

2012 Follow-up Blood Lead Exposure Study

The follow-up blood lead study was conducted to evaluate the effectiveness of the exposure reduction strategies in reducing lead exposure. The follow-up study, conducted in the Fall of 2012, followed a nearly identical approach to that used for the 2009 study. The one additional component was the collection of environmental samples (household dust, yard soil, tap water, and paint assessment) for households where children providing blood samples lived.

Blood samples were collected from 118 children under 7 years of age from the Flin Flon area. Comparison of the results from 2009 and 2012 indicated the following:

- Blood lead levels were significantly lower in 2012 as compared to 2009
- Significant decreases were noted across all subgroups including age, gender and region
- Blood lead levels of children in Flin Flon and Creighton appear to be slightly above the levels found in other Canadian children
- Like the 2009 study, blood lead levels were slightly higher in West Flin Flon as compared to other areas of Flin Flon and Creighton

Average and upper-end blood lead levels for all subgroups in the 2012 dataset were less than the normal levels established by the United States Centers for Disease Control (5 µg/dL). The potential influences that have reduced the average blood lead levels in the Flin Flon area are the closure of the smelter and dust prevention measures with reduced air emission of lead, as well as other measures such as hand washing and precautions used during renovation of older homes. However, the study did not find a strong influence of parental awareness of the Mighty Bubble Program on the child’s blood lead level, so the effect of hand washing in influencing the change in blood lead levels is uncertain.

The main influence found to explain the differences in blood lead levels in children from various homes throughout the community was the age of the home, with only a slight influence from levels of lead in soil, dust and paint. Personal factors did not seem to influence the blood lead levels. Even though this study did not find a strong influence of personal factors on blood lead levels, following general Canadian guidelines to reduce children’s exposure to lead such as hand washing, taking shoes off at the door, taking precautions to reduce exposure to lead paints, using cold water from the tap for drinking and cooking, and reducing children’s exposure to environmental tobacco smoke would still be warranted.

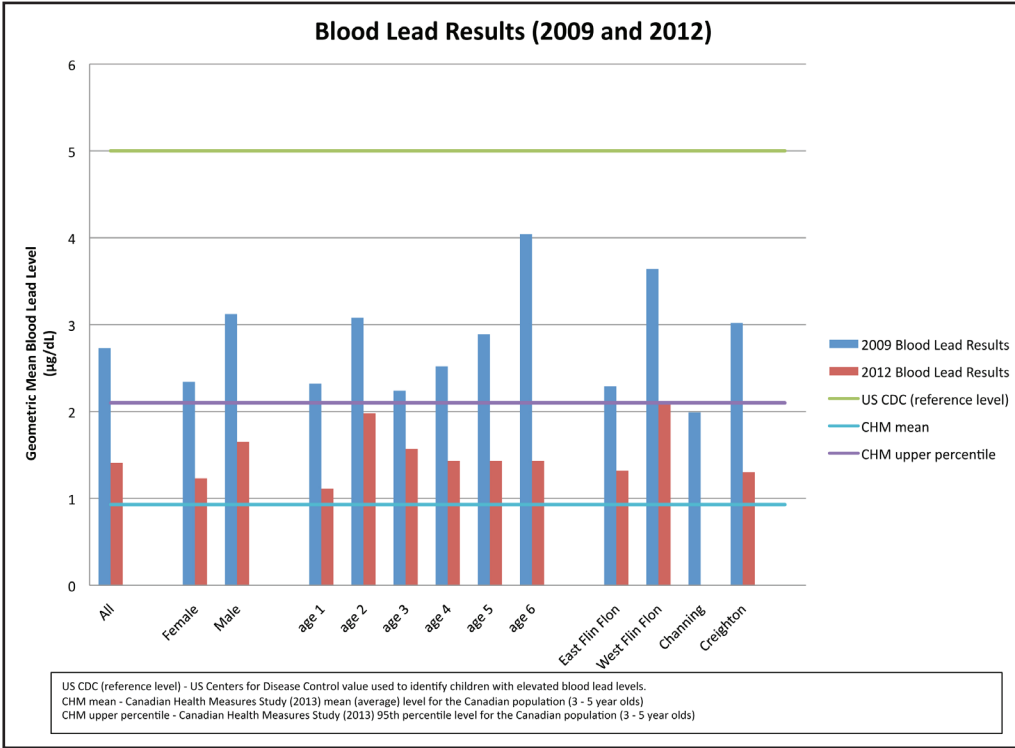
In summary, the 2012 Exposure Study showed that blood lead levels in children decreased significantly following the closure of the smelter in June 2010 and the implementation of various public education and awareness programs. Recent Canadian Health Survey data indicate that

