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Data Sources and Methods for the Levels of Exposure to Substances of Concern Indicator

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1 Introduction

The Levels of Exposure to Substances of Concern indicator is part of the Canadian Environmental Sustainability Indicators (CESI) (http://www.ec.gc.ca/indicateurs-indicators) program that provides data and information to track Canada's performance on key environmental sustainability issues.

Chemical substances are everywhere – in air, soil, water, products and food – and can enter the body through ingestion, inhalation, and skin contact. The Government of Canada uses a variety of methods, tools and models to assess human exposure to environmental chemicals and the potential effects this exposure may have on health. Human exposure to chemicals can be estimated indirectly by measuring chemicals in the environment, food or products, or directly using biomonitoring.

Biomonitoring is the measurement, in people, of a chemical, the products it makes after it has broken down, or the products that might result from interactions in the body. These measurements are usually taken in blood and urine and sometimes in other tissues and fluids such as hair, nails, and breast milk. The measurements are to see how much of a chemical or its elements are present in that person.

The Levels of Exposure to Substances of Concern Indicator uses human biomonitoring data on environmental chemicals collected by the Canadian Health Measures Survey (CHMS). The survey, developed by Health Canada, assesses the exposure to environmental chemicals and helps to develop and assess the effectiveness of policies to reduce exposure to chemicals for the protection of the health of Canadians.

2 Description and rationale of the Exposure to Substances of Concern indicator

The Canadian Environmental Sustainability Indicators (CESI) Levels of Exposure to Substances of Concern indicator presents the concentrations of cadmium, lead and mercury in blood for all participants in the Canadian Health Measures Survey (CHMS) (aged 6–79 years), and the concentration of polybrominated diphenyl ethers (PBDE-47) in blood plasma (aged 20–79 years). These results are intended to establish baseline levels of chemicals to track trends of exposure levels in Canadians over time.

3 Data

3.1 Data source

The data used to establish the Canadian Environmental Sustainability Indicators (CESI) Levels of Exposure to Substances of Concern indicator were directly from Health Canada's Report on Human Biomonitoring of Environmental Chemicals in Canada, available from: http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/chms-ecms/index-eng.php. This report presents national baseline data on concentrations of environmental chemicals in Canadians. These data were collected as part of Cycle 1 of the Canadian Health Measures Survey (CHMS), (http://www.statcan.gc.ca/survey-enquete/household-menages/5071-eng.htm) the most comprehensive national direct health-measures survey conducted in Canada to date. Statistics Canada, in partnership with Health Canada and the Public Health Agency of Canada, launched the CHMS to collect health and wellness data as well as biological specimens, from a nationally representative sample of Canadians. Data were collected between March 2007 and February 2009 from approximately 5600 Canadians aged 6–79 years at 15 sites across Canada.

3.2 Spatial coverage
Data were collected at 15 sites across Canada (Moncton, Québec, Montréal, Montérégie, South Mauricie, Clarington, North York, Don Valley, St. Catherines-Niagara, Kitchener-Waterloo, Northumberland County, Edmonton, Red Deer, Vancouver and William Lakes & Quesnel).

3.3 Temporal coverage
The Levels of Exposure to Substances of Concern indicator comprises data collected between March 2007 and February 2009. Collection for the second cycle of the CHMS was conducted from September 2009 to December 2011, and includes children as young as 3 years of age. Cycle 3 was launched in January 2012.

3.4 Data completeness
CHMS data are collected over a 3-year period, and approximately an additional 18 months are required for data interpretation, quality control and verification. Results from Cycle 2 are expected in 2013.

4 Methods

The data (survey) is representative of approximately 96% of the Canadian population aged 6–79 years. The results for the Levels of Exposure to Substances of Concern indicator are for the total of this population, and no age or sex distributions were used.

Concentrations
The following tables provide a summary of the data characteristics for the selected chemicals for the CESI indicator.

Concentrations of mercury, lead and cadmium in blood and polybrominated diphenyl ethers (PBDE-47) in blood plasma, Canada, 2007–2009

Chemicals	Sample size	Percentage of results that fall below the limit of detection (% <LOD)	Geometric mean** µg/L	95% CI µg/L
Cd	5319	2.91	0.35	0.32–0.38
Pb	5319	0.02	13.4	12.4–14.4
Hg*	5319	11.64	0.69	0.56–0.86
PBDE-47	1668	25.24	0.06	0.05–0.07

Note: * Hg is shown as total mercury (organic and inorganic). ** Geometric mean calculated at the 95% confidence interval (CI).
Source: Health Canada (2010) Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 1 (2007-2009). Retrieved on 30 January, 2012. Available from: http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/chms-ecms/index-eng.php.

The geometric mean was used because it is less influenced by extreme values and it provides a better estimate of central tendency. This type of mean is commonly used with biomonitoring data.

Further Reading on Methodology

Health Canada's Report on Human Biomonitoring of Environmental Chemicals in Canada presents national baseline data on concentrations of environmental chemicals in Canadians, collected as part of the CHMS. The report describes the methods used for the survey. For further reading on the methods, consult the following sections of the Health Canada report.

Section	Location	Description
Survey Design (http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/chms-ecms/index-eng.php#n3)	Chapter 3 p.3	Survey target population, sample size and allocation, collection sites, dwelling and respondent sampling, selection of environmental chemicals and ethical considerations
Fieldwork (http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/chms-ecms/index-eng.php#n4)	Chapter 4 p.8	Explanation of the data collection in the field (interview, visit to the mobile clinic, criteria, logistics, shipping procedures to lab, and QA/QC fieldwork protocols)
Laboratory Analysis (http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/chms-ecms/index-eng.php#n5)	Chapter 5 p.11	Description of the analytical methods used for each environmental chemical analysis
Statistical Data Analysis (http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/chms-ecms/index-eng.php#n6)	Chapter 6 p. 15	Statistical analysis, sample weights, data presentation, data units and data confidentiality

5 Caveats and Limitations

The CHMS survey was designed to provide national-level estimates and does not permit further breakdown of data by collection site. In addition, the CHMS design did not target specific exposure scenarios, and consequently did not select or exclude respondents on the basis of their potential for low or high exposures to environmental chemicals.

People living on reserves or in other Aboriginal settlements in the provinces, residents of institutions, full-time members of the Canadian Forces, persons living in certain remote areas, and persons living in areas with a low population density were excluded.

While not every province and territory in Canada had a collection site, the CHMS sites were chosen to represent the Canadian population, east to west, including larger and smaller population densities. Regardless, the CHMS covers 96% of the Canadian population.

For further reading on considerations when using the biomonitoring data please consult chapter 7 of the Health Canada's Report on Human Biomonitoring of Environmental Chemicals in Canada (http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/chms-ecms/index-eng.php#n7).

6 References and further reading

Health Canada (2010) Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 1 (2007-2009). Retrieved on 30 January, 2012. Available from: http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/chms-ecms/index-eng.php.

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Legrand M, Feeley M, Tikhonov C, Schoen D, & Li-Muller A (2010) Methylmercury blood guidance values for Canada. Canadian Journal of Public Health 101(1): 28-31. Retrieved on 4 February, 2012. Available from: http://journal.cpha.ca/index.php/cjph/article/view/2181.

Statistics Canada (2011) Canadian Health Measures Survey (CHMS) Data User Guide: Cycle 1. Retrieved on 30 January, 2012. Available from: http://www23.statcan.gc.ca:81/imdb-bmdi/pub/document/5071_D2_T1_V1-eng.htm.

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