SUMMARY REPORT

THE QUÉBEC ENVIRONMENTAL PROTECTION INDUSTRY

Profiles and Opportunities

Gouvernement du Québec
Ministère de l'Industrie, du Commerce et de la Technologie

Industry, Science and Technology Canada
Industrie, Sciences et Technologie Canada

CRIQ
CENTRE DE RECHERCHE INDUSTRIELLE DU QUÉBEC

The Quebec Environmental Protection Industry

PROFILES AND OPPORTUNITIES

Summary Report

Gouvernement du Québec
Ministère de l'Industrie, du Commerce et de la Technologie

Industry, Science and Technology Canada

Industrie, Sciences et Technologie Canada

CRIQ
CENTRE DE RECHERCHE INDUSTRIELLE DU QUÉBEC

Table of Contents

List of Tables

List of Figures

1.0 Foreword

In March 1993, a study report entitled *"Profil sectoriel de l'industrie québécoise de la protection de l'environnement (IPE)"* was submitted to MICT (*Ministère de l'Industrie, du Commerce et de la Technologie*) and to ISTC (Industry, Science and Technology Canada). The present document summarizes that study, performed by the information services of CRIQ (*Centre de recherche industrielle du Québec*).

The principal aims of this study were:

- to assess the Quebec supply and demand for the products and services of this industry in the sectors of air quality, drinking water and wastewater, solid and hazardous wastes and chemical preparations;
- to identify the principal firms making up the Quebec environmental protection industry and to quantify its current importance and projected growth in terms of goods and services in Quebec;
- to assess the industry's strengths and weaknesses;
- to identify avenues of development and market possibilities.

The study attempted to identify the existing and future needs of goods and service users and the size of the industry. It also sought to determine the directions in which the supply of goods and services is evolving. Finally, it outlined prospects for development in the areas of goods and services, R&D and government support.

The project was carried out in five stages:

- preparation of a classification;
- an exhaustive mail survey;
- examination of various firms in industrial sectors of priority interest to governments because of their environmental impact;
- compilation of the collected data in a database;
- development of the outlook for development of the EPI.

MICT and ISTC have defined the EPI as follows:

"The environmental protection industry includes firms which offer goods and services in one or more areas contributing to the analysis, reduction, recovery, transportation, recycling, treatment, upgrading or elimination of materials which are potentially damaging to the environment, defined in the very broad sense of the definition given in section 1 of the *Loi sur la qualité de l'environnement*."

2.0 Structure of Quebec's Environmental Protection Industry

Of the 417 firms responding to the mail survey, 135 provide goods and 282 services. Table 1 shows the distribution of the respondents.

Table 1: Distribution of respondents by category of EPI goods and services

Goods	
Manufacturers	83
Distributors	52
Total	**135**
Services	
Consultants	103
R&D	30
Operations	113
Laboratories	36
Total	**282**

An estimated 600 to 850 Quebec firms, two thirds of them service industries, offer goods and services in the area of environmental protection. According to the CRIQ survey, the firms providing operations services[1] are the most numerous, followed by consulting firms.

Together, moreover, all of these environmental protection firms employ an estimated 11,000 to 18,000 people in Quebec. Service firms account for almost 80% of these jobs. Large firms provide 60% of the jobs, although they represent only 25% of all firms.

The statistics presented in this part relate to the survey sample, rather than the EPI population. Tables A and B, in the appendix, provide detailed information on the number of respondents by sector and services category.

Markets for Quebec's EPI firms

The overwhelming majority, 98%, of the 318 firms responding to this question sell their goods and services in Quebec. Of these, some also sell goods and services elsewhere in Canada: 30%, or 97/318, in Ontario; 20%, or 66/318, in the Maritimes; and 16%, or 51/318, in Western Canada. Some respondents sell outside Canada as well, as follows:

United states:	10.0%	(32/318)
Europe:	3.0%	(9/318)
Mexico, South America and Asia:	3.0%	(9/318)
Africa:	2.2%	(7/318)

Note that the sum of the percentages for the different markets is greater than 100%, since a single firm may sell in a number of territories.

It will be noted that half of the Quebec firms sell goods and services in Ontario and the Maritimes, while only 10% sell in the United States, compared to 20% of the Ontario EPI.

1 This category includes service firms which collect, treat and dispose of solid and hazardous wastes. It also includes firms specializing in testing and monitoring, waste handling and the design of waste management processes.

Figure 1: Distribution of respondents' revenues by geographic market

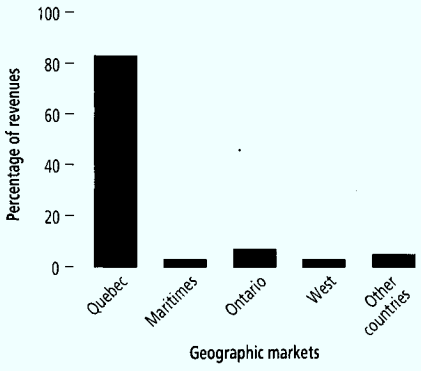
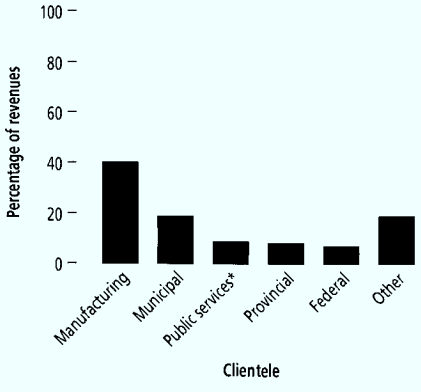
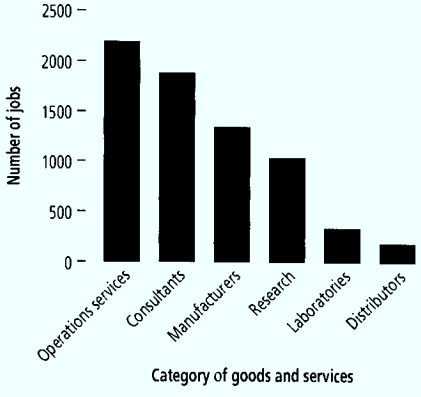


Figure 2: Distribution of respondents' revenues by clientele (1992)



* This sector includes electrical and gas distributors and firms offering transportation services.

Figure 3: Distribution of number of jobs provided by respondents by category of goods and services



These figures indicate that the respondents generate 83% of their revenues in Quebec, 11.5% elsewhere in Canada and 5.5% abroad. This distribution is illustrated in figure 1.

The respondents to CRIQ's 1992 survey sell their goods and services primarily to firms in the following sectors: the pulp and paper industry, the petroleum industry, primary metal processing and mines. Figure 2 illustrates the distribution of revenues by clientele. In 1992, the manufacturing sector led, with almost 40% of the sales. The second most important client group was municipalities, with 18%, followed by public services, with 9%, provincial governments, with 8%, and the federal government, with 6%. The remaining 19% of sales involved other bodies, including the agrifood, financial and business sectors, etc.

Employment

The 328 firms responding to the survey indicated that they provide employment for 7000 people. As figure 3 indicates, operations services account for the largest number of jobs with 2246, followed by consulting firms with 1890, manufacturers and distributors with 1470, research and development agencies with 1050 and laboratories, with 350. Environmental service firms thus provide a total of almost 80% of EPI jobs.

This job distribution is similar to that presented in a study performed by Ernst and Young on employment in the environmental industry in Canada. For example, they mention that production and distribution of goods represent 19% of the jobs, compared to 81% for services. Among service firms, waste handling and the operation of facilities, which are similar to the operations services category used here, account for 59% of all jobs and consulting services for 18%. Comparable similarities are evident between the distribution of employment in Quebec and in the Canadian industry.

Revenues

The 196 firms which provided this figure for the period 1990 to 1992 achieved revenues of $597 million in 1990 and $615 million in 1991. Estimated revenues for 1992 were $602 million, reflecting stability over this period, as indicated in table 2.

In 1990, 51% of the revenues of the firms responding to the survey were generated by manufacturers and distributors of goods, and the remainder by suppliers of services. In 1991 and 1992, this proportion declined to 45%.

The period studied shows an increase in the environmental activities of the existing firms. In fact, in 1990, the proportion of businesses generating environmental revenues of less than $500,000 was greater than in 1992, at 81% as compared to 75%. These figures also reflect fragmentation of the industry.

Table 2: Distribution of respondents' environmental revenues (real dollars)

Category	Number of respondents	Year 1990	1991	1992
Manufacturers	32	$ 292,821,294	$ 258,898,194	$ 255,281,384
Distributors	22	$ 13,615,500	$ 20,763,600	$ 16,260,000
Subtotal	**54**	**$ 306,436,794**	**$ 279,661,794**	**$ 271,541,384**
Consultants	71	$ 113,370,669	$ 138,055,420	$ 133,611,082
Research	10	$ 15,070,800	$ 16,057,300	$ 17,108,000
Laboratories	25	$ 19,969,789	$ 26,167,660	$ 25,827,206
Operations	36	$ 142,418,605	$ 155,131,649	$ 154,163,036
Subtotal	**142**	**$ 290,829,863**	**$ 335,412,029**	**$ 330,709,324**
TOTAL	**196**	**$ 597,266,657**	**$ 615,073,823**	**$ 602,250,708**

Firms providing operations services and manufacturers, as opposed to research agencies, show the largest proportion of revenues from environmental protection. Overall, however, all of the respondents experienced increases in environmental revenues between 1990 and 1992. These data suggest, once again, sustained growth of this industry in Quebec.

Table 3: Distribution of respondents and distribution of all industrial firms in Quebec

Regions	Number of respondents	%	All firms in Quebec [1] (%)
Lower St. Lawrence	7	1.7	2.8
Saguenay / Lac-Saint-Jean	9	2.0	3.3
Quebec City	49	11.7	7.0
Mauricie / Bois-Francs	29	7.0	9.6
Eastern Townships	13	3.0	5.3
Montreal	158	38.0	27.0
Outaouais	6	1.4	1.4
Abitibi-Témiscamingue	3	0.7	1.4
North Shore	2	0.5	0.7
Northern Quebec	0	—	0.2
Gaspé / Magdalen Islands	3	0.7	1.2
Chaudières / Appalachians	24	6.0	8.5
Laval	23	5.6	4.0
Lanaudière	14	3.3	5.4
Laurentians	12	2.8	5.5
Monteregian Hills	65	15.6	16.7
TOTAL	**417**	**100.0**	**100.0**

[1] CRIQ industrial database (manufacturing and wholesale industries), April 1992

Regional Distribution

The percentage of environmental firms in relation to all industrial sectors is higher in the Montreal and Quebec City regions. However, the inverse situation prevails in the regions, such as the North Shore or Abitibi. Table 3 illustrates these data. These observations suggest the following hypotheses:

- Except in the large centres, purchasers of goods and services must deal with suppliers from outside their region.
- The environmental industry is new and consequently less well developed in the regions than the other industrial sectors.

