

ÉTUDE SUR LA SANTÉ DANS LA RÉGION DE

# Belledune

AREA HEALTH STUDY

Belledune • Petit-Rocher • Pointe-Verte

## Appendix E - Pilot Lead Survey Results



Prepared for: Department of Health and Wellness, Government of New Brunswick

February 2005

# Table of Contents

1.0	Introduction.....	4
2.0	Approach .....	5
2.1	Participant recruitment.....	5
2.2	Sample collection and interviews.....	5
2.3	Shipping and analyses.....	6
3.0	Results.....	7
4.0	Discussion .....	9
5.0	Conclusions .....	14
6.0	Recommendation .....	14

# List of Figures

Figure 3.1: Distribution of blood lead levels .....	7
Figure 4.1: Relationship of blood lead level and adverse health outcomes .....	11

# List of Tables

Table 3.1: Survey participants .....	7
Table 3.2: Average blood lead levels .....	8
Table 4.1: Blood lead levels in children from selected references .....	12

# 1.0 Introduction

Lead smelter communities in Canada have been the focus of a number of investigations to assess their impact on blood lead levels of children.<sup>1</sup> Similarly, other studies have been carried out to examine children's blood lead levels in areas with lead contamination from a variety of historical and current industrial activities (see Table 4.1). Studies of lead exposure from point sources and from general non-point sources provide a background upon which to interpret the relative exposure status of blood lead levels in children today. Lead is a pervasive toxicant that has effects on children's intellectual development.<sup>2</sup> Its effects at the population level have been shown by several large epidemiologic studies.<sup>3</sup> Some analyses demonstrate that at the population level, risks can be shown with mean levels of blood lead in the range of 5 µg/dl (0.24 µmol/L).<sup>4</sup>

The New Brunswick Department of Health and Wellness undertook a pilot survey of children in the vicinity of the Noranda lead-zinc smelter located in the Belledune industrial park. This smelter has been operating since 1964. The soil lead in Belledune has been examined by Noranda, New Brunswick government department of the environment, and by other agencies. The results of these analyses show accumulation of lead in the soil from airborne deposition from the smelter. The objective of this survey was to examine if children in the neighborhoods closest to the smelter indicated levels of blood lead which would inform full scale testing of children in a larger geographic area. Thus, this survey was a pilot project.

The rationale for the use of the two neighborhoods was three-fold: first, these neighborhoods are closest to the smelter; second, there were enough children to test; and third, the community appeared to be interested in participating.

---

<sup>1</sup> Hilts SR. Effect of smelter emission reductions on children's blood lead levels. *Sci Total Environ*. 2003 Feb 15;303(1-2):51-8

<sup>2</sup> Pocock SJ, Smith M, Baghurst P. Environmental lead and children's intelligence: a systematic review of the epidemiological evidence. *BMJ*. 1994 Nov 5;309(6963):1189-97.

<sup>3</sup> Canfield RL, Henderson CR Jr, Cory-Slechta DA, Cox C, Jusko TA, Lanphear BP. Intellectual impairment in children with blood lead concentrations below 10 microg per deciliter. *N Engl J Med*. 2003 Apr 17;348(16):1517-26

<sup>4</sup> Lanphear BP, Dietrich K, Auinger P, Cox C. Cognitive deficits associated with blood lead concentrations <10 microg/dL in US children and adolescents. *Public Health Rep*. 2000 Nov-Dec;115(6):521-9.

## 2.0 Approach

### 2.1 Participant recruitment

All children between the ages of 3 and 15 currently residing in Townsite #2 or Lower Belledune (see Table 3.1) were invited to participate in the survey. A door to door survey carried out by two public health nurses in late September 2004 determined the presence of children of eligible age in the household and the family's willingness to participate in a short interview and in allowing a small blood sample to be taken from the children. Information on the nature of the survey, and a sample of the consent form was also provided on the first visit.

