Human Health Risk Assessment

Mercury in Fish in Central Alberta

Lac la Nonne and Lac Ste Anne

March 2009

For more information on Fish Consumption Advisories
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Executive Summary

Mercury enters the environment through various natural processes and human activities. Methylmercury is transformed from inorganic forms of mercury via methylation by microorganisms in natural waters, and can accumulate in some fish. Humans are exposed to very low levels of mercury directly from the air, water and food. Fish consumers may be exposed to relatively higher levels of methylmercury by eating mercury-containing fish from local rivers and lakes. Methylmercury can accumulate in the human body over time. Because methylmercury is a known neurotoxin, it is necessary to limit human exposure.

Lac la Nonne and Lac Ste Anne are two large lakes in Central Alberta. The First Nations and Métis net licenses are issued for Lac la Nonne and Lac Ste Anne. Local anglers can harvest northern pike, yellow perch, burbot and cisco on Lac la Nonne and lake whitefish, yellow perch and burbot on Lac Ste Anne. Recreational boaters and cottage owners are access to the lakes as well. Health Canada, Alberta Energy and Natural Resources and Alberta Environment issued fish consumption advisories for Lac la Nonne in the early 1990's. The advisories were published in the *Alberta Guide to Sportfishing Regulation* annually.

In September 2008, Department of Sustainable Resource and Development (SRD) collected fish from Lac la Nonne and Lac Ste Anne. In January 2009, Alberta Health and Wellness analyzed the data for human health risk assessment.

This report deals with (1) concentrations of total mercury levels in walleye and northern pike, (2) estimation of exposures, (3) fish consumption limits, (4) fish consumption advisories, and (5) health benefits of fish consumption. The results indicate that:

1. Concentrations of total mercury in fish from these two lakes in Central Alberta were within reported ranges for the same fish species from the rivers and lakes elsewhere in Canada and the United States.
2. The estimated human exposures were high for the high fish intake group (over 100 g/d) who consume walleye and northern pike, especially from Lac la Nonne.
3. Restriction of consumption of walleye and northern pike from these two lakes was indicated by the risk assessment, especially for women of reproductive age, pregnant women and young children.
4. Fish consumption advisories are voluntary measures to reduce potential health risk to local fish consumers. The balance between risk and benefits of consumption of mercury-containing fish needs to be understood and considered by consumers.

The Science Advisory Committee reviewed this document and made recommendations. The Public Health Management Committee made final decisions on fish consumption advisories and measures to inform the public accordingly.

Acknowledgments

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1. Introduction

Mercury (Hg) occurs naturally in the environment. There are three forms of mercury: elemental (metallic) mercury, inorganic mercury salts and organic mercury compounds. Mercury enters the environment through natural processes and human activities. The form of mercury most commonly found in the air is elemental mercury. Methylmercury (MeHg) is often formed from other forms of mercury during natural biological processes such as methylation by microorganisms in the water and sediment. MeHg can accumulate in some fish. People are exposed to very low levels of mercury in the air, water and food. Some people may be exposed to relatively higher levels of MeHg through eating mercury-containing fish. MeHg accumulates in the human body over time. Because MeHg is a known neurotoxin, it is necessary to limit human exposure.

To protect public health, Health Canada has proposed a few mercury guidelines, and advisories for different fish consumer groups (Health Canada,1979; Feeley and Lo, 1998; Health Canada 2007, Feeley 2008) based on total mercury (THg). These values are expressed either in units of μg THg per g of fish flesh or as a TDI in units of μg THg per kg of consumer body mass per day (see Section 2.1):

1. 0.5 μg THg/g for all commercial fish/seafood (Guideline);
2. 0.2 μg THg/kg bw/d Tolerable Daily Intake (TDI) for women of reproductive age and children (Guideline);
3. 0.47 μg THg/kg bw/d TDI for the general population (Guideline);
4. 1.0 μg THg/g for certain commercial fish species such as fresh and frozen tuna, shark, swordfish, escolar, marlin and orange roughy which are known to be consumed less frequently (Advisory); and
5. 0.2 μg THg/g for subsistence consumers (Advisory).

The guidelines for commercial fish/seafood are used as a general screening criterion, with the knowledge that most species of commercial fish usually contain lower levels (< 0.1 μg/g) of mercury. This guideline is enforceable by the Canadian Food Inspection Agency (CFIA). For example, the CFIA has been monitoring total mercury (THg) levels in commercial fish caught from Lake Athabasca in Alberta since the early 1990s. The recommendation for subsistence consumers proposed by the First Nations and Inuit Health Branch of Health Canada is used for the First Nations and Inuit people relying on subsistence fresh water fishing when they became aware of long-term fish consumption patterns of over 100 g/d (Health Canada 1979). The First Nations and Inuit consumers should limit their fish consumption if the mercury levels over 0.2 μg THg/g and under 0.5 μg THg/g.

Fish consumption advisories are developed based on these TDIs. These advisories provide the public warning of potential health risk resulting from consuming local mercury-containing fish. Fish consumption advisories are designed to minimize the

potential health risks to fish consumers who can voluntarily restrict their fish consumption.

Lac la Nonne and Lac Ste Anne are two large lakes in Central Alberta and located between Lac Ste. Anne County and Barrhead County, north-west from Edmonton (Figure 1). The First Nations and Métis net licenses are issued for Lac la Nonne and Lac Ste Anne. Local anglers can harvest northern pike, yellow perch, burbot and cisco on Lac la Nonne and lake whitefish, yellow perch and burbot on Lac Ste Anne. Recreational boaters and cottage owners are access to the lakes as well.

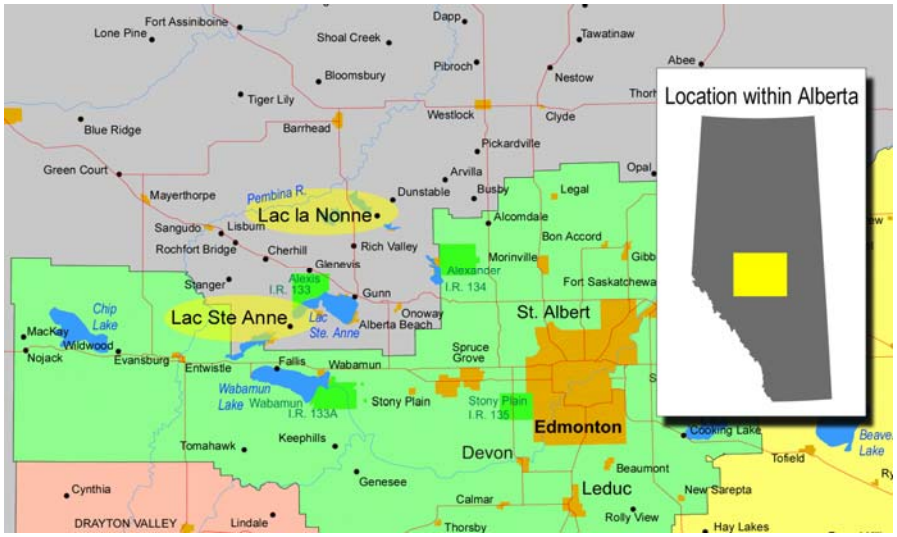

Figure 1 Location of Lakes

In 1980s, Alberta Environmental Centre with the Fish and Wildlife Division conducted surveys of contaminants including mercury in fish tissue in Lac la Nonne. Based on the results of these surveys, Health Canada, Alberta Energy and Natural Resources and Alberta Environment issued fish consumption advisories in the early 1990's. The advisories were published in the *Alberta Guide to Sportfishing Regulation* annually.

