

## Overview

The environment has been an issue of concern among Canadians and the subject of debate in the media for years. In 2007, it was the number one issue, and 45% of Canadians rated the quality of the environment as 'fair.' Of issues Canadians say the country is facing, climate change tops the list.

According to the 2007 Canadian Environmental Sustainability Indicators, the pressure on Canada's environment is steady or increasing. From 1990 to 2005, greenhouse gas (GHG) emissions and air quality were ongoing concerns. During the same period, guidelines for protecting aquatic life were not being met, at least occasionally, at many monitoring sites across the country.

While Canadians are changing their activities to protect the environment, reducing the nation's impact on the environment is proving difficult, especially in an era of population and economic growth. From 1990 to 2005,

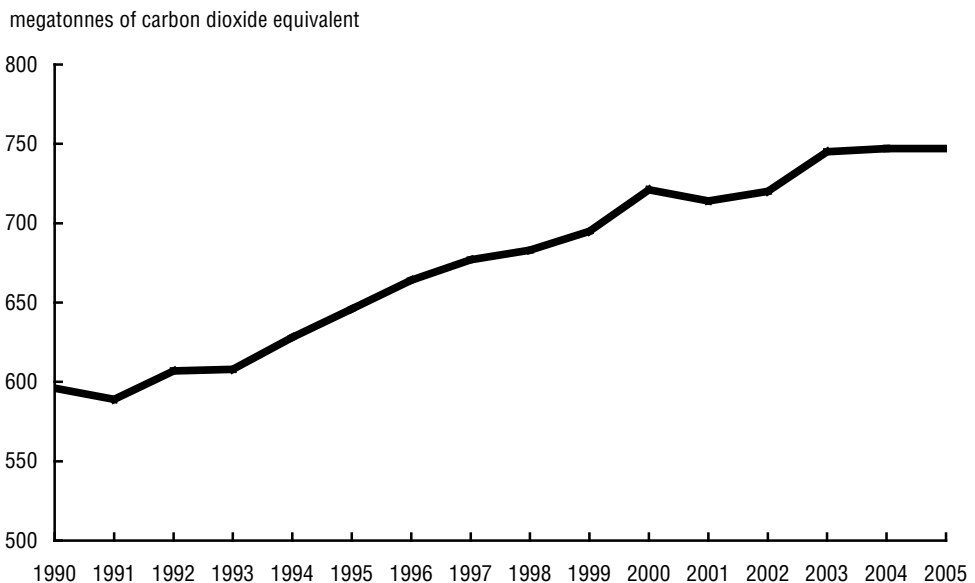
the country's population grew 17%, from 27.7 million people to 32.3 million, while the gross domestic product rose 51.4%, in 2002 constant prices.

Economic activity growth can also lead to industries using more energy and producing more GHGs and air pollutants. Some large energy-consuming industries became more efficient, which offset some of the growth in GHGs. For instance, while the manufacturing industry reduced its energy requirements to produce a unit of goods and services by 33% from 1990 to 2002, energy use still rose 4%.

## Greenhouse gases

GHGs occur naturally and help regulate the climate by trapping heat in the atmosphere and reflecting it back to the surface. GHG emissions from human activities amplify the natural greenhouse effect and contribute

**Chart 12.1**  
**Greenhouse gas emissions**



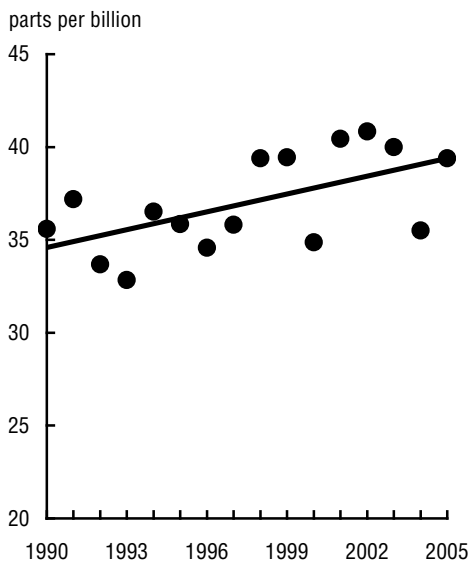
Source: Statistics Canada, Catalogue no. 16-251-XWE.

to climate change. Six GHGs are tracked by Canada's GHG emissions indicator: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), sulphur hexafluoride (SF<sub>6</sub>), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). Canada's GHG emissions increased about 25% from 1990 to 2005. In 1990, 596 megatonnes of CO<sub>2</sub> equivalent were emitted, and in 2005, 747 megatonnes.