### 2.2 Sample collection and interviews

Appointments were subsequently set up for the first week of November at a clinic facility away from the areas of potential. The clinic set up is described in Appendix A (*Clinic Set Up and General Procedures*). A venue to obtain blood samples away from the household ensures that lead contamination from the environment is minimized. At the clinic venue, the family signed appropriate consent forms, the household interview was carried out and the blood was obtained from the child or children via a fingerstick. The literature indicates that this is an appropriate approach for screening blood lead levels in children.<sup>5,6,7,8,9</sup> Blood samples were obtained from the children according to the procedures described in Appendix B (*Blood Collection Procedures*).

---

<sup>5</sup> Sargent JD, Dalton MA. Rethinking the threshold for an abnormal capillary blood lead screening test. *Arch Pediatr Adolesc Med.* 1996 Oct;150(10):1084-8.

<sup>6</sup> Schonfeld DJ, Cullen MR, Rainey PM, Berg AT, Brown DR, Hogan JC Jr, Turk DS, Rude CS, Cicchetti DV. Screening for lead poisoning in an urban pediatric clinic using samples obtained by fingerstick. *Pediatrics.* 1994 Aug;94(2 Pt 1):174-9.

<sup>7</sup> Schlenker TL, Fritz CJ, Mark D, Layde M, Linke G, Murphy A, Matte T. *JAMA.* 1994 May 4;271(17):1346-8. Screening for pediatric lead poisoning. Comparability of simultaneously drawn capillary and venous blood samples.

<sup>8</sup> Parsons PJ, Reilly AA, Esernio-Jenssen D. Screening children exposed to lead: an assessment of the capillary blood lead fingerstick test. *Clinical Chemistry* 1997;43:2(302-311)

<sup>9</sup> Sargent JD, Johnson L, Roda S. Disparities in clinical laboratory performance for blood lead analysis. *Arch Pediatr Adolesc Med.* 1996 Jun;150(6):609-14.

## 2.3 Shipping and analyses

Blood samples were sent by courier to trace metals and organic contaminants divisions of Quebec toxicology laboratories<sup>10</sup> according to their directions for shipping and transporting detailed in their documentation.

The blood was analyzed by graphite furnace atomic absorption spectrometry detailed in Section III (Laboratory methods). This method has a precision of .05 µmol/L that is comparable to other laboratories where blood lead levels in children are analyzed (see Appendix C).

---

<sup>10</sup> Trace metals and organic contaminants divisions; Human toxicology / INSPQ 945, avenue Wolfe 4e étage; Sainte-Foy, Québec

### 3.0 Results

The total number of participants in the survey was twenty-three children. As illustrated in Table 3.1 below, ten participants were between three and six years old. The remaining thirteen children were between seven and fifteen years old. Nineteen of the twenty-three children who participated were residents in Townsite #2. This represents a response rate of approximately 70% among eligible children in these two communities. Reasons for non-participation included fear of blood/needles, previously tested, just moved to neighbourhood, and unable to be accommodated by clinic hours.

*Table 3.1: Survey participants*

Age Group	# of Children	# of Children Tested
<b>3 to 6 years</b>	11	10
<b>7 to 15 years</b>	21	13
<b>Total</b>	32	23

As illustrated in Figure 3.1, 21 of the 23 children tested below the generally accepted “medical concern” of 0.48 µmol/L (10 µg/dL). Eighteen of the children tested below 0.20 µmol/L (4 g/dL). The blood lead levels in the 23 children ranged between 0.07 and 0.92 µmol/L (1.5 µg/dl – 19.2 µg/dl). Two children were above the individual intervention guideline of 10 µg/dl (0.48 µmol/L), one child in each of the age groups.