In September 2008, Department of Sustainable Resource and Development (SRD) collected fish from Lac la Nonne and Lac Ste Anne. In January 2009, Alberta Health and Wellness analyzed the data for human health risk assessment.

The results from this survey are discussed as follows:

1. mercury concentrations in fish,
2. comparison of mercury concentrations in the same fish species in the rivers and lakes in Canada and the U.S.,
3. local fish consumption rates,
4. estimated exposures for women at reproductive age, children and adults,
5. fish consumption advisories, and
6. health benefits of fish consumption.

2. Materials and Methods

2.1 Units Used for Expressing Mercury Data

A summary of the different units that may be used for expressing relevant mercury data is provided in Table 1. For the purposes of this report, to facilitate comparison of values reported from different sources, all data on mercury concentration in fish will be expressed as μg of mercury per g of fish, i.e. μg/g, which is equivalent to one unit of mercury per million units of fish (ppm). Likewise, human exposure will be expressed as μg of mercury per kg of human body mass, per day, i.e. μg/kg/d. Consumption advisories will be determined from human exposure limits and expressed as g of fish consumed per week, i.e. g/wk.

Table 1 Units Used for Expressing Mercury Data related to Fish

Measure	Preferred Unit	Alternate Unit	Equivalent Units
Hg Concentration	μg of Hg per g of fish, wet weight **μg/g**	mg of Hg per kg of fish, wet weight **mg/kg**	1 part Hg per million parts of fish **ppm**
TDI for mercury by humans	μg of Hg per kg of human body weight (mass) per day **μg Hg/ kg BW/ d**		
Recommended fish consumption limits	g / mercury-containing fish fillet consumed per week **g / wk**	oz / mercury-containing fish fillet consumed per week **oz / wk**	1 oz = 28.35 g

2.2 Field Collection

The field collection was conducted by Sustainable Resource Development on September 9 and 10, 2008. Fish were collected by gill-netting. Each sample was kept on ice, and then frozen flat within 5 hours at - 20 °C. Samples were individually bagged and tagged with a label with a unique number. The samples were submitted to Alberta Health Services for testing. Fish species included

- walleye (*Sander vitreus*)
- northern pike (*Esox lucius*)

A total of 26 fish from Lac la Nonne and a total of 22 fish from Lac Ste Anne were collected for total mercury analysis. The sample size, and mean of weight and fork length are summarized in Table 2.

Table 2 Sample Size and Mean of Weight and Length

	Year	Sample Size Total	Fork Length (cm)	Wet Weight (g)
Lac la Nonne				
Walleye	2008	19	44	801
Northern pike	2008	7	55	1006
Lac Ste Anne				
Walleye	2008	20	43	671
Northern pike	2008	2	60	1192
		48		

2.3 Laboratory Analysis

Laboratory analysis was performed in the ALS Laboratory in Edmonton. The analytical method was based on the modified USEPA methods 200.7 and 200.8 (USEPA 1994, 2001).

2.4 Estimation of Exposure Ratio

Estimated daily intake (EDI) was calculated as follows:

EDI = C * IR *BF/BW

C is measured THg concentrations in fish muscle (μg/g). From a human health perspective, the amount of MeHg is of most interest. In mercury analyses of fish, the sum of THg in the sample is measured rather than MeHg because the analysis of MeHg is more expensive. Some studies reported that the percentage of MeHg in THg ranged from 81% to 95% (CFIA 2003). For the purposes of health risk assessments, 100% of THg is assumed to be MeHg thereby erring on the side of caution.

IR is fish consumption rate (g/d).

BF is bioavailability factor (assuming 100%).

BW is average body weight in humans (kg). The average of body weight for male and female adults in Alberta is 73 kg. The average human body weights used by Health Canada are 65 kg for women of reproductive age, 26.4 kg for 5-11 years group and 14.4 kg for 1-4 years group (Health Canada 2007).

Exposure ratio (ER, unitless) was calculated by using the following equation:

ER= EDI/TDI

The tolerable daily intake (TDI, μg Hg/kg bw/d) is determined by toxicological risk assessment on mercury (Health Canada 2007). The TDI for mercury is the maximum amount of mercury that can be ingested on a daily basis over a lifetime without increased risk of adverse health effects. Health Canada proposed a TDI of mercury as 0.2 μg Hg/kg bw/d for women of reproductive (childbearing) age and for children. Children refer to two age groups: 5-11 years old group and 1-4 years old group. Health Canada proposed a TDI of mercury as 0.47 μg Hg/kg bw/d for adults (adult men and adult women who are not of reproductive age).

2.5 Consumption Limits

For quantitative fish advisories, the lifetime average consumption limits (weekly basis) are calculated. The calculation of the consumption limits (CR, g fish per week) is based on the following equation:

CR = TDI * BW (7 d/wk) / C

Where TDI is tolerable daily intake (μg Hg/kg bw/d),
BW is body weight (mass) in humans (kg), and
C (μg Hg / g fish) is the measured THg concentration in fish muscle.

The consumption limits that correspond to the Health Canada TDI and the commercial fish Hg recommendation (maximum concentration of 0.5 μg Hg /g fish) are provided below as a reference point.

Consumption Limits for adult men and adult women not of reproductive age
CR = (0.47μg Hg/kg bw/d)(73 kg)(7 d/wk) / (0.5 μg Hg / g fish) = 480 g fish /week

Consumption Limits for women of reproductive age
CR = (0.2μg Hg/kg bw/d)(65 kg)(7 d/wk) / (0.5 μg Hg / g fish) = 180 g fish /week

Consumption Limits for children age 5 – 11 (body weight 26.4 kg)
CR = (0.2μg Hg/kg bw/d)(26.4 kg)(7 d/wk) / (0.5 μg Hg / g fish) = 74 g fish /week

Consumption Limits for children age 1 – 4 (body weight 14.4 kg)
CR = (0.2μg Hg/kg bw/d)(14.4 kg)(7 d/wk) / (0.5 μg Hg / g fish) = 40 g fish /week

3. Results and Discussions

3.1 Concentrations in Fish

The total mercury concentrations in wet weight in fish are summarized in Table 3. The average THg levels were 0.63 μg/g in walleye collected from Lac la Nonne and 0.56 μg/g in northern pike. The average THg levels were 0.13 μg/g in walleye collected from Lac Ste Anne and 0.14 μg/g in northern pike. The average THg concentrations in Canadian market fish reported by Health Canada ranged from 0.02 to 1.82 μg/g (Health Canada 2007). Compared to Canadian market fish for different fish species, mean THg concentrations in local fish in two lakes in Central Alberta were within the ranges of Canadian market fish.

