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THE CLEAN AIR ACT
ANNUAL REPORT
1975–1976

Air Pollution Control Directorate
Environmental Protection Service
Department of Fisheries and the Environment

May 1976

Minister
Fisheries and Environment Canada

Ministre
Pêches et environnement Canada

His Excellency,
The Right Honourable Jules Léger,
Governor General and Commander-in-Chief of Canada.

May it Please Your Excellency:

I have the honour herewith, for the information of Your Excellency and the Parliament of Canada, to present the Annual Report on the Clean Air Act for the fiscal year ended March 31, 1976.

Respectfully submitted,

Roméo LeBlanc

Deputy Minister
Fisheries and Environment Canada

Sous-ministre
Pêches et environnement Canada

The Honourable Roméo LeBlanc
Minister of Fisheries and the Environment
Ottawa, Canada

Dear Mr. LeBlanc:

I have the honour to submit the Annual Report on the Clean Air Act for the fiscal year ended March 31, 1976.

Respectfully submitted,

J.B. Seaborn

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INTRODUCTION

The Clean Air Act was officially proclaimed on November 1, 1971. This report, submitted in accordance with Section 41 of the Act, covers operations for the period ending March 31, 1976.

The Clean Air Act provides the basis for the federal government's air pollution control activities and has three main objectives. The first and foremost is to promote a uniform approach across Canada. To achieve this, the Act is designed to prevent the creation of so-called 'pollution havens', a matter that is of great concern to both federal and provincial authorities.

A second major objective of the Act is to make provision for the mechanisms and institutions needed to ensure that all measures to control air pollution can be taken. Of major significance is the recognition that provinces have a direct responsibility in controlling air pollution and that joint cooperative efforts between provincial and federal authorities are required. To this end, the Act enables the federal government to enter into agreements with individual provinces and allows the delegation of administrative and enforcement authority where this is possible; the Act also provides for direct action by the federal government when this is necessary.

Finally, the Act attempts to delineate a leadership role for the federal government. It is recognized that certain tasks can and should be handled at the federal level either because of constitutional considerations or because the federal government is in the best position to manage the task.

RESPONSIBILITIES OF THE MINISTER

The responsibilities of the Minister under the Clean Air Act are to:

(a) establish, operate, and maintain a system of air pollution monitoring stations throughout Canada;

(b) collect, both through the operation of air pollution monitoring stations and from other appropriate sources, data on air pollution in Canada and process, correlate, and publish such data on a regular basis;

(c) conduct research and studies relating to the nature, transportation, dispersion, effects, control, and abatement of air pollution and provide consultative, advisory and technical services, and information related thereto;

(d) formulate comprehensive plans and designs for the control and abatement of air pollution and establish demonstration projects, and publicize, demonstrate, and make such projects available for demonstration; and

(e) publish or otherwise distribute or arrange for the publication or distribution of all pertinent information that would serve to inform the public of all aspects of ambient air quality and of the control and abatement of air pollution.

ENVIRONMENTAL PROTECTION SERVICE

Within Environment Canada the Clean Air Act is administered by the Environmental Protection Service through its five regional offices across Canada and through the Air Pollution Control Directorate and the Federal Activities Environmental Branch in Ottawa.

Air Pollution Control Directorate

The responsibilities of the Air Pollution Control Directorate are divided among three branches.

The Air Pollution Programs Branch is responsible for development and coordination of Canada's National Air Pollution Surveillance (NAPS) Program as well as specific ambient air monitoring and source sampling surveys. Nationwide inventories of air pollutant emissions and national inventories of potentially hazardous air contaminants are developed as prerequisites to the national program of air pollution control and abatement. The Branch is responsible for the nontechnical aspects of emission standard regulations and guidelines development, including analyses of the socioeconomic implications of air pollution control. The Branch coordinates the development and prescription of National Air Quality Objectives and is also responsible for interservice, intergovernmental and international liaison.

The Abatement and Compliance Branch is primarily concerned with the application of known technology to the capture and containment of pollutants from stationary and mobile sources. The Branch is the focal point of engineering and technical expertise on air pollution emissions and current control and abatement methods. Technical assessments, state-of-the-art reviews and industry studies are prepared and used as technical bases for the development of air pollution control guidelines, regulations and standards. Joint government-industry task forces, planned, organized and chaired by the Branch, recommend abatement technology for use in establishing guidelines and regulations. Major stationary sources of air pollution, such as iron and steel mills, nonferrous smelters, pulp and paper mills, thermal power generating stations and incinerators are the responsibilities of three divisions of the Branch: The Mining, Mineral and Metallurgical Division, the Chemical Process Sources Division and the Combustion Sources Division. Emissions from motor vehicles, ships, railways and aircraft are the responsibility of the Mobile Sources Division, and a fifth division, Fuels, is responsible for fuel production sources, for inventories of fuels and for fuel composition and additive regulations.

The Technology Development Branch has two primary responsibilities. One is to manage a cost-shared program with Canadian industry for the development and demonstration of new air pollution control technology and the other is to provide the technical and scientific services required by the Directorate. These services include the development and certification of analytical techniques required to support regulations and guidelines; the preparation of standard reference materials for analytical laboratories across Canada that are engaged in analysis of air pollutants; the operation of a motor-vehicle-testing facility which assesses the compliance and durability of pollution control equipment on new motor vehicles sold in Canada; the provision of a computerized information service on air pollution control; the editing, publication and distribtuion of all Directorate reports on its scientific and technical activities; and the training of inspectors, analysts and enforcement officers in federal, provincial and municipal jurisdictions. These functions are performed in three divisions: Engineering, Chemistry, and Publications and Training.

Major activities of the Directorate in the review period included the compilation of six national inventories of potentially hazardous air contaminants, the revision of the 1970 nationwide inventory of air pollutant emissions based on data for 1972, the development and implementation of the computerized National Emissions Inventory System, expansion of the National Air Pollution Surveillance Network, the establishment of additional National Air Quality Objectives, the prescription of additional National Emission Standards and Guidelines, the control of air pollution from works, undertakings, and businesses under federal legislative authority, the control of the composition of fuels produced in Canada or imported into the country, and the letting of two contracts for cost-shared demonstration of new air pollution control technology. Specific tasks done in these and other programs are described in more detail in the following pages. An organization chart for the Directorate and a resource summary for the Air Pollution Control Program are shown in Figure 1 and Table 1 respectively.

Environmental Protection Service Regional Offices

The primary points of contact with provincial environmental protection agencies are the five Environmental Protection Service Regional Offices located in Halifax, Montreal, Toronto, Edmonton, and Vancouver. Regional Directors are responsible for providing, within their region, direction and supervision of Environmental Protection Service programs arising from the Clean Air Act together with policies and commitments resulting from bilateral and international agreements. Regional Directors formulate and administer enforcement and other operational programs in accordance with national policies and guidelines.

Federal Activities Environmental Branch

The Federal Activities Environmental Branch was established to demonstrate the federal government's concern for its own activities. The Branch is Environment Canada's interface on pollution matters with all federal departments, agencies and crown corporations. It also represents the Department in negotiations on

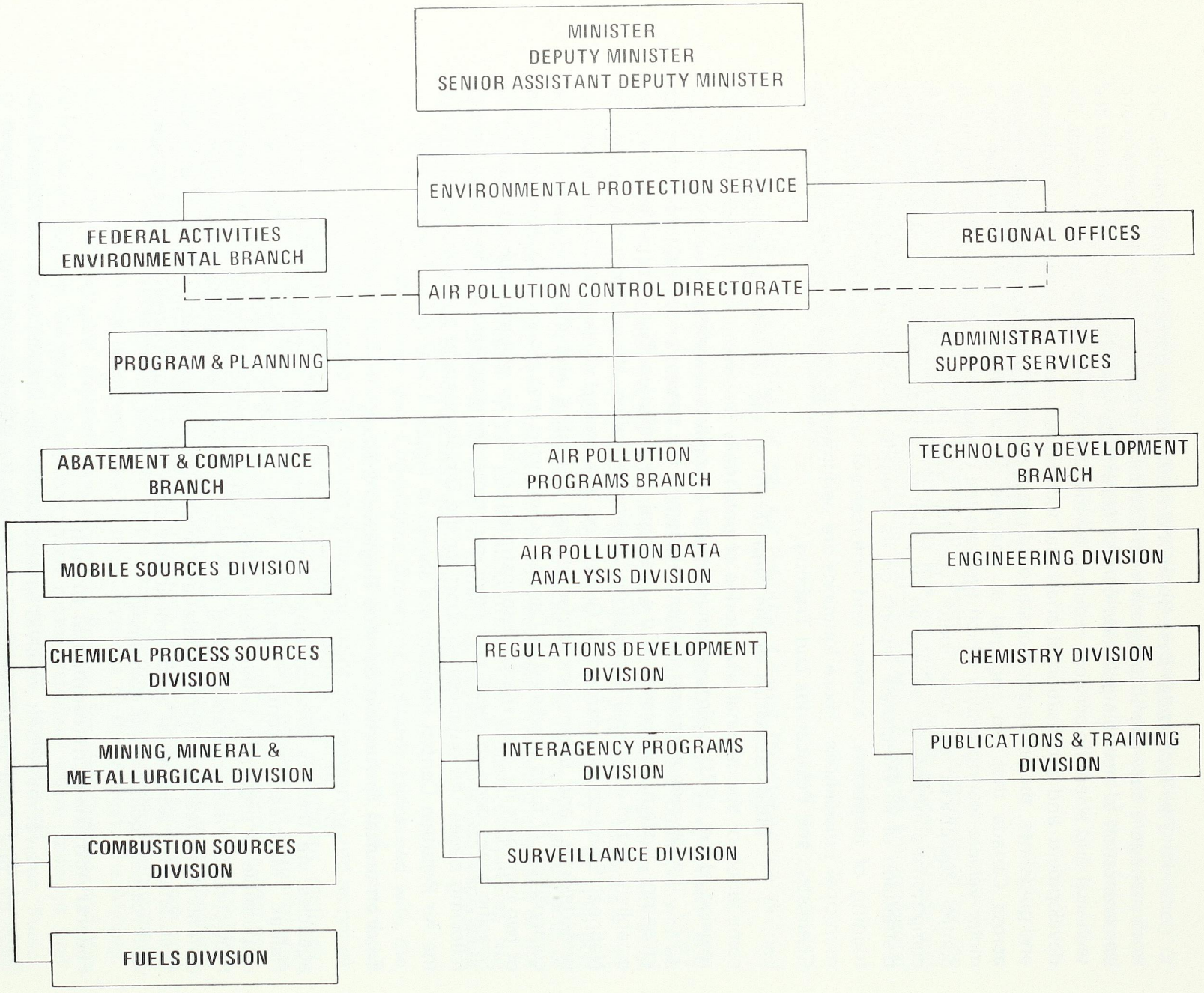

FIGURE 1 ORGANIZATION OF THE AIR POLLUTION CONTROL DIRECTORATE

TABLE 1 AIR POLLUTION CONTROL PROGRAM RESOURCE SUMMARY

Fiscal year	End of year strength	Salaries ($)	Goods and services ($)	Capital ($)	Total expenditure ($)
1970–1971	38	268 326	113 527	157 458	539 311
1971–1972	76	900 000	455 000	660 000	2 015 000
1972–1973	147	1 711 000	644 000	1 079 000	3 434 000
1973–1974	151	1 859 000	1 053 000	958 000	3 870 000
1974–1975	163	2 533 279	1 077 210	1 132 507	4 742 996
1975–1976	176	3 171 686	1 231 818	827 838	5 231 342

environmental matters with any organization receiving financial assistance or operating under permits granted by the federal government. The Branch is concerned with the treatment and disposal of waste water, toxic and hazardous substances, solid waste management, air pollution and noise for all land and off-shore facilities.

