Northern Saskatchewan Prenatal Biomonitoring Study General Summary Report

Ministry of Health, Government of Saskatchewan, 2019

Saskatchewan Health Authority

Saskatchewan

What was the study about?

Humans are surrounded by chemicals—some are essential to life (e.g., oxygen, iron, selenium), while some may cause harm under certain circumstances or at certain doses. Environmental chemicals describe those man-made or naturally occurring chemicals that we are exposed to in our daily lives. People interact with a variety of chemicals every day. Some may be eaten or drank, breathed in, or absorbed through the skin in consumer products, water, soil, food, or air.
The biomonitoring study looked at various environmental chemicals found in the blood of pregnant women in northern Saskatchewan.

What is biomonitoring and what is the purpose of biomonitoring?

Biomonitoring measures chemicals in humans through analyzing blood, urine, hair or breast milk. At this time, it is the most accurate means we have to determine the amount of a given chemical or element a person is exposed to in the environment. It gives us a snapshot in time and allows us to know the quantity of a given chemical in the body, but does not tell us information on the source, duration, or route exposure. The risk to human health is determined by the complex interplay between the type of chemical, the amount of the chemical, what kind of exposure, how often the exposure took place and the person exposed.

Information from biomonitoring can:

- enable the public and communities to become more aware of and take steps to reduce their exposure to environmental chemicals;
- enable comparisons between populations and over time assist government, environment and health agencies to assess risks and take public health or environmental actions; and
- assist in the prioritization of further research.

How was the study done?

The study involved the co-operation of pregnant women living in the Northern Administrative District of Saskatchewan between April 2011 and April 2013. The women allowed any blood remaining after their routine prenatal blood tests to be included in the study. Pooling of the residual blood from 855 serum samples was done to ensure there was enough specimen for testing of over 280 environmental chemicals.

There were six pools of specimens based on the area of northern Saskatchewan in which the women resided. This allowed for comparisons across the north as well as comparisons with results from a previously completed prenatal biomonitoring study in Alberta. Some comparisons were possible with other biomonitoring studies; however, for some chemicals, only baseline results are available.

Who are the agencies involved?

The study was done in partnership between the Saskatchewan Ministry of Health, northern Saskatchewan Health Authorities and Alberta Health.

A Steering Committee for the study was engaged to assist with overall direction of the project. This included representatives from the Ministries of Health and Environment, from northern health authorities including the northern Health Regions and the First Nations health authorities; and the First Nations Inuit Health Branch of Health Canada.

Feedback and support for the project was provided by the Northern Saskatchewan Environmental Quality Committee, the Boards of the Athabasca Health Authority, the Keewatin Yatthé and the Mamawetan Churchill River Health Regions, the Northern Intertribal Health Authority Board of Chiefs and Executive Council, the Prince Albert Grand Council Chiefs and the Meadow Lake Tribal Council Health and Social Services group.

Further information was provided to northern health professionals involved with the care of prenatal women including public health nurses and physicians. Community awareness was enhanced through the use of radio messaging in Cree, Dene and English as well as pamphlets available at all health centers and through prenatal education, and posters used at health centers and other community centers or bulletin boards.

What environmental chemicals were tested?

The chemicals selected were based on other Canadian biomonitoring projects as well as other chemicals that may be of concern in Alberta and Saskatchewan. Chemicals tested included:

- a wide variety of industrial and agricultural by-products,
- those used in the manufacture of consumer goods (furniture, building materials, clothing, cosmetics, etc.), and
- those that naturally exist in the environment.

A variety of mineral micronutrients (required for good health) and trace metals, and a wide variety of chemicals classified as pesticides, PCBs, flame retardants, phlalates, dioxians and furans were tested. In addition, because commercial tobacco contains many chemicals of concern, continine, a break-down product of nicotine, was also measured.

What did the study show?

Finding a chemical in the body through testing does not necessarily mean that this poses a health risk or causes a health problem. Some chemicals (e.g minerals) are required for good health, but too much exposure could increase the chance of health problems.

Overall, most of the environmental chemical testing for northern Saskatchewan revealed levels lower than or comparable to levels in pregnant women in the Alberta study. Some highlights include:

- Chemicals such as polybrominated diphenyl ethers, perfluorochemicals, most pesticides tested, dioxins and furans were either lower than Alberta levels or undetectable. Uranium, nonylphenol and bisphenol A were also not detectable or were below the level that could be accurately measured.
- Selenium and molybdenum were lower than the average levels in Alberta. Iron levels were also lower than Alberta but cobalt was higher. Both iron and cobalt help prevent anemia.
- The levels of lead, a heavy metal, were higher than the average levels seen in Alberta. People may be exposed to lead through lead-based paints (in older homes), drinking water coming in contact with old lead plumbing, consumer products, or ingestion of lead shot or lead bullet fragments in country foods. Smokers or those exposed to second hand smoke tend to have higher levels.