Table 3 Total Mercury Levels (μg/g, wet weight) in Fish

Species	Mean	Min	Max
Lac la Nonne			
Walleye	**0.63**	0.17	1.17
Northern pike	**0.56**	0.25	0.73
Lac Ste Anne			
Walleye	0.13	0.06	0.17
Northern pike	0.14	0.12	0.15

THg concentrations exceeding the 0.5 μg/g commercial fish limit are showed in **bold**.

Mean THg levels for walleye and northern pike from other water bodies in Canada and the U.S. reported in the literature are summarized in Table 4. Mean THg concentrations for the same fish species in the water bodies in Lac la Nonne and Lac Ste Anne were well within the ranges for the same fish species reported in the literature for other North American freshwater fish.

Mean THg concentration in fish fillets varied in other lakes, rivers and reservoirs in Canada and the U.S. The highest mean mercury levels in walleye and northern pike in the water bodies in eastern and northern Canada ranged from 1.00 to 2.98 μg/g. High levels tended to be found in larger, older fish. Fish absorb MeHg directly through their gills or through the consumption of prey which contain mercury. MeHg is tightly bound to proteins in all fish tissue resulting in larger, older fish containing higher mercury (Munn and Short 1997, Neumann and Ward 1999). In this survey, the fish caught were generally in the larger size group (Table 2).

Table 4 Mean THg Concentrations in Fish Muscles Reported in the Literature

Species	Mean (μg/g, ww)	Location	Reference
Walleye	0.05 – 0.99	18 Lakes, Northern Glaciated Plains, US	Selch et al. 2007
	0.19 – 0.30	Reservoirs, Manitoba, Canada	Bodaly et al. 2007
	0.42 – 2.98	Wabigoon River system*, Ontario, Canada	Kinghorn et al. 2007
	0.98 – 1.00	19 undisturbed lakes, Haute Mauricie, Quebec, Canada	Garcia and Carignan, 2005
	1.29 – 3.73	18 disturbed lakes, Haute Mauricie, Quebec, Canada	Garcia and Carignan, 2005
	0.759	lakes, rivers and reservoirs in northeastern of US and Canada (N=19,178)	Kamman et al. 2005
	0.58	Great Lakes, US	Gerstenberger and Dellinger, 2002
	0.47	Lakes in Northern Canada	Lockhart et al. 2005
	0.05 – 1.34	Canadian Arctic, Canada	Braune et al. 1999
	0.32 – 1.26	29 Lakes in the La Grande complex watershed, Quebec, Canada	Verdon et al. 1991
	0.19 – 1.43	Mackenzie River Basin Lakes	Evans et al. 2005 a
Northern Pike	0.26 – 0.32	Reservoirs, Manitoba, Canada	Bodaly et al. 2007
	0.44 – 2.10	Wabigoon River, Ontario, Canada	Kinghorn et al. 2007
	1.00 – 2.55	19 undisturbed lakes, Haute Mauricie, Quebec, Canada	Garcia and Carignan, 2005
	1.90 – 6.44	18 disturbed lakes, Haute Mauricie, Quebec, Canada	Garcia and Carignan, 2005
	0.645	lakes, rivers and reservoirs in northeastern of US and Canada (N=19,178)	Kamman et al. 2005
	0.16 – 1.1	Mackenzie River Basin, Canada	Evans, et al. 2005a
	0.12 – 0.74	Mackenzie River Basin, Canada	Evans, et al. 2005b
	0.378	Lakes in Northern Canada	Lockhart et al. 2005
	0.623 – 1.51	Yukon River, Kuskokwim River, US	Jewett et al. 2003
	0.11 – 0.63	Canadian Arctic, Canada	Braune et al. 1999
	0.25 – 0. 90	29 Lakes in the La Grande complex watershed, Quebec, Canada	Verdon et al. 1991
	0.108	Lakes in Northern Canada	Lockhart et al. 2005
	0.06 – 0.32	29 Lakes in the La Grande complex watershed, Quebec, Canada	Verdon et al. 1991

* The highest reported levels reflect current recovery levels in the highly contaminated Clay Lake system that received over 10 tonnes of mercury discharge from a chlor-alkalai plant from 1962 to 1970.

Trophic level is a major factor in mercury accumulation in predatory (fish-eating) fish through biomagnifications (Cabana et al. 1994). Bottom-feeding species may accumulate high mercury concentrations from direct contact with contaminated sediment or by eating benthic invertebrates and epibenthic organisms. Predatory fish species may accumulate and biomagnify mercury concentrations via several trophic levels of the food chains (Suedel et al. 1994). Predators are commonly used as good indicators of mercury contamination. In this survey, the higher mercury levels were observed in walleye and northern pike. Northern pike and walleye are highly piscivorous predatory fish.

3.2 Local Fish Consumption Rates

Three surveys of fish consumption patterns were conducted in communities of Central Alberta between 1997 and 2000. The first survey was conducted by Alberta Health and Wellness in Swan Hills communities in 1997 (AHW 1997). The second survey was conducted by the First Nations and Inuit Health Branch (FNIHB) of Health Canada for the First Nations people living in the Lesser Slave Lake area in 1999 (Health Canada 1999). The third survey was conducted by the Environmental Health Sciences Program at the University of Alberta for the residents living in the communities near the Athabasaca River and tributaries at Hinton (EHSUA 2000).

Fish consumption rates in different intake groups from these surveys are summarized in Table 5. A small proportion of local fishers and the First Nation people consumed local fish over 100 grams per day. Five percent of the First Nations people in the Lesser Slave Lake communities were high consumers who ate local fish at an average of 273 g/d, much higher than the 2% of those in Swan Hills communities who were high consumers at an average of 167 g/d and those in the communities nearby Hinton who were high consumers at an average rate of 121 g/d. The local fish consumption rates in the survey of the Lesser Slave Lake were similar with the results of the Swan Hills survey in medium, low and very low intake groups. The majority of local fish consumers (85%-92%) consumed fish at a low rate of 1.0 - 15 g/d. The majority of the First Nations group (81%) consumed fish at a low rate of 1.6 – 13 g/d.