3.0 Financing of Environmental R&D

This part of the study was designed to describe the principal players in Quebec's R&D sector, to update the data on the financial resources devoted to this activity, to estimate these resources and, finally, to describe the principal programs available in Quebec to assist R&D.

On the basis of the available data obtained from the principal participants, including MENVIQ, Environment Canada, Hydro-Québec, CRIQ and the university community, environmental R&D expenditures in Quebec for 1991-1992 can be estimated at approximately $60 million. Table 4 indicates the approximate total expenditures and their sources. It should be noted that the reference years selected for this assessment were not the same for all participants and that the figures are indicated in 1991-1992 dollars.

Table 4: Estimated R&D-E expenditures in Quebec, 1991-1992 (millions of dollars)

Quebec ministries	19.5 *
Paragovernmental agencies	18.9
Industries	N/A
Environment Canada, internal	8.0
Environment Canada, external	4.5
Other federal departments	N/A
Fonds pour la formation des chercheurs et l'aide à la recherche	0.6
National Sciences and Engineering Research Council	3.4
University contributions	4.0
TOTAL	**58.9**

* 1989 data

Source: CRIQ

Government departments and other agencies offer the following major assistance programs for R&D-E.

Provincial Government

MENVIQ's *Direction de la recherche et des technologies environnementales* directs and administers four major programs of assistance for R&D-E. They are:

- *Fonds de recherche et de développement en environnement (FRDT-E)*
- *Programme d'aide à la RD-E*, general *(PARDE-GÉNÉRAL)*
- *Programme d'aide à la RD-E*, manure management improvement (*PARDE-PAAGF*)
- *Programme d'aide à la RD-E*, urban (*PARDE-URBAIN*)

FRDT-E, created in 1990, is one of the major programs. It has been allocated credits totalling $50 million over five years. Its purpose is to acquire strategic expertise in the areas of environmental protection and sustainable development, and to promote the emergence and development of an environmental industrial sector with the potential for high growth.

In total, 60% of project financing is provided by MENVIQ and 40% by the private sector.

In addition, a federal-provincial agreement, the Development and Demonstration of Site Remediation Technology Program (DESRT), was also signed in 1991. This program, which is administered by MENVIQ, includes three components: provincial orphan sites, technology demonstration and development, and remediation of federal sites.

CQVB (*Centre québécois de valorisation de la biomasse*) has been assigned the task of promoting R&D and technological innovation in the area of biomass upgrading. CQVB has contributed to 34 R&D projects involving technological innovation. These projects, which are designed to upgrade biomass, represent expenditures of some $1.4 million of a total investment of $5.5 million.

Federal Government

Environment Canada's **SLC** (**St Lawrence Centre**) is responsible for SLAP (St Lawrence Action Plan). This is a joint federal-provincial plan designed to reduce by 90%, by the end of 1993, the toxic liquid wastes discharged into the St Lawrence River and its principal tributaries by 50 large firms, considered to be the major polluters.

One component of the plan involves cooperation with the private sector in the development and demonstration of new environmental technologies for the elimination, or at least reduction, of the quantity of toxic substances, particularly industrial wastes, discharged into the St. Lawrence. The budget for the technological development and demonstration program totalled $17 million for the period 1989 to 1993; the program is to be extended.

Table 5 presents the total costs associated with each area of activity, together with the financial participation of the SLC. In addition, the Canadian government has announced that phase 2 of SLAP may begin in April 1993 with a budget of $100 million.

Environment Canada and ISTC also offer assistance programs for environment-related R&D as part of the Green Plan. The principal federal programs available to business are the following:

- ***Technologies for Environmental Solutions Initiative, consisting of three components:***
  - Environmental Technology Network;
  - Technology Transfer Program;
  - Environmental Technology Commercialization Program.

Table 5: Costs of technological development and demonstration projects conducted jointly by private-sector participants and SLC

Sector	Number of Projects	Total Cost ($000)	SLC Participation ($000)
Industrial wastewater	11	6,797.5	1,795.9 (26%)
Hazardous wastes	7	3,469.6	1,185.6 (34%)
Contaminated sediments	7	836.3	398.3 (48%)
Contaminated soils	6	3,501.1	789.8 (23%)
TOTAL	**31**	**14,604.5**	**4,169.8 (29%)**

Source: Technological Development and Demonstration, Project Profiles, Environment Canada, St Lawrence Centre, September 1992.

This $100-million initiative, launched in October 1991 for a period of five years, is designed to develop and market environmental technologies for dealing with the problems associated with pollution. Its aims include waste reduction and recycling, prevention of air and water pollution, and water conservation.

- ***Development and Demonstration of Resource and Energy Conservation Technology Program (DRECT).***

The Mine Environment Neutral Drainage Program (MEND) is designed to find new economical, effective and lasting methods of neutralizing effluents from slag heaps and mine tailings. This program is financed and administered by the Canadian mining industry and the governments of Canada, British Columbia, Manitoba, Ontario, Quebec and New Brunswick. Approximately $18 million are to be invested by 1997. To date, Quebec has invested $1.2 million. **CRM** (**Centre de recherche minérale**) administers more than a dozen research projects.

4.0 Factors in the Development of Quebec's EPI

In order to understand the development of an expanding industry like the EPI, it is essential to know the factors affecting it. These factors are government regulation, political authority, economic conditions and public opinion.

Experts and participants agree that environmental regulations are the major factor driving EPI growth. Other elements, however, affect the EPI market as well. Economic cycles, for example, have a relative impact on the amount of waste generated and on the firms' financial ability to undertake environmental projects.

Political authorities play a role as well, not only through the regulations which they impose and the manner in which they are administered, but also through their willingness to support the EPI. Finally, public opinion is an increasingly important factor and one which is making itself felt in various environmental decisions.

5.0 Estimated Demand for Goods and Services

The environmental protection market in Quebec is valued at approximately $1.5 billion for 1990. Demand has been assessed for 1990 in order to avoid excessive extrapolation, since most of the statistics relate to 1989. Table 6 summarizes the distribution of the market.

The market is divided almost equally between capital expenditures and operating or recurrent costs.

Assessment of this market involves a number of difficulties because the EPI is not a separate industrial sector but a group of multisectoral activities directed towards the improvement of the environment.

Table 6: Estimated demand for environmental protection goods and services in Quebec, 1990

Class	1990 Revenues (millions of dollars)
Construction of environmental systems	295
Materials, equipment, instrumentation, supplies	393
Consulting engineers and other consulting services	98
Analytic and laboratory services	17
Solid and hazardous waste management	743
TOTAL	**1,546**

6.0 Trends in the Demand for Air Treatment

The principal atmospheric pollutants measured are particulates, SO_2 (sulphur dioxide), CO (carbon monoxide), NO_x (nitrogen oxides), O_3 (ozone) and HCs (hydrocarbons). In addition, toxic pollutants such as lead, VOCs (volatile organic compounds) and PAHs (polycyclic aromatic hydrocarbons) are currently being studied by Environment Canada in the major cities and in the Windsor-Quebec and other corridors.

SO_2 Emissions

Quebec industries have achieved the objectives established by the Quebec government in 1980 in terms of SO_2 emission reductions. Because they have done so within the proposed timetable and because of the efforts of the copper industry, the regulations are unlikely to be tightened over the next ten years. Instead, long-range transport of this pollutant will be reduced by efforts to meet the objectives announced by the United States, under the terms of an air-quality agreement with Canada signed in March 1991. Scientific estimates indicate that 50% of the acid precipitation affecting Quebec comes from the United States and 25% from Ontario.

VOC and NO_x Emissions

In another context, two types of pollutants, VOCs and NO_x, are receiving increased attention from the provincial and federal governments. These two pollutants are believed to be responsible for the formation of **ground-level ozone**.

The various sources of VOC and NO_x emissions include transportation, which accounts for 33.1%, diffuse sources, such as gasoline stations and dry cleaning establishments (38.5%), combustion, such as wood heat and thermal power stations (13.8%), the petrochemical industry (10.4%), metallurgy (1.4%), the pulp and paper industry (0.8%), and other industries (2.0%).

In October 1988, the CCME (Canadian Council of Ministers of the Environment) developed a management plan for the reduction of NO_x and VOCs, which is expected to help eliminate the problem of ground-level ozone in Canada by 2005.

Greenhouse Gases

Canada is also committed to stabilizing emissions of greenhouse gases by the year 2000 and reducing them to 1990 levels. However, the measures required to meet this commitment have not yet been defined. A memorandum is to be submitted shortly to the CCME regarding the formation of a committee to develop strategies and measures for meeting this objective. The elements primarily responsible for the greenhouse effect are CO_2 (carbon dioxide), CH_4 (methane), N_2O (nitrous oxide) and CFCs (chlorofluorocarbons).

Toxic Substances

Finally, Environment Canada plans to prepare assessments by 1994 of 44 substances currently classified as being of priority interest under the *Canadian Environmental Protection Act*. Reports will be published by that date on options for the control of toxic substances in the emissions produced by the major industrial sectors. These include metal casting establishments, petroleum refineries, chemical plants, the metal plating industry, metal mines, metal processing plants and steel mills. All regulations and control mechanisms will be revised and updated every five years.

Opportunities in the Area of Air Treatment

The market for atmospheric pollution control is driven by three major factors: economic cycles, technological development and regulation.

In general, the costs of dust- and gas-control equipment are included in the costs of factories long before they come into operation. Given the current economic slowdown, a number of industries, including pulp and paper, refineries, steel mills and metal casting establishments, with the exception of aluminum plants, are unlikely to experience substantial increases in production which would necessitate the construction of new facilities.

Equipment for the treatment of dust and gases is not mass produced. It is normally "made to measure". Because it is dependent on the pollutant in question and the size of the industry, every technique is of some potential value. Solutions are thus developed by engineering firms for large numbers of companies. It is impossible to identify major technological trends. No one process is indispensable. To complicate matters for purchasers, a single dust collector or scrubber may not be enough. Entire systems of appropriate processes must be developed as well.

Finally, new plants designed to incinerate household or industrial wastes should be in place by the year 2000. They represent a potential market for the dust collection and gas scrubbing industry. Treatment of household wastes is difficult, not only because of their low heating capacity and varied composition, but also because of the hydrochloric acid and ash produced during incineration.

The principal industrial wastes requiring incineration are volatile organic compounds, such as solvents, oils, hydrocarbons and toxic heavy metals, including cadmium, mercury and lead.