*Figure 3.1: Distribution of blood lead levels*

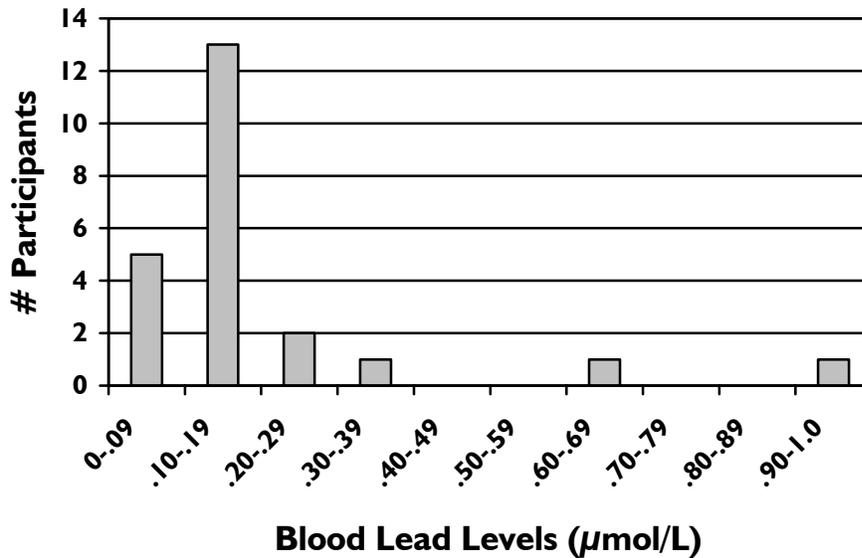


Table 3.2 contains the ranges, arithmetic means, and geometric means according to age groups. Means and ranges are presented in both the standard international units of “ $\mu\text{mol/L}$ ” and the more common unit in the literature, “ $\mu\text{g/dL}$ ”.

*Table 3.2: Average blood lead levels*

Age Group	Range ( $\mu\text{mol/L}$ )	Range ( $\mu\text{g/dL}$ )	Arithmetic Mean ( $\mu\text{mol/L}$ )	Arithmetic Mean ( $\mu\text{g/dL}$ )	Geometric Mean ( $\mu\text{mol/L}$ )	Geometric Mean ( $\mu\text{g/dL}$ )
3 to 6 years (n=10)	(0.10-0.60)	(2.1-12.5)	0.21	4.35	0.17	3.54
7 to 15 years (n=13)	(0.07-0.92)	(1.7-19.2)	0.18	3.78	0.13	2.70
<b>Total (n=23)</b>	<b>(0.07-0.92)</b>	<b>(1.7-19.2)</b>	<b>0.19</b>	<b>3.90</b>	<b>0.14</b>	<b>2.91</b>

## 4.0 Discussion

The average blood lead levels found in the children residing closest to the Noranda Smelter in Belledune are higher than average values reported for urban children in Niagara County, in 2001<sup>11</sup>, the last large survey of volunteer urban and suburban children reported, and higher than Ottawa-Carleton children in 2000<sup>12</sup>, without unusual sources of exposure (see Table 4.3). They are very similar to those levels found among children in 1991 from urban “control” communities measured as part of the Ontario blood studies<sup>13</sup>. The GBA levels are lower than the levels found in children living in areas of extensive lead contamination from lead reclamation plants (i.e., Trail, BC, 2001; Québec, 1991<sup>14</sup>).

The average levels found among GBA children are below the community or individual intervention level of 0.48 µmol/L or 10 µg/dL. On the other hand, the current pilot survey illustrated that two children (or 9% of participants) were above the intervention level in this small community, which is more than desirable. Investigation of their singular environments will determine if their level is stable and if their exposure is from a known source, an unusual source of lead within the house, or from the general environment.

The health risk assessment (HHRA) indicates that air lead and soil lead are currently not significant pathways of exposure to Lower Belledune and Townsite 2 children. It is likely that *previous* higher emissions impacted children more strongly. The HHRA points to what may be important *current* sources of contribution to children from consumption of local wild mussels. Contributions to lead exposure are also posited for other pathways, but together, not enough to provide exposure that exceeds the toxicological reference value (TRV) for lead of 0.0036 mg/kg body weight /day. Without an individual family, detailed environmental pathway analysis, it is not possible to tell what the major contributor to exposure is for a specific individual.

The Task Force on blood lead and intervention levels (1994)<sup>15</sup> recommended targeted surveys of children in smelter communities. The 2003 Canadian Task Force on the Periodic Health Examination<sup>16</sup> also recommends (as a B-level recommendation) targeted surveys of blood lead in children living in smelter communities.