the blood lead levels of children in the Flin Flon area appear to be slightly above the levels found in other Canadian children, although levels in Flin Flon area children are similar to those in children across the United States.

The Path Forward

The blood lead levels in Flin Flon and Creighton are significantly lower than those measured in the past and levels are only slightly higher than what may be found in children in other Canadian communities.

- The following activities are recommended to continue:**
- **Mitigation measures to reduce dust produced from tailings impoundments and vehicular traffic within the Metallurgical Complex. This includes the paving of in-plant roads, material handling upgrades, and re-vegetation of the area in and around the complex**
 - **Public outreach and education programs targeted at raising awareness of potential sources of lead and practical methods for reducing exposure. The distribution of resources to encourage proper hand washing, particularly among young children, still continues to be a positive practice in exposure reduction**
 - **Additional measures to raise awareness on limiting exposure to lead in paint through proper renovation techniques and reducing exposure to lead in drinking water are also encouraged**



For more information:

The results of the Flin Flon Soils Study will be released at a community open-house at the Flin Flon City Hall on May 14, 2013. Study experts will be available to answer questions from the public. Inquiries and comments on this Study can also be made by:

- Email: questions@flinflonsoilsstudy.com

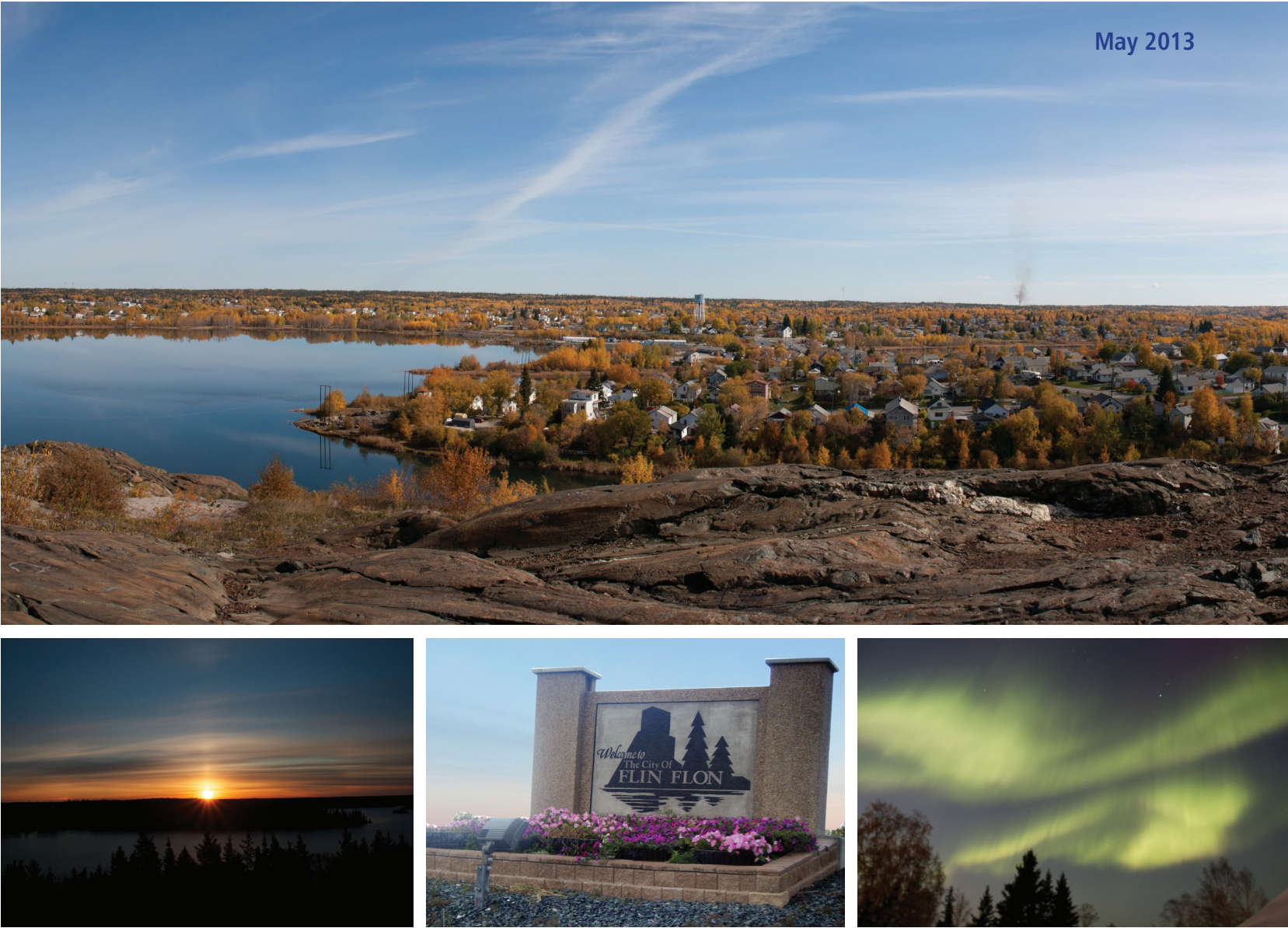
Tel: 204-271-9555

Web: flinflonsoilsstudy.com (online comment form)
- Mail: Flin Flon Soils Study – Public Comments
c/o Intrinsik Environmental Science Inc.
500-6605 Hurontario St., Mississauga, ON L5T 0A3

This pamphlet was created to provide residents and the general public with a summary of the results, conclusions and recommendations from the Flin Flon Soils Study. For more information about the Study, the complete scientific technical reports may be viewed at the Flin Flon public library and online at www.flinflonsoilstudy.com

