



Catalogue No. 16F0006XIE

Environment Accounts and Statistics Division

# Environmental Protection Expenditures in the Business Sector, 1998

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# Symbols

The following standard symbols are used in Statistics Canada publications:

- .. figures not available
- ... figures not appropriate or not applicable
- nil or zero
- amount too small to be expressed
- x confidential to meet secrecy requirements of the *Statistics Act*

All figures in this report are given in current dollars.

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## Preface

This publication presents estimates from the *Survey of Environmental Protection Expenditures, 1998*. The survey covers capital and operating expenditures made in 1998 by businesses in order to anticipate or to respond to environmental regulations, environmental conventions or voluntary agreements.

Environmental regulations, current and anticipated, play a major role in the evolution of industry spending on environmental protection. For the past decade, governments in Canada have imposed various environmental regulations regarding the prevention or reduction of air emissions, effluents, solid waste, as well as the protection of wildlife and habitat. However, industry spending on environmental protection may also be affected by environmental conventions and voluntary agreements between governments and industry representatives. These are increasingly important and include specific actions on pollution prevention or abatement.

The *Survey of Environmental Protection Expenditures* (SEPE) tries to fill gaps in the data regarding the cost to industry of environmental protection and the demand for associated environmental products and services. In addition to covering business expenditures on environmental protection, the SEPE, since 1997, has been broadened to cover the adoption of environmental management practices, pollution prevention practices and environmental technologies. The analysis of such practices and technologies is published in another publication titled *Environmental Management and Technologies in the Business Sector*, Catalogue No. 16F0024XIE, fall 2001.

Beginning reference year 1998, the Survey of Environmental Protection Expenditures has been changed from an annual to a biennial survey, partly in an effort to reduce respondent burden.

The data presented in this report do not reflect the **1999 Nunavut boundaries** since all data refer to the period before April 1, 1999. Therefore, where data on the Northwest Territories are shown, these data refer to the Northwest Territories (including Nunavut), as defined before April 1, 1999.<sup>1</sup>

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1. On April 1, 1999 the Territory of Nunavut was officially established through the **Nunavut Land Claim Agreement** and the **Nunavut Act**.

## Acknowledgements

The cooperation of survey respondents were critical to the successful completion of this publication and are gratefully acknowledged.

This report was prepared by the Environment Accounts and Statistics Division under the direction of Claude Simard, Director and Alice Born, Chief, Environmental Protection Accounts and Surveys. Data collection for this survey was conducted by the Operations and Integration Division (Mel Jones, Director) and the Environment Accounts and Statistics Division.

Jeff Fritzsche, Analyst, Environment Protection Accounts and Surveys, managed the survey.

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# 1 Highlights

- Total environmental protection expenditures reached \$4.7 billion in 1998, representing the second consecutive year expenditures have declined.
- Business capital expenditures declined 0.8% in 1998 to \$1.7 billion, due mostly to a drop in pollution prevention capital expenditures (-9.5%), and to a lesser degree, end-of-pipe capital expenditures (-0.9%).
- 1998 represents the first year that capital expenditures in pollution prevention processes declined since the survey began in 1994.
- Operating expenditures on environmental protection totalled \$3.0 billion in 1998, virtually unchanged from 1997. Almost half of the operating expenditures were directed at end-of-pipe processes, while pollution prevention processes accounted for just over 13%.
- For the fifth consecutive year, the Pulp, Paper and Paperboard Mills industry reported the largest operating and capital expenditures on environmental protection. However, environmental protection expenditures by the Pulp, Paper and Paperboard Mills industry have declined annually since 1995. Capital spending in that industry on environmental protection in 1998 was characterised by large amounts allocated to pollution prevention (\$179.2 million) and end-of-pipe changes (\$89.1 million), totalling \$268.3 million.
- The Chemicals industry reported the second largest amount of capital investment in environmental protection (\$189.2 million), a 24% increase over 1997. Close behind was the Oil and Gas Extraction industry (\$186.5 million, virtually unchanged from 1997), and the Primary Metals industry (\$184.0 million), reporting a 37% decline over 1997.
- Between 1995 and 1998, capital expenditures on pollution prevention, abatement and control (PPAC) shifted from preventing, abating or controlling substances released to surface waters to those released to the air. The proportion of expenditures directed at preventing, abating or controlling substances emitted to air grew from just over 35% in 1995 to almost 55% in 1998.
- Businesses favoured the use of pollution prevention processes to reduce substances emitted to air in 1998. Over 65% of capital investment in pollution prevention was directed at reducing air emissions.
- Businesses directed less than half (43%) of end-of-pipe capital investment toward abatement and control of substances emitted to air. Most of the remaining capital expenditures were directed at mitigating emissions to surface water and at the management of on-site contained solid and liquid waste.
- The most popular pollution prevention method employed by businesses in 1998 was the on-site reuse and recycling of materials.<sup>1</sup> This was followed by the prevention of leaks and spills and energy conservation. These have been the three most popular methods since 1995.

## 1.1 Survey objectives

The *Survey of Environmental Protection Expenditures* (SEPE) is conducted to measure the cost imposed on Canadian industry to comply with present or anticipated environmental regulations, conventions and voluntary agreements. The SEPE also collects information on environmental management practices and environmental technologies used by industry for the purpose of preventing, abating or controlling pollution.

A second report entitled *Environmental Management and Technologies in the Business Sector*<sup>2</sup> will also be available shortly. It will present additional information from the survey on environmental management, pollution prevention practices and the use of specific environmental technologies by business.

## 1.2 Definitions

The business sector is involved in a variety of activities aimed directly or indirectly at protecting the environment from the effects of its production. These activities have often been brought about by environmental regulations and, more recently, by voluntary agreements and actions. One method of assessing the effectiveness of these activities is to measure expenditures made on environmental protection (Text Boxes 1.2.1 and 1.2.2).

1. Includes recirculation, reuse, recovery or recycling of water, materials or substances generated during production, excluding materials transferred or recycled off site. Examples include vapour recovery, recovery of sludge, water recirculation, and reuse of water for refrigeration condenser operations.

2. Statistics Canada, fall 2001, Catalogue No. 16F0024XIE.

## Text Box 1.2.1

**Environmental Protection Expenditures**

Environmental protection expenditures are defined as all capital (or investment) and repair expenditures and operating (or current) expenditures incurred in order to comply with or to anticipate environmental regulations, conventions<sup>1</sup> or voluntary agreements that apply to Canada.

The difficulty is to measure multiple-purpose expenditures, that is, expenditures made in order to reduce production costs but, at the same time, reduce energy consumption or waste generation. This is a particular problem with business expenditures. For this reason, the 1997 survey expanded the criterion of environmental protection to include any expenditure that ensures or anticipates compliance to environmental regulation or official voluntary agreement.<sup>2</sup> Environmental protection expenditures are classified as follows:

- **Expenditures on pollution prevention, abatement and control (PPAC):** expenditures for solid waste management; for wastewater management; for environmental monitoring (e.g., air quality); and for equipment and construction used to prevent, reduce, abate or control pollution;
- **Other environmental protection expenditures:** expenditures for site reclamation and decommissioning; for environmental assessments and audits; and for protection and restoration of wildlife and habitat.

Expenditures on environmental research and development are excluded, in principle, from the data on business expenditures. The data are collected through another Statistics Canada survey, the *Research and Development in Canadian Industry Survey*<sup>3</sup>.

**Capital investment expenditures** refer to all relevant outlays in 1998 (fiscal year) for machinery and equipment and their installation and repair, as well as for the construction of non-residential facilities (by contractors or own employees).

**Operating expenditures** refer to all cash expenses, rather than accruals, incurred during the 1998 fiscal year for maintenance and repair (of existing environmental equipment), labour, fuel and electricity, materials and supplies, and purchased services.

1. Environmental conventions include any formal multiparty commitment to meet specific targets relating to habitat protection and waste and pollution abatement, such as the Canada–U.S. Air Quality Agreement, the National Packaging Protocol, and the Responsible Care Program adopted by the Canadian Chemical Producers' Association.
2. Any voluntary agreement implemented by an establishment or the participation in any voluntary environmental program such as ARET (Accelerated Reduction/Elimination of Toxics).
3. Statistics Canada, Catalogue No. 88-001-XIB.

## Text Box 1.2.2

**Classification of Business Environmental Protection Expenditures**

Business operating, capital and repair expenditures on environmental protection are broken down according to the following categories:<sup>1</sup>

**Environmental monitoring:** expenditures for purchase of equipment, supplies, labour and services required to monitor pollutant emissions that would affect air, water or soil quality;

**Environmental assessments and audits:** expenditures made to review current operations' compliance with regulations and to evaluate the environmental impact of proposed projects;

**Site reclamation and decommissioning:** expenditures for clean-up of environmental damage and for closing a site;

**Wildlife and habitat protection:** expenditures made to protect wildlife and habitat from the effects of economic activity and to restore stocks that have been adversely affected by such activity;

**Pollution abatement and control (end-of-pipe processes):** expenditures related to funding of separately identifiable processes whose sole purpose is to abate or control undesirable substances emitted during normal production activities (integrated processes), without any incidence on the production process itself; expenditures on waste and sewage management and treatment;

**Pollution prevention:**<sup>2</sup> expenditures made to develop a new or significantly modified production process (integrated processes) in order to prevent or reduce the generation of pollutants and waste; expenditures on leak and spill prevention; expenditures on energy and water conservation; expenditures on on-site recirculation, recovery, reuse and recycling of materials and substances;-

**Environmental fees, fines and licences; and**

**Other environmental protection:** expenditures for administration of environmental projects, for training, and for other initiatives not elsewhere specified.

1. Each category includes salaries and wages of the business own-account employees for environmental projects as well as purchases of environmental services from a private contractor or from government.
2. Please note that previous *Environmental Protection Expenditures in the Business Sector* reports refer to pollution prevention as "PAC integrated processes". Integrated processes are a subset of pollution prevention.

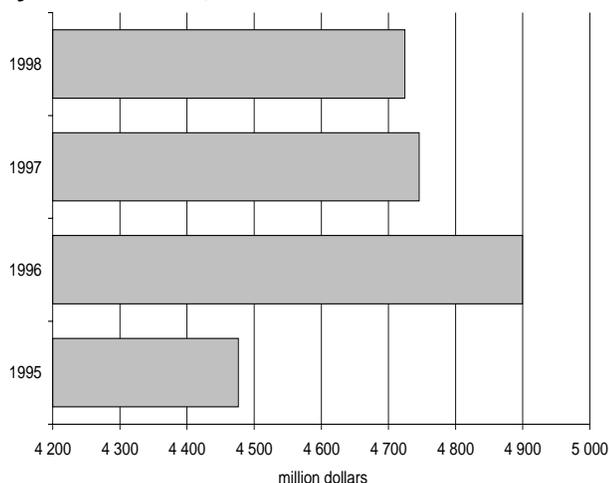
## 2 Survey Results

### 2.1 Total environmental protection expenditures

Environmental protection expenditures totalled just over \$4.7 billion in 1998, down slightly from 1997 (Figure 2.1.1 and Table 2.1.1). After an increase of over \$400 million from 1995 to 1996, total environmental protection expenditures declined in both 1997 and 1998. Most of the increase from 1995 to 1996 was attributable to a rise in operating expenditures. Since 1996, total operating expenditures have remained stable at about \$3.0 billion (Figure 2.1.2).

Expenditures on pollution prevention, abatement and control (PPAC)<sup>1</sup> totalled \$3.7 billion in 1998 (Tables A.1 and A.11). Almost 60% of the expenditures were for operating costs (\$2.2 billion) while the remainder were capital expenditures (\$1.5 billion). Two-thirds of the PPAC operating expenditures were for pollution abatement and control (end-of-pipe) processes while over 80% PPAC capital expenditures were split evenly between pollution abatement and control (end-of-pipe) and pollution prevention processes (\$684.6 million and \$648.7 million respectively).

Figure 2.1.1  
Total Environmental Protection Expenditures by Businesses, 1995-1998



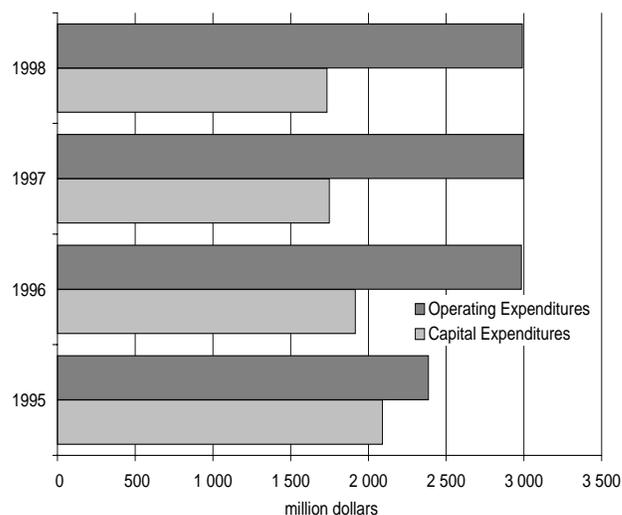
**Note:** Includes primary and manufacturing industries. For a complete description of the coverage of the SEPE, please refer to Section 3, Survey Methodology.  
**Source:** Statistics Canada, Environment Accounts and Statistics Division.

1. Capital expenditures on pollution prevention, abatement and control (PPAC) include capital expenditures on pollution abatement and control (end-of-pipe) processes, pollution prevention (integrated) processes and environmental monitoring.

### Business capital expenditures on environmental protection<sup>2</sup>

Business capital expenditures on environmental protection totalled \$1.7 billion in 1998 (Tables 2.1.1, 2.1.2 and A.1).<sup>3</sup> This represented a decrease of less than one percent compared to 1997 (Figure 2.1.2). The decline was due mainly to the 9.5% decrease in expenditures on pollution prevention processes.<sup>4</sup> In comparison, capital expenditures on end-of-pipe processes declined by 0.9% (Table 2.1.2). Since 1995, businesses have steadily reduced their investment in end-of-pipe processes while increasing pollution prevention investment. However, 1998 represents the first year investment in pollution prevention processes has declined (Figure 2.1.3).

Figure 2.1.2  
Business Operating and Capital Environmental Protection Expenditures, 1995-1998



**Note:** Includes primary and manufacturing industries. For a complete description of the coverage of the SEPE, please refer to Section 3, Survey Methodology.  
**Source:** Statistics Canada, Environment Accounts and Statistics Division.

Although capital expenditures on environmental protection has decreased each year from 1995 to 1998, the decline was less pronounced in 1998 than in previous years (Table 2.1.2). Investment in end-of-pipe processes (i.e., expenditures to abate or to control undesirable substances resulting from production) in 1998 was 43% lower than in 1995. In comparison, investment in pollution prevention processes was 141% higher for the same period.

2. For a description of capital expenditures, please see Text Box 1.2.1, page 2.

3. Includes the "Other manufacturing" category.

4. Excludes the "Other manufacturing" category. Please note that previous *Environmental Protection Expenditures in the Business Sector* reports refer to pollution prevention as "PAC integrated processes". For a description of pollution prevention and end-of-pipe processes, please see Textbox 1.2.2, page 2.)

**Table 2.1.1  
Distribution of Expenditures on Environmental Protection by Industry and by Province and Territory, 1998**

Industry	Capital expenditures		Operating expenditures		Total expenditures million dollars
	million dollars	percent of total	million dollars	percent of total	
Logging	7.4	6.0	116.5	94.0	124.0
Oil and Gas Extraction	186.5	41.9	258.4	58.1	444.9
Mining	81.2	24.6	248.8	75.4	330.0
Electric Power Generation, Transmission and Distribution	124.0	29.6	295.6	70.4	419.6
Natural Gas Distribution	16.8	65.4	8.9	34.6	25.7
Food	60.8	33.0	123.7	67.0	184.5
Beverage and Tobacco Products	5.5	20.6	21.2	79.4	26.7
Wood Products	96.3	41.2	137.6	58.8	233.8
Pulp, Paper and Paperboard Mills	287.7	42.6	387.5	57.4	675.2
Petroleum and Coal Products	141.0	42.9	187.3	57.1	328.3
Chemicals	189.2	44.9	231.9	55.1	421.1
Non-Metallic Mineral Products	54.3	55.7	43.2	44.3	97.6
Primary Metals	184.0	30.5	419.2	69.5	603.1
Transportation Equipment	48.7	25.9	139.4	74.1	188.1
Pipeline Transportation	115.6	78.2	32.2	21.8	147.9
Other Manufacturing <sup>1</sup>	135.0	28.5	338.8	71.5	473.8
<b>Total</b>	<b>1 734.2</b>	<b>36.7</b>	<b>2 990.2</b>	<b>63.3</b>	<b>4 724.4</b>
Province/Territory	Capital expenditures		Operating expenditures		Total expenditures million dollars
	million dollars	percent of total	million dollars	percent of total	
Newfoundland	14.5	46.0	17.0	54.0	31.4
Prince Edward Island	1.2	28.0	3.1	72.0	4.4
Nova Scotia	15.7	26.4	43.7	73.6	59.4
New Brunswick	53.4	34.8	99.9	65.2	153.3
Quebec	263.2	31.9	560.9	68.1	824.1
Ontario	573.8	32.1	1 211.4	67.9	1 785.2
Manitoba	61.5	46.2	71.4	53.8	132.9
Saskatchewan	168.5	58.5	119.6	41.5	288.1
Alberta	379.2	43.8	487.0	56.2	866.2
British Columbia	194.5	34.7	366.1	65.3	560.6
Yukon and Northwest Territories <sup>2</sup>	8.7	46.4	10.0	53.6	18.7
<b>Canada</b>	<b>1 734.2</b>	<b>36.7</b>	<b>2 990.2</b>	<b>63.3</b>	<b>4 724.4</b>

**Notes:**

Figures may not add up to totals due to rounding.

1. 'Other Manufacturing' includes all other manufacturing industries not already specified.

2. Includes Nunavut.

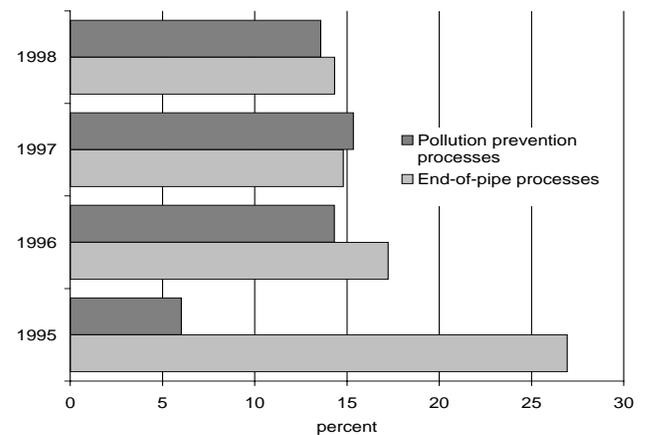
**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Not surprisingly, there appears to be a strong positive correlation between the levels of environmental protection capital spending and total capital spending by industry. For example, several industries (such as the Non-Metallic Mineral Products; Petroleum and Coal Products; Chemicals; and Pipeline Transportation industries) that increased their environmental protection capital expenditures in 1998 compared to 1997, also increased their overall capital spending over the same period. The same was true for those industries that reduced their environmental protection capital expenditures (such as Logging; Pulp, Paper and Paperboard Mills; Primary Metals; and Transportation Equipment industries). These industries also reduced their overall capital expenditures.<sup>1</sup>

1. Statistics Canada, *Public and Private Investment in Canada, Revised Intentions 1998*, Catalogue No. 61-206 XIB, Ottawa.