7.0 Trends in the Demand for Wastewater Treatment

7.1 Industrial Wastewaters

The various government programs and provincial and federal regulations will have a substantial impact on water treatment activities. A number of trends have been noted in the United States and Ontario with respect to the use of chemicals. Some of the factors which affect the demand for goods and services in this field include:

- the proposed regulations on liquid wastes (R-300);
- the proposed regulations on liquid effluents from refineries;
- the provincial regulations on pulp and paper mills;
- the federal regulations on effluents from pulp and paper mills;
- the St Lawrence Action Plan;
- the Ontario government's MISA (Municipal Industrial Strategy for Abatement), which requires the elimination of persistent toxic substances and prohibits effluents which are damaging to fish;
- Ontario's multi-media approach, which will promote the demand for low-sludge water treatment systems;
- the new standards for liquid wastes from petroleum refineries, announced by the Ontario government in August 1992 and considered by the Vice-President of the Canadian Petroleum Products Institute to be among the most severe in North America;
- the current review of the *Clean Water Act* in the United States, which will stress reductions in the use of chemicals by industry in certain processes rather than wastewater treatment.

The PAEQ (*Programme d'assainissement des eaux du Québec*) was launched in 1978 as one of the Quebec government's principal efforts to control wastewater discharges into waterways and sewage systems. The program includes three components: urban, agricultural and industrial. Of the three, the urban component is the most advanced: in 1990, only 170 of 830 eligible municipalities were still unregistered, whereas the agricultural and industrial components did not begin to escalate until the late 1980s.

In addition, MENVIQ's PRRI (*Programme de réduction des rejets industriels*) will come into effect in the near future. This program is designed to reduce all industrial wastes — air, water, semi-liquid and solid — by 75% within the next ten years.

Under this program, MENVIQ will contact approximately 600 firms responsible for 80% of all wastes. Over the first five years, 200 firms from the pulp and paper, metallurgical, chemical and petroleum sectors which discharge effluents directly into waterways will be affected. By the year 2000, the standards governing discharges of wastes by approximately 400 firms in the metal plating, casting and tertiary petrochemical sectors, the majority of which discharge their effluents into sewage systems, will be tightened.

Under the PRRI, all industrial establishments concerned will be required to obtain a pollution control certificate in order to remain in business. As a result, they will be forced to comply with standards applying uniformly to all establishments within the same sector and governing wastes, installation and operation of wastewater treatment equipment, waste monitoring and transmission of the results to MENVIQ.

In 1988, the federal government, acting in collaboration with MENVIQ, launched the St Lawrence Action Plan, which was designed to reduce by 90%, by the end of 1993, the toxic wastes discharged by the 50 major polluters established along the St Lawrence River. This plan has permitted a tightening of the standards governing toxic wastes in effluents discharged by the pulp and paper, petroleum and chemical industries.

Firms not affected by PAEQ or SLAP will thus probably become subject to regulations which impose more visible restrictions on their effluents.

Opportunities in the Area of Industrial Wastewater Treatment

The initial restrictions on industry were designed to reduce organic materials (BOD) and suspended materials. This type of pollution could be controlled by means of primary treatment.

Since the mid-1980s, concern has focussed on discharges of effluents containing mercury, PCBs, metals and other toxic substances. The effects of these discharges on the environment have led to the analysis of several hundred substances, which are now included in the environmental standards. The facilities required to control this type of pollution involve secondary treatment, and in some cases tertiary treatment as well for pulp and paper mills and refineries.

A number of trends in wastewater treatment are becoming apparent:

- The number of contaminants to be controlled or eliminated is growing rapidly.
- Reductions in volume, recycling of water and recovery of energy are attracting growing interest.
- Departments of the Environment will emphasize prevention at the source through the use of clean technologies and process modifications, the impact of these wastes on water, air and soil, and non-transfer of problems from one medium to another.
- Low-sludge water treatment equipment and systems will be given priority.
- Regulations and standards governing wastewater treatment are rapidly becoming more stringent.
- Sludge disposal is a current concern and should lead to the development of new upgrading techniques.

To be competitive in industrial wastewater treatment, the EPI must be at the cutting edge in the fields of adsorption, advanced separation techniques such as membrane filtration, biological water treatment, including bioreactors, the development of new strains of bacteria, the use of aerating equipment, diffusers, etc, computer management and direct instrumentation, the use of industrial automation software and, finally, the treatment, upgrading or destruction of solids removed from wastewaters by means of incineration, solidification, oxidation and neutralization.

7.2 Municipals Wastewaters

On the municipal front, it is primarily the large municipalities which have acquired water and sewage treatment facilities. Some 66% of the total budget of approximately $7 billion has already been committed.

Small municipalities, those with 75 to 200 homes, do not have wastewater treatment systems. Currently, 250 of these municipalities in Quebec have sewage systems but do not treat their wastewaters. Of this number, 200 have populations under 1000. Because of their size, these municipalities, unlike those with populations over 1000, cannot justify the installation of traditional wastewater treatment systems. In addition, there may a market for lodging establishments containing more than six rooms and not covered by the regulations governing isolated homes, which use septic tanks and are not connected to a sewage system. Examples include isolated establishments with septic tank capacities of less than 4.8 m^3, such as tourist lodges, hotels, golf clubs and administrative, commercial or recreational establishments frequented by the public.

In view of the fact that the program was introduced in 1978 and that some types of equipment have an estimated lifespan of ten years, replacements will be required at least twice in the next few years. Some of the principal products and operations covered by these investments include air blowers (14%), sludge treatment (13.5%), screening (12%), sand removal (10.5%), settling tanks (9.5%), biodisks (7.5%) and wall-mounted slide valves (7.5%).

In addition, certain items of equipment which have presented problems or which have not lasted as long as anticipated will also have to be replaced. Examples include belt filters, blowers for oxidation ponds, where rotors and gaskets have shown premature wear, motors for centrifugal blowers, pump gaskets for pumping stations and equipment for the prevention of water-hammering.

Water treatment creates another problem: sludge disposal. According to MENVIQ data, the volume of sludge from purification plants is increasing rapidly. In fact, MENVIQ predicts that 180,000 metric tonnes, dry weight, will be recovered in the year 2000, compared to 60,000 tonnes in 1990. At the present time, 58% of these sludges are incinerated, 40% are landfilled and almost 2% are upgraded for agriculture and energy production. These proportions are unlikely to change, with the exception of landfilling, which, according to MENVIQ, should decline to 18%. It is estimated that 30% of these sludges could be processed to produce fertilizer.

Finally, the urban comunities of Montreal and Quebec City (CUM and CUQ) have projects for energy production through sludge incineration.

Drinking Water

MENVIQ plans to revise its regulations on drinking water to update its quality standards and improve quality control of drinking water through more frequent sampling and minimum treatment requirements for surface waters. These changes to the *Règlement sur l'eau potable* are to be released shortly by MENVIQ.

Of the municipalities drawing water from rivers and lakes, 150 perform no treatment. In addition, 310 public water departments and approximately 150 private systems do not provide sufficient treatment to meet the new standards.

Large municipalities are required to provide complete treatment, including flocculation, settling and filtration of surface waters, in addition to chlorination. Stricter standards would require some municipalities to use more advanced treatment technologies, such as ozonation and activated charcoal filtration. Small systems relying on surface waters could meet the new standards primarily through the use of slow sand filtration, direct filtration, the compact system, membrane filtration, diatomaceous earth and chlorination. In general, bottled waters meet the standards defined in the current regulations.

Opportunities in the Area of Drinking Water and Municipal Wastewater

With the progress of the PAEQ, the EPI has developed some expertise, particularly in relation to sewage systems and wastewater treatment facilities for municipalities with populations over 1000.

Several types of treatment are used for the purification of wastewaters, including aerated ponds, activated sludge and oxidation ditches. MENVIQ has promoted the use of ponds in particular, because of their reliability, performance, economy, ease of operation and ability to absorb water overloads during periods of thaw.

However, the need to provide water treatment for municipalities with populations under 400 and for lodging facilities necessitates the development and testing of techniques to complement the primary treatment of community septic systems.

Certain types of treatment adapted and tested by Quebec firms will be approved within the next year: examples include "macrophyte" marshes, recirculating gravel filters, greenhouse treatment and biofiltration through peat. Most of these treatments were developed in France and Germany and must be adapted to the constraints imposed by Quebec's climate.

Proposed MENVIQ regulations, released in December 1992, are expected to impose stricter standards with respect to drinking water quality. These standards may require compulsory monitoring and more demanding treatment for systems serving more than 30 people.

To reduce concentrations of micropollutants, large urban centres may be required to add ozonation and activated charcoal filtration to their treatment of drinking water.

Similarly, municipalities which draw their supplies from surface waters will soon be required to install treatment systems or to improve those currently in use.

8.0
Trends in the Demand for Waste Management

In 1989, MENVIQ announced its policy of integrated solid waste management. This policy, designed to promote sustainable development, seeks to achieve two fundamental objectives: to reduce by 50% the amount of waste requiring disposal and to ensure that the means used to dispose of the remaining wastes are appropriate and environmentally safe.

This policy is designed to reduce the volume of wastes being sent to landfill sites by 50% by the year 2000 and to provide these sites with the tools required for sanitary and environmentally sound management. Moreover, it is consistent with policies adopted elsewhere in Canada. Integrated management is based on the concepts of reduction, reuse, recycling, upgrading and disposal.

MENVIQ has two sets of regulations to ensure compliance with the terms of the *Loi sur la qualité de l'environnement*: the regulations on solid wastes and the regulations on hazardous wastes. Both are presently under review to provide a more satisfactory framework for the recovery, reuse and recycling of hazardous and non-hazardous products alike.

The revised regulations on solid waste management establish quotas for regional landfill sites, require control of leachates and biogases and oblige the owners of these sites to pay one dollar for each tonne of landfill to a trust fund to ensure follow-up monitoring after the site is closed. In addition, cities will be permitted to charge fees for garbage collection, prohibit the disposal of certain types of waste to force recycling, and realize profits on community facilities.

The primary impact of the planned amendments to the regulations on solid wastes will fall on those firms involved in the recovery process: composters, recovery and upgrading centres and other participants, rather than recyclers, who are considered manufacturers.

The anticipated changes to the regulations on hazardous wastes are expected to simplify transportation activities and those aspects relating to insurance and permits.

On the Canadian level, the federal government and the provinces have signed a national protocol aimed at reducing packaging by 50%.

Finally, two further initiatives announced in the context of the Green Plan may have an impact on industrial activities. The first involves the establishment of national standards, codes, laws and regulations to promote the reduction, reuse and recycling of other types of waste. The second involves the development, by 1996, in cooperation with the provinces, of regulations and guidelines for hazardous waste management, including reduction, reuse, recovery, recycling, transportation, storage and disposal.

8.1 Management of Solid Wastes

In 1990, the various regions of Quebec produced more than 7 million tonnes of solid wastes. These wastes include a recoverable fraction and another fraction which is classified as refuse because of the lack of practical and economical solutions other than disposal. Approximately one third of these wastes are of household origin, while the rest are produced by the industrial, commercial and institutional sectors.

Industrial Wastes

Industrial solid wastes are generally transported by the firms producing them or collected by specialized firms. They are disposed of in sanitary landfill sites or sites for dry materials, depending on their composition. Debris from demolition is disposed of in sites authorized under the regulations on solid wastes. Recovery and recycling play an important role in the metallurgical and pulp and paper sectors.