Centres for facilitating exchanges between the many organizations which have needs and those which have expertise have been established in the Environmental Protection Service Regional Offices. Guidelines, technical advice and assistance are arranged through these centres to ensure that all new federal projects are examined for possible environmental effects and that proper environmental protection measures are incorporated into project designs and operations. The Federal Activities Environmental Branch is also charged with defining pollution problems at existing facilities, developing courses of remedial action, and, in consultation with other departments, recommending clean-up project priorities and allocating funds from a central Federal Activities Clean-Up Fund.

INTERAGENCY COOPERATION AND COLLABORATION

General

The Environmental Protection Service maintains close contact with all provincial pollution control agencies, with other federal government departments and agencies, and with foreign and international organizations responsible for air pollution control.

Because the provinces have jurisdictional control over most air pollution sources, it is essential for the federal government to maintain collaboration with provincial agencies. Control programs initiated by the Environmental Protection Service are frequently implemented by provincial agencies. Close liaison is also maintained with the Office of Air Quality Planning and Standards of the United States Environmental Protection Agency to facilitate information exchange.

The Air Pollution Control Directorate participates with other federal agencies in a number of international environmental organizations. These include the Environment Committee of the Organization for Economic Cooperation and Development (OECD), the World Health Organization (WHO), the Economic Commission for Europe (ECE), and the North Atlantic Treaty Organization Committee on the Challenges of Modern Society (NATO/CCMS). The Directorate contributes to the activities of the International Joint Commission through membership on the International Air Pollution Advisory Board and the International Michigan-Ontario Air Pollution Advisory Board. The Directorate also provides program support to the Air Pollution Control Association.

Federal-Provincial

The Federal-Provincial Committee on Air Pollution is the principal national mechanism for obtaining federal-provincial cooperation and for promoting provincial participation in specific national projects. The committee was established on an ad hoc basis in 1969 by the Department of National Health and Welfare. With the formation of Environment Canada in 1971, the committee was formally established under the aegis of the Minister of the Environment. The committee provides a forum for the exchange of technical and scientific information and methodologies and for the regular surveillance of the state of air quality in Canada. During the review period a meeting of the committee was held in Ottawa (May 6-8, 1975).

In 1970, a subcommittee of experts was established to recommend to the parent committee appropriate levels for National Air Quality Objectives. Recommendations of the subcommittee have permitted air quality objectives to be prescribed at the desirable and acceptable levels for sulphur dioxide, suspended particulates, carbon monoxide, oxidants and nitrogen dioxide. These objectives have been published in the Canada Gazette.

A separate subcommittee of the Federal-Provincial Committee on Air Pollution has been established to recommend Maximum Tolerable Levels of Air Quality. These levels denote concentrations of air contaminants that require abatement without delay to avoid further deterioration of conditions to an air quality that endangers the prevailing life-style or, ultimately, to an air quality that poses a substantial risk to public health. During the review period, the subcommittee recommended Maximum Tolerable Levels for sulphur dioxide and particulate matter, separately and in combination. The levels are 800 $\mu g/m^3$ (0.31 ppm) over 24 h for sulphur dioxide; 400 $\mu g/m^3$ over 24 h for suspended particulate matter; and 125 000 $(\mu g/^3)^2$ over 24 h for the product of the sulphur dioxide and the suspended particulate matter.

Another subcommittee was formed in 1974 to recommend criteria for air-monitoring site selection. This subcommittee has met several times and will probably make recommendations to the parent committee during the next review period. At the 1975 meeting of the Committee an ad hoc subcommittee was established to examine whether the Committee should involve itself with air quality indices, and, if so, what form the indices should take. The first meeting of this subcommittee was held in the past year and recommendations are expected during 1976.

Another important activity of the committee is the National Air Pollution Surveillance (NAPS) Network. The NAPS Network is a cooperative effort of the federal and provincial levels of government that monitors all locally significant air pollution parameters in all major centres of population. The network enables the surveillance of progress in air pollution control across the country. Its method of operation and other pertinent details are explained elsewhere.

Because the provinces have jurisdiction over most air pollution sources, Environment Canada has adopted the basic strategy of promoting and supporting

provincial control agencies through federal-provincial cooperation. Assistance to the provinces has included the free exchange of data, the training of enforcement officers, inspectors and technicians and the provision of monitoring equipment for the National Air Pollution Surveillance Network and technical and advisory services.

International

Environmental Protection Agency. Officers of the Environmental Protection Service maintain many contacts with officials of the United States Environmental Protection Agency to exchange information and services.

The Air Pollution Control Directorate acquired the computerized Emissions Inventory System from the Environmental Protection Agency and modified it to meet Canadian requirements. The new system, called the National Emissions Inventory System, became partially operational late in 1975. Emissions data accumulated manually over the years are now being incorporated into the system which will eventually be used for the development and maintenance of Canadian air pollutant emission inventories.

Through regular attendance at the United States National Air Quality Criteria Advisory Committee, which advises the Environmental Protection Agency, Environment Canada is kept informed on many areas pertaining to air quality research, priorities and programs. The Environmental Protection Service cooperated with the Environmental Protection Agency in the completion of a program of quality control and method development for laboratory analysis of ambient air samples as part of the United States vinyl chloride monitoring program. This has resulted in improved detection limits in the analysis of gaseous vinyl chloride.

For the third consecutive year, the Environmental Protection Agency made the services of its Air Pollution Technical Information Center freely available to the Air Pollution Control Directorate. Details of the operation of this information service in Canada are provided elsewhere.

International Joint Commission. The International Air Pollution Advisory Board is a standing board of the International Joint Commission (IJC). Air pollution problems that arise along the Canada-United States border are investigated by the Board and reported to the Commission. The Board is involved in resolving instances of transboundary air pollution and has participated in examining the potential for transboundary pollution from projects on both sides of the border. The Air Pollution Control Directorate provides the Canadian Chairman of the Board as well as a member and technical assistance.

A report on the study of transboundary air pollution in the Detroit-Windsor and Sarnia-Port Huron areas was issued by the International Joint Commission in 1972. The Premier of Ontario and the Governor of Michigan signed a Memorandum of Agreement in 1975 to implement an integrated cooperative program for the abatement of transboundary air pollution in the southeastern Michigan-southwestern Ontario area.

As requested in the Agreement, the IJC created the International Michigan-Ontario Air Pollution Board to monitor the progress of air pollution control programs in the transboundary area. The Air Pollution Control Directorate provides the Canadian Chairman and technical assistance to this Board.

Other International Organizations. To ensure that Canada remains well informed with respect to international developments in air pollution control technology and fulfills her international obligations in air pollution control, the Air Pollution Control Directorate continued to participate in several international programs. This participation is coordinated through the Department of External Affairs and involves programs of the World Health Organization (WHO), the Organization for Economic Cooperation and Development (OECD), the Economic Commission for Europe (ECE), the NATO Committee on the Challenges of Modern Society (NATO/CCMS) and the United Nations Environment Program (UNEP). The Air Pollution Control Directorate provides Canada's delegate to the OECD Air Management Sector Group and participates through the Interdepartmental Committee of International Environment Affairs in activities of the Environment Committee and other sector groups. Canada is involved in studies such as photochemical air pollution and control strategies for sulphur dioxide pollution.

The Air Pollution Control Directorate provided Canada's representative to the January-1975 meeting of the Economic Commission for Europe Working Party on Air Pollution Problems. In this forum, the Directorate is participating in the preparation of a seminar on air pollution control in the inorganic chemical industry and is represented on a task force of rapporteurs responsible for the development of guidelines for the control of emissions from nonferrous metallurgical industries.

The Directorate provided Canada's representative to meetings of the Assessment Methodology Panel of the Air Pollution Pilot Study of NATO/CCMS. Canada is involved in the preparation of NATO/CCMS documents on Emission Inventory Techniques and Data Handling, Emission Projection Techniques and Guidelines to Assessment of Air Quality.

Interdepartmental

Regular contact is maintained with the Environmental Health Directorate of Health and Welfare Canada on public health aspects of air pollution control. The Department of Indian and Northern Affairs is kept informed of Service activities related to air pollution control in the Yukon and Northwest Territories. Communications are maintained, as necessary, with other departments and agencies of the federal government such as the National Research Council, the Department of Industry, Trade and Commerce, the Department of Energy, Mines and Resources, and the Economic Council of Canada.

SURVEILLANCE ACTIVITIES

General

Section 3 of the Clean Air Act makes provision for the collection and publication of data on air pollution. This includes a responsibility for maintaining a continuing record of ambient air pollution levels in urban areas on a national basis, for defining problems through field investigations, for ensuring compliance with regulations and for providing consultative services to federal or provincial agencies on air monitoring and surveillance.

Air Pollutant Emission Inventories

A prerequisite to an effective air pollution control program is an accurate definition of the pollution problem. Such a definition can be made only through the compilation of inventories of the sources and emissions of pollutants and through a determination of the concentration of various pollutants in the atmosphere. The latter is accomplished through the NAPS Network and various ambient air quality studies which will be discussed in later sections; the former through the air pollutant emissions inventory program.

One of the first actions taken after passage of the Clean Air Act was to contract with a consultant for the compilation of a Nationwide Emissions Inventory for Canada. The inventory provided an overview for 1970 of air pollution problems with respect to five major contaminants: sulphur dioxide, particulate matter, carbon monoxide, hydrocarbons and nitrogen oxides. The inventory was recently revised and updated by the Air Pollution Control Directorate to provide a similar overview of nationwide emissions for 1972. Results of this survey are summarized in Table 2. A further revision based on data for 1974 is now underway. The inventory will be updated regularly to provide a basis for assessing the effect of provincial and federal air pollution regulatory activities.