Table 5 Local Fish Consumption Rates in Communities of Central Alberta

Intake	**Subsistence Consumer** Lesser Slave Lake*		**Local Fish Consumer** Swan Hills		**Local Fish Consumer** Athabasaca River	
Group	mean (g/d)	%** (n=125)	mean (g/d)	% (n=127)	mean (g/d)	% (n=45)
High (>100g/d)	273	5	167	2	121	2
Medium (30-99 g/d)	46	14	47	13	51	6
Low (5-29 g/d)	13	38	13	28	15	26
Very Low (< 4g/d)	1.6	43	2	57	1.0	66

* mean from Phase I and Phase II studies (Health Canada 1999). ** % of surveyed population

The most common fish species consumed by the surveyed populations were rainbow trout, northern pike, walleye, lake whitefish, and lake trout by the First Nations people in the Lesser Slave Lake communities, walleye, northern pike, perch, brook trout, lake whitefish and arctic grayling by the residents in Swan Hills communities, and rainbow trout, arctic grayling, mountain whitefish, northern pike and walleye by the residents in the communities nearby Hinton.

The results from the above surveys were derived from adults only. Fish consumption rates could vary in different subpopulations (USEPA 2000). Children may consume larger quantities compared to their body weight than adults. Prenatal exposure may occur through pregnant women. For the purpose of risk management, these subpopulations are considered as potential high risk groups for exposure to mercury from fish consumption.

3.3 Estimated Exposures

Exposure ratios were estimated for consuming walleye and northern pike. Estimated exposure ratios based on the TDIs from Health Canada are summarized in Table 6 for women of reproductive age and adults. Specific fish consumption rates were not available for women at reproductive age and young children. As a result, the estimation of exposures for young children was not performed. The fish consumption rate for all adults was used for estimating exposures for women at reproductive age.

In general, the estimated exposure ratios were greater than one for the high intake group, especially for a subpopulation of women of reproductive age if consuming predatory fish like the larger walleye and northern pike. The values of TDIs were derived from risk assessment approaches with many assumptions and uncertainties. The risk assessment is specifically designed to avoid underestimating risk. The results do not mean that specific individuals or populations face inevitable or even likely health consequences from mercury exposure. An estimated exposure ratio greater than one should be used as a reference point for making risk management decision. In particular, those exposure scenarios with an exposure ratio greater than one warrant closer attention including the provision of information about maximum recommended fish consumption to allow individual consumers the opportunity to make risk-informed choices.

Many factors influence the estimated exposure levels such as body weight and consumption rates. The body weight of 73 kg used in this assessment was derived from the 1994 National Populations Health survey in Alberta adults. In this report, the age-specific body weights for women at reproductive age and young children in Alberta were not available. The average body weights used by Health Canada were 65 kg for women at reproductive age, 26.4 kg for 5-11 years old group, and 14.4 kg for 1-4 years old group. The consumption rates used in this report were based on three surveys in adults living in Central Alberta. The estimated exposure was solely based on fish from local specific sources. People may also be exposed to mercury from market fish and other market food items.

Table 6 Estimated Exposure Ratios

	Local Consumer High Intake (170 g/d)	**Local Consumer** Medium Intake (50 g/d)	**Subsistence Consumer** High Intake (270 g/d)
Women at Reproductive Age			
Lac la Nonne			
Walleye	8.1	2.3	12
Northern pike	7.1	2.0	13
Lac Ste Anne			
Walleye	1.6	<1.0	2.6
Northern pike	1.7	<1.0	2.8
Adults			
Lac la Nonne			
Walleye	3.1	<1.0	5.0
Northern pike	2.7	<1.0	4.4
Lac Ste Anne			
Walleye	<1.0	<1.0	<1.0
Northern pike	<1.0	<1.0	<1.0

Note: mean of total mercury listed in Table 3; body weight = 65 kg; TDI = 0.2 μg/kg bw/d for women, TDI = 0.47 μg/kg bw/d for adults

3.4 Consumption Limits

For the purpose of quantitative fish advisories, the lifetime consumption limits were calculated for subgroups of women, young children and adults (Table 7). These consumption limits were specific to fish species and site. The values provide the information on the maximum amount of local fish that can be safely consumed on a weekly basis for a lifetime by subpopulations. Fish preparation and cooking methods do not reduce the concentrations of total mercury in fish (Morgan et al. 1997).

Table 7 Lifetime Fish Consumption Limits

Species	**THg***	**Women**		**Children (5-11 yr)**		**Children (1-4 yr)**		**Adults**	
	μg/g	g/w	oz/w	g/w	oz/w	g/w	oz/w	g/w	oz/w
Lac la Nonne									
Walleye	0.63	140	5	60	2	30	1	380	13
Northern pike	0.56	160	6	70	2	35	1	400	15
Lac Ste Anne									
Walleye	0.13	700	26	300	10	150	6	-	-
Northern pike	0.14	700	26	300	10	150	6	-	-

Note: mean of total mercury is an average level from all years, body weight = 73 kg for adults, 65 kg for women, 26.4 for children 5 – 11 yr, and 14.4 kg for children 1 – 4 yr; TDI = 0.2 μg/kg bw/d for women at reproductive age and young children, and 0.47 μg/kg bw/d for adults.

Walleye from Lac la Nonne should be limited for consumption at the lower amounts of 140 grams per week for women of reproductive age, 60 grams per week for children at age of 5 – 11 years old, and 30 grams per week for children at age of 1 – 4 years old. Northern pike from Lac la Nonne should be limited for consumption at the amounts of 160 grams per week for women of reproductive age, 70 grams per week for children at age of 5 – 11 years old, and 35 grams per week for children at age of 1 – 4 years old.

Walleye and northern pike from Lac Ste Anne should be limited for consumption at the lower amounts of 700 grams per week for women of reproductive age, 300 grams per week for children at age of 5 – 11 years old, and 150 grams per week for children at age of 1 – 4 years old.

3.5 Fish Consumption Advisories

Fish consumers may be exposed to MeHg by consuming locally-caught fish. MeHg is rapidly absorbed after ingestion and distributed throughout the body (WHO 1990). MeHg in the body is relatively stable and can cross the placental and blood/brain barriers (Kerper et al. 1992). The half-life of MeHg in the human body varies from 44 to 80 days (USEPA 2000). MeHg leaves the human body via urine, feces and breast milk. Small amounts of ingested MeHg are eliminated from the body with no overall adverse effects. At the high exposure levels, MeHg produces a variety of health effects. Larger amounts of MeHg may damage the nervous system. Neurotoxicity may occur in the developing embryo or fetus during pregnancy, young children and adults. As a result, it is prudent to reduce MeHg exposure for women of reproductive age and younger children. The TDIs proposed by Health Canada are intended to protect susceptible populations.

Because mercury occurs naturally, mercury is found in all commercial or non-commercial fish and other foods at low levels. People are exposed to very low levels of mercury via sources such as breathing the air, mercury amalgam dental fillings and eating other foods. Alberta Health and Wellness conducted a survey of mercury levels in blood, urine and hair in adults and children living in the Wabamun Lake and surrounding area communities in 2006 (AHW 2006). The survey found that the average levels of total mercury in blood, urine and hair in Alberta participants were lower than people living in other areas and countries.