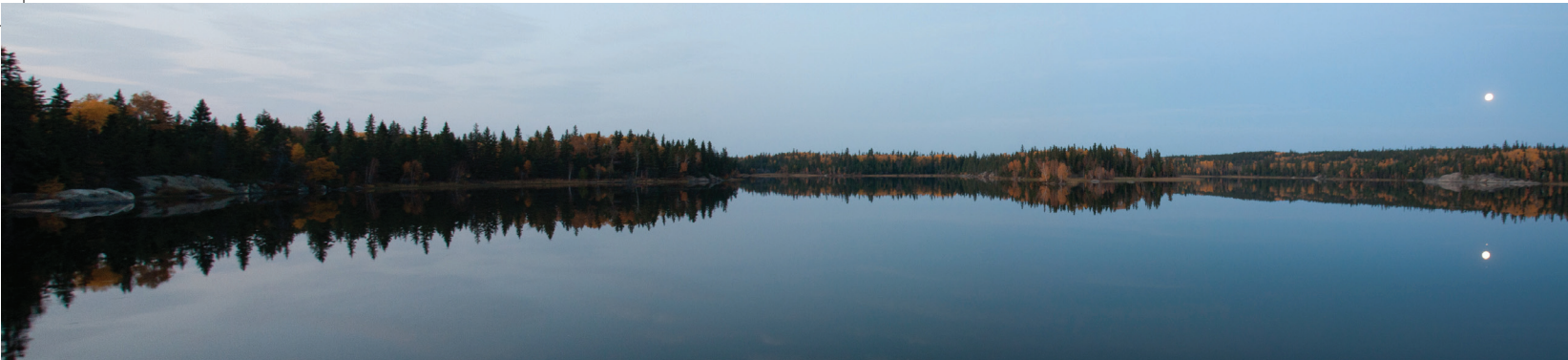
The Flin Flon Soils Study

An Assessment of Exposure and Human Health Risks in the Flin Flon Area



The Flin Flon Soils Study was a multi-year investigation that looked at how people are exposed to metals in the environment in the Flin Flon area, and whether or not these exposures could affect people’s health. The Study included the measurement of metals in the local environment, the completion of a Human Health Risk Assessment (HHRA), and the completion of two Evaluation of Exposure studies (2009 and 2012) involving the collection of blood and urine samples from children. The 2012 Evaluation of Exposure study was conducted to evaluate the effectiveness of exposure reduction strategies implemented to reduce lead exposure following the 2009 study.

The overall conclusion of the Flin Flon Soils Study is that the likelihood of adverse health effects among Flin Flon area residents from exposure to the metals evaluated is negligible to low.



Why was the Flin Flon Soils Study conducted?

Hudbay Minerals (Hudbay) has operated a mine and base metal smelting complex in Flin Flon, Manitoba, since the 1930's. Studies have suggested that mining and smelting activities have gradually led to a build-up of naturally occurring metals in the environment in the Flin Flon area.

For the purpose of this study, the 'Flin Flon area' includes Flin Flon, MB; Channing, MB; Flin Flon, SK and Creighton, SK.

Many scientific studies have looked at the impact of emissions from the Hudbay smelter on the local environment. A 2007 report from Manitoba Conservation concluded that the levels of some metals were elevated in soil but that there was no immediate risk to human health. The report recommended further study to better understand potential health risks for people living in the Flin Flon area related to the Hudbay smelter emissions. The Flin Flon Soils Study was the result of this recommendation.

The 2012 Evaluation of Exposure study was conducted to evaluate the effectiveness of exposure reduction strategies implemented to reduce lead exposure following a similar study conducted in 2009.

For the purpose of the study, 'metals' refers to the specific elements studied: arsenic, cadmium, copper, lead, mercury and selenium.

How was the study conducted?

The Flin Flon Soils Study had many different parts. Each part focused on collecting information that could be used to understand how Flin Flon area residents are potentially exposed to metals in their everyday lives. The largest part of the study was an HHRA which predicted how people are exposed to metals, and whether or not these exposures could affect people's health. Another part of the study was the Evaluation of Exposure which measured the actual levels of metals in the blood and urine of children on two separate occasions (in 2009 and 2012). Details of the overall study process and components can be found at <http://www.flinflonsoilssstudy.com/doclibrary.php>.

Who conducted the study?

Many groups, agencies and individuals were involved in ensuring that the study was conducted in an independent and scientifically sound manner. The HudBay-led study was conducted by independent scientific experts under the oversight of a Technical Advisory