Inventories are also compiled on pollutants that may present a significant danger to health. These inventories provide problem definitions and assist federal and provincial control agencies in developing programs and establishing control priorities. National inventories of the sources and emissions of zinc, cadmium, arsenic, manganese and fluoride for 1972 have been compiled through a contract with a consultant and a national inventory of vanadium emissions for the same year has been completed by Directorate staff. Their findings are summarized in Table 3. Inventories of this type will be updated as new data become available.

All inventory information acquired will be stored in a computer for rapid retrieval. The recently developed National Emissions Inventory System is now operational and information is being incorporated into the system. An agreement has been reached with the Province of Ontario to include some of the air pollutant emissions data held by the Air Management Branch of the Ontario Ministry of the Environment. Similar agreements are being negotiated with other provinces.

TABLE 2 NATIONWIDE AIR POLLUTANT EMISSIONS, 1972

Source	Emissions (tons x 10^3)				
	Particulate matter	Sulphur oxides*	Nitrogen oxides**	Hydro-carbons	Carbon monoxide
Transportation	71	85	1213	1521	10 698
Fuel combustion in stationary sources	304	1550	490	31	74
Industrial processes	1572	4966	136	147	1 295
Solid waste incineration	56	3	4	46	543
Miscellaneous	342	–	71	819	2 453
TOTAL	2345	6604	1914	2564	15 063

* Sulphur oxides (SO_x) expressed as SO_2
** Nitrogen oxides (NO_x) expressed as NO_2

TABLE 3 SUMMARY OF EMISSIONS OF SPECIFIC AIR POLLUTANTS, 1972

Province or Territory	Emissions (tons)					
	Zinc	Cadmium	Arsenic	Vanadium	Manganese	Fluoride
Yukon, N.W.T.	48	2	169	<1	1	<1
Maritimes	645	29	21	566	239	1 169
Newfoundland	21	1	1	75	2	157
Quebec	3225	421	416	1326	1509	7 553
Ontario	1618	72	2921	57	4285	2 747
Manitoba	1162	19	508	5	109	103
Saskatchewan	893	3	5	7	384	186
Alberta	263	3	7	12	74	1 316
British Columbia	276	10	18	15	22	2 412
CANADA*	8153	560	4073	2065	6625	15 644

* All estimates are to the nearest ton. Total provincial estimates may not equal the CANADA total shown.

National Air Pollution Surveillance Network

To ensure sound planning of activities within the air pollution control program, it is important to have a continously updated knowledge of the nature and extent of air pollution across Canada. The National Air Pollution Surveillance Program regularly provides data on ambient air levels of the major contaminants on a continuing basis. Short-term surveys are used to provide information in response to special requirements. The National Air Pollution Surveillance (NAPS) Network consists of air monitoring instruments located in major population centres across Canada. The accumulation of network data has permitted the detection of trends in the levels of pollution with changing industrial activity, population density and air pollution abatement progress. Information collected by the program can be used in epidemiological studies and in the development of air quality objectives.

During 1975-76, the NAPS Network was expanded and improved. On March 31, 1976, the Network comprised 484 instruments, including 212 continuous gaseous pollutant monitors, located at 150 stations in 48 cities. Expansion of the Network during the year included the installation of 16 suspended particulate samplers, 13 sulphur dioxide monitors, 15 carbon monoxide monitors, 6 nitrogen oxide monitors, 6 ozone monitors and 9 hydrocarbon monitors. There are now 30 stations in the Network with continuous monitors for all pollutants of current major concern. Figure 2 is a map showing the location of the sampling stations.

Data from these stations are compiled by the Directorate and published as monthly and annual summaries. Measurements include soiling index, suspended particulates, lead, dustfall, sulphation rate, sulphur dioxide, carbon monoxide, ozone, nitrogen oxides and hydrocarbons. Data for suspended particulates, sulphur dioxide, carbon monoxide, ozone and nitrogen dioxide at selected locations are listed in Tables 4, 5, 6, 7 and 8 respectively.

A statistical analysis of ambient air quality in Canada during the period 1970-74, based on data compiled by the National Air Pollution Surveillance Network, was initiated and results will be reported shortly.

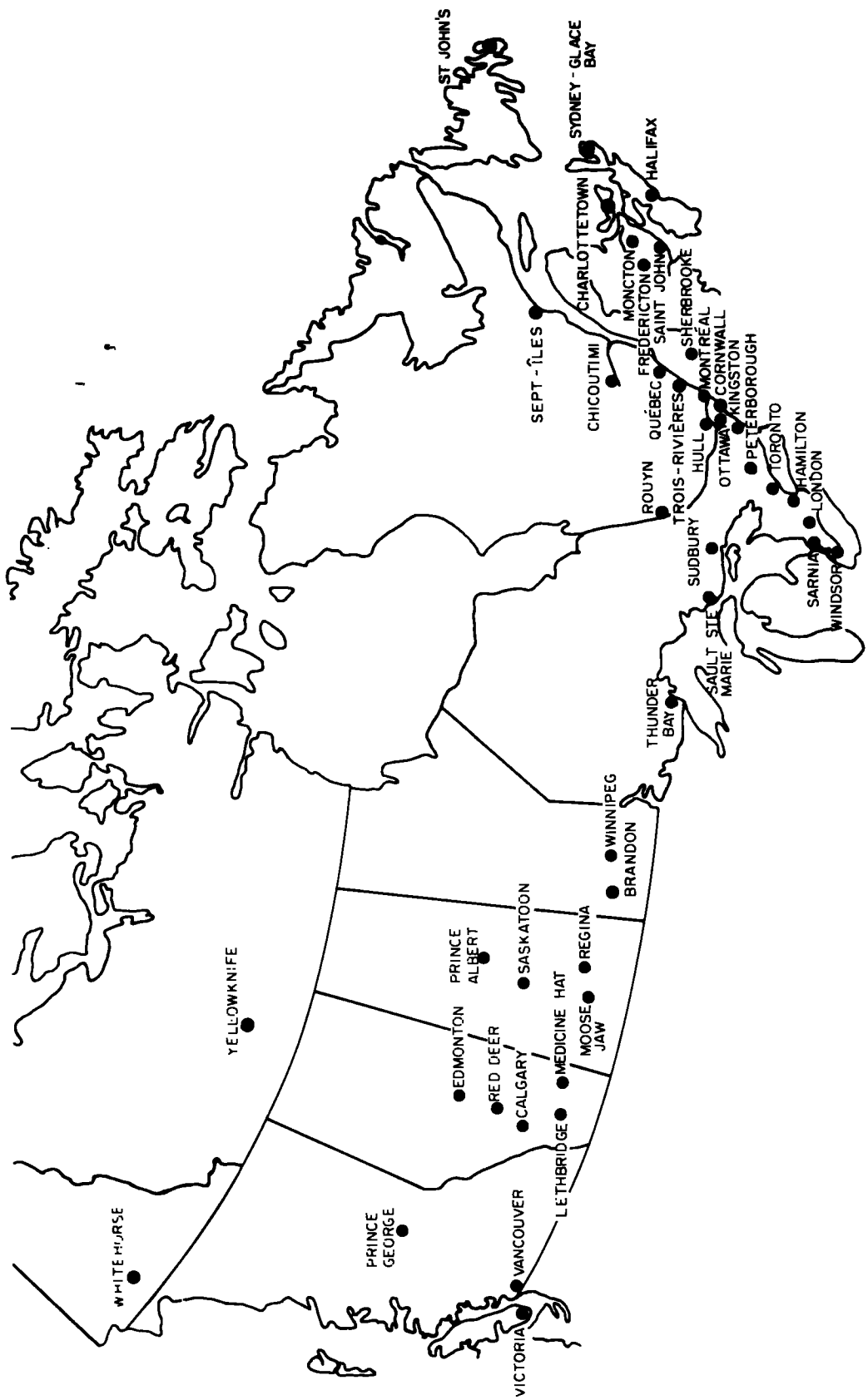

FIGURE 2 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK (DECEMBER 1975)

TABLE 4 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR SUSPENDED PARTICULATES–COMMERCIAL DOWNTOWN CORE AREAS

Location	Annual geometric mean (micrograms per cubic metre)					
	1970	1971	1972	1973	1974	1975
St. John's, Duckworth & Ordinance			54	55	51	49
Charlottetown, Kent & Queen				50	49	43
Halifax, N.S. Tech. College			42	49	47	52
Sydney, County Jail			46	66	68	*
Fredericton, Woodstock	33	36	*	19	23	+
Fredericton, York						46
Saint John, 110 Charlotte	61	54	46	55	60	55
Moncton, Post Office	77	54	54	54	*	*
Montreal, 1212 Drummond		111	132	101	128	101
Montreal, Duncan & Decarie					167	136
Hull, Rue Principale	77	73	69	72	79	80
Quebec, Parc–Autos Paquet–Laliberte			83	101	104	103
Chicoutimi, City Hall			75	57	57	68
Ottawa, Slater & Elgin	109	92	75	87	91	77
Windsor, City Hall	142	122	91	121	122	80
Toronto, 67 College	111	99	92	101	81	71
Hamilton, Barton & Sanford	140	144	133	128	105	98
Sudbury, 19 Lisgar				63	55	50
Sault Ste. Marie, Prov. Ont. Bldg.	44	55	66	58	50	42
Thunder Bay, 14 Algoma	84	69	60	76	60	54
London, King & Rectory		125	95	94	92	73
London, 372 Dundas		83	60	69	59	51
Sarnia, 156 Victoria		105	98	104	89	73
Peterborough, 139 George		.	72	80	*	*
Winnipeg, Kennedy & York	79	73	75	78	77	+
Winnipeg, 270 Osborne						75
Brandon, 11th & Princess				68	69	49
Regina, 12th & Smith	66	57	49	58	66	64
Saskatoon, City Library		72	68	65	71	77
Moose Jaw, Telephone Bldg.			48	65	69	74
Prince Albert, 49–12th St. E			51	69	77	68
Edmonton, 100 St. & 102 Ave.				65	71	117
Calgary, 316–7th Ave.	117	105	85	147	122	125
Red Deer, 4747 50th	74	59	58	61	62	57
Medicine Hat, 770 1st St. SE	67	57	57	74	88	71
Lethbridge, 13th St. & 9th Ave. S	38	41	38	57	45	37
Yellowknife, 50th Ave. & 51st St.				79	60	49
Vancouver, 739 West Hastings	104	89	77	61	56	53
Victoria, Police Station	51	59	44	47	44	44
Whitehorse, Federal Bldg.					85	52

* Insufficient data available to calculate valid annual geometric mean concentrations.

