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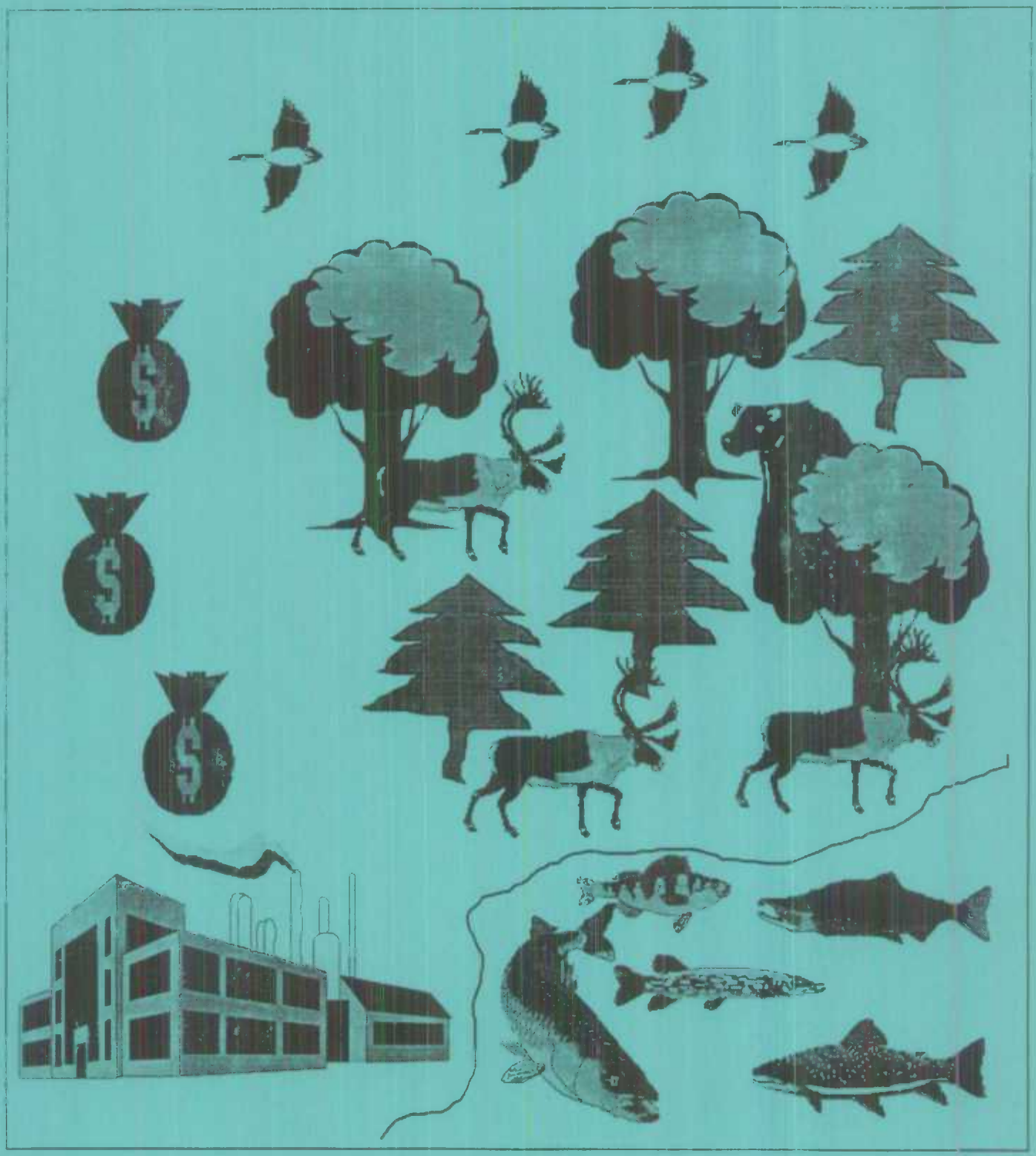
National Accounts and Environment Division
System of National Accounts

Environmental Protection Expenditures in the Business Sector, 1994



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Environmental Protection Expenditures in the Business Sector, 1994

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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*

Preface

This report presents the results of the *1994 Environmental Protection Expenditure Survey*. The survey, addressed to thirteen industries, was produced in order to fill important gaps in the data regarding the cost to industry of environmental protection and of demand for associated environmental products and services. Very little information exists on the cost to industry of pollution prevention and abatement technologies, environmental management systems, environmental assessments, audits and monitoring, etc., required in order to comply with environmental legislation or conventions. For the most part companies have started to use environmental cost accounting in their management decisions. Certain companies provide their shareholders with environmental performance reports that show how money is spent on environmental protection, in addition to indicators of the company's environmental performance.

The 1994 Environmental Protection Expenditure Survey covered all expenditures made in response to or in anticipation of an environmental regulation or convention. 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 and reduction of air pollution, effluent, solid waste, and the protection of wildlife and habitat (see Text Box 1.1).

Industry spending on environmental protection may also be affected by the existence of environmental conventions or voluntary agreements between government and industry representatives, or within a particular industry, that would include specific actions on pollution prevention or abatement (see Text Box 1.1).

The survey is part of a major project on developing a national statistics database on the "environment industry", under the Environment Industry Strategy, launched by the federal government in the fall of 1995. The database will provide information allowing the identification and measurement of the supply of goods, services and technologies that are produced by the environment industry, as well as the markets

for Canadian companies active in the environment industry. Information on the demand for environmental protection goods and services will also include data on capital and repair expenditures for selected assets associated with pollution abatement and control, research and development expenditures for pollution abatement and control, as well as data on government expenditures on environmental protection.

Acknowledgments

This report was prepared by the Environmental Statistics sub-division of the National Accounts and Environment Division under the direction of Claude Simard, Director, and Cynthia Baumgarten, Assistant Director. Data collection for the survey was conducted by the Operations and Integration Division under the supervision of Françoise Jean-Marie and Brenda Schoenherr.

Major contributions to the project were made at various times by:

Craig Gaston
Anik Lacroix
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Mitzi Ross and Hélène Trépanier provided valuable technical help and/or editorial advice.

The contributions of respondents themselves were critical to this undertaking and are also gratefully acknowledged.

1 Environmental Protection Expenditures in Selected Industries, 1994

Introduction

This study examines the cost incurred in 1994 by selected industries in complying with actual or anticipated environmental regulations and conventions (see Text Box 1.1). Industries were chosen after examining results from Statistics Canada's *Capital and Repair Expenditure Survey*, and from pollution abatement and control (PAC) expenditure surveys taking place in other countries. Only those industries that were found to have significant PAC expenditures in these surveys were selected[1]. Consequently estimations presented here constitute a lower threshold of environmental protection expenditures made by the business sector. This study covers expenditures made by primary industries (logging, mining, crude petroleum and natural gas, electrical power and gas distribution) and selected manufacturing industries (see Text Box 2.1).

Not all expenditures with environmental benefits are included here. Certain companies cannot distinguish environmental protection expenditures from total expenditures (capital plus operating), when environmental protection is an additional benefit from an efficiency enhancement investment, even though an environmental regulation or convention may apply.

1.1 Total environmental protection expenditures

In 1994, total environmental protection expenditures (capital and operating, see Text Box 1.2 for a list of categories) in the selected industries were $ 3.6 billion. Capital investment amounted to $1.6 billion, or 43% of total environmental protection expenditures. To put this in perspective of total economy, this $1.6 billion represented one percent of the total fixed capital formation of business sector. Operating expenditures on environmental protection accounted for more than half of environmental protection expenditures and amounted to slightly more than $2 billion.

1. See Chapter 2 for more information on these surveys.

Text Box 1.2
Environmental Protection Expenditures

Environmental protection expenditures are defined as all operating and capital expenditures incurred in order to comply with or anticipate environmental regulations or conventions which apply to Canada. Examples of environmental regulations include the Canada Fisheries Act Regulations on liquid effluents from the pulp and paper, metal mining and petroleum refining industries. Environmental conventions include any formal multi-party 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, the "Responsible Care" Program adopted by the Canadian Chemical Producers Association, etc.

