



Data Sources and Methods for the Emission of Toxic Substances to Air Indicators

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1 Introduction

The emission of toxic substances to air indicators are part of the Canadian Environmental Sustainability Indicators (CESI) program, which provides data and information to track Canada's performance on key environmental sustainability issues.

The indicators track emissions of toxic substances released to the air by human activity in Canada. These indicators help to inform Canadians about key air pollutants that have been listed as toxic to human health and the environment. The indicators also help the government to identify priorities and to develop and track progress on strategies and policies put in place to reduce or control air pollution.

2 Description and rationale of the emission of toxic substances to air indicators

2.1 Description

The indicators track anthropogenic emissions of 2 toxic substances to air: mercury (Hg) and hexavalent chromium (Cr(VI)). For each toxic substance, emissions are provided at the national, provincial or territorial, source (by sector) and facility level.

Mercury and hexavalent chromium are on the List of Toxic Substances under Schedule 1 of the Canadian Environmental Protection Act, 1999 (CEPA 1999). (<http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&xml=0DA2924D-E77E-2E16-A9D2-95388AD49B21>) This means that they are "entering or may enter the environment in a quantity or concentration or under conditions that 1) have or may have an immediate or long-term harmful effect on the environment or its biological diversity and/or 2) constitute or may constitute a danger to the environment on which life depends and/or 3) constitute or may constitute a danger in Canada to human life or health."

2.2 Changes since last report

This is the first time that these indicators are reported as part of the Canadian Environmental Sustainability Indicators (CESI).

3 Data

3.1 Data source

The mercury (Hg) emissions indicators reported in CESI come from the air pollutant emission summaries and trends (http://ec.gc.ca/pdb/websol/emissions/ap/ap_query_e.cfm) compiled by Environment Canada's National Pollutant Release Inventory (NPRI) program. (<http://www.ec.gc.ca/inrp-npri/default.asp?lang=en>) The hexavalent chromium (Cr(VI)) emissions indicators come solely from the NPRI database of reported facility emissions.

The air pollutant emission summaries and trends are compiled in collaboration with provincial, territorial, and regional environmental agencies. The emissions inventory (summaries and trends) includes emissions reported by facilities to the NPRI and provincial/municipal inventories, as well as emissions estimated for other sources by Environment Canada using the latest published statistics or sources of information such as surveys, special emissions studies and emissions estimation techniques.

Emissions reported on the interactive map were retrieved directly from the NPRI database (<http://www.ec.gc.ca/inrp-npri/default.asp?lang=en&n=0EC58C98-1#Facility>)

3.2 Spatial coverage

The indicators are calculated at the national, provincial or territorial, and sectoral level. Air toxic emissions by facility are displayed on the interactive map.

3.3 Temporal coverage

Past years are also available at the national level for Hg (1990-2009) and for Cr(VI) (2003-2009). The year 1990 was selected for the Hg trend because it is the base year for Canada's international commitment for reporting on Hg to the Convention on Long-Range Transboundary Air Pollution (CLRTAP). For Cr(VI) the base year selected is 2003 because it is the first year with the latest NPRI reporting thresholds.

3.4 Data completeness

Some portions of the 2009 Hg emissions in NPRI's air pollutant emission summaries and trends (http://ec.gc.ca/pdb/websol/emissions/ap/ap_query_e.cfm) were approximated using 2008 data because 2009 information was unavailable at the time of inventory production. 2008 estimates were used for some area and mobile source emissions.

For Cr(VI), emissions compiled in the NPRI database include point source emissions only. The Cr(VI) inventory is not a comprehensive emissions inventory. Only the facilities that meet the NPRI reporting requirements are listed. The table below indicates the number of facilities that reported Cr(VI) emissions since 2003.

Table 1: Number of NPRI facilities that reported Cr(VI) air emissions, Canada

Year	2003	2004	2005	2006	2007	2008	2009
Number of facilities	129	140	143	142	136	127	115

Number of facilities that reported in all years from 2003 to 2009: 62

3.5 Data timeliness

The data are current up to 2009. The indicators are reported approximately two years after data collection because of the time required for data validation, analysis and interpretation.

4 Methods

Emissions of toxic substances to air are measured or estimated through one of the following:

- Continuous Emission Monitoring Systems (CEMS)
- Predictive Emission Monitoring (PEM)
- Source testing
- Mass balance
- Site-specific emission factor
- Published emission factor
- Engineering estimates
- Special studies

These estimation techniques are used by the facilities to report their releases in NPRI (point sources) and by Environment Canada in their estimations of the other sources not accounted in NPRI facility data (area and mobile sources).

The emissions estimation methods are reviewed, updated and improved on a periodic basis in collaboration with sector experts from within and outside Environment Canada. Additional information on these methods is available through the Environment Canada NPRI website on air pollutant emissions, available from: <http://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=5C71562D-1>.