While the long-term trend points upwards, emissions stopped growing from 2003 to 2005, primarily as a result of reduced emissions from electricity generation. This reduction was the result of reduced coal and increased hydro and nuclear generation, lower demand for fuels because of warmer winters, and a reduced rate of increase in fossil fuel production.

Energy production and consumption accounted for most (82%) of Canada's total GHG emissions in 2005. GHG emissions from the oil, gas and coal industry increased

**Chart 12.2**  
Ground-level ozone exposure



Note: Population weighted.

Source: Statistics Canada, Catalogue no. 16-251-XWE.

**Table 12.a**  
Households affected by swimming restrictions, by province, 2005

	Were aware of any swimming restrictions or closures at a nearby beach <sup>1</sup>	Prevented from swimming by restrictions <sup>2</sup>
	%	
Newfoundland and Labrador	F	F
Prince Edward Island	F	F
Nova Scotia	19	76
New Brunswick	9E	72
Quebec	13	53
Ontario	45	70
Manitoba	44	69
Saskatchewan	6	F
Alberta	15	73
British Columbia	11	64

1. Includes only those households reporting a household member who had swum or had planned to swim at a nearby beach in 2005.

2. Only households reporting awareness of swimming restrictions.

Source: Statistics Canada, Households and the Environment Survey, 2006.

48% from 1990 to 2005, as crude oil and natural gas production and export increased. GHG emissions from road transportation rose 33% in the same period, mainly because of a shift in consumer preference from automobiles to less fuel-efficient vehicles and an increase in heavy truck transport. GHG emissions from thermal-electric power and heat generation increased 37%, as electricity production rose to meet demand and more fossil fuels were used to generate electricity.

### Air quality

Monitoring stations across Canada track air quality indicators for ground-level ozone and fine particulate matter, both key components of smog and two of the most pervasive and widespread air pollutants.

Ground-level ozone is formed by chemical reactions principally involving nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds

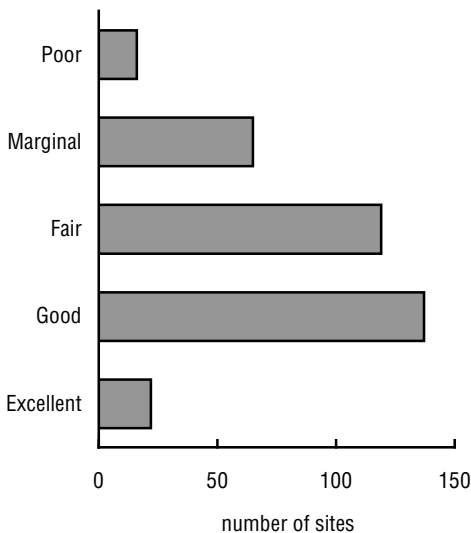
(VOCs) in the presence of sunlight. The burning of fossil fuels in transportation, industry, and electricity generation and the production and use of paints, cosmetics, and solvents increase concentrations of  $\text{NO}_x$  and VOCs, creating ground-level ozone.

Ozone exposure increased about 12% from 1990 to 2005, an average 0.8% increase per year. Concentrations increased 17% in southern Ontario and 15% in southern Quebec. In other regions, the ozone exposure showed no significant changes.

Fine particulate matter is emitted directly as a pollutant or is formed in the air as a secondary pollutant from sulphur dioxide,  $\text{NO}_x$ , VOCs and ammonia. Most fine particulate matter emissions are a result of industry, wood burned for heating and transportation.

Canada's exposure indicator for fine particulate matter showed no significant increase or decrease, either nationally or regionally, from 2000 to 2005.

**Chart 12.3**  
**Freshwater quality at sites in southern Canada, 2003 to 2005**



Source: Statistics Canada, Catalogue no. 16-251-XIE.

## Water quality

At least 115,000 tonnes of pollutants were directly discharged into Canada's freshwater and coastal surface waters in 2005. Manufacturers, service providers, institutions and households discharge hundreds of different substances into rivers and lakes. Many pollutants make their way into water bodies indirectly, after being released into the air or onto the land.