- Mercury levels were comparable or slightly lower than Alberta; however, the levels in the far northern area of Saskatchewan were higher. Methylmercury levels tend to be higher in those who consume a lot of fish, especially large predatory fish.
- Continine levels, a breakdown product of nicotine, were higher in northern Saskatchewan women indicating higher exposures to tobacco smoke either through smoking or passive smoke exposure. Exposure to tobacco smoke increases exposure to many other environmental chemicals as well.

Further details on the study can be found in the report "Biomonitoring in Northern Saskatchewan Technical Summary Report" at:
https://publications.saskatchewan.ca:443/api/v1/products/101374/formats/112048/download

What's next?

This is the first biomonitoring initiative of this magnitude in Saskatchewan. The findings will:

- serve as baseline information for boreal areas of Saskatchewan and across Canada;
- inform decision makers on future policies and programs to address exposure to environmental chemicals when they are found to be harmful;
- support further research on links between exposure to certain chemicals and health effects;
- identify chemicals to watch for increasing or changing levels over time; and
- support healthy practices for people in the surveyed area.

APPENDIX

Biomonitoring Findings

Most of the **other chemicals** measured (not within this table) had concentrations that were comparable or slightly lower to those found in Alberta or had no comparison in the Alberta study.

Chemical	**What is it?**	**How can I be exposed?**	**What are the health effects?**	**Levels in SK compared to AB**
Cotinine	A breakdown product of nicotine	Tobacco smoke is the primary source of exposure. Commercial tobacco smoke contains many harmful chemicals.	The health effects of cotinine are not of concern, but the health effects of tobacco smoke exposure are well understood and concerning.	Higher in SK than in AB study
Polybrominated diphenyl ethers (PBDEs)	A flame retardant used for decades in commercial products such as furniture and clothes to reduce the risk from fire.	Through dust in homes and workplaces and through diet	No definitive link to negative health outcomes in people; however, research on rats and mice show effects on thyroid and liver function and at high concentration, neurologic function and immune system.	Lower in SK than AB study
Perfluorochemicals (PFCs)	Used in industrial processes and commercial products mostly as stain repellants	Through dust in homes and workplaces and through diet	Not linked to human health effects. Studies on animals indicate high doses can affect development, reproduction and liver function.	Lower in SK than AB study
Bisphenol A (BPA)	Used in manufacturing plastics and resins (toys, food and beverage bottles, eyeglass lenses, medical equipment, dental sealants, and water pipes)	As BPA leaches from the plastics and resins, it can be found in food and beverages. BPAs can leach from landfills and enter the surrounding environment.	Human health effects have yet to be determined. From animal studies there is a link to developmental and reproductive issues, neurotoxicity, ovarian dysfunction, and recurrent miscarriages.	Not detected in SK pools
Methylmercury	Widespread naturally occurring metal found across the globe; increases seen in areas with erosion, forest fires, volcanic activity and from industrial contamination. The most toxic form of mercury to humans.	Produced when bacteria transform other forms of mercury in aquatic sediments. Greatest exposure is eating certain fish and seafood. Large predatory fish are of particular concern.	Known to cause adverse effects to both the motor and sensory nervous systems with memory loss, attention deficits, language issues and visual-motor skill problems in childhood.	SK either comparable or higher than AB study

