THE CLEAN AIR ACT
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Air Pollution Control Directorate
Environmental Protection Service
Department of the Environment

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Minister
Environment Canada

Ministre
Environnement Canada

His Excellency
The Right Honourable Edward Schreyer
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, 1978.

Respectfully submitted,

L. S. Marchand

Len Marchand
Minister of State (Environment)

Deputy Minister
Environment Canada

Sous-ministre
Environnement Canada

The Honourable Len Marchand
Minister of State (Environment)
Ottawa, Canada

Dear Mr. Marchand:

I have the honour to submit the Annual Report on the Clean Air Act for the fiscal year ended March 31, 1978.

Respectfully submitted,

J.B. Seaborn

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HIGHLIGHTS

Air pollution control is not marked by the so-called dramatic breakthroughs that draw newspaper headlines or coverage in the national news broadcasts.

And yet, important advances, protective of public health and the environment, are indeed taking place not only in scientific and engineering fields but also in the essential area of cooperation between federal and provincial authorities.

It all adds up to a quietly ongoing but wholly determined effort to recapture, as much as is practically possible, the air purity that this country knew in its early days.

That is the long range goal of the federal Clean Air Act and each year since its passage in 1971 has seen significant movement in that direction.

Despite the increase in urban living, industrialization and use of the ubiquitous automobile, air pollution has generally been lessening. Surely a newsworthy trend!

The reader seriously interested in air pollution control in Canada will find a detailed story in the main body of this report. For a fast, overview sampling, some of the year's highlights follow.

- The federal government's special concern about air contaminants deemed hazardous to health led to further preventive steps. National emission standards for such air contaminants now cover lead from secondary lead smelters. Standards will become effective for mercury from chlor-alkali plants (July 1, 1978), asbestos from mines and mills (December 31, 1978), vinyl chloride from manufacturing operations (July 1, 1979), and arsenic from gold roasters (1979). A program to ensure compliance has been developed and is being implemented using provincial regulatory systems where possible.

- In the high priority area of national air quality objectives, maximum tolerable levels - concentrations requiring immediate attention - were prescribed for sulphur dioxide, particulate matter, carbon monoxide, oxidants and nitrogen dioxide.

- Release of an inventory of selenium sources and emissions brought to 12 the compilations on air pollutants that may present a significant danger to health and/or the environment. A thirteenth, benzene, will shortly be added. These inventories indicate the potential for a problem and enable control agencies to plan their control activities.

• The National Air Pollution Surveillance (NAPS) network was expanded and now consists of 554 instruments located at 157 stations in 54 cities. This extensive coverage includes 43 stations that provide continuous monitoring for all five major pollutants. Results were published as monthly and annual summaries.

• The trend of air quality in Canada for the 1970-74 period, based on NAPS network data, showed pollution levels generally to be on the decrease. An analysis covering the 1970-77 period will be released in the coming fiscal year.

• The nationwide inventory of the major air contaminants, updated biannually, provides a basis for assessing the effectiveness of regulatory activities across the country.

• Federal government guidelines for the cement, asphalt, coke oven and arctic mining industries continued to serve as models for provincial legislation passed during the year. Guidelines for other sectors are being developed.

• Under a program to aid industry develop new technology, a joint contract with the Ontario Ministry of the Environment was let to evaluate a commercial remote sensor for the measurement of sulphur dioxide point source emissions. This technique offers considerable advantage over the present method.

• Projects supported under the federal "unsolicited proposal" program included:

- work on a prototype instrument for sulphur trioxide determination in the presence of the dioxide in air or in stack gas;
- a study to improve the efficiency of electrostatic precipitators in non-ferrous smelter operations; and
- development of a novel mass spectrometer capable of measuring traces of organic contaminants in the air.

• Because of wide variations in the emission rates of most industrial processes, reliable information must depend on continuous monitoring. Such an instrument has been developed for mercury in stack gases with a high sulphur dioxide concentration.

• A quality control program was launched for laboratories analysing air pollutants. Involving some 60 laboratories across Canada, it completed its first project-comparative analyses on samples containing lead.

• Source testing took place at many industrial sites in cooperation with provincial authorities. It included sampling such diverse operations as a woodwaste incinerator, copper-zinc and secondary lead smelters, thermal power and polyvinyl chloride plants. These tests have a variety of applications.

• Air pollution assessment studies made at various sites from Dartmouth, N.S. to Kitimat, B.C., ranged from incinerators to a heavy water plant.

• Ambient air surveys yielded meteorological and other data in the Lingan area of Cape Breton, N.S.; measured carbon monoxide and suspended particulate matter at Lake Louise, Alta.; and monitored nitrogen oxides simultaneously with carbon monoxide in Whitehorse, Yukon.

• The Environmental Protection Service equipped seven of the twelve stations comprising the Lower Mainland air monitoring committee's network in the Fraser River Valley of British Columbia.

• Assistance went to Saskatchewan in the form of emission tests at two potash plants and a report on control technology for that industry; to Quebec in a source sampling project at the Noranda smelter; and to Manitoba in a quality assurance procedure for analysing heavy metals.

• With motor vehicles a major source of urban air pollution, federal research and regulations continued their role in reducing unwanted tailpipe emissions by

- ensuring compliance with new-car standards. Over 40 such vehicles were subjected to more than 300 emission tests under controlled driving conditions.

- a survey of 40 in-use 1977 model cars. It showed they were already badly tuned, emitting twice as much carbon monoxide and consuming 7.5% more fuel than they should. This was reported to the provincial authorities responsible for excess emissions from in-use vehicles.

- fuels information regulations dealing with petroleum fuels and additives and crude oil impurities. They become effective January 1, 1979.

- testing 2594 lead-free gasoline samples in a national monitoring program; 103 exceeded the allowable lead limit and corrective action followed immediately. One company that failed to report importing and producing leaded gasoline (which also exceeded the lead limit) pleaded guilty and was fined $3,000.

• Three field studies, part of a 10-year program, have now been completed on the estimated impact of the Alberta oil sands development on the area's air quality.

• A workshop on Canadian research into air quality criteria and standards was held and the proceedings will be published.