\+ Station relocated.

TABLE 5 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR SULPHUR DIOXIDE-COMMERCIAL DOWNTOWN CORE AREAS

Location	Annual arithmetic mean[1] (parts per hundred million)					
	1970	1971	1972	1973	1974	1975
Charlottetown, Kent & Queen					1.1	1.1
Halifax, N.S. Tech. College			3.3	3.2	3.1	
Halifax, Barrington & Duke						1.8
Saint John, Post Office					2.5	1.4
Montreal, 1125 Ontario	5.4	4.1	3.7	2.0	2.7	2.5
Montreal, 1212 Drummond	9.9	8.0	6.6	4.7	5.2	3.6
Montreal, Duncan & Decarie					1.3	1.8
Hull, Rue Principale	2.4	1.7	1.3	1.2	0.9	1.0
Ottawa, Slater & Elgin	4.5	2.2	3.0	2.5	2.4	2.0
Windsor, 471 University	3.6	4.3	3.6	3.2	3.3	2.9
Toronto, 67 College	7.1	5.2	3.0	1.4	1.2	1.5
Hamilton, Barton & Sanford	3.7	2.9	1.7	1.8	2.2	2.0
London, King & Rectory		1.4	0.6	0.4	0.8	0.5
Sarnia, 156 Victoria		2.7	1.9	1.7	2.6	2.3
Winnipeg, Kennedy & York			1.0	0.4	0.7	
Winnipeg, 270 Osborne						0.2
Regina, 12th & Smith			0.0	0.1	0.0	0.0
Saskatoon, City Library				0.4	0.0	0.0
Moose Jaw, Telephone Bldg.				0.1	0.0	0.0
Edmonton, 109th St. & 98th Ave.			0.1	0.0	0.0	0.0
Calgary, 620-7th Ave. SW			0.3	0.2	0.2	0.0
Vancouver, 739 West Hastings			1.4	0.7	0.7	
Vancouver, Hornby & Smythe						1.1
Victoria, Police Station			1.1	0.6	0.5	0.2
Whitehorse, Federal Bldg.					0.6	0.6

1 Due to instrument limitations, extreme caution should be exercised in interpreting mean values less than 1 pphm.

TABLE 6 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR CARBON MONOXIDE–COMMERCIAL DOWNTOWN CORE AREAS

Location	Annual arithmetic mean (parts per million)		
	1973	1974	1975
Montreal, 1125 Ontario		2.5	2.4
Ottawa, Slater & Elgin	3.1	3.2	3.1
Windsor, 471 University	4.7	5.1	4.8
Toronto, 67 College		1.9	1.3
Hamilton, Barton & Sanford	2.1	2.0	1.5
London, King & Rectory		1.0	1.5
Winnipeg, Kennedy & York	2.4	1.6	
Winnipeg, 270 Osborne			1.2
Regina, 12th & Smith		0.6	0.8
Saskatoon, City Library		1.0	0.7
Edmonton, 109th St. & 98th Ave.	2.1	2.0	1.3
Calgary, 620–7th Ave. SW	4.3	3.1	2.5

TABLE 7 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR OZONE–COMMERCIAL DOWNTOWN CORE AREAS

Location	Annual arithmetic mean (parts per hundred million)		
	1973	1974	1975
Montreal, 1125 Ontario	0.8	1.1	1.3
Montreal, Duncan & Decarie	1.7	1.0	1.0
Windsor, 471 University	1.9	1.3	1.7
Toronto, 67 College		2.0	2.4
Hamilton, Barton & Sanford	3.0	1.8	2.3
Sarnia, 156 Victoria	2.6	1.7	2.4
Winnipeg, 270 Osborne		0.9	1.0
Edmonton, 109th St. & 98th Ave.	0.8	1.3	2.2
Calgary, 620–7th Ave. SW	0.9	1.3	1.4

TABLE 8 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR NITROGEN DIOXIDE-COMMERCIAL DOWNTOWN CORE AREAS

Location	Annual arithmetic mean (parts per hundred million)		
	1973	1974	1975
Montreal, 1125 Ontario		3.0	2.1
Windsor, 471 University	2.8	2.6	2.9
Toronto, 67 College	2.9	3.2	2.8
Edmonton, 109th St. & 98th Ave.		3.6	4.8

Source Testing

Source tests were conducted at several industrial plants to evaluate or develop source sampling reference methods, to gather data for use in the development of emission guidelines and regulations, and to obtain information in response to specific requests. Plants at which sampling tests were done inlcuded three asbestos mining and milling plants, three chlor-alkali plants, two municipal waste incinerators, two sewage sludge incinerators, one thermal power plant and one gold smelter.

Standard Reference Methods for Source Testing. A standard reference method for measuring sulphur dioxide emissions was completed. Reference methods for measuring nitrogen oxides, asbestos and mercury in stack emissions are in preparation.

Ambient Air Surveys

Responsibility for the operation of the Strait of Canso air monitoring network, now in its fifth year, was transferred to the Nova Scotia Department of Environment. A survey of mercury in the ambient air was completed in the vicinity of a chlor-alkali plant at Lebel-sur-Quévillon, Quebec. In New Brunswick, the Saint John-Lorneville air sampling network completed its second year of operation. This is a cooperative study by the province of New Brunswick with the city of Saint John, the Atmospheric Environment Service and the Atlantic Regional Office of the Environmental Protection Service. Data from this study will be used in planning control strategies for the Lorneville industrial complex. During a six-week period in the spring of 1975, ambient concentrations of sulphates, manganese, cadmium and vanadium were measured at 75 sampling stations across Canada. Similar surveys, using the facilities of the NAPS Network, will be repeated periodically for pollutants of special interest.

Evaluation of Air Monitoring Instruments. The purpose of this program is to find the most reliable equipment, methods and procedures for monitoring air pollution

levels. During the review period, five sulphur dioxide monitors were evaluated in the laboratory. Similar evaluations of air monitors for other pollutants, of calibration devices, and ancillary equipment were finished and 18 instrument evaluation reports were completed. Minimum instrument performance specifications and test procedures were incorporated into the evaluation program to eliminate by extensive testing all but the most suitable equipment.

A major study to determine the effect of sample flow rate, particle size and loading on total suspended particulate measurements was completed in four cities (Windsor, Toronto, Montreal and Sydney). Three types of cascade impactors were evaluated to assess their accuracy and precision. The data are now being analyzed and the most suitable instrument will be recommended for inclusion in the NAPS Network.

Effects Studies. The air pollution study being done with the cooperation of Health and Welfare Canada in Sydney, Nova Scotia is still in progress. It will be continued for several years and will provide information on air contaminant levels near the steel mill and the effects of these contaminants on human health and welfare. Data are being obtained on total suspended particulates, particle size distribution, sulphur dioxide concentrations, sulphation rate, dustfall, various meteorological parameters and the effects of air pollution on various types of structural metals.

Calibration. An extensive calibration program was started for the NAPS Network. The objective is to improve the quality of the data gathered by the Network through the incorporation of standard reference materials for the calibration of air monitors.

Quality Assurance. Standard methods and procedures are being developed and published to provide air monitoring agencies with uniform guidance in all phases of ambient air monitoring activities, including the collection, analysis, interpretation, validation and presentation of ambient air pollution data. Although the work is directed towards the NAPS Network, it will be applicable to any air monitoring survey or network.

TECHNOLOGY DEVELOPMENT

Program for the Development and Demonstration of Pollution Abatement Technology (DPAT)

The effective control of air and water pollution depends upon the availability of technically sound and economically feasible methodology. Recognizing that it might be necessary for the federal government to encourage the development and demonstration of new control technology, the Clean Air Act makes provision for such a program in Section 3. Accordingly, the Environmental Protection Service developed a program that provides for cost-shared agreements with industry to develop and demonstrate new control technology. The DPAT program became operational during this

review period. In the air sector the initial emphasis was placed on the development of technology for the capture and containment of fine particulates and sulphur compounds.

The first contract let by the Air Pollution Control Directorate was to British Columbia Forest Products Limited. The Company is developing a new type of dry, high-temperature impact scrubber to remove a salty smoke which results from the burning of waste from logs previously stored in salt water. During the process of combustion at high temperatures and in the presence of the wood char, some of the salt is converted to a corrosive chemical that could cause adverse health effects when inhaled. If this new technology development is successful, it will be widely applied in the forest products industry and will also be transferable to other industry sectors in Canada.

The second contract let by the Air Pollution Control Directorate was for the containment of a mixed gaseous and particulate emission from a kraft paper mill at St-Anne-Nackawic, New Brunswick. The technology under development is based on a wet scrubber that will simultaneously collect fine particulate emissions from a recovery boiler and dissolve a gaseous emission containing odiferous sulphur compounds. If successful, the technology will find wide application across Canada in the pulp and paper industry. In an average size plant, the new technology will permit the recirculation of several thousand dollars worth of chemicals that are daily being lost to the atmosphere as air pollutants.

Standard Reference Methods

Every air pollution control standard regulation is supported by a sampling technique and a method of analysis for the regulated pollutant. During the review period a standard reference method for mercury emissions was developed in support of a regulation for chlor-alkali plants. The method has been successfully field tested with industrial cooperation.

When Health and Welfare Canada decided that it would be prudent to control the level of lead in gasoline, Environment Canada developed regulations and the supporting sampling and analytical techniques. Two such methods were developed, a rapid method for inspectors in the field and a more accurate one for application in the laboratory. The methods used are applicable with minor procedural differences to the analysis of leaded and unleaded gasolines.

During the review period, vinyl chloride monomer was recognized as a carcinogenic air pollutant and new sampling techniques and analytical methods were developed. A field survey adjacent to a major manufacturing facility was completed. The results of the analytical assessment support the requirement for a Canadian regulation on emissions of vinyl chloride monomer.

To support a forthcoming regulation on asbestos: sampling technology and analytical methods were developed

Air Sampling Technology and Analytical Method Development

In recent years, it has become evident that some complex chemicals can have serious environmental effects. Among these are polychlorinated biphenyls, which are manufactured for many uses such as insecticides, herbicides, plasticizers and heat transfer media. They are characterized by their persistence in the environment and their tendency to accumulate in the food chain. Another group of complex organic materials includes polycyclic aromatic hydrocarbons which are generated during the combustion of fossil fuels and are generally less stable than polychlorinated biphenyls. A typical sample of polluted air may contain one hundred and fifty separate and distinct materials. During the review period, work continued on the development of analytical chemical methods for the separation and identification of these complex materials. Some of this work was done in cooperation with the Environmental Protection Agency of the United States. Other cooperative programs involved the World Health Organization and the United States National Bureau of Standards.