Runoff from agricultural lands and urban areas, which often have high concentrations of nitrogen or phosphorous, can degrade water quality. Changes in water flows, snow melts and heavy rainfall can also harm water quality by, for example, increasing levels of suspended sediments that are often high in nutrients and metals.

Poor water quality affects aquatic life and human uses of water. For example, high concentrations of nitrogen and phosphorus in the water may result in excessive aquatic plant growth, such as algal blooms, which reduce the amount of dissolved oxygen available for fish and other aquatic animals. Some algal blooms are toxic, killing livestock and harming shellfish.

The quality of Canada's freshwater is measured using the Water Quality Index, an indicator that examines the extent to which water quality guidelines for the protection of aquatic life (plants, invertebrates and fish) are being met at selected lake and river monitoring sites throughout Canada.

Freshwater quality for 359 monitoring sites in southern Canada was rated as 'good' or 'excellent' at 44% of the sites, 'fair' at 33%, and 'marginal' or 'poor' at 23%. Freshwater quality measured at 36 monitoring sites in northern Canada was rated as 'good' or 'excellent' at 56% of the sites, 'fair' at 31%, and 'marginal' or 'poor' at 14%.

## Households' impact on the environment

If asked what they do to reduce their impact on the environment, most Canadians probably think of recycling or composting, conserving energy, curbing residential pesticide use or conserving water.

Diverting waste through recycling makes for less waste entering our landfills, helps conserve natural resources and energy, saves landfill space and reduces emissions of methane, which is a greenhouse gas produced in landfills.

In 2006, 93% of Canadian households had access to at least one recycling program, and 97% of these households used at least one of the programs they had access to. Across Canada, 27% of households composted their kitchen waste, their lawn and garden waste or both, up from 23% in 1994.

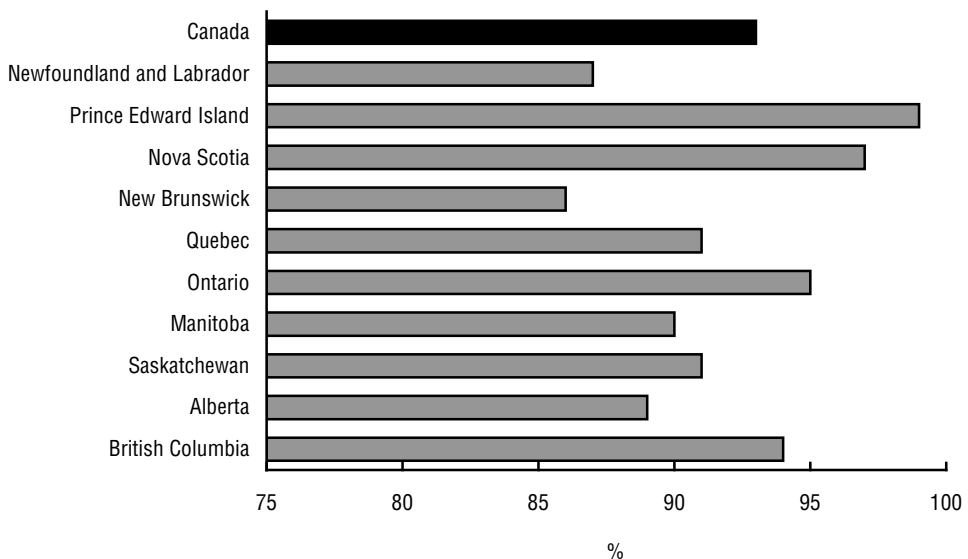
Some types of household wastes can pose environmental problems. When Canadians were asked how they disposed of leftover

paint, disused or expired medication, and computers and other electronics, significant proportions said they were holding onto paint (38%), medication (11%) and computers and communications devices, such as cellphones (35%), because they were unsure how to dispose of them safely.

Conservation is catching on: among households that use thermostats, the proportion with a programmable thermostat increased from 16% in 1994 to 40% in 2006. Among all households with a thermostat, programmable or not, 53% turned down the heat before retiring at night.

The possible negative effects of lawn and garden pesticides have fuelled public debate for several years. In 2005, 29% of Canadian households with a lawn or garden used pesticides, down slightly from 1994. Among the provinces, rates ranged from 14% in Prince Edward Island to 44% in Manitoba.

