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Childhood lead exposure and housing sources: Does a problem exist in Ontario?

Position paper and resolution adopted by the Ontario Public Health Association (OPHA)

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Resolutions

Resolution 1

WHEREAS lead is a known and undisputed developmental neurotoxin; and,

WHEREAS the exposure profile of lead has shifted and U.S. data indicates that housing can be the primary source of lead exposure for young children; and,

WHEREAS the Canada Mortgage and Housing Corporation identifies housing built before 1960 as a potential source of lead exposure for children; and,

WHEREAS 26% of homes in Canada were built prior to 1960; and,

WHEREAS there are few well designed Canadian studies which have specifically assessed children at risk of lead exposure due to residential sources; and,

WHEREAS a recent Health Canada survey of Ottawa homes found *interior* dust lead concentrations in amounts that would exceed provincial guidelines for residential soil lead levels;

THEREFORE BE IT RESOLVED THAT the OPHA encourage the Ontario Ministry of Health and Long-term Care to fund a pilot study that specifically addresses residential sources of lead in relation to children's blood lead levels; and, THAT the OPHA ask to be involved in the development of the protocol for this pilot study.

Resolution 2

WHEREAS lead is a known and undisputed developmental neurotoxin; and,

WHEREAS the exposure profile of lead has shifted and U.S. data indicates that housing can be the primary source of lead exposure for young children; and,

WHEREAS 26% of homes in Canada were built prior to 1960; and,

WHEREAS there are few well-designed Canadian studies which have specifically assessed children at risk of lead exposure due to residential sources;

WHEREAS a recent Health Canada survey of Ottawa homes found *interior* dust lead concentrations in amounts that would exceed provincial guidelines for residential soil lead levels; and,

WHEREAS the Canada Mortgage and Housing Corporation identifies housing built before 1960 as a potential source of lead exposure for children; however this figure is not based on Canadian data; there has been no large scale survey of Canadian homes to determine residential sources of lead;

THEREFORE BE IT RESOLVED THAT the OPHA seek the support of the CPHA, to encourage Health Canada to undertake a national survey to investigate residential sources of lead

in Canadian housing and to determine the vintage of housing that poses the greatest risk of lead exposure.

Resolution 3

WHEREAS lead is a known and undisputed developmental neurotoxin; and,

WHEREAS the exposure profile of lead has shifted and U.S. data indicates that housing can be the primary source of lead exposure for young children; and,

WHEREAS the Canada Mortgage and Housing Corporation identifies housing built before 1960 as a potential source of lead exposure for children; and,

WHEREAS 26% of homes in Canada were built prior to 1960; and,

WHEREAS a recent Health Canada survey of Ottawa homes found *interior* dust lead concentrations in amounts that would exceed provincial guidelines for residential soil lead levels; and,

WHEREAS there are no Canadian standards for lead in interior dust;

WHEREAS there is very strong evidence to indicate a linear relationship between interior dust lead levels and children's blood lead levels;

THEREFORE BE IT RESOLVED THAT the OPHA collaborate with the Canadian Public Health Association (CPHA) and the Canadian Partnership for Children's Health and the Environment (CPCHE), to encourage the Canadian Council of Ministers for the Environment to develop standards for lead levels in interior lead dust which are protective of Canadian children.

Resolution 4

WHEREAS lead is a known and undisputed developmental neurotoxin;

WHEREAS early childhood lead exposure is a preventable public health issue,

WHEREAS there is some evidence that lead exposure due to housing and other sources exists in Ontario,

WHEREAS lead poisoning awareness is not part of Ontario's Mandatory Health Program; and,

WHEREAS few Ontario health units provide public awareness programming regarding residential and other sources of lead;

THEREFORE BE IT RESOLVED THAT the OPHA advocate for the inclusion of lead awareness and lead exposure prevention programming into the Mandatory Health Program and Services Guidelines.

Implementation Plan

The resolution will be implemented by the Lead Sub-Committee of the OPHA's Environmental Health Work Group.

Step 1. Copies of the background paper, the resolution and an accompanying letter will be sent to the Ontario and Federal Ministers of Health, the Ontario Minister of the Environment, the Association of Municipalities of Ontario, the Federation of Canadian Municipalities, the Centre for Urban Housing [Toronto], the Association of Local Public Health Agencies, the Canadian Council of Ministers for the Environment; and, the Canadian Task Force on Preventative Health Care. Support for this resolution will be sought from the Canadian Public Health Association and organizations that have an expressed interest in this issue such as the Canadian Learning Disabilities Association of Ontario, the Canadian Environmental Law Association, the Canadian Association of Physicians for the Environment, The College of Family Physicians of Ontario, The Canadian Task Force on Preventative Health Care, and Pollution Probe.