In the comprehensive emissions tables for Hg, three different emissions sources are included: area, mobile and point (stationary) sources. Emissions are compiled using top-down and bottom-up approaches.

Area source emissions are from sources that are too small or too numerous to be reported as individual point sources. They are usually compiled through a top-down approach by applying emission factors to activity levels to estimate emissions.

Mobile source (transportation) emissions are compiled using a combination of bottom-up and top-down approaches. Emissions are estimated using models that include fuel consumption, number of vehicles, movement, distance travelled and many other parameters (e.g. MOBILE Canadian model).

Point-source emissions are compiled through a bottom-up approach starting with facility-level emissions from combustion, processes and fugitive sources. The NPRI and the provincial and territorial emissions inventories are used to compile emissions from point sources.

Double counting of emissions for the same sector is eliminated through data reconciliation. If emissions can be compiled from point sources, the reconciliation process assures that they are not included in the area source summation to avoid double counting. A data quality control process is also in place to avoid discrepancies in the database, both in data compilation and in production of summary tables.

5 Caveats and limitations

The mercury (Hg) emissions charts in CESI provide total emissions excluding open and natural sources and are consistent with Environment Canada's 2009 Air Pollutant Emission Summaries and Historical Emission Trends (<http://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=2DAFE231-1>)

Hg emissions from products are included in the 2007-2009 estimates. However, they are not yet included in the estimates for previous years.

Data reported from emitting facilities may be updated from time to time as new and more up-to-date information is received and reviewed.

Facilities reporting to the NPRI may use different calculation methods to report how much of a particular substance they release. These methods vary depending on the substance and/or the facility and may also change from year to year.

CESI classifies emission sources for Hg by summarizing emissions from multiple categories and sectors as defined in the NPRI. The CESI emission contribution comparisons do not include emissions from open and natural sources.

Table 2: Comparison of sectors for Hg used in CESI and NPRI

CESI Sectors	NPRI Air Pollutant Emissions Sources Sectors
Mining and Rock Quarrying	Mining and Rock Quarrying
Petroleum Industry	Upstream Petroleum Industry
	Downstream Petroleum Industry
Cement and Concrete Industry	Cement and Concrete Industry
Iron and Steel Industries	Iron and Steel Industries
Non-Ferrous Smelting and Refining Industry	Non-Ferrous Smelting and Refining Industry
Incineration	Crematorium
	Industrial and Commercial Incineration
	Municipal Incineration
	Other Incineration and Utilities
Electric Power Generation (Utilities)	Electric Power Generation (Utilities)
Other Sources	Abrasives Manufacture
	Aluminum Industry
	Asbestos Industry
	Asphalt Paving Industry
	Bakeries
	Chemicals Industry
	Mineral Products Industry
	Foundries
	Grain Industries
	Iron Ore Mining Industry
	Pulp and Paper Industry
	Wood Industry
	Petroleum Product Transportation and Distribution
	Other Industries
	Metal Fabrication
	Glass Manufacture
	Vehicle Manufacture (Engines, Parts, Assembly, Painting)
	Electronics
	Plastics Manufacture
	Food Preparation
	Paint and Varnish Formulation
	Textiles
	Miscellaneous Industrial Sectors
	Commercial Fuel Combustion
	Residential Fuel Combustion
	Residential Fuel Wood Combustion
	Air Transportation
	Heavy-duty Diesel Vehicles
	Heavy-duty Gasoline Trucks
	Light-duty Diesel Trucks
	Light-duty Diesel Vehicles
Light-duty Gasoline Trucks	
Light-duty Gasoline Vehicles	
Marine Transportation	
Motorcycles	
Rail Transportation	
Tire Wear and Brake Linings	
Off-road use of Diesel	

CESI Sectors	NPRI Air Pollutant Emissions Sources Sectors
	Off-road use of Gasoline/LPG/CNG
	Cigarette Smoking
	Dry Cleaning
	General Solvent Use
	Marine Cargo Handling Industry
	Meat Cooking
	Refined Petroleum Products Retail
	Printing
	Structural Fires
	Surface Coatings
	Human
	Other Miscellaneous Sources

6 References and further reading

6.1 References

Environment Canada (2011) Air Pollutant Emissions Summaries and Trends. Retrieved on March 2011. Available from: http://www.ec.gc.ca/pdb/websol/emissions/ap/ap_query_e.cfm

Environment Canada (2011) National Pollutant Release Inventory (NPRI) Database. December 20 2010 version, retrieved on June 2011. Available from: <http://www.ec.gc.ca/inrp-npri/default.asp?lang=en&n=0EC58C98-#Facility>

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