Environmental protection expenditures consist of expenditures undertaken with the intention of preventing, reducing and remedying environmental degradation or preserving the environment. They include expenditures for pollution abatement and control (PAC) and expenditures for restoring wildlife and habitat, along with 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.

Text Box 1.2
Categories of Expenditures on Environmental Protection

Environmental monitoring: includes expenditures related to equipment, labour and purchased services required for the monitoring of pollutant emissions that would affect air, water or soil quality.

Environmental assessments and audits: includes expenditures for reviews of current operations for compliance with regulations, and expenditures to evaluate the environmental impact of proposed projects.

Site reclamation and decommissioning: includes expenditures to clean up environmental damage and expenditures related to the closure of a site.

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

Purchase of waste management and sewerage services from a private contractor or a government body.

End-of-pipe PAC expenditures: Their sole purpose is to abate or to control undesirable substances emitted during regular production activities; end-of-pipe facilities and equipment do not affect the production process itself.

Process-integrated expenditures for PAC: These expenditures lead to a new or significantly modified production process in order to prevent or reduce emissions of pollutants and the amount of waste generated.

Environmental fees, fines and licences

Other environmental protection expenditures: the costs of administrating environmental projects, training, etc.

In general most industries surveyed reported higher operating expenditures than capital expenditures on environmental protection as shown in Table 1.1. The only exception was the pulp and paper industry, where 69% of environmental protection expenditures consisted of capital expenditures.

From the survey data it appears that companies were significantly involved in investing in and running end-of-pipe facilities and equipment for pollution abatement and control in 1994. Indeed PAC end-of-pipe expenditures represented half of total environmental protection expenditures, almost $2 billion. In comparison, PAC integrated process expenditures accounted for $402 million or 11% of total environmental protection expenditures. Monitoring expenditures were the third most important environmental protection expenditure made.

Table 1.1
Industrial Distribution of Environmental Protection Expenditures, 1994

Industry	Capital expenditures	Operating expenditures	Total
	percent		
Logging	11.3	88.7	100
Mining	30.6	69.4	100
Crude petroleum, natural gas and refined products[1]	47.0	53.0	100
Food	28.4	71.6	100
Beverage	48.8	51.2	100
Pulp and paper	69.2	30.8	100
Primary metals	18.2	81.8	100
Fabricated metal products	15.7	84.3	100
Transportation equipment[2]	24.7	75.3	100
Non-metallic mineral products	39.4	60.6	100
Chemicals and chemical products	29.6	70.4	100
Electric power and gas distribution	49.8	50.2	100
Total	43.4	56.6	100

Notes:
1. Includes the following two industries: crude petroleum and natural gas, and refined petroleum and coal products.
2. Includes the following industries: aircraft and aircraft parts, motor vehicles, motor vehicle parts and accessories, trucks, bodies and trailers.

Source:
Statistics Canada, National Accounts and Environment Division.

1.2 Capital expenditures on environmental protection

Expenditures by type of activity

As shown in Table 1.2, investment in environmental protection activities was characterized by end-of-pipe construction and equipment for PAC purposes, which in 1994 accounted for $ 1 billion or 63% of capital expenditures on environmental protection. Lower capital expenditures on integrated processes for PAC were reported ($216 million, or 13.7% of total investment in environmental protection). It may be that implementation of process integrated equipment or construction was done first for efficiency reasons and as such was not included in the survey, with pollution prevention being a secondary benefit to a company. Among other environmental protection activities, investment in environmental monitoring and in reclamation and decommissioning projects represented respectively 9% and 7% of environmental protection investment (see also Tables A.2 and A.3 of the Statistical Annex).

Regional breakdown

For all regions the majority of investment was made for end-of-pipe PAC facilities and equipment. However, the size of investment in other environmental protection activities varied from one region to the next, due to the types of industries and environmental regulations (Table A.2).

Quebec and Ontario each accounted for about 31% of investment on environmental protection. In Ontario and in the Atlantic provinces the second largest capital expenditures after end-of-pipe expenditures for PAC were expenditures for PAC integrated processes ($91 million and $19 million respectively). In contrast, in Quebec and in British Columbia, environmental monitoring was the second highest capital expenditure on environmental protection, after PAC end-of-pipe projects (12% and 19% of environmental protection investment respectively). However, reclamation and decommissioning projects were the second most important investment activity in the Prairies provinces, after end-of-pipe investment.

Industry breakdown

Among the industries covered by the survey, the largest investment in environmental protection by far was made by the pulp and paper industry (39% of total environmental protection investment or $613 million), as shown in Table 1.2. This large expenditure coincides with the impending deadlines for regulation of emissions imposed by the federal government and certain provincial governments, especially Quebec. This caused companies to invest in waste-water treatment facilities (end-of-pipe) and closed-loop systems that would reuse water. Indeed more than three quarters of pulp and paper investment in environmental protection was directed toward end-of-pipe PAC facilities, especially those relating to secondary waste-water treatment. The second most important investment in this industry was monitoring equipment ($81.5 million).

Crude petroleum, natural gas and refined petroleum and coal products industries invested $306 million on environmental protection (19% of total investment on environmental protection). In these industries, end-of-pipe investment for PAC represented 62% of their whole investment in environmental protection. In comparison, reclamation and decommissioning projects accounted for 15% of capital expenditures for environmental protection in that industry group, followed by integrated processes for PAC (Table A.3).

Table 1.2
Capital Expenditures on Environmental Protection by Industry and Type of Activity, 1994

Industry	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	PAC end-of-pipe facilities	PAC integrated processes	Total	Share of total
	million dollars							percent
Logging	0.5	..	1.6	4.0	1.5	1.0	8.6	0.5
Mining	8.4	0.6	27.8	1.1	42.5	20.2	100.6	6.4
Crude petroleum, natural gas and refined products[1]	20.8	14.4	44.4	2.1	189.8	34.4	305.9	19.4
Food	6.6	0.3	1.2	..	13.6	12.5	34.2	2.2
Beverage	..	..	3.5	-	4.0	14.1	21.7	1.4
Pulp and paper	81.5	0.7	3.3	1.0	469.8	57.0	613.3	38.8
Primary metals	2.3	x	0.7	x	63.8	18.2	87.0	5.5
Fabricated metal products	4.1	0.1	0.1	..	2.3	1.4	8.1	0.5
Transportation equipment[2]	1.1	0.3	2.9	..	9.6	21.2	35.0	2.2
Non-metallic mineral products	2.8	x	0.2	x	13.6	3.1	20.3	1.3
Chemicals and chemical products	8.4	0.1	6.5	0.1	48.7	20.4	84.2	5.3
Electric power and gas distribution	9.5	36.2	17.9	45.1	140.6	12.8	262.1	16.6
Total	145.9	55.1	109.9	54.2	999.7	216.2	1 581.0	100.0

Notes:
Figures may not add due to rounding.
1. Includes the following two industries: crude petroleum and natural gas, refined petroleum and coal products.
2. Includes the following industries: aircraft and aircraft parts, motor vehicles, motor vehicle parts and accessories, trucks, bodies and trailers.
Source:
Statistics Canada, National Accounts and Environment Division.

The electric power and gas distribution industry invested $262 million in environmental protection. Capital expenditures on PAC end-of-pipe dominated as well, representing about half of capital expenditures on environmental protection in that industry. Other areas of investment included wildlife and habitat protection, and environmental assessments and audits.

Some integrated mining and forestry companies could not provide good detail by industrial sector. This could help to explain the lower value in logging, especially because in that industry environmental protection expenditures are often part of the cost of doing business. Environmental protection expenditures in logging were mostly operational (see Table 1.5).

Capital expenditures by type of medium

PAC end-of-pipe investment

As shown in Table 1.3 and Table A.4, end-of-pipe construction and equipment for PAC purposes were characterized mainly by projects involving the reduction of effluents since half of end-of-pipe investment related to the protection of surface water. Waste-water treatment technologies for instance were frequently listed among the most significant end-of-pipe projects. Air pollution control accounted for 28% of end-of-pipe investment. A very small proportion of end-of-pipe investment was related to noise and radiation protection.