Between 1965 and 1990, the proportion of fibre produced from old paper rose from 4.6% to 11.4% of all Canadian pulp and paper production. Proposals for five de-inking plants have been announced recently in Canada and three are already in operation. They will produce a total of 628,000 tonnes of de-inked pulp, enough to supply seven newsprint plants in the province of Quebec. By 1993, more than one million tonnes of old paper will be required to supply Quebec's de-inking plants.

Quebec will thus have to accelerate the recovery of old paper. The Canadian recovery rate represented 23% of production in 1990, compared to 51% in the Netherlands. In the short term, Quebec plants will be obliged to import more old paper to meet their needs. "In 1990, approximately 30% of the old paper used by Canadian plants came from the United States. This proportion may easily reach 50% in 1993."

In 1990, 960,000 tonnes of ferrous metal and 104,000 tonnes of non-ferrous metal were recovered for recycling. Metal wastes consist of internal manufacturing wastes, metal processing wastes, metal parts which are no longer functional, wastes from electronic equipment and household garbage.

Household Wastes

Household wastes are collected by municipal services or by private firms operating on a contract basis.

MENVIQ estimates the annual rate of production of household wastes at 30% of all solid wastes, for an annual municipal waste production of approximately 2,100,000 metric tonnes.

According to the report prepared by UQAM (*Université du Québec à Montréal*) on the production and treatment of household wastes in Montreal, average composition by weight follows the distribution presented in the list below. This composition varies over time, depending on the season and on changes in packaging and containers.

Composition of household wastes in Montreal by weight, 1989

Paper - cardboard	32.1%
Glass	6.2%
Ferrous metals	3.7%
Non-ferrous metals	0.7%
Plastic	6.5%
Biodegradable materials	24.5%
Wood	2.3%
Hazardous wastes	0.7%
Other	14.9%

There are two approaches to the management of household wastes. The first is the "green bag" approach, which requires no change in the current system of garbage collection: bags are taken to a sorting centre, where the garbage is divided into recyclable materials and compostable materials. This type of centre requires a higher degree of mechanization because of the mixture of wet and dry garbage.

The other approach involves selective collection. This requires a minimum level of cooperation from consumers, who sort their garbage at the source: glass, metal, paper-cardboard, plastics and biodegradable materials.

Opportunities in the Area of Solid Waste Management

According to MENVIQ's data, in September 1991 Quebec had 75 sanitary landfill sites, 342 trench dumps, 78 dumps for dry materials and 50 open-air dumps.

Half of these landfill sites fail to meet the required standards. In future, existing sites will require testing for the presence of heavy metals, treatment of leachates and biogases released from the sites, and the development and implementation of plans for closure, including covering, replanting and monitoring. The eight new sites approved for development within the next few years must be made impermeable through the use of membranes or clay, and be equipped with facilities for the treatment of leachates and biogases. Further site approvals will require geological and hydrogeological studies and surveys.

Selective collection and sorting centres will create an increased demand for goods and services, given the limited lifespan of landfill sites and the growing concern for resource conservation. On the other hand, if this sector is to expand, efforts must be made to develop markets for reclaimed materials and to structure the sector accordingly.

8.2 Management of Hazardous and Special Wastes

Data collected for Environment Canada in 1988 indicate that Quebec was producing 1.3 million metric tonnes of hazardous industrial wastes at that time. These data are based on the characteristics of the industrial sectors for all provinces of Canada during the 1980s. At the same time, Ontario was producing 3.8 million tonnes.

A similar estimate presented to the *Commission d'enquête sur les déchets dangereux* in 1990 indicates that organic wastes represented 26% of the total and inorganic wastes 68%. The remaining 6% were unclassified.

Four technological options to deal with the problem of hazardous wastes are currently being considered in Quebec, as elsewhere. They are: reduction at the source, treatment and disposal, integrated treatment centres and remediation of contaminated sites.

Reduction at the source implies changes in the selection of raw materials or in the manufacturing process, up to and including the substitution of cleaner technology. With this approach, the firms concerned are in the best position to assess and purchase the most appropriate equipment.

Treatment and disposal processes can be grouped in four major categories: physical, chemical, thermal or biological. Physical treatments include filtration, evaporation, inverse osmosis, centrifugation, encapsulation and sedimentation. These are common industrial treatments and, in the area of filtration, innovative equipment will soon be available for ultrafiltration and microfiltration. The principal chemical treatments currently in use include neutralization, oxidation-reduction, precipitation, ion exchange, decontamination and solidification-fixation. For example, Stablex Canada inc of Blainville uses solidification-fixation to treat inorganic wastes. Common thermal treatments include vacuum pyrolysis, static, rotary or tilting incinerators, roasters, hearth roasters or fluidized bed roasters. While these facilities are normally permanently installed, some portable equipment, which has been tested with very encouraging results, is available for on-site waste treatment.

Few **integrated centres** have been established; they have not been greeted with enthusiasm.

Finally, the primary **remediation techniques** consist of confinement in closed reactors and removal of contaminated soils, which are then transported for treatment by a third party.

According to a recent study, by the Menviq, there are only a few technologies which may offer complete and definite solutions on the provincial scale. If we include the thermal destruction of heavy hydrocarbons, there is still much to be done to provide Quebec with a range of technologies capable of solving the contaminated soil problem of which certain aspects have not yet to date been sufficiently exploited.

Furthermore, it is quite important to prepare viable alternatives to land filling without treatment and, this, even with the use of leak proof cells, which is the most used method of today.

Opportunities in the Area of Hazardous Waste Management

It is very difficult at this stage to detect trends in the area of hazardous waste management in Quebec. MENVIQ will soon be completing its analysis of the situation in the metallurgical and mining industries. To date, only the pulp and paper sector has been studied in full by MENVIQ; the recently introduced regulations are evidence of this effort. New measures which will have an impact on the demand for goods and services can thus be anticipated in these industrial sectors. These measures will probably encourage firms to eliminate their wastes more efficiently, by recycling and upgrading them, for example.

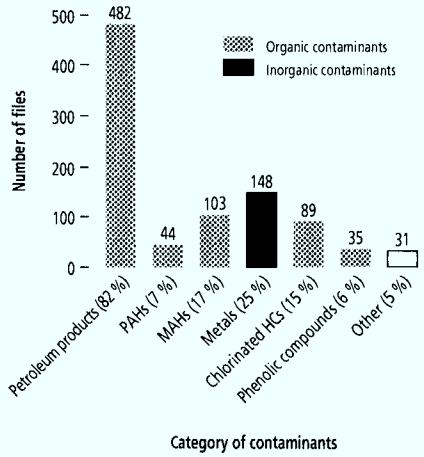
Most industrial sectors produce or use materials which the regulations classify as hazardous. Hazardous waste management is particularly difficult in some fields, including the petroleum, chemical, metallurgical and surface treatment industries, because of the quantity and nature of the materials involved.

In the short term, industrial waste management requires technical solutions for the disposal of these wastes, research studies on recycling, controls on their transportation and the establishment of integrated treatment centres. In the long term, reduction of waste volumes will involve recycling, product substitution and the adoption of cleaner processes. There is thus a need for development and demonstration studies aimed at developing techniques, processes, methods or management practices to improve the identification, assessment, reuse or recycling of hazardous wastes.

According to the action plan presented in 1990 by the *Commission d'enquête sur les déchets dangereux*, the following operations and approaches will be required if Quebec is to avoid increases in the volumes of waste produced: regional collection systems, networks of transfer centres, reduction and recycling facilities, used-oil refineries, use of cement plants for upgrading, despite the technical and political problems involved, expansion of the Stablex plant for the treatment of inorganic wastes, mobile incinerators for PCBs and other organic wastes, and enlargement of existing permanent facilities. It should be noted that a contract for the treatment of PCBs being held by MENVIQ was recently awarded to the consortium formed by Cintec Environnement Inc, SNC-Lavalin and Sanexen.

9.0 Trends in the Demand for Contaminated Soil Management

Figure 4: number of files on contaminated soils by category of major contaminants



Source: MENVIQ, *Bilan du traitement des dossiers de terrains contaminés* (GERSOL), June 1, 1992.

In 1983, MENVIQ established GERLED (*Groupe d'études et de restauration des lieux d'élimination de déchets dangereux*). This group identified 346 sites and classified them on the basis of the risk which they presented to health and the environment. On April 1, 1991, these sites were distributed as follows:

Category	Number of Sites	Risk to Health	Risk to the Environment
I	72	high	high
II	99	low	moderate
III	166	none	low
IIIR	4	none	low
Downgraded	5		

GERLED's second mandate was to prepare and implement a plan of action for the remediation of these sites. According to a 1991 report, MENVIQ had not yet begun operations on 230 of these 346 sites.

According to MENVIQ data, on June 1, 1992, 73% of the sites were contaminated by organic compounds, 8% by inorganic compounds, 18% by a combination of the two and the remaining 1% by unknown materials.

There is a second type of contaminated sites in Quebec. These consist largely of industrial sites contaminated over the years by toxic substances used in the daily operations of the firms concerned or by accidental spills. In addition, some sites, such as service stations, contain underground tanks. Contamination may also result from toxic materials buried on factory sites.

MENVIQ has therefore established a second team, GERSOL (*Groupe d'études pour la restauration des sols contaminés*), to deal with these sites. On January 1, 1992, there were 589 sites corresponding to this description, distributed as follows on the basis of the progress of remediation activities:

Number of Sites	Stage	Percentage
200	Completed	34
137	Active – characterized	23
136	Active – reclaimed	23
24	Inactive	4
4	Unknown	1
88	Unclassed	15

The most common contaminants are petroleum products (83%), polycyclic and monocyclic hydrocarbons (24%), metals (lead, zinc and copper) (25%), and chlorinated products and phenolic compounds (21%). Figure 4 indicates the number of files within each category of major contaminants.

The treatment of contaminated soils differs somewhat from that of hazardous industrial wastes, which are relatively homogeneous, because of the fact that they often include interrelated solid, liquid and gas phases. In addition, their variable physical, chemical and biological characteristics make each site unique. It is often difficult to find a single technique which can be used to treat all these elements while simultaneously reflecting the economic, environmental and social features involved.

In another context, "contaminated soils can be treated in two ways: on site (extraction, scrubbing, immobilization, chemical breakdown, biodegradation and thermal volatilization, for example) or following excavation (thermal, biodegradation, physical, chemical extraction, stabilization-fixation-solidification processes, etc)".

The treatment of contaminated soils offers promising opportunities for the environmental protection industry, particularly in terms of the following services:

- sampling;
- chemical analysis of water and soil;
- hydrogeology and geology;
- remediation;
- monitoring of groundwater and pollutant migration in the soil, among other characteristics;
- transportation and disposal.