Step 2. A letter will be sent to the Minister of Health and Long-term Care asking the Minister to either conduct a pilot study or provide funding for one. The OPHA will ask to be involved in the development of the protocol for this pilot study.

A letter will be sent to Health Canada asking that they undertake a national survey to investigate residential sources of lead in Canadian housing and to determine the vintage of housing that poses the greatest risk of lead exposure.

A letter will be sent to the Canadian Council of Ministers of the Environment encouraging the development of protective standards for lead in interior dust.

Step 3. If there is no response from either the federal or provincial ministry within six months of the original letter being sent, and after telephone and electronic follow-up, the Environmental Group of the OPHA will take steps to conduct an independent pilot study.

Step 4. The OPHA will advocate for the inclusion of lead awareness and lead exposure prevention programming in the Mandatory Health Program and Services Guidelines over the next year by meeting with key government officials to discuss the actions consistent with the above stated goal; and, meeting with key partners to gain their support.

Position Paper Executive Summary

The neurotoxic properties of the metal lead are undisputed and the particular vulnerability of children to its toxic effects, especially those children between the age of 0 and 6 years are well documented Rice, 1998; 1995. While average blood lead levels of Canadian and American children have declined considerably following the removal of lead from gasoline and interior paint; Wang et al, 1997; Pirkle et al., 1994 American physicians continue to discover populations of children with elevated blood lead levels. The most common factor in these cases is living in housing built before the 1950's. Research shows a correlation between age of housing, housedust, and blood lead levels in children Lanphear, Matte, 1998.

In 1994, the [Canadian] Federal-Provincial Committee report Update of Evidence for Low-Level Effects of Lead and Blood Lead Intervention Levels and Strategies estimated that 5-10 % of urban Canadian children continued to have elevated blood lead levels Federal Provincial Working Group, 1994 and recommended that, "investigations be carried out to assess the existence and extent of undue exposure to lead in paint in dwellings in Canadian cities." This recommendation, among others from this report, has not been acted upon, to date. There has not been a national blood lead survey of Canadian children since 1978, and no large scale study has ever been conducted to determine the extent of lead dust contamination in Canadian housing.

Canadian homes, in particular those built prior to 1960, do contain lead paint CMHC, 2004, so it is conceivable that lead dust from paint poses an on-going risk to Canadian children. A study of Ottawa dwellings found widespread elevation of lead levels in house-dust that did not correlate with the lead levels found in exterior soil Rasmussen et al., 2001. This suggests that the source of the lead in house dust is inside the house, with leaded paint being the likely source. Follow-up to this study is essential to determine the extent of the problem in Ontario and whether action needs to be taken to protect children's health and development.

Given that lead from housing sources is a preventable source of exposure, attention should be paid to this problem. It is recommended that the Ontario Minister of Health and Long-term Care commission a pilot study to assess pediatric blood lead levels in relation to residential sources of lead and that the Ontario Public Health Association be involved in developing the protocol for this study. It is also recommended that Health Canada conduct a national survey of Canadian dwellings to determine the vintage of housing that poses the greatest concern regarding residential sources of lead; that the Canadian Council of Ministers for the Environment be encouraged to develop protective standards for lead in interior dust; and, that the OPHA advocate for the inclusion of childhood lead awareness and prevention programming in Ontario's Mandatory Health Programs and Services Guidelines.

1. Introduction

The neurotoxic properties of the metal lead are undisputed, and the particular vulnerability of children to its toxic effects, especially those children between the age of 0 and 6 years are well documented Rice, 1998; 1995. *Average* blood lead levels of Canadian and American children have declined considerably following the removal of lead from gasoline and interior paint; Wang et al, 1997; Pirkle et al., 1994 yet, American physicians continue to discover populations of children with blood lead levels above the level of concern. The most common factor in these recent cases is living in housing built before the 1950's. Research shows a correlation between age of housing, housedust, and blood lead levels in children. Lanphear, Matte, 1998. In the United States, age of housing is considered the single most important environmental marker of lead poisoning in a given community Bailey et al., 1994. Is there evidence to support the case that a similar problem exists in Canada?

2. Health Effects

Lead exposure can lead to a range of health effects in humans. While lead can affect multiple organ systems Fleming & Ursitti, 1994 the most critical and sensitive endpoints are the neurological effects of lead exposure on children ATSDR, 2002. Some of the cognitive effects associated with childhood blood levels between 10 and 15 µg/dL include deficits in attention; executive skills such as planning; organizing and cognitive flexibility; social behaviour (internalizing or externalizing); memory, language development; academic ability in reading; writing, math and spelling; visual motor integration; fine motor skills; and abstract thinking Dietrich, 1999; Rosen & Mushak, 2001. Three studies now show that lead can cause IQ deficits in children at levels below 10 µg/dL Needleman & Landrigan, 2004. A more recent study found deficits in multiple cognitive and behavioural outcomes for blood lead levels as low as 3 µg/dL Chiodo, Jacobson & Jacobson, 2004.