In the crude petroleum, natural gas and refined petroleum and coal products industries projects involving air pollution control were the main reason for PAC end-of-pipe investment (in projects such as flare systems or flue gas desulphurization). In the transportation equipment industries, air pollution control was also the main reason for investing in end-of-pipe installations (some of the projects included precipitators and separators equipment). In the logging and electric power and gas distribution industries, protection of soil and groundwater was the main reason for investing in end-of pipe equipment. However in the latter case, air pollution control involved significant end-of-pipe investment as well.

Table 1.3
Distribution of End-of-Pipe Capital Expenditures for Pollution Abatement and Control by Medium and Industry, 1994

Industry	Surface water	Air	Soil and groundwater	Noise and radiation	Total
	percent				
Logging	10.8	9.8	79.8	-	100
Mining	60.3	12.1	27.5	0.1	100
Crude petroleum, natural gas and refined products[1]	10.2	65.9	22.6	1.3	100
Food	73.2	16.7	8.6	1.5	100
Beverage	96.0	2.5	1.6	-	100
Pulp and paper	82.7	8.5	8.6	0.1	100
Primary metals	39.6	40.4	18.8	1.5	100
Fabricated metal products	32.9	35.9	30.8	0.4	100
Transportation equipment[2]	19.9	54.8	22.7	2.6	100
Non-metallic mineral products	14.3	78.1	7.3	0.3	100
Chemicals and chemical products	53.7	26.8	19.4	0.3	100
Electric power and gas distribution	8.0	39.6	44.5	7.8	100
Total	51.5	28.4	18.5	1.6	100

Notes:
Figures may not add due to rounding.
1. Includes the following two industries: crude petroleum and natural gas, and refined petroleum and coal products.
2. Includes the following industries: aircraft and aircraft parts, motor vehicles, motor vehicle parts and accessories, trucks, bodies and trailers.
Source:
Statistics Canada, National Accounts and Environment Division.

Process-integrated PAC investments

Half of capital expenditures on PAC integrated processes were made to prevent or reduce air pollution in all regions, while 28% were related to surface water protection, as shown in Table 1.4. The exceptions were food, pulp and paper, and fabricated metals industries where the majority of expenditures on PAC integrated processes were made to abate effluents. In the electrical power industry, most of PAC integrated process investment was associated with noise and radiation abatement. In the logging industry soil protection was the main reason for investing in integrated process changes.

Table 1.4

Distribution of Process-Integrated Capital Expenditures for Pollution Abatement and Control by Medium and Industry, 1994

Industry	Air	Surface water	Soil and groundwater	Noise and radiation	Total
	percent				
Logging	40.0	-	60.0	-	100
Mining	58.6	19.1	20.3	2.1	100
Crude petroleum, natural gas and refined products[1]	91.3	1.7	6.9	0.2	100
Food	19.4	73.0	6.4	1.3	100
Beverage	80.3	13.6	6.2	-	100
Pulp and paper	38.2	59.3	2.5	-	100
Primary metals	43.3	26.5	29.7	0.5	100
Fabricated metal products	35.6	61.0	2.4	1.0	100
Transportation equipment[2]	51.5	18.2	30.1	0.2	100
Non-metallic mineral products	55.9	12.5	31.7	-	100
Chemicals and chemical products	72.4	9.2	16.3	2.1	100
Electric power and gas distribution	18.1	-	0.6	81.4	100
Total	54.0	28.4	12.2	5.4	100

Notes:

Figures may not add due to rounding.

1. Includes the following two industries: crude petroleum and natural gas, and refined petroleum and coal products.
2. Includes the following industries: aircraft and aircraft parts, motor vehicles, motor vehicle parts and accessories, trucks, bodies and trailers.

Source:

Statistics Canada, National Accounts and Environment Division.

Even though air pollution control accounted for the highest proportion of process-integrated investment , other projects cited as process-integrated PAC projects included water use reduction and reuse, energy conservation systems and land management projects.

Examples of end-of-pipe and integrated process projects for certain industries are shown in Table A.6.

1.3 Operating expenditures on environmental protection

Expenditures by type of activity

Like capital expenditures, operating expenditures on end-of-pipe installations and equipment dominated in 1994, at $828 million or 40% of total operating, as shown in Table 1.5. Purchases of waste and sewerage services from contractors or governments and monitoring expenditures were also significant, each representing around 12% of operating expenditures on environmental protection.

Regional breakdown

Forty-two percent of operating expenditures for environmental protection were made in Ontario, whereas less than 19% were made in Quebec. This represents a much smaller share of the total than the capital expenditure share (Tables A.2 and A.7). In addition, Quebec was the only region where capital expenditures were more important than operating expenditures for environmental protection. This was true of most activities.

In addition to PAC end-of-pipe expenditures, operating expenditures on environmental protection in Ontario were also characterised by the purchase of waste management and sewerage services ($134 million or 15% of operating expenditures on environmental protection), as shown in Table A.7. In Quebec, environmental monitoring was the second most important type of environmental protection expenditure, at $69 million (18% of operating expenditures on environmental protection). In British Columbia and in the Prairies provinces, running reclamation and decommissioning projects consumed the second largest amount of spending (12% and 15% of operating expenditures on environmental protection).

Industry breakdown

As shown in Table 1.5 it is the primary metals industry that spent the most on operating environmental protection projects ($391 million or 19% of total operating expenditures on environmental protection). Almost half of its expenditures were made toward end-of-pipe facilities and equipment. Operating expenditures on PAC integrated processes, in comparison, represented 18% of total operating expenditures on environmental protection in the primary metals industry, while running environmental monitoring projects accounted for 12% of operating expenditures on environmental protection (Table A.8).

The second largest amount of operating expenditures was made by the crude petroleum, natural gas and refined petroleum and coal products industries ($345 million or 17% of total operating on environmental protection). In addition

Table 1.5
Operating Expenditures on Environmental Protection by Industry and Type of Activity, 1994

Industry	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	Waste management and sewerage services	PAC end-of-pipe facilities	PAC integrated processes	Fees, fines and licences	Other	Total	Share of total
	million dollars										percent
Logging	4.5	1.1	23.4	29.0	2.4	2.2	0.8	0.8	3.0	67.4	3.3
Mining	30.4	8.7	47.9	2.6	4.0	102.3	14.6	6.0	11.4	227.8	11.1
Crude petroleum, natural gas and refined products[1]	14.6	6.0	38.9	5.7	17.3	220.4	19.1	4.5	18.9	345.4	16.8
Food	9.6	12.3	3.1	0.3	39.8	11.3	1.5	4.5	3.6	86.1	4.2
Beverage	0.2	1.0	3.8	-	12.8	1.4	0.8	1.2	1.6	22.8	1.1
Pulp and paper	59.9	5.9	11.5	3.1	22.6	101.6	45.5	7.3	15.9	273.3	13.3
Primary metals	46.0	4.6	18.5	0.2	39.3	185.2	71.2	7.9	17.5	390.6	19.0
Fabricated metal products	8.0	1.2	3.8	-	15.8	14.9	0.2	0.3	1.2	43.5	2.1
Transportation equipment[2]	5.5	2.7	9.8	0.7	47.2	24.1	4.0	0.6	12.5	107.0	5.2
Non-metallic mineral products	3.9	1.1	5.3	0.2	8.0	6.3	1.3	1.5	3.7	31.3	1.5
Chemicals and chemical products	35.2	8.1	24.4	0.6	36.1	74.2	7.8	1.1	13.0	200.6	9.7
Electric power and gas distribution	19.9	26.6	26.6	26.0	12.4	84.2	19.6	7.7	39.2	264.2	12.8
Total	235.9	81.3	217.2	68.4	257.7	828.1	186.2	43.6	141.6	2 060.0	100.0

Notes:
Figures may not add due to rounding.
1. Includes the following two industries: crude petroleum and natural gas, refined petroleum and coal products.
2. Includes the following industries: aircraft and aircraft parts, motor vehicles, motor vehicle parts and accessories, trucks, bodies and trailers.
Source:
Statistics Canada, National Accounts and Environment Division.

to PAC end-of-pipe expenditures, these industries were also involved in operating reclamation and decommissioning projects for $39 million (11% of operating expenditures on environmental protection.