MeHg levels are high enough in some fish species in some rivers and lakes that limitation of fish consumption is warranted. Although fish consumers may be exposed to relatively higher levels of MeHg if they eat large amounts of local mercury-containing fish, the results from three surveys from Northern Alberta indicated that local fish consumption is not the primary source of dietary mercury intake for most surveyed populations.

In order to protect all human consumers, issuing fish consumption advisory is one risk management option. Fish consumption advisories are designed to reduce potential health risks to consume for local fish consumers. Advisories should provide the necessary information to the public, so that local fish consumers can voluntarily restrict their fish

consumption to a level judged to be safe. Fish consumption advisories elicit voluntary actions unlike mandatory measures such as catch and release regulations or outright fishing bans which restrict consumer actions.

Since the early 1990s, some fish consumption advisories related to mercury have been issued and published in the *Alberta Guide to Sportfishing Regulation* annually. In Alberta, the provincial government is responsible for issuing and reviewing fish consumption advisories for non-commercial fish. The Ministries of Alberta Environment (then including the current Department of Sustainable Resource and Developments) and Alberta Health and Wellness established the process to issue food consumption advisories in 1997. The advisories can take the form of non-consumption or restricted-consumption advisories for adults and sensitive subpopulations.

3.6 Benefits of Fish Consumption

The benefits and risk of fish consumption is a recent focus of public health interests. Fish is an important source of nutrition for people, because it contains beneficial nutrients like the long-chain omega-3 fatty acids like eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), vitamin D, selenium and iodine. Fish is considered an excellent source of high quality protein. The benefits of fish consumption include the prevention of cardiovascular diseases, myocardial infarction (heart attack) and arrhythmia, especially reduction of risk for ischemic heart disease and stroke (Zhang et al. 1999; Chan and Egeland 2004; Bouzanc et al. 2005; Cohen et al. 2005; Koning et al. 2005; Kris-Etherton et al. 2005; Stern 2005). Health Canada reviewed the evidence showing an association between reduced risk of sudden cardiac death and fish consumption frequency at least once per week (Health Canada 2007). In one case-control study, researchers found that the reduced risk of myocardial infarction with fish consumption of at least one meal per week was not diminished by mercury (Hallgren et al. 2001). In contrast, one population-based cohort study found that the higher mercury levels in human hair samples attenuated the benefits of the omega-3 fatty acids (Virtanen et al. 2005).

Fish consumption is important for neurodevelopment in infant and young children. DHA is an integral structural component of the brain and essential nutrient for pregnant women. DHA can be easily and rapidly absorbed into the developing fetal brain during gestation and in the early years of life of young children (Dovydaitis 2008). DHA was found to improve the visual-motor development in healthy term infants (Uauy et al. 2003; Oken et al. 2008). Some studies showed that fish consumption can increase a child's intelligence quotient (Helland et al. 2003; Cohen et al. 2005a; Dunstan et al. 2008). Meanwhile, the Cohen et al. (2005b) analysis indicated that sufficient prenatal exposure to MeHg could decrease a child's intelligence quotient. A cohort studies found that maternal fish consumption was associated with subtle neurodevelopment deficits in children (Debes et al. 2006). In another study, researchers found that the benefits of the modest fish consumption (1-2 servings per week) for women of reproductive age outweighed the potential risks from exposure to MeHg in fish (Mozaffarian and Rimm, 2006). Although

scientific evidence in the literatures does not adequately demonstrate causation, evidence suggests that there are benefits from fish consumption, but consuming high amount of Hg-containing of fish should be avoided. (Mozaffarian and Rimm 2006; Domingo 2007; Mahaffey et al. 2008; Oken and Bellinger 2008).

From a nutritional perspective, regular fish consumption is beneficial to the general population. From toxicological perspective, fish is associated with environmental contaminants like methylmercury, which pose a potential threat to humans. Fish consumers are often confused by the conflicting message. People appeared to be influenced more strongly by the danger message (toxicological risk of mercury) as compared to beneficial (nutritional) message (Verbeke et al. 2008). Following the issue of some national fish consumption advisories in the U.S. in 2001, some pregnant women reduced their fish consumption (Oken et al. 2003). Communication to the public about the competition between benefits and risks is important to include in a fish consumption advisory. Fish consumption advisories should enable people to make informed decision about what is a safe amount of fish consumption in order to address risks posed by environmental hazards, and to optimize the nutritional benefits of fish consumption with regard to preventing of certain lifestyle health conditions and improving of neurodevelopment in infant and young children.

Establishment of guidelines for fish consumption is an important public health practices. The American Heart Association recommended fish consumption of at least two servings per week (125 g uncooked fish per serving) (Levenson and Axelrad 2006). For commercial fish, Health Canada's current advice is provided in Canada's Food Guide. For large predatory fish, adults can eat up to 150 g per week. Women who are or may become pregnant and breastfeeding mothers can eat up to 150 g per month. Young children between 5 and 11 years of age can eat up to 125 g per month. Very young children between 1 and 4 years of age should eat no more than 75 g per month of large predatory fish species.

Because fish consumers can ingest both omega-3 fatty acids and MeHg. MeHg may attenuate the beneficial effects from the omega-3, the balance between the risks and benefits of consuming mercury-containing fish needs to be considered before issuing local fish consumption advisories (Mergler et al. 2007). For local fish, the fish-species-specific, site-specific consumption limits were calculated in this report. If local residents in Central Alberta do not consume commercial fish every day, recommended consumption amounts for different groups are presented in Table 8.

Table 8 Recommended Fish Consumption Amount

Fish		Water Body	Consumption Limit (g/week)			
Hg (μg/g)	**Species**		**Women**	**Children 1-4 yr**	**Children 5-11 yr**	**Adult**
> 0.5	WE	Lac la Nonne	avoid	avoid	avoid	400
	NP					400
0.1 – 0.5	WE	Lac Ste Anne	700	150	300	-
	NP		700	150	300	-

Note: WE = Walleye, NP = Northern Pike; Women = women at reproductive age and pregnant women.

4. Conclusions

Concentrations of total mercury in walleye and northern pike collected from Lac la Nonne and Lac Ste Anne in Central Alberta were within the ranges reported in the literature for the same fish species from other rivers and lakes elsewhere in Canada and the U.S. The higher mercury levels (over 0.5 μg/g) were observed in large piscivorous (predatory) fish such as walleye and northern pike in Lac la Nonne as is expected based on North American monitoring results elsewhere and our current understanding of how mercury contamination occurs in fish.

The estimated mercury exposures warranted limitation of consumption for the higher fish intake group (over 100 grams per day), especially if they consumed walleye and northern pike. Restriction of consumption was indicated for specific groups such as women of reproductive age, pregnant women and young children (Table 8). Because the guideline of mercury in retailed fish proposed by Health Canada is 0.5 μg/g, women at reproductive age and younger children should avoid eating these fish and healthy adults should limit fish consumption when the mercury levels in fish from Lac la Nonne were over 0.5 μg/g. Because the mercury levels in fish from Lac Ste Anne were between 0.1 - 0.5 μg/g, people in specific groups should limit fish consumption and healthy adults may eat unlimited amount of fish. Fish consumption advisories apply to local First Nations residents and recreational anglers.