The *level of concern* in the United States for children (aged 6 months to 15 years) is 10 micrograms of lead per decilitre of blood (µg/dL) CDC, 2000a and 25 µg/dL for adults CDC, 2000b. In Canada, intervention strategies are recommended, for *all* populations, beginning at blood lead levels of10 µg/dL. Federal Provincial Working Group, 1994. David Bellinger, one of the leading U.S. researchers on childhood lead poisoning describes the 10 µg/dL screening guideline as a "risk management tool" and advises that "it should not be interpreted as a threshold for toxicity" Bellinger, 2004. The stance adopted by the Center for Disease Control in the United States (1991) is that there is no safe threshold for lead exposure. Ontario officials supported this position in 1994 Fleming & Ursitti, 1994 and data since that time is validative Bellinger, 2004; MMWR, September 2003.

3. Residential Sources of Lead Exposure

Lead may enter the body through inhalation, ingestion, dermal contact (organic lead) or transfer to the fetus via the placenta Fleming & Ursitti, 1994. Two decades ago, leaded gasoline, and lead contaminated food were the major sources of lead exposure for children Fleming & Ursitti, 1994. Today, the exposure profile has shifted so that for certain populations, the most significant exposure pathway is the ingestion of lead dust from housing sources. Interior dust can contribute as much as 69% of total lead exposure Rasmussen, 2001. **Figure 1** illustrates the relationship

between interior dust lead levels and children's blood lead levels. Young children, between the ages of 6 months to five years are at particular risk due to increased hand to mouth exploring Moya et al., 2004.

3.1 Lead paint dust

Lead paint deteriorates over time, especially on high friction surfaces such as windowsills, doorways, stairwells, and floors, creating potential "hot spots" for lead dust accumulation Livingston, 2000. Lead also accumulates in exterior entrances of buildings Clark et al., 2004. Older homes which have recently undergone renovations also contain high levels of lead dust MMWR, January 1997. Although the addition of lead to residential paint and coatings was restricted in the United States in 1978, 75% of pre-1980 U.S. housing still contains some leaded paint. U.S. studies have found that homes built before *1950* contain the greatest lead concentrations and children living in these homes are five times more likely to have an elevated blood lead level than children living in homes constructed after 1973. The risk is even higher for *low-income* children living in pre-1946 dwellings, with a 16% prevalence rate versus a 4% rate for middle-income children Matte et al., 2002; MMWR, September 2003. **Figure 2** illustrates the relationship of housing age and condition to lead dust levels.

The Canada Mortgage and Housing Corporation booklet *Lead in Your Home* extends its warning to Canadian homes built prior to *1960*; however, this figure is not based on Canadian data. There has been no large scale survey of Canadian homes to determine residential sources of lead Fugler, 2004 [#]

[#] In Canada, leaded paint was commonly in use in Canadian homes until the late 1970's, and possibly into the early 1990's. It was only in 1991, that the Canadian Paint and Coatings Association *voluntarily* agreed to limit lead content in consumer paints, adopting the 1977 U.S. standard of 600 parts per million (RIAS, 2003) .

Figure 1: Relationship of Dust Lead Levels to Blood Lead Levels in Children. (Assumes children are exposed to a soil lead concentration equal to the U.S. national average level (72 ppm). (Source: CDC, 2002 pp. 35).