**Figure 2.1.3  
Capital Expenditures on Pollution Prevention and End-of-pipe as a Share of Total Environmental Protection Expenditures, 1995-1998**



**Note:**

Before 1997, the expenditure category "pollution prevention" was titled "PAC integrated processes". Includes primary and manufacturing industries. For a complete description of the coverage of the SEPE, please refer to Section 3, Survey Methodology.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table 2.1.2  
**Expenditures on Environmental Protection by Industry and Type of Activity, 1997 and 1998**

Industry	Environmental monitoring		Environmental assessments and audits		Reclamation and decommissioning		Wildlife and habitat protection		Pollution abatement and control processes (end-of-pipe) <sup>1</sup>		Pollution prevention processes		Fees, fines and licences		Other		Total	
	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998
	million dollars																	
<b>Operating expenditures</b>																		
Logging	1.6	3.0	3.1	5.0	10.5	19.1	68.8	70.4	7.9	5.4	1.7	4.4	0.5	1.4	2.0	7.8	96.1	116.5
Oil and Gas Extraction <sup>2</sup>	17.4	16.0	13.4	8.6	107.4	110.2	1.6	1.3	61.1	55.0	15.2	26.4	6.8	9.2	26.0	31.7	248.8	258.4
Mining	20.4	20.6	7.5	4.8	54.9	55.8	3.2	2.3	122.4	104.9	39.0	38.7	4.1	4.6	20.0	17.2	271.6	248.8
Electric Power Generation, Transmission and Distribution <sup>3</sup>	6.4	6.6	x	34.2	x	5.7	25.6	12.0	70.2	x	x	5.3	30.2	32.7	28.7	x	240.3	295.6
Natural Gas Distribution <sup>4</sup>	..	0.3	..	1.6	..	0.6	..	0.1	..	2.4	..	0.7	..	0.1	..	3.2	..	8.9
Food <sup>5</sup>	8.3	11.0	x	2.6	x	0.2	0.6	3.7	70.6	78.4	x	14.2	9.7	9.6	3.4	4.0	115.8	123.7
Beverage and Tobacco Products	0.6	0.8	0.5	0.5	1.4	0.9	-	..	13.4	13.3	1.3	1.6	2.8	2.3	2.2	1.8	22.2	21.2
Wood Products	5.9	8.5	2.2	2.4	5.9	15.8	10.4	29.4	28.9	x	8.9	21.4	6.6	5.6	2.8	x	71.7	137.6
Pulp, Paper and Paperboard Mills <sup>6</sup>	52.6	43.7	11.9	3.6	6.4	3.3	25.4	11.4	251.1	241.9	95.7	62.8	9.2	8.0	26.1	12.8	478.3	387.5
Petroleum and Coal Products	7.3	7.3	3.8	2.4	32.8	4.1	0.5	..	111.2	101.5	66.0	56.4	0.2	1.1	13.5	14.4	235.3	187.3
Chemicals	31.9	25.0	7.0	6.5	30.6	42.3	1.3	1.3	104.7	101.5	34.1	34.5	2.2	2.5	15.1	18.3	226.9	231.9
Non-Metallic Mineral Products	1.8	2.5	3.2	3.3	6.2	2.8	-	1.0	17.6	20.8	5.5	5.9	1.4	2.8	3.4	4.1	39.1	43.2
Primary Metals	44.0	37.2	5.6	5.8	28.5	16.9	6.0	5.8	319.0	275.7	60.5	61.4	4.9	2.7	16.9	13.6	485.4	419.2
Transportation Equipment	6.5	5.8	2.7	2.3	2.8	18.0	3.8	0.1	101.7	89.8	12.0	10.8	1.4	0.9	8.7	11.7	139.5	139.4
Pipeline Transport <sup>8</sup>	1.4	2.0	2.6	0.7	5.0	4.2	0.3	0.3	13.4	8.1	2.9	4.4	0.9	1.4	8.3	11.2	34.8	32.2
Other manufacturing	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	291.2	338.8
<b>Total excluding "Other manufacturing"</b>	<b>206.1</b>	<b>190.2</b>	<b>81.0</b>	<b>84.3</b>	<b>298.2</b>	<b>300.1</b>	<b>147.4</b>	<b>139.2</b>	<b>1 293.2</b>	<b>1 304.8</b>	<b>421.8</b>	<b>348.8</b>	<b>80.9</b>	<b>84.9</b>	<b>177.2</b>	<b>199.1</b>	<b>2 705.9</b>	<b>2 651.4</b>
<b>Total</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>2 997.1</b>	<b>2 990.2</b>
million dollars																		
<b>Capital expenditures</b>																		
Logging	..	0.5	0.6	0.1	0.8	0.2	0.8	3.0	0.9	1.5	4.6	2.1	..	..	..	..	7.6	7.4
Oil and Gas Extraction <sup>2</sup>	7.7	4.3	8.7	9.9	63.4	69.4	3.2	0.9	59.2	55.5	40.7	46.5	..	..	..	..	183.0	186.5
Mining	2.3	2.1	5.2	5.8	7.7	8.1	0.8	3.8	31.0	33.4	33.4	28.1	..	..	..	..	80.4	81.2
Electric Power Generation, Transmission and Distribution <sup>3</sup>	x	4.9	18.9	19.2	x	1.7	17.5	20.7	57.4	56.5	9.8	21.0	..	..	..	..	113.9	124.0
Natural Gas Distribution <sup>4</sup>	..	0.1	..	0.6	..	0.6	..	0.2	..	1.0	..	14.5	..	..	..	..	..	16.8
Food <sup>5</sup>	x	2.5	0.1	0.9	x	1.3	x	5.8	39.5	37.6	31.5	12.7	..	..	..	..	73.8	60.8
Beverage and Tobacco Products	0.8	1.0	0.1	0.2	0.8	0.1	-	0.2	3.4	2.6	1.4	1.5	..	..	..	..	6.5	5.5
Wood Products	3.4	3.1	1.0	0.6	x	6.4	x	2.4	49.3	66.0	21.6	17.8	..	..	..	..	77.4	96.3
Pulp, Paper and Paperboard Mills <sup>6</sup>	6.2	13.2	1.9	0.5	3.5	4.6	3.0	1.1	180.0	89.1	136.8	179.2	..	..	..	..	331.5	287.7
Petroleum and Coal Products	2.8	0.5	3.1	3.0	13.4	5.4	3.8	1.2	38.7	82.2	63.2	48.6	..	..	..	..	124.8	141.0
Chemicals	7.4	18.6	5.3	3.3	9.4	7.0	0.8	0.4	64.5	65.7	65.0	94.3	..	..	..	..	152.5	189.2
Non-Metallic Mineral Products <sup>7</sup>	0.3	4.0	0.7	0.1	1.9	2.5	-	..	19.8	32.6	9.4	15.1	..	..	..	..	32.1	54.3
Primary Metals	18.5	4.6	0.4	0.4	x	1.4	x	1.3	107.7	102.9	161.9	73.4	..	..	..	..	290.4	184.0
Transportation Equipment	0.8	0.7	0.2	0.2	x	1.0	x	0.2	24.8	16.3	93.2	30.4	..	..	..	..	121.2	48.7
Pipeline Transportation <sup>8</sup>	0.6	0.6	6.2	6.4	5.0	2.9	1.3	0.5	14.1	41.6	43.3	63.7	..	..	..	..	70.6	115.6
Other manufacturing	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	82.9	135.0
<b>Total excluding "Other manufacturing"</b>	<b>60.9</b>	<b>60.7</b>	<b>52.3</b>	<b>51.0</b>	<b>113.8</b>	<b>112.5</b>	<b>32.3</b>	<b>41.6</b>	<b>690.3</b>	<b>684.6</b>	<b>716.0</b>	<b>648.7</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>1 665.7</b>	<b>1 599.1</b>
<b>Total</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>1 748.6</b>	<b>1 734.2</b>

**Notes:**

Figures may not add up to totals due to rounding.

Before the 1998 reference year, establishments were selected based on the 1980 Standard Industrial Classification System (SIC). However, beginning with reference year 1998, industry selection was based on the North American Industry Classification System (NAICS). For further information, see Section 3, Survey Methodology.

1. Purchases of 'Waste management and sewerage services' are included with operating expenditures for 'Pollution abatement and control processes' (end-of-pipe).

2. In 1997, this industry was titled 'Crude Petroleum and Natural Gas.'

3. In 1997, this industry was titled 'Electric Power Systems.'

4. In 1997, figures for this industry are not available. They are combined with estimates for 'Pipeline Transport.'

5. In 1997, 'Food' also included 'Tobacco Products.'

6. In 1997, this industry was titled 'Pulp and Paper.'

7. Capital expenditures on 'Wildlife and habitat protection' are included with expenditures on 'Reclamation and decommissioning.'

8. In 1997 'Pipeline Transport' figures are combined with the figures from the industry 'Natural Gas Distribution.'

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

### Business operating expenditures on environmental protection

Business operating expenditures on environmental protection stayed virtually the same between 1997 and 1998 at \$3.0 billion (Tables 2.1.1. and 2.1.2).<sup>1</sup> Operating expenditures represented 63.3% of total environmental protection expenditures in 1998. Almost half of operating costs were directed at end-of-pipe processes.<sup>2</sup> In comparison, operating expenditures for pollution prevention processes accounted for 13.2% of total operating expenditures on environmental protection.

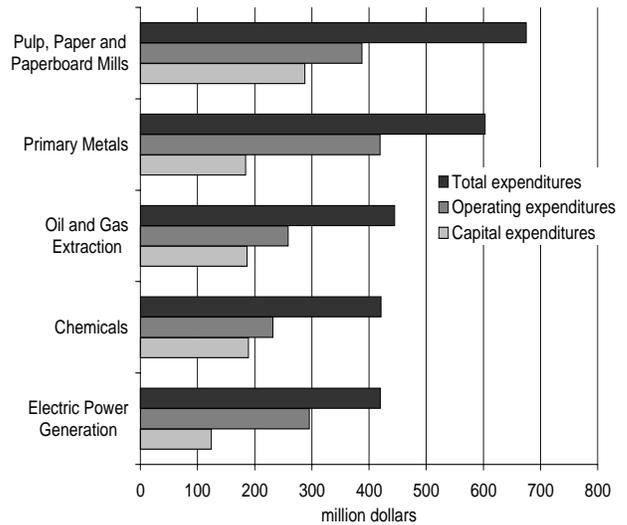
With the exception of the Natural Gas Distribution, Non-Metallic Mineral Products and Pipeline Transportation industries, businesses in all other industries reported the majority of their expenditures were directed at operating costs. For example, businesses in the Logging, Mining, and Beverage and Tobacco Products industries directed over 75% of their environmental expenditures at operating costs.

## 2.2 Environmental protection expenditures by industry<sup>3</sup>

The top five biggest spenders on environmental protection in 1998 were the Pulp, Paper and Paperboard Mills, Primary Metals, Oil and Gas Extraction, Chemicals and the Electric Power Generation, Transmission and Distribution industries (Figure 2.2.1). Combined, they spent over \$2.5 billion on environmental protection in 1998. According to results from Environment Canada's 1998 National Pollutant Release Inventory (NPRI),<sup>4</sup> these five industries also reported the largest on-site releases of NPRI pollutants. Although the NPRI identifies only a portion of all chemical pollutants released by industry, and any comparison with the SEPE should be made with caution, it is a useful starting point for comparing environmental protection expenditures by industry and emissions.

1. Includes the "Other manufacturing" category.  
 2. Excludes the "Other manufacturing" category.  
 3. Before the 1998 reference year the 1980 Standard Industrial Classification System (SIC) was used for reporting. However, beginning with reference year 1998, industry statistics are based on the North American Industry Classification System (NAICS). For further information, see Section 3, Survey Methodology.  
 4. The National Pollutant Release Inventory (NPRI) is a nationally legislated inventory of pollutant releases and transfers in Canada. Any facility that meets the reporting requirements of the NPRI must file a report with Environment Canada. For more information, please see Environment Canada, Pollution Data Branch, *National Pollutant Release Inventory - National Overview 1998*, Ottawa, or visit Environment Canada's website at <www.ec.gc.ca/pdb/npri/npri\_home\_e.cfm>, accessed May 24, 2001.

Figure 2.2.1  
**Top 5 Spenders on Environmental Protection by Industry, 1998**



Source: Statistics Canada, Environment Accounts and Statistics Division.

### Pulp, Paper and Paperboard Mills

Total environmental protection expenditures in the Pulp, Paper and Paperboard Mills industry declined 16.6% to \$675.2 million dollars in 1998 compared with 1997 (Table 2.1.1). More than half of the decline was due to environmental protection operating costs in 1998 (\$90.8 million less) compared to 1997, while environmental protection capital expenditures fell \$43.8 million (Table 2.1.2). By comparison, total capital spending (both environment and non-environment) by the industry also declined during the same time period.<sup>5</sup>

The decline in environmental protection capital investment in 1998 was much less pronounced than in previous years. For example, 1997 capital expenditures declined by \$319.3 million dollars compared to 1996. Industry sources suggest that the focus had shifted among pulp and paper companies from large capital investment expenditures on environmental protection during the late 1980s and early 1990s to improved production processes and product quality.<sup>6</sup> Also, the Pulp and Paper industries<sup>7</sup> were subject to strict environmental regulations to reduce wastewater effluents and air emissions in the early 1990s. Compliance to federal and provincial regulations on effluents was scheduled by the end of 1995, explaining the large decreases in environmental capital spending in 1996, 1997

5. Statistics Canada, *Public and Private Investment in Canada, Revised Intentions*, various issues, Catalogue No. 61-206 XIB, Ottawa.  
 6. Baily, J., 1998, *Upgrading and Expanding Production is Still Industry Focus*, Pulp and Paper Canada, June, Vol. 99, No. 6, pp. 21-34.  
 7. The Pulp Mills industry and Paper Mills industry are a subset of the Pulp, Paper and Paperboard Mills industry. For more information, please see Statistics Canada, *North American Industry Classification System, Canada 1997*, Catalogue No. 12-501-XPE, Ottawa, 1998.

and 1998. The continuing world-wide slump in commodity prices in 1998<sup>1</sup> may have also been one of the factors contributing to the decline in investment expenditures by the industry.

Despite the decline, the Pulp, Paper and Paperboard Mills industry made the largest capital investments in environmental protection in 1998 compared to the other industries (\$287.7 million) for the fifth consecutive year. Capital expenditures were characterised by large amounts allocated to pollution prevention processes (\$179.2 million), representing an increase of 30.9% over 1997 (Table 2.1.2). Despite the overall increase in pollution prevention capital expenditures in 1998, the majority of respondents in this industry reported lower capital expenditures on pollution prevention processes. This was offset by a small number of large projects that made up for the declines. Pulp and paper companies have implemented a number of pollution prevention projects, such as switching from fossil fuels to biomass, process efficiency improvements and increased use of co-generation.<sup>2</sup> Capital investment in end-of-pipe processes totalled \$89.1 million in 1998, a 50.5% decline compared to 1997.

### Primary Metals

The Primary Metals industry spent just over \$603.2 million on environmental protection expenditures in 1998, a decline of 22.3% compared to 1997 (Tables 2.1.1 and 2.1.2).

Operating expenditures declined by \$66.2 million to \$419.2 million compared to 1997, due mainly to reduced expenditures on reclamation and decommissioning (-\$11.6 million) and end-of-pipe processes (-\$43.3 million).

Environmental spending on capital projects declined by \$106.4 million to \$184.0 million compared with 1997. The decline was due mainly to reduced investments in pollution prevention processes (-\$88.5 million) and environmental monitoring (-\$13.9 million). After reaching a peak of \$180.5 million in 1996, capital investments in pollution prevention processes have declined each year to \$73.4 million in 1998. In 1998, end-of-pipe capital expenditures (\$102.9 million) were greater than pollution prevention capital expenditures for the first time since 1995.

Total capital expenditures on environmental protection in the Primary Metals industry increased each year from 1996 to 1997, but declined in 1998. This was similar to the overall trend of increased total capital investment observed in the industry over the same time period, with a corresponding decline in 1998.<sup>3</sup> Lower production in the industry may have

been one of the factors for reduced investments in environmental protection in 1998.<sup>4</sup>

### Oil and Gas Extraction

The Oil and Gas Extraction industry was the third highest spender on environmental protection in 1998 (\$444.9 million) (Table 2.1.1). This represented an increase of 3.0% from the same period a year earlier (Table 2.1.2). The largest expenditure made by the industry was directed at reclamation and decommissioning (\$179.6 million). Of this total, \$110.2 million were operating expenditures and the remainder (\$69.4 million) were made on capital investments, representing an increase of 2.6% and 9.5% respectively.

Capital expenditures on pollution prevention processes grew annually from 1995 to 1998, reaching \$46.5 million in 1998, an increase of 14.2% from 1997. Investment spending on end-of-pipe processes declined 6.1% in 1998 to \$55.5 million.

### Chemicals

Overall environmental protection expenditures in the Chemicals industry increased 11.0% in 1998 to \$421.1 million dollars from a year earlier (Table 2.1.1). This followed increases in both 1996 and 1997 (+30.0% and +22.2% respectively). Most of the growth in 1998 was due to higher capital spending (up \$36.8 million or 24.1%) while operating expenditures increased a more modest 2.2% or \$5.0 million (Table 2.1.2). This increase in environmental protection capital expenditures corresponds to the overall increase in total capital spending by this industry in 1998.<sup>5</sup>

The Chemicals industry reported capital spending in 1998 of \$94.3 million on pollution prevention, an increase of \$29.3 million (+45.1%) from the year before. The rising trend of investing in pollution prevention processes was evident from the growth in expenditures in 1997 as well, rising from \$17.2 million in 1996 to \$65.0 million in 1997. Cogeneration, energy efficiency and flare-reduction are examples of the pollution prevention activities employed by the Chemicals industry.<sup>6</sup> The second area of significant increased capital spending was for environmental monitoring which grew by \$11.2 million over 1997 to \$18.6 million.

Capital expenditures by the Chemicals industry on end-of-pipe processes also increased between 1995 and 1998. Investment was up slightly (+1.7%) in 1998 to \$65.7 million compared to 1997. However, investment in end-of-pipe

1. Statistics Canada, *1998 Quarterly financial statistics for enterprises*, Catalogue No. 61-008-XPB, Ottawa.

2. Natural Resources Canada, Office of Energy Efficiency, 1999, *Canadian Industry Program for Energy Efficiency, 1998/1999 Annual Report*, Ottawa.

3. Statistics Canada, *Public and Private Investment in Canada, Revised Intentions*, various issues, Catalogue No. 61-206 XIB, Ottawa.

4. Statistics Canada, *1998 Quarterly financial statistics for enterprises*, Catalogue No. 61-008-XPB, Ottawa.

5. Statistics Canada, *Public and Private Investment in Canada, Revised Intentions*, various issues, Catalogue No. 61-206 XIB, Ottawa.

6. Natural Resources Canada, Office of Energy Efficiency, 1999, *Canadian Industry Program for Energy Efficiency, 1998/1999 Annual Report*, Ottawa.

process changes increased more dramatically in 1996 and 1997, growing 29.8% and 43.1% respectively.

### Petroleum and Coal Products

After reporting significant growth in environmental protection expenditures in 1996 and 1997 (+56.2% and +16.1% respectively), the Petroleum and Coal Products industry reduced expenditures by 8.8% in 1998 to \$328.3 million (Table 2.1.1). Reduced expenditures on reclamation and decommissioning, as well as pollution prevention process changes accounted for most of the decline (Table 2.1.2).

The Petroleum and Coal Products industry reported the largest decline in reclamation and decommissioning expenditures of all industries reporting to the survey. Both operating (-87.4%) and capital (-59.2%) expenditures for this category fell for an overall decline of \$36.6 million.

Expenditures on pollution prevention process fell by \$24.2 million to \$105.0 million during the same period. More than half of the decline (\$29.2 million) was due to reduced capital expenditures, while the remainder was due to decreased operating costs.

In contrast to capital expenditures on pollution prevention, capital expenditures on end-of-pipe processes more than doubled to \$82.2 million in 1998 compared to 1997. This surpassed the previous high of \$67.1 million in 1995. Much of the increase was attributed to a small number of large projects. Despite the increase in end-of-pipe capital investment, operating expenditures declined almost 9% to \$101.5 million in 1998.

### Pipeline Transportation and Natural Gas Distribution<sup>1</sup>

The Pipeline Transportation and Natural Gas Distribution industries reported spending 64.7% more on environmental protection in 1998 representing the largest industrial gain observed. Total environmental protection expenditures reached \$173.6 million (Table 2.1.1). Virtually all of the increase could be attributed to higher capital expenditures on end-of-pipe and pollution prevention process changes (Table 2.1.2). While operating expenditures increased 18.1% to \$41.1 million compared to 1997, capital expenditures increased 87.7% to \$132.5 million (+\$61.9 million). The Pipeline Transportation industry also reported a large increase in total capital expenditures for pipeline expansion

and infrastructure renewal in 1998 compared to 1997 (+63.7%), responding to increased demand for energy due to strong economic growth and capital turnover<sup>2</sup>.