Fish consumption advisories promote voluntary reductions in consumption to minimize potential health risk to local fish consumers. The balance between potential health risk and health benefits of consumption of mercury-containing fish needs to be considered.

The Science Advisory Committee reviewed the human health risk assessment document. The recommendations are made as below:

1. Recommended consumption limits for Alberta fish consumers to make informed decision;
2. Balance the healthy benefits of fish consumption; and
3. Continue to regularly monitor mercury levels in fish in Lac la Nonne and Lac Ste Anne, including walleye, northern pike and other fish species that are commonly consumed by local residents.

Provincial Chief Medical Officer issued the fish consumption advisories (Appendix). The information of new advisories is published in the *Alberta Guide to Sportfishing Regulation* and posted in Alberta government websites.

5. References

1. AHW (Alberta Health and Wellness). Mercury in fish from six rivers in Southern Alberta. AEC84-R2. Vegreville, Alberta:Alberta Environmental Centre,1984.

2. AHW (Alberta Health and Wellness). Swan Hills Special Waste Treatment Centre - Human Health Impact Assessment. Edmonton, Alberta, Canada:1997.

3. AHW (Alberta Health and Wellness). Wabamun and Area Community Exposure and Health Effects Assessment Program. Edmonton, Alberta, Canada:Alberta Health and Wellness,2006.

4. Bodaly RA, St Louis VL, Paterson MJ, Fudge RJ, Hall BD, Rosenberg DM, Rudd JW. Bioaccumulation of mercury in the aquatic food chain in newly flooded areas. Met Ions Biol Syst 34:259-287 (1997).

5. Bodaly RA, Jansen WA, Majewski AR, Fudge RJ, Strange NE, Derksen AJ, Green DJ. Postimpoundment time course of increased mercury concentrations in fish in hydroelectric reservoirs of northern Manitoba, Canada. Arch Environ Contam Toxicol 53:379-389 (2007).

6. Bouzan C, Cohen JT, Connor WE, Kris-Etherton PM, Gray GM, Konig A, Lawrence RS, Savitz DA, Teutsch SM. A quantitative analysis of fish consumption and stroke risk. Am J Prev Med 29:347-352 (2005).

7. Braune B, Muir D, DeMarch B, Gamberg M, Poole K, Currie R, Dodd M, Duschenko W, Eamer J, Elkin B, Evans M, Grundy S, Hebert C, Johnstone R, Kidd K, Koenig B, Lockhart L, Marshall H, Reimer K, Sanderson J, Shutt L. Spatial and temporal trends of contaminants in Canadian Arctic freshwater and terrestrial ecosystems: a review. Sci Total Environ 230:145-207 (1999).

8. Bryski M. Water Management Project in Southern Alberta. Personal communication.

9. Cabana G, Tremblay A, Rasmussen JB. Pelagic food chain structure in Ontario Lakes: a determinant of mercury levels in Lake Trout. Canadian Journal of Fisheries and Aquatic Sciences 51:381-389 (1994).

10. Canadian Food Inspection Agency (CFIA). Draft Sablefish Mercury Report - Investigation of mercury in B.C. Sablefish sampled between October 2002 and November 2003. Unpublished document.2003.

11. Chan HM, Egeland GM. Fish consumption, mercury exposure, and heart diseases. Nutr Rev 62:68-72 (2004).

12. Cohen JT, Bellinger DC, Connor WE, Kris-Etherton PM, Lawrence RS, Savitz DA, Shaywitz BA, Teutsch SM, Gray GM. A quantitative risk-benefit analysis of changes in population fish consumption. Am J Prev Med 29:325-334 (2005).

13. Cohen JT, Bellinger DC, Connor WE, Shaywitz BA. A quantitative analysis of prenatal intake of n-3 polyunsaturated fatty acids and cognitive development. Am J Prev Med 29:366-374 (2005).

14. Cohen JT, Bellinger DC, Shaywitz BA. A quantitative analysis of prenatal methyl mercury exposure and cognitive development. Am J Prev Med 29:353-365 (2005).

15. Debes F, Budtz-Jorgensen E, Weihe P, White RF, Grandjean P. Impact of prenatal methylmercury exposure on neurobehavioral function at age 14 years. Neurotoxicol Teratol 28:536-547 (2006).

16. Domingo JL. Omega-3 fatty acids and the benefits of fish consumption: is all that glitters gold? Environ Int 33:993-998 (2007).

17. Dovydaitis T. Fish consumption during pregnancy: an overview of the risks and benefits. J Midwifery Womens Health 53:325-330 (2008).

18. Dunstan JA, Simmer K, Dixon G, Prescott SL. Cognitive assessment of children at age 2(1/2) years after maternal fish oil supplementation in pregnancy: a randomised controlled trial. Arch Dis Child Fetal Neonatal Ed 93:F45-F50 (2008).

19. EHSUA (Environmental Health Sciences Program UoA. Development of A Fish Consumption Advisory Risk Communication/Public Participation Protocol for Alberta: A Case Study in Athabasaca River and Tributaries.unpublished, internal report,2000.

20. Evans MS, Muir D, Lockhart WL, Stern G, Ryan M, Roach P. Persistent organic pollutants and metals in the freshwater biota of the Canadian Subarctic and Arctic: an overview. Sci Total Environ 351-352:94-147 (2005).

21. Evans MS, Lockhart WL, Doetzel L, Low G, Muir D, Kidd K, Stephens G, Delaronde J. Elevated mercury concentrations in fish in lakes in the Mackenzie River Basin: the role of physical, chemical, and biological factors. Sci Total Environ 351-352:479-500 (2005).

22. Feeley MM, Lo M-T. Risk Assessment for Mercury in Health Canada - Development of the Provisional Tolerable Daily Intake (pTDI) Value. In: Proceedings of the Conference on Mercury in Eastern Canada and the Northeast States, 21-23 September, 1998 (Pilgrim W, Burgess N, Giguère M-F, eds).www.eman-rese.ca/eman/reports/publications/98_mercury2/oralpresentations_day2.html#head2_1,1998.

23. Feeley MM. Health Canada Mercury Guidelines. Personal communication.

24. Garcia E, Carignan R. Mercury concentrations in fish from forest harvesting and fire-impacted Canadian Boreal lakes compared using stable isotopes of nitrogen. Environ Toxicol Chem 24:685-693 (2005).

25. Gerstenberger SL, Dellinger JA. PCBs, mercury, and organochlorine concentrations in lake trout, walleye, and whitefish from selected tribal fisheries in the Upper Great Lakes region. Environ Toxicol 17:513-519 (2002).

26. Hallgren CG, Hallmans G, Jansson JH, Marklund SL, Huhtasaari F, Schutz A, Stromberg U, Vessby B, Skerfving S. Markers of high fish intake are associated with decreased risk of a first myocardial infarction. Br J Nutr 86:397-404 (2001).