<sup>11</sup> Decou ML. Blood Lead in Niagara County. Regional Niagara Health Department. 2001

<sup>12</sup> Ellis, E. Blood Lead in Ottawa Carleton. Ottawa-Carleton Regional Health Department. 2001

<sup>13</sup> Langlois P, Fleming S, Smith LF, Gould R, Goel V, Gibson BL. Risk factors for high blood lead in Toronto children: a look at communities with and without abatement. Archives of Environmental Health 1996;51(1):59-67.

<sup>14</sup> Levallois P, Lavoie M, Goulet L, Nantel AJ, Gingras S. Blood lead levels in children and pregnant women living near a lead-reclamation plant. CMAJ. 1991 Apr 1;144(7):877-85.

<sup>15</sup> Health Canada 1994. Report of the Federal Provincial Committee on Blood lead levels, Interventions and Strategies.

<sup>16</sup> Feldman W., Randel P. Screening children for lead exposure in Canada. In: Canadian Task Force on the Periodic Health Examination. Canadian Guide to Clinical Preventive Health Care, Ottawa, Health Canada, 1994; 268-288.

IARC classifies inorganic lead as a 2A carcinogen, that is that there is some animal data of good quality to state that it is probably carcinogenic to humans and that there is not sufficient epidemiological data to support a higher classification. ("The available data from animal bioassays, notably with lead acetate, lead subacetate and lead phosphate, led the Working Group to conclude that there is *sufficient evidence* for the carcinogenicity to experimental animals of exposure to inorganic lead compounds." The evidence in experimental animals for the carcinogenicity of exposure to organic lead compounds was considered to be *inadequate*."<sup>17</sup> As a result, lead is treated as a toxic substance, not a carcinogen, with reference doses related to toxicity as measured by epidemiological evidence of adverse effects.

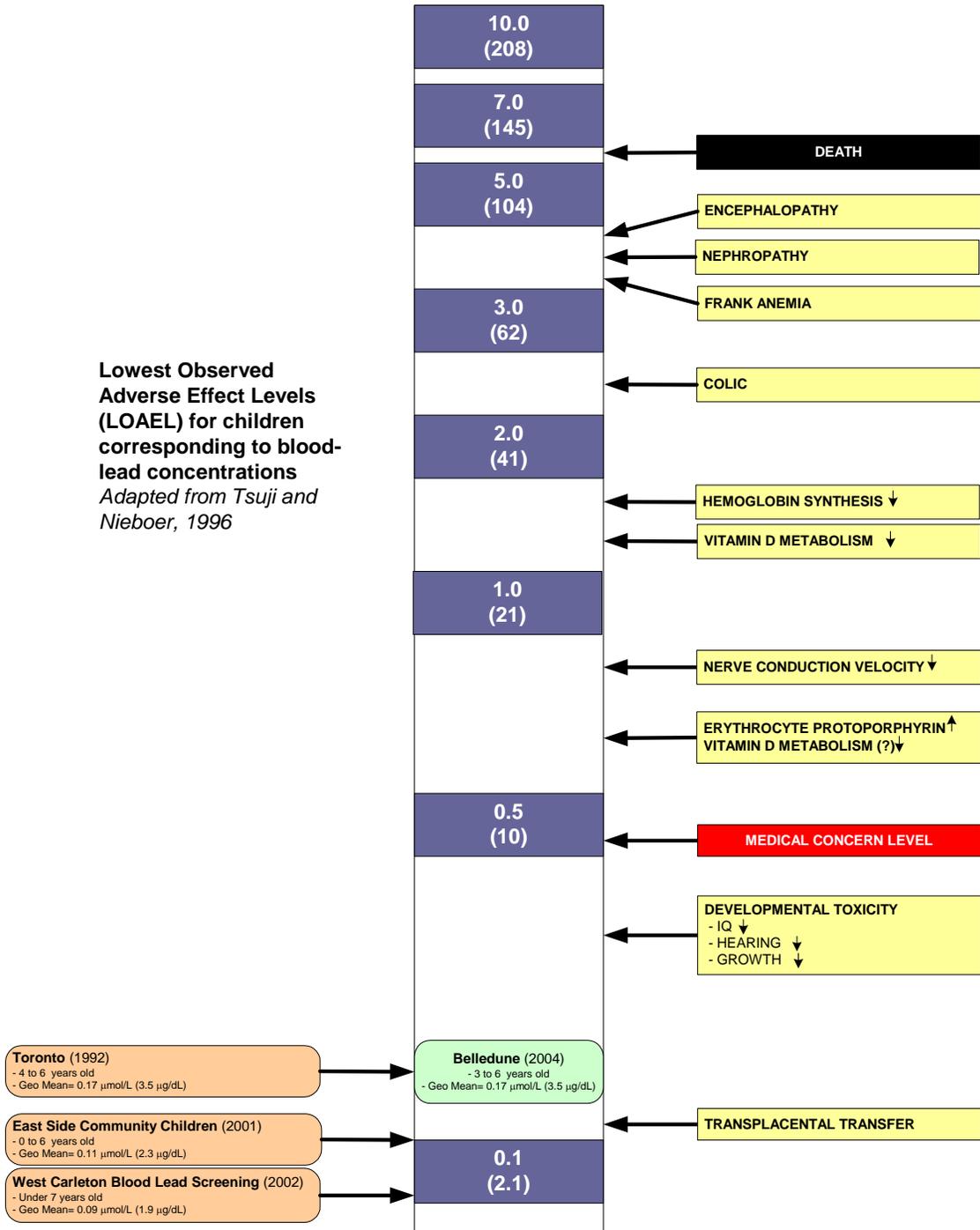
The children tested represent 70% (23/32) of children ages 3-15 years residing in these two neighborhoods. Inferences about smelter-affected exposure to other children, all things being equal, can be made from the results of this community. If the children closest to the smelter are in the low range of lead exposure, then other children in the GBA may experience similar levels of exposure depending on emissions deposition patterns. Current emissions are not likely to have as strong an impact on exposure from inhalation but soil for historical deposition may still play a role in exposure of children further from the smelter. However, this cannot be absolutely certain without confirmation by a larger survey with representative samples of children in the community.