End-of-pipe capital expenditures were \$43.6 million in 1998, up from \$14.1 million in 1997. Pollution prevention investment expenditures reached \$92.6 million in 1998, up from \$43.3 million in 1997. Expenditures on pollution prevention processes have increased each year since 1995. The Pipeline Transportation and Natural Gas industries have invested in such areas as improved fuel efficiency, fuel reformulation, and improved piping technology and storage tanks.<sup>3</sup>

### Other Industries

The Electric Power Generation, Transmission and Distribution industry reported \$419.6 million in environmental protection expenditures in 1998, an increase of 18.4% compared with 1997 (Tables 2.1.1 and 2.1.2). The Mining industry reported environmental protection expenditures of \$330.0 million, a decrease of 6.2% compared with 1997. Most of the decline was due to lower operating costs for end-of-pipe processes (-\$17.5 million) and lower capital expenditures on pollution prevention processes (-\$5.3 million).

The Wood Products (+56.8%) and Logging (+19.5%) industries both posted increases in environmental protection expenditures compared to 1997 (Table 2.1.1). Higher expenditures on end-of-pipe and pollution prevention processes in the Wood Products industry accounted for much of the increase (Table 2.1.2). Most of the increase in the Logging industry was due to higher operating costs for reclamation and decommissioning and the "Other"<sup>4</sup> category.

Expenditures on environmental protection by the Non-Metallic Minerals Products industry increased 37.2% to \$97.5 million compared to 1997 (Table 2.1.1). Most of the increase was due to higher capital expenditures on end-of-pipe processes (+\$12.8 million) and a lesser extent on pollution prevention (+\$5.7 million) and environmental monitoring (+\$3.8 million) (Table 2.1.2). In contrast, the Transportation Equipment industry reported lower environmental protection expenditures in 1998 (\$188.1 million in 1998 versus \$260.8 million in 1997) due to lower end-of-pipe (-\$20.4 million) and pollution prevention (-\$62.8 million) expenditures. Much of the decline was due

1. Data for the Pipeline Transportation industry and Natural Gas Distribution industry are reported separately in 1998. They have been combined for comparison purposes to previous years. The Pipeline Transportation industry is comprised of establishments primarily engaged in the transport of products by pipeline, such as crude oil, natural gas and refined petroleum products. The Natural Gas Distribution industry is comprised of establishments engaged in the distribution of natural or synthetic gas to the ultimate consumer through a system of mains. Please see Statistics Canada, March 1998, *North American Industry Classification, Canada 1997*, Catalogue No. 12-501-XPE, Ottawa.

2. Natural Resources Canada, Office of Energy Efficiency, 1999, *Canadian Industry Program for Energy Efficiency, 1998/1999 Annual Report*, Ottawa.

3. *Ibid.*

4. "Other" environmental protection operating costs include such things as the cost of administration for an environmental affairs division; environmental training and information programs; and any other additional expense required to comply with environmental regulations, conventions or voluntary agreements. Please see Annex B, Questionnaire.

to reduced environmental protection expenditures in the automotive manufacturing sector.

## 2.3 Environmental protection expenditures by province and territory

Almost three quarters of the total environmental protection expenditures for 1998 were made in Ontario (\$1 785.2 million), Alberta (\$866.2 million), and Quebec (\$824.1 million) (Table 2.1.1). Unlike previous years, 1998 environmental protection expenditures in Quebec were lower than those in Alberta due mostly to a major decline in environmental expenditures in Quebec.

The proportion of the total environmental protection expenditures for 1998 made in the remaining provinces was as follows: the Atlantic provinces (5.3%), Manitoba (2.8%), Saskatchewan (6.1%), British Columbia (11.9%) and the Yukon and Northwest Territories (0.4%).

### Quebec

Total environmental protection expenditures in Quebec declined steadily from 1996 to 1998. From 1997 to 1998 total environmental protection expenditures fell by approximately \$138 million. Operating expenditures on environmental protection declined 4.0%, while capital investment in environmental protection declined 30.3% (-\$114.5 million). Both PAC end-of-pipe and pollution prevention capital expenditures fell (Table 2.3.1).

The largest reductions in environmental protection capital expenditures in Quebec were found in the following industries: Pulp, Paper and Paperboard Mills (-66.8%); Mining (-45.0%); Primary Metals (-36.3%); and Electric Power Generation, Transmission and Distribution (-40.3%).

Much of the overall decline in capital spending in Quebec was attributable to the Pulp, Paper and Paperboard Mills industry. The industry spent less on environmental protection than in previous years (for further explanation see section 2.2 Environmental protection expenditures by industry, page 6). This corresponds to the overall decline in environmental protection expenditures in the Canadian Pulp, Paper and Paperboard Mills industry and the relative importance of the industry in Quebec.

The ice storm that hit southwestern Quebec in January of 1998 may also have contributed to the decrease in environmental protection investment in the province by diverting investment away from environmental protection and towards infrastructure renewal.

### Ontario

Since 1995 total environmental protection expenditures in Ontario have been increasing. In 1998, Ontario industries spent \$9.3 million more on environmental protection than in 1997. However, excluding the "Other manufacturing" category, total environmental protection expenditures decreased in 1998 (-\$70.7 million). Reduced environmental operating costs and capital expenditures on pollution prevention (-\$51.2 million and -\$50.6 million respectively) accounted for most of this decline. A \$13.6 million reduction in capital expenditures on end-of-pipe processes was offset by an \$41.3 million increase in end-of-pipe operating costs (Table 2.3.1).

The largest declines in capital expenditures on environmental protection in Ontario occurred in the following industries: Transportation Equipment (-63.1%); Beverage and Tobacco products (-50.5%); Primary Metals (-29.7%); and Petroleum and Coal Products (-28.7%).

In contrast, environmental protection capital expenditures in the Pulp, Paper and Paperboard Mills industry in Ontario increased by \$30 million in 1998 compared to 1997. However, the increase was due to a small number of large capital projects rather than widespread increased investment spending by the industry.

### Manitoba

Total environmental protection expenditures in Manitoba increased 12.4% in 1998 (\$132.8 million) compared to 1997. This increase is primarily the result of higher environmental capital spending made by the following industries: Primary Metals, Non-Metallic Mineral Products, Chemicals, and Electric Power Generation, Transmission and Distribution.

### Saskatchewan

Total environmental protection expenditures in 1998 increased \$99.9 million in Saskatchewan compared to the same period a year earlier (Table 2.1.1). Most of the increase (+\$100 million) can be attributed to increased capital expenditures on pollution prevention processes, which grew from \$25.4 million in 1997 to \$137.7 million in 1998.

The following three industry groups invested a total of \$102.3 million more in environmental protection than they did in 1997: Pulp, Paper and Paperboard Mills; Primary Metals; and Electric Power Generation, Transmission and Distribution.

### Alberta

In Alberta, total environmental protection expenditures have generally increased each year since 1995. In 1998, environmental protection expenditures rose \$88.3 million over

Table 2.3.1

**Capital Expenditures for Pollution Prevention and Pollution Abatement and Control by Province and Territory, 1995-1998**

Province/Territory	Pollution prevention processes				Pollution abatement and control (end-of-pipe) processes			
	1995	1996	1997	1998	1995	1996	1997	1998
	million dollars							
Newfoundland	0.1	2.7	13.0	2.5	x	38.4	1.7	7.8
Prince Edward Island	x	x	0.6	0.2	0.1	x	x	x
Nova Scotia	2.3	4.8	6.3	6.2	26.7	23.0	7.8	5.0
New Brunswick	16.4	9.9	12.6	11.3	93.1	66.2	25.7	36.7
Quebec	71.1	238.7	130.5	71.7	335.1	148.1	160.6	111.3
Ontario	77.1	133.4	254.1	203.5	271.2	240.3	261.8	248.2
Manitoba	18.6	4.9	17.6	26.1	31.5	13.6	8.5	14.0
Saskatchewan	5.2	18.5	24.3	137.7	38.5	18.5	37.3	25.1
Alberta	37.0	43.0	91.7	139.5	233.8	199.5	102.1	121.0
British Columbia	40.9	225.1	162.4	47.3	129.6	70.3	82.7	112.6
Yukon and Northwest Territories <sup>1</sup>	x	x	2.8	2.4	x	x	x	x
<b>Canada</b>	<b>268.9</b>	<b>681.8</b>	<b>716.0</b>	<b>648.4</b>	<b>1203.5</b>	<b>821.4</b>	<b>690.3</b>	<b>684.5</b>

**Notes:**

Figures may not add up to totals due to rounding.

Excludes the "Other manufacturing" category.

1. Includes Nunavut.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

1997. Most of this increase was the result of a rise (+25.2%) in environmental protection capital spending. Although end-of-pipe capital expenditures increased by 18.5% to \$121.0 in 1998, pollution prevention capital expenditures increased by 52.1% to \$139.5 million.

The industries responsible for the largest increases in environmental capital expenditures in Alberta were: Chemicals (97.7%); Electrical Power Generation, Transmission and Distribution (134.5%); and Natural Gas Distribution and Pipeline Transportation (226%).<sup>1</sup>

The Oil and Gas Extraction industry accounts for approximately half of the environmental protection expenditures made in Alberta. Total environmental protection expenditures in that industry increased to \$427.8 million in 1998, 41.4% of which went towards operating and capital costs for pollution prevention, abatement and control. Capital expenditures on environmental assessments (+13.5%), and reclamation and decommissioning (+34.5%) also increased for 1998.

The Natural Gas Distribution and Pipeline Transportation industry reported a substantial increase in environmental capital expenditures in 1998 (+226.0%) compared to a year earlier. Most of the increase in capital expenditures were for environmental monitoring (+57.0%), environmental assess-

ments (+33.3%), and pollution prevention and abatement and control (PPAC) (+308.0%).

The Natural Gas Distribution and Pipeline Transportation industries have increased investments in pipeline expansion and infrastructure renewal in response to increased demand for energy due to strong economic growth and overall increasing demand for energy.<sup>2</sup> These industries have invested in such areas as improved fuel efficiency, fuel reformulation and improved piping technology and storage tanks.<sup>3</sup>

**British Columbia**

Since 1996, businesses in British Columbia have reported steady declines in environmental protection expenditures. Expenditures fell by \$112.8 million in 1998 compared to 1997. Most of the decline can be attributed to reduced environmental protection capital expenditures (-\$77.6 million in 1998- a decrease of 28.5%), particularly in the Pulp, Paper and Paperboard Mills industry. Virtually all of the decline was found in pollution prevention capital expenditures, which fell just over 70% to \$47.3 million. Pollution abatement and control (end-of-pipe) capital expenditures, however, grew to \$112.6 million from \$82.7 million in 1997.

The Pulp, Paper and Paperboard Mills industry in British Columbia reported the largest reduction in environmental protection capital expenditures. In 1998, establishments in this industry spent \$34.8 million on environmental

1. Data for the Pipeline Transportation industry and Natural Gas Distribution industry are reported separately in 1998. They have been combined for comparison purposes. The Pipeline Transportation industry is comprised of establishments primarily engaged in the transport of products by pipeline, such as crude oil, natural gas and refined petroleum products. The Natural Gas Distribution industry is comprised of establishments engaged in the distribution of natural or synthetic gas to the ultimate consumer through a system of mains. Please see Statistics Canada, March 1998, *North American Industry Classification, Canada 1997*, Catalogue No. 12-501-XPE, Ottawa.

2. Statistics Canada, CANSIM Matrix 11507, D878454: Capital and Repair Expenditures, Canada - Pipeline Transportation, Capital Expenditures.

3. Natural Resources Canada, Office of Energy Efficiency, 1999, *Canadian Industry Program for Energy Efficiency, 1998/1999 Annual Report*, Ottawa.

protection capital projects in 1998, 67.9% decline compared to 1997. The Primary Metals industry in British Columbia also reported a decrease in environmental capital expenditures of \$41.8 million (-67.9%) in 1998. Total environmental expenditures in the Mining industry fell by about 21% in 1998 due mostly to a decrease in operating expenditures (-25.7%). However, environmental capital expenditures increased by 14.3% led by increased investment in pollution prevention (+21.1%) and end of pipe (+10.8%) processes.

### The Atlantic provinces, Yukon Territory and Northwest Territories

Total environmental protection expenditures in the Atlantic provinces (Newfoundland, Prince Edward Island, Nova Scotia, and New Brunswick) increased to \$248.5 million in 1998. This represented an increase of approximately 7% compared to the same period a year earlier, due primarily to higher operating expenditures in the Logging, Primary Metals, Wood Products and Non-Metallic Mineral Products industries.

Total environmental protection expenditures in the Yukon and Northwest Territories increased to 18.7 million in 1998, a 3.3% increase over 1997.

## 2.4 Capital expenditures on pollution prevention, abatement and control by type of environmental medium<sup>1</sup>

Between 1995 and 1998, there was a general change in the focus of pollution prevention, abatement and control (PPAC)<sup>2</sup> capital investment from preventing or abating substances released to surface waters to reducing those emitted to air (Figure 2.4.1). For example, almost 55% of PPAC capital investment was directed toward preventing or abating substances emitted to air in 1998, up from just over 35% in 1995. In contrast, PPAC capital expenditures directed at reducing substances released to surface waters have declined each year, from a high of 54.6% in 1995 to 21.4% in 1998.

The proportion of PPAC capital investment expenditures directed at the prevention or abatement of on-site contained solid and liquid waste management has also increased each year from 1995 to 1998, from just under 10% to just over 20% respectively.

1. Includes reported data only. Before the 1997 reference year, the category "on-site contained solid and liquid waste" was titled "soil and groundwater". Comparisons should be made with caution.

2. PPAC includes both expenditures on pollution prevention and pollution abatement and control (end-of-pipe) processes.

Interestingly, facilities reporting to the Environment Canada's National Pollutant Release Inventory (NPRI) have reported declining on-site releases to surface water between 1995 and 1998, while the proportion of on-site air emissions have increased from almost 61% of total emissions in 1996 to just under 70% in 1998. The proportion of on-site pollutant releases to land have increased as well, from just over 9% of total emissions in 1995 to over 12% in 1998.<sup>3</sup>

There has been increased international focus in recent years on air emissions due to mounting evidence of the link between greenhouse gas emissions and climate change. In 1997, 160 nations agreed to the Kyoto Protocol which aims to reduce the collective greenhouse gas emissions of these countries 5.2% from 1990 levels by 2010. In Canada, several voluntary programs are in place to encourage organizations to reduce their emissions of greenhouse gases such as the Voluntary Challenge and Registry and ÉcoGeste.<sup>4</sup> The reduction of greenhouse gas emissions are but one driver of environmental protection by businesses. Other important environmental issues include ground-level ozone (smog); dioxins and furans in water, soil, and air; particulate matter in air; mercury in water, soil, and air; benzene in air; and petroleum hydrocarbons in soil.<sup>5</sup>

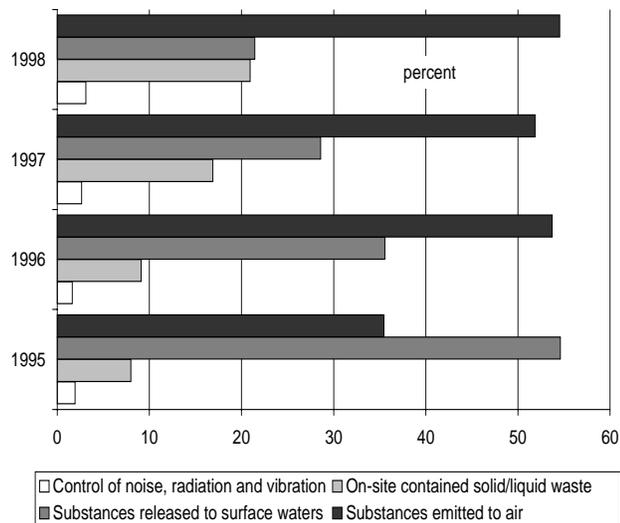
The proportion of PPAC capital expenditures directed towards the reduction of substances released to surface waters declined each year from 1995 to 1998 for both end-of-pipe and pollution prevention processes. In 1998, just over 40% of the capital investments in pollution abatement and control (end-of-pipe) processes were directed at abating substances emitted to air, 26.2% was directed at substances released to surface waters and 25.3% was directed at the management of on-site contained solid and liquid waste (Tables A.7 and A.8 and Figure 2.4.3). In contrast, over 65% of investment expenditures in pollution prevention processes were directed at preventing substances emitted to air, the remainder being shared between the prevention of on-site contained solid and liquid waste and substances released to surface waters (Figure 2.4.2 and Tables A.9 and A.10).

3. Environment Canada, *National Pollutant Release Inventory, National Overview*, various documents, Ottawa. Readers should be cautioned that comparisons between results from the *Survey of Environmental Protection Expenditures* and the NPRI are made for general comparison purposes only. Differences in methodology, reporting, sector make-up etc. make detailed comparisons inappropriate. For more information on the NPRI, please visit Environment Canada's website at <[www.ec.gc.ca/pdb/npri/npri\\_home\\_e.cfm](http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm)>, accessed May 24, 2001.

4. For an inventory of voluntary initiatives related to GHG emissions, see Climate Change Secretariat, *Enhanced Voluntary Action Issue Table, 1998, Foundation Paper*, Ottawa.

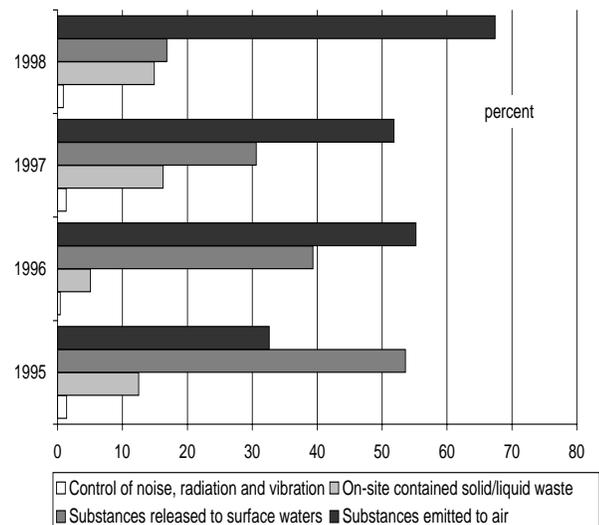
5. Statistics Canada, 2000, *Human Activity and the Environment, 2000*, Catalogue No. 11-509-XPE, Ottawa.

Figure 2.4.1  
**Capital expenditures on Pollution Prevention, Abatement and Control by Environmental Medium, 1995-1998**



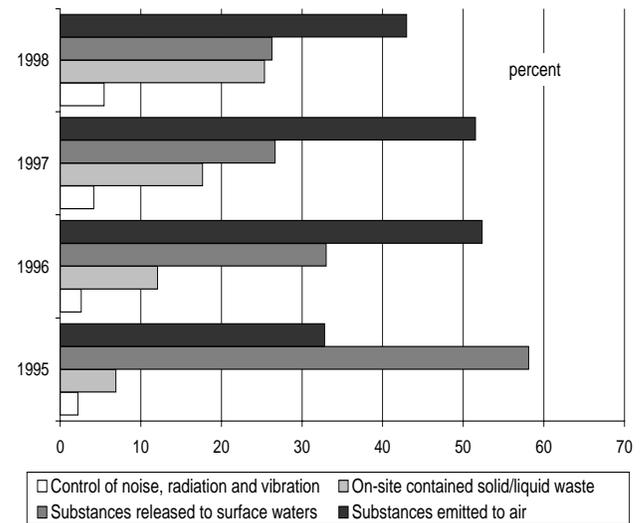
**Note:** Before the 1997 reference year, the category "on-site contained solid and liquid waste" was titled "soil and groundwater". Comparisons should be made with caution.  
**Source:** Statistics Canada, Environment Accounts and Statistics Division.

Figure 2.4.2  
**Capital Expenditures on Pollution Prevention by Environmental Medium, 1995-1998**



**Note:** Before the 1997 reference year, the category "on-site contained solid and liquid waste" was titled "soil and groundwater". Comparisons should be made with caution.  
**Source:** Statistics Canada, Environment Accounts and Statistics Division.

Figure 2.4.3  
**Capital Expenditures on PAC (End-of-pipe) by Environmental Medium, 1995-1998**



**Note:** Before the 1997 reference year, the category "on-site contained solid and liquid waste" was titled "soil and groundwater". Comparisons should be made with caution.  
**Source:** Statistics Canada, Environment Accounts and Statistics Division.

Although there was an overall shift from the proportion of PPAC expenditures directed at the prevention of substances released to surface waters to substances emitted to air, and a lesser extent, to on-site contained solid and liquid waste, there were significant differences found amongst the provinces (Table A.6). For example, comparing 1997 and 1998, businesses in Quebec and Alberta increased PPAC capital investment aimed at preventing or abating substances released to surface waters and on-site contained solid and liquid waste while decreasing capital investment aimed at the prevention or abatement of substances emitted to air.