27. Health Canada. Methylmercury in Canada. Exposure of Indian and Inuit Residents to Methylmercury in the Canadian Environment. Ottawa:Ministry of National Health and Welfare, Medical Services Branch,1979.

28. Health Canada. Human Health Risk Assessment of Mercury in Fish and Health Benefits of Fish Consumption. Ottawa, Canada:Health Canada,2007.

29. Helath Canada. Lesser Slave Lake Health Study.Unpublished, Medical Service Branch, Health Canada,1999.

30. Helland IB, Smith L, Saarem K, Saugstad OD, Drevon CA. Maternal supplementation with very-long-chain n-3 fatty acids during pregnancy and lactation augments children's IQ at 4 years of age. Pediatrics 111:e39-e44 (2003).

31. Jewett SC, Zhang X, Naidu AS, Kelley JJ, Dasher D, Duffy LK. Comparison of mercury and methylmercury in northern pike and Arctic grayling from western Alaska rivers. Chemosphere 50:383-392 (2003).

32. Kamman NC, Burgess NM, Driscoll CT, Simonin HA, Goodale W, Linehan J, Estabrook R, Hutcheson M, Major A, Scheuhammer AM, Scruton DA. Mercury in freshwater fish of northeast North America--a geographic perspective based on fish tissue monitoring databases. Ecotoxicology 14:163-180 (2005).

33. Kerper LE, Ballatori N, Clarkson TW. Methylmercury transport across the blood-brain barrier by an amino acid carrier. Am J Physiol 262:R761-R765 (1992).

34. Kinghorn A, Solomon P, Chan HM. Temporal and spatial trends of mercury in fish collected in the English-Wabigoon river system in Ontario, Canada. Sci Total Environ 372:615-623 (2007).

35. Konig A, Bouzan C, Cohen JT, Connor WE, Kris-Etherton PM, Gray GM, Lawrence RS, Savitz DA, Teutsch SM. A quantitative analysis of fish consumption and coronary heart disease mortality. Am J Prev Med 29:335-346 (2005).

36. Kris-Etherton PM, Harris WS, Appel LJ. Fish consumption, fish oil, omega-3 fatty acids, and cardiovascular disease. Arterioscler Thromb Vasc Biol 23:e20-e30 (2003).

37. Levenson CW, Axelrad DM. Too much of a good thing? Update on fish consumption and mercury exposure. Nutr Rev 64:139-145 (2006).

38. Lockhart WL, Stern GA, Low G, Hendzel M, Boila G, Roach P, Evans MS, Billeck BN, Delaronde J, Friesen S, Kidd K, Atkins S, Muir DC, Stoddart M, Stephens G, Stephenson S, Harbicht S, Snowshoe N, Grey B, Thompson S, DeGraff N. A history of total mercury in edible muscle of fish from lakes in northern Canada. Sci Total Environ 351-352:427-463 (2005).

39. Mahaffey KR, Clickner RP, Jeffries RA. Methylmercury and omega-3 fatty acids: co-occurrence of dietary sources with emphasis on fish and shellfish. Environ Res 107:20-29 (2008).

40. Mergler D, Anderson HA, Chan LH, Mahaffey KR, Murray M, Sakamoto M, Stern AH. Methylmercury exposure and health effects in humans: a worldwide concern. Ambio 36:3-11 (2007).

41. Morgan JN, Berry MR, Graves RL. Effects of commonly used cooking practices on total mercury concentration in fish and their impact on exposure assessments. J Expo Anal Environ Epidemiol 7:119-133 (1997).

42. Mozaffarian D, Rimm EB. Fish intake, contaminants, and human health: evaluating the risks and the benefits. JAMA 296:1885-1899 (2006).

43. Munn MB, Short TM. Spatial heterogeneity of mercury bioaccumulation by walleye in Franklin D. Roosevelt Lake and the Upper Columbia River, Washington. Trans Am Fish Soc 126:477-487 (1997).

44. Neumann RM, Ward SM. Bioaccumulation and biomagnification of mercury in two warmwater fish communities. J Freshwater Ecol 14:487-494 (1999).

45. Oken E, Kleinman KP, Berland WE, Simon SR, Rich-Edwards JW, Gillman MW. Decline in fish consumption among pregnant women after a national mercury advisory. Obstet Gynecol 102:346-351 (2003).

46. Oken E, Radesky JS, Wright RO, Bellinger DC, Amarasiriwardena CJ, Kleinman KP, Hu H, Gillman MW. Maternal fish intake during pregnancy, blood mercury levels, and child cognition at age 3 years in a US cohort. Am J Epidemiol 167:1171-1181 (2008).

47. Oken E, Bellinger DC. Fish consumption, methylmercury and child neurodevelopment. Curr Opin Pediatr 20:178-183 (2008).

48. Selch TM, Hoagstrom CW, Weimer EJ, Duehr JP, Chipps SR. Influence of fluctuating water levels on mercury concentrations in adult walleye. Bull Environ Contam Toxicol 79:36-40 (2007).

49. Stern AH. A review of the studies of the cardiovascular health effects of methylmercury with consideration of their suitability for risk assessment. Environ Res 98:133-142 (2005).

50. Suedel BC, Boraczek JA, Peddicord RK, Clifford PA, Dillon TM. Trophic transfer and biomagnification potential of contaminants in aquatic ecosystems. Rev Environ Contam Toxicol 136:21-89 (1994).

51. Uauy R, Hoffman DR, Mena P, Llanos A, Birch EE. Term infant studies of DHA and ARA supplementation on neurodevelopment: results of randomized controlled trials. J Pediatr 143:S17-S25 (2003).

52. USEPA. Trace Elements In Water, Solids, And Biosolids By Inductively Coupled Plasma-Atomic Emission Spectrometry. EPA-821-R-01-010. Washington DC:Office of Sciences and Technology, USEPA,2001.

53. USEPA (United States Environmental Protection Agency). Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories II Risk Assessment and Fish Consumption Limits. EPA 823-B-00-008. Washington, DC:Office of Sceince and Technology, Office of Water, USEPA,2000.

54. Verbeke W, Vanhonacker F, Frewer LJ, Sioen I, De Henauw S, Van Camp J. Communicating Risks and Benefits from Fish Consumption: Impact on Belgian Consumers' Perception and Intention to Eat Fish. Risk Anal (2008).

55. Verdon R, Brouard D, Demers C, Lalumiere R, Laperle M, Schetagen R. Mercury evolution (1978-1988) in fishes of the La Grande Hydroelectric complex, Quebec, Canada. Water, Air, and Soil Pollution 56:405-417 (1991).

56. Virtanen JK, Voutilainen S, Rissanen TH, Mursu J, Tuomainen TP, Korhonen MJ, Valkonen VP, Seppanen K, Laukkanen JA, Salonen JT. Mercury, fish oils, and risk of acute coronary events and cardiovascular disease, coronary heart disease, and all-cause mortality in men in eastern Finland. Arterioscler Thromb Vasc Biol 25:228-233 (2005).