• To examine the serious problem of long range transport of air contaminants, one of the more serious aspects of which is the increased acidity of precipitation, a Canadian network of 50 stations for sampling precipitation went into operation. There is special concern over the projected increase in the use of coal as a North American fuel because coal combustion can be a major contributor to the long range transport problem.

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, 1978.

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 protect the health of the public of Canada from air pollution. To this end, federal regulations are promulgated limiting the emission of hazardous pollutants such as lead, mercury, vinyl chloride, asbestos and arsenic from specific industrial sectors. The second objective is to promote a uniform approach across Canada in the control of other pollutants. To achieve this and to provide appropriate leadership by the federal government, the Act enables the issuance of industrial sector guidelines aimed at preventing so-called "pollution havens", a matter that is of great concern to both federal and provincial authorities.

The third objective 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 establishment of arrangements for the implementation of regulations made under the Act; the Act also provides for direct action by the federal government when this is necessary.

RESPONSIBILITIES OF THE MINISTER

The responsibilities of the Minister under the Clean Air Act include:

(a) ensuring the development of regulations limiting the emissions of hazardous substances and guidelines recommending appropriate means of control for other substances;

(b) establishing, operating, and maintaining a system of air pollution monitoring stations throughout Canada;

(c) collecting, both through the operation of air pollution monitoring stations and from other appropriate sources, data on air pollution in Canada and processing, correlating, and publishing such data on a regular basis;

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

(e) formulating comprehensive plans and designs for the control and abatement of air pollution and establishing demonstration projects, and publicizing, demonstrating, and making such projects available for demonstration; and

(f) publishing or otherwise distributing or arranging for the publication or distribution of all pertinent information which would serve to inform the public in respect to all aspects of the quality of the ambient air and of the control and abatement of air pollution.

ENVIRONMENTAL PROTECTION SERVICE

Within the Department of the Environment 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 Branch in Ottawa. A resource summary for the Air Pollution Control Program is shown in Table 1.

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 contaminant emissions are developed and maintained as prerequisites to the national program of air pollution control and abatement and as an effective evaluation mechanism. The Branch is responsible for the nontechnical aspects of emission

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
1976-1977	165	3 069 500	1 210 300	795 487	5 075 287
1977-1978	156	3 411 000	2 024 800	781 800	6 217 600

standard regulations and guidelines development. The Branch coordinates the development and prescription of National Air Quality Objectives and is also responsible for interservice, intergovernmental and international liaison and coordination.

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 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: Mining, Mineral and Metallurgical, Chemical Process Sources, and Combustion Sources. Emissions from motor vehicles, ships, railways and aircraft are the responsibility of the Mobile Sources Division, and a fifth division, Fuels, is responsible for the regulation of 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 that 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 distribution 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.

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 General 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 General formulate and administer enforcement and other operational programs in accordance with national policies and guidelines.

Federal Activities Branch

The Federal Activities Branch was established to demonstrate the federal government's concern for its own activities. The Branch is the Department of the Environment's interface on pollution matters with all federal departments, agencies and crown corporations. It also represents the Department in negotiations on 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 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 air pollution control is a shared federal-provincial jurisdiction, 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 Environmental Protection Service participates with other federal agencies in a number of international environmental organizations.

Federal-Provincial

Federal-Provincial Committee on Air Pollution. This 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 discussion of air pollution control programs in Canada. During the review period a meeting of the Committee was held in Ottawa (May 9-11, 1977).

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. Objectives at the desirable and acceptable levels for hydrogen sulphide and hydrogen fluoride will be prescribed when the standard reference methods of measurement have been completed.

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, following the recommendations of this subcommittee, Maximum Tolerable Levels were prescribed in the Canada Gazette for sulphur dioxide, particulate matter, carbon monoxide, oxidants and nitrogen dioxide. The two subcommittees continue to consider proposals for air quality objectives as the need arises and they undertake periodic reviews of existing objectives.

Another subcommittee was formed in 1974 to recommend criteria for air-monitoring site selection. This subcommittee's recommendations for criteria for selecting sites for air monitoring instrumentation were accepted by the Committee at its 1976 meeting.

An ad hoc subcommittee was established in 1975 to examine whether the Committee should involve itself with air quality indices and, if so, what form the indices should take. The subcommittee presented preliminary recommendations to the parent committee at the 1976 meeting. Recommendations on a system of national air quality indices were presented and reviewed at the 1977 meeting. Final recommendations are expected to be made to the Committee at its 1978 meeting.

The Federal-Provincial Committee on Air Pollution has instituted an interlaboratory quality control program for methods of analysis of air pollutants. Approximately sixty laboratories are participating. The first comparative analyses, on samples containing lead, were completed.

An important concern of the Committee is the National Air Pollution Surveillance (NAPS) network. The NAPS network is a cooperative effort of the federal, provincial and municipal levels of government that monitors the concentrations of locally significant air pollutants in all major centres of population. The network enables the monitoring of progress in air pollution control across the country. Its method of operation and other pertinent details are explained elsewhere in this report.

Because the provinces have jurisdiction over most air pollution sources, the Department of the Environment 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 NAPS network and technical and advisory services.

Other Activities. During the review period, the Ontario Region of the Environmental Protection Service, the Air Pollution Control Directorate and the Province of Ontario continued their cooperative survey to determine fluoride concentrations in the ambient air and vegetation of Cornwall Island. Concentrations of fluorides were high in both cases. The results of the survey have been presented to the Air Pollution Advisory Board of the International Joint Commission. An aluminum smelter located in New York State is the source of the fluoride emissions.

A study jointly funded by the Department of the Environment and the Province of Ontario was completed on the evaluation of five continuous particulate monitors. The tests were done on a secondary lead smelter stack and the results showed the superiority of devices based on light attenuation and light scattering. In another cooperative venture with the Province of Ontario, combustion efficiency and stack emission tests were done on a fluidized bed wood waste boiler.

The Northwest Region of the Service and the Province of Saskatchewan jointly completed emission tests at two potash plants in Saskatchewan. The Air Pollution Control Directorate provided a technical report on control technology in the potash industry. These activities were in support of the Saskatchewan regulation development program.