Business in Ontario maintained similar proportions of PPAC expenditures by media in 1998 compared to 1997, while businesses in Manitoba reported the largest increase in the proportion of PPAC capital investment expenditures directed at the prevention or abatement of substances emitted to air (from 27.0% in 1997 to 64.7% in 1998). Businesses in British Columbia shifted their PPAC expenditure to air emissions (from 35.1% in 1997 to 56.4% in 1998) and solid and liquid waste management (11.5% in 1997 to 22.7% in 1998) from the prevention or abatement of emissions to water (52.9% in 1997 to 20.5% in 1998).

Businesses in Saskatchewan reported the highest proportion of PPAC capital investment directed toward preventing or abating substances emitted to air (81.1%) in 1998 (Table A.6). This was up from 67.4% in 1997. However, it is important to note that this increase was primarily the result of a small number of large capital projects, rather than widespread increased investments in the reduction of air emissions.

## Capital investment in pollution abatement and control (end-of-pipe) processes

The proportion of capital investment expenditures on end-of-pipe processes aimed at reducing substances emitted to air fell from 51.5% in 1997 to 43.0% in 1998 (Tables A.7 and A.8). Capital expenditures shifted from the abatement of substances emitted to air to on-site contained solid and liquid waste management, where the share of total end-of-pipe investment expenditures grew from 17.7% in 1997 to 25.3% in 1998. Four out of the top five industries with the largest capital expenditures on end-of-pipe processes increased the proportion dedicated to the management and/or treatment of on-site contained solid and liquid waste (Table A.2).

## Capital investment in pollution prevention

Investment expenditures on pollution prevention directed at air pollution increased markedly in 1998, growing from 51.8% in 1997 to 67.4% in 1998 (Tables A.9 and A.10). In 1998, 16.8% of capital expenditures were associated with preventing substances released to surface waters, almost half the 1997 share (30.6%). The shift in capital expenditures was widespread with the majority of industries reported investing more in pollution prevention for air pollution control. A second important factor is the increase in capital expenditures on pollution prevention processes brought about by the Pulp, Paper and Paperboard Mills industry directed at air emission control. These expenditures more than tripled between 1997 and 1998.

## 2.5 Pollution Prevention Methods<sup>1</sup>

The federal government defines pollution prevention as the use of processes, practices, materials, products or types of energy that avoid or minimise the creation of pollutants and waste and reduce overall risk to human health and the environment (Text Box 2.5.1). Pollution prevention seeks to eliminate pollution rather than to treat the waste or pollution generated. It involves continuous improvement through changes in product design, technology, operations and behaviour. Pollution prevention is seen as a more effective way of protecting the environment than the traditional end-of-pipe methods and can even lead to lower production costs.<sup>2</sup>

1. Includes reported data only.

2. Government of Canada, 2000, *Progress in Pollution Prevention, 4th Annual Report*, Ottawa.

### Text Box 2.5.1

#### Pollution Prevention Methods

The federal government defines pollution prevention as: 'the use of processes, practices, materials, products or types of energy that hinder or minimize production of pollutants, wastes and wastage, while providing a general decrease in threats to human and environmental well-being.'<sup>1</sup> Based on this definition, the Survey of Environmental Protection Expenditures (SEPE) 1998 asked businesses to indicate which of the following pollution prevention methods they used in 1998 and which ones they were planning to use during the next two years:

- product design or reformulation;
- substitution or modification of production process (integrated process);
- on-site recirculation, recovery, reuse or recycling;
- energy conservation;
- material or solvent substitution;
- prevention of leaks and spills.

Pollution prevention is sometimes characterized by economic as well as environmental benefits. For instance, energy conservation practices allow businesses to cut electricity costs while reducing the use of energy resources, thus reducing the emissions of greenhouse gases.<sup>2</sup>

1. Government of Canada, 1995, *Pollution Prevention - A Federal Strategy*, Ottawa.

2. For specific examples of pollution prevention efforts by Canadian businesses, visit Environment Canada, *The Canadian Pollution Prevention Information Clearinghouse* at <<[http://www3.ec.gc.ca/cppic/index\\_e.htm](http://www3.ec.gc.ca/cppic/index_e.htm)>>.

Nationally, businesses reported the use of processes related to reuse and recycling of materials<sup>3</sup> more than any other pollution prevention method in 1998 (Table A.15). Over 65% of businesses indicated they used recycling and reuse methods, followed by the prevention of leaks and spills (59%), and energy conservation (45%).<sup>4</sup> These three methods have been the three most popular since 1995. With respect to plans for 1999-2000, businesses reported an increase in the intent to use each pollution prevention method, with the exception of the "Other" category (Table A.16).

3. Includes recirculation, reuse, recovery or recycling of water, materials or substances generated during production, excluding materials transferred or recycled off-site. Examples include vapour recovery, recovery of sludge, water recirculation, reuse of water for refrigeration condenser operations.

4. The question on pollution prevention methods differed in reference years 1995 and 1996. Therefore, comparisons from 1995 to 1998 provide a general view but should be treated with caution.

### **On-site Recirculation, recovery, recycle and reuse**

Sixty-five percent of all businesses used the "4Rs" as a means to reduce their use of natural resources and substances as well as their waste output in 1998 (Table A.15), and, businesses overall did not plan to increase further the use of this pollution prevention method in 1999-2000 (Table A.16).

### **Prevention of leaks and spills**

Excluding the "Other manufacturing" category, just over 65% of businesses indicated they used equipment and practices that prevented leaks and spills (Table A.15). The proportion fell to just over 58% when the "Other manufacturing" category was included. However, the proportion of businesses using this method was higher than in 1997 (51%). In fact, the prevention of leaks and spills has grown in usage more than any other pollution prevention method. Over 80% of businesses in the Logging, Oil and Gas Extraction, Electric Power Generation, Transmission and Distribution and Pipeline Transportation industries used this method of pollution prevention.

### **Energy conservation**

The proportion of respondents that adopted energy conservation at their establishment reached 45% in 1998, up from 42% in 1997 (Table A.15). Excluding the "Other manufacturing" category, the proportion was 49%. The proportion of businesses preventing pollution through energy conservation increased for the fourth consecutive year. The Pipeline Transportation (75%), Oil and Gas Extraction (75%) and Electric Power Generation, Transmission and Distribution (74%) industries reported the largest proportion of businesses using energy conservation methods. Most industry groups indicated they would increase the use of energy conservation to prevent pollution in 1999-2000 (Table A.16).

### **Substitution or modification of production process**

The popularity of substitution or modification of production processes has declined since 1995. While 23% of businesses indicated they used substitution or modification of production process in 1998, this was down from 32% in 1995. All industry groups reported that they would increase the use of substitution or modification of production processes as a method of preventing pollution in 1999-2000 (Table A.16).

### **Material or solvent substitution**

After becoming increasingly popular from 1995 to 1997, the proportion of businesses that used material or solvent substitution as a method of pollution prevention fell from 37% in 1997 to 31% in 1998. Over 50% of the businesses

in the Electric Power Generation, Transmission and Distribution and Transportation Equipment industries indicated they used this method in 1998 (Table A.15). All industry groups reported that they would increase the use of material and solvent substitution as a method of preventing pollution in 1999-2000 (Table A.16).

### **Product design or reformulation**

Product design or reformulation has grown in popularity each year since 1995. Almost 17% of businesses indicated they used this method in 1998, up from under 10% in 1995 (Table A.15). All industries planned to increase this method of pollution prevention in 1999-2000, with the exception of the Electric Power, Generation and Transmission; Beverage and Tobacco Products; and Chemicals industries (Table A.16).

### **Pollution Prevention by Province**

On a provincial level, businesses in Quebec, Ontario and British Columbia all increased their use of prevention of leaks and spills, while the use of energy conservation increased greatly in Newfoundland, Prince Edward Island, Nova Scotia, Manitoba, and Alberta (Table A.17).

## **2.6 Concentration**

Table 2.6.1 shows that just under half (46%) of total environmental protection expenditures were made by the top 100 survey establishments. This figure indicates a decrease in concentration when compared with 1995 results.<sup>1</sup> In that year, the top 100 survey establishments accounted for almost 51% of total environmental protection expenditures.

The top 5 establishments reported \$526.9 million of total environmental protection expenditures, while the next 5 reported spending less than half that amount (\$236.8 million). The top 15 establishments accounted for 19% of total environmental protection expenditures.

The top 15 establishments accounted for more than a quarter of capital expenditures on environmental protection while the top 100 accounted for 60% of such expenditures. This was down from 65% in 1995. The top 15 establishments accounted for 19% of operating expenditures on environmental protection, while the top 100 establishments accounted for 44%, down from 48% in 1995. These results indicate there was lower concentrations of capital and operating expenditures on environmental protection in 1998 compared to 1995. However, there was still more concentration of capital expenditures as opposed to operating expenditures on environmental protection.

1. Statistics Canada, 1998, *Environmental Protection Expenditures in the Business Sector, 1995*, Catalogue No. 16F0006XIE, Ottawa.

Table 2.6.1  
**Concentration of Environmental Protection Expenditures, 1998**

Establishments	Expenditures million dollars	Accumulated	Share of
		expenditures	total
			percent
<b>Capital expenditures</b>			
Top 5	265.9	265.9	15.3
Next 5	131.4	397.3	22.9
Next 5	98.1	495.4	28.6
Next 85	545.8	1 041.2	60.0
Remaining establishments	693.0	1 734.2	100.0
<b>Operating expenditures</b>			
Top 5	339.7	339.7	11.4
Next 5	131.8	471.4	15.8
Next 5	96.7	568.1	19.0
Next 85	750.5	1 318.6	44.1
Remaining establishments	1 671.6	2 990.2	100.0
<b>Total</b>			
Top 5	526.9	526.9	11.2
Next 5	236.8	763.7	16.2
Next 5	176.8	940.5	19.9
Next 85	1 241.4	2 181.9	46.2
Remaining establishments	2 542.5	4 724.4	100.0

**Note:**

Figures may not add up to totals due to rounding.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

## 2.7 Work-in-progress

The 2000 Survey of Environmental Protection Expenditures is scheduled to be mailed out in October, 2001. 1998 environmental protection expenditure estimates will be made available by industry and geographic region in the near future. A second report entitled *Environmental Management and Technologies in the Business Sector, 1998* will be available winter, 2001. Estimates of environmental research and development from the *R&D in Canadian Industry Survey* for 1996, 1997 and 1998 are being planned.

On an industry by industry basis, there were a wide range of differences in the proportion of total environmental protection expenditures made up by the top 5 establishments. For example, the top 5 establishments in the Oil and Gas Extraction industry (making up just over 6% of the total number of establishments in that industry) accounted for 50% of total expenditures. The top 5 establishments in the Electric Power Generation, Transmission and Distribution industry (making up 16% of the total number of establishments in that industry) accounted for 86% of total expenditures. The Food industry had the lowest concentration of expenditures by the top 5 establishments (11%) which represented less than one percent of the total number of establishments in that industry.

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## 3 Survey Methodology

### 3.1 Objective

The *Survey of Environmental Protection Expenditures* (SEPE) is conducted to measure the cost imposed on Canadian industry to comply with present or anticipated environmental regulations, conventions and voluntary agreements. The SEPE also collects information on environmental management practices and environmental technologies used by industry for the purpose of preventing, abating or controlling pollution.

The SEPE has been conducted on an annual basis since 1994, however as of reference year 1998 this survey is conducted every two years.

### 3.2 Coverage and data collection

The SEPE does not cover the entire economy (i.e., agriculture, construction, distributive trades, service industries and the government sector are not surveyed). Instead, the survey targets a number of industries where environmental protection spending is likely to constitute a relatively large proportion of total expenditures.

The data reported in this study are based upon a survey of 2 543 establishments in primary industries (resource extraction industries), manufacturing industries, the Electric Power Generation, Transmission, and Distribution industry, the Pipeline Transportation industry, the Oil and Gas Extraction industry and the Natural Gas Distribution industry. In order to be selected in the survey, an establishment had to have more than 49 employees<sup>1</sup>.

#### 3.2.1 Survey frame

A list of establishments to be surveyed was produced using the frame from Statistics Canada's *Annual Survey of Manufactures*, the Business Register and other frames that contain establishments or companies active in the following industries: Oil and Gas Extraction; Pipeline Transportation; Petroleum and Coal Products; Electric Power Generation, Transmission and Distribution; and Natural Gas Distribution. Metal and non-metal mining establishments were added based on Natural Resource Canada's *Census of Mines*.

1. In some provinces and territories, in order to obtain minimum coverage, the employment thresholds were reduced.

#### 3.2.2 Sample selection

##### Industry classification

In previous years establishments were selected based on the 1980 Standard Industrial Classification System (SIC). However, beginning with reference year 1998 industry selection was based on the North American Industry Classification System (NAICS).

This new classification system was developed as a cooperative effort between the statistical agencies of Canada, Mexico and the United States. Created against the background of the North American Free Trade Agreement, it is designed to provide common definitions of the industrial structure of the three countries and a common statistical framework to facilitate the analysis of the three economies.<sup>2</sup>

The establishments that were surveyed in both 1997 and 1998 were compared to examine any differences in industry classification resulting from the switch to NAICS. It was found that an insignificant number of establishments were reclassified into different industry groups, thus allowing for comparisons with previous survey years.<sup>3</sup>

##### Target industries

A total of 15 industry groups were targeted for increased survey coverage in 1998 based on 4, 5, and 6-digit NAICS industries (Text Box 3.2.1). Previous survey results determined that these targeted industries are more likely to have high levels of environmental expenditures. Typically, target industries were identified as those reporting more than \$1 000 of environmental expenditures per employee in 1997. Additional information obtained from the annual reports of companies and Statistics Canada's annual *Capital and Repair Expenditure Survey*<sup>4</sup> was also used in making this designation.

The following target industries were included in the census (take-all) portion of the survey: Logging (excluding contract logging); Mining (excluding quarrying); Oil and Gas Extraction; Beverages and Tobacco Products; Pulp, Paper and Paperboard Mills; Primary Metals; Petroleum and Coal Products; Electric Power Generation, Transmission, and Distribution; Pipeline Transportation; and Natural Gas Distribution.

2. Statistics Canada, 1997, *North American Industry Classification System*, Catalogue No. 12-501-XPE, Ottawa.

3. For additional information on the impact of the conversion to a NAICS-based classification system from SIC80, please see: Statistics Canada, September 1999, *Private and Public Investment in Canada, Revised Intentions, 1999*, pp. 11-14, Catalogue No. 61-206-XIB.

4. The *Capital and Repair Expenditure Survey* provided information on industries that had relatively high capital expenditures on assets associated with pollution abatement and control (PAC). In the past, information from surveys in other countries was also used to help determine target industries.

Text Box 3.2.1

**List of Selected Targeted Industries**

- Logging (NAICS 113311, 113312)
- Oil and Gas Extraction (NAICS 211)
- Mining (NAICS 2121, 2122, 21239)
- Electric Power Generation, Transmission and Distribution (NAICS 2211)
- Natural Gas Distribution (NAICS 2212)
- Food (NAICS 311)
- Beverage and Tobacco Products (NAICS 312)
- Wood Products (NAICS 321)
- Pulp, Paper, and Paperboard Mills (NAICS 3221)
- Petroleum and Coal Products (NAICS 324)
- Chemicals (NAICS 325)
- Non-Metallic Mineral Products (NAICS 327)
- Primary Metals (NAICS 331)
- Transportation Equipment (NAICS 336)
- Pipeline Transportation (NAICS 4861, 4862, 4869)

**Manufacturing sample**

The manufacturing sample was a stratified sample based upon employment. This employment-based stratified sample was used to determine a take-all portion and a take-some portion. The take-all strata contained the following industries: Beverage and Tobacco Products; Pulp, Paper, and Paperboard Mills; Primary Metals; and Petroleum and Coal Products. All establishments with over 49 employees in these target manufacturing industries were surveyed as take-all using a more detailed (long) questionnaire (non-targeted manufacturing industries received a shorter version of the questionnaire).

The remaining target manufacturing industries (Food; Wood Products; Non-metallic Mineral Products; Transportation Equipment; and Chemicals) were sampled using a combination of the take-all and take-some strata. These industries were sampled because of their low environmental expenditure per employee ratio (at the 4, 5 or 6-digit NAICS level, depending on the industry) and their large number of small and medium-sized establishments. However, these six manufacturing industries remained target industries because the environmental expenditure to employee ratio was higher than \$1 000 at the 3-digit NAICS level. Consequently, establishments in these industries received a long form.

The non-targeted manufacturing industries were sampled at the 4-digit NAICS level and grouped into an "other manufacturing" category. To minimize response burden,

sampled establishments (with more than 49 employees) in these industries received a short questionnaire.

The take-some strata were selected by ranking establishments within each 4, 5, or 6-digit NAICS (again depending on the industry group) by total employment. If there were 50 or more establishments in the 4-digit NAICS, the top 15% of establishments were selected. If there were between 15 and 49 establishments, the top 20% were selected. Where the total number of establishments fell below 15, all establishments were selected. In some provinces and territories, in order to obtain minimum coverage, the employment thresholds were reduced. The sample selected the largest establishments in order to minimise response burden.

Analysis had shown that there was no correlation between the environmental expenditure to employment ratio and employment size. Therefore, it was assumed that no bias was introduced by surveying the largest establishments in an industry group.

**Non-manufacturing sample**

All establishments with more than 49 employees in Logging; Mining; Oil and Gas Extraction; Electric Power Generation, Transmission and Distribution; Natural Gas Distribution; and Pipeline Transportation industries were selected. All establishments were surveyed using the long (more detailed) questionnaire.

**3.3 Environment protection expenditure questionnaire**

The survey questionnaire was originally designed in consultation with key public and private sector groups and by referencing the experiences from other countries who have conducted similar surveys. The scope of the survey was to include all expenditures that were made to meet environmental regulation, convention or voluntary agreement (see the questionnaire for further explanation). The mail out of the 1998 survey took place in November 1999.

Sampled establishments in the non-targeted manufacturing industries received a short version of the questionnaire. The short version of the questionnaire requests the breakdown of expenditures into capital (investment) expenditures and operating expenditures for:

- pollution abatement and control;
- other environmental protection activities;
- purchase of waste and sewerage management services; environment-related construction and engineering services; other environmental services.<sup>1</sup>

1. This information is used for internal purposes only to fill data gaps on the supply side of environmental services.

The long questionnaire was provided to establishments in target industries and required a more detailed breakdown of expenditures. In addition to the information asked on the short form, the long form asked respondents to report their capital (investment) expenditures and operating expenditures for:

- pollution prevention;
- pollution abatement and control (end-of-pipe);
- environmental monitoring;
- environmental assessments and audits;
- site reclamation and decommissioning;
- protection and restoration of wildlife and habitat;
- environmental charges.

Also included on the long form were two questions introduced in 1997. The first question (Question 12) provided a list of over 100 environmental processes and technologies that the respondent could choose from by checking the appropriate technologies. The checkbox options for this question were modified for the 1998 questionnaire to improve the accuracy of the response. The response rate for Question 12 for 1998 increased to 76% compared to 62% in 1997. The second question (Question 13) was related to the environmental management practices of the establishment.

Both the short and long forms also included a question asking respondents to choose from a list of pollution prevention methods (long form) or pollution prevention and abatement methods (short form). Respondents were asked to select all methods that were used by the establishment for the reference year, as well as those that were planned for use in the two years following the reference year.

### 3.4 Response and data quality

Data collection took place during the first quarter of 2000 (1998 reference year). Survey questionnaires were mailed to specific establishments identified by the sample and the responses were returned by mail. The surveys were addressed to a contact person who was either responsible for, or had knowledge of, the environmental operations of the company. In the case of some multi-establishment firms, the survey was mailed to the head office which either forwarded the questionnaire to the appropriate establishment or provided a combined report for all targeted establishments.

Follow-ups via fax and/or telephone were carried out after the due date to remind respondents to return their surveys.

Questionnaires were edited in two steps. First, validity edits were applied to ensure that responses to particular questions fell within a limited range of possible values.

Second, consistency edits were applied. Cases where responses in one section of the questionnaire were inconsistent with those given in other sections were identified and edited. These edits were done on an ongoing basis throughout the data collection phase.

Additional follow-ups were carried out to collect missing data and to resolve inconsistencies.