Instrument Development and Evaluation

Very few industrial processes operate steadily at a uniform rate. Usually there are wide process fluctuations with correspondingly wide variations in emission rates. The most reliable information on emissions can therefore be obtained only with continuous monitoring. During the review period a continuous chemiluminescent monitor was designed and constructed for monitoring reactive hydrocarbons, particularly olefins. A continuous monitor for mercury emissions was also designed and constructed. The instrument is helpful to plant operators because it permits them to adjust their process to minimize emissions.

Analytical Services

Analytical services for the NAPS Network and for several ambient air surveys were provided during the review period. The pollutants analyzed routinely were heavy metals, particularly lead, cadmium, vanadium and manganese; sulphates; mercury; arsenic; polychlorinated biphenyls and polynuclear aromatic hydrocarbons. Dustfall measurements were also made. Compressed gas mixtures for instrument standardization were analyzed for oxygen, carbon dioxide, carbon monoxide, oxides of nitrogen and hydrocarbons.

SCIENTIFIC AND TECHNICAL INFORMATION

Air Pollution Information System

During the development of a regulation or guideline for a stationary source, a major "state-of-the-art" review for the industry under study is compiled. The information in it is drawn from many sources: published literature, consultants' reports and computerized information banks. To ensure that Directorate staff have access to all available information, an information system was established for air pollution control.

It also serves current awareness requirements for senior staff, and the special air pollution information requirements for Canadian universities and industry. The system has full access to the APTIC computer-stored information system in the Environmental Protection Agency of the United States and handles all Canadian enquiries to that system. During the review period more than 100 computerized literature searches were completed for federal, provincial and municipal government agencies in Canada and more than 2000 individual information requests were answered. The system has more than 80 000 documents available on microfiche. Over 10 000 were added during this review period.

Training in Air Pollution Control Technology

In support of the regulatory activities of air pollution control agencies across Canada, air pollution control training courses continue to be presented for enforcement officers of the federal, provincial and municipal governments. Six courses were offered this year. They related to air pollution control technology, the cleaning of industrial gases, stationary source testing and air pollution meteorology. The courses were attended by 150 students representing three levels of government enforcement agencies. The training course in stationary source testing was prepared and presented under contract by the Industrial Research Institute of the University of Windsor. The remaining courses were developed internally and presented by lecturers from the Environmental Protection Service, universities, Canadian and United States' industry and consulting firms. One course was presented in Winnipeg, the remainder at headquarters.

Courses on the legal aspects of air pollution control were presented in Vancouver and Edmonton in cooperation with the Department of Justice. They were attended by 40 people.

With the exception of the course on stationary source testing, lectures continue to be recorded on videotape. The tapes are available to enforcement agencies across Canada for training purposes. Other audiovisual material on air pollution control has been added to the library which now contains about 220 videotaped lectures and 30 audio cassettes.

The first courses in the reading of plume opacity were held in the Quebec and Northwest regional offices of the Environmental Protection Service during the review period. Ninety enforcement officers were certified. Courses will be held at six-month intervals for recertification.

Publications

The Air Pollution Control Directorate edits, publishes and distributes the scientific and technical reports produced by its staff and consultants. During the review period 30 reports in four categories were published. Normal distribution is about 600 copies of each report. The clientele includes foreign governments, international

organizations,universities, industries, involved members of the public, federal, provincial and municipal government departments.

The reports published during the review period were the following:

Regulations, Codes and Protocols Series

EPS 1-AP-74-3	Standard Reference Methods for Source Testing: Measurement of Emissions of Sulphur Dioxide from Stationary Sources
EPS 1-AP-75-3	The Clean Air Act - Regulations and Guidelines. Compilation 1 (Oct. 1973 - May 1975)

Policy and Planning Series

EPS 2-AP-74-1	Canada's Motor Vehicle Pollution Control Program
EPS 2-AP-74-1	Le programme canadien de contrôle de la pollution des véhicules automobiles
EPS 2-AP-75-1	Canada's Air Pollution Control Program

Economic and Technical Review Series

EPS 3-AP-74-2	Air Pollution Emissions and Control Technology. Asphalt Paving Industry
EPS 3-AP-74-6	Air Pollution Emissions and Control Technology. Metallurgical Coke Manufacturing Industry
EPS 3-AP-75-1	Air Pollution Aspects of Odorous Substances. A Literature Survey
EPS 3-AP-75-2	An Annotated Bibliography of Canadian Air Pollution Literature
EPS 3-AP-75-3	Air Pollution Emissions and Control Technology. Secondary Lead Smelter and Allied Industries
EPS 3-AP-75-4	Control Technology for the Utilization and Disposal of Wood Residue
EPS 3-AP-76-1	National Inventory of Sources and Emissions of Manganese, Fluoride and Vanadium. Summary of Emissions for 1972

Surveillance Series

EPS 5-AP-75-1 to EPS 5-AP-75-12	National Air Pollution Surveillance Monthly Summaries for the year 1974, January to December inclusive

EPS 5-AP-76-1 to EPS 5-AP-76-6	National Air Pollution Surveillance Monthly Summaries for the year 1975, January to June inclusive

NATIONAL AIR QUALITY OBJECTIVES

General

National Air Quality Objectives are designed to protect public health and welfare by setting limits on levels of contaminants in the air. The Clean Air Act makes provision for three levels of air quality objectives: 'desirable' 'acceptable', and 'tolerable', for each major air pollutant.

The maximum acceptable level is intended to provide adequate protection against adverse effects on soil, water, vegetation, materials, animals, visibility, personal comfort and well-being. It represents the realistic objective today for all parts of Canada. When this level is exceeded, control action by a regulatory agency is indicated.

The maximum desirable level defines the ultimate goal for air quality and provides a basis for an antidegradation policy for the unpolluted parts of the country and for the continuing development of control technology.

The maximum tolerable level denotes a concentration of an air contaminant that requires abatement without delay to avoid further deterioration to an air quality that endangers the prevailing life-style or, ultimately, to an air quality that poses a substantial risk to public health.

National Air Quality Objectives prescribed to date by the Governor in Council and published in the Canada Gazette are shown in Table 9.

It is acknowledged that the effects of sulphur dioxide, carbon monoxide, suspended particulate matter and oxidants on public health and welfare are not necessarily understood to the extent considered desirable. As more information on the effects of these and other air pollutants becomes available, the National Air Quality Objectives will be revised accordingly.

NATIONAL EMISSION GUIDELINES

General

Under Section 8 of the Clean Air Act provision is made for the promulgation of National Emission Guidelines. These are now being developed for various industry sectors. The purpose of these guidelines is to specify levels of emissions of air contaminants that reflect the application, to the industrial processes involved, of best operating practices and best practicable technology in air pollution control. The adoption of these guidelines by appropriate regulatory agencies will result in significant

TABLE 9 NATIONAL AIR QUALITY OBJECTIVES

Air contaminant	Maximum acceptable level	Maximum desirable level
Sulphur dioxide	60 $\mu g/m^3$ (0.02 ppm) Annual arithmetic mean	30 $\mu g/m^3$ (0.01 ppm) Annual arithmetic mean
	300 $\mu g/m^3$ (0.11 ppm) Average concentration over a 24-h period	150 $\mu g/m^3$ (0.06 ppm) Average concentration over a 24-h period
	900 $\mu g/m^3$ (0.34 ppm) Average concentration over a 1-h period	450 $\mu g/m^3$ (0.17 ppm) Average concentration over a 1-h period
Suspended particulate matter	70 $\mu g/m^3$ Annual geometric mean	60 $\mu g/m^3$ Annual geometric mean
	120 $\mu g/m^3$ Average concentration over a 24-h period	
Carbon monoxide	15 mg/m^3 (13 ppm) Average concentration over an 8-h period	6 mg/m^3 (5 ppm) Average concentration over an 8-h period
	35 mg/m^3 (30 ppm) Average concentration over a 1-h period	15 mg/m^3 (13 ppm) Average concentration over a 1-h period
Oxidants (ozone)	30 $\mu g/m^3$ (0.015 ppm) Annual arithmetic mean	30 $\mu g/m^3$ (0.015 ppm) Average concentration over a 24-h period
	50 $\mu g/m^3$ (0.025 ppm) Average concentration over a 24-h period	100 $\mu g/m^3$ (0.05 ppm) Average concentration over a 1-h period
	160 $\mu g/m^3$ (0.08 ppm) Average concentration over a 1-h period	
Nitrogen dioxide	100 $\mu g/m^3$ (0.055 ppm) Annual arithmetic mean	60 $\mu g/m^3$ (0.033 ppm) Annual arithmetic mean
	200 $\mu g/m^3$ (0.11 ppm) Average concentration over a 24-h period	
	400 $\mu g/m^3$ (0.22 ppm) Average concentration over a 1-h period	

reductions in emissions of air contaminants and thus prevent deterioration of air quality on a national basis. The guidelines also establish the minimum standards required for all works, businesses and undertakings involving the federal government.

The guidelines are published in a form that allows their ready adoption by regulatory agencies, in particular provincial air pollution control agencies, as minimum standards for industry located within their jurisdiction. It is recognized that local conditions, such as topography or density of industrial development, may necessitate the adoption of more stringent environmental requirements.

Asphalt Paving Industry

Asphalt paving plants produce asphalt concrete by heating and drying aggregate and mixing it with asphalt cement. National emission guidelines were published in the Canada Gazette Part I on April 5, 1975, specifying the quantities above which particulate matter should not be emitted into the ambient air from these plants. Particulate emission limits were set at 0.3 g per normal cubic metre (or 0.10 grain per standard cubic foot) and plume opacity of 20%. The guidelines were developed in cooperation with the provinces and the asphalt paving industry.

There are approximately 350 asphalt plants in Canada with an annual production exceeding 14.5 million tons of paving asphalt valued at $116 million. Implementation of the guidelines on a national basis would reduce the emissions of particulate matter from asphalt paving plants to about 600 tons per year, from an estimated 60 000 tons per year, based on 1975 figures.

Coke Oven Industry

National emission guidelines for the coke oven industry, developed jointly by the federal and provincial governments together with industry representatives, were published in the Canada Gazette Part I on May 31, 1975.

Almost all coking coal consumption in Canada is directly related to the primary production of iron and steel. Metallurgical coke manufacturing is, therefore, directly geared to the growth of the Canadian steel industry. Because most of the coke-making plants in Canada are located in industrial or residential communities, the industry has been prompted to reduce particulate and sulphur dioxide emissions to acceptable levels.