Operating expenditures made by the pulp and paper industry and by the electricity and gas distribution industry were also significant, representing each 13% of operating expenditures on environmental protection. In the pulp and paper industry monitoring represented 22% of operating expenditures on environmental protection. The lowest amounts were recorded in the beverage and non-metallic minerals products industry groups, each accounting for 1% of total operating expenditures on environmental protection

Purchase of waste management and sewerage services

Purchases of waste collection and treatment services and of sewerage services constituted the second type of operating expenditure on environmental protection in 1994 (12.5%). Most of those services, 85%, were provided by private contractors ($219 million), and this was true of all regions and industries (Tables A.9 and A.10).

The largest purchases of waste management and sewerage services were made in the transportation equipment industry ($47 million or 18% of total purchases of waste management and sewerage services). Other major purchases were made by the food and primary metals industries, and by the chemicals and chemical products industry.

Conclusion

The Environmental Protection Expenditure Survey, 1994 provided new detailed information on the types of environmental protection activities and related costs that industries were facing in 1994, in response to or in anticipation of environmental regulations and conventions. The study revealed that the largest expenditures were associated with PAC end-of-pipe solutions. This does not mean that companies did not implement or operate integrated processes for PAC purposes. Rather, those that did would not necessarily report such expenditures as PAC expenditures. In those cases, consequently, there was no environmental protection expenditure as defined in this study.

The survey also showed that the distribution of environmental protection expenditures by type of activity varied from one region to the other. The pulp and paper industry invested more than any other industry surveyed in environmental protection. This can be explained by the limit date for compliance of pulp and paper mills to federal and Quebec environmental regulations in particular by the end of 1995. The primary metals industry, along with the group composed of the crude oil and natural gas industry and the refined petroleum and coal products industry spent the most on running environmental projects.

Other projects

In order to continue collecting data on environmental protection expenditures, the second cycle of the *Environmental Protection Expenditure Survey*, for 1995, has just been

launched. It covers all establishments with 50 or more employees active in the industries surveyed in 1994, but the survey scope has been extended to cover the rest of the manufacturing sector as well, through a sample. The 1995 survey also covers all of the oil and gas pipeline transport industry.

A simplified version of the questionnaire is given to respondents from the manufacturing industries introduced in the 1995 survey, as an attempt to reduce the response burden of companies not expected to have expenditures as significant as those reported in industries surveyed in 1994. Results are expected to be released in May, 1997.

The Statistics Canada survey on *Research and Development in the Canadian Industry* provides some information on total expenditures for research and development (R&D) made for pollution abatement and control purposes since 1990 in industry. R&D expenditures were not covered in this study. A report on PAC R&D expenditures, based on the R&D survey, has just been released in Statistics Canada's *Science Statistics Service Bulletin* for November.

Data on government expenditures on environmental protection are also being collected, mainly from public accounts data. In addition to information on the cost of adopting environmental protection practices, Statistics Canada is also involved in collecting data on the producers of environmental goods and services, in identifying and measuring the "environmental industry". To that effect information on revenues from environmental projects earned by consulting engineers firms and by scientific services firms is being collected. It will be completed by a new survey, the *Environment Industry Survey*, which will gather financial data on companies involved in that industry, as well as information on markets and types of activities. Also, the *Waste Management Industry Survey* collects data on revenues, expenses and volume of waste associated with the transportation and treatment of waste.

2 Survey Methodology

2.1 Objective

The Environmental Protection Expenditure Survey provides information on capital and operating expenditures made by the industry in order to comply to or to anticipate environmental regulations or conventions. It follows on the *1989 Pollution Abatement and Control Survey*, a pilot survey on pollution abatement and control (PAC) expenditures made by the public and business sectors in 1989. In the 1994 survey governments are not covered but the scope was broadened to allow for a more extensive coverage of environmental protection activities (see Text Box 1.1). Therefore any comparison with the results of the 1989 survey should be done with caution. An analysis of the 1989 results is available from Statistics Canada (1992).

Some data on capital expenditures in the business sector exist for selected assets relating to pollution abatement and control (PAC), such as PAC construction and equipment, waste disposal facilities and sewerage systems, sanitation equipment and mine tailing disposal systems (See Gagnon, 1996). However, since the pilot survey of 1989 on pollution abatement and control, no other data on operating costs of environmental protection in the business sector had been produced.

2.2 Coverage and data collection

The data reported in this study are based upon a survey of 3577 establishments in thirteen industries selected for their relatively high levels of PAC expenditures (Text Box 2.1). These industry groups were chosen based upon the results of Statistics Canada's annual *Capital and Repair Expenditure Survey*. That survey provided information on industries that had relatively high capital expenditures on assets associated with pollution abatement and control. The *U.S. Pollution Abatement Costs and Expenditures Survey* provided guidance as to which industries had relatively high operating expenditures for PAC purposes. Other environmental protection expenditure surveys done in Australia and the Netherlands were also examined.

A list of establishments was produced using mailing lists from Statistics Canada's *Manufacturing Survey, Capital and Repair Expenditure Survey*, and other mailing lists of establishments active in the following industries: crude petroleum and natural gas, coal mining, electrical power and gas distribution. A list of metal and non-metal mining establishments was produced, based on Natural Resource Canada's *Census of Mines*.

Text Box 2.1
List of Selected Industries

- Logging (SIC 041)
- Mining (SICs 061, 062, 063)
- Crude Petroleum and Natural Gas (SIC 071)
- Food (two digit SIC 10)
- Beverage (two digit SIC 11)
- Pulp and Paper (SIC 271)
- Primary Metals (two digit SIC 29)
- Fabricated Metal Products (two digit SIC 30)
- Transportation Equipment: Aircraft and Aircraft Parts; Motor Vehicles; Trucks, Bus Bodies and Trailers; Motor Vehicle Parts and Accessories (SICs 321, 323, 324, 325)
- Non-Metallic Mineral Products (two digit SIC 35)
- Refined Petroleum and Coal Products (two digit SIC 36)
- Chemicals and Chemical Products (two digit SIC 37)
- Electric Power Systems and Gas Distribution Systems (SICs 491, 492)

The selected manufacturing industries accounted for about half of total manufacturing employment in 1994, while the establishments surveyed in these manufacturing industries represented almost 34% of total manufacturing employment. In the mining and crude petroleum and natural gas industries in comparison, the surveyed establishments accounted for almost three quarters of total employment in these industries[1].

Pilot survey

A preliminary pilot survey of 500 establishments was conducted in May 1995 to test the questionnaire. It excluded the food and beverage industries, the fabricated metal products industry and the transportation equipment industry. From this test it was concluded that establishments with less than 50 employees had relatively few environmental protection expenditures and therefore would not be surveyed.

It was also concluded that questions relating to process-integrated PAC had to be simplified. On the initial questionnaire, several questions were asked to attempt to differentiate between, on the one hand, expenditures for efficiency purposes that had an environmental effect, and on the other, expenditures that were primarily for environmental purposes. Finally, after examining a number of ways to determine that distinction, including expenditure estimates

1. Data on employment comes from Industry Division's various publications.

in other countries, it was left to the respondent to determine this distinction. The scope was to include all expenditures that were required by environmental regulation or convention (See the questionnaire for further explanation). The full mail out of the survey took place in October, 1995.

2.3 Response and data quality

The quality of the data depends, among other influences, upon the accuracy of the responses as well as the response rate. The accuracy of the responses to this survey is difficult to assess since there are very few possibilities to cross-check the data. Most Statistics Canada surveys collect financial data that can be compared to company financial statements. These statements provide some control since the total expenditure is known and it is possible to judge the elements of expenditures in this context, using also environmental protection expenditure statements where they exist. However, accounting for environmental protection expenditures is still relatively new. Certainly, environmental protection expenditures must be less than total expenditures but there is no historical evidence by the business sector as to what could be used to set confidence intervals. This will be developed as the survey is repeated over time. However some partial information on capital expenditures for pollution abatement and control construction and equipment may be used as described above (see Section 2.1), based on the *Capital and Repair Expenditure Survey*[1].