### Response rates

Table 3.4.1 shows the response rate for each industry and province and territory, according to both number of reporting establishments and employment, as a percentage of the total number of survey establishments in scope.

For the 1998 reference year, there were 2 108 reports received for 2 543 surveyed establishments. The response rate for the 1998 survey was 83%, based on the number of reporting establishments, and 88% based on employment covered. Response rates for the *Survey of Environmental Protection Expenditures* have improved each survey year. For example, the response rate for the 1996 survey was 73%, based upon the number of reporting establishments, and 76% in 1997.

### Verification, imputation and estimation

After data capture was complete, further validation of the data was performed to ensure that totals were correct and to verify that there were no outliers. The latter validation was performed by comparing figures with those from the previous year.

Imputation for non-response was performed in four stages:

First, all possible related information was assembled (e.g. information from the *Capital and Repairs Expenditure Survey*, Business Register, *Pulp and Paper Canada* and from company annual reports) and some companies were re-contacted to help provide further indicators that would allocate expenditures by province or industry where this information was missing;

Second, when possible, the previous year's operating expenditure data were used to impute for 1998 operating expenditure data. An industry growth factor was calculated for establishments within the industry that responded for both years (1997 and 1998). The appropriate industry growth factor was then applied to impute operating expenditure data for records that were a non-response in the current cycle but responded in the previous cycle<sup>1</sup>;

Third, total environmental protection expenditures were estimated on a per-employee basis. The mean of environ-

1. Regression analysis has shown that using the previous year's operating expenditures is a reasonable predictor of future operating expenditures.

mental expenditures per employee by industry (3-digit NAICS for "Other manufacturing" records) and province or region<sup>1</sup> was used to estimate for non-responding establishments. If there were not enough donors at the industry and province/region level, then imputation was based on the mean of the environmental expenditure per employee ratio for a more aggregated group of donors: 1) industry and Canada; 2) pooled (similar) industries and province/region; 3) pooled industry and Canada; or 4) total for Canada;

Finally, the missing components of environmental protection expenditures were estimated as a proportion of total expenditures using donors from the same industry.

Table 3.4.2 shows the proportion of imputed value over the total value of environmental protection expenditures (value for complete and partial responses + imputed value for non-response), by industry and by province and territory. Table 3.4.3 provides the same information by expenditure category.

Estimation was done for establishments that had 49 or more employees but were not surveyed. The mean of the environmental protection expenditures to employment ratio was used for estimation in a manner similar to that for imputation. No estimation or imputation was done for the qualitative information collected in questions 6b, 7c, 12 or 13.

The improvement in response rates shown in Table 3.4.1 is reflected in the general decrease in imputation rates for 1998 when compared to 1997.<sup>2</sup>

## Sampling and non-sampling errors

There are two general categories of error in surveys. The first, sampling error, arises from the fact that a sample or subset of the target population is used to represent the population and its size is quantifiable. The second category is referred to as non-sampling error and is not as easily quantified. Non-sampling error refers to all the other kinds of error that arise in surveys. For example, incomplete or inaccurate lists of the general population, respondent misinterpretation of questions, provision of erroneous information, failure or refusal to respond, and information processing errors and so on.

Typically the sampling error is measured by the expected variability of the estimate from the true value, expressed as a percentage of the estimate. This measure is referred to as the coefficient of variation or the standard deviation.

1. The mean of environmental protection expenditures to employment ratio by region was used when there were not enough donors at the provincial level.

2. For more information regarding the 1997 EPES response rates, please see Statistics Canada, 2000, *Environment Protection Expenditures in the Business Sector, 1996 and 1997 (revised)*, Catalogue No. 16F0006XIE, Ottawa, August.

However, in the case of the *Survey of Environmental Protection Expenditures*, the sample is not a random sample. Rather, a minimal sample number was calculated, and the establishments with the largest number of employees were sampled. This methodology was used in order to survey the largest proportion of employment in each target industry while keeping response burden to a minimum. Given the nature of the sampling process, no coefficient of variation was produced.

Every attempt was made to eliminate the non-sampling error. For example, establishments brought into the survey for the first time were researched and contact information was verified. Instructions and definitions were further refined to be more clear and straightforward. The returned questionnaires were verified and validated before data capture. The data was edited and tabulated automatically. Extensive follow-up was carried out for incomplete responses and for non-response. As 1998 represents the 5th year this survey has been conducted, many establishments have received it in the past and are more familiar with the concepts, and as a result their responses are more accurate. In fact, in some cases establishments have modified their accounting practices in order to provide, as accurately as possible, the information required by the survey.

The most common difficulty reported by respondents was the inability of their record-keeping systems to isolate the environmental protection component of their expenditures. Expenditures made either for capital investment or for current operations often provide a combination of benefits, such as increased efficiency and reduced waste. In these circumstances, it is difficult to determine what proportion of the expenditure to credit towards environmental protection. Consequently, respondents may over-estimate or under-estimate that proportion. Another example of such bias is the inclusion of health protection expenditures in the reported environmental protection expenditures, because of the respondent's inability to distinguish between the two sets of costs.

## Future improvement

Continuous improvements are being made to the survey methodology and questionnaire content and design. Future survey cycles should take into account spending on various projects that have environmental benefits, whatever the direct purpose (for instance energy saving or input minimization). They will try to reflect the changing nature of business activities toward pollution prevention and sustainable production.

Table 3.4.1  
**Response Rates by Industry and by Province and Territory, 1998**

Industry	According to number of reporting units			According to employment		
	Responses	Total <sup>1</sup>	Response as a percentage of total <sup>1</sup>	Number of employees	Total <sup>1</sup>	Response as a percentage of total <sup>1</sup>
Logging	77	90	86	11 189	12 395	90
Oil and Gas Extraction	63	77	82	19 020	20 682	92
Mining	133	151	88	41 102	45 139	91
Electric Power Generation, Transmission and Distribution	28	29	97	71 380	71 460	100
Natural Gas Distribution	12	13	92	12 659	12 727	99
Food	184	207	89	62 453	70 477	89
Beverage and Tobacco Products	72	83	87	16 358	19 237	85
Wood Products	159	202	79	30 213	39 517	76
Pulp, Paper and Paperboard Mills	138	159	87	55 797	62 942	89
Petroleum and Coal Products	37	41	90	7 876	8 330	95
Chemicals	254	293	87	49 557	55 122	90
Non-Metallic Mineral Products	70	100	70	11 356	16 068	71
Primary Metals	204	240	85	78 464	86 155	91
Transportation Equipment	109	124	88	134 864	141 665	95
Pipeline Transportation	22	22	100	7 100	7 100	100
Other manufacturing	546	712	77	231 213	284 337	81
<b>Total</b>	<b>2 108</b>	<b>2 543</b>	<b>83</b>	<b>840 601</b>	<b>953 353</b>	<b>88</b>

Province/Territory	According to number of reporting units			According to employment		
	Responses	Total <sup>1</sup>	Response as a percentage of total <sup>1</sup>	Number of employees	Total <sup>1</sup>	Response as a percentage of total <sup>1</sup>
Newfoundland	25	28	89	10 146	10 355	98
Prince Edward Island	10	12	83	2 049	2 146	95
Nova Scotia	45	52	87	18 744	19 857	94
New Brunswick	45	58	78	15 395	19 483	79
Quebec	518	642	81	212 066	247 600	86
Ontario	881	1 044	84	404 584	451 928	90
Manitoba	77	93	83	34 612	37 012	94
Saskatchewan	64	69	93	17 327	17 854	97
Alberta	233	277	84	67 419	75 696	89
British Columbia	198	252	79	56 989	69 615	82
Yukon and Northwest Territories <sup>2</sup>	12	16	75	1 270	1 807	70
<b>Canada</b>	<b>2 108</b>	<b>2 543</b>	<b>83</b>	<b>840 601</b>	<b>953 353</b>	<b>88</b>

**Notes:**

1. The total excludes out of scope establishments, mergers, closed and/or sold establishments, etc.
2. Includes Nunavut.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table 3.4.2

**Imputation for Non Response as a Share of Total Environmental Protection Expenditures by Industry and by Province and Territory, 1998**

	Imputed value as a percentage of total value ( including the imputation value)
<b>Industry</b>	
Logging	8.3
Oil and Gas Extraction	6.1
Mining	8.2
Electric Power Generation, Transmission and Distribution	0.1
Natural Gas Distribution	0.3
Food	10.6
Beverage and Tobacco Products	21.5
Wood Products	22.7
Pulp, Paper and Paperboard Mills	8.3
Petroleum and Coal Products	3.6
Chemicals	6.7
Non-Metallic Mineral Products	25.6
Primary Metals	9.9
Transportation Equipment	4.6
Pipeline Transportation	0.0
Other manufacturing	16.8
<b>Total</b>	<b>7.6</b>
	Imputed value as a percentage of total value ( including the imputation value)
<b>Province/Territory</b>	
Newfoundland	4.3
Prince Edward Island	5.1
Nova Scotia	3.0
New Brunswick	10.6
Quebec	11.7
Ontario	6.6
Manitoba	4.8
Saskatchewan	0.4
Alberta	5.9
British Columbia	12.1
Yukon and Northwest Territories <sup>1</sup>	17.8
<b>Canada</b>	<b>7.6</b>

**Note:**

1. Includes Nunavut.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table 3.4.3  
**Imputation for Non Response as a Share of Total Environmental Protection Expenditures by Category, 1998**

	Imputed value as a percentage of total value ( including the imputation value)
<b>Expenditure category excluding other manufacturing industries</b>	
Environmental monitoring - Operating	7.3
Environmental monitoring - Capital	8.7
Environmental monitoring - Total	7.6
Environmental assessments and audits - Operating	4.4
Environmental assessments and audits - Capital	3.8
Environmental assessments and audits - Total	4.1
Site reclamation and decommissioning - Operating	6.9
Site reclamation and decommissioning - Capital	5.8
Site reclamation and decommissioning - Total	6.6
Protection and restoration of wildlife and habitat - Operating	8.3
Protection and restoration of wildlife and habitat - Capital	4.6
Protection and restoration of wildlife and habitat - Total	7.3
Pollution abatement and control (end-of-pipe processes) - Operating	7.2
Pollution abatement and control (end-of-pipe processes) - Capital	8.5
Pollution abatement and control (end-of-pipe processes) - Total	7.7
Pollution prevention - Operating	8.1
Pollution prevention - Capital	6.1
Pollution prevention - Total	6.8
Environmental fees, fines and licences - Operating	7.6
Other environmental protection expenditures - Operating	5.7
<b>Total expenditures on environmental protection - Operating</b>	<b>7.1</b>
<b>Total expenditures on environmental protection - Capital</b>	<b>7.1</b>
<b>Total expenditures on environmental protection - Total</b>	<b>7.1</b>
<b>Other manufacturing</b>	
Pollution prevention, abatement and control expenditures - Operating	18.3
Pollution prevention, abatement and control expenditures - Capital	14.3
Pollution prevention, abatement and control expenditures - Total	16.9
Other environmental protection expenditures - Operating	14.8
Other environmental protection expenditures - Capital	14.0
Other environmental protection expenditures - Total	14.7
<b>Total expenditures on environmental protection - Operating</b>	<b>17.9</b>
<b>Total expenditures on environmental protection - Capital</b>	<b>14.3</b>
<b>Total expenditures on environmental protection - Total</b>	<b>16.8</b>

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

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**[www.statcan.ca](http://www.statcan.ca)**



## **Annex A: Statistical Expenditure Tables**

Table A.1  
**Capital Expenditures on Environmental Protection by Industry, 1998**

Industry	Pollution prevention, abatement and control expenditures (PPAC) <sup>1</sup>	Other environmental protection expenditures <sup>2</sup>	Total	Share of total percent
	million dollars			
Logging	4.1	3.4	7.4	0.4
Oil and Gas Extraction	106.3	80.2	186.5	10.8
Mining	63.6	17.6	81.2	4.7
Electric Power Generation, Transmission and Distribution	82.3	41.7	124.0	7.2
Natural Gas Distribution	15.5	1.3	16.8	1.0
Food	52.8	8.0	60.8	3.5
Beverage and Tobacco Products	5.1	0.4	5.5	0.3
Wood Products	86.9	9.4	96.3	5.6
Pulp, Paper and Paperboard Mills	281.6	6.1	287.7	16.6
Petroleum and Coal Products	131.3	9.7	141.0	8.1
Chemicals	178.6	10.7	189.2	10.9
Non-Metallic Mineral Products	51.8	2.6	54.3	3.1
Primary Metals	180.9	3.1	184.0	10.6
Transportation Equipment	47.4	1.3	48.7	2.8
Pipeline Transportation	105.9	9.8	115.6	6.7
Other Manufacturing <sup>3</sup>	130.9	4.2	135.0	7.8
<b>Total</b>	<b>1 524.9</b>	<b>209.3</b>	<b>1 734.2</b>	<b>100.0</b>

**Notes:**

Figures may not add up to totals due to rounding.

1. Capital expenditures on 'Pollution prevention, abatement and control (PPAC)' include capital expenditures on 'Pollution abatement and control (PAC) processes' (also referred to as end-of-pipe processes), 'Pollution prevention processes' and 'Environmental monitoring.'

2. Capital expenditures on 'Other environmental protection' include capital expenditures on 'Environmental assessments and audits', 'Site reclamation and decommissioning', and 'Wildlife and habitat protection.'

3. 'Other manufacturing' includes all other manufacturing industries not already specified.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.2  
**Capital Expenditures on Environmental Protection by Type of Activity and by Industry, 1998**

Industry	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	Pollution abatement and control	Pollution prevention processes	Total	Share of total percent
					(end-of-pipe)			
million dollars								
Logging	0.5	0.1	0.2	3.0	1.5	2.1	7.4	0.4
Oil and Gas Extraction	4.3	9.9	69.4	0.9	55.5	46.5	186.5	10.8
Mining	2.1	5.8	8.1	3.8	33.4	28.1	81.2	4.7
Electric Power Generation, Transmission and Distribution	4.9	19.2	1.7	20.7	56.5	21.0	124.0	7.2
Natural Gas Distribution	0.1	0.6	0.6	0.2	1.0	14.5	16.8	1.0
Food	2.5	0.9	1.3	5.8	37.6	12.7	60.8	3.5
Beverage and Tobacco Products	1.0	0.2	0.1	0.2	2.6	1.5	5.5	0.3
Wood Products	3.1	0.6	6.4	2.4	66.0	17.8	96.3	5.6
Pulp, Paper and Paperboard Mills	13.2	0.5	4.6	1.1	89.1	179.2	287.7	16.6
Petroleum and Coal Products	0.5	3.0	5.4	1.2	82.2	48.6	141.0	8.1
Chemicals	18.6	3.3	7.0	0.4	65.7	94.3	189.2	10.9
Non-Metallic Mineral Products <sup>1</sup>	4.0	0.1	2.5	..	32.6	15.1	54.3	3.1
Primary Metals	4.6	0.4	1.4	1.3	102.9	73.4	184.0	10.6
Transportation Equipment enquête	0.7	0.2	1.0	0.2	16.3	30.4	48.7	2.8
Other Manufacturing <sup>2</sup>	0.6	6.4	2.9	0.5	41.6	63.7	115.6	6.7
<b>Total excluding Other Manufacturing</b>	<b>60.7</b>	<b>51.0</b>	<b>112.5</b>	<b>41.6</b>	<b>684.6</b>	<b>648.7</b>	<b>1 599.1</b>	<b>92.2</b>
<b>Total</b>							<b>1 734.2</b>	<b>100.0</b>

**Notes:**

Figures may not add up to totals due to rounding.

1. Capital expenditures on 'Wildlife and habitat protection' are included with the capital expenditures on 'Reclamation and decommissioning.'

2. 'Other manufacturing' includes all other manufacturing industries not already specified.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.3

**Capital Expenditures on Environmental Protection by Province and Territory, 1998**

Province/Territory	Pollution prevention, abatement and control expenditures (PPAC) <sup>1</sup>	Other environmental protection expenditures <sup>2</sup>	Total	Share of total
	million dollars			percent
Newfoundland	10.6	3.9	14.5	0.8
Prince Edward Island	x	x	1.2	0.1
Nova Scotia	12.8	2.9	15.7	0.9
New Brunswick	49.9	3.4	53.4	3.1
Quebec	232.2	31.0	263.2	15.2
Ontario	545.0	28.8	573.8	33.1
Manitoba	x	x	61.5	3.5
Saskatchewan	164.0	4.5	168.5	9.7
Alberta	282.6	96.7	379.2	21.9
British Columbia	177.2	17.3	194.5	11.2
Yukon and Northwest Territories <sup>3</sup>	x	x	8.7	0.5
<b>Canada</b>	<b>1 524.9</b>	<b>209.3</b>	<b>1 734.2</b>	<b>100.0</b>

**Notes:**

Figures may not add up to totals due to rounding.

This table includes the 'Other Manufacturing' industries category.

1. Capital expenditures on 'Pollution prevention, abatement and control (PPAC)' include capital expenditures on 'Pollution abatement and control (PAC) processes' (also referred to as end-of-pipe processes), 'Pollution prevention processes' and 'Environmental monitoring.'

2. Capital expenditures on 'Other environmental protection' include capital expenditures on 'Environmental assessments and audits', 'Site reclamation and decommissioning', and 'Wildlife and habitat protection.'

3. Includes Nunavut.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.4

**Capital Expenditures on Environmental Protection by Type of Activity and by Province and Territory, 1998**

Province/Territory	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	Pollution abatement and control processes (end-of-pipe)	Pollution prevention processes	Total	Share of total
					million dollars			percent
Newfoundland	0.2	0.3	0.8	2.8	7.8	2.5	14.4	0.9
Prince Edward Island	--	x	--	--	x	0.2	1.1	0.1
Nova Scotia	0.5	0.4	1.6	0.8	5.0	6.2	14.5	0.9
New Brunswick	1.0	1.4	0.8	1.3	36.7	11.3	52.4	3.3
Quebec	10.9	x	5.8	x	111.3	71.9	224.4	14.0
Ontario	16.1	4.4	18.2	3.4	248.2	203.5	493.8	30.9
Manitoba	x	x	1.7	x	14.0	26.1	58.4	3.7
Saskatchewan	0.7	2.0	2.3	0.2	25.1	137.7	168.0	10.5
Alberta	17.4	15.3	75.5	5.7	121.0	139.5	374.5	23.4
British Columbia	12.0	2.9	5.3	8.7	112.6	47.3	188.9	11.8
Yukon and Northwest Territories <sup>1</sup>	x	x	0.4	x	x	2.4	8.7	0.5
<b>Canada</b>	<b>60.7</b>	<b>51.0</b>	<b>112.5</b>	<b>41.6</b>	<b>684.6</b>	<b>648.7</b>	<b>1 599.1</b>	<b>100.0</b>

**Notes:**

Figures may not add up to totals due to rounding.

This table excludes the 'Other Manufacturing' industries category.

1. Includes Nunavut.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.5

### Distribution of Capital Expenditures for Pollution Prevention, Abatement and Control (PPAC) by Medium and by Industry, 1998

Industry	Air	Surface water	On-site	Control of	Total
			contained solid and liquid waste	noise, radiation and vibration	
percent					
Logging	36.1	25.1	37.1	1.8	100
Oil and Gas Extraction	45.6	25.8	26.6	2.0	100
Mining	15.3	52.2	32.4	0.1	100
Electric Power Generation, Transmission and Distribution	35.4	22.6	22.8	19.2	100
Natural Gas Distribution	83.9	6.9	7.6	1.6	100
Food	19.6	37.0	42.3	1.0	100
Beverage and Tobacco Products	9.5	50.5	32.5	7.4	100
Wood Products	37.7	4.7	56.5	1.1	100
Pulp, Paper and Paperboard Mills	71.9	16.1	11.7	0.3	100
Petroleum and Coal Products	76.0	13.6	10.3	0.1	100
Chemicals	47.3	27.2	20.8	4.7	100
Non-Metallic Mineral Products	73.8	21.5	4.1	0.6	100
Primary Metals	53.2	20.6	25.6	0.6	100
Transportation Equipment	59.8	21.7	17.4	1.1	100
Pipeline Transportation	59.1	18.3	15.5	7.2	100
Other Manufacturing <sup>1</sup>	35.6	21.3	40.7	2.5	100
<b>Total</b>	<b>54.5</b>	<b>21.4</b>	<b>20.9</b>	<b>3.1</b>	<b>100</b>

**Notes:**

Figures may not add up to 100% due to rounding.