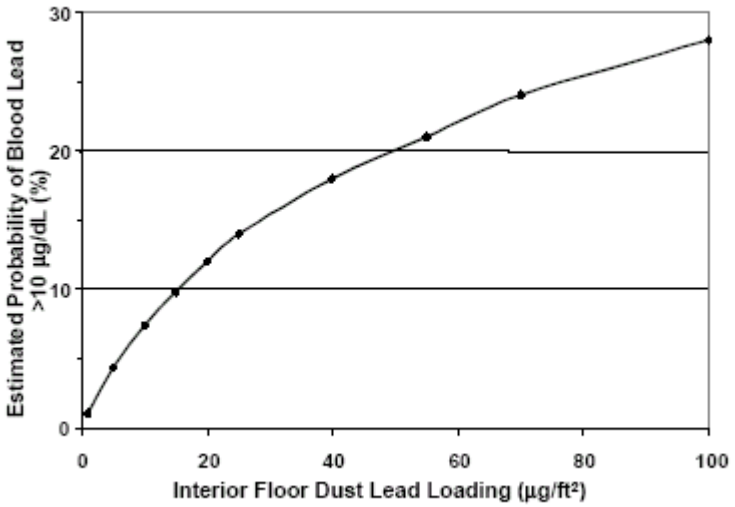
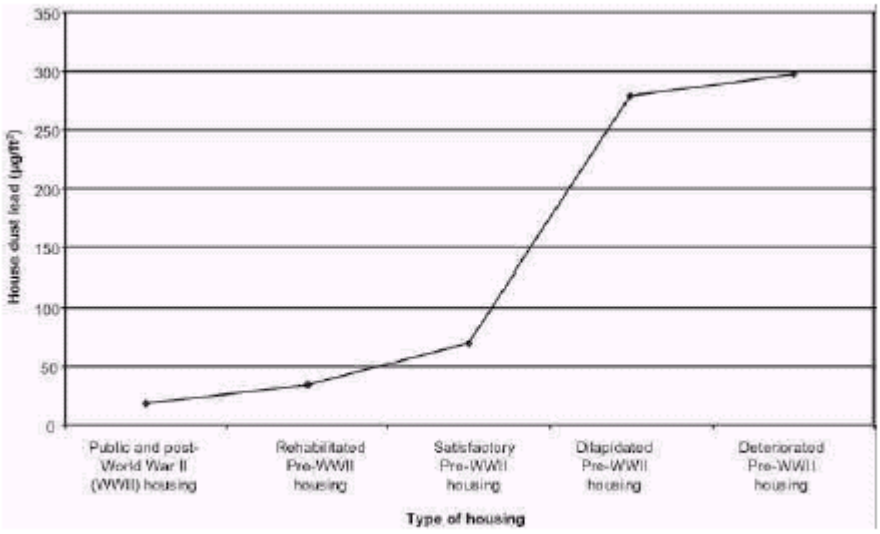


Figure 2: Relationship of Housing Age and Condition to Lead Dust Levels (Source: CDC, 2002 pp. 34)



3.2 Drinking water

Lead can also be present in household plumbing, in solder, lead service connectors, and lead pipes CMHC, 1995. Lead from drinking water can be the first source of exposure for infants and young children under the age of two years. In Canada, lead service connectors were commonly in use prior to 1940; leaded plumbing was commonly employed in "well-built" homes prior to 1920; and, 50% lead solder was used to join household plumbing until the mid 1980's.

3.3 Soil

Soil surrounding the perimeter of houses, especially in urban centres can also be high in lead Mielke, 1999; Lanphear et al., 1998. A recent St. John's Newfoundland soil survey found lead levels that exceed federal soil remediation guidelines (140 mg/kg) in 60 % of residential samples Bell, 2003. Lead levels in homes may be further elevated by lead brought in from contaminated soil Clark et al., 2004.

4. Other Sources of Lead

4.1 Consumer products

Childhood lead exposure can result from mouthing consumer products such as lead containing jewellery; lead dust residue derived from burning candles with leaded wicks; Health Canada Consumer Product Safety lead residue found on some PVC mini blinds; Schaller & Arreola, 1999 consuming lead contaminated wild game obtained using lead shot; Levesque et al., 2003; Tsuji et al., 2001 some foods such as imported candy MMWR, August 2002; and some lead containing folk remedies MMWR, July 2004. Skin absorption from exposure to organoleads such as leaded gasoline is likely rare since its prohibition for regular use in Canada December 1, 1990 Health Canada, 1997.

4.2 Occupational Exposure

Lead dust can be carried home on clothing, contaminating vehicles and living quarters. One study found high dust lead levels on a child's car seat Livingston, 2000. Some industrial trades associated with lead exposure include battery manufacturing, painting, nonferrous smelting, radiator repair, brass and bronze foundries, pottery production, scrap metal recycling, firing ranges, and wrecking and demolition MMWR, December 2002.

4.3 Hobbies

Hobbies such as recreational target shooting, home remodeling, casting bullets and fishing weights, making stained glass and ceramics, use of traditional remedies, and drinking homemade alcoholic brews can also be sources of lead exposure in a non-industrial setting. MMWR, December 2002.

5. Is there evidence of a problem?

In Canada there is little data available to evaluate the extent of the problem of childhood lead exposure due to housing sources. The last country-wide blood lead survey of Canadian children took place in 1978 Canada Health Survey, 1982. In 1994, a Federal Provincial Working Group, based on sparse data, *estimated* that 5 -10 % of urban Canadian children had blood lead levels above 10 micrograms per deciliter (µg/dL), our current intervention level Federal-Provincial Committee, 1994. The report identified the following risk factors:

- living near point-source emissions of lead (smelters, metal refineries);
- living near soils contaminated by lead from mine tailings, etc.; and,
- living in houses painted internally or externally with lead containing paint.

One of the recommendations from this report was that "investigations be carried out to assess the existence and extent of undue exposure to lead in paint in dwellings in Canadian cities" Federal-Provincial Committee, 1994.