The Quebec Region of the Service participated in a source sampling program initiated by the Province of Quebec at the Noranda smelter. The Air Pollution Control Directorate cooperated with the Province of Manitoba in a quality assurance program for the analysis of heavy metals.

International

Environmental Protection Agency. Liaison with the United States Environmental Protection Agency became more important during the review period. The exchange of information and services with the Environmental Protection Agency (EPA) has always been of considerable importance to the National Air Pollution Control Program and recent events have demonstrated the need to develop and maintain an even wider range of contacts with officials of the Agency.

Significant amendments to the United States Clean Air Act were passed in August 1977. Of particular interest to Canada is a section dealing with international air pollution. Under this section, the EPA Administrator, upon notification of complaint, can request that the State Implementation Plan for the area where the problem originates be modified to take into account anticipated endangerment of public health or welfare in a foreign country. The Secretary of State has the authority to ask the Administrator to request such a modification. This section of the United States Clean Air Act can only be invoked when reciprocal arrangements exist with the other country. Under Section 7 of the Canadian Clean Air Act, the Government of Canada can control the transboundary movement of non-hazardous pollutants only when the requirements of an international obligation are not being met. To bring about reciprocity, it will be necessary to create such an obligation through an appropriate international legal instrument.

The frequency with which issues of transboundary movement of air pollutants between Canada and the United States arise is increasing. This is expected to continue both as a result of the designation of large land areas in the United States near the Canadian border as pristine areas under United States Prevention of Significant Deterioration regulations and because of growing concern over the long range transport of various air pollutants.

Through regular attendance at various meetings in the United States, the Department of the Environment is kept informed on many areas pertaining to air quality research, priorities and programs. The Directorate continued to cooperate with the Environmental Protection Agency in quality assurance programs by testing the Agency's analytical methods and by exchanging samples for interlaboratory comparisons.

For the fifth 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 in this report.

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 Air Pollution Control Directorate provides the Canadian Chairman of the Board, a member and technical assistance.

One of the most important problems of transboundary air pollution in recent years has been the fluoride air pollution on Cornwall Island in the St. Lawrence River. The source is an aluminum smelter in New York State. In February, 1978, the Department of External Affairs initiated formal consultations with the State Department of the United States on this problem. The consultations have three purposes. The first is to review the 1977 IJC report that indicates that cattle on the Island are suffering from fluorosis. The other purposes are to inform the United States of Canada's concerns and to explore informally solutions to the problem.

The Board has reported to the Commission on two thermal power generation projects: Poplar River in Saskatchewan and Atikokan in northwestern Ontario. The Government of Canada has stated that, based on studies to date, there will be no significant risk to public health or property in the United States as a result of the operation of these two facilities.

In 1975, the Premier of Ontario and the Governor of Michigan signed a memorandum of understanding to implement an integrated cooperative program for the abatement of transboundary air pollution in the southeastern Michigan-southwestern Ontario area. As a result of this memorandum, the two governments requested the IJC to create the International Michigan-Ontario Air Pollution Board to monitor the progress of air pollution control programs being implemented in the transboundary area. The Air Pollution Control Directorate provides the Canadian Chairman and technical assistance to this Board.

Other International Organizations. In order that Canada may be well informed about developing policies and technology concerning air pollution control in other countries, the Service continued to participate in a broad spectrum of international programs. In doing so Canada's international obligations to contribute to this aspect of environmental protection are also satisfied. The participation of the Service in such programs 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 North Atlantic Treaty Organization Committee on the Challenges of Modern Society (NATO/CCMS) and the United Nations Environment Program (UNEP). The Canadian delegate to the OECD Air Management Sector Group is provided by the Air Pollution Control Directorate and is currently Chairman of the Group. Through the Interdepartmental Committee on Environment, Canada participates in activities of the Environment Committee and other sector groups of the OECD. The Air Pollution Control Directorate again provided Canada's representative to the Economic Commission for Europe Working Party on Air Pollution Problems.

The Directorate has been providing Canada's representative to meetings of the Assessment Methodology Panel of the Air Pollution Pilot Study of NATO/CCMS. Canada has been involved in the preparation of NATO/CCMS documents on Air Pollution Emissions Inventory Systems, Air Pollution Emissions Projection, and Air Quality Management Systems. The Panel is expecting to terminate its activities during the 1978-79 fiscal year.

During the review period the Service continued to participate in the Global Environmental Monitoring program of the World Health Organization by monitoring sulphur dioxide and suspended particulates in Hamilton, Montreal, Toronto and Vancouver. These cities form part of a global urban air pollution monitoring network.

The Service provided the Canadian representative to the Intergovernmental Maritime Organization's Ad-Hoc Group on Incineration at Sea and submitted technical guidelines for the control of the incineration of toxic wastes at sea.

In the development of analytical and sampling methodology, the Directorate maintains a close liaison with the American Society for Testing and Materials. The Directorate is a corporate member of the Society and Directorate scientists serve as members and chairmen of analytical subcommittees of the Society's Committee on Methods of Sampling and Analysis of Atmospheres.

The Directorate provides program support to the Air Pollution Control Association.

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, the Ministry of Transport, the Economic Council of Canada, the Department of Regional Economic Expansion and the National Energy Board.

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 and for providing consultative services to federal or provincial agencies on air monitoring and surveillance.

Inventories of Air Contaminant Emissions

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 contaminants and through a determination of the concentration of various contaminants in the atmosphere. The latter is accomplished through the NAPS network and various ambient air quality studies which are discussed in later sections; the former through the national inventory of air contaminant emissions program.

One of the first actions taken after passage of the Clean Air Act was to let a contract for the compilation of a Nationwide Inventory of Air Pollutant Emissions for Canada. The first inventory provided an overview for 1970 of air pollution problems with respect to the five contaminants that are the most significant in quantity: sulphur oxides, particulate matter, carbon monoxide, hydrocarbons and nitrogen oxides. The inventory was subsequently revised and updated by the Air Pollution Control Directorate to provide similar overviews of nationwide emissions for 1972 and 1974. Results of the 1974 inventory are shown in Table 2. The data will be published in the 1978-79 fiscal year. A further revision based on 1976 data is now in progress. The inventory is being updated bi-annually to provide a basis for assessing the effect of municipal, provincial and federal air pollution regulatory activities.