This table includes reported capital expenditure shares only.

This table excludes capital expenditures on the 'Environmental monitoring' category.

This table includes only capital expenditures on 'Pollution abatement and control (end-of-pipe) processes' and 'Pollution prevention processes' for all industries except the 'Other Manufacturing' industries category.

1. 'Other Manufacturing' includes all other manufacturing industries not already specified.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.6

### Distribution of Capital Expenditures for Pollution Prevention, Abatement and Control (PPAC) by Medium and by Province and Territory, 1998

Province/Territory	Air	Surface water	On-site	Control of	Total
			contained solid and liquid waste	noise, radiation and vibration	
percent					
Newfoundland	66.3	13.2	20.5	-	100
Prince Edward Island	x	x	x	x	100
Nova Scotia	12.9	27.8	58.1	1.2	100
New Brunswick	60.1	34.9	5.0	--	100
Quebec	29.6	30.1	38.9	1.3	100
Ontario	55.1	22.0	17.1	5.8	100
Manitoba	64.7	26.3	7.1	1.9	100
Saskatchewan	81.1	6.9	11.5	0.6	100
Alberta	48.5	22.6	25.1	3.9	100
British Columbia	56.4	20.5	22.7	0.4	100
Yukon and Northwest Territories <sup>1</sup>	x	x	x	x	100
<b>Canada</b>	<b>54.5</b>	<b>21.4</b>	<b>20.9</b>	<b>3.1</b>	<b>100</b>

**Notes:**

Figures may not add up to 100% due to rounding.

This table includes reported capital expenditure shares only.

This table excludes capital expenditures on the 'Environmental monitoring' category.

This table includes only capital expenditures on 'Pollution abatement and control (end-of-pipe) processes' and 'Pollution prevention processes' for all industries except the 'Other Manufacturing' industries category.

1. Includes Nunavut.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.7

### Distribution of Capital Expenditures on Pollution Abatement and Control (end-of-pipe) by Medium and by Industry, 1998

Industry	Air	Surface water	On-site	Control of	Total
			contained solid and liquid waste	noise, radiation and vibration	
percent					
Logging	60.4	25.9	13.7	-	100
Oil and Gas Extraction	40.0	20.7	37.3	2.0	100
Mining	14.1	59.8	26.1	0.1	100
Electric Power Generation, Transmission and Distribution	32.7	26.0	15.9	25.4	100
Natural Gas Distribution	70.5	3.6	25.8	-	100
Food	11.3	37.4	50.3	1.0	100
Beverage and Tobacco Products	5.5	60.7	33.8	-	100
Wood Products	34.2	5.5	59.9	0.5	100
Pulp, Paper and Paperboard Mills	46.5	28.2	24.9	0.3	100
Petroleum and Coal Products	69.3	18.2	12.5	--	100
Chemicals	26.3	35.4	29.6	8.8	100
Non-Metallic Mineral Products	73.3	24.3	2.0	0.4	100
Primary Metals	46.3	28.0	25.6	0.2	100
Transportation Equipment	77.2	14.4	5.7	2.8	100
Pipeline Transportation	49.6	9.2	23.6	17.7	100
<b>Total</b>	<b>43.0</b>	<b>26.2</b>	<b>25.3</b>	<b>5.4</b>	<b>100</b>

**Notes:**

Figures may not add up to 100% due to rounding.

This table includes reported capital expenditure shares only.

This table excludes capital expenditures on the 'Environmental monitoring' category.

The distribution of capital expenditures on 'Pollution abatement and control (end-of-pipe)' are not available for the 'Other Manufacturing' industries category.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.8

### Distribution of Capital Expenditures on Pollution Abatement and Control (end-of-pipe) by Medium and by Province and Territory, 1998

Province/Territory	Air	Surface water	On-site	Control of	Total
			contained solid and liquid waste	noise, radiation and vibration	
percent					
Newfoundland	65.3	10.8	23.9	-	100
Prince Edward Island	x	x	x	x	100
Nova Scotia	16.4	28.7	53.2	1.6	100
New Brunswick	58.2	39.8	1.9	-	100
Quebec	20.2	43.9	35.3	0.7	100
Ontario	45.8	27.4	16.7	10.1	100
Manitoba	64.2	28.9	4.0	2.9	100
Saskatchewan	15.8	21.4	60.6	2.3	100
Alberta	40.7	17.9	34.1	7.2	100
British Columbia	60.3	12.3	27.1	0.3	100
Yukon and Northwest Territories <sup>1</sup>	x	x	x	x	100
<b>Canada</b>	<b>43.0</b>	<b>26.2</b>	<b>25.3</b>	<b>5.4</b>	<b>100</b>

**Notes:**

Figures may not add up to 100% due to rounding.

This table includes reported capital expenditure shares only.

This table excludes capital expenditures on the 'Environmental monitoring' category.

The distribution of capital expenditures on 'Pollution abatement and control (end-of-pipe)' are not available for the 'Other Manufacturing' industries category.

1. Includes Nunavut.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.9  
**Distribution of Capital Expenditures on Pollution Prevention by Medium and by Industry, 1998**

Industry	Air	Surface water	On-site	Control of	Total
			contained solid and liquid waste	noise, radiation and vibration	
percent					
Logging	15.9	24.4	56.4	3.3	100
Oil and Gas Extraction	52.9	32.7	12.4	2.0	100
Mining	16.8	43.0	40.2	--	100
Electric Power Generation, Transmission and Distribution	42.8	13.6	41.2	2.4	100
Natural Gas Distribution	84.8	7.1	6.4	1.7	100
Food	44.0	36.1	18.8	1.1	100
Beverage and Tobacco Products	16.8	31.9	30.2	21.1	100
Wood Products	46.0	2.7	48.6	2.8	100
Pulp, Paper and Paperboard Mills	83.6	10.5	5.7	0.3	100
Petroleum and Coal Products	89.3	4.6	5.9	0.3	100
Chemicals	63.1	21.0	14.3	1.6	100
Non-Metallic Mineral Products	75.1	15.3	8.6	1.0	100
Primary Metals	62.8	10.4	25.6	1.1	100
Transportation Equipment	50.4	25.7	23.7	0.2	100
Pipeline Transportation	65.3	24.2	10.1	0.3	100
<b>Total</b>	<b>67.4</b>	<b>16.8</b>	<b>14.9</b>	<b>0.9</b>	<b>100</b>

**Notes:**

Figures may not add up to 100% due to rounding.

This table includes reported capital expenditure shares only.

This table excludes capital expenditures on the 'Environmental monitoring' category.

The distribution of capital expenditures on 'Pollution prevention' are not available for the 'Other Manufacturing' industries category.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.10  
**Distribution of Capital Expenditures on Pollution Prevention by Medium and by Province and Territory, 1998**

Province/Territory	Air	Surface water	On-site	Control of	Total
			contained solid and liquid waste	noise, radiation and vibration	
percent					
Newfoundland	69.8	20.7	9.6	-	100
Prince Edward Island	x	x	x	x	100
Nova Scotia	9.3	25.7	63.9	1.1	100
New Brunswick	66.9	17.5	15.6	-	100
Quebec	43.9	18.2	35.7	2.2	100
Ontario	68.8	13.6	16.6	1.0	100
Manitoba	66.7	24.6	7.4	1.3	100
Saskatchewan	92.4	4.3	3.0	0.2	100
Alberta	54.8	26.4	17.6	1.2	100
British Columbia	49.6	39.3	11.2	-	100
Yukon and Northwest Territories <sup>1</sup>	x	x	x	x	100
<b>Canada</b>	<b>67.4</b>	<b>16.8</b>	<b>14.9</b>	<b>0.9</b>	<b>100</b>

**Notes:**

Figures may not add up to 100% due to rounding.

This table includes reported capital expenditure shares only.

This table excludes capital expenditures on the 'Environmental monitoring' category.

The distribution of capital expenditures on 'Pollution prevention' are not available for the 'Other Manufacturing' industries category.

1. Includes Nunavut.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.11  
**Operating Expenditures on Environmental Protection by Industry, 1998**

Industry	Pollution prevention, abatement and control expenditures (PPAC) <sup>1</sup>	Other environmental protection expenditures <sup>2</sup>	Total	Share of total
	million dollars			percent
Logging	12.8	103.8	116.5	3.9
Oil and Gas Extraction	97.4	161.0	258.4	8.6
Mining	164.1	84.7	248.8	8.3
Electric Power Generation, Transmission and Distribution	x	x	295.6	9.9
Natural Gas Distribution	3.3	5.6	8.9	0.3
Food	103.6	20.1	123.7	4.1
Beverage and Tobacco Products	15.7	5.5	21.2	0.7
Wood Products	x	x	137.6	4.6
Pulp, Paper and Paperboard Mills	348.4	39.1	387.5	13.0
Petroleum and Coal Products	165.2	22.1	187.3	6.3
Chemicals	161.0	70.9	231.9	7.8
Non-Metallic Mineral Products	29.2	14.0	43.2	1.4
Primary Metals	374.3	44.9	419.2	14.0
Transportation Equipment	106.4	33.0	139.4	4.7
Pipeline Transportation	14.5	17.8	32.2	1.1
Other manufacturing <sup>3</sup>	306.9	31.9	338.8	11.3
<b>Total</b>	<b>2 150.7</b>	<b>839.5</b>	<b>2 990.2</b>	<b>100.0</b>

**Notes:**

Figures may not add up to totals due to rounding.

1. Operating expenditures on 'Pollution prevention, abatement and control (PPAC)' include operating expenditures on 'Pollution abatement and control (PAC) processes' (also referred to as end-of-pipe processes), 'Pollution prevention processes', 'Environmental monitoring', and purchase of 'Waste management and sewerage services'.

2. Operating expenditures on 'Other environmental protection' include operating expenditures on 'Environmental assessments and audits', 'Site reclamation and decommissioning', 'Wildlife and habitat protection', 'Fees, fines and licences', and 'Other' environmental activities.

3. 'Other Manufacturing' includes all other manufacturing industries not already specified.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.12  
**Operating Expenditures on Environmental Protection by Type of Activity and by Industry, 1998**

Industry	Pollution abatement and control processes								Total	Share of total
	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	(end-of-pipe), waste management and sewerage services	Pollution prevention processes	Fees, fines and licences	Other		
million dollars										
Logging	3.0	5.0	19.1	70.4	5.4	4.4	1.4	7.8	116.5	3.9
Oil and Gas Extraction	16.0	8.6	110.2	1.3	55.0	26.4	9.2	31.7	258.4	8.6
Mining	20.6	4.8	55.8	2.3	104.9	38.7	4.6	17.2	248.8	8.3
Electric Power Generation, Transmission and Distribution	6.6	34.2	5.7	12.0	x	5.3	32.7	x	295.6	9.9
Natural Gas Distribution	0.3	1.6	0.6	0.1	2.4	0.7	0.1	3.2	8.9	0.3
Food	11.0	2.6	0.2	3.7	78.4	14.2	9.6	4.0	123.7	4.1
Beverage and Tobacco Products <sup>1</sup>	0.8	0.5	0.9	..	13.3	1.6	2.3	1.8	21.2	0.7
Wood Products	8.5	2.4	15.8	29.4	x	21.4	5.6	x	137.6	4.6
Pulp, Paper and Paperboard Mills	43.7	3.6	3.3	11.4	241.9	62.8	8.0	12.8	387.5	13.0
Petroleum and Coal Products <sup>1</sup>	7.3	2.4	4.2	..	101.5	56.4	1.1	14.4	187.3	6.3
Chemicals	25.0	6.5	42.3	1.3	101.5	34.5	2.5	18.3	231.9	7.8
Non-Metallic Mineral Products	2.5	3.3	2.8	1.0	20.8	5.9	2.8	4.1	43.2	1.4
Primary Metals	37.2	5.8	16.9	5.8	275.7	61.4	2.7	13.6	419.2	14.0
Transportation Equipment	5.8	2.3	18.0	0.1	89.8	10.8	0.9	11.7	139.4	4.7
Pipeline Transportation	2.0	0.7	4.2	0.3	8.1	4.4	1.4	11.2	32.2	1.1
Other manufacturing <sup>2</sup>	..	..	..	..	..	..	..	..	338.8	11.3
<b>Total excluding Other Manufacturing</b>	<b>190.2</b>	<b>84.3</b>	<b>300.1</b>	<b>139.2</b>	<b>1 304.8</b>	<b>348.8</b>	<b>84.9</b>	<b>199.1</b>	<b>2 651.4</b>	<b>88.7</b>
<b>Total</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>2 990.2</b>	<b>100.0</b>

**Notes:**

Figures may not add up to totals due to rounding.

1. Operating expenditures on 'Wildlife and habitat protection' are included with operating expenditures on 'Reclamation and decommissioning'.

2. 'Other Manufacturing' includes all other manufacturing industries not already specified.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.13

**Operating Expenditures on Environmental Protection by Province and Territory, 1998**

Province/Territory	Pollution prevention, abatement and control expenditures (PPAC) <sup>1</sup>	Other environmental protection expenditures <sup>2</sup>	Total	Share of total
	million dollars			percent
Newfoundland	12.5	4.5	17.0	0.6
Prince Edward Island	2.6	0.5	3.1	0.1
Nova Scotia	32.4	11.3	43.7	1.5
New Brunswick	76.0	24.0	99.9	3.3
Quebec	452.1	108.8	560.9	18.8
Ontario	978.2	233.2	1 211.4	40.5
Manitoba	51.0	20.4	71.4	2.4
Saskatchewan	81.0	38.7	119.6	4.0
Alberta	258.4	228.6	487.0	16.3
British Columbia	200.5	165.6	366.1	12.2
Yukon and Northwest Territories <sup>3</sup>	6.0	4.0	10.0	0.3
<b>Canada</b>	<b>2 150.7</b>	<b>839.5</b>	<b>2 990.2</b>	<b>100.0</b>

**Notes:**

Figures may not add up to totals due to rounding.

This table includes the 'Other Manufacturing' industries category.

1. Operating expenditures on 'Pollution prevention, abatement and control (PPAC)' include operating expenditures on 'Pollution abatement and control (PAC) processes' (also referred to as end-of-pipe processes), 'Pollution prevention processes', 'Environmental monitoring', and purchases of 'Waste management and sewerage services'.

2. Operating expenditures on 'Other environmental protection' include operating expenditures on 'Environmental assessments and audits', 'Site reclamation and decommissioning', 'Wildlife and habitat protection', 'Fees, fines and licences' and 'Other' environmental activities.

3. Includes Nunavut.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.14

**Operating Expenditures on Environmental Protection by Type of Activity and by Province and Territory, 1998**

Province/Territory	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	Pollution abatement and control processes (end-of-pipe), waste management and sewerage services	Pollution prevention processes	Fees, fines and licences	Other	Total	Share of total
Newfoundland	1.4	0.6	0.8	1.3	8.7	2.2	0.2	1.6	16.7	0.6
Prince Edward Island	x	0.2	--	0.1	x	x	--	0.1	3.0	0.1
Nova Scotia	2.1	0.9	1.3	2.3	22.2	4.9	1.1	5.3	40.1	1.5
New Brunswick	6.5	1.5	12.7	4.4	50.9	16.3	1.7	3.4	97.4	3.7
Quebec	46.1	8.9	21.9	22.8	256.6	81.5	12.8	36.6	487.2	18.3
Ontario	51.5	44.2	68.4	25.5	620.5	111.6	14.6	58.3	994.6	37.7
Manitoba	5.6	0.9	3.7	2.0	20.1	15.2	8.3	4.9	60.7	2.3
Saskatchewan	7.7	2.5	16.9	0.6	51.0	20.7	12.6	6.0	117.9	4.4
Alberta	35.7	13.7	132.3	12.0	148.0	62.1	11.7	57.8	473.4	17.8
British Columbia	31.4	10.5	40.7	68.1	121.6	33.2	21.5	23.5	350.5	13.2
Yukon and Northwest Territories <sup>1</sup>	x	0.5	1.5 <sup>2</sup>	.. <sup>2</sup>	x	x	0.4	1.7	10.0	0.4
<b>Canada</b>	<b>190.2</b>	<b>84.3</b>	<b>300.1</b>	<b>139.2</b>	<b>1 304.8</b>	<b>348.8</b>	<b>84.9</b>	<b>199.1</b>	<b>2 651.4</b>	<b>100.0</b>

**Notes:**

Figures may not add up to totals due to rounding.

This table excludes the 'Other manufacturing' industries category.

1. Includes Nunavut.

2. Operating expenditures on 'Wildlife and habitat protection' are included with operating expenditures on 'Reclamation and decommissioning'.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.15  
**Frequency of Pollution Prevention Methods by Industry, 1998**

Industry	Product design or reformulation	Substitution or modification of production process	Recirculation, recovery, reuse or recycling	Energy conservation	Material or solvent substitution	Prevention of leaks and spills	Other	Proportion of respondents who reported
								percent
percent of total number declared								
Logging	-	15.2	33.3	12.1	3.0	81.8	3.0	42.9
Oil and Gas Extraction	27.1	35.4	70.8	75.0	39.6	87.5	6.3	76.2
Mining	5.9	17.6	67.1	42.4	21.2	52.9	8.2	63.9
Electric Power Generation, Transmission and Distribution	13.0	21.7	65.2	73.9	52.2	87.0	4.3	82.1
Natural Gas Distribution	-	25.0	37.5	62.5	25.0	75.0	-	66.7
Food	13.1	26.3	71.7	60.6	34.3	54.5	3.0	53.8
Beverage and Tobacco Products	7.9	15.8	50.0	50.0	23.7	63.2	10.5	52.8
Wood Products	23.3	24.7	61.6	39.7	21.9	57.5	12.3	45.9
Pulp, Paper and Paperboard Mills	10.1	23.6	76.4	53.9	38.2	73.0	6.7	64.5
Petroleum and Coal Products	26.3	31.6	73.7	63.2	26.3	78.9	-	51.4
Chemicals	29.6	24.0	71.5	33.0	27.4	70.9	3.9	70.5
Non-Metallic Mineral Products	17.8	20.0	66.7	51.1	26.7	48.9	8.9	64.3
Primary Metals	14.2	28.3	81.7	54.2	30.8	55.0	5.8	58.8
Transportation Equipment	21.1	25.4	69.0	56.3	50.7	69.0	8.5	65.1
Pipeline Transportation	25.0	25.0	58.3	75.0	33.3	91.7	-	54.5
Other Manufacturing <sup>1</sup>	14.8	19.7	55.7	34.5	31.1	39.1	20.0	59.5
<b>Total excluding Other Manufacturing</b>	<b>17.4</b>	<b>24.2</b>	<b>68.9</b>	<b>49.0</b>	<b>30.6</b>	<b>65.3</b>	<b>6.2</b>	<b>60.3</b>
<b>Total</b>	<b>16.7</b>	<b>23.0</b>	<b>65.5</b>	<b>45.3</b>	<b>30.7</b>	<b>58.6</b>	<b>9.7</b>	<b>60.1</b>

**Notes:**

This table includes reported data only.

1. 'Other Manufacturing' includes all other manufacturing industries not already specified.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.16  
**Planned Pollution Prevention Methods by Industry, 1999-2000<sup>1</sup>**

Industry	Product design or reformulation	Substitution or modification of production process	Recirculation, recovery, reuse or recycling	Energy conservation	Material or solvent substitution	Prevention of leaks and spills	Other	Proportion of respondents who reported
								percent
percent of total number declared								
Logging	-	18.5	29.6	7.4	11.1	81.5	7.4	35.1
Oil and Gas Extraction	35.6	44.4	71.1	80.0	48.9	91.1	4.4	71.4
Mining	8.1	24.4	68.6	46.5	26.7	50.0	5.8	64.7
Electric Power Generation, Transmission and Distribution	12.5	33.3	70.8	70.8	58.3	83.3	4.2	85.7
Natural Gas Distribution	-	25.0	37.5	62.5	25.0	87.5	-	66.7
Food	17.1	32.4	66.7	61.9	32.4	59.0	4.8	57.1
Beverage and Tobacco Products	2.1	12.8	66.0	61.7	19.1	68.1	6.4	65.3
Wood Products	27.8	34.2	73.4	45.6	27.8	57.0	12.7	49.7
Pulp, Paper and Paperboard Mills	12.0	25.0	72.0	60.0	33.0	71.0	8.0	72.5
Petroleum and Coal Products	31.8	40.9	72.7	63.6	22.7	68.2	-	59.5
Chemicals	29.4	31.0	67.4	42.2	42.2	67.9	7.5	73.6
Non-Metallic Mineral Products	25.5	38.3	74.5	53.2	31.9	48.9	4.3	67.1
Primary Metals	16.8	32.0	74.4	60.8	31.2	53.6	4.8	61.3
Transportation Equipment	31.0	33.8	64.8	69.0	57.7	69.0	11.3	65.1
Pipeline Transportation	30.8	30.8	61.5	61.5	38.5	92.3	-	59.1
Other Manufacturing <sup>2</sup>	23.5	31.5	59.9	46.6	41.7	45.7	6.5	59.3
<b>Total excluding Other Manufacturing</b>	<b>20.3</b>	<b>30.5</b>	<b>68.4</b>	<b>54.9</b>	<b>35.1</b>	<b>64.5</b>	<b>6.7</b>	<b>63.1</b>
<b>Total</b>	<b>21.1</b>	<b>30.8</b>	<b>66.3</b>	<b>52.8</b>	<b>36.7</b>	<b>59.8</b>	<b>6.6</b>	<b>62.1</b>

**Notes:**

This table includes reported data only.