This recommendation, among others, has not been acted upon, to date. Data defining the extent of residential sources of lead in Canada does not exist, nor is there data to illuminate the extent of childhood lead exposure. Presently in Canada, save for smelter communities, neither physicians nor public health agencies routinely evaluate blood lead levels of "at risk" children, and there is no central agency for the collection of lead screening data Sanborn et al., 2002.

In the past decade, and since the restriction of lead in paint and gasoline which occurred between 1976-1990, there have been some risk surveys conducted in various provinces. These have been short in duration, however, and most have examined only lead contaminated soil. Few Canadian studies have looked at children's lead exposure in relation to housing sources. Two studies where residential sources of lead exposure were assessed, found an incidence of elevated blood lead levels (>10 µg/dL) in approximately 11 % of the population tested Levallois et al., 1991; Balram & Giffin, 1993. Canadian blood lead and environmental lead surveys are summarized in **Appendix A**.

There is evidence that Canadian homes have elevated lead dust concentrations. A recent Health Canada survey of 50 Ottawa homes (construction age ranged from 1893 to 1987) found *interior* dust lead concentrations ranging from 50.20 mg/kg to 3,225 mg/kg with an arithmetic mean of 405.56 mg/kg Rasmussen et al., 2001. Values greater than 200 mg/kg would exceed provincial guidelines for residential soil lead levels. Lead levels in interior house-dust did not correlate with the lead levels in soil suggesting that the source of the lead in house dust began inside the house, with leaded paint being the main suspect. There are no Canadian standards for *interior lead dust* concentrations. **Appendix B** provides information on U.S. standards.

It is unlikely that Ottawa's situation is unique. In Canada, approximately 26% of homes were built prior to 1960 Statistics Canada. 2001. In Ontario, there are 1,396,105 dwellings built before 1960. Of these, 172,870 are in need of major repair Statistics Canada. 2001. * While there is no direct evidence that these homes contain leaded paint, it is well established that age of housing

*Major repairs refers to defective plumbing or electrical wiring, structural repairs to walls, floors or ceilings, etc. Statistics Canada. 2001

and state of repair are correlated with lead paint dust. The study of Ottawa homes provides evidence that housing sources of lead exposure do exist.

There is evidence of *childhood lead poisoning* occurring due to residential sources of lead. The Canadian Medical Association Journal documents the recent case of a 4 year old Montreal boy poisoned as a result of ingesting "lead-free" paint, which in Canada is still defined as a paint lead concentration of 5000 parts per million Lavoie & Bailey, 2004. [+]

6. Recommendations

American surveillance data has established that the most significant exposure pathway to lead for children in that country comes from housing sources, and leaded house dust has been shown to be a primary risk factor for childhood lead poisoning in the United States. In Canada, it is likely that the situation is similar although there is insufficient surveillance data to fully gauge the extent of the problem in this country.

The New Brunswick study Balram & Giffin, 1993 is one of the few Canadian studies that has examined the relationship between residential sources of lead and children's blood lead levels. It was commissioned in 1993 by the Minister of Health and Community Services after elevated lead levels were found in St. John domestic water supply. The Ottawa finding Rasmussen et al., 2001 of elevated interior dust lead concentrations in residential dwellings indicates a need for further investigation. There is no published record of a follow-up blood lead survey of the Ottawa study's occupants.

Prevention of lead poisoning due to housing sources can be accomplished in large part, through public education Campbell et al., 1999 In the early 1990's, two documents identified and described preventative measures for dealing with childhood lead poisoning in Ontario: the Ministry of Environment and Energy "Scientific Criteria Document for Multimedia Environmental Standards Development – Lead" Fleming & Ursitti, 1994 and the Metropolitan Toronto Teaching Health Unit lead awareness kit, "Why Barns are Red" Muir & Campbell, 1995 and yet, a decade later, few public health units provide public awareness information on this health issue. A June 2004 audit of the 37 Ontario health unit websites found only 7 (19%) that offer easily accessible information on environmental sources of lead and, of those 7, only 2 health units offer links to information on remediation. Audit, 2004 Lead awareness is not part of Ontario's Mandatory Health Programs and Services Guidelines.

A coordinated national, provincial, and community level approach to lead awareness is essential. Agencies in the United States have been aggressively and persistently dealing with the issue of lead in housing for over a decade. In 1992, Congress passed Title X of the Housing and Community Development Act that mandated the creation of an infrastructure to correct lead

[+] A 1976 amendment to the Hazardous Products Act limited lead in interior consumer paints, and paint applied to children's toys and furniture to 5000 parts per million (ppm) Hazardous Products Act January 1, 1976. An amendment to the Hazardous Products Act will legally restrict lead in all surface coatings to 600 mg/kg Part I Canada Gazette, June 14, 2003 although three Health Canada surveys of interior and exterior consumer paints, conducted in 1991, 1992 and 1995 found that 99 % of paints already met the 600 mg/kg voluntary limit Korpan, June 2004.