Lead is pervasively toxic to developing youngsters and can cause many health effects (see Figure 4.1), and therefore, no matter how low the levels, every effort is warranted to raise awareness about children's exposure to lead and ways to reduce exposure. Recommendations for prevention of exposure include proper iron, calcium and vitamin C intake, correction of iron deficiency anemia, hand washing before eating and good housekeeping, and the removal of specific sources of lead from in and around the home.

---

<sup>17</sup> IARC 2004 IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: Inorganic and organic lead compounds (Vol. 87, 10–17 February 2004) <http://www-cie.iarc.fr/htdocs/announcements/vol87.htm>

Figure 4.1: Relationship of blood lead level and adverse health outcomes



**Table 4.1: Blood lead levels in children from selected references**

Reference	Place/Emissions	Study Particulars	Number of children /pregnant women	Geometric Mean $\mu\text{mol/L}$	Range (% at and above 0.48 $\mu\text{mol/L}$ )
<b>New Brunswick Department of Health and Wellness, 2004<sup>18</sup></b>	<ul style="list-style-type: none"> <li>• Townsite 2 and Lower Belledune, NB</li> <li>• Community closest to Noranda Lead-Zinc smelter</li> </ul>	<ul style="list-style-type: none"> <li>• Prevalence survey</li> <li>• Pin prick blood</li> </ul>	Ages 3 – 15 yrs (N=23)	<b>0.14</b>	0.07 - 0.92 (9% above)
			Ages 3 – 6 (N=10)	<b>0.17</b>	0.10 - 0.60 (10% above)
			Ages 7 – 15 (N=13)	<b>0.13</b>	0.07 - 0.92 (8% above)
<b>Decou 2001<sup>19</sup></b>	East Side Community, Port Colborne <ul style="list-style-type: none"> <li>• Community in close proximity to a nickel smelter</li> <li>• Soil lead levels (approximately 1/3 of residential properties' soil exceeded 400<math>\mu\text{g/g}</math> lead)</li> </ul>	<ul style="list-style-type: none"> <li>• Prevalence survey</li> <li>• Pin prick blood</li> </ul>	Ages 0 – 6 yrs (N=42)	<b>0.11</b>	0.04 - 0.83 no difference between 0-2 yrs and 3-6 yrs
			Ages 7-14 (N=57)	<b>0.09</b>	0.04 - 0.61
	Port Colborne Community <ul style="list-style-type: none"> <li>• outside heavily impacted area</li> <li>• volunteers</li> <li>• variable soil lead</li> </ul>		Ages 0 – 6 yrs (N=56)	<b>0.10</b>	0.04 – 0.37 no difference between 0-2 yrs and 3-6 yrs
			Ages 7-14 (N=63)	<b>0.08</b>	0.04 – 0.40
	Outside Port Colborne <ul style="list-style-type: none"> <li>• volunteers</li> </ul>		Ages 0 – 6 yrs (N=17)	<b>0.07</b>	0.04 – 0.16 no difference between 0-2 yrs and 3-6 yrs
			Ages 7-14 (N=19)	<b>0.07</b>	0.04 - 0.18