There was considerable variability in the ability of companies to respond to the survey. Some were able to report without problems, whereas others had considerable difficulty, indicating that environmental protection expenditures (especially operating) were an integral part of their overall operations and they were difficult to distinguish with any reliability. This problem was particularly pronounced in the mining, petroleum, chemical and logging industries.

Response rates

Table 2.1 shows the response rates obtained for each industry, according to both number of reporting units and employment. There were 2633 reports for 3577 establishments.

The response rate for the 1994 survey was around 65%, depending on whether it was based on number of reporting units or on employment covered. This is a good result con-

1. See Gagnon, 1996 for more details on these types of assets.

Table 2.1
Response Rates by Industry and Region, 1994

	According to number of reporting units			According to employment		
Industry	Selected	Returned	Returns as a percentage of selections	Selected	Returned	Returns as a percentage of selections
Logging	73	40	55	9 446	6 507	69
Mining	143	72	50	38 157	22 453	59
Crude oil and natural gas	81	47	58	20 261	13 715	68
Food	609	373	61	119 121	76 922	65
Beverage	40	22	55	11 351	3 763	33
Pulp and paper	82	65	79	52 757	36 177	69
Primary metals	165	107	65	76 979	52 654	68
Fabricated metal products	551	365	66	63 522	42 255	66
Transportation equipment[1]	345	235	68	161 222	92 182	57
Non-metallic mineral products	157	92	59	15 762	9 382	60
Refined petroleum and coal products	28	17	61	4 676	2 830	60
Chemicals and chemical products	289	199	69	58 104	34 744	60
Electric power & gas distribution	70	55	79	107 855	91 907	85
Total	**2 633**	**1 689**	**64**	**739 213**	**485 491**	**66**
Region	Selected	Returned	Returns as a percentage of selections	Selected	Returned	Returns as a percentage of selections
Atlantic provinces[2]	223	123	55	72 281	28 509	39
Quebec	551	358	65	193 628	113 793	59
Ontario	1 245	837	67	334 911	245 667	73
Prairie provinces[3], Yukon and Northwest Territories	373	228	81	83 167	56 476	68
British Columbia	241	143	59	55 226	41 046	74
Total	**2 633**	**1 689**	**64**	**739 213**	**485 491**	**66**

Notes:
1. Includes the following industries: aircraft and aircraft parts, motor vehicles, motor vehicle parts and accessories, trucks, bodies and trailers.
2. Atlantic provinces include Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick.
3. Prairie provinces include Manitoba, Saskatchewan and Alberta.

Source:
Statistics Canada, National Accounts and Environment Division.

sidering that this was the first year that the survey was conducted and the questions were relatively difficult to answer.

Verification and imputation

A validation of the data was done first to ensure that totals added and that the proper units were used.

Imputation for missing responses was performed in three stages. First, all possible related information was assembled and some companies were re-contacted to provide further indicators to help allocate expenditures by province or region where this information was missing. Second, total environmental protection expenditures were estimated on a per-employee basis. A linear regression was performed in order to determine an unbiased estimator relating employment and environmental protection expenditures. This estimator, which was specific to region and industry, used employment of non-responding establishments. Finally, the missing components of environmental protection expenditures (for partial responses) were estimated as a proportion of total expenditures, using donors from the same industry and region where possible.

It could be argued that revenue is a better imputation variable than employment since there are considerable differences in per-employee revenues depending upon the degree of capitalization of a company. Although this may be true, these fluctuations are attenuated by segmenting the sample by region and industry for imputation purposes. Employment was the one variable that was readily available for most establishments but in subsequent years the use of revenue or expenditure will be investigated.

Table 2.2 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 expenditure category and by industry. It can be seen that the percentage of imputed value to the total value was higher for the crude petroleum and gas industry and the non-metallic mineral products industry, around 40%. For that reason and also because of confidentiality problems, data from the crude petroleum and natural gas industry were combined with data from the refined petroleum and coal products industry. A comparable solution was not available for the non-metallic mineral products industry. Therefore results from that industry are to be interpreted with caution.

Table 2.2
Imputation for Non Response as a Share of Total Environmental Protection Expenditures, 1994

Expenditure category	Imputed value as a percentage of total value (including imputation value)
Environmental monitoring - Operating	20.9
Environmental monitoring - Capital	17.1
Environmental assessments and audits - Operating	21.1
Environmental assessments and audits - Capital	12.9
Reclamation and decommissioning - Operating	25.4
Reclamation and decommissioning - Capital	30.0
Wildlife and habitat protection - Operating	23.8
Wildlife and habitat protection - Capital	14.3
Waste management and sewerage services, private contractor	24.0
Waste management and sewerage services, government	25.2
PAC end-of-pipe processes - Operating	20.2
PAC end-of-pipe processes - Capital	16.4
PAC integrated processes - Operating	19.4
PAC integrated processes - Capital	21.1
Fees, fines and licences	22.0
Other	20.4

Industry	Imputed value as a percentage of total value (including imputation value)
Logging	33.6
Mining	32.4
Crude oil and natural gas	38.5
Food	25.5
Beverage	27.5
Pulp and paper	8.8
Primary metals	19.8
Fabricated metal products	25.1
Transportation equipment[1]	21.2
Non-metallic mineral products	42.8
Refined petroleum and coal products	9.0
Chemicals and chemical products	24.5
Electric power and gas distribution	11.7

Notes:

Figures may not add due to rounding.

1. Includes the following industries: aircraft and aircraft parts, motor vehicles, motor vehicle parts and accessories, trucks, bodies and trailers.

Source:

Statistics Canada, National Accounts and Environment Division.

Data quality

There are two general categories of error in surveys. The first arises from the fact that a sample or subset of the target population is used to represent the population. This is referred to as sampling error and its size is quantifiable. The other category is referred to as a non-sampling error and is not as easily quantified because of its nature. Non-sampling error refers to all the other kinds of error that arise in surveys - incomplete or inaccurate lists of the target population, respondent misinterpretation of questions, provision of erro-

neous information, failure or refusal to respond, information processing errors, and so on.

Since this survey was sent to all establishments that were known to have more than 49 employees, in selected industries, the results are not affected by sampling errors. However they can only be taken to represent the group surveyed - establishments with more than 49 employees, carrying out business in the selected industries. For this same reason, the results can be said to represent a lower threshold for business sector expenditures on environmental protection - both for the selected industries and for manufacturing in general. Undoubtedly, if all establishments in all manufacturing industries were surveyed, the reported expenditures would exceed the results of this survey. Unfortunately, it is not possible to estimate with reasonable accuracy to what extent the expenditures would exceed these results, even by using some information from the *Capital and Repair Expenditure Survey*.

Every attempt was made to eliminate the non-sampling errors from the results of this survey. The retumed questionnaires were verified and validated before data capture. The data were edited and tabulated automatically. Extensive follow-up was carried out for incomplete responses and for non-response. Instructions and definitions had been refined using the results from Statistics Canada's pilot *Pollution Abatement and Control Survey*.

The most common difficulty reported by respondents was the inability of their record-keeping systems to isolate the environmental protection component of their many expenditures. As noted earlier, 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, with the consequence that 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 both sets of costs separately.

References

Gagnon, Pierre, 1996, "Private Sector Investment in Pollution Abatement and Control", in *Environmental Perspectives 3: Studies and Statistics*, Statistics Canada, Catalogue No. 11-528-XPE, No. 3, Ottawa, p.11-16.

Statistics Canada,1992, *Analysis of the 1989 Pollution Abatement and Control Survey*, uncatalogued, Investment and Capital Stock Division, Ottawa.