paint hazards in housing. In 2000, the President's Task Force on Environmental Health Risks and Safety Risks to Children EPA, 2000 developed a strategy to eliminate lead paint hazards in housing where children under six live, by 2010. This strategy includes targeted federal grants for low-income housing and the leveraging of private and other non-federal funds to control lead paint hazards; promotion and education for lead-safe painting, renovation, and maintenance work; and, enforcement of lead paint laws. EPA, 2000

In the United States, it costs, on average, $120/unit for lead hazard screening; $2,500/unit for interim controls such as paint stabilization, window work, and cleanup, and $9,000 (U.S. dollars) for full abatement (complete removal of lead paint). The monetary benefit derived from full abatement of all low-income U.S. housing over a ten year period is conservatively estimated to be $37.7 billion, derived from reduced costs of medical care and special education, increased lifetime earnings due to increased cognitive ability, and increased market value as a result of housing improvements. EPA, 2000

Recommendation 1

Lack of attention in Ontario to childhood lead poisoning may be due, in part, to a lack of comprehensive exposure data on childhood blood lead levels at the federal and provincial levels, and a sparseness of data on this problem in relation to housing sources. We therefore recommend that the OPHA encourage the Ontario Minister of Health and Long-term Care to commission a pilot assessment of selected "at-risk" Ontario communities to characterize exposure occurring from residential sources of lead, to determine whether there is a need for wider scale monitoring and interventions to protect children's health; and, that the OPHA ask to be involved in the development of the protocol for this pilot study.

Kentucky researchers define "at-risk" as being 6 to 35 months of age and living in a home built before 1950 or in a target zone, an area where at least 27% of the homes were built before 1950. Through this method, researchers made the discovery of 79 homes that were responsible for 35% of the 524 children with blood lead levels ≥10 µg/dL Reissman et al., 2001. **Appendix C** provides various American and Canadian definitions of "risk." An example of a risk assessment questionnaire can be viewed at: http://midata.msu.edu/bll/ (Michigan Department of Community Health). Based on the results of a pilot study, a screening questionnaire can be developed for Ontario populations.

Recommendation 2

The Health Minister has certain powers and duties under the Department of Health Act, (1966) which include:

- The promotion and preservation of the physical, mental and social well-being of the people of Canada;
- the protection of the people for Canada against risks to health and the spreading of diseases;
- investigation and research into public health, including the monitoring of diseases; the collection, analysis, interpretation, publication and distribution of information relating to public health; and,
- cooperation with provincial authorities with a view to the coordination of efforts made or proposed for preserving and improving public health

We therefore recommend that the OPHA collaborate with the Canadian Public Health Association (CPHA) and the Canadian Partnership for Children's Health and the Environment (CPCHE) to encourage Health Canada to conduct a survey of lead paint concentrations in Canadian dwellings to determine the vintage of housing that poses the greatest concern for lead paint hazards.

Recommendation 3

The Ministry of the Environment, through the Canadian Council of Ministers for the Environment (CCME), is responsible for environmental standard setting in Canada. Therefore, the OPHA will encourage the Canadian Council of Ministers of the Environment, through our provincial CCME representative, to develop protective standards for lead in interior dust. The Canadian Public Health Association will be approached to advocate in support of this issue.

Recommendation 4

Because early childhood lead exposure is a preventable public health issue, and because there is some evidence that lead exposure due to housing and other sources exists in Ontario, the OPHA will advocate for the inclusion of lead awareness and lead exposure prevention programming in the Mandatory Health Program and Services Guidelines.

Over the next year, the OPHA Environmental Health Work Group will:

- Disseminate this paper to key stakeholders in the province;
- Meet with key government officials to discuss the actions consistent with the above stated goal; and,
- Meet with key partners to gain their support.

Future Recommendation for the OPHA

Information from a pilot study will help identify high risk communities and contribute to our understanding of the extent of this problem in Ontario. Findings of a problem, ideally, will lead to the development of case management protocols for children with elevated blood lead levels and preventative measures.

A. Upon findings of a problem, the OPHA will work with its members, other related ministry officials, public health units, provincial associations and other key partners to share the information and to promote the development of the provincial/interministerial strategy aimed specifically at the prevention of childhood lead exposure due to residential sources through integrated multidisciplinary approaches;[1] and,

[1] *Recommendations A,B,C & D adapted from the OPHA position paper: Public Health and Violence Prevention: Maintaining the Momentum: http://www.opha.on.ca/ppres/2003-05_pp.pdf*

B. The OPHA will work with local and provincial bodies (councilors, district health councils, municipal sectors) to ensure the development and adoption of policies and/or legislation that prevents and reduces childhood lead exposure within their own communities; and,

C. The OPHA will advocate for access to adequately funded, coordinated, and appropriate services for the treatment of childhood lead poisoning at the local and provincial level; and,

D. The OPHA will foster communication, professional development, and the sharing of effective strategies among Public Health practitioners across Ontario and appropriate OPHA workgroup members on measures to reduce childhood lead exposure.

