H.M. Chan. 2011. *Assessing risk of mercury exposure and nutritional benefits of consumption of caribou (Rangifer tarandus) in the Vuntut Gwitchin First Nation community of Old Crow, Yukon, Canada*. Environmental Research. Vol 111. Pp 881 – 887. May.

This study documents an investigation of mercury content of traditional foods consumed by the Vuntut Gwitchin First Nation including sampling and analysis caribou muscle/meat, liver and kidney tissues.

This study provides potentially useful information on median and 90^{th} percentile intake of caribou meat, kidney and liver in g/person/d. Data from this study will be examined and incorporated into the current study.

Tobias, T. and J. Kay. 1993. *The bush harvest in Pinehouse, Saskatchewan, Canada*. ARCTIC. Vol 47, No. 3. Pp 207 – 221. September.

This paper reports the findings of a harvest survey based on one-year recall. The village's total harvest of fish, mammals, birds, berries, and fuelwood is documented by species from April 1983 through March 1984. Conversion factors were used to translate data into numbers of animals by species (cords for fuelwood), and then to whole and edible weights.

This study provides potentially useful information on harvest/hunting yeilds and allows for data to be interpreted on a per-capita basis. Data from this study will be examined and incorporated into the current study.

Trifonopoulos, M., H. Kuhnlein and O. Receveur. 1998. *Analysis of 24-hour recalls of 164 fourth-to-sixth-grade Mohawk children in Kahnawake*. Research and Professional Briefs. Vol 98, No. 7. Pp 814 – 816.

This study examined food consumption patterns of aboriginal children living in a Canadian boreal forest area. The study included both store-bought and country foods (traditional foods). Data were acquired through interviews with a dietician and using twenty-four-hour recalls of food consumption.

The study provides energy intake rates in kcal per day and food intake rates in grams per day; however, the study does not distinguish between food and energy obtained from traditional foods and that obtained from market (store-bought) foods. Data from this study will be examined and incorporated into the current study.

Tsuji, L., K. Cooper and H. Manson. 2005. *Utilization of land use data to identify issues of concern related to contamination at Site 050 of the Mid-Canada radar line*. Canadian Journal of Native Studies XXV. Vol 2. Pp 491 – 527.

This paper reports the findings of a survey on community members' recreational activity, habitation, work and harvesting activity.

This study provides potentially useful information on commonly harvested species though quantitative information is limited to frequency of use, in terms of percentage (not mass per time [g/d]). A list of species most commonly hunted or fished is provided. The species list from this study will be examined and incorporated into the current study.

Van Oostdam, J., S.G. Donaldson, M. Feeley, D. Arnold, P. Ayotte, G. Bondy, L. Chan, E. Dewaily, C.M. Furgal, H. Kuhnlein, E. Loring, G. Muckle, E. Myles, O. Receveur, B. Tracy, U. Gill and S. Kalhok. 2005. *Human health implications of environmental contaminants in Arctic Canada: a review*. Science of the Total Environment. Vol. 351-352. Pp 165 – 246. March.

The objectives of this paper are to: assess the impact of exposure to current levels of environmental contaminants in the Canadian Arctic on human health (using a risk assessment methodology); identify the data and knowledge gaps that need to be filled by future human health research and monitoring; and examine how these issues have changed since the previous 1999 study by these authors. The paper focuses on exposure to organochloride and metal contaminants in the environment through ingestion of foods characteristic of a northern aboriginal diet.

The exposure assessment component of this study does include information on dietary intakes for actic Aboriginal Peoples. This information is in the form of the number of days-per-week that the top 5 traditional foods are consumed, along with some traditional food intake values (in grams per day). The study also provides a potentially useful species list.

Data from this study will be examined and incorporated into the current study.

Wein, E., J. Henderson-Sabry, F. Evers. 1991. *Food consumption patterns and use of country foods by Native Canadians near Wood Buffalo National Park, Canada*. ARCTIC. Vol 44, No. 3. Pp 196 – 205. September.