**Chart 12.4**  
Households with access to at least one recycling program, by province, 2006



Source: Statistics Canada, Catalogue no. 11-526-XIE.

# Protecting and managing the environment

Canadian businesses play a key role in environmental protection. By changing product design, technology, operations and behaviour, firms can curb waste and pollution in manufacturing processes.

Businesses spent \$6.8 billion on environmental protection in 2004, about the same as in 2002. Of this, \$2.9 billion was for capital expenditures, including pollution prevention.

The most used methods of pollution prevention were pollution prevention training (69%), prevention of leaks and spills (67%), and recirculation, recovery, reuse or recycling (62%). The remaining \$3.8 billion was for operating expenses, including \$1.5 billion for pollution abatement and control, or 'end-of-pipe' technologies.

To curb the release of substances to air, businesses spent \$409 million in capital for end-of-pipe technologies, and \$826 million on pollution prevention.

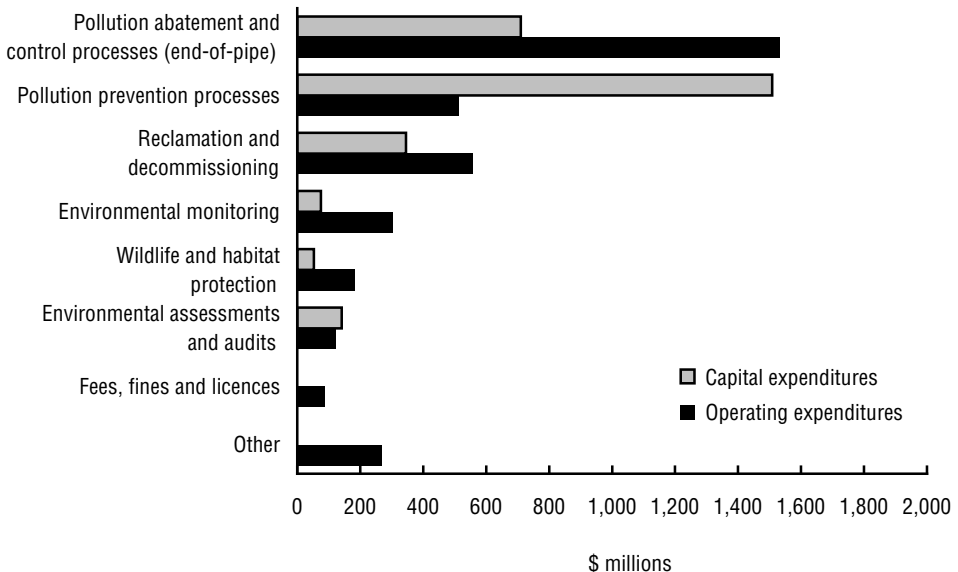
They spent \$576 million from operating funds and \$379 million from capital funds to reduce greenhouse gas emissions.

Energy conservation processes and technologies can reduce emission of pollutants, reduce costs or improve productivity. Over half of businesses (59%) used technologies and processes to reduce energy consumption in 2004. One-third used an energy management or monitoring system, while 29% performed an energy audit sometime during the period from 2002 to 2004.

The petroleum and coal products industry spent the most on environmental protection in 2004, followed by the oil and gas extraction industry. Pulp, paper and paperboard firms were the most likely to use energy conservation technologies.

The federal government funds research and development to care for the environment: \$401 million in 2005/2006.

**Chart 12.5**  
**Environmental protection expenditures, all industries, 2004**



Source: Statistics Canada, Catalogue no. 16F0006XIE.