About 1700 lb of coke are burned to produce one ton of iron. Reported atmospheric emissions of particulate matter and sulphur dioxide from the production of coke in Canada during 1972 were 8863 and 19 556 tons respectively (Table 10) and estimated emissions for 1975 were 8816 and 26 093 tons respectively.

The emission limits were set at 2.6 lb of sulphur dioxide and 1 lb of particulate matter for each ton of dry coke produced. In detail, the limits are:

(a) 100 grams of particulate matter per metric ton of dry coke produced (or 0.20 lb (avdp.) per short ton), for the charging operation;

(b) 0.046 gram of particulate matter per normal cubic metre (or 0.020 grain per standard cubic foot), measured dry and undiluted, for the exhaust gases downstream of the gas-cleaning equipment, for the pushing operation;

(c) 50 grams of particulate matter per metric ton of dry coke produced (or 0.10 lb (avdp.) per short ton) for the quenching operation;

(d) 0.046 gram of particulate matter per normal cubic metre (or 0.020 grain per standard cubic foot), measured dry and undiluted, for the exhaust gases downstream of the gas-cleaning equipment, for the operations involved in the crushing and screening of coal and coke;

(e) 0.069 gram of particulate matter per normal cubic metre (or 0.030 grain per standard cubic foot), measured dry and undiluted, for the exhaust gases from the battery stack(s)

(f) 1300 grams of sulphur dioxide per metric ton of dry coke produced (or 2.60 lb (avdp.) per short ton) (which is equivalent to a hydrogen sulphide content in the coke oven gas of 50 grains per 100 standard cubic feet), from the combustion of the coke oven gas.

Installation of pollution control equipment and changes in operating practice or technology, scheduled by the Canadian coke-making industry for 1975 and later, are expected to reduce particulate and sulphur dioxide emissions from this industry to a small fraction of the total now emitted. Modifications to meet the guideline levels would reduce total emissions by almost 70%.

Arctic Mining

Emission guidelines for arctic mining operations have been completed and will be published in the new fiscal year.

Other Industry Sectors

National emission guidelines now being developed for other industry sectors are listed below in the approximate order in which their completion is expected:

Natural gas processing industry
Thermal power generation industry
Petroleum refining industry
Incineration
Ferrous foundry industry

Pulp and paper industry
Iron and steel industry
Nonferrous smelting industry
Ferro-alloy industry
Chlor-alkali industry

TABLE 10 REPORTED AND ESTIMATED PARTICULATE AND SULPHUR DIOXIDE EMISSIONS FOR 1972 AND 1975 FROM THE CANADIAN METALLURGICAL COKE MANUFACTURING INDUSTRY[1]

Year	Region	No. of plants	Tons: Coke production	Tons: Emission	Tons: Total	Emission rate (lb/ton of coke)
PARTICULATE						
1972	Ontario	3	4 370 056	7 022	8 863	3.2
	Others	4	715 263	1 841		5.1
1975[2]	Ontario	3	5 195 000	5 914	8 816	2.3
	Others	4	1 090 000	2 902		5.3
SULPHUR DIOXIDE[3]						
1972	Ontario	3	4 370 056	15 897	19 556	7.3
	Others	4	715 263	3 659		10.2
1975[2]	Ontario	3	5 195 000	19 102	26 093	7.4
	Others	4	1 090 000	6 991		12.8

1 Based on normal operations from data reported in Air Pollution Control Directorate Questionnaire, 1973, from 7 plants.

2 Estimated from expected air pollution control equipment expenditures and changes in operating practice or technology at Canadian coke plants for the period 1973-75.

3 Total sulphur dioxide released because of coke oven gas use throughout the steel and coke complex.

NATIONAL EMISSION STANDARDS

General

Section 7 of the Clean Air Act empowers the Governor in Council to prescribe National Emission Standards for air contaminants which constitute a significant danger to human health. National emission inventories of such contaminants are essential to this activity and are reported under Surveillance Activities. Socioeconomic analyses are usually done in conjunction with this activity. The Air Pollution Control Directorate consults with the Health Protection Branch of Health and Welfare Canada to obtain recommendations on the potential health hazards of such contaminants. This year, Health and Welfare Canada advised that it would be prudent to control atmospheric emissions of vinyl chloride and arsenic to minimize the danger to public health. Accordingly, work proceeded on the development of regulations for these contaminants. Health and Welfare Canada had previously made similar recommendations for lead, mercury and asbestos.

Secondary Lead Smelters

During normal operations, secondary lead smelters produce emissions of particulate matter containing high levels of lead. Control technology is available to capture most of these particulate emissions. National Emission Standards Regulations for Secondary Lead Smelters were completed during the review period and will be announced in Part I of the Canada Gazette in the 1976-77 fiscal year.

Asbestos Mining and Milling

Approximately 95% of asbestos emissions to the ambient air arise from asbestos mining and milling operations. Control technology is available to provide a high degree of containment for emissions from these sources. Proposed National Emission Standard Regulations for this industry were developed and published in Part I of the Canada Gazette on December 13, 1975. The regulations were based on recommendations from a task force of representatives of the federal and provincial governments and the asbestos mining and milling industry.

In these regulations, the concentration of asbestos fibre in emissions from primary mining and milling operations is limited to a maximum of two asbestos fibres per cubic centimetre for the crushing, drying and milling operations and dry rock storage. These are the major sources covered under the proposed regulations. Developmental work is continuing for other mining and milling sources. Asbestos emissions from the manufacturing sector of the industry are not included. They will be the subject of a separate future regulation.

Mercury

Plants producing chlorine and caustic soda by a mercury cell process emit significant amounts of mercury to the atmosphere during their operations. A regulation

has been developed which will limit the amount of mercury emitted to the ambient air from mercury cell chlor-alkali plants. The regulation will be published in the 1976-77 fiscal year.

Arsenic

The major source of atmospheric emissions of arsenic has been identified as the metallurgical industry. Work on the background documents required to develop a regulation for arsenic emissions from this industry was started during the review period.

Vinyl Chloride

During the manufacture of vinyl chloride monomer and polyvinyl chloride, vinyl chloride is emitted to the ambient air. A state-of-the-art review of the emissions and the available control technology was completed during the review period. Work is proceeding to determine appropriate limits for a vinyl chloride emissions standard regulation.

Asbestos

In the manufacture of caustic by the diaphragm cell process, asbestos fibres may be released into the ambient air from the asbestos filters used in the process. During the review period, a draft regulation for these asbestos emissions was completed.

INSPECTORS AND ANALYSTS

Under Section 27 of the Clean Air Act the Minister may appoint any person to act as inspector or analyst for the purpose of enforcing regulations promulgated under the Act. In 1975-76, eight inspectors were designated. The training of these personnel for their enforcement duties was begun during this review period.

FEDERAL ACTIVITIES PROTECTION

General

The federal government's conduct of its own activities, as perceived by the public, has a powerful potential to work for or against the endeavours of the government in its role as a leader in environmental protection. Environment Canada has direct responsibility for ensuring that the federal government minimizes adverse environmental effects from all of its works, undertakings and businesses. Policies concerning these operations have been developed and include:

setting exemplary and comprehensive standards, guidelines and codes of good practice based on the best practicable technology for pollution control and protection of the environment;

- compiling an inventory of pollution problems associated with existing federal sources and activities;
- defining, through engineering investigations, all factors and circumstances pertinent to existing pollution problems and developing courses of remedial action and design concepts in consultation with operator departments and other departments with jurisdiction for environmental protection and with the provinces;
- recommending, in consultation with other government departments, government-wide project priorities and allocations on an annual basis for cleaning up existing pollution;
- arranging for or providing advice, assistance, and review of plans during design and construction phases;
- screening all new government facilities and activities for potential adverse effects on the environment;
- reviewing and assessing new projects to ensure that proper and adequate environmental control measures are provided;
- making measurements for surveillance and monitoring to ensure compliance with established environmental standards, guidelines, and codes of good practice;
- assessing the operations of crown corporations to ensure that they meet industrial standards as promulgated under the Clean Air Act;
- consulting with those departments and agencies responsible for environmental legislation to ensure the development of consistent federal regulations and requirements for pollution control, environmental protection and energy conservation; and
- assisting in the instruction of other government departments in the methods of implementing the Codes and Guidelines for Federal Facilities.

A guide is being developed for use by government departments in assessing the environmental consequences of proposed projects. The guide incorporates a screening system, which is the first phase in the evaluation process, to determine a project's level of environmental impact. Although each government department is responsible for environmental impact evaluation, the guide emphasizes that Environment Canada has the technical expertise available to assist government departments in fulfilling this responsibility.

In its pollution control programs, the federal government emphasizes leadership through a positive approach to the prevention, control and abatement of environmental pollution from federal activities. In this way,considerable leverage is

exerted on other public agencies and on the private sector to examine their own responsibilities in establishing measures for pollution control. The onus has been placed on Environment Canada to ensure consistency and effectiveness in the planning and implementation of the required programs. This includes identifying environmental problems, remedies, priorities, and monitoring. Examples of the types of projects managed under this program are given below.

Heat Recovery Incinerators at Toronto International Airport

The use of heat recovery incinerators at Toronto International Airport has been assessed and design studies are in progress. The concept involves on-site modular controlled air incinerators with boilers. The release of pollutants to the environment is minimized and energy from the waste is recovered as hot water for use at the airport. The concept is being studied for use at Halifax International Airport, CFB Petawawa, CFB Downsview and the CNR Transcona Yard.

Solid Waste-Sewage Incinerator at the Bedford Institute

A solid waste-sewage incinerator was installed and tested at the Bedford Institute of Oceanography to assess its practicability for use on federal vessels and in the Arctic. In connection with the control of pollution from federal vessels, a subgroup of the Interdepartmental Vessel Working Group was formed to investigate means of minimizing pollution from these vessels.

Air Pollution Assessment Studies

Air pollution assessment studies were completed for various federal facilities including the heating plant in Moose Factory, the Canadian Grain Elevator in Edmonton and the Agriculture Canada incinerator in Hull. Assessment studies were also done as part of a Royal Military College study of energy sources at all military installations.

Development of Guidelines

The following guidelines are being developed and will be completed shortly:

Guidelines Applicable to Incinerators at Federal Facilities
Guidelines Applicable to Boilers at Federal Facilities
Guidelines for the Monitoring and Surveillance of Pollution Control at Federal Establishments

Other Projects

The guidelines being prepared for boilers at federal facilities will propose a limit on emissions of sulphur dioxide. The installation of a sulphur dioxide scrubber is being investigated to demonstrate an alternative to fuel switching.