TABLE 2 NATIONWIDE EMISSIONS OF AIR CONTAMINANTS, 1974

	Emissions (tons x 10^3)				
Source	Particulate matter	Sulphur oxides*	Nitrogen oxides**	Hydro-carbons	Carbon monoxide
Transportation	81	91	1 330	1 320	10 806
Fuel combustion in stationary sources	338	1 436	504	147	165
Industrial processes	1 452	4 642	164	147	1 320
Solid waste incineration	34	3	6	30	358
Miscellaneous	480	-	78	855	2 688
TOTAL	2 385	6 172	2 082	2 499	15 337

* Sulphur oxides (SO_x) expressed as SO_2.

**Nitrogen oxides (NO_x) expressed as NO_2.

TABLE 3 SUMMARY OF SELENIUM EMISSIONS BY PROVINCE AND SECTOR, 1973 (lb)

	Province												
	Nfld.	P.E.I.	N.S.	N.B.	Qué.	Ont.	Man.	Sask.	Alta.	B.C.	Yukon-N.W.T.	Total Canada	% Total
Natural emissions[a]	-	-	-	-	-	-	-	-	-	-	-	-	-
Mining and milling of copper-bearing ores	-	-	-	-	459	781	364	-	-	972	[c]	2 576	0.65
Mining and milling of lead-zinc ores	5	-	-	[d]	[d]	-	-	-	-	[d]	276	582	0.15
Primary copper and nickel	-	-	-	-	[d]	[d]	[d]	-	-	-	-	198 000	50.15
Primary lead and zinc	-	-	-	[d]	[d]	[d]	[d]	-	-	[d]	-	6 087	1.54
Selenium processing	-	-	-	-	[d]	[d]	-	-	-	-	-	72 960	18.48
Glass manufacture	-	-	-	-	4 498	2 117	-	-	-	-	-	6 615	1.68
Alloy steels manufacture	-	-	-	-	-	388	-	-	-	-	-	388	0.10
Pharmaceutical manufacture	-	-	-	-	<1	-	-	-	-	-	-	<1	-
Rectifier manufacture	-	-	-	-	-	<1	-	-	-	-	-	<1	-
Pigment production	-	-	-	-	N*	-	-	-	-	-	-	N*	-
Rubber manufacture							Negligible					N*	-
Coal combustion	13	33	4 679	822	2 865	52 644	2 528	10 976	22 696	1 148	-	98 404	24.93
Heavy fuel oil combustion	261	84	729	644	2 407	755	30	19	23	252	5	5 209	1.32
Diesel oil combustion	16	1	8	11	69	66	23	33	44	66	14	351	0.09

Transportation	64	15	118	99	717	915	129	126	258	288	15	2 744	0.70
Solid waste incineration	5	1	36	6	164	197	44	16	17	26	N*	512	0.13
Sewage sludge incineration	-	-	-	-	-	131	-	3	-	1	-	135	0.03
Natural gas processing	-	-	-	-	-	-	-	-	154	-	-	154	0.04
Coal cleaning	-	-	2	-	-	-	-	-	10	14	-	26	0.01
Tobacco smoking						14						14	N*
TOTAL[b]	364	134	5 572	1 952	74 347	217 042	57 188	11 172	23 201	3 450	321	394 758	
% TOTAL	0.09	0.03	1.41	0.49	18.83	54.98	14.49	2.83	5.88	0.87	0.08	(197 tons)	100.0

[a]Unknown.

*Negligible.

[b]Because emissions from one sector are not broken down into provinces, the provincial totals are incomplete and do not sum to the Canada total shown.

[c]Included in B.C. total.

[d]Individual provincial emissions are not recorded in order to maintain confidentiality.

All inventory information about these five contaminants is being stored in the National Emissions Inventory computerized System (NEIS) for easy access and retrieval of data. Pursuant to an agreement reached previously with the Province of Ontario, some of the air contaminant emissions data held by the Air Management Branch of the Ontario Ministry of the Environment have been added to the NEIS. Discussions are continuing with other agencies for similar participation.

Inventories are also compiled on contaminants that may present a significant danger to health and/or to the environment. These inventories provide problem definitions and assist federal and provincial control agencies in developing programs and establishing control priorities. To date, twelve such inventories have been completed and published, the most recent estimating emissions of selenium. A summary of the results of this inventory is shown in Table 3. An inventory of the sources and emissions of benzene is now being compiled by Directorate staff. During the review period the data collection by a consultant for the compilation of inventories of eleven additional contaminants was completed. This information, which is limited in scope, will be complemented with other data during the next fiscal year to form the basis for national inventories of the sources and emissions of nickel, cobalt, antimony, tin, bismuth, chromium, copper, barium, phosphorus, chlorine gas and hydrogen sulphide. Inventories of this type will be updated as new data become available.

The Directorate made an important contribution during the review period to the development of a departmental program plan on the long range transport of air pollutants. During the next fiscal year, the Directorate will continue to be significantly involved in the program by developing a comprehensive inventory of sulphur dioxide sources and emissions for eastern Canada, by assessing available control technology and by reviewing the appropriate legislation in North America. The Atlantic Region participated in the committee work and prepared a report on the long range transport and deposition of sulphates, nitrates, mercury and other substances. Programs for monitoring mercury in precipitation and aerosol sulphates were initiated in the Atlantic Region.

National Air Pollution Surveillance Network

To ensure sound planning of activities within the air pollution control program, it is important to have a continuously updated knowledge of the nature and extent of air pollution across Canada. The National Air Pollution Surveillance activity

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 network is a cooperative effort of the federal, provincial and municipal governments. 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 network can be used in epidemiological studies and in the development of air quality objectives.