<sup>18</sup> New Brunswick Department of Health and Wellness, 2004. Pilot Study of community closest to Noranda Lead-Zinc smelter

<sup>19</sup> Decou ML. Blood Lead in Niagara County. Regional Niagara Health Department. 2001

Appendix E – Pilot Lead Survey

Reference	Place/Emissions	Study Particulars	Number of children /pregnant women	Geometric Mean $\mu\text{mol/L}$	Range (% at and above 0.48 $\mu\text{mol/L}$ )
<i>Ellis 2000</i> <sup>20</sup>	Ottawa-Carleton • Overall - near an old mine site • In and outside “target area” • With and without mine tailings	<ul style="list-style-type: none"> <li>• Prevalence survey</li> <li>• Pin prick blood</li> </ul>	Ages 4 – 6 yrs (N=145)	<b>0.09</b>	0.04 – 0.76
	Ottawa-Carleton • In “target area” • With mine tailings on property		Ages 4 – 6 yrs (N=26)	<b>0.10</b>	0.04 – 0.51
	Ottawa-Carleton • In “target area” • Without mine tailings on property		Ages 4 – 6 yrs (N=31)	<b>0.08</b>	0.04 – 0.24
	Ottawa-Carleton • Outside “target area” • With mine tailings on property		Ages 4 – 6 yrs (N=15)	<b>0.09</b>	0.04 – 0.76
	Ottawa-Carleton • Outside “target area” • Without mine tailings on property		Ages 4 – 6 yrs (N=24)	<b>0.08</b>	0.04 – 0.32
<i>Ontario Blood Lead Surveys (1990,1992)</i> <sup>21</sup>	Urban “control” neighborhood • Neighborhood used as a control over two periods to serve as “urban background”	<ul style="list-style-type: none"> <li>• Prevalence survey</li> <li>• Pin prick blood</li> </ul>	Ages 4 – 6 yrs (N=227)	<b>0.17</b>	<ul style="list-style-type: none"> <li>• 8% at or above 0.48 <math>\mu\text{mol/L}</math></li> <li>• 4% above 0.48 <math>\mu\text{mol/L}</math></li> </ul>
	Toronto point source neighborhood • Lead battery recycling plant		Ages 4 – 6 yrs	<b>0.19</b>	<ul style="list-style-type: none"> <li>• 7% above 0.48 <math>\mu\text{mol/L}</math></li> </ul>
<i>Levallois 1991</i> <sup>22</sup>	Quebec • Lead reclamation plant • Higher exposure area	<ul style="list-style-type: none"> <li>• Prevalence survey</li> <li>• Venous blood</li> </ul>	Ages 0 - 5 yrs	<b>0.49</b>	Younger children were higher than older children in all areas
	Quebec • Lead reclamation plant • Intermediate exposure area		Ages 0 - 5 yrs	<b>0.35</b>	
	Quebec • Lead reclamation plant • lower exposure area		Ages 0 - 5 yrs	<b>0.28</b>	

<sup>20</sup> Ellis, E. Blood Lead in Ottawa Carleton. Ottawa-Carleton Regional Health Department. 2001

<sup>21</sup> Langlois P, Fleming S, Smith LF, Gould R, Goel V, Gibson BL. Risk factors for high blood lead in Toronto children: a look at communities with and without abatement. Archives of Environmental Health 1996;51(1):59-67.