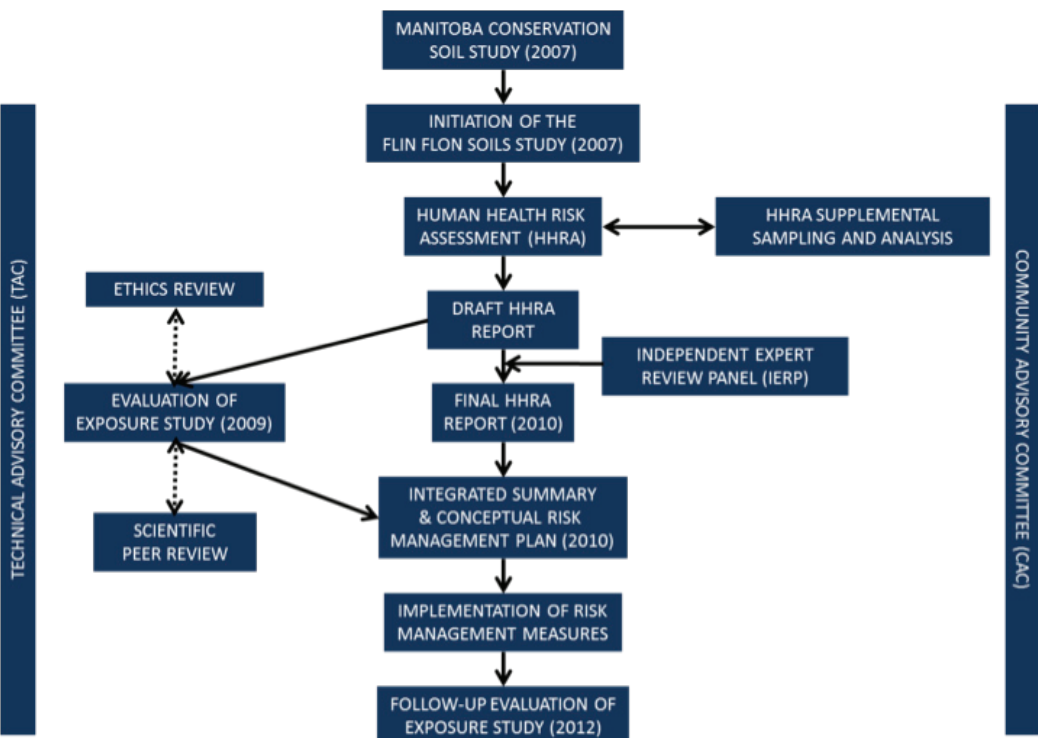
Committee (TAC), a Community Advisory Committee (CAC), an External Facilitator, and independent expert peer review of study components. The advisory committees provided input into study design and research methods, and were regularly updated on study progress. The Evaluation of Exposure study passed through an additional review which focused on the ethics involved in conducting the study and making sure that people were properly informed before deciding to participate.

Human Health Risk Assessment (HHRA)

An HHRA predicts people's exposure to certain chemicals such as metals. The HHRA can then determine whether these exposures could potentially result in negative health effects. The HHRA used the following information to estimate how much exposure people would have for each metal:

- Measured levels of metals in the Flin Flon area environment (soil, indoor dust, air, water, fish, local food)
- Surveys of the community eating habits and lifestyle behaviours