10.0 Trends in the Demand for the Development of Chemical Products

Canadian firms hold a substantial share of the market for the chemicals commonly used in water and wastewater treatment. However, they are experiencing some difficulty in penetrating the market for special products. Canadian users of special chemical products are supplied primarily by multinationals. Most such products sold in Canada are manufactured in Canada as well, either under licence or by Canadian subsidiaries of foreign multinationals.

The development of improved special products, particularly coagulants for filtration and materials for sludge processing, would bring about a marked improvement in the effectiveness of treatment processes.

11.0
Trends in the Demand for Agricultural Sanitation

Agriculture has changed considerably over the past forty years, moving from extensive production to intensive high-yield mass production. In fact, a recent introductory document issued by the UPA (*Union des producteurs agricoles*) stated:

> "Between 1951 and 1985, Quebec's total agricultural production increased by more than 124%. In 1950, the major proportion of agricultural production, some 75%, originated on mixed farms; today, 95% comes from specialized farms".

Serious environmental problems in terms of soil quality and waterway deterioration are becoming evident.

> "Agriculture contributes to waterway deterioration in two ways: pollution from point sources and from diffuse sources.
>
> "Agricultural pollutants from point sources come from a precise, visible and identifiable location. These sources of pollution are usually easy to identify and correct. In recent years, producers and government agencies have invested almost $300 million in the construction of storage facilities to eliminate these point sources. MENVIQ estimated in 1990 that 49% of all stored manure was in compliance with the regulations.
>
> "However, diffuse pollution is, as the term implies, very difficult to recognize and, consequently, to correct. It reaches waterways by means of underground or surface runoff. This complex phenomenon, which is affected by numerous climatic, physical and agronomic factors in constant interaction, originates not in a specific area but over the entire farming region. Diffuse pollution makes the identification of contaminant origin difficult, particularly since some contaminants, including nitrogen, are found in all three sectors (agricultural, municipal and industrial).
>
> "During the 1980s, MENVIQ published a series of reports on waterway quality. In general, water quality has deteriorated in rivers draining areas with high concentrations of animal and farming operations.
>
> "Since the publication of these studies, measures have been taken to resolve the problems of manure disposal and pesticide use through the *Programme d'aide à l'amélioration de la gestion des fumiers* (PAAGF) and programs of assistance for tracking systems concerned with the more rational use of pesticides."

Integration of these environmental concerns will encourage farm producers to consider the following measures over the next few years:

- remediation of agricultural soils through research and technology transfer in the area of agricultural practices; use of trained consultants; monitoring of soil quality;
- initiation of preventive measures for the conservation of waterways exposed to diffuse pollution through the use of the river basin approach, organic rather than chemical fertilizers, a plant health strategy and water quality monitoring;
- continued research and technology transfers to reduce unpleasant odours.

In addition, a demand for goods and services in the following areas of agricultural activity can be anticipated over the next few years:

- soil management: fertilization plans, operations software;
- farming practices: training, soil analysis, farming equipment, etc;
- fertilization: manure and liquid manure, sludge from purification plants, spreaders, dosimeters, etc;
- treatment of liquid manure at the farm level and on a very large scale: regional treatment centre;
- odour reduction in buildings, storage and spreading.

12.0 Strengths and Weaknesses of the Quebec EPI

This section analyses the strengths and weaknesses of the Quebec EPI in the air, water, waste, chemical and agricultural sanitation sectors. Because Quebec's EP industry is still in a state of development, extreme diversification and constant evolution, this analysis cannot be considered exhaustive. It is intended solely to stimulate some reflection on the strengths and weaknesses of the EPI.

12.1 Air

According to the CRIQ survey, this sector includes 26 manufacturers and 24 distributors of industrial ventilation equipment, dust collectors, separators, scrubbers and instruments for the measurement, analysis and monitoring of air quality, as well as a number of consulting firms offering design and analysis services.

A wide range of specialized equipment is used to control and monitor air quality. The principal examples include electrostatic precipitators, fabric filter separators, wet or dry scrubbers and cyclone centrifuges.

The majority of the manufacturers responding to the survey indicated that they were distributors as well. Based on their responses, it appears that the Quebec industry supplies approximately 75% of the province's air pollution control systems.

A total of 33 firms, or 65% of the respondents, are owned by Quebec interests and the other 17 by Canadian and foreign firms. Nonetheless, this sector appears to be dominated by foreign-based internationals. Air pollution control equipment generally contains few highly technical elements and its production requires no specialized tools or manpower.

The best represented products, that is, those offered by a large number of Quebec firms, are, in decreasing order:

- industrial ventilation equipment;
- air quality measurement and monitoring equipment;
- dust collectors;
- air filtration products and supplies.

Other Quebec firms offering services in this sector are distributed as follows: 23 consultants, 17 laboratories and 15 R&D agencies and firms. These are all essential services for facility design, construction and start-up, and for audits of technical and environmental performance in terms of emission rates.

Three types of suppliers are involved in the dust collector and gas scrubber market: engineering firms which are not involved in manufacturing, firms which design and produce complete systems, and manufacturers specializing in the production of certain components. The major firms in the dust collector and gas scrubber sector are based in Europe, particularly Sweden and Germany, and in the United States. These are the countries with the longest-established and most restrictive regulations.

Quebec has no particular strength in the atmospheric pollution sector. However, some expertise has been acquired in the following areas:

- treatment of aluminum industry emissions;
- measurement and treatment of odours, for example the development of an olfactometer and biofiltration equipment for the Agropur and Alex Couture plants.

In another context, the possible tightening of the regulations on VOC and NO_x emissions to levels similar to those of the Montreal Urban Community will provide an opportunity, between now and the year 2000, for the development of scrubbing equipment for use in such sectors as refining, printing, metal finishing and resin drying.

The weaknesses of this sector, on the other hand, can be summarized as follows:

- Shortage of human resources and technical expertise. These resources are found primarily in Ontario, where the Ministry of the Environment and Environment Canada are concentrating the necessary infrastructure and their research and development efforts.
- Inadequate training of technicians and engineers. Only one course in basic atmospheric chemistry is offered, even in advanced programs.
- Research of a primarily fundamental nature, performed largely by the provincial and federal governments. Its major focus is meteorology, the prediction and understanding of transboundary phenomena such as acid rain.
- Less extensive and active industrial association in this sector than in the United States (Air and Waste Management Association).

12.2 Drinking Water and Wastewater

Drinking water and wastewater represent Quebec's most highly developed sector. It includes manufacturers and distributors of materials for use in settling operations, water treatment, aeration, dosimetry and sludge treatment and instruments for measuring and monitoring water quality. In addition, a number of firms offer consulting services for the design of watermain and sewage systems and purification plants, as well as laboratories for the analysis and monitoring of water quality. Finally, several firms specialize in the construction of treatment facilities.

The principal purchasers of water treatment equipment are governments, municipalities, the pulp and paper industry, the chemical industry, petroleum refineries and the metallurgical industry. Municipalities represent the largest market for equipment used in the treatment of drinking water (coagulation, flocculation, settling, sand and anthracite filtration and chlorination) and wastewater (activated sludges, ponds, biodisks, lagoons and septic systems), as well as equipment for sewer and watermain systems.

According to the results of the CRIQ survey, this sector includes almost equal numbers of manufacturers and distributors, with 35 and 36 respectively. Virtually all of the equipment manufacturers handle distribution as well. Eighteen firms sell equipment for the treatment of drinking water. Over 70% of the firms responding to the CRIQ survey, 50 out of 71, are owned by Quebec interests.

A report published in March 1991 by SQAE (*Société québécoise d'assainissement des eaux*) on the economic impact of the PAEQ (*Programme d'assainissement des eaux du Québec*) indicated that, in 1980, only 25% of purification and pumping station equipment was Quebec-owned. In 1991, this figure was approximately 75% to 80% for small and medium-sized treatment facilities. Quebec is even able to export certain types of equipment, including filters and materials for use in biological treatment, settling and oil removal.

In addition, the SQAE mandate has been expanded since December 1992 to include an international component. SQAE's international involvement will be centred on support for the private sector and on relationships with international organizations in a position to promote economic spinoffs for Quebec firms.

As a result of these changes, Quebec will be prepared to export products and services in the water sector and to ensure the spread of Quebec's expertise at the international level.

Service suppliers in this sector are also well represented, with 40 to 50 consulting firms, 32 laboratories and 45 research agencies and firms responding to the CRIQ survey. These services cover studies of water quality, including facility design, construction and operation, in addition to control, monitoring and research. In this area as well, some expertise is now being exported to other parts of Canada and the United States.

The principal strengths of the sector can be summarized as follows:

- High-quality human resources and solid technical expertise in both the private and public sectors.
- Firms with capacities equivalent to those found in Ontario for the manufacture and installation of specialized equipment.
- The support of high-calibre government and university research centres: the Maurice Lamontagne Institute, *INRS-Eau*, the *Université de Sherbrooke*, *Université Laval*, McGill University and the *École Polytechnique*, which has established a Chair in Drinking Water.
- More highly developed training programs for technicians and engineers than are available in other provinces. At least five universities offer advanced programs in water treatment. Two colleges offer complete technical courses in the management of municipal water treatment plants.
- One of the largest and most dynamic industrial associations within the EPI, the *Association québécoise des techniques de l'eau*.
- Firms with more than ten years of experience and established clienteles.
- Firms with some export capacity: 30% to Ontario, 20% to the Maritimes and 16% to Western Canada. Some have even established marketing networks in the United States.

A number of weaknesses do, however, exist:

- A weak representation of industry at the national level.
- Limited international competitiveness of small firms in relation to European and American multinationals.
- Firms with limited financial resources because of their size; few, perhaps one third, are able to conduct R&D.
- Firms with a limited knowledge of foreign markets: only 5.5% of revenues are generated abroad.
- Firms receiving little benefit from the industrial component of the provincial government's water treatment program. With the exception of the St. Lawrence Action Plan, none of the revised versions of the principal programs and regulations in this sector, including the PRRI, are yet in effect. The industrial wastewater treatment certificate required by the PRRI will require R&D efforts beyond the adaptation of existing equipment and technologies which is often all that has been required by municipal programs.

12.3 Wastes

The wastes sector includes manufacturers and distributors of storage, collection, treatment, disposal and recycling equipment and systems. Only a few distribute products for waste reclamation and upgrading.

A number of firms in this sector offer services in the areas of waste collection and disposal, analysis, monitoring, handling and process design.

The survey conducted by CRIQ in June 1992 reveals 20 distributors and 30 manufacturers offering a variety of products. The most important are:

1. Materials and systems for waste collection and transportation.
2. Instruments for measurement and monitoring.
3. Materials and systems for handling and packaging.
4. Materials and systems for recycling.
5. Materials for treatment and disposal.
6. Materials and systems for upgrading.
7. Equipment for monitoring materials and processes.