Annex: Statistical Tables

Table A.1

Capital Expenditures on Environmental Protection by Industry and Region, 1994

Industry	Atlantic provinces[1]	Quebec	Ontario	Prairie provinces[2], Yukon and Northwest Territories	British Columbia	Canada
			million dollars			
Logging	1.6	1.6	2.1	0.3	2.9	8.6
Mining	8.3	21.0	29.1	23.9	18.3	100.6
Crude petroleum, natural gas and refined products[3]	x	x	45.9	198.1	x	305.9
Food	4.5	4.8	20.5	3.0	1.4	34.2
Beverage	0.9	3.1	10.9	5.2	1.7	21.7
Pulp and paper	50.1	278.6	148.1	23.6	112.9	613.3
Primary metals	x	39.8	29.4	3.7	x	87.0
Fabricated metal products	0.2	0.7	5.1	1.7	0.4	8.1
Transportation equipment[4]	x	x	24.5	2.3	0.7	35.0
Non-metallic mineral products	0.9	3.9	10.6	3.8	1.2	20.3
Chemicals and chemical products	–	21.2	46.9	15.4	0.7	84.2
Electric power and gas distribution	13.9	77.7	126.7	29.1	14.7	262.1
Total	**108.1**	**486.3**	**499.8**	**310.1**	**176.8**	**1 581.0**

Notes:
Figures may not add due to rounding.
1. The Atlantic provinces include Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick.
2. The Prairie provinces include Manitoba, Saskatchewan and Alberta.
3. Includes the following two industries: crude petroleum and natural gas, and refined petroleum and coal products.
4. Includes the following industries: aircraft and aircraft parts, motor vehicles, motor vehicle parts and accessories, trucks, bodies and trailers.
Source:
Statistics Canada, National Accounts and Environment Division.

Table A.2

Capital Expenditures on Environmental Protection by Region and Type of Activity, 1994

Region	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	PAC end-of-pipe facilities	PAC integrated processes	Total
			million dollars				
Atlantic provinces[1]	6.2	x	4.2	x	65.2	19.5	108.1
Quebec	57.7	x	10.8	x	316.4	41.1	486.3
Ontario	29.4	11.3	19.2	4.3	344.3	91.3	499.8
Prairie provinces[2], Yukon and Northwest Territories	18.4	5.7	61.1	5.5	176.9	40.4	310.1
British Columbia	34.2	2.7	14.7	6.4	94.9	23.9	176.8
Canada	**145.9**	**55.1**	**109.9**	**54.2**	**999.7**	**216.2**	**1 581.0**

Notes:
Figures may not add due to rounding.
1. The Atlantic provinces include Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick.
2. The Prairie provinces include Manitoba, Saskatchewan and Alberta.
Source:
Statistics Canada, National Accounts and Environment Division.

Table A.3

Distribution of Capital Expenditures on Environmental Protection by Industry and Type of Activity, 1994

Industry	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	PAC end-of-pipe facilities	PAC integrated processes	Total
			percent				
Logging	5.9	--	18.2	46.5	17.1	11.7	100
Mining	8.4	0.6	27.6	1.1	42.2	20.1	100
Crude petroleum, natural gas and refined products[1]	6.8	4.7	14.5	0.7	62.1	11.2	100
Food	19.2	0.9	3.4	--	39.7	36.6	100
Beverage	--	--	16.1	--	18.5	64.9	100
Pulp and paper	13.3	0.1	0.5	0.2	76.6	9.3	100
Primary metals	2.6	x	0.8	x	73.3	21.0	100
Fabricated metal products	50.9	1.2	1.2	--	28.1	17.4	100
Transportation equipment[2]	3.1	0.9	8.1	--	27.3	60.4	100
Non-metallic mineral products	13.5	x	1.2	x	67.0	15.2	100
Chemicals and chemical products	10.0	0.1	7.7	0.1	57.8	24.2	100
Electric power and gas distribution	3.6	13.8	6.8	17.2	53.6	4.9	100
Total	**9.2**	**3.5**	**7.0**	**3.4**	**63.2**	**13.7**	**100**

Notes:
1. Includes the following two industries: crude petroleum and natural gas, and refined petroleum and coal products.
2. Includes the following industries: aircraft and aircraft parts, motor vehicles, motor vehicle parts and accessories, trucks, bodies and trailers.

Source:
Statistics Canada, National Accounts and Environment Division.

Table A.4

Distribution of End-of-Pipe Capital Expenditures for Pollution Abatement and Control by Medium and Region, 1994

Region	Surface water	Air	Soil and groundwater	Noise and radiation	Total
			percent		
Atlantic provinces[1]	67.3	17.3	14.2	1.2	100
Quebec	74.5	13.3	11.9	0.3	100
Ontario	46.3	27.1	23.4	3.2	100
Prairie provinces[2], Yukon and Northwest Territories	17.6	61.6	19.0	1.8	100
British Columbia	46.6	26.5	24.9	--	100
Canada	**51.5**	**28.4**	**18.5**	**1.6**	**100**

Notes:
Figures may not add due to rounding.
1. The Atlantic provinces include Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick.
2. The Prairie provinces include Manitoba, Saskatchewan and Alberta.

Source:
Statistics Canada, National Accounts and Environment Division.

Table A.5

Distribution of Process-Integrated Capital Expenditures for Pollution Abatement and Control by Medium and Region, 1994

Region	Air	Surface water	Soil and groundwater	Noise and radiation	Total
			percent		
Atlantic provinces[1]	60.0	21.5	9.0	9.5	100
Quebec	39.0	25.4	17.3	18.2	100
Ontario	46.8	40.3	11.5	1.4	100
Prairie provinces[2], Yukon and Northwest Territories	74.3	9.0	14.2	2.5	100
British Columbia	67.3	26.9	5.5	0.2	100
Canada	**54.0**	**28.4**	**12.2**	**5.4**	**100**

Notes:
Figures may not add due to rounding.
1. The Atlantic provinces include Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick.
2. The Prairie provinces include Manitoba, Saskatchewan and Alberta.

Source:
Statistics Canada, National Accounts and Environment Division.

Table A.6

Examples of End-of-Pipe and Integrated Process Projects for Pollution Abatement and Control, 1994

Industry	Project
Mining	Water use reduction and reuse Treatment and consolidation of tailings
Crude petroleum, natural gas and refined products[1]	Flare system Flue gas desulphurization Combustion and incineration systems Energy efficiency conversion, waste-to-energy system and other energy conservation projects Noise and odour control
Pulp and paper	Secondary waste water treatment systems, including activated sludge systems Water use reduction and reuse Electrostatic precipitators and separation
Primary metals	Air filtration Electrostatic precipitators and separation Flue gas desulphurization
Transportation equipment[2]	Electrostatic precipitators and separation Membrane filtration Oil/water separation
Chemicals and chemical products	Air filtration CFC control system Water use reduction and reuse Energy conservation systems
Electric power and gas distribution	Noise and odour control Catalytic oxidation and reduction systems Flue gas desulphurization Electrostatic precipitators/separation Oil/water separation Fuel substitution

Notes:
The list is not exhaustive.
1. Includes the following two industries: crude petroleum and natural gas, refined petroleum and coal products.
2. Includes the following industries: aircraft and aircraft parts, motor vehicles, motor vehicle parts and accessories, trucks, bodies and trailers.

Source:
Statistics Canada, National Accounts and Environment Division.

Table A.7

Operating Expenditures on Environmental Protection by Region and Type of Activity, 1994

Region	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	Waste management and sewerage services	PAC end-of-pipe facilities	PAC integrated processes	Fees, fines and licences	Other	Total
	million dollars									
Atlantic provinces[1]	8.0	3.0	12.5	2.9	8.6	58.4	23.1	1.0	5.8	123.3
Quebec	68.9	11.2	28.6	10.7	59.1	133.4	31.3	9.2	32.6	384.9
Ontario	81.9	44.1	82.3	12.8	134.2	369.9	76.7	13.8	53.9	869.4
Prairie provinces[2], Yukon and Northwest Territories	47.1	14.2	58.9	9.6	39.0	162.0	27.8	8.3	29.1	396.1
British Columbia	30.1	8.8	35.0	32.4	16.9	104.4	27.3	11.2	20.2	286.3
Canada	**235.9**	**81.3**	**217.2**	**68.4**	**257.7**	**828.1**	**186.2**	**43.6**	**141.6**	**2 060.0**

Notes:
Figures may not add due to rounding.
1. The Atlantic provinces include Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick.
2. The Prairie provinces include Manitoba, Saskatchewan and Alberta.
Source:
Statistics Canada, National Accounts and Environment Division.