During 1977-78, the NAPS network was expanded and improved. On March 31, 1978, the network comprised 554 instruments, including 271 continuous gaseous pollutant monitors, located at 157 stations in 54 cities. Expansion of the network during the year included the installation of 8 suspended particulate samplers, 6 soiling index monitors, 7 sulphur dioxide monitors, 5 carbon monoxide monitors, 4 oxides of nitrogen monitors and 3 ozone monitors. There are now 43 stations in the network with continuous monitors for all pollutants of major concern. Figure 1 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 and nitrogen oxides. 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.

A trend analysis of ambient air quality in Canada during the period 1970-74, based on data compiled by the National Air Pollution Surveillance network, was completed and published. The results showed a general decreasing trend in air pollution levels since the beginning of the decade. An analysis for 1970-77 is in progress. The results will be released during the next fiscal year. The trend analysis will be updated periodically as new data become available.

TABLE 4 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR SUSPENDED PARTICULATES-SELECTED SITES

Location	Annual geometric mean (micrograms per cubic metre)					
	1972	1973	1974	1975	1976	1977
St. John's, Duckworth & Ordinance	54	55	51	49	50	*
Charlottetown, 56 Fitzroy		50	49	43	44	39
Halifax, N.S. Tech. College	42	49	47	52	49	47
Sydney, County Jail	46	66	68	*	73	53
Fredericton, York				46	43	52
Saint John, 110 Charlotte	46	55	60	55	55	62
Montreal, 1212 Drummond	132	101	128	101	78	74
Montreal, Duncan & Decarie			167	136	112	99
Montreal, 2900 Boul. Concorde					68	59
Hull, Rue Principale	69	72	79	80	*	**
Quebec, Parc-Autos Paquet-Laliberte	83	101	104	103	85	*
Sherbrooke, Wellington & Albert				*	54	*
Chicoutimi, City Hall	75	57	57	68	*	*
Trois-Rivières, Hart & Ste-Cécile					72	51
Ottawa, Slater & Elgin	75	87	91	77	60	63
Windsor, City Hall	91	121	122	80	76	83
Toronto, 67 College	92	101	81	71	63	67
Hamilton, Barton & Sanford	133	128	105	98	101	85
Sudbury, 19 Lisgar		63	55	50	46	44
Thunder Bay, 14 Algoma	60	76	60	54	*	49
London, King & Rectory	95	94	92	73	64	62

Sarnia, 156 Victoria	98	104	89	73	74	77
St. Catharines, North & Geneva					*	69
Brantford, Dalhousie & Queen					57	53
Winnipeg, 270 Osborne				75	80	74
Brandon, 11th & Princess		68	69	49	62	59
Regina, 12th & Smith	49	58	66	64	57	58
Saskatoon, 4th Ave. & 23rd St.	68	65	71	77	91	112
Moose Jaw, Fairford & 1st Ave.	48	65	69	74	74	65
Prince Albert, 1257-1st Ave. E.	51	69	77	68	73	73
Edmonton, 100 St. & 102 Ave.		65	71	117	137	92
Calgary, 316-7th Ave.	85	147	122	125	111	93
Red Deer, 4747 50th	58	61	62	57	63	66
Medicine Hat, 770 1st St. SE	57	74	88	71	78	61
Lethbridge, 13th St. & 9th Ave. S.	38	57	45	37	46	44
Yellowknife, 50th Ave. & 51st St.		79	60	49	54	*
Vancouver, 970 Burrard				*	68	69
Victoria, 1106 Cook				*	47	50
Whitehorse, Federal Bldg.			85	52	51	61

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

**Station closed.

TABLE 5 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR SULPHUR DIOXIDE-SELECTED SITES

Location	Annual arithmetic mean (parts per hundred million)					
	1972	1973	1974	1975	1976	1977
Charlottetown, 56 Fitzroy			1.1	1.1	1.1	*
Halifax, Barrington & Duke				1.8	1.3	<1.0
Saint John, Post Office			2.5	1.4	*	1.6
Montreal, 1125 Ontario	3.7	2.0	2.7	2.5	2.4	1.9
Montreal, 1212 Drummond	6.6	4.7	5.2	3.6	2.7	3.6
Montreal, Duncan & Decarie			1.3	1.8	1.7	<1.0
Montreal, 2900 Boul. Concorde				*	1.0	1.0
Hull, Rue Principale	1.3	1.2	<1.0	1.0	*	**
Quebec, 155 Dorchester			*	*	2.4	2.6
Sept-Iles, City Hall				*	<1.0	<1.0
Trois-Rivières, Hart & Ste-Cecile				*	2.2	2.3
Ottawa, Slater & Elgin	3.0	2.5	2.4	2.0	*	1.3
Ottawa, Rideau & Wurtemburg					1.8	1.2
Windsor, 471 University	3.6	3.2	3.3	2.9	2.7	2.2
Toronto, 67 College	3.0	1.4	1.2	1.5	1.5	1.4
Hamilton, Barton & Sanford	1.7	1.8	2.2	2.0	2.1	2.3
Thunder Bay, 435 James					*	<1.0
London, King & Rectory	<1.0	<1.0	<1.0	<1.0	1.3	<1.0
Sarnia, 156 Victoria	1.9	1.7	2.6	2.3	2.4	2.3
Brantford, Dalhousie & Queen					<1.0	*
St. Catharines, North & Geneva					*	<1.0
Kitchener, Edna & Frederick					*	<1.0

Winnipeg, 270 Osborne				<1.0	<2.0	*
Brandon, 11th St. & Princess				*	<1.0	<1.0
Regina, 12th & Smith	<1.0	<1.0	<1.0	<1.0	*	*
Saskatoon, 4th Ave. & 23rd St.		<1.0	<1.0	<1.0	*	<1.0
Moose Jaw, Fairford & 1st. Ave.		<1.0	<1.0	<1.0	*	*
Prince Albert, 1257-1st Ave., E.				*	<1.0	<1.0
Edmonton, 109th St. & 98th Ave.	<1.0	<1.0	<1.0	<1.0	<1.0	**
Edmonton, 10255-104th St.						<1.0
Calgary, 620-7th Ave. SW	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vancouver, 970 Burrard				1.1	<1.0	*
Victoria, 625 Fisguard	1.1	<1.0	<1.0	<1.0	*	*
Whitehorse, Federal Bldg.			<1.0	<1.0	*	*

* Insufficient data available to calculate valid annual arithmetic mean concentrations.
**Station closed.