**Table 12.1 Greenhouse gas emissions, by source, 1990 and 2005**

	Carbon dioxide		Methane		Nitrous oxide	
	1990	2005	1990	2005	1990	2005
	kilotonnes					
<b>Total<sup>1</sup></b>	<b>459,000</b>	<b>583,000</b>	<b>3,800.00</b>	<b>5,200.00</b>	<b>150.00</b>	<b>140.00</b>
Energy	428,000	544,000	1,700.00	2,600.00	30.00	30.00
Stationary combustion sources	276,000	338,000	200.00	200.00	7.00	8.00
Electricity and heat generation	94,700	128,000	1.80	5.10	2.00	2.00
Fossil fuel industries	49,600	70,400	80.00	100.00	1.00	2.00
Petroleum refining and upgrading	16,000	18,000	...	...	0.30	0.40
Fossil fuel production	34,100	52,000	80.00	100.00	0.70	1.00
Mining and oil and gas extraction	6,140	15,500	0.10	0.30	0.10	0.40
Manufacturing industries	54,200	45,400	3.00	3.00	2.00	2.00
Iron and steel	6,420	6,460	0.20	0.20	0.20	0.20
Non-ferrous metals	3,170	3,170	0.07	0.07	0.05	0.05
Chemical	7,050	5,320	0.15	0.11	0.10	0.09
Pulp and paper	13,400	7,040	2.00	2.00	0.80	0.80
Cement	3,680	4,570	0.07	0.10	0.04	0.04
Other manufacturing	20,500	18,800	0.40	0.40	0.40	0.40
Construction	1,860	1,300	0.03	0.02	0.05	0.03
Commercial and institutional	25,700	36,600	0.50	0.60	0.50	0.70
Residential	41,300	39,500	100.00	90.00	2.00	2.00
Agriculture and forestry	2,400	1,930	0.04	0.03	0.05	0.06
Transport <sup>2</sup>	142,000	190,000	30.00	30.00	20.00	20.00
Civil aviation (domestic aviation)	6,220	8,420	0.50	0.50	0.60	0.80
Road transportation	97,700	131,000	15.00	9.40	10.00	11.00
Light-duty gasoline vehicles	45,100	39,800	7.80	3.20	6.20	4.10
Light-duty gasoline trucks	20,200	42,800	3.10	3.20	3.20	5.30
Heavy-duty gasoline vehicles	7,950	6,370	1.30	0.38	0.22	0.43
Motorcycles	147	255	0.14	0.16	0.00	0.01
Light-duty diesel automobiles	355	432	0.01	0.01	0.03	0.03
Light-duty diesel trucks	708	2,150	0.02	0.05	0.05	0.20
Heavy-duty diesel vehicles	21,000	38,600	1.00	2.00	0.60	1.00
Propane and natural gas vehicles	2,170	706	1.00	0.70	0.04	0.01
Railways	6,310	5,620	0.30	0.30	3.00	2.00
Navigation (domestic marine)	4,730	6,070	0.30	0.40	1.00	1.00
Other transportation	27,000	38,000	20.00	20.00	6.00	9.00
Off-road gasoline	7,000	7,000	8.00	8.00	0.10	0.20
Off-road diesel	14,000	21,000	0.70	1.00	6.00	9.00
Pipelines	6,700	9,850	6.70	9.80	0.20	0.30
Fugitive sources	11,000	16,000	1,500.00	2,300.00	0.10	0.10
Coal mining	...	...	90.00	30.00	...	...
Oil and natural gas	10,600	16,500	1,440.00	2,310.00	0.10	0.10
Oil	95	170	193.00	260.00	0.10	0.10
Natural gas	23	61	613.00	989.00	...	...
Venting	6,090	10,800	627.00	1,050.00	...	0.01
Flaring	4,400	5,400	2.60	3.70	0.00	0.01

See notes and source at end of table.

Table 12.1 Greenhouse gas emissions, by source, 1990 and 2005 (continued)