Of these 50 firms, 37, or 74%, are owned by Quebec interests; the remaining 13 are Canadian- or foreign-owned. Equipment classified in groups 2, 4 and 7 is generally sold by distributors. Groups 1, 3 and 5, on the other hand, include a large proportion of manufacturers who sell their own products.

The service industries identified in the course of the CRIQ survey are distributed as follows: 52 consulting firms, 20 laboratories, 22 research agencies and firms and between 50 and 70 firms involved in operations. In addition, of these, 14 consulting firms, 1 laboratory and 9 operations firms have conducted R&D activities.

The strengths and weaknesses listed below relate to solid wastes, hazardous wastes, special wastes and contaminated soils.

Strengths

- Significant support from university and government research centres for the development of biotechnologies relating to the treatment of contaminated soils, wastes and residues: *Centre de recherche industrielle du Québec*, *Institut Armand Frappier*, Biotechnology Research Institute.
- Existence of de-inking plants.
- Existence in Quebec of two centres for the treatment and disposal of wastes, one for organic wastes and the other for inorganic wastes.

Weaknesses

- Growth of firms in this sector is largely dependent on government regulations and their application.
- Shortage of human resources with a high level of technical expertise. Most workers acquire their training on the job.
- Few government or university research centres focussing on waste and residue recovery and recycling.
- Limited training programs for technicians or engineers in the fields of waste or residue recovery and recycling.
- Few major industrial associations.
- Extensive fragmentation of this sector, with small firms in business for only a few years, and thus limited financial resources and R&D involvement.
- Difficulty in obtaining financing.

In addition, other, more specific, weaknesses exist in the following subsectors:

Solid Wastes

- Shortage and instability of outlets for reclaimed and recycled materials from selective collection or municipal sorting centres.
- Importing of specialized equipment for sorting and recycling centres, including magnetic separators, blowers and crushers.

Hazardous Wastes

- Few suppliers of mobile equipment for on-site waste treatment. The volumes involved, stability of supply, development and constant improvement of the technical equipment required for effective disposal of these wastes demand research and considerable investments.
- Shortage of outlets, making the reuse of certain industrial wastes difficult in the short term.
- Difficulties and delays in obtaining operating permits, threatening the profitability of certain projects.
- Lack of innovative treatment technologies of proven effectiveness.

Special Wastes

- Shortage of outlets for most industrial wastes.

Contaminated Soils

- Limited financial resources available to firms for developing and marketing technologies.
- Lack of an integrated treatment and disposal plant capable of handling all types of contaminated soils.

12.4 Chemical Preparations

This sector includes primarily manufacturers and distributors of air and water treatment products, absorbents, and agglomeration and pelletizing products.

Of the 25 firms responding to the CRIQ survey, 9 are distributors and 16 manufacturers. In addition, 14, or 56%, are owned by Quebec interests, 8 by Canadian interests and 3 by foreign interests.

This sector is dominated by multinationals in a position to provide the specialized products required for the operation of municipal wastewater treatment stations. Growth in this sector is dependent primarily on the development of the PAEQ.

12.5 Agricultural Sanitation

Firms in this sector were difficult to identify on the basis of the CRIQ survey. The type of pollution involved and the diffuse nature of its sources, including fertilizers, suspended materials and pesticides, make the activities associated with this sector difficult to define for the purposes of the survey.

However, data provided by MENVIQ permitted the identification of a number of firms in this sector. While they include some equipment manufacturers, these are primarily university bodies and consulting firms involved in R&D.

One of the programs from which all these firms have benefited is PARDE (*Programme d'aide à la recherche et au développement en environnement*), particularly the manure management component. Growth in the sector is attributable largely to this program. An integral part of PAEQ, it centres on the development of new techniques for use in the agricultural environment in assessing and reducing the effect of farm effluents on the quality of the air, surface and groundwater, and soil.

The environmental regulations governing Quebec's farming activities are among the strictest in North America. The province's sanitation techniques compare favourably with those in the rest of the country and the United States. Indeed, one consulting firm indicated, in the course of the survey, that in some areas, including its functional approach to problems and cooperation among the parties concerned, Quebec is already catching up with the countries of Europe, despite their 25-year lead in agricultural sanitation.

Exportable goods and services include geomatics as a tool for soil management, large- and small-scale processing of manure and liquid manure, and liquid-manure spreading equipment. However, three or four years of R&D will be required before this equipment and these services are ready for marketing.

13.0 Government Programs

This section presents a summary and brief analysis of the principal federal and provincial programs affecting the EPI.

Without attempting to minimize the role of the other federal departments involved in environmental protection, the sectoral profile has concentrated primarily on the activities of EC (Environment Canada), ISTC (Industry, Science and Technology Canada), MENVIQ and its affiliated agencies, and MICT. These are the agencies which are believed to have the most to offer Quebec's EPI. The programs of the two governments are summarized in tables C and D, in the appendix.

Environment Canada plans to focus its activities over the next decade on four areas:

- Technology development and transfer – the government, in partnership with industry and the university community, promotes the creation of new technologies for pollution control and the transfer of these technologies, together with the necessary expertise.
- Education – EC provides information on the role which the public can play in such areas as waste production and water and energy conservation.
- Economic tools – over the next few years, these tools will be increasingly used and integrated in the decision-making process; they will become a means of achieving sustainable development.
- Regulation – regulations governing the disposal of toxic substances will soon come into effect and the federal government will adopt a new procedure for reviewing the environmental impact of its projects.

While EC clearly plays a primary role in federal operations for the protection of the environment, other departments, including Energy, Mines and Resources Canada, Agriculture Canada and Fisheries and Oceans Canada, contribute actively to the Green Plan as well. The Green Plan, a major action plan released in 1991, is the most ambitious of the federal government's strategies. It consists of 100 initiatives based on scientific principles and backed by public consultation.

ISTC has participated with the provinces in the preparation of studies on four regions of Canada, including the present sectoral profile of Quebec. ISTC, which has a primarily economic role, is using these studies to prepare a portrait of the EPI in three regions of Canada and in the country as a whole.

ISTC has announced its intention to concentrate its efforts on four elements:

- to improve awareness among EPI firms of the needs and the dynamic and changing context of the market;
- to develop tools which will enable these firms to penetrate Canadian and foreign markets;
- to ensure the training of the skilled human resources required for the growth of the industry;
- to promote the formation of a national association to speak for these firms and to ensure a certain degree of cohesion.

Finally, in July 1992 ISTC announced the establishment of the Canadian Office for Training in the Environment. ISTC will serve as a national mechanism to assist development in other countries by providing them with information on Canada's experience and on what it has to offer in the area of environmental management, processes and technologies. The Office will be directed by an advisory committee formed primarily of representatives from the private sector.

MENVIQ's principal programs and measures affecting the development of the EPI include its industrial wastes reduction program, wastewater treatment program, contaminated soils remediation policy, environmental research and technological development fund, manure management improvement assistance program and its participation in the St Lawrence Action Plan.

It should be noted that, since the announcement of the industrial cluster strategy by Gérald Tremblay, Minister of Industry, Commerce and Technology, this ministry has adopted a plan of action for the EPI cluster.

In fact, following an initial meeting in May 1992 with a number of EPI firms, MICT adopted the following goals:

- to become familiar with Quebec's EPI and existing technologies;
- to seize the commercial opportunities created by government regulations and programs and to promote the further development of goods and services;
- to foster cooperation among participants (manufacturers, research centres, promoters, etc);
- to identify and define the environmental responsibilities of lenders, borrowers and investors;
- to encourage, accentuate and target more effectively the testing and development of environmental technologies and products;
- to promote the penetration of foreign markets and licensed manufacturing agreements where foreign expertise is available and adaptable to Quebec needs.

14.0
The North American and European EPI Markets

The environmental protection industry generates annual revenues of $5 to $9 billion in Canada. It includes 4000 companies and employs 70,000 people dealing specifically with the environment. Between 70% and 80% of these jobs are concentrated in Quebec and Ontario.

The American market, in contrast, is valued at $100 to $130 billion. The sector offering the greatest potential for Quebec firms is municipal and industrial water treatment. It is estimated that, by the year 2000, this area will be worth $60 billion. Biotechnologies will play a dominant role in this market. To achieve access to this market, Quebec firms should consider alliances with American firms for improved visibility.

In Mexico, demand rose from $218 to $280 million (US) between 1989 and 1992. Imports represent approximately 12% of this demand. There is still much to be done in terms of wastewater treatment and waste collection, the sectors in which Quebec firms have the greatest proven experience. Despite recent legislative measures, this environmental market will apparently become accessible only in the medium term.

The EEC represents a potential market for the Quebec industry, but one which will probably be difficult to penetrate. Some exchanges have already taken place. In fact, a number of European companies have already established partnership agreements with Quebec firms. This market can be described as follows:

- The EEC's market for environmental protection goods and services was estimated to be in the order of $50 to $100 billion (US) in 1989.
- The German market is the largest in the EEC, worth $16 billion (US).
- Drinking water and wastewater treatment accounts for 35% to 50% of the total market for EP goods and services. Solid wastes account for 35% of the total. Air quality concerns attract 25% to 35% of total expenditures.
- In Germany and the Netherlands, the current emphasis in industry is on changes in production processes that reduce waste generation. The market for traditional end-of-pipe systems in these countries will be weakened by the new emphasis on integrated, clean technologies. The UK and France are five to six years behind in the use of this technology. Among these countries, municipal water treatment projects frequently involve the introduction of tertiary treatments to precipitate nitrates and phosphates.
- In general, Southern Europe, where controls are only now being put in place, is still focussed on end-of-pipe solutions for industry and introducing primary treatment systems for municipal wastewater. This region is about fifteen years behind the rest of the EEC in terms of its adoption of environmental protection technologies.
- Germany will remain the largest EEC market. Italy and Spain will grow rapidly, but not pass the UK or France in total market size. Spain expects Canadian and Quebec firms to participate in an enormous $15-billion program designed to bring its industries into line with EEC pollution standards by 1995.

While the environmental problems faced by Eastern Europe are enormous, funding for addressing these problems is delaying the growth in these markets, which are estimated at about $5-10 billion. However, public pressure and the desire for membership in the EEC are encouraging some of these countries to bring their environmental standards into line with those of the western countries; economic considerations, however, come first, and these countries are in the throes of reconstruction. European firms are better placed geographically to serve this market.

15.0 Conclusion

The environmental protection market is growing rapidly, in Quebec as in the rest of North America. In 1990, this market was valued at about $1.5 billion in Quebec.

Growth prospects for sales of goods and services are approximately 20% to 25% for 1993. In 1992, almost 65% of the firms surveyed had environmental revenues of more than $500,000, compared to 56% in 1990. This growth in revenues demonstrates, to some extent, the sustained growth of Quebec's EPI.

In addition, approximately 18% of the Quebec firms surveyed export their goods and services outside Canada, while 75% sell elsewhere in Canada, primarily to the manufacturing industry.