Chemical	What is it?	How can I be exposed?	What are the health effects?	Levels in SK compared to AB
Elemental mercury	Naturally occurring, introduced to the environment by weathering of rocks and minerals as well as volcanic activitiy. Used in a variety of industrial, commercial, and medicinal products (i.e. electrical instruments, thermometers, batteries, cosmetics, etc.) It is being phased out of most products.	Can be released into the air, water or soil by use or disposal of mercury containing products, burning of coal, and through mining and industrial processes. Most humans are exposed through ingestion and inhalation of food, water or air containing trace amounts of mercury. Primary source is organic mercury (methylmercury).	Background concentrations are not known to cause any ill health effects. Exceptionally high exposures (such as accidental releases or unusual occupational exposures), may cause serious health effects such as neurological, renal or digestive system problems. Rash and eye irritation may also occur.	SK was comparable to AB for those ages 26 and older, but slightly higher for ages 18-25. Levels were higher in the far northern area of SK.
Cesium	Naturally occurring and enters the environment from weathering of rocks and minerals. Cesium compounds are used in products including alkaline storage batteries, photoelectric cells, optical instruments, glasses and atomic clocks. Disposal of these products can release cesium into the environment.	Primarily through ingestion or inhalation of food, water, soil, or air containing trace amounts (most common food source is tea and coffee. Yeast, herbs and spices can have high concentrations as well as some lichens).	Not known to cause any ill health effects in humans. Long term exposure is not well understood	SK either comparable or higher than AB study
Lead	Naturally occurring heavy metal. Used in industrial and commercial products and then released into homes and environments with use of the products as well as a consequence of some industrial processes.	Lead containing dust in places where lead-based paints were used; drinking water delivered through older water pipes; tobacco smoking; lead shot shells and bullets. Rapidly absorbed by the body by ingestion and inhalation.	Depending on the dose, can result in spontaneous abortion, premature delivery, neurotoxic effects in developing fetus; fetus may also be affected by anemia, motor or sensory nervous system, immune system and reproductive system problems.	Higher in SK than in AB study

Chemical	What is it?	How can I be exposed?	What are the health effects?	Levels in SK compared to AB
Uranium	Naturally occurring; found in rock, soil and water. Distribution in the environment is based on existing geology and climactic processes. Used to enrich fuel in commercial nuclear power plants, and for some military purposes.	Usually through root vegetables and drinking water.	Health effects of background uranium are not known and the radiation risk from natural uranium is very low. At high levels of exposure uranium can cause kidney damage.	The concentration in SK was too low to measure with confidence.
Selenium	Naturally occurring substance in the earth's crust. Can be used in plastic, rubber, agriculture, paints, ceramics and glass, electronic material, drug products, natural health products, lubricants, and metallurgical applications. Mining and burning of fossil fuels can release selenium into the environment, as can volcanic activity and weathering of soils and rocks. Necessary for human functioning (enzymes require it) and for normal growth and metabolism.	Exposure in low levels on a daily basis through food, water and air, most from dietary sources. Selenium is also found in some vitamins including prenatal vitamins. Fish consumption recommendations for some lakes in the eastern Athabascan Region of SK are in place (since 2003) due to high concentrations of selenium in fish from historical uranium mining in the area.	Not enough selenium is hazardous to health by making the body more susceptible to illness caused by nutritional, biochemical or infectious stresses. Consuming high levels of selenium over an extended period of time can cause selenosis. It leads to brittle hair, deformed nails and/or tooth decay. In extreme cases it can lead to a loss of feeling and control in the arms and legs.	Slightly lower in SK than AB study
Molybdenum	Naturally occurring in the Earth's crust; in rocks, soil sediment, surface water, groundwater, plants, animals and humans. Natural and man-made processes can release it into the environment (weathering, burning coal, sewage sludge, and mining). Fertilizer use is a source of aquatic species exposure. Required for some enzymes to work in the human body.	Diet is the primary source.	Health effects of low levels are unknown. Long-term exposure of very high levels can cause gout-like symptoms.	SK either comparable or slightly lower than AB study

Chemical	What is it?	How can I be exposed?	What are the health effects?	Levels in SK compared to AB
Cobalt	Found in most rocks, water, soil, plants and animals. Burning of fossil fuels, sewage, sludge, phosphate fertilizers, mining, and smelting of cobalt containing ores and industrial processes are man-made sources of cobalt in the environment.	The diet is main source for the general population. For people with joint prosthesis made with cobalt alloys they can get exposure from the prosthesis. Some studies suggest smokers have higher cobalt levels.	Key component of vitamin B-12 which is essential for good health. Low levels of vitamin B-12 can lead to anemia and affect the nervous system. Exposure to normal levels of environmental cobalt is not harmful to humans.	Higher in SK than in AB study
Iron	Critical to human physiology as many enzymes need for normal functioning.	Present in many foods - most common exposure is through eating. To a lesser degree, iron is also present in drinking water.	Not enough iron is linked to anemia which causes fatigue and limited stamina. In pregnant women, not enough iron can cause fatigue, heart stress, lower immunity, and maternal anemia. Also increases the risk for premature delivery, low birth weight, and increased risk of perinatal infant loss.	SK slightly lower than AB study