<sup>22</sup> Levallois P, Lavoie M, Goulet L, Nantel AJ, Gingras S. Blood lead levels in children and pregnant women living near a lead-reclamation plant. CMAJ. 1991 Apr 1;144(7):877-85.

## 5.0 Conclusions

From the DHW pilot survey, children’s average blood lead levels in the potentially most impacted communities indicate that, even though they are well below the the community or individual intervention level of 0.48  $\mu\text{mol/L}$  (geometric mean was 0.14  $\mu\text{mol/L}$ ), they are higher than what have been recently measured in other communities. In addition, there were two children (or 9% of participants) above the intervention level in this small community. This indicates that there is likely exposure occurring at such a level that it warrants additional investigation on a community level given the concerns expressed by the community and the pervasive toxicity of lead to young children.

## 6.0 Recommendation

Of high priority would be to conduct an expanded survey of blood lead among child residents and pregnant women for the GBA. Given the results from the pilot survey combined with the HHRA findings and concerns of the community, an expanded blood lead survey of a representative sample from the other communities within the GBA is warranted. *(Higher Priority)*

## Appendix A - Clinic Set Up and General Procedures

## Clinic Set Up and General Procedures For Lead Screening Clinics at Jacquet River Health Clinic

**Reception Area:** Administrative support to greet clients. Consent reviewed and signed. Label for blood collection tube completed with person's name and clinic ID number.

**Hand washing/soaking area:** Hands washed with liquid Ivory soap and hand to be tested scrubbed with lead free surgical soft scrub brush (bridine brush) for 3 minutes. Timer used. Hand to be tested then soaked in basin (rubber maid food storage container) of hot water for 5 minutes. Timer used. Need to ensure there is no contact with sink taps and hand to be tested is kept immersed in water until ready for testing. (Improves circulation greatly). Lead free paper towels used to wrap hand.

Scrub brushes and soaking basins were washed with ethanolic citric solution between clients.

**Blood Screening/Clinic Area:** one blood letting clinical area was set up on one large meeting table. Table was covered with lead free paper. Blood letting station had sharps container, latex powder free gloves, sterile 2 X 2 gauze, microtainer safety flow lancets (blue – infants/children), microtainer blood collection tubes EDTA, adhesive bandages, alcohol and ethanolic citric solution in dispensing containers.

Emergency kit with adrenalin and BP cuff on hand.

Ministry of Health vaccine transport bag with ice packs for storing blood (fridge also used to store samples).

**Procedure:** have patient sit in chair (adult can sit with child). Don gloves and obtain microtainer to collect blood. Hand to be tested should be dried with lead free paper towel.

- Clean finger to be pricked with ethanolic citric solution.
- Wipe the finger tip with sterile gauze.
- Clean finger to be pricked with alcohol.
- Wipe the finger tip with sterile gauze.
- Puncture side of finger tip with sterile lancet.
- Wipe away first drop of blood with sterile gauze.
- Collect approximately 100 ul of blood – allow the blood to flow by gravity through the Flo Top collector. Attempt to contact the underside of blood drop with collector.
  
- Apply pressure to puncture site and secure with adhesive bandage.
- Place mauve stopper back on blood collection tube and rotate 10 times to allow the blood to mix with the anticoagulant solution.
- Attach patient label to microtainer and place in transport bag.

**Preparing the Ethanolic Citric Solution:** 15cc citric acid added to 450 ml of 70 % ethyl alcohol compound (prepared by pharmacist)

## Appendix B - Blood Collection Procedures

## Blood Collection Procedures

Instructions cover the collection of blood samples for lead screening purposes. This includes preparatory stage; procedure; hand washing technique; preparing ethanolic solution; labeling; packing up procedure; disposal of used material; shipping procedure; care of cooler; coding instructions for blood samples.

- ▶ **Station #1 Reception area**
  - Public Health Nurse reviews consent with parent (or guardian). Consent signed. Label with name & ID code completed.
  - Given directions to move to washing area.
  
