The Flin Flon Soils Study

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

June 2010

This document answers the following questions:

- Why was the Flin Flon Soils Study conducted?
- How was the study conducted?
- Who conducted the study?
- What did the study find?
- What happens now?
- How do I get more information?

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.

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Why was the Flin Flon Soils study conducted?

Hudson Bay Mining and Smelting Co., Limited (HBMS) has operated a fully-functional mine and base metal smelting complex in Flin Flon, Manitoba since the 1930's. Recent studies suggest that mining and smelting activities have gradually led to a build-up of naturally occurring metals in the environment in the Flin Flon area.

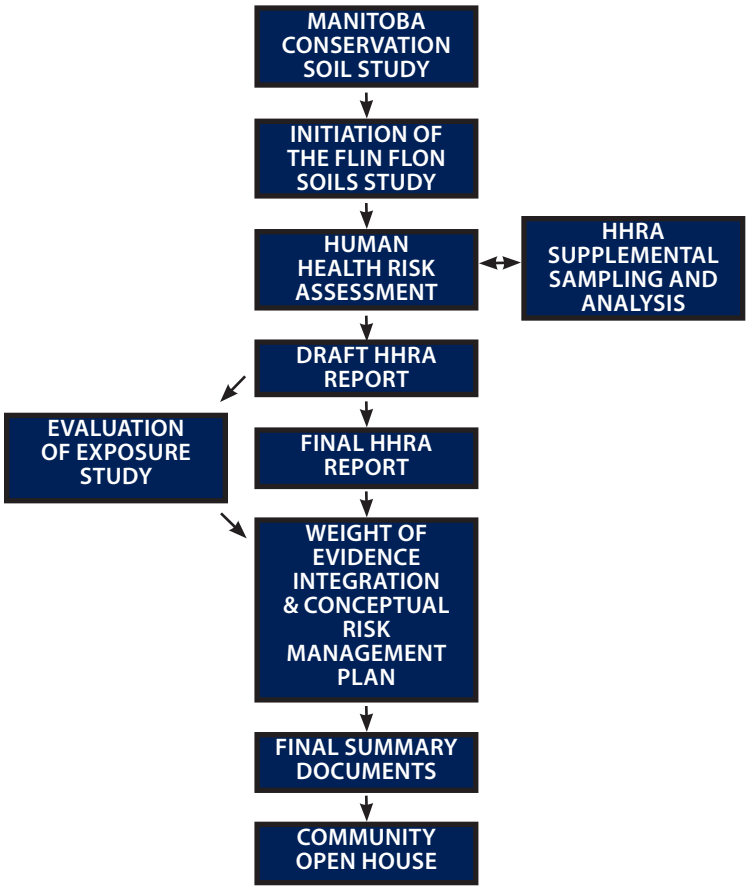
For the purpose of this study, the 'Flin Flon area' includes Flin Flon and Channing, Manitoba, and, Flin Flon and Creighton, Saskatchewan.

Many scientific studies have looked at the impact of emissions from the HBMS smelter on the local environment. A 2007 report from Manitoba Conservation, called "Concentrations of Metals and Other Elements in Surface Soils of Flin Flon, Manitoba and Creighton, Saskatchewan, 2006", 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 HBMS smelter emissions. The Flin Flon Soils Study was the result of this recommendation.

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 piece 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 a Human Health Risk Assessment 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 metal in the blood and urine of chlidren.



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. Human health risks are calculated based on four factors:

- How dangerous a chemical is known to be;
- How sensitive people are to the chemical;
- How a person might come into contact with the chemical such as swallowing, breathing, or skin contact as well how often and how long they are exposed; and,
- How much of the chemical a person is exposed to.

HHRAs follow specific methods that have been developed by government agencies such as Health Canada and the US Environmental Protection Agency. Acceptable levels of exposure are decided by government regulatory agencies. They base their decisions on a thorough review of current scientific evidence and existing regulatory policies, making sure to err on the side of safety.

The HHRA estimated how much exposure people would have for each metal. The HHRA used the following information:

- Measured levels of metals in the Flin Flon area environment (soil, indoor dust, air, water, fish, local food),
- Surveys of the community's eating habits, and lifestyle behaviors,
- 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.