TABLE 6 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR CARBON MONOXIDE-SELECTED SITES

Location	Annual arithmetic mean (parts per million)				
	1973	1974	1975	1976	1977
Halifax, Barrington & Duke					1.4
Montreal, 1125 Ontario		2.5	2.4	2.7	2.3
Montreal, 2900 Boul. Concorde			*	0.7	*
Montreal, 677 Ste-Catherine, W.			*	5.4	4.3
Quebec, 155 Dorchester S.		*	2.4	2.4	*
Ottawa, Slater & Elgin	3.1	3.2	3.1	3.0	2.2
Ottawa, Rideau & Wurtemburg				0.9	0.9
Windsor, 471 University	4.7	5.1	4.8	*	2.2
Toronto, 67 College***		1.9	1.3	1.1	2.8
Toronto, Lawrence & Kennedy		*	2.1	2.4	1.8
Toronto, Elmcrest				1.0	1.3
Hamilton, Barton & Sanford	2.1	2.0	1.5	1.4	1.4
London, King & Rectory		1.0	1.5	1.7	1.1
Sarnia, 156 Victoria		*	0.9	1.3	1.8
St. Catharines, North & Geneva				*	1.5
Winnipeg, 270 Osborne			1.2	1.5	1.4
Regina, 12th & Smith		0.6	0.8	*	*
Saskatoon, 4th Ave. & 23rd St.		1.0	0.7	*	*
Edmonton, 109th St. & 98th Ave.	2.1	2.0	1.3	1.5	**
Edmonton, 10255-104th St.					2.0
Calgary, 620-7th Ave. SW	4.3	3.1	2.5	2.1	2.3

Vancouver, 2294 West 10th Ave.	2.6	*	*	1.7
Victoria, 1106 Cook		1.2	1.8	*

* Insufficient data available to calculate valid annual arithmetic mean concentrations.
** Station terminated.
***Sampling level in 1977 was 3 metres above ground; in previous years 20 metres.

TABLE 7 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR OZONE-SELECTED SITES

Location	Annual arithmetic mean (parts per hundred million)				
	1973	1974	1975	1976	1977
Halifax, Barrington & Duke			*	1.7	*
Montreal, 1125 Ontario	0.8	1.1	1.3	1.4	0.8
Montreal, Duncan & Decarie	1.7	1.0	1.0	1.0	1.0
Montreal, 2900 Boul. Concorde			*	*	2.4
Quebec, 155 Dorchester S.		*	1.8	1.2	1.7
Ottawa, Slater & Elgin			*	1.1	1.7
Ottawa, Rideau & Wurtemburg				1.7	1.9
Windsor, 471 University	1.9	1.3	1.7	2.0	2.1
Toronto, 67 College		2.0	2.4	1.7	1.6
Toronto, Lawrence & Kennedy		*	1.9	1.5	1.5
Toronto, Elmcrest				1.7	1.7
Hamilton, Barton & Sanford	3.0	1.8	2.3	1.8	1.7
London, King & Rectory			1.6	1.9	2.1
Sarnia, 156 Victoria	2.6	1.7	2.4	1.9	1.9
St. Catharines, North & Geneva				*	2.2
Kitchener, Edna & Frederick				*	2.5
Winnipeg, 270 Osborne		0.9	1.0	1.2	1.4
Edmonton, 109th St. & 98th Ave.	0.8	1.3	2.2	2.5	**
Edmonton, 10255-104th St.					1.4
Calgary, 620-7th Ave. SW	0.9	1.3	1.4	1.1	1.2
Vancouver, 2294 West 10th Ave.		1.3	1.1	1.0	0.9
Victoria, 1106 Cook			2.4	2.2	2.4

* Insufficient data available to calculate valid annual arithmetic mean concentrations.
**Station terminated.

TABLE 8 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR NITROGEN DIOXIDE-SELECTED SITES

Location	Annual arithmetic mean (parts per hundred million)				
	1973	1974	1975	1976	1977
Halifax, Barrington & Duke		*	*	1.1	*
Montreal, 1125 Ontario		3.0	2.1	3.5	3.6
Montreal, 2900 Boul. Concorde			*	2.8	2.7
Quebec, 155 Dorchester S.		*	2.0	2.4	2.1
Ottawa, Rideau & Wurtemburg				2.0	2.0
Windsor, 471 University	2.8	2.6	2.9	3.4	3.3
Toronto, 67 College	2.9	3.2	2.8	3.2	3.2
Toronto, Lawrence & Kennedy		2.6	2.1	2.4	4.0
Toronto, Elmcrest				2.2	2.2
Hamilton, Barton & Sanford			*	3.9	5.7
Sarnia, 156 Victoria			*	2.5	2.7
St. Catharines, North & Geneva				*	2.4
Edmonton, 109th St. & 98th Ave.		3.6	4.8	5.2	**
Edmonton, 10255 - 104th St.					3.9
Calgary, 620-7th Ave. SW			*	3.1	4.4

* Insufficient data available to calculate valid annual arithmetic mean concentrations.
**Station terminated.

FIGURE 1 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK (MARCH 1978)

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 source tests were done included a chlor-alkali plant, a wood waste incinerator, a copper-zinc smelter, a thermal power plant, a polyvinyl chloride plant and a secondary lead smelter. A report was completed on the results of a source survey of a fluidized bed sewage sludge incinerator.

Standard Reference Methods for Source Testing. Standard reference methods for measuring nitrogen oxides, arsenic, mercury, vinyl chloride, hydrogen chloride, carbon monoxide and total reduced sulphur compounds in stack emissions are in preparation.