TECHNICAL AND ADVISORY SERVICES

The Environmental Protection Service continued to provide advice and assistance in those areas of air pollution control where its scientific and technical staff have developed unique specialized skills and knowledge. During the review period, technical assistance and advice were provided to other federal departments, provincial and municipal agencies, universities and industry. For example, assistance was provided to the Department of External Affairs and the Province of Saskatchewan during negotiations with the State Department of the United States and the State of Montana concerning the possibility of transboundary air pollution from the proposed Poplar River thermal generating station. Among other advisory or technical services provided were:

- provision of advice to the Department of Public Works and the Ontario Regional Office of the Environmental Protection Service in the Ottawa Master Plan Study;
- coordination and participation in the monitoring of the stack at the Ashbridge Bay sewage waste incinerator, Toronto;
- provision of advice on the burning in a cement kiln of chlorinated hydrocarbons and tar sand coke from the Great Canadian Oil Sands Company Limited;
- provision of comments to the National Energy Board hearing into the export of power by Ontario Hydro;
- provision of advice to the Pacific Regional Office of the Environmental Protection Service in the preparation of an assessment of British Columbia Hydro's preliminary impact assessment of the proposed Hat Creek thermal generating station;
- provision of technical advice and assistance to regional laboratories of the Environmental Protection Service and others on specialized analytical techniques such as atomic absorption spectrophotometry;
- review of environmental impact assessment documents prepared for the 125 000 barrel/day synthetic crude oil project proposed for startup in 1978 in the Athabasca Tar Sands area;
- participation with the Province of Alberta in a review of air pollution control technology applicable to the Syncrude project;
- provision of technical advice to the Pollution Control Board inquiry into the pollution control objectives for the forest products industry of British Columbia;

- provision of advice and technical assistance to the Cooperative Pollution Abatement Research (CPAR) programs for the pulp and paper industry;
- participation in the technical assessment of a fluoride pollution problem in Newfoundland;
- provision of technical advice to the Province of Saskatchewan in the development of regulations to control emissions from potash plants;
- provision of assistance to the Province of Manitoba in a series of Clean Environment Commission hearings regarding a nonferrous smelter in Thompson, Manitoba;
- participation in international standards committee work to ensure international uniformity of analytical methods;
- provision of technical advice to industry relative to potentially useful technology transfers for air pollution control; and
- support of the work of professional societies engaged in air pollution control.

REGULATION OF FUELS AND FUEL ADDITIVES

Sections 22 through 26 of the Clean Air Act provide for the regulation of fuel composition and fuel additives to reduce emissions of air pollutants when fuels are burned. During the review period, a state-of-the-art report was prepared on fuels and fuel additives. This study, with information gathered in surveys of the fuel processing industries, will permit the development of regulations which can limit:

a) fuel composition
b) impurity content of fuels
c) additives that can be used in fuels

To date, studies have been confined to petroleum fuels. In later reporting periods, natural gas and coal will be examined.

Lead-Free Gasoline Program

During the review period, 3535 samples of lead-free gasoline were tested under the national monitoring program. Sixty samples were found to exceed the allowable concentration of 0.06 gram of lead per imperial gallon of lead-free gasoline. Immediate corrective action was taken by the gasoline marketing companies. A consignment of gasoline fuel was seized in Saskatchewan when a gross contamination was detected. The alleged violator took prompt action to replace the contaminated fuel.

Leaded Gasoline Program

Refineries have been submitting quarterly reports to Environment Canada since September 1974 on the quantities of lead being added to gasolines at each refinery. In 1975, about 35 million pounds of lead were added to the premium and regular gasoline production. This is equivalent to an average lead concentration of 2.15 grams per imperial gallon. Effective January 1, 1976, the maximum lead content allowable in leaded gasoline is 3.5 grams per imperial gallon.

MOBILE SOURCES

General

There are no direct provisions in the Clean Air Act for the regulation of air pollution emissions from mobile sources. Other federal acts provide the authority to regulate these sources. The Clean Air Act does, however, address itself to mobile as well as stationary sources under its general provisions for air quality objectives, air quality monitoring and surveillance, fuel composition regulations, and federal-provincial cooperative programs.

With the passage of the Motor Vehicle Safety Act, the federal government initiated a program to combat air pollution from all new motor vehicles manufactured in or imported into Canada starting with the 1971 model year. Transport Canada was made responsible for the administration of the Motor Vehicle Emissions Regulations and Environment Canada for the execution of the required compliance testing and the provision of technical advisory services in support of the regulations.

The mobile source programs conducted by Environment Canada and in cooperation with other government agencies and industry provide technical test data for setting future emission standards and for reducing air pollution caused by in-use motor vehicles. These programs investigate the effects on emissions of the Canadian climate, of basic engine characteristics and fuels, of maintenance and driving habits, of variables in test equipment and procedures, and of commercial fleet operations. Scientific studies and evaluations include new power sources such as turbine and diesel, alternate fuels such as hydrogen and propane, inventions and test instruments. A fleet of eight test vehicles is maintained for these programs.

Compliance Monitoring Program

Automobile manufacturers are required to certify that new motor vehicles offered for sale in Canada conform to current emission standards. The federal government's compliance monitoring program is designed to ensure that emission rates from new automobiles do not exceed those standards.

Each model year, approximately 50 new motor vehicles representing the most popular makes, models and engine families and family combinations sold in Canada are tested for compliance with the emission standards. This work includes test

driving a total of 400 000 miles on a prescribed urban-rural route in the Ottawa area and performing 350 emission tests. Complete servicing and maintenance of each vehicle is done by the Emission Testing Laboratory of the Technology Development Branch.

Cold Weather Programs

This continuing program was started in November 1972 to determine the effects of the Canadian climate on emissions. Under this program, a fleet of 12 vehicles undergoes daily conditioning and emission testing (CVS-CH test procedure) at ambient temperatures in the range -10° to 60°F. Fifteen percent of the tests are done at baseline conditions (68°-86°F) on a rotational basis for comparison. Data from about 250 tests on vehicles equipped with different emission control systems indicated that emission levels increase substantially as temperature decreases. For example, at -10°F the levels can be as much as 150% higher, and at 20°F, 100% higher than baseline results.

Motor Vehicle Air Pollutant Inventory

Data from earlier surveys of truck and taxi activities in urban areas were incorporated into a new motor vehicle air pollutant inventory that is used to evaluate emission control strategies in major Canadian cities. To improve and update private motor vehicle statistics, a questionnaire was developed and sent to a small sample of vehicle owners in Toronto, Montreal, Vancouver, Edmonton, Calgary, Quebec City, Ottawa and Hull. The results of this survey will be published shortly. The data gathered in these studies and outputs from the model have been extensively used to evaluate the impact of motor vehicles in urban areas.

Control and Abatement of Air Pollution from Motor Vehicles

Emission Standards. To achieve significant emission reductions at low cost the federal government, in the past, followed the policy of paralleling United States' motor vehicle emission regulations. As a result, by meeting standards of 3.4, 3.9, and 3.0 grams per mile (CVS-CH test procedure) for hydrocarbons, carbon monoxide and oxides of nitgrgen, respectively, 1973 and 1974 model year cars were emitting only about one-third as much as uncontrolled vehicles. The Canadian Standards for 1975 were established at 2.0, 2.5, and 3.1 grams per mile (CVS-CH test procedure) for hydrocarbons, carbon monoxide and oxides of nitrogen respectively. These standards, which lead to a reduction in emissions of about 72% from uncontrolled values, will remain the same through the 1980 model year. Corresponding United States' standards for 1975-76 require about 82% control. A proposed new standard limiting carbon monoxide emissions from idling motor vehicles, for application to cars of the 1978 and later model years, was announced. To facilitate the tuning of motor vehicles with respect to emissions, new labelling requirements are being considered.

Annual Vehicle Inspections. Although the control of emissions from in-use motor vehicles is outside federal jurisdiction, the dramatic increase in emissions from

badly maintained vehicles is of great concern. A continuing program to review and evaluate compulsory emission inspection systems used in Canada, the United States, and several European countries has been started. The Air Pollution Control Directorate has proposed tentative guidelines for provincial and municipal motor vehicle inspection programs. These programs will be coordinated with the Ministry of Transport's feasibility study on annual safety inspections. Extensive advice continued to be given to the Quebec government to assist them in developing an inspection program. The Emission Testing Laboratory continued to perform emission tests to determine effects of maintenance on vehicle emissions and to evaluate test equipment that could be used in these inspections. A program was designed in cooperation with taxi companies in the Ottawa-Hull area to determine the emissions from a fleet of vehicles throughout their lifetime.

ATMOSPHERIC ENVIRONMENT SERVICE

General

The Atmospheric Environment Service has an active research program in support of air pollution control agencies and provides a wide range of meteorological information and consultation to federal and provincial agencies. The Service also participates in international activities concerned with air quality. Resources expended by the Service on its air quality program during the review period were 68 man years and $2.8 million.

Atmospheric Chemistry Studies

Trace substances from the atmosphere are deposited on the earth's surface in gaseous and particulate form by the scavenging action of precipitation and by fallout. More emphasis has been placed on research to assess the relative importance of these deposition processes under various combinations of atmospheric concentrations, surface characteristics and meteorological conditions. Deposition in precipitation appears to be the most important single contributor in many cases and field work this year was largely confined to precipitation chemistry. A field test of automatic precipitation collectors and a comparison of precipitation-only and bulk (precipitation plus dry dustfall) collectors was finished. The Service's precipitation chemistry network is being expanded to permit the investigation of regional differences in the wet deposition of trace substances in Canada.

The rate of oxidation of sulphur dioxide to sulphuric acid and sulphates has been studied at Sudbury using an aircraft to collect samples. Samples of the acid and particulates were collected on glass fibre filters while sulphur dioxide was trapped on chemically impregnated filter papers. Sulphur dioxide oxidation rates were found to be approximately 1%/h.

During sunny days in the Toronto area, a pale but distinctive orange-brown haze often develops. This phenomenon is most frequently seen in the summer but

occasionally appears at other times of the year. The Chemistry Division is studying the brown haze and its formation to determine whether it is photochemical in nature and whether it can be correlated with meteorological conditions. The Division is attempting to evaluate the transport of pollutants into Toronto and the movements of locally generated pollutants in the Toronto area. It is possible that pollutants originating elsewhere may contribute more to the formation of the brown haze than pollutants generated in the Toronto area itself.

Trace substances in the stratosphere are also being studied by the Service. Under Project STRATOPROBE, three high-altitude research balloon flights were completed in Saskatchewan. Data on the concentration of a number of gases were collected simultaneously and support results obtained at Fort Churchill in 1974. These measurements provide important information on the role of the ozone balance in the stratosphere. They also show that freons from aerosol sprays and refrigerators are being transported into the stratosphere where they are photodissociated by ultraviolet light.