Evaluation of Exposure

Since the early results of the HHRA indicated some potential for elevated exposure, it was determined that additional information on three of the metals would help provide a better understanding of Flin Flon area exposure levels. The HHRA indicated the need for additional information on lead, inorganic mercury, and arsenic; no additional information was necessary for copper, cadmium and selenium. The Evaluation of Exposure study measured the actual exposure of children to these three metals by collecting and analyzing blood and urine samples. The study focused on children due to thier increased sensitivities to the metals, as well as their behaviors that result from increased exposures.

The Evaluation of Exposure Study was designed to answer these four questions:

- What is the current level of lead, arsenic, and inorganic mercury in the blood and urine of children in the Flin Flon area?

- Do Flin Flon area children have higher lead, arsenic, and/or inorganic mercury levels than residents living in other parts of Canada?
- Based upon the current scientific literature, what are the health risks from the levels of lead in blood, and arsenic and inorganic mercury in urine that were found in children in the Flin Flon area?
- What personal factors are associated with the level of chemicals in the children of Flin Flon, such as place of residence, parents place of work, age, gender, diet, personal habits and playing habits such as children putting soil in their mouths.

During fall 2009, 447 Flin Flon area children participated in the study, providing 202 blood samples and 379 urine samples. Parents received their children's lab results, and were referred to their family physician for follow-up, if required. Households with participating children also provided information for a survey of characteristics and personal factors such as; area of their residence, children's play activities, number of silver-colour fillings, diet including whether or not they eat local game, and parents' occupations. The survey helped to determine what factors might contribute to exposure levels.

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.

Who conducted the study?

As with most large studies, there were many groups, agencies and individuals involved in ensuring that the study was conducted in an independent and scientifically sound manner. These included a Technical Advisory Committee (TAC) and a Community Advisory Committee (CAC), involvement of an External Facilitator, and independent expert peer review of study components. The advisory committees provided input into study design and research methods and were reguarly updated on study progress.

Community Advisory Committee: The CAC, consisting of interested members of the public, and representatives from local organizations, was formed to provide public input to the process, and to help make the study an open and transparent process from start to finish.

Technical Advisory Committee: The TAC was a key element in ensuring that the study was a thorough, scientifically rigorous assessment of potential health risks to the community. The TAC is made up of members from Manitoba Conservation, Manitoba Health, Manitoba Innovation, Energy and Mines (IEM), Manitoba Water Stewardship, Saskatchewan Ministry of Environment, Saskatchewan Ministry of Health, Health Canada and representatives from the CAC.

Scientific Consultants: Intrinsik Environmental Sciences Inc. (Intrinsik) was retained by HBMS to assess the potential human health risks associated with exposure to smelter-related metals in soils and other environmental media in the Flin Flon area. HBMS chose to have an independent consultant conduct the Flin Flon Soils Study to further ensure that study results were non-biased, conclusive and provided reliable and scientifically defensible data.

Expert Peer Reviewers: The study components underwent a rigorous review by an Independent Expert Review Panel. This panel had eight leading North American scientists, from government, industry and academia. The panel was formed and administered by Toxicology Excellence for Risk Assessment (TERA), an international not-for-profit organization. This review process made sure that the Flin Flon Soils Study was monitored carefully by outside, independent experts and that the results were scientifically sound and acceptable for regulatory purposes.

Ethics Review Board: The Evaluation of Exposure study passed through an additional review focused on the ethics involved in conducting the study and making sure that people were properly informed before deciding to participate.

Next Steps: What Happens Now?

Overall, the findings from these studies are reassuring, but some low level risks were identified from some metals. Reducing air emissions, continued monitoring and some additional precautionary measures are recommended.

The HBMS smelter ceased operations in mid-June 2010. This closure is anticipated to significantly reduce the concentrations of metals in air. It is recommended that provincial and HBMS air monitoring programs be continued in the future to confirm that concentrations of metals in the air are decreased after that time. Ongoing activities on the HBMS property designed to minimize the generation of dust on the site as this should help to limit future exposures in the community.

Fish are an important part of a healthy diet and contain high-quality protein and other essential nutrients and are low in saturated fats. A well-balanced diet including a variety of fish can contribute to a healthy heart, proper growth and development in children. Recreational fish consumption guidelines (*e.g.*, guidelines regarding the size, species of fish, and the maximum number of meals recommended for consumption per month) are in place to address concerns related to mercury concentrations in fish for many provincial lakes. It is recommended that the Provinces evaluate the need for advisories on the lakes with increased fish mercury concentrations identified in this study.