Ambient Air Surveys

In the Lingan area of Nova Scotia, two surveys were completed by the EPS Atlantic Region in cooperation with the Atmospheric Environment Service. Data were collected on meteorological variables and on ambient air concentrations of air contaminants. The EPS Northwest Region compiled baseline data on carbon monoxide and suspended particulate matter in the Lake Louise area in support of activities by Parks Canada. The EPS Pacific Region participated in the Lower Mainland Air Monitoring Committee's network of air quality monitoring stations in the Fraser Valley. Seven stations of the twelve were equipped by the Service. The monitoring of carbon monoxide continued during the winter in Whitehorse, Yukon and simultaneous monitoring of nitrogen oxides began.

Evaluation of Air Monitoring Instruments. The purpose of this activity is to find the most reliable equipment, methods and procedures for monitoring air pollution levels. During the review period, evaluation reports were completed for mass flowmeters, data recorders and monitors for sulphur dioxide concentrations in the ambient air. A report on the recommended laboratory test procedures for ambient air pollutant monitors was completed. Drawings and specifications for shelters to house monitoring equipment were prepared. Two portable calibration systems were evaluated and one was selected for use in implementing phase II of the NAPS calibration program.

The projects to evaluate particulate sizing instruments and continuous monitors for particulates are still in progress.

Calibration. The calibration program for the NAPS network continued. During the review period, approximately 200 cylinders of compressed gases and 75 sulphur dioxide sources were analysed and incorporated into the NAPS network to complete phase I of the calibration program.

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 could 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 environmental 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 on April 1, 1975. 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. This emphasis has been broadened to include the pollutants for which regulations or guidelines have been announced or are being developed.

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 into 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 scrubbers were installed in 1977 and will become operational early in the 1978-79 fiscal year.

The second contract let by the 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. The project is on schedule and the wet scrubber system is expected to become operational during the 1978-79 fiscal year.

The third contract let by the Directorate was for the evaluation and demonstration of infra-red and ultra-violet correlation spectrometers for the remote measurement of specific sulphur dioxide source emissions. The successful demonstration of a method to measure accurately the mass emissions of sulphur dioxide from industrial sources would provide the basis for further development of the technique for the quantitative measurement of sulphur dioxide transported from or into industrial areas or across international boundaries. It would also provide evidence in support of control measures. The technique could lead to the development of standard procedures for measuring sulphur dioxide emissions that would not require access to proprietory information or to private property.

Projects Sponsored under the Department of Supply and Services' Unsolicited Proposal Program

This program provides bridge financing for unsolicited proposals in science and technology submitted by the private sector that are worthy of support by one or more government departments. Proposals that fall within the mission of the

department but cannot be accommodated with current funds are eligible for assistance under the Unsolicited Proposal Program. Several projects are now receiving support by the Environmental Protection Service.

One project supported by the Air Pollution Control Directorate is for the development of a laboratory prototype instrument for the specific quantitative measurement of sulphur trioxide in the presence of sulphur dioxide in ambient air or in a synthetic stack gas. In the atmosphere, sulphur trioxide can be converted into sulphuric acid, the effects of which on public health and the environment are of great concern to the federal government. There are no known commercial instruments for monitoring sulphur trioxide in the presence of sulphur dioxide.

A second project currently sponsored by the Directorate is for the identification of conditions that will enhance the collection efficiency of electrostatic precipitators used on non-ferrous smelter operations. The project is addressed in general terms to the containment of particulates and heavy metals and in particular to the containment of arsenic emissions.

The Ontario Region of the Environmental Protection Service is supporting an unsolicited proposal for a novel mass spectrometer, the Trace Air Gas Analyzer, that is capable of measuring in real time trace quantities of organic contaminants in ambient air. The analyzer was installed in a van and tested in numerous industrial locations in Ontario. It was successful in measuring trace quantities of hydrogen fluoride, ammonia, nickel carbonyl, aniline and other compounds. The analyser was also used successfully to obtain a comprehensive profile of the constituents of the emissions from fibre glass manufacturing plants.

The Quebec Region of the Environmental Protection Service supported an unsolicited proposal for industrial-scale tests on the burning of an acid sludge in a cement kiln. The sludge remains as a waste product after the re-refining of used lubricating oils. It is extremely acid and presents substantial disposal problems.

Other Technology Development Programs

In the Pacific Region of the Service, funds from the Cooperative Pollution Abatement Research program were used to support a project to test wet scrubbers that had electrically-enhanced collection efficiencies for fine particulates. The

scrubbers were tested on a forest products industry power boiler which burned hog fuel from logs previously stored in salt water. The project was terminated because problems with corrosion and difficulties with electrical isolation could not be overcome.

Standard Reference Methods

Every air pollution control standard regulation, guideline and national air quality objective is supported by a sampling technique and a method of analysis for the pollutant in question. During the review period, work continued on the development of standard reference methods for arsenic emissions from gold roasters, for arsenic, lead and mercury emissions from non-ferrous smelters, for vinyl chloride emissions from vinyl chloride and polyvinyl chloride manufacturing operations and on the revision of the present standard reference method for lead emissions from secondary lead smelters.

Development work also continued on standard reference methods in support of national emission guidelines for hydrogen chloride emissions from incinerators and for emissions of total reduced sulphur compounds from the wood pulping industry. In support of national air quality objectives, work proceeded on standard reference methods for hydrogen fluoride and hydrogen sulphide All of these standard reference methods are scheduled for completion in the next fiscal year.

Air Sampling Technology and Analytical Method Development

In recent years, it has become evident that some complex chemicals can have serious health and environmental effects. Among these are polychlorinated biphenyls and polycyclic aromatic hydrocarbons. A typical sample of polluted air may contain more than 150 separate and distinct materials. During the review period, progress was made on the separation and analysis of these complex materials. Methods used included high pressure liquid chromatography and a computerized system combining gas chromatography and mass spectrometry. A collection of industrial dusts was established and work began to develop methods to measure the amounts of toxic elements in the dusts.

Further progress was made in developing and testing a method for collecting and measuring mercury in the ambient air.