- ▶ **Station # 2 Washing area**
  - Wash hands with Ivory liquid soap.
  - Wash hands a second time with lead free soap using hand brush. Bridine brush used for 3 minutes. Timer used.
  
- ▶ **Station # 3 Soaking area**
  - Hand used for blood sample immersed in hot water (42 C/107.6 F) for 5 minutes. Timer used.
  
- ▶ **Station #4 Blood screening/clinic set up area**
  - N.B. Be sure to avoid “Milking” the skin puncture site
  - For children use finger-tip procedure.
  
- ▶ **Station #5 labeling & packaging area**
  - Station not lead secure.
  - Professional needs to take microtainer containing the blood sample & rotate the sample for 10 times to allow blood to mix with anticoagulant solution.
  - Hold tip of finger on mauve stopper, if stopper does not seem secure after rotation reinforce with tape.
  - Apply label.
  - Place microtainer in collector package.

1. Instruct child/adult to hold sterile gauze firmly on puncture site for 1 minute.
2. Initial consent form & verify blood label name & number are correct before putting on microtainer.
3. Place microtainer in cooler for transport.
4. Place sheer spot band aid over area.
5. For children give them a sticker and Halloween treat.

***Important notes on handling of the microtainers***

- If top has fallen off the box, be careful not to touch the end that fits inside the microtainer with your fingers. Pick the top up by the outside & place on lead free paper for preparation of blood test.
- If top does not fit tightly after taking blood, tape the top on the microtainer using tape.

***Hand washing technique***

- Brush hand carefully, using nail brush, with lead free soap.
- Run hands under warm water.
- Dry well with lead free towel.

***Preparing the ethanolic citric solution***

- Add 1 level tablespoon (15cc) of citric acid to one bottle (450 ml) of 70% ethyl alcohol compound. Mix well.

## Appendix C - Laboratory Analytic Method for Blood Lead

**1. TYPE OF METHOD**

Graphite Furnace Atomic Absorption Spectrometry

**2. APPLICATION RANGE**

0.05 umol/L to 5 umol/L

**3. INSTRUMENTATION**

Atomic Absorption Spectrometer – Perkin Elmer ZL 4100

**4. DESCRIPTION**

Blood is diluted with an acidic Triton-X, ammonium phosphate solution, analysed by graphite furnace with Zeeman background correction, using a non-pyro coated graphite tube. Calibration is achieved by addition of lead on normal human blood.

**5. PRECISION AND DETECTION LIMIT**

Routine checks of accuracy and precision are accomplished using reference materials from the Laboratoire de la Direction de la toxicologie humaine / INSPQ interlaboratory comparison program. Also, periodic evaluations are accomplished by our participation in the same program. The method detection limit obtained is 0.05 umol/L. Variation coefficients at levels of 0.11 umol/L and 0.81 umol/L are 20.8 % and 3.2 % respectively.

**6. REFERENCE RANGE AND OCCUPATIONAL EXPOSURE LEVELS**

General population : 0 - 0.32 umol/L<sup>(3)</sup>

Alert level : 1.5 umol/L

Action level : 4.0 umol/L

**7. INTERLABORATORY COMPARISON PROGRAMS**

Blood Lead Laboratory Reference System (BLLRS), CDC, Atlanta

Wisconsin State Laboratory of Hygiene, Madison

State of New-York Department of Health

Laboratoire de la Direction de la toxicologie humaine / INSPQ

**8. REFERENCE**

- (1) Parsons PJ., Slavin W. 1993. A rapid Zeeman graphite furnace atomic absorption spectrometric method for the determination of lead in blood, *Spectrochimica Acta*. Vol. 48B, No. 6/7, 925-939.
- (2) ACGIH, Documentation of threshold limit values and biological exposure indices, 6<sup>th</sup> edition, Cincinnati, 1992
- (3) LeBlanc A et al. Étude sur l'établissement de valeurs de référence d'éléments traces et de métaux dans le sang, le sérum et l'urine de la population de la grande région de Québec. Institut national de santé publique de Québec, Octobre 2003.

ÉTUDE SUR LA SANTÉ DANS LA RÉGION DE

**Belledune**

AREA HEALTH STUDY

Belledune • Petit-Rocher • Pointe-Verte