- General assumptions about physical characteristics, lifestyle and activity patterns of people living in the Flin Flon area (time spent outside, length of time living in community, age)

All of the information was then used to predict how much people might be exposed to metals in the Flin Flon area. This was then used to understand whether or not increased health risks may occur as a result of exposure to these metals. The HHRA was completed between July 2007 and May 2010.



Community Health Status Assessment

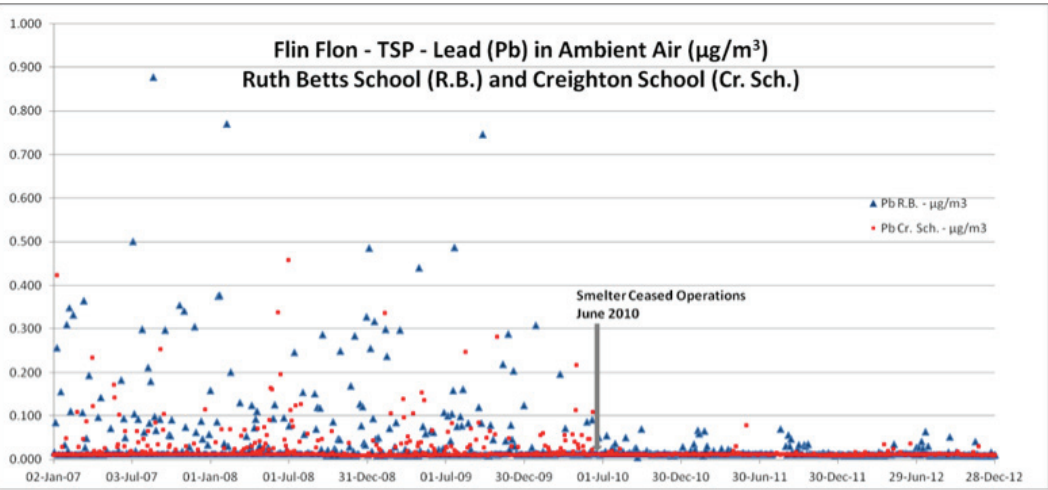
A Community Health Status Assessment of Flin Flon and Creighton, completed by public health officials from Manitoba Health and Healthy Living and the Saskatchewan Ministry of Health, indicated that the overall health status of the Flin Flon area population is as good if not better than the provincial averages for most health outcomes studied. Cancer incidence rates for men and women were not significantly elevated in the Flin Flon area.