This study examined food consumption patterns of native (Indian and Metis) Canadians living in a boreal forest area with access to both store-bought and country foods (traditional foods). Frequency of use was examined by interviews and using twenty-four-hour recalls of individual food consumption.

This study provides potentially useful information on traditional food intake rates (in g/person/d). Data from this study will be examined and incorporated into the current study.

Wein, E., M. Gee and Z. Hawrysh. 1992. *Food consumption patterns of Native school children and mothers in Northern Alberta*. Journal of the Canadian Dietetic Association. Vol 53, No. 4. Pp 267 – 273.

This study examined food consumption patterns of aboriginal children living in a Canadian boreal forest area. The study included both store-bought and country foods (traditional foods). Data were acquired through interviews with a dietician and using twenty-four-hour recalls of food consumption.

The study provides energy intake rates for traditional foods in terms of percentage-of-daily energy intake. Data from this study will be examined and incorporated into the current study.

Wein, E. and M. Freeman. 1995. *Frequency of traditional food use by Thre Yukon First Nations living in four communities*. ARCTIC. Vol 48, No. 2. Pp 161 – 171.

This study documented the frequency of use of traditional food species among 122 adults from three Yukon First Nations. The informants resided in four communities: Haines Junction, Old Crow, Teslin, and Whitehorse. Food patterns were examined in two ways: (1) estimated frequency of household use of traditional food species over a one-year period, and (2) frequency of traditional foods in four daily diet recalls of men and women, collected once per season.

A list of species most commonly hunted or fished is provided. The species list from this study will be examined and incorporated into the current study.

Wolever, T., S. Hamad, J. Gittelsohn, A. Hanley, A. Logan, S. Harris and B. Zinman. 1997. *Nutrient intake and food use in an Jibwa-Cree Community in Northern Ontario assessed by 24-hr dietary recall*. Nutrition Research. Vol 17, No. 4. Pp 603 – 618.

This study documenteds the findings of an insulin tolerance test (blood sample) and dietary nutrition characterization performed on the Sandy Lake First Nations community in Northern Ontario. This study presents data collected as part of the screening phase of the Sandy Lake Health and Diabetes Project initiated in 1992.

The study provides energy intake rates in kcal per day and food intake rates in grams per day; however, the study does not distinguish between food and energy obtained from traditional foods and that obtained from market (store-bought) foods. Data from this study will be examined and incorporated into the current study.

Reference Material Reviewed and Excluded from the Report:

Assembly of First Nations (AFN). 2012. *ANF Report on "Alternative Exposure Groups, Characteristics and Data for the Post-Closure Safety Assessment of a Deep Geological Repository".* Submitted to the Nuclear Waste Management Organization (NWMO). May.

This document outlines the findings of the AFN's review of the NWMO's 2005 report titled "*Alternative Exposure Groups, Characteristics and Data for the Post-Closure Safety Assessment of a Deep Geological Repository".* This report was prepared for the NWMO in 2005 by SENES Consultants Ltd, the lead author is N. Garisto, as such this study is referred to as Garisto (2005).

The AFN report offers guidance and constructive commentary on the Garisto 2005 report. Namely, it mentions a series of documents which should be reviewed and incorporated into the Garisto 2005 study. Though the AFN report highlights areas of improvement and recommends reference documentation, the report itself does not provide quantitative information for use in the update of the Garisto 2005 report.

Berkes, F., Hughes, A., George, P.J., Preston, Cummins, B.D., and R.J.Turner, J. 1995. *The Persistence of Aboriginal Land Use: Fish and Wildlife Havest Areas in the Hudson and James Bay Lowland, Ontario*. ARCTIC. Vol. 48, No. 1. pp 81-93. March.

Wildlife harvesting areas used in 1990 by the Aboriginal People of the Mushkegowuk region, Hudson and James Bay Lowland, were documented and mapped by interviewing hunters from eight communities (Moose Factory, Moosonee, New Post, Fort Albany, Kashechewan, Attawapiskat, Peawanuck and Fort Severn).

Though the study involves hunting and trapping territories, it does not quantitatively characterize food intake rates or amounts, harvest/hunting yeilds, or frequencies.