Dispersion Studies

During 1975, work continued on several important aspects of the local and regional dispersion, transport and deposition of pollutants.

Research continued into dispersion from tall stacks, using the plume from the Sudbury 480-metre chimney as a test case. A variety of techniques were used to permit the quantitative evaluation of the differences in behaviour of this plume from those of the more 'classical' type of dispersion from lower stacks.

Dry and wet pollutant deposition mechanisms were investigated and plans for a 40-station Canadian precipitation sampling network were developed.

In response to the increasing concern about long-range transport of air pollutants, the Service is taking the lead in developing a departmental plan to investigate this problem in eastern Canada. Plans for the first pilot study of long-range transport were completed during the review period. This study, on sulphates, will be done in August 1976.

Several techniques for the remote sensing of pollutants and relevant meteorological parameters are being developed and evaluated. A contract to refine the Service's prototype minisonde was completed and the instrument is now commercially available from a Canadian company. Other techniques tested during the review period include the use of a correlation spectrometer for sulphur dioxide monitoring, Lidar monitoring of particulates, acoustic sounding and a special minisonde temperature sensor.

The Service is using computers to model the boundary layer so that urban and regional air quality predictions can be made. Existing urban and regional models are being assessed to determine their applicability to Canadian conditions. These models will be modified or new ones developed as appropriate.

Additional field work in Edmonton and Montreal on dispersion in urban atmospheres was delayed because of resource restraints. A contract was let to l'Université de Québec à Montréal to perform detailed analyses of data on the sulphur dioxide concentrations over Montreal, collected by helicopter several years ago. A field study at the Strait of Canso was completed and the data are being used to develop a regional dispersion model for that area.

The Service has a major role in the Alberta Oil Sands Environmental Research Program. During 1975 plans were finalized for an extensive meteorological monitoring system to complement the air quality monitoring system being installed by Alberta Environment. A major observational study was done in cooperation with Alberta Environment in March 1976. Several monitoring systems were used simultaneously to obtain information on small time and space scales. The systems included minisondes, a tethersonde, acoustic radar, plume photography, airborne plume sampling and ground-based and airborne correlation spectrometer measurements.

Cause-Effect Criteria

As part of the Saint John Regional Study, an assessment of the impact of air pollution on ecosystems is continuing, using lichens as sensitive indicators. An Index of Atmospheric Purity based on species frequency, distribution and coverage is being developed. Samples of lichens are being analyzed for atmospheric pollutants such as sulphur and heavy metals.

At the request of the New Brunswick Department of Fisheries and the Environment, a fumigation episode in Saint John, New Brunswick was evaluated in terms of vegetation damage. Extensive plant damage was characterized and related to sulphur dioxide emissions from two possible local emission sources.

A contract was let to the University of Guelph to derive air quality criteria for agricultural crops under various meteorological conditions.

Studies to establish the effects of air pollutants on arctic vegetation under a range of meteorological conditions are continuing under contract. Species which grow in harsh arctic climates may have different responses to the same burden of air pollution from species found in more southern regions.

Information and Consultation

In recent years, the Service has received increasing numbers of requests for advice from federal and provincial agencies, particularly with respect to environmental impact assessments. A small group has been established to provide advice on the air quality aspects of environmental assessments. A Canadian climatological study of poor ventilation conditions was completed using data collected for four years from 46 upper-air stations in Canada and the United States. For each station, the frequencies of occurrence and mean values for several pollution-potential indicators, including mixing height, wind speed and ventilation coefficient, were

recorded and stored on microfiche. These tables provide first approximations of the air quality impact of emissions at given locations. Caution must be exercised in interpolating results in areas with highly variable topography such as mountains and coastlines.

Several major air quality impact studies were completed during the review period. At the request of the Environmental Protection Service, studies were done on a proposed power plant at Poplar River, Saskatchewan, for renewal of the INCO Thompson, Manitoba permit, and on the Syncrude Oil Sands plant. The methodology for these studies is now well established and a manual is being prepared which, with the tables referred to above, will facilitate future research.

There has been a growing demand for advice and document review related to a wide range of environmental problems and associated topics including energy, transportation, agriculture and arctic development.

Monitoring

Ten stations are now being operated at rural and remote locations across Canada as part of the global air quality monitoring network of the World Meteorological Organization (Figure 3). The objective is to develop long-term records on background atmospheric composition. Special emphasis is placed on those constituents which may influence climate. All stations measure atmospheric turbidity and collect precipitation samples for subsequent chemical analysis. During 1975, Alert, Northwest Territories and Sable Island were extensively tested for suitability as carbon dioxide sampling sites, using a transportable carbon dioxide analysis system developed by the Service. Flask samples are now being obtained at both stations and analyzed for carbon dioxide concentrations by the Ocean Chemistry Division of Environment Canada in Victoria, British Columbia. A program to determine regional background levels of sulphur dioxide was started at the Service's upper air station at Shelburne, Nova Scotia.

A cooperative network of 22 tall towers ranging from 50 to 300 metres in height is coordinated by the Service. The network collects data on winds and temperature. Progress is being made towards placing instruments on the new CN Tower in Toronto to obtain data on the variation of temperature with height.

Science Subvention Program

During the review period a number of research programs were completed under the science subvention program and through direct research contracts. These activities fall into two broad categories: studies related to the physics and chemistry of the atmosphere, and studies related to the effects of meteorological conditions and air quality on water, soil and vegetation. Information from the second category of activities is used in assessing the applicability of cause-effect criteria to Canadian conditions. These criteria are then used in the establishment of national air quality objectives.

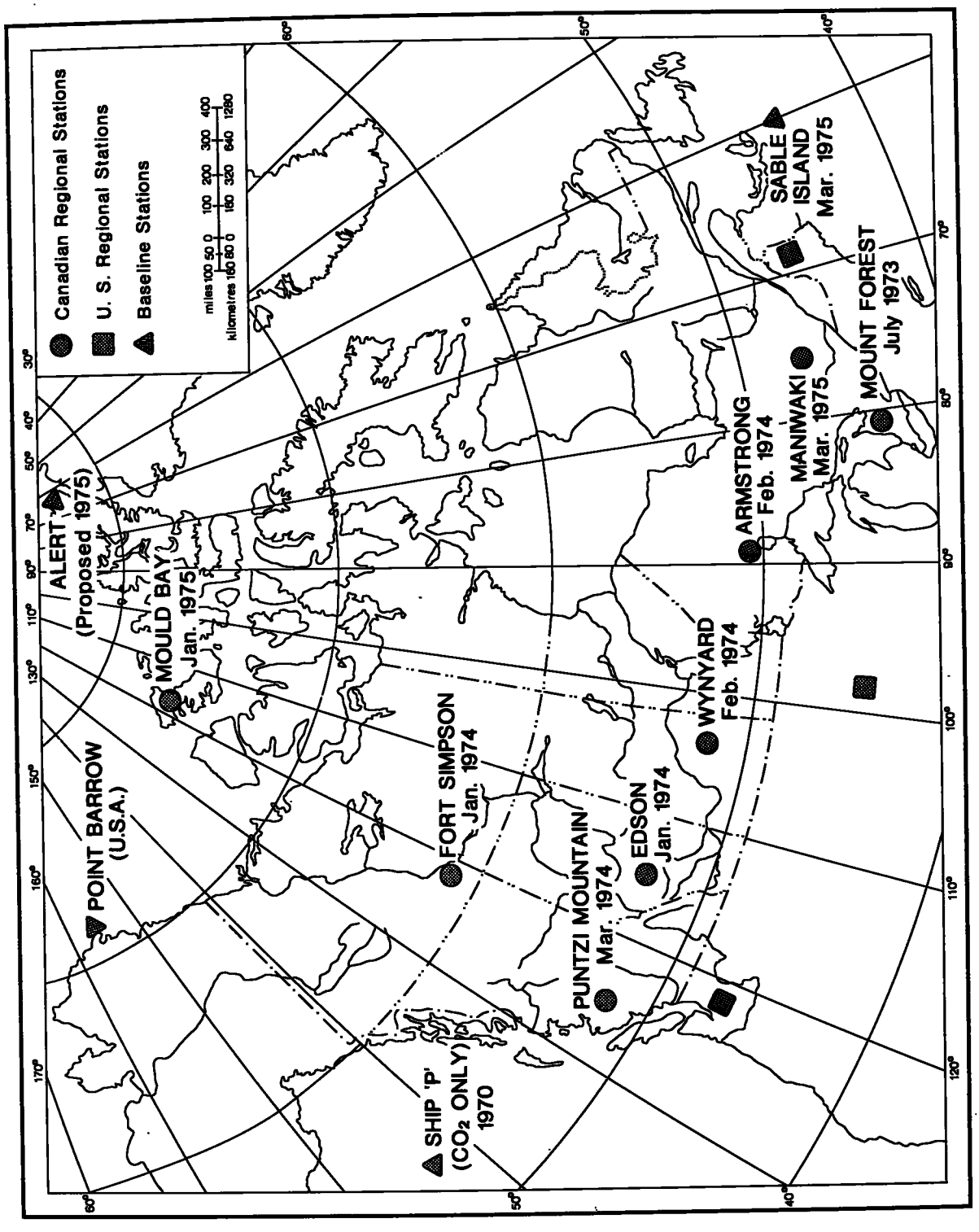

FIGURE 3 WORLD METEOROLOGICAL ORGANIZATION
BACKGROUND AIR POLLUTION STATIONS

International

Scientists of the Service continued to participate in various intergovernmental groups and international organizations involved in studies on topics such as the long-range transport of pollutants (OECD Working Group), multiple-source modelling of urban pollution (NATO/CCMS Working Group), environmental monitoring and assessment (WMO Working Group; International Congress of Scientific Unions), climatic change and the assessment of human activities as a change-forcing mechanism (WMO Working Groups; Global Atmospheric Research Program) and the input of airborne material to receptor surfaces (IJC Study of the Upper Great Lakes; WMO Rapporteur on Plant Injury by Air Pollution). Such international contacts provided an exchange of information on a wide variety of air pollution problems.

The Service cosponsored an international workshop: "First Specialty Symposium on the Atmospheric Contribution to the Chemistry of Lake Waters". The Proceedings were published by the International Association for Great Lakes Research. The Service hosted a WMO expert meeting on wet and dry deposition. The purpose was to exchange information on general developments in wet and dry deposition monitoring and to prepare a report for WMO's background pollution stations on the best available monitoring techniques.

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