	Carbon dioxide		Methane		Nitrous oxide	
	1990	2005	1990	2005	1990	2005
	kilotonnes					
Industrial processes	30,000	39,000	...	...	37.80	12.60
Mineral products	8,300	9,500	...	...	...	...
Cement production	5,400	7,200	...	...	...	...
Lime production	1,700	1,700	...	...	...	...
Mineral product use <sup>3</sup>	1,090	599	...	...	...	...
Chemical industry	3,900	5,000	...	...	37.80	12.60
Ammonia production	3,900	5,000	...	...	...	...
Nitric acid production	...	...	...	...	3.27	4.08
Adipic acid production	...	...	...	...	35.00	8.50
Metal production	9,770	11,900	...	...	...	...
Iron and steel production	7,060	7,010	...	...	...	...
Aluminum production	2,700	4,800	...	...	...	...
Sulfur hexafluoride used in magnesium smelters and casters	...	...	...	...	...	...
Consumption of halocarbons and sulfur hexafluoride	...	...	...	...	...	...
Other and undifferentiated production	8,300	13,000	...	...	...	...
Solvent and other product use	...	...	...	...	0.56	0.57
Agriculture	...	...	1,000.00	1,300.00	80.00	93.00
Enteric fermentation	...	...	880.00	1,200.00	...	...
Manure management	...	...	120.00	150.00	13.00	17.00
Agricultural soils	...	...	...	...	67.00	76.00
Direct sources	...	...	...	...	39.00	41.00
Pasture, range and paddock manure	...	...	...	...	10.00	14.00
Indirect sources	...	...	...	...	20.00	20.00
Waste	270	190	1,100.00	1,300.00	2.00	2.00
Solid waste disposal on land	...	...	1,000.00	1,300.00	...	...
Wastewater handling	...	...	11.00	12.00	2.00	2.00
Waste incineration	270	190	0.40	0.06	0.40	0.20
Land use, land use change and forestry	-130,000	-26,000	150.00	260.00	6.40	11.00
Forest land	-160,000	-35,000	130.00	240.00	5.50	10.00
Cropland	14,000	180	20.00	9.00	0.80	0.50
Grassland	.	.	.	.	.	.
Wetlands	5,000	1,000	0.40	2.00	0.01	0.07
Settlements	9,000	8,000	5.00	5.00	0.20	0.20

**Note:** Figures may not add to totals because of rounding.

1. National totals exclude all greenhouse gas emissions from the 'Land use, land use change and forestry' sector.

2. Emissions from ethanol fuel are reported within the gasoline vehicle subcategories under 'Transport.'

3. The category 'Mineral product use' includes carbon dioxide emissions from the use of limestone and dolomite, soda ash and magnesite.

**Source:** Environment Canada.

**Table 12.2 Substances released to land, 2005**

	Releases <sup>1</sup> tonnes	Share of total %
Hydrogen sulphide	268,623.7	83.8
Zinc and its compounds	10,077.8	3.1
Asbestos (friable form)	6,354.4	2.0
Ammonia <sup>2</sup>	6,805.6	2.1
Methanol	5,901.4	1.8
Manganese and its compounds	5,366.7	1.7
Phosphorous (total)	4,762.9	1.5
Ethylene glycol	2,633.8	0.8
Lead and its compounds	3,126.4	1.0
Vanadium and its compounds (except when in an alloy)	1,288.4	0.4

**Note:** Top 10 substances only.

1. Data include disposals.

2. Refers to the total of both ammonia (NH<sub>3</sub>) and ammonium ion (NH<sub>4</sub><sup>+</sup>) in solution.

**Source:** Statistics Canada, Catalogue no. 16-201-XIE.

**Table 12.3 Waste disposal and diversion, by province, 2002, 2004 and 2006**

	Total waste disposed			Total materials diverted		
	2002	2004	2006	2002	2004	2006
	tonnes					
<b>Canada</b>	<b>24,081,371</b>	<b>25,226,766</b>	<b>27,249,178</b>	<b>6,641,546</b>	<b>7,112,735</b>	<b>7,749,030</b>
Newfoundland and Labrador	376,594	400,048	407,728	30,386	35,308	30,385
Nova Scotia	389,194	399,967	401,670	192,006	239,845	275,983
New Brunswick	413,606	442,173	450,238	130,728	139,262	252,174
Quebec	5,846,459	6,454,000	6,808,440	1,743,376	2,130,100	2,456,300
Ontario	9,645,633	9,809,264	10,437,780	2,265,968	2,414,552	2,396,856
Manitoba	896,556	928,117	1,024,272	215,815	157,490	152,799
Saskatchewan	795,124	794,933	833,753	116,296	114,182	106,868
Alberta	2,890,294	3,077,311	3,819,872	690,517	620,080	652,637
British Columbia	2,687,882	2,767,657	2,917,080	1,218,475	1,209,216	1,366,191

**Note:** Data for Prince Edward Island and the territories suppressed to meet the confidentiality requirements of the *Statistics Act*.