Another valuable sector is research and development in the area of environmental protection. According to CRIQ's estimates, total R&D-E expenditures in Quebec were estimated at $60 million for 1991-1992. Government assistance to the EPI is directed primarily towards R&D and technological demonstration activities aimed at promoters. Most research relates to the water sector. Waste and residue management and the remediation of contaminated sites are, however, considered areas of priority concern by Quebec's *Ministère de l'Environnement*.

No substantial tightening of the regulations on atmospheric pollution, which have achieved positive results over the past ten years in relation to the traditional pollutants, including sulphur dioxide, carbon monoxide, particulates and lead, is anticipated before the year 2000. With the adoption of the *Clean Air Act* in the United States, however, adjustments will be required to reflect emissions trading rights. Certain currently unregulated atmospheric pollutants, including ground-level ozone, nitrogen oxides, volatile organic compounds, hydrocarbons and greenhouse gases, will come under increasing scrutiny in the coming years. The industrial sectors primarily affected will be the petrochemical and metallurgical industries.

Since the mid-1980s, the number of toxic contaminants which must be monitored and removed from water has increased rapidly. Federal and provincial environmental authorities will emphasize treatment at the source or prevention, process modifications and non-transfer of pollutants from one medium to another. Waste reduction, water recycling and energy recovery are attracting growing interest. Most of the demand will come from the pulp and paper, mining and chemical industries. If it is to be competitive, then, the environmental protection industry must be at the cutting edge in such areas as adsorption, membrane filtration, biotreatment, computer management, automation software, direct instrumentation and the treatment of solids recovered from wastewaters.

In addition, water treatment for municipalities with populations under 400 and for lodging establishments will require the use of processes other than aerated ponds and activated sludge. These will include "macrophyte" marshes, recirculating gravel filters and greenhouse treatment. To meet new standards, drinking water distribution systems may become

subject to compulsory monitoring and more demanding treatment. Ozonation and activated charcoal filtration may be used to reduce micropollutant concentrations in the drinking water of large urban centres.

To ensure that solid waste landfill sites comply with the regulations, owners will be required to conduct regular sampling, treat leachates and biogases and prepare site closure plans. Sorting and selective collection centres will make it possible to extend the life of landfill sites, provided these centres have access to outlets for reclaimed or recycled materials and to specialized equipment, such as magnetic separators, crushers and blowers.

In addition, hazardous waste management requires the use of technical solutions for disposal, including integrated treatment centres, controls on waste transportation and research on recycling. In the long term, waste reduction will require recycling and the adoption of cleaner processes. There is a growing need for the development of processes, methods or management practices for improved identification, assessment, reuse or recycling of hazardous wastes.

Finally, the treatment of contaminated soils also presents opportunities for the EPI, particularly with respect to services in the areas of sampling, chemical analysis of water and soil, remediation, monitoring, transportation and disposal.

ACRONYMS

BRI: Biotechnology Research Institute

CCME: Canadian Council of Ministers of the Environment

CQVB: *Centre québécois de valorisation de la biomasse*

CRIQ: *Centre de recherche industrielle du Québec*

CRM: *Centre de recherche minérale*

CUM: *Communauté urbaine de Montréal*

CUQ: *Communauté urbaine de Québec*

DESRT: Development and Demonstration of Site Remediation Technology Program

DRECT: Development and Demonstration of Resource and Energy Conservation Technology Program

EC: Environment Canada

EEC: European Economic Community

EP: Environmental Protection

EPI: Environmental Protection Industry

FCAR: *Fonds pour la formation des chercheurs et aide à la recherche*

FRDT-E: *Fonds de recherche et de développement technologique en environnement*

GERLED: *Groupe d'étude et de restauration des lieux d'élimination de déchets dangereux*

GERSOL: *Groupe d'étude et de restauration des sols contaminés*

IAF: *Institut Armand-Frappier*

INRS: *Institut national de recherche scientifique*

ISTC: Industry, Science and Technology Canada

MEND: Mine Environment Neutral Drainage Program

MENVIQ: *Ministère de l'Environnement du Québec*

MICT: *Ministère de l'Industrie, du Commerce et de la Technologie du Québec*

MISA: Municipal Industrial Strategy for Abatement

NSERC: Natural Sciences and Engineering Research Council

PAAGF: *Programme d'aide pour l'amélioration de la gestion des fumiers*

PAEQ: *Programme d'assainissement des eaux du Québec*

PARDE: *Programme d'aide à la recherche et au développment en environnement*

PRRI: *Programme de réduction des rejets industriels*

R&D-E: Environmental research and development

SLAP: St Lawrence Action Plan

SLC: St Lawrence Centre

SQAE: *Société québécoise d'assainissement des eaux*

UPA: *Union des producteurs agricoles*

UQAM: *Université du Québec à Montréal*

CHEMICAL ELEMENTS AND FORMULAE

BOD_5: biochemical oxygen demand after five days

CFCs: chlorofluorocarbons

CH_4: methane

CO: carbon monoxide

CO_2: carbon dioxide

HCs: hydrocarbons

N_2O: nitrous oxide

NO_x: nitrogen oxides (in general)

O_3: ozone

PAHs: polycyclic aromatic hydrocarbons

PCBs: polychlorinated biphenyls

SO_2: sulphur dioxide

VOCs: volatile organic compounds

BIBLIOGRAPHY

ERNST and YOUNG, *Study of the Ontario Environmental Protection Industry*, 1992, 225 pages.

ERNST and YOUNG, *Les ressources humaines dans l'industrie de l'environnement*, 1992, 35 pages.

MINISTÈRE DE L'ENVIRONNEMENT DU QUÉBEC, *L'Environnement au Québec: Un premier bilan synthèse*, 1988, 96 pages.

HOULE, G et al, *Source d'émissions des contaminants précurseurs de la pollution photochimique au Québec*, Conference on Acid Precipitation and Ozone Pollution, Montreal, 1991, 17 pages.

CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT, *Plan de gestion pour les oxydes d'azote (NO_x) et les composés organiques volatils (COV)*, 1990, 237 pages.

FENTON, B, *Science Council of Canada, The Canadian Water Resources Equipment Industry: Opportunities for Research and Manufacturing*, Ottawa, 1988, 36 pages.

SOCIÉTÉ QUÉBÉCOISE D'ASSAINISSEMENT DES EAUX, *Rapport concernant les retombées économiques du programme d'assainissement des eaux du Québec*, 1991, 67 pages.

SOLÉCO CONSULTANTS INC, *Le programme d'assainissement des eaux du Québec, Les besoins d'équipements, la recherche et le développement*, Montreal, 1987.

BEAULIEU, R, *État de la situation de la valorisation des boues de stations d'épuration des eaux usées municipales au Québec*, 1991, 14 pages.

ENVIRONMENTAL PROTECTION AGENCY, *Environmental Pollution Control Alternatives: Drinking Water Treatment for Small Communities*, 1990, EPA/625/5-90/025.

MINISTÈRE DE L'ENVIRONNEMENT DU QUÉBEC, *Politique de gestion intégrée des déchets solides*, Quebec City, 1989, 14 pages.

ANONYMOUS, *Le recyclage à la québécoise*, in *Le Papetier*, vol 28, No 2, June 1992, 5 pages.

FENCO, LAVALIN, *Economic Profile of the Hazardous Waste Management Service Industry Subsector in Canada*, 1988, 120 pages.

BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT, *Les déchets dangereux au Québec, Rapport présenté au ministre de l'Environnement du Québec*, 1990, 471 pages.

GAUTHIER, R et al., *Une solution définitive au problème d'élimination des déchets dangereux et de sols contaminés*, in *Le Chimiste*, September 1988, 3 pages.

MÉNARD, Louis, *L'UPA à l'heure des choix durables*, 1993.

INDUSTRY, SCIENCE AND TECHNOLOGY CANADA, *Le marché canadien de produits et services liés à la protection de l'environnement (faits saillants)*, 1991, 11 pages.

GAGNON, C, *"Le boom de l'écoindustrie: Le Québec est dans la course internationale"*, in *Québec international*, September 1992: pp 15-19.

ANONYMOUS, *"Le marché de l'environnement* aux États-Unis", in *CanadExport*, July 1991, pp 1-4.

APPENDIX
Tables

Table A: Distribution of manufacturers and distributors by segment according to survey

Segment	Number of firms
MATERIALS AND EQUIPMENT FOR WATER TREATMENT	**71**
Materials for treatment of drinking water	18
Dosimeters	13
Chemical recovery systems	4
Materials for aeration	8
Materials for settling and oil removal (including basins)	7
Materials for biotreatment of wastewater	13
Materials for physico-chemical treatment of wastewater	13
Materials for pretreatment of wastewater	8
Septic tanks	3
Materials for treatment of sludge	7
Materials for in-plant handling of sludge	7
Filters	20
Instruments for measurement and monitoring of water quality	17
Sampling materials and systems	3
Equipment for monitoring of materials and processes	10
Other materials for monitoring and treatment of water	4
MATERIALS FOR THE CONTROL OF AIR POLLUTION	**50**
Gas absorption and adsorption systems	7
Industrial ventilation equipment	20
Catalytic converters (for automobiles)	7
Chemical recovery systems	0
Dust collectors	17
Fabric filter separators	8
Products and supplies for air filtration	14
Dry scrubbers	5
Instrument for measurement and monitoring of air quality	18
Sampling materials and systems	4
Equipment for monitoring of materials and processes	7
Materials and systems for noise control	3
Other materials for monitoring air quality	5
MATERIALS FOR THE MANAGEMENT OF HAZARDOUS AND NON-HAZARDOUS WASTES	**50**
Materials and systems for treatment and disposal	5
Materials and systems for recycling	10
Materials and systems for waste collection and transportation	19
Materials and systems for waste separation (sorting)	6
Materials and systems for waste handling and packaging	11
Measurement and monitoring instruments	14
Materials and systems for waste sampling	1
Equipment for monitoring of materials and processes	7
Materials and systems for waste disposal	2
Materials for remediation of contaminated sites	1
Materials and systems for waste upgrading	2
Other materials for waste management	5
CHEMICAL PREPARATION5 AND OTHER SUPPLIES	**25**
Absorbents and adsorbents	5
Agglomeration and pelletizing products	2
Bacteria and enzymes	2
Cleaning products	3
Products for corrosion and deposit control	3
Dust control products	3
Air treatment products	5
Water treatment products	10
Other chemical products	3

Note: Since a firm may be active in more than one segment, the actual number of firms is lower than the number of firms for all segments.