Chan, L. 2005. *Health and Environment Issues with Canada's Aboriginal Communities.* McGill University. Centre for Indigenous People's Nutrition and Environment. March 31st.

This document focusses on health issues related to chemical toxicity. Environmental contaminants are the primary topic of discussion and their effects on indigenous peoples. No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies is available.

Donaldson, S.G., J. Van Oostdam, C. Tikhonov, M. Feeley, B. Armstrong, P. Ayotte, O. Boucher, W. Bowers, L. Chan, F. Dallaire, R. Dallaire, E. Dewailly, J. Edwards, G.M. Egeland, J. Fontaine, C. Furgal, T. Leech, E. Loring, G. Muckle, T. Nancarrow, D. Pereg, P. Plusquellec, M. Potyrala, O. Receveur and R.G. Shearer. 2010. *Environmental contaminants and human health in the Canadian Arctic*. Science of the Total Environment. Vol. 408. Pp 5165 – 5234. August.

This paper presents the findings of The third Canadian Arctic Human Health Assessment conducted under the Canadian Northern Contaminants Program (NCP), in association with the circumpolar Arctic Monitoring and Assessment Programme (AMAP), addresses concerns about possible adverse health effects in individuals exposed to environmental contaminants through a diet containing country foods.

The objectives here are to: 1) provide data on changes in human contaminant concentrations and exposure among Canadian Arctic peoples; 2) identify new contaminants of concern; 3) discuss possible health effects; 4) outline risk communication about contaminants in country food; and 5) identify knowledge gaps for future contaminant research and monitoring.

While the study provides a wide range of information, quantitative data on traditional food intakes is not presented explicitly. This study refers the reader to other studies for detailed information.

Effects on Aboriginals from the Great Lakes Environment Project (EAGLE). 2001. *Socio-cultural pilot project technical report.* A partnership of the Assembly of First Nations (AFN), Chiefs of Ontario, and Health Canada. May.

This document focusses on socio-cultural impacts related to the Great Lakes. Little to no quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies is available. This reference has already been incorporated into the Garisto (2005) study.

This is one of the main studies recommended for inclusion by the Assembly of First Nations (in their review of the Garisto 2005 study).

First Nations Information Governance Committee and Health Canada (HC). 2005. *First Nations regional longitudinal health survey (RHS) 2002/03 – results for adults, youth and children living in First Nations Communities*. November.

No quantitative values of food intake rates or amounts, harvest/hunting yeilds, or frequencies could be found. Most nutrition information is population-level, namely percentages of First Nations people that consume a "balanced and nutritios" diet, and on what basis. Dietary components are not discussed in details such as intake amounts, rates or frequencies.

This is one of the main studies recommended for inclusion by the Assembly of First Nations (in their review of the Garisto 2005 study).

Fitzgerald, E., S.A. Hwang, K. Brix, B. Bush, K. Cook and P. Worswick. 1995. *Fish PCB concentrations and consumption patterns among Mohawk women at Akwesasne*. Journal of Exposure Analysis and Environmental Epidemiology. Vol. 5, No. 1. Pp 1 - 19.

This paper describes a study conducted to determine concentrations of PCBs in local fish and to establish patterns of fish consumption of nursing Mohawk women residing near three industrial hazardous waste sites. The study included interviews with commonity members as well as fish sampling.

The study characterizes fish consumption only broadly, for example, by recording the total number of meals consumed per-year that countained local fish, and by breaking the sample group into categories such “1-9 meals per year”. It does not characterize the quantity of fish in the meals, and it does not provide intake rates/amounts in terms of mass per time or harvest/hunting yeilds.

Gamberg, M. *et al*. 2005. *Spatial and temporal trends of contaminants in terrestrial biota from the Canadian Arctic*. Science of the Total Environment. 351-352. pp. 148-164.

This document focusses on establishing contaminant loads in terrestrial species in the Canadian arctic.

No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies could be found.