**Source:** Statistics Canada, Catalogue no. 16-253-XIE.



**Table 12.4 Capital expenditures on pollution prevention, by environmental milieu and by industry, 2004**

	All environmental milieu	Air	Surface water	On-site milieu contained solid and liquid waste	Noise, radiation and vibration	Other
\$ millions						
<b>All industries</b>	<b>1,507.9</b>	<b>826.0</b>	<b>306.9</b>	<b>276.9</b>	<b>45.9</b>	<b>52.2</b>
Logging	0.1	0.0	0 <sup>s</sup>	0 <sup>s</sup>	0.0	0.1
Oil and gas extraction	207.3	131.1	18.9	42.8	3.6	11.0
Mining	51.8	6.2	24.3	21.2	0.0	0.1
Electric power generation, transmission and distribution	71.8	36.7	19.4	x	x	x
Natural gas distribution	8.0	2.1	0.2	5.7	0.0	0.0
Food	36.0	11.6	12.3	6.9	0.1	5.2
Beverage and tobacco products	4.5	2.8	0.9	0.1	0.0	0.7
Wood products	46.4	26.7	15.4	x	x	x
Pulp, paper and paperboard mills	53.3	27.7	14.3	4.2	1.3	5.7
Petroleum and coal products	779.5	446.3	170.1	123.5	x	x
Chemicals	38.3	14.3	7.3	10.2	0.4	6.0
Non-metallic mineral products	54.6	31.8	3.7	7.0	0.1	12.1
Primary metals	46.7	17.5	3.4	23.4	0.1	2.3
Fabricated metal products	20.3	19.6	0.1	0.1	0.0	0.5
Transportation equipment	52.0	46.6	1.1	1.8	0.2	2.3
Pipeline transportation	37.3	5.1	15.3	13.4	1.2	2.3

Source: Statistics Canada, Catalogue no. 16-201-XIE.

**Table 12.5 Capital expenditures on pollution abatement and control, by environmental milieu and by industry, 2004**

	All environmental milieu	Air	Surface water	On-site milieu contained solid and liquid waste	Noise, radiation and vibration
\$ millions					
<b>All industries</b>	<b>710.0</b>	<b>409.4</b>	<b>183.0</b>	<b>96.4</b>	<b>21.2</b>
Logging	0.5	0.1	0.0	0.4	0.0
Oil and gas extraction	65.5	31.9	13.9	17.0	2.7
Mining	85.9	x	53.1	2.9	x
Electric power generation, transmission and distribution	80.1	x	20.8	9.7	x
Natural gas distribution	2.2	0.4	0.0	1.8	0.0
Food	34.7	12.1	11.4	11.0	0.2
Beverage and tobacco products	6.0	0.5	4.8	0.2	0.6
Wood products	30.7	24.7	4.1	1.7	0.1
Pulp, paper and paperboard mills	99.7	58.9	29.5	10.6	0.7
Petroleum and coal products	93.1	41.1	22.5	22.5	7.1
Chemicals	32.5	16.8	10.2	4.6	0.9
Non-metallic mineral products	25.7	24.3	0.4	0.4	0.6
Primary metals	103.2	82.1	9.9	10.5	0.8
Fabricated metal products	12.3	10.6	1.2	0.3	0.1
Transportation equipment	33.1	x	0.5	0 <sup>s</sup>	x
Pipeline transportation	4.7	1.1	0.9	2.7	0.0

Source: Statistics Canada, Catalogue no. 16-201-XIE.

**Table 12.6 Production of selected mineral commodities, 2005 and 2006**

	2005	2006 <sup>a</sup>
	carats	
Diamonds	12,314,031	13,233,813
	kilograms	
Gold	120,541	103,807
Platinum group	23,904	24,082
	tonnes	
Zinc	666,664	633,500
Copper	595,383	608,286
Nickel	199,932	234,111
Lead	79,254	82,393
Uranium	11,627	9,862
Molybdenum	7,935	7,842
Cobalt	5,767	6,976
Silver	1,124	982
Cadmium	723	549
Bismuth	170	222
Antimony	79	90
Gemstones	92	109
Tantalum	63	58
	kilotonnes	
Sand and gravel	246,629	236,477
Stone	165,966	164,615
Iron ore	32,513	35,010
Salt	13,496	13,505
Potash	10,594	8,295
Gypsum	9,241	9,138
Quartz	1,914	1,977
Peat	1,363	1,237
Nepheline syenite	743	719
Soapstone, talc, pyrophyllite	90	82
Barite	23	21

**Note:** Canadian mines only.

**Source:** Statistics Canada, Catalogue no. 26-202-XIB.