Based on the outcome of the HHRA and exposure studies, which indicate that lead levels in Flin Flon are slightly higher than available population normal levels and that sources of lead exposure in the community may be caused by multiple factors, a community awareness and education strategy for lead is recommended. These strategies are described in the detailed summary document. In addition, it is anticipated that the smelter closure will further reduce lead exposures. A follow-up blood lead analysis is recommended for the fall of 2011 to evaluate the effectiveness of these exposure reduction strategies in reducing lead exposure. Based on the results of the Flin Flon Soils Study, the removal or management of soils in the community are not justified at this time.

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Results: What Did the Flin Flon Soils Study Find?

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.

Short-term risks associated with infrequent exposure scenarios were evaluated for air, soil and snow related exposures. The results of this evaluation indicated that on rare occasions some people may experience short-term and reversible minor health effects from exposure to metals in soil and air. These inclusde irritation of the eyes, nose or throat; or aggravation of symptoms of those with asthma. Long-term risks are associated with regular and repeated exposure scenarios that may occur throughout a lifetime. Results are provided below:

Copper

- No elevated risks from exposure to copper were predicted.

Selenium

- No elevated risks from exposure to selenium were predicted.

Cadmium

- Air concentrations of cadmium could pose a low long-term health risk. However, increased cases of lung cancer in the Flin Flon area are not expected, given the small population size and estimated low risk level. The HBMS smelter ceased operation mid-June 2010. This closure is anticipated to significantly reduce the concentrations of metals in the air. Actual levels will continue to be monitored after smelter closure.
- No significant increased rates of lung cancer were identified for the Flin Flon area within the Community Health Assessment.

Methyl Mercury

- Some fish in Flin Flon area lakes had elevated concentrations of mercury. Mercury is a naturally occurring element and most fish contain some amounts of mercury, with older, larger fish accumulating the highest amounts. The elevated levels in fish generally appeared to increase with distance from the HBMS facility, which suggests that these concentrations in fish are not related to the HBMS facility.

Inorganic Mercury

- No elevated levels of inorganic mercury in the urine of children.

Arsenic

- Air concentrations of arsenic could pose a low long-term health risk. However, increased cases of lung cancer in the Flin Flon area are not expected, given the small population size and estimated low risk level. The HBMS smelter ceased operation mid-June 2010. This closure is anticipated to significantly reduce the concentrations of metals in the air. Actual levels will continue to be monitored after smelter closure.
- No significant increased rates of lung cancer were identified for the Flin Flon area within the Community Health Assessment.
- Levels of inorganic arsenic in the urine of children were not elevated. The community levels were very similar to the levels found in other Canadian communities where soil levels were not elevated.

Lead

- Measured blood lead levels in children from the Flin Flon area do 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 of the general population.
- Blood lead levels in Canada have declined significantly over time. However, some of the latest studies on lead indicate that there may be slight developmental and cardiovascular effects even at low levels. The findings from the studies show lead exposure in Flin Flon is slightly higher than available population data but well below the current action levels for medical intervention.
- Few children (about 2%) had measured blood lead levels above Health Canada's current 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.
- 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 exposures such as from lead in paint or pipes).

For more information:

The results of the Flin Flon Soils Study were released at a community open-house at the Flin Flon City Hall on June 17, 2010. There will be a second open house in the fall of 2010. Study experts will be available to answer questions at the Flin Flon City Hall, on:

- **Friday June 18, 2010 between the hours of 9 am to 9 pm**
- **Saturday June 19, 2010 between the hours of 9 am to 6 pm**
- **Monday June 21, 2010 between the hours of 9 am to 5 pm**

Study experts will also be available to answer any general or scientific study questions until October 15, 2010.

By EMAIL: questions@flinflonsoilsstudy.com

By TELEPHONE: 204-271-3792

How to submit your comments:

Members of the public are invited to review the Flin Flon Soils Study reports and submit written questions and comments during the public comment period: June 18, 2010 to October 15, 2010. The study team and the TAC will review all comments and respond to these comments in an appendix to the final report.

By MAIL: Flin Flon Soils Study – Public Comments

c/o Intrinsik Environmental Sciences Inc.
500-6605 Hurontario Street
Mississauga, ON L5T 0A3

By EMAIL: comments@flinflonsoilsstudy.com

By INTERNET: www.flinflonsoilsstudy.com (online comment form)

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, a more detailed summary document is available. Also, the complete scientific technical reports may be viewed at the Flin Flon public library and online at www.flinflonsoilstudy.com