Table A.8

Distribution of Operating Expenditures on Environmental Protection by Industry and Type of Activity, 1994

Industry	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	Waste management and sewerage services	PAC end-of-pipe facilities	PAC integrated processes	Fees, fines and licences	Other	Total
	percent									
Logging	6.8	1.7	34.8	43.1	3.6	3.2	1.2	1.2	4.4	100
Mining	13.4	3.8	21.0	1.1	1.7	44.9	6.4	2.6	5.0	100
Crude petroleum, natural gas and refined products[1]	4.2	1.7	11.3	1.6	5.0	63.8	5.5	1.3	5.5	100
Food	11.2	14.3	3.6	0.4	46.2	13.1	1.7	5.3	4.2	100
Beverage	0.9	4.4	18.8	.	56.2	6.0	3.5	5.2	7.1	100
Pulp and paper	21.9	2.2	4.2	1.1	8.3	37.2	16.6	2.7	5.8	100
Primary metals	11.8	1.2	4.7	0.1	10.1	47.4	18.2	2.0	4.5	100
Fabricated metal products	13.7	2.8	8.8	.	36.4	34.2	0.4	0.8	2.9	100
Transportation equipment[2]	5.2	2.5	9.2	0.6	44.1	22.5	3.7	0.5	11.7	100
Non-metallic mineral products	12.5	3.8	16.9	0.7	25.4	20.1	4.1	4.7	11.9	100
Chemicals and chemical products	17.5	4.1	12.2	0.3	18.0	37.0	3.9	0.6	6.5	100
Electric power and gas distribution	7.5	10.8	10.1	9.8	4.7	31.9	7.4	2.9	14.8	100
Total	**11.5**	**3.9**	**10.5**	**3.3**	**12.5**	**40.2**	**9.0**	**2.1**	**6.9**	**100**

Notes:
1. Includes the following two industries: crude petroleum and natural gas, and refined petroleum and coal products.
2. Includes the following industries: aircraft and aircraft parts, motor vehicles, motor vehicle parts and accessories, trucks, bodies and trailers.
Source:
Statistics Canada, National Accounts and Environment Division.

Table A.9

Purchase of Waste Management and Sewerage Services by Region, 1994

Region	Private contractor	Government	Total
	million dollars		
Atlantic provinces[1]	7.1	1.5	8.6
Quebec	53.4	5.6	59.1
Ontario	113.1	21.0	134.2
Prairie provinces[2], Yukon and Northwest Territories	30.5	8.5	39.0
British Columbia	14.5	2.4	16.9
Canada	**218.7**	**39.0**	**257.7**

Notes:
Figures may not add due to rounding.
1. The Atlantic provinces include Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick.
2. The Prairie provinces include Manitoba, Saskatchewan and Alberta.
Source:
Statistics Canada, National Accounts and Environment Division.

Table A.10

Purchases of Waste Management and Sewerage Services by Industry, 1994

Industry	Private contractor	Government	Total
	million dollars		
Logging	2.3	0.1	2.4
Mining	3.7	0.3	4.0
Crude petroleum, natural gas and refined products[1]	17.0	0.3	17.3
Food	22.7	17.1	39.8
Beverage	7.4	5.4	12.8
Pulp and paper	19.2	3.4	22.6
Primary metals	37.0	2.4	39.3
Fabricated metal products	14.6	1.3	15.8
Transportation equipment[2]	44.1	3.1	47.2
Non-metallic mineral products	6.9	1.0	8.0
Chemicals and chemical products	31.9	4.2	36.1
Electric power and gas distribution	11.8	0.6	12.4
Total	**218.7**	**39.0**	**257.7**

Notes:
Figures may not add due to rounding.
1. Includes the following two industries: crude petroleum and natural gas, and refined petroleum and coal products.
2. Includes the following industries: aircraft and aircraft parts, motor vehicles, motor vehicle parts and accessories, trucks, bodies and trailers.
Source:
Statistics Canada, National Accounts and Environment Division.

National Accounts and Environment Division

Survey of Environmental Protection Expenditures, 1994

Confidential when completed

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

Français au verso

Correct as required

Establishment name

Operating name

C / O

Address

City

Province Postal code

SURVEY OBJECTIVE

This survey measures the cost imposed on industry by environmental protection in Canada through Canadian regulations and conventions.

The results of this survey will be combined with government and household expenditures to form a complete accounting of the costs of environmental protection for 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.

INFORMATION

Important: please read the definitions and instructions provided at the end of the questionnaire before answering.

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, Canada
K1A 0T6

Telephone (toll-free): **1-800-255-7726**
Fax: **1-613-951-0709**

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.

Please return this questionnaire within 20 days of receipt.

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

1a. Reporting year.

Report must cover your most recent financial year ending between **April 1, 1994** and **March 31, 1995**.

	Day	Month	Year		Day	Month	Year
From	010	020	030	to	040	050	060

For Statistics Canada use only

Rec. D M Y	Ed. D M Y	Kyd. D M Y	Bat.	Coll.	FSC

4-2200-6, 1995-09-08 STC / CDN - 475-04244

1b. Industrial Activity.

This survey targets the 16 industrial sectors listed below. **Please complete one questionnaire for each of the sectors listed below in which you operate one or more establishments with at least 50 employees.** Only one questionnaire is required for any sector in which you operate regardless of the number of establishments which meet the above criterion.

Please consult the attached sheet for the list of your establishments that, according to our records, have 50 or more employees in the sector specified on the list. Please report any update on the list provided. If you are active in a sector listed below but have not received a questionnaire for that sector, please notify the Operations and Integration Division.

Industrial sectors surveyed:

- Logging (0411)
- Mines (061)
- Crude petroleum and natural gas (071)
- Pulp and paper (271)
- Primary metals (290)
- Non-metallic mineral products (350)
- Refined petroleum and coal products (360)
- Chemicals and chemical products (370)
- Food (100)
- Beverage (110)
- Fabricated metal products (300)
- Aircaft and aircraft parts (321)
- Motor vehicles (323)
- Trucks, bus bodies and trailers (324)
- Motor vehicule parts and accessories (325)
- Electrical power and gas distribution (491, 492)

If it is not possible to exclude expenditures for establishments with less than 50 employees, please include them and check here [1] ◯.

2. Environmental monitoring. *If response is none, please write "0" in corresponding box.*

Include

- all costs related to equipment, supplies, labour and purchased services that are used in response to or in anticipation of regulation or conventions requiring the monitoring of pollutants emitted by your company

	Operating expenditures $ 000		Capital expenditures $ 000		Total expenditures $ 000
Atlantic	095	+	105	=	115
Quebec	096	+	106	=	116
Ontario	097	+	107	=	117
Prairies, Yukon and N.W.T.	098	+	108	=	118
British Columbia	099	+	109	=	119
TOTAL	100	+	110	=	120

3. Environmental assessments and audits. *If response is none, 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 costs and consulting costs

	Operating expenditures $ 000		Capital expenditures $ 000		Total expenditures $ 000
Atlantic	125	+	135	=	145
Quebec	126	+	136	=	146
Ontario	127	+	137	=	147
Prairies, Yukon and N.W.T.	128	+	138	=	148
British Columbia	129	+	139	=	149
TOTAL	130	+	140	=	150

4. Site reclamation and decommissioning. *If response is none, please write "0" in corresponding box.*

Include

- expenditures to clean up environmental damage resulting from your company's operations
- decommissioning expenditures

Exclude

- any fine or compensation for environmental damage (this is to be reported in Question 13)
- any provision for future environmental liability

	Operating expenditures $ 000		Capital expenditures $ 000		Total expenditures $ 000
Atlantic	155	+	165	=	175
Quebec	156	+	166	=	176
Ontario	157	+	167	=	177
Prairies, Yukon and N.W.T.	158	+	168	=	178
British Columbia	159	+	169	=	179
TOTAL	160	+	170	=	180

5. Protection and restoration of wildlife and habitat. *If response is none, please write "0" in corresponding box.*

Include

- expenditures made in compliance with regulations or conventions to protect wildlife and habitat from the effects of your company'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		Capital expenditures $ 000		Total expenditures $ 000
Atlantic	185	+	195	=	205
Quebec	186	+	196	=	206
Ontario	187	+	197	=	207
Prairies, Yukon and N.W.T.	188	+	198	=	208
British Columbia	189	+	199	=	209
TOTAL	190	+	200	=	210