57. WHO (World Health Organization). Methylmercury. Geneva:World Health Organization,1990.

58. Zhang J, Sasaki S, Amano K, Kesteloot H. Fish consumption and mortality from all causes, ischemic heart disease, and stroke: an ecological study. Prev Med 28:520-529 (1999).

Appendix

News Release

Alberta News release

February 2, 2009

Fish Consumption Limit Established for Lac la Nonne and Lac Ste. Anne

PUBLIC HEALTH ADVISORY

After reviewing results of recent testing for mercury in walleye and northern pike taken from Lac la Nonne and Lac Ste. Anne, Alberta's Acting Chief Medical Officer of Health, Dr. Richard Musto, has issued a public health notice about eating fish from these lakes. Albertans are advised as follows:

Lac la Nonne:

- Women of child bearing age and children 1 - 11-years-old should avoid eating walleye and northern pike.
- Healthy adults may eat walleye and northern pike up to 400 grams (2.5 cups, 13 oz) per week.

Lac Ste. Anne:

- Women of childbearing age may eat walleye and northern pike up to 700 grams (4.5 cups, 23 oz) per week.
- Children 1 - 4-years-old may eat walleye and northern pike up to 150 grams (1 cup, 5 oz) per week.
- Children 5 - 11-years-old may eat walleye and northern pike up to 300 grams (2 cup, 10 oz) per week.
- Healthy adults may eat unlimited quantities of walleye or northern pike.

“While levels of methylmercury identified do not pose an immediate threat, limiting consumption in this way is a prudent measure,” said Dr. Richard Musto, Alberta’s Acting Chief Medical Officer of Health. “When dealing with issues that may even remotely affect public health, it is best to err on the side of caution. I am therefore advising that precautionary measures be taken to minimize potential longer-term health risks.”

This advisory is based on test results received by Alberta Health and Wellness from Alberta Sustainable Resource Development and Alberta Health Services from fish samples collected in these lakes.

For more information on this health advisory, please call Surveillance and Environmental Health, Alberta Health and Wellness at 780-427-4518 between the hours of 8:15 a.m. and 4:30 p.m., Monday to Friday.

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Media inquiries north of Red Deer may be directed to:
John Tuckwell, Communications, Alberta Health and Wellness, 780-427-7164

Media inquiries in Red Deer and south may be directed to:
Howard May, Communications, Alberta Health and Wellness, 403-660-1870

Media inquiries for Dr. Richard Musto, please contact:
Don Stewart, Communications, Alberta Health Services, 403-943-1210

To call toll free within Alberta dial 310-0000.

Alberta

Backgrounder

February 2, 2009

Questions and Answers

What is methylmercury?

Mercury is a naturally occurring element found in rocks, soils, water and air. Mercury is released into the air naturally, and from household and industrial wastes such as burning coal. Mercury in the air returns to the ground with the rain and snow. Once in a lake, mercury is converted to methylmercury by bacteria or chemical reactions. Mercury in fish in Lac la Nonne and Lac Ste Anne likely originates from natural sources.

How does methylmercury get into fish?

Fish absorb methylmercury from water as it passes through their gills, or from the prey they eat. It is likely that all fish contain small amounts of mercury because mercury is a naturally occurring element. However, large predatory fish like walleye and northern pike accumulate more methylmercury as they consume smaller fish. Methylmercury is found in all fish tissues, including meat. Methylmercury is easily absorbed by humans when eating fish. There is no method of cooking or cleaning fish which reduces the amount of mercury in a meal.

What are the potential health risks of eating mercury-contaminated fish?

Methylmercury builds up in your body over time. Small amounts of mercury can be safely eliminated, but large amounts of mercury in the body may damage the nervous system. An unborn baby is more sensitive to mercury poisoning due to rapid brain development during this period.

What are the health benefits of eating fish?

Fish is an important source of nutrition, particularly for pregnant women and young children, because it contains omega-3 fatty acids. Omega-3 fatty acids and other nutrients such as selenium, potassium, iodine and vitamins are important for the developing brain of the fetus, infants and young children. Health Canada recommends eating at least two servings (2 x 75 grams) of fish per week for a healthy pregnancy.

What levels of methylmercury are safe to eat?

Health Canada makes different mercury recommendations for different consumer groups:

- 0.5 parts per million (ppm) for people who infrequently eat commercially-produced fish and seafood;
- 0.2 ppm for those people who eat fish on a regular day to day basis.

For people eating fish caught in local lakes and rivers, the amount of fish that can be consumed is called the "Tolerable Daily Intake" (TDI). The TDI is an estimate of the amount of a chemical contaminant in food that can be eaten daily over a lifetime without posing a potential health risk. For the First Nations consumers, the First Nations and Inuit Health Branch (FNIHB) of Health Canada recommended to limit the fish consumption if the consumers eat large amounts of fish and the mercury levels in fish were over 0.2 ppm and under 0.5 ppm.

Why the fish consumption advisory?

The Government of Alberta is responsible for issuing and reviewing fish consumption advisories for fish caught from local water bodies. Fish consumption advisories enable people to make informed decisions about what is a safe amount of fish that can be consumed, balancing potential health risks and known health benefits of eating fish. Fish consumption advisories can tell the public which fish should be eaten less or should not be eaten at all depending on the mercury levels in particular species.

Can I eat fish caught from Lac la Nonne?

Mercury levels measured in walleye and northern pike caught from Lac la Nonne in 2008 were higher than the 0.5 ppm guideline. Women of childbearing age and young children less than 11-years-old should avoid eating walleye and northern pike from this lake. Adults may eat up to 400 grams of walleye and northern pike each week.

Can I eat fish caught in Lac Ste Anne?

Mercury levels measured in walleye and northern pike caught from Lac Ste Anne in 2008 were less than 0.5 ppm and 0.2 ppm guidelines. People may eat walleye and northern pike as follows:

- up to 700 grams per week for women of childbearing age;
- 150 grams per week for children 1 - 4-years-old, and 300 grams per week for children 5 - 11-years-old;
- Healthy adults may eat unlimited amounts of walleye and northern pike.

Can I eat other fish species caught from Lac la Nonne or Lac Ste Anne?

Currently there are no mercury monitoring data for burbot, yellow perch and lake whitefish from these lakes. AHW in collaboration with Sustainable Resources Development will pursue further sampling and advise accordingly.

Are there other Lakes in Alberta that contain Fish Consumption Advisories for Mercury?

Currently there are Mercury advisories for the following fish:

- Eastern Brook Trout in Chrystina Lake and Edith Lake
- Northern Pike in Edwards Lake
- Walleye and Northern Pike in Helena, Hilda and Ironwood Lakes
- Walleye in Lac La Nonne
- Walleye and Northern Pike in Moose and Muskwa Lakes

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