Health Canada and the McGill Centre for Indigenous Nutrition and the Environment (CINE). 2005. *Network for Aboriginal environmental health research workshop – final report*. Prepared for the Health Canada First Nations and Inuit Health Branch (FNIHB). May.

The study focusses on how to involve First Nations better in reaserch, and, on how to best establish a consolidated or formalized network/agency/body to organize and oversee all First-Nations-related research accross Canada.

No information on food intake rates or amounts, harvest/hunting yeilds, or frequencies. The only diet related information offered by the study is that consumption of fish is the leading cause of contaminant intake by First Nations people, though, no quantitative values or further characterization is given.

Health Canada. 2010. *Federal contaminnated site risk assessment in Canada – supplemental guidance on human health risk assessment for country foods.* Health Canada Contaminated Sites Division. Safe Environments Directorate. October.

This document provides general guidance on human health assessments involving country food components, but, provides no nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies.

The document does list numerous references for the reader to investigate for potentially useful information on dietary intakes and composition of country (traditional) foods for Aboriginal Peoples.

Heaslip, R. 2008. *Monitoring salmon aquaculture waste: the contribution of First Nations' rights, knowledge, and practices in British Columbia, Canada*. Marine Policy. 32. pp. 988-996.

This document focusses on British Columbia's approach to monitoring salmon aquaculture waste and how the salmon aquaculture industry affects the First Nations.

No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies could be found.

Hermanson, M.H. and J.R. Brozowski. 2005. *History of Inuit community exposure to lead, cadmium, and mercury in sewage lake sediments*.

This document focusses on First Nations community exposure to heavy metals as a result of ingestion and inhalation.

No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies could be found.

Hermanson, M.H. *et al*. 2010. *History of Inuit community excretion of polychlorinated biphenyls recorded in sewage lake sediments.* Chemosphere. 78. pp. 1322-1328.

This document focusses on community exposure to polychlorinated byphenols as a result of ingestion.

No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies could be found.

Hubbs-Tait, L. *et al*. 2005. *Neurotoxicants, micronutrients and social environments: individual and combined effects of children's development*. Psychological Science in the Public Interest. 6-3. pp. 57-121.

This document focusses on child development in the presence of neurotoxins.

No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies could be found.

Kwiatkowski, R.E. 2011. *Indigenous community based participatory research and health impact assessment: a Canadian example*. Environmental Impact Assessment Review 31. pp. 445-450.

This document focusses on why First Nations and Inuit community involvement is important in Health Canada policy making.

No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies could be found.

La Corte, E. and S. Wuttke. 2012. *The First Nations biomonitoring initiative – FNBI*. International Journal of Hygiene and Environmental Health. 215. pp. 168-171.

This document focusses on establishing a biomonitoring framework specific to First Nations communities living on reserves. The document describes the proposed study's approach to monitor health issues related to chemical toxicity, diet, and lifestyle (e.g. weight).

No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies could be found.

Lavangie, J.C. 2009. *A bottom up approach to evaluate risk assessment tools for drinking water safety in First Nations Communities.* October.

This document focusses on criteria for evaluating risk assessment approaches as they apply to First Nations drinking water.

No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies could be found.

Liberda, E.N. 2007. *Concentrations and latitudinal variations of PBDEs in First Nation Peoples of the James Bay Region.*

This document focusses on the concentration of PBDEs in animals.

No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies could be found.

Liberda, E.N. *et al*. 2011. *Dietary exposure of PBDEs resulting from a subsistence diet in three First Nation communities in the James Bay Region of Canada.* Environment International. 37. pp. 631-636.

This document focusses on the dietary exposure to PBDEs of First Nations communities in James Bay Region. Dietary information for this study were taken from Health Canada 2007 and Tsuji *et al* 2007.

No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies could be found.

McAuley, C. and L.D. Knopper. 2011. *Impacts of traditional food consumption advisories: compliance, changes in diet and loss of confidence in traditional foods.* Environmental Health. 10:55.

This document focusses on the impact that food consumption advisories have on First Nations people.

No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies could be found.