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Appendix A: Summary of Canadian Lead Studies in Past 10-15 Years

BLLs = blood lead levels **EBLs = Elevated blood lead level** µg/dL = microgram per deciliter
µmol/L = micromole per litre **Note**: to convert µg/dL to µmol/L, divide by 20.72

Location of Study	**Risk Factors Assessed (measured)**					**Age Range of study participants**	**% with EBLs (> 10 µg/dL or > .48 µmol/L)**	**Comments**
	Paint/ paint dust	**water**	**soil**	**other**	**BLLs**			
Quebec City (BL samples from 1989) 1	Household dust samples, paint flakes	First draw water		Information collected on socio-demographic characteristics, personal habits of children, environmental sources of lead collected using questionnaire	venous	1-6 years	10.8% (urban population) 1.3% (rural population)	Residential sources of lead (paint & water) measured and were possible contributing factors in 6/10 urban cases of EBLs. Although not measured directly, automobile exhaust & municipal incinerator fumes were thought to be contributing factors to urban population EBLs. Occupational exposure was ruled out using questionnaire.
Vancouver BC (using BL samples from. 1986-87) 2					venous	24-36 mos	8%	Risk factors identified as soldering performed in home, aboriginal heritage, dwelling built before 1921, age of water service connection, other.
Lead reclamation plant Quebec (1991) 3 To determine relationship between soil lead levels and venous blood lead levels in High, Intermediate and Low exposure groups.	Dust lead samples collected in 3 homes. Paint chip samples collected/ analyzed in some homes.	First draw water sample collected in some homes	✓		venous	Children ≤ 10 yrs Pregnant women	High exposure group: 52.3% of children Low exposure group: 13.2% had BLLs >0.49 µmol/L	Within each exposure group, children ages 1-2 yrs had highest BLLs. 'Fewer children with a low level of exposure than those in the other groups lived in older houses.'
Moosonee Moose Factory 4 (using 1992 samples)				Questionnaire to identify risk factors	✓ Finger prick	395 children ages 1-6 years	5% of children 1-2 years; 4% of children 1-6 years	BLL range 0-18.9 µg/dL . Lead shot, fishing sinkers made/handled at home, lead fumes from shotguns, lead contaminated meat (from lead shot) identified as putative sources of exposure.
Ontario 1992 5					✓	Children 3-6 years	8.1%	
Abandoned metal-recovery plant Montreal Island (1994) 6			Residential soil lead con-centration range 20-3700 ppm (median 430 ppm)	Air borne particles (1987) Road dusts (1990)	Venous & finger prick (3 cases)	6 mos to 5 yrs living in area where soil lead concentration >500 ppm		Former site of a metal recovery plant and a scrap metal smelter. Both plants closed 1986. Results: 3/52 children had BLs of .55, .56, & 1.01 µmol/L Gender, age and yard soil lead concentrations found to have small independent influence on BLLS.

Location of Study	Risk Factors Assessed (measured)					Age Range of study participants	% with EBLs (> 10 µg/dL or > .48 µmol/L)	Comments
	Paint/ paint dust	water	soil	other	BLLs			
Saint John, NB -1993 7 -1995 8 Elevated drinking water lead levels triggered the study.	✓	✓ dwelling tap-water	✓	✓ food	venous	Children 1-3 years (1993) Adults (1995)	11.3% -	Risk factors identified as living in certain areas of St. Johns, lead service, use of hot tap water for food preparation, peeling paint, employment in oil refinery or chemical plant, other (1993) Resident's age, water lead levels and lead in paint primary contributors to EBLs (1995).
Montreal Island (using BL sample data from 1981-1989) 9					✓	Children <15 yrs living on Montreal Island.	12 cases	Utilized archived BL data from hospital clinics and medical records dept to find cases of EBLs (defined as > 25 µg/dL) Paint identified as principal source of exposure. BLL Range: 27-94 µg/dL
Toronto 1990 10					Maternal & cord blood lead levels of 95 mother-infant pairs			Study to determine if neonates born in Toronto are in a high risk group for early lead exposure due to maternal sources
Inuit population Nunavik, PQ (1993-96) 11				Consumption of wild game shot using lead shot	Cord blood lead levels	newborns	7% of newborns had elevated cord blood lead levels	Risk factor identified as maternal consumption of game procured using lead shot.
South Riverdale, Toronto ON(using BL data from 12 cross-sectional studies 1984-1992) 12	Residential sources of lead exposure such as leaded paint not assessed	✓ (1987)	✓ (1987)	Atmospheric lead Questionnaires	Finger prick	Children 1-6 yrs	7.3% children of South Riverdale (1992)	Study to analyze the impact of abatement on residential BLLs in young children
BL surveys in: Toronto (1984. 1985, 1988) Peel Region (1987) Niagara region (1987) Urban Southern Ontario (1984 Northern Ontario (1987, 1992)) 13				Consumption of lead in leaded gasoline	capillary			Statistical analysis