6. Purchased waste collection and disposal services and purchased sewerage services provided by a private contractor or by a government. *If response is none, please write "0" in corresponding box.*

Include

- all operating expenditures related to the use of a waste collection and disposal service provided by a private contractor or a federal, provincial or local government body
- all operating expenditures related to the use of a sewerage service provided by a federal, provincial or local government body

Exclude

- any expenditure for waste management activities done by your company's own employees
- any expenditure already included in Questions 2 to 5

Services provided by:	Private contractor(s) $ 000		Government(s) $ 000		Total $ 000
Atlantic	215	+	225	=	235
Quebec	216	+	226	=	236
Ontario	217	+	227	=	237
Prairies, Yukon and N.W.T.	218	+	228	=	238
British Columbia	219	+	229	=	239
TOTAL	220	+	230	=	240

End-of-Pipe Pollution Abatement and Control (PAC) Expenditures

7. End-of-Pipe PAC expenditures.

End-of-pipe PAC construction and equipment are not an integral part of production. Their sole purpose is to abate or to control undesirable substances emitted during normal production activities.

If response is none, 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 prevent or to reduce emissions of pollutants
- any expenditure related to the implementation or operation of an incinerator or a landfill site belonging to your company

Exclude

- any expenditure already included in Questions 2 to 6
- any waste recycling expenditure if that activity is integrated into a production process (Question 10)

	Operating expenditures $ 000		Capital expenditures $ 000		Total expenditures $ 000
Atlantic	245	+	255	=	265
Quebec	246	+	256	=	266
Ontario	247	+	257	=	267
Prairies, Yukon and N.W.T.	248	+	258	=	268
British Columbia	249	+	259	=	269
TOTAL	250	+	260	=	270

8. Did you report capital expenditures in Question 7?

1 ◯ Yes 2 ◯ No *Go to Question 10*

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

	Substances emitted to air %		Substances released to surface waters %		Substances released to soil or groundwater %		Noise or radiation %		
Atlantic	275	+	285	+	295	+	305	=	100%
Quebec	276	+	286	+	296	+	306	=	100%
Ontario	277	+	287	+	297	+	307	=	100%
Prairies, Yukon and N.W.T.	278	+	288	+	298	+	308	=	100%
British Columbia	279	+	289	+	299	+	309	=	100%

9. Please provide a brief description of your main end-of-pipe PAC projects.
Refer to page 8 for examples.

Process-integrated PAC Expenditures

10. Process-integrated PAC expenditures. *If response is none, please write "0" in corresponding box.*

Include

- all expenditures for new or significantly modified production processes that are mainly required by environmental regulations or conventions in order to prevent or to reduce emissions of pollutants and the amount of waste generated. Examples are process modifications to allow for material substitution, use of improved catalysts, and reuse of waste or water in the production system

Exclude

- expenditures already reported in Questions 2 through 7

	Operating expenditures $ 000		Capital expenditures $ 000		Total expenditures $ 000
Atlantic	495	+	505	=	515
Quebec	496	+	506	=	516
Ontario	497	+	507	=	517
Prairies, Yukon and N.W.T.	498	+	508	=	518
British Columbia	499	+	509	=	519
TOTAL	500	+	510	=	520

11. Did you report capital expenditures in Question 10?

1 ◯ Yes 2 ◯ No *Go to Question 13*

What percentage of this amount was spent on abating or controlling each of the

	Substances emitted to air %		Substances released to surface waters %		Substances released to soil or groundwater %		Noise or radiation %	
Atlantic	525	+	535	+	545	+	555	= 100%
Quebec	526	+	536	+	546	+	556	= 100%
Ontario	527	+	537	+	547	+	557	= 100%
Prairies, Yukon and N.W.T.	528	+	538	+	548	+	558	= 100%
British Columbia	529	+	539	+	549	+	559	= 100%

12. Please provide a brief description of your main process-integrated PAC projects.
Refer to page 8 for examples.

13. Environmental charges. *If response is none, please write "0" in corresponding box.*

Include

- permits, fees, levies, special assessments
- other charges paid to regulating bodies in order to allow operations to take place in your company
- any fines, penalties, or damage awards paid to government agencies or to individuals

	$ 000
Atlantic	755
Quebec	756
Ontario	757
Prairies, Yukon and N.W.T.	758
British Columbia	759
TOTAL	760

14. Other environmental protection expenditures. *If response is none, please write "0" in corresponding box.*

Include

- the costs of administration for an environmental affairs division
- training and information programs
- any other additional expenditures that are required to comply with environmental regulations or conventions

Exclude

- research and development expenditures

	$ 000
Atlantic	765
Quebec	766
Ontario	767
Prairies, Yukon and N.W.T.	768
British Columbia	769
TOTAL	770

Certification

I certify that, to the best of my knowledge, the information provided in this questionnaire is correct and complete.

775	Signature	Date (D / M / Y)	785	Title		
	X					
780	Name of person completing this questionnaire (Type or print)		790	Telephone No.	795	Fax No.

Comments *(Add a page if needed)*

Thank you for your cooperation

SELECTED ENVIRONMENTAL TECHNOLOGIES - Reference: Capital Projects, Questions 9 and 12.

Air and Water Treatment

Absorption and adsorption systems
Activated sludge systems
Aeration systems
Aerobic lagoon and pond systems
Air filtration equipment
Air stripping
Anaerobic contact systems
Bed filtration systems
Biological polishing
Catalytic oxydation and reduction systems
CFC control equipment
Chemical oxidation and reduction systems
Chlorination
Coagulation, flocculation and flotation
Combustion and incineration systems
Electrostatic precipitators and separators
Flare systems
Flue gas desulphurization
Gravity settling systems
Inertial separator
Ion exchanger
Membrane filtration
Neutralization systems
Nitrification and denitrification
Noise and odour control
Oil/water separation
Ozonation
Precipitation chambers
Primary clarification
Screening and degritting
Steam stripping
Tall stack systems
Thermal oxidation systems
Ultravoilet photolysis systems
Vapour condenser
Ventilation systems
Wet oxidation systems
Wet scrubbing systems

Land Management

Aeration/vapour extraction systems
Bioremediation methods
Injection grouting technology
Landfarming methods
Pozzalanic treatment methods
Pump and treat technologies
Remediation using soil washing
Solvent extraction technology
Thermal desorption technology

Site Decommissioning

Asbestos remediation technologies
Land clean up methods
PCB decontamination methods
Plant decommissioning
Site clean up methods
Underground storage tanks handling

Resource Management

Acid mine drainage control
Composting technology
Ecological landscaping methods
Geophysical methods
Geotechnical methods
Renaturalization methods
Site restoration methods

Energy Conservation

Clean fuel systems
Cogeneration
Energy efficiency conversions
Fuel substitution
Waste-to-energy systems

DEFINITIONS AND CONCEPTS

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

Environmental conventions refer to any formal, multi-party commitment 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 are the National Packaging Protocol to reduce packaging by 50 percent by the year 2000, the Canada-U.S. Air Quality Agreement, Ontario's Countdown on Acid Rain and the Pollution Prevention Pledge Program.

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

Pollution abatement and control (PAC) expenditures include all outlays for the primary purpose of preventing, abating or controlling the release of pollutants and generation of waste resulting from the operations of this company. Expenditures to produce PAC equipment for sale are excluded, as are expenditures for research and development, since the latter are reported in the Statistics Canada Survey on Research and Development in Canadian Industry.

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 1994 fiscal year.

Include all outlays for machinery and equipment 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 amortized nor depreciated.

Exclude any provisions for future environmental liability.

TO REPORT OPERATING EXPENSES

Include all cash expenses, rather than accruals, incurred during your 1994 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 that reduce the allowable harvest.

FOR MINING ACTIVITIES

Use Question 7 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. Use Question 14 to report imputed interest on funds held in trust against future environmental liabilities. Report only actual expenditures.