2009 Evaluation of Exposure Study

Early results of the HHRA indicated some potential for elevated exposure to certain metals. As a result, an Evaluation of Exposure was conducted to collect additional information on three metals (lead, inorganic mercury, arsenic) to help provide a better understanding of Flin Flon area exposure levels. In Fall 2009, the Evaluation of Exposure study was conducted to measure the actual exposure of children to these three metals by collecting and analyzing blood and urine samples. The study focused on children due to their increased sensitivities to the metals, as well as their behaviours that result in increased exposures. In Fall 2009, 202 blood samples were analyzed for lead and 379 urine samples were analyzed for inorganic mercury and arsenic. Participating households also completed a survey of characteristics and personal factors. The survey helped to determine what factors might contribute to exposure levels.

The 2009 Exposure Study indicated:

- Levels of inorganic arsenic and inorganic mercury in the urine of children were not elevated. The community urinary arsenic levels were very similar to the levels found in other Canadian communities where soil levels were not elevated.
- Measured blood lead levels in children from the Flin Flon area did not indicate immediate health concerns. The blood lead results for Flin Flon area children were comparable with or even slightly lower than other Canadian smelter communities, and were slightly higher than the average levels reported for a large US national study.
- Many factors were associated with the measured blood lead levels in Flin Flon area children including gender, area of residence, and the year that their house was constructed (age of house may indicate other sources of exposures such as from lead in paint or pipes).



Few children (about 2%) had measured blood lead levels above the Canadian Blood Lead Intervention Level. As a precaution, a more sensitive reference point was used for the study; as a result, about 13% of the children tested were referred to a physician for follow-up.

What were the results of the HHRA and the 2009 Exposure Study?

The overall conclusion of the HHRA and the 2009 Exposure Study was that the likelihood of adverse health effects among Flin Flon area residents from exposure to the metals evaluated was negligible to low.

Overall, the findings from these studies were reassuring, but some low level risks were identified from some metals (e.g. lead). Based on these findings, recommendations were made in 2010 to undertake efforts to reduce children's exposure to lead. The main efforts undertaken included a public health awareness campaign that targeted:

- Parents and children to improve the frequency and quality of handwashing among children
- Homeowners and contractors undertaking renovations to ensure proper training, procedures and clean-up (including making HEPA vacuums available for rental/borrowing as needed)



Other efforts included the continuation of a HudBay program of progressive remediation and re-vegetation of the area in and around the Flin Flon Metallurgical Complex, as well as a sustained effort by HudBay to continue with operating practices and procedures aimed at minimizing dust emissions. HudBay continued other environmental improvements within its operations such as the paving of in-plant roads and material handling upgrades to help improve ambient air quality.

A follow-up blood lead monitoring program was recommended to determine the extent to which the community blood lead levels of children living in the Flin Flon area were affected by the implementation of these exposure

reduction strategies. Following the closure of the smelter in June 2010, it was recommended that provincial and Hubay air monitoring programs be continued to confirm that concentrations of metals in the air decreased after that time. Recent air monitoring has shown that concentrations of metals in air have decreased following the closure of the smelter and the ongoing efforts to reduce the generation of dust. The triangles and squares in the picture represent measurements of lead in the air. This exhibit shows that there has been a sharp drop in the lead level measured in air since June 2010.