Table B: Distribution of service firms by segment according to survey

Segment	Number of firms
CONSULTING SERVICES	**103**
Risk analysis	25
Environmental audits (site assessments)	43
Environmental studies and impact studies	25
Studies of physical environments	38
Studies of the biological environment	31
Studies of the human environment	26
Studies of the sound environment	18
Studies of air quality	19
Studies of water quality	31
Monitoring of air pollution	23
Water treatment	39
Solid waste management studies	52
Liquid waste management studies	39
Hazardous waste management studies	39
Monitoring and control (data acquisition)	24
Oceanology	8
Acoustics, noise and vibration reduction	5
Legal consulting services	11
Communications services	11
Training and education services	9
Other consulting services	18
OPERATIONS AND OTHER SERVICES	**113**
Waste collection and transportation	52
Waste storage	12
Recovery	57
Recycling	40
Waste treatment and disposal	27
Waste incineration	3
Waste upgrading	12
Composting	6
Disposal (landfilling)	21
Emergency services	13
Site decontamination	19
Construction of treatment facilities	10
Operating and maintenance services	10
Pollution insurance services	0
Computer consulting services	2
Other environmental protection services	8
LABORATORY SERVICES[1]	**36**
Air	17
Water	31
Soil	36
Wastes	20
Toxicology	6
Other laboratory services	14
RESEARCH SERVICES[1]	**30**
Air	15
Water	39
Soil	22
Health, society, economics	3
Wastes (solid, liquid, hazardous)	22
Other areas of research	12

[1] Some consulting firms are active in this category as well. As a result, the total number of firms in some segments is greater than the actual number of firms.

Note: Since a firm may be active in more than one segment, the actual number of firms is lower than the number of firms for all segments.

Table C: Summary of federal government programs

Program	Description	Timetable	Funding	Eligibility
DRECT	Development and demonstration of equipment, processes and systems to reduce or eliminate waste production, save energy and conserve natural resources	1978-...	50% of total costs to a maximum of $200,000/year	All provinces
St Lawrence Action Plan (SLAP)	Four components: - Conservation of species and habitats ($25 M) - Protection. Identification of industrial sites and assessment of toxic substances ($14 M) - Remediation of federal sites and wetlands ($21 M) - Environmental technologies. Development and application of antipollution techniques; assessment of water quality; in partnership with industry ($50 M)	1988-1993	$110 M over five years	Quebec only
Technology transfer	Help Canadian companies to identify, assess, transfer and promote environmental technologies	1992-1998	$18 M for the creation and operation of three centres for four years	Western, Central and Eastern Canada
Environmental Technologies Commercialization Program	Provide funds in conjunction with private capital to accelerate the development and demonstration of profitable environmental technologies.	1992-1998	$80 M	All provinces
National Contaminated Sites Remediation Program (NCSRP)	This bilateral federal-provincial program involves three components: decontamination of orphan sites, development or demonstration of remediation technologies and financing of projects for the identification and remediation of contaminated sites	1991-...	$64 M	All provinces

Source: Environment Canada

Table D: Programs and regulations of the government of Quebec

Program	Description	Duration	Industrial Sector	Conditions
PRRI (Programme de réduction des rejets industriels)	75% reduction in *all* industrial wastes (air, water, solid and semi-liquid)	10 years	**Short term:** Pulp/paper Mines Metallurgy Chemistry Petroleum **Long term:** Metal plating Mineral prospecting Metal casting Tertiary petrochemical	**Seven revised regulations:** Water: Pulp/paper Petroleum refineries Air: Air quality Concrete/asphalt Quarries/sandpits Soil: Hazardous wastes Solidwastes **New regulations:** Pollution control certificate Wastes in sewage Municipal wastes
SLAP (St Lawrence Action Plan) (technology demonstration)	90% reduction by 1993 in toxic wastes discharged into the St. Lawrence (federal-provincial agreement)	5 years	50 major firms	Program funds are currently exhausted.
PAEQ (1978) (Programme d'assainissement des eaux du Québec) (urban)	Financial incentives for the development of wastewater treatment systems	10 years	Municipalities and urban communities	Total cost of investments $6.7 billion (April 1, 1990)
NCSRP (National Contaminated Sites Remediation Program)	Development and demonstration of techniques for remediation of contaminated soils (federal-provincial agreement) Orphan sites: $25.5M Technology: $6.375M	5 years	Contaminated sites (identified by GERLED) Demonstration of technologies	Contaminated sites must meet NCSRP requirements to be eligible
FRDT-E (1989) (Fonds de recherche et de développement technologique en environnement)	Initial budget: $50 million to promote the development of an environmental industrial sector with high growth potential	5 years	Environmental protection industry	**Three priorities 1991-1994:** Waste and residue management Remediation of water, air and soil; Sustainable development (means of preventing environmental deterioration and integrating natural resources with economic and social concerns) **Two project categories:** Exploratory research on the environment, eligible expenditures: $50,000-$300,000 Technological innovation, eligible expenditures: <$500,000

Table D: Programs and regulations of the government of Quebec (cont'd)

Program	Description	Duration	Industrial Sector	Conditions
PARDE (Programme d'aide à la recherche et au développement en environnement)	Financial support for projects not eligible for FRDT-E (<$50,000) Budget envelope $447,000 (1991-1992) Three components: General Urban Manure management	Ends March 31, 1993	Universities and affiliated researchers Non-university research centres and laboratories Consultants Associations	**General:** Research projects Organization of scientific events (maximum $10,000) **Urban (SQAE):** Research and development projects initiated by PAEQ ($100,000/year for a maximum of 3 years) **Manure management (PAAGF):** Development of techniques to reduce the impact of animal effluent management processes and practices Development of methods of measuring and monitoring contamination ($100,000/year for a maximum of 3 years)
PACPI (MICT) (Programme d'aide à la concrétisation de projets industriels)	Financial support for project pre-implementation studies 50% of professional fees for costs < $100,000	NA	Manufacturing firms in MICT sectors Recycling firms Industrial R&D and scientific service firms Site remediation firms	**Eligible projects:** Technical or economic feasibility study Comparative investment study Quantitative and qualitative market assessment Analysis of possibilities for redirection or diversification Feasibility of proposed mergers, purchases or regroupings
SME innovation (MICT 1992)	Accelerate innovation, transfer and dissemination of technologies in regional SMEs Help defray costs of internal and external resources required to implement projects Eligible costs: $30,000 to $100,000	NA	Manufacturing firms Recycling firms Construction firms (treatment centres, waste upgrading, waste transfer centres, incineration centres) Research and scientific services laboratories, computer, creation and design services Distribution firms Cultural sector firms	**Three components:** Diagnosis and technological action plan Analysis and development of projects involving technology transfer, R&D, adaptation to subcontracting, automation Implementation of production technologies

Source: MENVIQ

Published by: Direction de l'information industrielle et technologique
du Centre de recherche industrielle du Québec

Prepared by: Daniel Lefebvre, ing.
Groupe équipements et techniques de fabrication
Direction de l'information industrielle et technologique
Centre de recherche industrielle du Québec

With the collaboration of: Marie-Christine Dumais, M.B.A.
Groupe études de marché
Direction de l'information industrielle et technologique
Centre de recherche industrielle du Québec

Made for: Ministère de l'Industrie, du Commerce et
de la Technologie (MICT)
and Industry, Science and Technology Canada (ISTC)

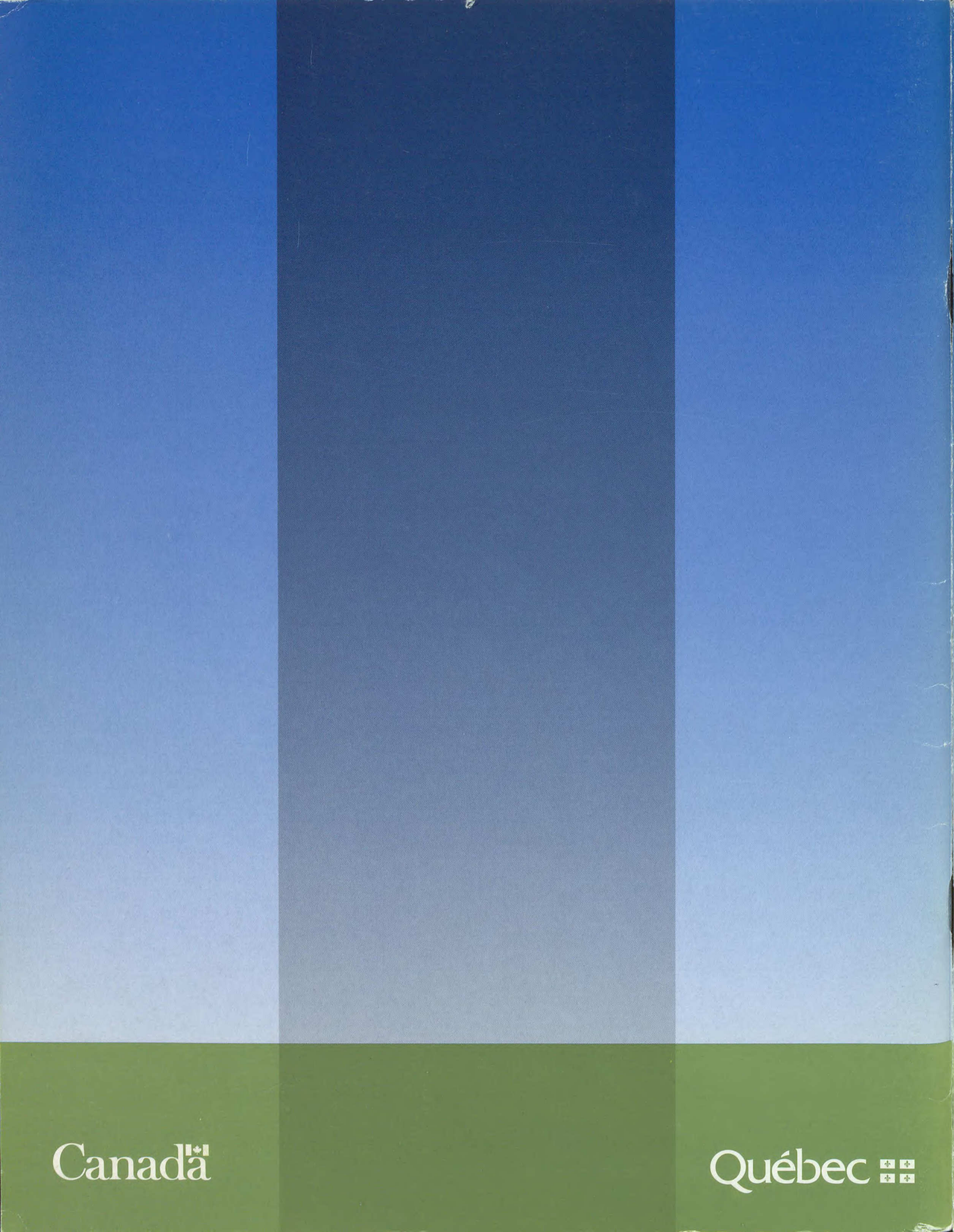
Dépôt légal, 2e trimestre 1993
Bibliothèque nationale du Québec

Cat. No. C2-216 1993E
ISBN 0-662-20727-0


Printed on recycled fibers

DATE DUE - DATE DE RETOUR

JUL 04 1994	


Canada
Québec