Muir, D., F. Shearer, J. Van Oostdam, S. Donaldson and C. Furgal. 2005. *Contaminants in Canadian arctic biota and implications for human health: conclusions and knowledge gaps.* Science of the Total Environment. Vol 351-352. Pp 539-546. October.

This paper summarizes the major findings of a number of individual papers dealing with the issue of contaminant levels in arctic biota, and from the special issue entitled Contaminants in Canadian Arctic Biota and Implications for Human Health. Information on contaminants in biota is primarily from the Canadian arctic as well as from Alaska, Greenland and the European Arctic. Temporal and spatial trends are examined and potential biological effects on wildlife are assessed.

The paper does not discuss topics that relate to First Nations diet and consumption of traditional foods.

Nitschke, C. 2008. *The cumulative effects of resource development on biodiversity and ecological integrity in the Peace-Moberly region of Northeast British Columbia.* Biodiversity Conservation. Vol 17. Pp 1715-1740. March.

Using habitat modeling and GIS analysis the effects of 35 years of agricultural and industrial development on forest biodiversity and ecological integrity were investigated for a 410,000 ha landscape in north-eastern British Columbia. The study examines the effects and attempts to quantify them from a landscape point of view.

The paper does not discuss topics that relate to First Nations diet and consumption of traditional foods.

Page., J. 2007. *Salmon farming in First Nations' Territories: a case of environmental injustice on Canada's West Coast.* Local Environment. Vol 12, No. 6. Pp 613-626. December.

This paper examines issues surrounding salmon aquaculture practices on First Nations' land on Canada's West Coast. It developes arguments (sociological and qualitative) that salmon aquaculture operations situated in First Nations' claimed territories on Canada's West Coast create issues environmental, political, social, and medical in nature.

The paper discusses topics that relate to First Nations diet and consumption of traditional foods, but does not quantitatively characterize food intake rates or amounts, harvest/hunting yeilds, or frequencies.

Pal, S. 2009. *The association between persistent organic pollutants, type-2 diabetes, and insulin resistance in two First Nations communities in Northern Ontario.* Thesis submitted to the Faculty of Graduate and Postdoctoral Studies University of Ottawa.

This document examines the potential associations between environmental contaminants and diabetes/insulin resistance using surveys and blood samples from community members of Wapekeka and Kasabonika. Diet is not discussed in detail (and not in a quantitative manner) as it relates to traditional foods.

Richmond, C., S.J. Elliott, R. Matthews and B. Elliott. 2005. *The political ecology of health: perceptions of environment, economy, health and well-being among 'Namgis First Nation'.* Health and Place. Vol 11. pp. 349 – 365.

This paper investigates First Nation's perceptions of the links between environment, economy and health and well-being. A case study of Namgis First Nation (Alert Bay, British Columbia, Canada) is used to explore the risks and benefits of salmon aquaculture for British Columbia's First Nations.

The study mentions traditional foods only broadly, in the context of traditionally harvest foodstocks (salmon) being impacted by aquaculture activities. The paper does not discuss First Nations' people's diet.

Richmond, C. and N. Ross. 2008. *The determinants of First Nation and Inuit Health: a critical population health approach.* Health and Place. Vol 15. pp. 403 – 411.

The study examines the use of a critical popultion health approach to explore the determinants of health in rural and remote First Nations and Inuit communities and to conceptualize the pathways by which environmental dispossession affects these health determinants and the members of the communities.

The study mentions traditional foods and diet only broadly, and not in a quantitative manner. It does not quantitatively characterize food intake rates or amounts, harvest/hunting yeilds, or frequencies.

Seabert, T. 2012. *Dietary markers and contaminant exposures are correlated to wild food consumption in two Northern Ontario First Nations communities*. Thesis submitted to the Faculty of Graduate and Postdoctoral Studies University of Ottawa.

The study reviews current literature to determine if there is a case for examingin the presence of toxins in traditional foods and in the environment as a possible risk factor for Type-2 diabetes in Canadian Aboriginal Peoples.