1. 'Pollution prevention methods' planned in the next two years.

2. 'Other Manufacturing' includes all other manufacturing industries not already specified.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.17  
**Frequency of Pollution Prevention Methods by Province and Territory, 1998**

Province/Territory	Product design or reformulation	Substitution or modification of production process	Recirculation, recovery, reuse or recycling	Energy conservation	Material or solvent substitution	Prevention of leaks and spills	Other	Proportion of respondents who reported
								percent
percent of total number declared								
Newfoundland	6.3	12.5	56.3	62.5	25.0	68.8	6.3	64.0
Prince Edward Island	16.7	-	66.7	50.0	50.0	66.7	-	60.0
Nova Scotia	13.6	31.8	77.3	54.5	18.2	50.0	-	48.9
New Brunswick	4.3	13.0	87.0	47.8	47.8	60.9	8.7	51.1
Quebec	14.1	22.0	65.6	37.5	28.2	51.5	8.9	56.2
Ontario	20.4	22.0	65.6	44.8	34.1	57.9	12.0	62.3
Manitoba	8.2	26.5	67.3	55.1	32.7	46.9	10.2	63.6
Saskatchewan	16.7	38.1	71.4	61.9	26.2	59.5	7.1	65.6
Alberta	16.7	22.7	66.0	55.3	28.7	71.3	6.7	64.4
British Columbia	14.4	27.0	56.8	40.5	23.4	67.6	7.2	56.1
Yukon and Northwest Territories <sup>1</sup>	12.5	25.0	50.0	25.0	25.0	50.0	25.0	66.7
<b>Canada</b>	<b>16.7</b>	<b>23.0</b>	<b>65.5</b>	<b>45.3</b>	<b>30.7</b>	<b>58.6</b>	<b>9.7</b>	<b>60.1</b>

**Notes:**

This table includes reported data only.

This table includes the 'Other Manufacturing' industries category.

1. Includes Nunavut.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

Table A.18  
**Planned Pollution Prevention Methods by Province and Territory, 1999-2000<sup>1</sup>**

Province/Territory	Product design or reformulation	Substitution or modification of production process	Recirculation, recovery, reuse or recycling	Energy conservation	Material or solvent substitution	Prevention of leaks and spills	Other	Proportion of respondents who reported
								percent
percent of total number declared								
Newfoundland	6.3	18.8	56.3	56.3	18.8	81.3	6.3	64.0
Prince Edward Island	16.7	-	83.3	50.0	66.7	66.7	-	60.0
Nova Scotia	16.7	29.2	79.2	62.5	37.5	54.2	-	53.3
New Brunswick	3.3	33.3	73.3	56.7	43.3	63.3	10.0	66.7
Quebec	16.2	27.9	64.5	44.5	33.1	54.5	7.2	56.0
Ontario	25.5	32.5	66.8	53.9	39.9	58.5	6.2	65.9
Manitoba	16.0	38.0	70.0	60.0	38.0	52.0	6.0	64.9
Saskatchewan	18.6	34.9	69.8	60.5	32.6	60.5	9.3	67.2
Alberta	21.5	30.2	65.8	57.7	38.9	71.1	5.4	63.9
British Columbia	21.7	27.8	62.6	53.9	27.0	66.1	8.7	58.1
Yukon and Northwest Territories <sup>2</sup>	16.7	33.3	50.0	33.3	33.3	50.0	16.7	50.0
<b>Canada</b>	<b>21.1</b>	<b>30.8</b>	<b>66.3</b>	<b>52.8</b>	<b>36.7</b>	<b>59.8</b>	<b>6.6</b>	<b>62.1</b>

**Notes:**

This table includes reported data only.

This table includes the 'Other Manufacturing' industries category.

1. 'Pollution prevention methods' planned in the next two years.

2. Includes Nunavut.

**Source:**

Statistics Canada, Environment Accounts and Statistics Division.

## **Annex B: Questionnaire**

ELECTRONIC PUBLICATIONS AVAILABLE AT  
**[www.statcan.ca](http://www.statcan.ca)**





Environment Accounts and Statistics Division

# Survey of Environmental Protection Expenditures, 1998

Confidential when completed

Collected under the authority of the Statistics Act, Revised Statutes of Canada, 1985, Chapter S19.

Si vous préférez ce questionnaire en français, veuillez cocher

### Correct as required

Establishment name

Operating name

C / O

Address

City

Province/Territory

Postal code



## Please read before completing

### SURVEY OBJECTIVE

This survey provides a measure of the cost imposed on industry by environmental protection in Canada through Canadian and international environmental regulations, conventions and voluntary agreements. The survey also aims at identifying practices and technologies used in Canadian industry for the purpose of preventing or abating pollution.

The results of this survey will be published in the Statistics Canada publication *Environmental Protection Expenditures in the Business Sector 1998*, Catalogue No. 16F0006XIE. The results will also be combined to government and household expenditures to form a complete account of the costs of environmental protection to Canadians.

### CONFIDENTIALITY

Statistics Canada is prohibited by law from publishing any statistics which would divulge information obtained from this survey that relates to any identifiable business, without the previous written consent of that business. The data reported will be treated in strict confidence, used for statistical purposes and published in aggregate form only. The confidentiality provisions of the Statistics Act are not affected by either the Access to Information Act or any other legislation.

### AUTHORITY

This survey is conducted under the authority of the Statistics Act, Revised Statutes of Canada, 1985, Chapter S19. **COMPLETION OF THIS QUESTIONNAIRE IS A LEGAL REQUIREMENT UNDER THE STATISTICS ACT.**

### INFORMATION

If you require assistance in completing this questionnaire or if you have any questions or comments regarding this survey, please contact:

**Operations and Integration Division  
Statistics Canada  
Ottawa, ON, Canada, K1A 0T6**

Telephone (toll-free): **1-800-255-7726 (within Canada)**  
Fax: **1-800-755-5514 (within Canada)**  
E-mail address: **enviro.oid.exp@statcan.ca**

The questionnaire is available in an electronic spreadsheet format. Please contact the Operations and Integration Division if you prefer to use this reporting option.

In all correspondence concerning this questionnaire, please quote the identification number that appears on the address label.

**Important :** Please read the Definitions and concepts on page 14 before answering. If your response for an item is zero, please write "0" in the corresponding box rather than leaving the cell blank.

**Please return this questionnaire within 30 days of receipt.**

If you are unable to do so, kindly inform the Operations and Integration Division of the expected completion date.

For Statistics Canada use only

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4-2300-2.1: 1999-08-31 STC / NAD - 475-04244

**Please report expenditures in thousands of Canadian dollars**

**1. Reporting year**

Report must cover your financial year ending between **April 1, 1998** and **March 31, 1999**.

<b>Day</b>	<b>Month</b>	<b>Year</b>	<b>Day</b>	<b>Month</b>	<b>Year</b>
010	020	030	040	050	060
From			to		

**2. Environmental monitoring** *If the expenditure is zero, please write "0" in corresponding box.*

**Include**

- ◆ All costs related to equipment, supplies, labour and purchased services required for monitoring pollutants emitted by this establishment. Expenditures associated with participation to the National Pollutant Release Inventory (NPRI) and other similar programs are to be included.

<b>Operating expenditures</b>	<b>Capital expenditures</b>	<b>Total expenditures</b>
\$ 000	\$ 000	\$ 000
100	110	120

**3. Environmental assessment and audits** *If the expenditure is zero, please write "0" in corresponding box.*

**Include**

- ◆ Expenditures for reviews of current operations for compliance with regulations (audits)
- ◆ Expenditures to evaluate the environmental impact of proposed programs or projects (assessments)
- ◆ Associated legal and consulting costs

<b>Operating expenditures</b>	<b>Capital expenditures</b>	<b>Total expenditures</b>
\$ 000	\$ 000	\$ 000
130	140	150

**4. Site reclamation and decommissioning** *If the expenditure is zero, please write "0" in corresponding box.*

**a) Expenditures on site remediation made during the fiscal year 1998 for any active site belonging to your establishment**

<b>Operating expenditures</b>	<b>Capital expenditures</b>	<b>Total expenditures</b>
\$ 000	\$ 000	\$ 000
161	171	181

**b) Expenditures on site decommissioning made during the fiscal year 1998 following the closing down of a site (even if closing occurred before 1998)**

<b>Operating expenditures</b>	<b>Capital expenditures</b>	<b>Total expenditures</b>
\$ 000	\$ 000	\$ 000
162	172	182

*A list of processes and technologies associated with site reclamation and decommissioning is provided in Question 12e.*

**Exclude**

- ◆ Any fine or compensation for environmental damage (this is to be reported in Question 8)
- ◆ Any provision for future environmental liability

**Please report expenditures in thousands of Canadian dollars**

**5. Protection and restoration of wildlife and habitat** *If the expenditure is zero, please write "0" in corresponding box.*

**Include**

- ◆ All expenditures made to protect wildlife and habitat from the effects of this establishment's operations or to restore stocks that have been adversely affected by such operations

**Exclude**

- ◆ Expenditures for site reclamation and decommissioning which are already reported in Question 4
- ◆ Expenditures for aesthetic purposes

Operating expenditures  
\$ 000

190

Capital expenditures  
\$ 000

200

Total expenditures  
\$ 000

210

+ =

**6. Treatment and control of pollution (end-of-pipe processes)**

Treatment and control of pollution are performed using end-of-pipe equipment or installation. **These end-of-pipe processes are not an integral part of production**; their sole purpose is to abate or to control undesirable substances resulting from normal production.

**a) Pollution treatment and control expenditures** *If the expenditure is zero, please write "0" in corresponding box.*

**Include**

- ◆ Any capital or operating expenditure for equipment or facilities which are separately identifiable and which have been installed exclusively to reduce or eliminate pollutants resulting from production
- ◆ Any expenditure related to waste collection, removal and treatment done by your establishment's or company's employees
- ◆ Any purchase of waste and sewerage management services or any other purchase of services reported in Question 11

**Exclude**

- ◆ Any expenditure specific to workers' health and safety
- ◆ Any expenditure for on-site recycling (Question 7)

Operating expenditures  
\$ 000

250

Capital expenditures  
\$ 000

260

Total expenditures  
\$ 000

270

+ =

**b) Did you report capital expenditures in Question 6a?**

1  Yes    2  No    ► *Go to Question 7*

What percentage of this amount was spent on reducing or abating each of the following?

Substances emitted to air  
%

280

Substances released to surface waters  
%

290

On site contained solid/liquid waste  
%

300

Noise, vibration or radiation  
%

310

+ + + = 100%

*A list of environmental processes/technologies is provided in Question 12.*

**Please report expenditures in thousands of Canadian dollars**

**7. Pollution prevention**

"Pollution prevention is the use of processes, practices, materials, products or energy that avoid or minimise the creation of pollutants and waste, and reduce overall risk to human health or the environment."

*Pollution Prevention - A Federal Strategy for Action, Government of Canada (1995)*

This question identifies expenditures and methods used for the purpose of preventing or minimising pollution and waste, or promoting resource conservation.

**a) Expenditures on pollution prevention** *If the expenditure is zero, please write "0" in corresponding box.*

**Include**

- ◆ All operating and capital expenditures for equipment or facilities integrated to a production process that avoid or minimise the production of pollutants and waste
- ◆ All operating and capital expenditures for equipment or facilities related to leak and spill prevention. They may include expenditures on the following: spill containments; dyke extensions; accessories (valves, pumps); and emission detection equipment
- ◆ All operating and capital expenditures for equipment or facilities used for conserving energy or water
- ◆ All operating and capital expenditures for equipment or facilities associated with recirculation, recovery, reuse and recycling of materials or substances

**Exclude**

- ◆ Any expenditure already included in Questions 2 to 6
- ◆ Any expenditure specific to worker's health and safety

<b>Operating expenditures</b>	<b>Capital expenditures</b>	<b>Total expenditures</b>	
\$ 000	\$ 000	\$ 000	
500	+	510	=
		520	

**b) Did you report capital expenditures in Question 7a?**

1  Yes    2  No    ► *Go to Question 7c*

**What percentage of this amount was spent on preventing or minimising each of the following?**

<b>Substances emitted to air</b>	<b>Substances released to surface waters</b>	<b>On site contained solid/liquid waste</b>	<b>Noise, vibration or radiation</b>	
%	%	%	%	
530	+	540	+	550
		+		560
				=
				<b>100%</b>

**Please report expenditures in thousands of Canadian dollars**

**7. Pollution prevention - Continued**

**c) Pollution prevention methods**

If you have prevented or reduced waste, or pollutants or conserved resources in fiscal year 1998, or if you are planning to do so in the next 2 years, please indicate how it was/will be achieved by checking the appropriate boxes. Please include any project, regardless of whether or not they are required by environmental regulation or convention.

Methods of pollution prevention	1998	1999-2000
Product design or reformulation	810 <input type="checkbox"/>	815 <input type="checkbox"/>
Substitution or modification of production process (integrated process)	830 <input type="checkbox"/>	835 <input type="checkbox"/>
Recirculation, recovery, on-site recycling or reuse of materials or substances <sup>1</sup>	850 <input type="checkbox"/>	855 <input type="checkbox"/>
Energy conservation	860 <input type="checkbox"/>	865 <input type="checkbox"/>
Material substitution, reduction or elimination, or solvent substitution	870 <input type="checkbox"/>	875 <input type="checkbox"/>
Prevention of leaks and spills	880 <input type="checkbox"/>	885 <input type="checkbox"/>
Other	890 <input type="checkbox"/>	895 <input type="checkbox"/>

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1. Recirculation, recovery, reuse or recycling: recirculation, reuse, recovery or recycling of water, materials or substances generated during production, excluding materials transferred or recycled off site.  
 Examples: vapour recovery, recovery of sludge, water recirculation, reuse of water for refrigeration condenser operation.

*A list of environmental processes/technologies is included in Question 12.*

**8. Environmental charges** *If the expenditure is zero, please write "0" in corresponding box.*

**Include**

- ◆ Permits, fees, levies, special assessment and related fees
- ◆ Other charges paid to regulating bodies in order to allow operations to take place at this establishment
- ◆ Any fines, penalties, or damage awards paid to government agencies or to individuals

\$ 000

760
-----

**9. Other environmental protection expenditures** *If the expenditure is zero, please write "0" in corresponding box.*

**Include**

**Exclude**

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>◆ The costs of administration for an environmental affairs division</li> <li>◆ Training and information programs</li> <li>◆ Any other additional expenditures that are required to comply with environmental regulations or conventions</li> </ul> | <ul style="list-style-type: none"> <li>◆ Research and development expenditures</li> </ul> |
|---|---|

\$ 000

770
-----

**Please report expenditures in thousands of Canadian dollars**

**10. Total expenditures on environmental protection** *If the expenditure is zero, please write "0" in corresponding box.*

Cell 801: includes total from operating expenditures reported in questions 2 to 9.  
 Cell 802: includes total from capital expenditures reported in questions 2 to 7.  
 They should also include all data for which breakdowns were not available.

Operating expenditures \$ 000	Capital expenditures \$ 000	Total expenditures \$ 000
801	+	802
		=
		803

**11. Purchase of environmental services** *If the expenditure is zero, please write "0" in corresponding box.*

**From the total environmental protection expenditures reported in Question 10, what was the amount of environmental services purchased from a private contractor or a government?**

**a) Waste management services or sewerage services** \$ 000  
240

**Include**

- ◆ All expenditures related to the use of a waste collection, disposal or treatment service, or an off-site recycling service provided by a private contractor or a federal, provincial or local government body
- ◆ All expenditures related to the use of a sewerage service provided by a federal, provincial or local government body

**Exclude**

- ◆ Any expenditures for waste management activities done by your establishment's or company's employees (Question 6)
- ◆ Any expenditure for recycling on site (Question 7)

**b) Environment-related construction and engineering services** \$ 000  
805

**c) Other environmental services** \$ 000  
804

**Examples:**

- ◆ purchase of environmental assessment and audit services
- ◆ purchase of services for site reclamation or decommissioning
- ◆ purchase of services associated with wildlife and habitat protection and restoration

**d) Total purchase of environmental services** \$ 000  
806

**Include**

- ◆ sum of cells 240, 805 and 804

**Exclude**

- ◆ any expenditure for environmental services provided by the employees of your establishment or your company

## 12. Environmental processes and technologies

Indicate how this establishment has abated or prevented pollution resulting from normal production by checking the appropriate boxes. If you use a process not already specified, please report it next to the "Other" category.