Location of Study	Risk Factors Assessed (measured)					Age Range of study participants	% with EBLs (> 10 µg/dL or > .48 µmol/L)	Comments
	Paint/ paint dust	water	soil	other	BLLs			
Port Hope (c. 1997) 14 Soil contamination triggered study.			✓		venous	Preschool children ages 3-6	4%	EBLs traced back to housing sources
Lynnview, Calgary, Alta (c. 2000) 15 Soil contamination due to oil refinery triggered the study.								No written report available
West Carleton, ON (2000) 16 Former lead/zinc mine. Elevated soil lead levels triggered the study.		private wells	✓		venous	Age 0 years to adult,	1.7% of children under 7 years	Other possible sources of lead were identified as home renovation with exposure to old leaded paint, hobbies involving lead, and occupational exposure.
Ottawa ON (2001) 17 Study conducted to assess natural levels of environmental metals.	House-dust		✓					Study found lead dust in homes in City of Ottawa, a relatively "non-industrial" community, that exceeded both federal and provincial soil remediation guidelines. No evidence of blood lead follow-up survey to assess exposure.
Eastside Community Port Colborne, ON (2001) 18 Elevated soil lead and nickel levels triggered this study.		municipal water system private wells	✓		venous	Majority tested were adults 11 % of study population were children age 0-6 years	2.9% of children 0-6 yrs	Former nickel refinery.
Uplands & Rockliffe military bases Ottawa (2002) 19 Elevated interior house dust lead levels triggered this study.	house-dust				venous 2 day screening-clinic	Children and adults	No age distribution of results	Lead dust exceeding USEPA standards for lead dust found in some residential homes.

Location of Study	Risk Factors Assessed (measured)					Age Range of study participants	% with EBLs (> 10 µg/dL or > .48 µmol/L)	Comments
	Paint/ paint dust	water	soil	other	BLLs			
Rouyn-Noranda, PQ (1989-1999) 20 21 22 Copper smelter community. Ongoing screening program.			✓		venous	12-60 mos	50 % (1989) 6% (1999)	Neighborhood located at < 0.5 km from smelter. Decrease in BLLs due to soil remediation (1990) and reduction in lead dustfall (1998).
Trail BC (1991-2002) 23 Lead smelter community. Ongoing screening program.					venous	6-60 mos 6-36 mos	80% (1991) 17% (2002)	Decrease in BLLs due to smelter emission reductions. BL testing focused on 6-36 months age group starting in 2001
St. John's Nfld (2003) 24 Study to determine *natural* levels of lead in urban environment.			✓					60% of samples exceed CCME residential soil lead guideline of 140 mg/kg Samples that exceed guideline primarily from properties that were over 50 yrs old. Highest soil lead value was 7048 mg/kg taken next to a clapboard house suggesting "lead – based paint is the source."
Belledune Area, New Brunswick (Dec. 2003) 25 Site of lead smelter			✓					Soil lead levels ranged from 7.3 - 2210 mg/kg
Sydney, Nova Scotia, tar ponds (2004) 26	Housedust sampling (lead dust loading)		✓ (lead con-centration)					Survey of participants to document age, construction and condition of doorway, cleaning of doorway & floor where dust samples collected. Study evaluated lead, arsenic, and polycyclic aromatic hydrocarbon (PAH) contamination in the residential communities adjacent to the Sydney, Nova Scotia, tar pond

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14. Contact: Dr. Alex Hukowich, Medical Officer of Health for Haliburton Kawartha, Pine Ridge District Health Unit. 200 Rose Glen Road, Port Hope ON L1A 3V6. Tel: (905) 885-9100
15. Contact: Dr. Tim Lambert, Epidemiologist, Calgary Health Region. Tel: (403) 943-8048
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Regarding resolutions, position papers and motions:

***Status*:** Policy statements (resolutions, position papers and motions) are categorized as:
Active, if:

1. The activities outlined in the policy statement's implementation plan have not yet been completed; or
2. The policy statement addresses an issue that is currently relevant to public health in Ontario.

Archived, if:

1. The activities outlined in the policy statement's implementation plan have been completed; or
2. The policy statement addresses an issue that is not currently relevant to public health in Ontario or is not based upon the most current evidence. The statement remains the position of the OPHA until a new statement is adopted that effectively reverses or essentially negates all or major elements of an earlier statement. In this instance, the former supersedes the latter