The study characterizes traditional foods and diet only broadly, through the use of survey results recording the number of community members that consume 'wild food' meals: once per day or more, once per day or less, once per week or less, once per week or more. It does not quantitatively characterize the types of food included in 'wild food' meals, or food intake rates/amounts (in terms of mass per time), harvest/hunting yeilds, or frequencies.

Sharp, D. 2009. *Environmental toxins, a potential risk factor for diabetes among Canadian Aboriginals*. International Journal of Circumpolar Health. Vol. 68: 4. Pp 316-326.

The study reviews current literature to determine if there is a case for examingin the presence of toxins in traditional foods and in the environment as a possible risk factor for Type-2 diabetes in Canadian Aboriginal Peoples.

Though the study involves traditional foods and diet, it does not quantitatively characterize food intake rates or amounts, harvest/hunting yeilds, or frequencies.

Stout, R., T. Dionne Stout and R. Harp. 2009. *Maternal and infant health and the physical environment of First Nations and Inuit communities: a summary review.* Prepared for the British Columbia Centre for Excellence for Women's Health (BCCEWH) and the Prairie Women's Health Centre of Excellence (PWHCE). April.

This document provides brief summaries of individual studies largely focussing on chemical and toxicity testing of pregnant mother blood and breast-milk, as well as infant blood for levels of contaminants. Some studies examine levels of contaminants in blood and their relationship to known sources of nearby contamintion (such as nearby waste facilities) and the effectiveness of fish-consumption-advisories.

No quantitative nutritional information such as food intake rates or amounts, harvest/hunting yeilds, or frequencies is available.

Tsuji, L., H. Manson, B. Wainman, E. Vanspronsen, J. Schecapio-Blacksmith and T. Rabbitskin. 2007. *Identifying potential receptors and routes of contaminant exposure in the traditional territory of the Ouje-Bougoumou Cree: Land use and a geographical information system*. Environmental Monitoring Assessment. Vol. 127. pp 293-306. August.

The study defines the traditional hunting territories and harvested animal species of the Oje-Bougoumou Cree, and uses GIS technology to map these areas and overlap them against areas with known environmental contamination.

Though the study involves hunting and trapping territories and traditional food use, it does not quantitatively characterize food intake rates or amounts, harvest/hunting yeilds, or frequencies.

The study does provide a list of animals sought after by the Oje-Bougoumou Cree through hunting, fishing, and trapping activities.

Tsuji, L., B. Wainman, I. Martin, C. Sutherland, J.P. Weber, P. Dumas and E. Nieboer. 2008. *Lead shot contribution to blood lead of First Nations people: The use of lead isotopes to identify the source of exposur*e. Science of the Total Environment. Vol. 405. pp 180-185. June.

The study investigates the blood lead levels of members of a First Nations community and their relationship with lead shot used to hunt (and subsequently consume) wild game birds.

Though the study mentions that all participants did consume wild game birds as traditional food, it does not characterize food intake rates or amounts, harvest/hunting yeilds, or frequencies.

Tyrrell, M. 2006. *Making sense of contaminants: a case study of Arviat, Nunavut*. ARCTIC vol. 59, No.4. pp 370-380. April.

The study describes a case study in one coastal Arctic community: Arviat. The paper investigates the issues surrounding contaminants in the environment, their effects on human health and the perception of these effects, and the concerns of members of the community.

Some information is available on harvest/hunting yeilds along with population data, though it is limited. Since the current study includes an *Inland* Tundra receptor group, as opposed to a *Coastal* Tundra group, the information from a coastal community is not applicable.

Wein, E. and M. Freeman. 1992. *Inuvialuit food use and food preferences in Aklavik, Northwest Territories, Canada*. Medical Science. Vol. 51. pp 159-172.

The study describes annual frequency of use and degree of pereference of traditional foods in households of Aklavik, Northwest Territories. Values are compared between adult members and children.

The study does not provide food intake rates, or harvest yeilds, or population data. The data available from the study are frequency of use of different types of traditional foods, but there is no description of how much (e.g. grams/day) is consumed at any given occurence. Data are also available on the food preferences of community members (adults and children).