Processes and Technologies	Do you use this technology?	If yes, please check the purpose	
		Is the purpose pollution abatement?	Is the purpose pollution prevention?
<b>a) Gas treatment process</b>			
Please indicate, by checking the appropriate box(es), if you use pollution abatement (end-of-pipe) processes or pollution prevention processes as defined in questions 6 and 7.			
<b>Physical treatment</b>			
Gravity deposition			
Precipitation chamber .....	1000 <input type="checkbox"/> Yes ➤	1001 <input type="checkbox"/>	1002 <input type="checkbox"/>
Dust collector system .....	1003 <input type="checkbox"/> Yes ➤	1004 <input type="checkbox"/>	1005 <input type="checkbox"/>
Inertial separator			
Cyclone .....	1006 <input type="checkbox"/> Yes ➤	1007 <input type="checkbox"/>	1008 <input type="checkbox"/>
Vortex .....	1009 <input type="checkbox"/> Yes ➤	1010 <input type="checkbox"/>	1011 <input type="checkbox"/>
Centrifugal precipitator .....	1012 <input type="checkbox"/> Yes ➤	1013 <input type="checkbox"/>	1014 <input type="checkbox"/>
Impingement eliminator .....	1015 <input type="checkbox"/> Yes ➤	1016 <input type="checkbox"/>	1017 <input type="checkbox"/>
Electrostatic precipitator .....	1018 <input type="checkbox"/> Yes ➤	1019 <input type="checkbox"/>	1020 <input type="checkbox"/>
Filtration			
Bag house .....	1021 <input type="checkbox"/> Yes ➤	1022 <input type="checkbox"/>	1023 <input type="checkbox"/>
Activated carbon filter .....	1024 <input type="checkbox"/> Yes ➤	1025 <input type="checkbox"/>	1026 <input type="checkbox"/>
Membrane filter .....	1027 <input type="checkbox"/> Yes ➤	1028 <input type="checkbox"/>	1029 <input type="checkbox"/>
Adsorption			
Activated carbon adsorption .....	1030 <input type="checkbox"/> Yes ➤	1031 <input type="checkbox"/>	1032 <input type="checkbox"/>
Other media .....	1033 <input type="checkbox"/> Yes ➤	1034 <input type="checkbox"/>	1035 <input type="checkbox"/>
Other (please specify) <input type="text"/>	1036 <input type="checkbox"/> Yes ➤	1037 <input type="checkbox"/>	1038 <input type="checkbox"/>
<b>Biological treatment</b>			
Biological filtration .....	1039 <input type="checkbox"/> Yes ➤	1040 <input type="checkbox"/>	1041 <input type="checkbox"/>
Activated sludge .....	1042 <input type="checkbox"/> Yes ➤	1043 <input type="checkbox"/>	1044 <input type="checkbox"/>
Phytoremediation .....	1045 <input type="checkbox"/> Yes ➤	1046 <input type="checkbox"/>	1047 <input type="checkbox"/>
Other (please specify) <input type="text"/>	1048 <input type="checkbox"/> Yes ➤	1049 <input type="checkbox"/>	1050 <input type="checkbox"/>
<b>Chemical treatment</b>			
Scrubbing			
Wet scrubbing system .....	1051 <input type="checkbox"/> Yes ➤	1052 <input type="checkbox"/>	1053 <input type="checkbox"/>
Air scrubbing .....	1054 <input type="checkbox"/> Yes ➤	1055 <input type="checkbox"/>	1056 <input type="checkbox"/>
Desulfurisation .....	1057 <input type="checkbox"/> Yes ➤	1058 <input type="checkbox"/>	1059 <input type="checkbox"/>
Catalytic reduction .....	1060 <input type="checkbox"/> Yes ➤	1061 <input type="checkbox"/>	1062 <input type="checkbox"/>
Chemical oxidation .....	1063 <input type="checkbox"/> Yes ➤	1064 <input type="checkbox"/>	1065 <input type="checkbox"/>
Ozonation .....	1066 <input type="checkbox"/> Yes ➤	1067 <input type="checkbox"/>	1068 <input type="checkbox"/>
Other (please specify) <input type="text"/>	1069 <input type="checkbox"/> Yes ➤	1070 <input type="checkbox"/>	1071 <input type="checkbox"/>
<b>Thermal treatment</b>			
Flare system .....	1072 <input type="checkbox"/> Yes ➤	1073 <input type="checkbox"/>	1074 <input type="checkbox"/>
Vapour condenser .....	1075 <input type="checkbox"/> Yes ➤	1076 <input type="checkbox"/>	1077 <input type="checkbox"/>
Dryer .....	1078 <input type="checkbox"/> Yes ➤	1079 <input type="checkbox"/>	1080 <input type="checkbox"/>

## 12. Environmental processes and technologies - Continued

Processes and Technologies	Do you use this technology?	If yes, please check the purpose	
		Is the purpose pollution abatement?	Is the purpose pollution prevention?
<b>Thermal treatment - Concluded</b>			
Incineration			
Thermal recuperative incineration .....	1081 <input type="checkbox"/> Yes ➤	1082 <input type="checkbox"/>	1083 <input type="checkbox"/>
Catalytic incineration .....	1084 <input type="checkbox"/> Yes ➤	1085 <input type="checkbox"/>	1086 <input type="checkbox"/>
Thermal regenerative incineration .....	1087 <input type="checkbox"/> Yes ➤	1088 <input type="checkbox"/>	1089 <input type="checkbox"/>
Fluidised bed .....	1090 <input type="checkbox"/> Yes ➤	1091 <input type="checkbox"/>	1092 <input type="checkbox"/>
Oxidation			
Thermal oxidation .....	1093 <input type="checkbox"/> Yes ➤	1094 <input type="checkbox"/>	1095 <input type="checkbox"/>
Catalytic oxidation .....	1096 <input type="checkbox"/> Yes ➤	1097 <input type="checkbox"/>	1098 <input type="checkbox"/>
Cooling tower .....	1099 <input type="checkbox"/> Yes ➤	1100 <input type="checkbox"/>	1101 <input type="checkbox"/>
Other (please specify) <input type="text"/>	1102 <input type="checkbox"/> Yes ➤	1103 <input type="checkbox"/>	1104 <input type="checkbox"/>
<b>b) Liquid treatment</b>			
<b>Physical treatment</b>			
Screening .....	1105 <input type="checkbox"/> Yes ➤	1106 <input type="checkbox"/>	1107 <input type="checkbox"/>
Degritting .....	1108 <input type="checkbox"/> Yes ➤	1109 <input type="checkbox"/>	1110 <input type="checkbox"/>
Primary clarification (sedimentation, gravity settling chamber) .....	1111 <input type="checkbox"/> Yes ➤	1112 <input type="checkbox"/>	1113 <input type="checkbox"/>
Precipitator .....	1114 <input type="checkbox"/> Yes ➤	1115 <input type="checkbox"/>	1116 <input type="checkbox"/>
Centrifugal precipitator .....	1117 <input type="checkbox"/> Yes ➤	1118 <input type="checkbox"/>	1119 <input type="checkbox"/>
Oil/water separation			
Gravity .....	1120 <input type="checkbox"/> Yes ➤	1121 <input type="checkbox"/>	1122 <input type="checkbox"/>
Oilphyllic pads .....	1123 <input type="checkbox"/> Yes ➤	1124 <input type="checkbox"/>	1125 <input type="checkbox"/>
Coalescing separators .....	1126 <input type="checkbox"/> Yes ➤	1127 <input type="checkbox"/>	1128 <input type="checkbox"/>
Adsorption system			
Activated carbon adsorption .....	1129 <input type="checkbox"/> Yes ➤	1130 <input type="checkbox"/>	1131 <input type="checkbox"/>
Polymer .....	1132 <input type="checkbox"/> Yes ➤	1133 <input type="checkbox"/>	1134 <input type="checkbox"/>
Other media .....	1135 <input type="checkbox"/> Yes ➤	1136 <input type="checkbox"/>	1137 <input type="checkbox"/>
Contact system			
Air stripping .....	1138 <input type="checkbox"/> Yes ➤	1139 <input type="checkbox"/>	1140 <input type="checkbox"/>
Steam stripping .....	1141 <input type="checkbox"/> Yes ➤	1142 <input type="checkbox"/>	1143 <input type="checkbox"/>
Flotation .....	1144 <input type="checkbox"/> Yes ➤	1145 <input type="checkbox"/>	1146 <input type="checkbox"/>
Filtration			
Bed filtration system (e.g. sand filter) .....	1147 <input type="checkbox"/> Yes ➤	1148 <input type="checkbox"/>	1149 <input type="checkbox"/>
Pressure (press filter, filter leaf) .....	1150 <input type="checkbox"/> Yes ➤	1151 <input type="checkbox"/>	1152 <input type="checkbox"/>
Vacuum (rotary, drum, centrifugal) .....	1153 <input type="checkbox"/> Yes ➤	1154 <input type="checkbox"/>	1155 <input type="checkbox"/>
Membrane (dialysis, reverse osmosis, ultrafiltration, electro dialysis, piezodialysis, pervaporation) .....	1156 <input type="checkbox"/> Yes ➤	1157 <input type="checkbox"/>	1158 <input type="checkbox"/>
Gravity (belt) .....	1159 <input type="checkbox"/> Yes ➤	1160 <input type="checkbox"/>	1161 <input type="checkbox"/>
Equalisation pond .....	1162 <input type="checkbox"/> Yes ➤	1163 <input type="checkbox"/>	1164 <input type="checkbox"/>
UV disinfection .....	1165 <input type="checkbox"/> Yes ➤	1166 <input type="checkbox"/>	1167 <input type="checkbox"/>
Other (please specify) <input type="text"/>	1168 <input type="checkbox"/> Yes ➤	1169 <input type="checkbox"/>	1170 <input type="checkbox"/>

## 12. Environmental processes and technologies - Continued

Processes and Technologies	Do you use this technology?	If yes, please check the purpose	
		Is the purpose pollution abatement?	Is the purpose pollution prevention?
<b>b) Liquid treatment - Continued</b>			
<b>Chemical treatment</b>			
Oxidation			
Wet oxidation system .....	1171 <input type="checkbox"/> Yes ➤	1172 <input type="checkbox"/>	1173 <input type="checkbox"/>
Chemical oxidation .....	1174 <input type="checkbox"/> Yes ➤	1175 <input type="checkbox"/>	1176 <input type="checkbox"/>
Electrochemical oxidation .....	1177 <input type="checkbox"/> Yes ➤	1178 <input type="checkbox"/>	1179 <input type="checkbox"/>
Disinfection			
Chlorination .....	1180 <input type="checkbox"/> Yes ➤	1181 <input type="checkbox"/>	1182 <input type="checkbox"/>
Ozonation .....	1183 <input type="checkbox"/> Yes ➤	1184 <input type="checkbox"/>	1185 <input type="checkbox"/>
Reduction system			
Dephosphating .....	1186 <input type="checkbox"/> Yes ➤	1187 <input type="checkbox"/>	1188 <input type="checkbox"/>
Denitrification .....	1189 <input type="checkbox"/> Yes ➤	1190 <input type="checkbox"/>	1191 <input type="checkbox"/>
Dechlorination .....	1192 <input type="checkbox"/> Yes ➤	1193 <input type="checkbox"/>	1194 <input type="checkbox"/>
Neutralisation .....	1195 <input type="checkbox"/> Yes ➤	1196 <input type="checkbox"/>	1197 <input type="checkbox"/>
Ion exchange .....	1198 <input type="checkbox"/> Yes ➤	1199 <input type="checkbox"/>	1200 <input type="checkbox"/>
Flocculation .....	1201 <input type="checkbox"/> Yes ➤	1202 <input type="checkbox"/>	1203 <input type="checkbox"/>
Coagulation .....	1204 <input type="checkbox"/> Yes ➤	1205 <input type="checkbox"/>	1206 <input type="checkbox"/>
Demineralisation .....	1207 <input type="checkbox"/> Yes ➤	1208 <input type="checkbox"/>	1209 <input type="checkbox"/>
Nitrification .....	1210 <input type="checkbox"/> Yes ➤	1211 <input type="checkbox"/>	1212 <input type="checkbox"/>
Other (please specify) <input type="text"/>	1213 <input type="checkbox"/> Yes ➤	1214 <input type="checkbox"/>	1215 <input type="checkbox"/>
<b>Thermal treatment</b>			
Incineration .....	1216 <input type="checkbox"/> Yes ➤	1217 <input type="checkbox"/>	1218 <input type="checkbox"/>
Drying .....	1219 <input type="checkbox"/> Yes ➤	1220 <input type="checkbox"/>	1221 <input type="checkbox"/>
Evaporation .....	1222 <input type="checkbox"/> Yes ➤	1223 <input type="checkbox"/>	1224 <input type="checkbox"/>
Distillation .....	1225 <input type="checkbox"/> Yes ➤	1226 <input type="checkbox"/>	1227 <input type="checkbox"/>
Fluidised bed .....	1228 <input type="checkbox"/> Yes ➤	1229 <input type="checkbox"/>	1230 <input type="checkbox"/>
Thermal oxidation .....	1231 <input type="checkbox"/> Yes ➤	1232 <input type="checkbox"/>	1233 <input type="checkbox"/>
Other (please specify) <input type="text"/>	1234 <input type="checkbox"/> Yes ➤	1235 <input type="checkbox"/>	1236 <input type="checkbox"/>
<b>Biological treatment</b>			
Aerobic treatment			
Activated sludge dewatering .....	1237 <input type="checkbox"/> Yes ➤	1238 <input type="checkbox"/>	1239 <input type="checkbox"/>
Biological polishing or biofiltration .....	1240 <input type="checkbox"/> Yes ➤	1241 <input type="checkbox"/>	1242 <input type="checkbox"/>
Aeration pond .....	1243 <input type="checkbox"/> Yes ➤	1244 <input type="checkbox"/>	1245 <input type="checkbox"/>
Aerobic lagoon .....	1246 <input type="checkbox"/> Yes ➤	1247 <input type="checkbox"/>	1248 <input type="checkbox"/>
Aeration system .....	1249 <input type="checkbox"/> Yes ➤	1250 <input type="checkbox"/>	1251 <input type="checkbox"/>
Anaerobic treatment			
Septic tank .....	1255 <input type="checkbox"/> Yes ➤	1256 <input type="checkbox"/>	1257 <input type="checkbox"/>
Anaerobic digester reactor .....	1258 <input type="checkbox"/> Yes ➤	1259 <input type="checkbox"/>	1260 <input type="checkbox"/>

## 12. Environmental processes and technologies - Continued

Processes and Technologies	Do you use this technology?	If yes, please check the purpose	
		Is the purpose pollution abatement?	Is the purpose pollution prevention?
<b>b) Liquid treatment - Concluded</b>			
<b>Biological treatment - Concluded</b>			
Biosystem			
Biological reactor .....	1264 <input type="checkbox"/> Yes ➤	1265 <input type="checkbox"/>	1266 <input type="checkbox"/>
Multiplate reactor .....	1267 <input type="checkbox"/> Yes ➤	1268 <input type="checkbox"/>	1269 <input type="checkbox"/>
Other (please specify) <input type="text"/>	1270 <input type="checkbox"/> Yes ➤	1271 <input type="checkbox"/>	1272 <input type="checkbox"/>
<b>c) Treatment of noise, vibration or radiation</b>			
Acoustic barriers .....	1273 <input type="checkbox"/> Yes ➤	1274 <input type="checkbox"/>	1275 <input type="checkbox"/>
Mufflers .....	1276 <input type="checkbox"/> Yes ➤	1277 <input type="checkbox"/>	1278 <input type="checkbox"/>
Other (please specify) <input type="text"/>	1279 <input type="checkbox"/> Yes ➤	1280 <input type="checkbox"/>	1281 <input type="checkbox"/>
<b>d) Energy conservation</b>			
Do you use one or more of the following energy conservation processes? If yes, please check the appropriate box(es).			
Cogeneration .....			1282 <input type="checkbox"/>
Energy efficiency .....			1283 <input type="checkbox"/>
Fuel substitution .....			1284 <input type="checkbox"/>
Waste-to-energy system .....			1285 <input type="checkbox"/>
Clean fuel system .....			1286 <input type="checkbox"/>
Renewable energy source .....			1287 <input type="checkbox"/>
Solar .....			1288 <input type="checkbox"/>
Wind power .....			1289 <input type="checkbox"/>
Geothermal .....			1290 <input type="checkbox"/>
Biomass energy .....			1291 <input type="checkbox"/>
Other (please specify) <input type="text"/>			1292 <input type="checkbox"/>
<b>e) Site reclamation and decommissioning (including treatment of soils)</b>			
Do you use one or more of the following processes for site reclamation or decommissioning? If yes, please check the appropriate box(es).			
<b>Storage and physical treatment</b>			
Underground storage tanks handling .....			1293 <input type="checkbox"/>
Excavation .....			1294 <input type="checkbox"/>
Solvent extraction system .....			1295 <input type="checkbox"/>
Vapour extraction systems .....			1296 <input type="checkbox"/>
Geomembrane .....			1297 <input type="checkbox"/>
Injection grouting technology .....			1298 <input type="checkbox"/>
Soil washing .....			1299 <input type="checkbox"/>
Reduction .....			1300 <input type="checkbox"/>

**12. Environmental processes - Concluded**

**e) Site reclamation and decommissioning (including treatment of soils) - Concluded**

**Biological treatment**

- Biological degradation by aeration or bioventilation ..... 1302
- Bioslurping ..... 1303
- Bioremediation ..... 1304
- Renaturalisation ..... 1305
- Phytoremediation ..... 1306

**Thermal treatment**

- Thermal desorption technology ..... 1308
- Thermal oxidation system ..... 1309
- Incineration ..... 1310

**Other** (please specify)  1311

**f) Waste management**

**Do you use one or more of the following waste management processes? If yes, please check the appropriate box(es).**

**Physical**

- Container ..... 1312
- Dehydration ..... 1313
- Packaging ..... 1314
- Modification or preparation of landfill or waste treatment sites ..... 1315
- Pozzolanic treatment method ..... 1316
- Compacting ..... 1317
- Shredding ..... 1318
- Grinding ..... 1319
- Crushing ..... 1320
- Screening ..... 1321
- Degritting ..... 1322

**Thermal treatment**

- Fluidised bed incineration ..... 1324
- Pyrolysis ..... 1325
- Incineration ..... 1326

**Biological treatment**

- Biopiles ..... 1328
- Composting technology ..... 1329
- Landfarming method ..... 1330

**Other** (please specify)  1331

### 13. Environmental practices

Indicate the environmental practices adopted by this establishment to avoid or minimise pollution or to conserve resources.

	Yes	No
a) Does this establishment use an environmental management system? If yes, could you briefly describe?  _____ _____	951 <input type="checkbox"/>	<input type="checkbox"/>
b) Is this establishment ISO 14000 certified or does it have an equivalent certification? If yes, please describe.  _____ _____	953 <input type="checkbox"/>	<input type="checkbox"/>
c) Is this establishment implementing any environmental voluntary agreement, or is participating in any voluntary environmental program such as ARET (Accelerated Reduction/Elimination of Toxics)? If yes, please list programs, accords or agreements.  _____ _____	955 <input type="checkbox"/>	<input type="checkbox"/>
d) Does this establishment have a "green" procurement policy?	957 <input type="checkbox"/>	<input type="checkbox"/>
e) Are any of the goods produced by this establishment certified by an environmental Program, for example "Eco-Logo" operated by Terrachoice Inc.? If yes, please describe.  _____ _____	959 <input type="checkbox"/>	<input type="checkbox"/>
f) Does this establishment report information to the National Pollutant Release Inventory (NPRI)?	961 <input type="checkbox"/>	<input type="checkbox"/>
g) Does this establishment publish an annual report on its environmental performance or sustainable development?	963 <input type="checkbox"/>	<input type="checkbox"/>
h) Does this establishment use life-cycle analysis for decision-making?	965 <input type="checkbox"/>	<input type="checkbox"/>
i) Other  _____ _____ _____	967 <input type="checkbox"/>	<input type="checkbox"/>



## Definitions and concepts

**Environmental protection expenditures** are defined in this survey as all operating expenses and capital, and repair expenditures that are incurred in order to anticipate or to comply with Canadian or international environmental regulations, conventions or voluntary agreements. They consist of expenditures for pollution abatement and control and expenditures for restoring wildlife and habitat, expenditures for environmental monitoring, environmental assessments and audits, and expenditures for reclamation and decommissioning of sites. Expenditures to improve employee health, workplace safety and site beautification are excluded.

Expenditures to produce pollution abatement and control equipment for sale are also excluded as they would appear twice in the expenditure data produced by Statistics Canada. Expenditures for environment-related research and development are also excluded since they are reported in Statistics Canada's *Survey on Research and Development in Canadian Industry*.

**Environmental conventions** or voluntary agreements refer to any formal, multi-party commitment by an industry or an

industry association for instance, to meet specific targets in terms of habitat protection, waste reduction, or the elimination or reduction of specific materials that are considered to be harmful or toxic to the natural environment in Canada. Examples include the following: the National Packaging Protocol (reduction of packaging by 50 percent by the year 2000); the Montreal Protocol (elimination of CFCs by 1998); the Canada-U.S. Air Quality Agreement; the "Responsible Care" program from the Canadian Chemical Producers Association; the Accelerated Reduction/Elimination of Toxics (ARET) Program; the Voluntary Challenge and Registry (VCR) Program on climate change; etc.

**Environmental regulations** refer to any current Canadian federal, provincial, municipal law or international legislation that is intended to protect or to restore the environment in Canada. Expenditures related to anticipated legislation may be included as long as its provisions are known.

## How to report

Please report expenditures in **thousands of Canadian dollars**. If, for certain categories, no expenditures have been incurred, **please write "0" in the corresponding box**.

Where precise data are not available, your best estimate is acceptable. If additional information is available in an annual report or an environmental performance report, **please include a copy** when you return the questionnaire.

### TO REPORT CAPITAL EXPENDITURES

Report expenditures made during the 1998 fiscal year.

**Include** all relevant outlays for machinery and equipment and their installation and repair, as well as for the construction of non-residential facilities (contractors or own employees). For construction, include all costs associated with demolition, planning and design (such as engineering and construction fees), any materials supplied to construction contractors for installation and any costs associated with the purchase of land that are neither amortised nor depreciated.

**Exclude** any provisions for future environmental liability.

### TO REPORT OPERATING EXPENSES

**Include** all cash expenses, rather than accruals, incurred during your 1998 fiscal year for labour, fuel and electricity, materials and supplies, and purchased services.

### FOR LOGGING ACTIVITIES

Use Question 5 to report additional expenditures for logging caused by environmental regulation or convention. **Include** the extra cost of any practice that would not otherwise be followed in the absence of environmental regulation or convention. **Exclude** the foregone revenues resulting from regulations or conventions that reduce the allowable harvest.

### FOR MINING ACTIVITIES

Use Question 6 or 11a to report any expenditures that are related to the handling and treatment of mine tailings and that are required by environmental regulation. Even if some of these activities are now considered to be "standard practice", include related expenditures if they are required by regulation or convention. Use Question 9 to report imputed interest on funds held in trust against future environmental liabilities. Report only actual expenditures.

### FOR PETROLEUM OPERATIONS

Please report separately, if possible, environmental protection expenditures associated with different petroleum operations: exploration, refining, chemical products, pipeline transportation.