At the request of the Federal-Provincial Committee on Air Pollution, an analytical quality control program was established. During the review period, fifty laboratories from the federal and provincial governments and industry participated in a study of the analysis of lead from the ambient air collected on high volume filters. This program will be expanded to include six additional pollutants over a three year period. Participation in quality control programs initiated by other agencies aided in establishing the quality of existing analytical facilities for sulphate in particulates from ambient air, lead in gasoline, and heavy metals in dusts. A cooperative program with industry for the development of a method to measure mercury in its various forms in the ambient air was established.

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, the design and construction of a monitor to measure mercury concentrations in stack emissions containing high concentrations of sulphur dioxide was completed.

Analytical Services

Analytical services for the NAPS network and for specific surveys were provided during the review period. The pollutants analyzed routinely were heavy metals, particularly lead in gasoline and particulates, cadmium, vanadium and manganese; sulphates and nitrates; arsenic; and polychlorinated biphenyls and polynuclear aromatic hydrocarbons. Dustfall measurements were also made. Heavy metals and complex organic compounds were analysed in a variety of samples such as industrial dusts, fuels, river sediments, aerosol propellants and heat transfer media. A collection of polycyclic aromatic hydrocarbons was established and maintained and many of these rare chemicals were supplied to other laboratories on request.

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 Service staff have access to all available information, an information system on air pollution control was established in 1973. The system also serves current awareness requirements for senior staff and the special air pollution information requirements of Canadian universities and industry. The system has full access through the Lockhead DIALOG online computer system to the Air Pollution Technical Information Center (APTIC) computer-stored information system of the United States Environmental Protection Agency. Free searches of the APTIC file are provided to all levels of government in Canada. Searches are done at cost for others. In accordance with an information agreement with the United States Environmental Protection Agency, microfiche copies of APTIC documents are provided free of charge to all Canadian users. During the review period more than 100 computerized literature searches were completed for federal, provincial and municipal government agencies in Canada and more than 5000 individual information requests were answered. The system has more than 100 000 documents available on microfiche. Over 8000 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 were again presented for enforcement officers of the federal, provincial and municipal governments. During this fiscal year, however, because of staff shortages fewer training courses were presented than in previous years. Three courses were offered this year on stationary source testing, the statistical evaluation of air pollution data and the enforcement of regulations. The courses were attended by 102 students representing three levels of government enforcement agencies and industry. The training course in stationary source testing was again prepared and presented under contract by the Industrial Research Institute of the University of Windsor. The course in data analysis was developed jointly with the Canadian Society for Chemical Engineering and presented by lecturers from the Department of the Environment.

Additions were again made to the library of videotapes on air pollution control topics. The tapes are available to enforcement agencies across Canada for training purposes. Other audiovisual material on air pollution control was added to the library which now contains about 325 videotaped lectures and 52 audio cassettes.

Courses for inspectors in the reading of plume opacity were held in the Quebec and Northwest regions of the Environmental Protection Service during the review period. Thirty-six enforcement officers were certified. Courses are held at six- or twelve-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 35 reports in the EPS Series were published. Normal distribution is about 800 copies of each report. The clientele includes foreign governments, international organizations, universities, industries, members of the public, and federal, provincial and municipal government departments. In a new activity during this fiscal year, the Directorate published fact sheets on ten subjects of topical interest. Six scientific papers written by Directorate staff were published in international journals.

The reports and fact sheets published during the review period were the following:

Regulations, Codes and Protocols Series

EPS 1-AP-75-1	Standard Reference Method for Source Testing: Measurement of Emissions of Asbestos from Asbestos Mining and Milling Operations
EPS 1-AP-75-2	Standard Reference Method for Source Testing: Measurement of Opacity of Emissions from Stationary Sources
EPS 1-AP-76-1	Standard Reference Method for Source Testing: Measurement of Emissions of Mercury from Mercury Cell Chlor-Alkali Plants
EPS 1-AP-77-4	The Clean Air Act - Compilation of Regulations and Guidelines

Economic and Technical Review Series

EPS 3-AP-74-5F	Analyseurs de gaz d'échappement des véhicules automobiles
EPS 3-AP-76-5	Air Pollution Emissions and Control Technology: Thermal Power Generation Industry. Vol. 1 Internal Combustion Engines
EPS 3-AP-76-6	Air Pollution Emissions and Control Technology: Asbestos Mining and Milling Industry
EPS 3-AP-77-2	A Nationwide Inventory of Air Pollutant Emissions (1972)
EPS 3-AP-77-3	Air Pollution Emissions and Control Technology: Packaged Incinerators

Surveillance Series

EPS 5-AP-76-14	Ambient Air Quality 1970-1974. A Statistical Analysis
EPS 5-AP-76-15	National Air Pollution Surveillance. Annual Summary 1974
EPS 5-AP-76-16	National Air Pollution Surveillance. Annual Summary 1975
EPS 5-AP-77-1 to EPS 5-AP-77-12	National Air Pollution Surveillance. Monthly Summaries January to December 1976 inclusive
EPS 5-AP-77-13	National Air Pollution Surveillance. Annual Summary 1976
EPS 5-AP-78-1 to EPS 5-AP-78-7	National Air Pollution Surveillance. Monthly Summaries January to July 1977 inclusive

Air Pollution Control Directorate Series

APCD 76-4	Coal Gasification - A Technological Review

Miscellaneous Publications

Clean Air Act Annual Report 1975-1976

Publications List - Air Pollution Control Directorate

Air Pollution Control Directorate Fact Sheets

Air Pollution Control in the Secondary Lead Smelting Industry

Airborne Asbestos from Mining and Milling Operations

Airborne Mercury from Chlor-Alkali Plants

Air Pollution Emission Inventories

Air Quality Trends in Canada

Coal Burning Thermal Power Plants: New Technology for Limiting Sulphur Dioxide Emissions

Regulating Lead in Gasoline

Winter Driving and Air Pollution

Car Maintenance, Driving and Air Pollution

Air Pollution Technical Information Service

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 contaminant.

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 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 for all parts of Canada. When this level is exceeded, control action by a regulatory agency is indicated.

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 published to date are shown in Table 9.

TABLE 9 NATIONAL AIR QUALITY OBJECTIVES*

Air contaminant	Maximum desirable level	Maximum acceptable level	Maximum tolerable level
Sulphur dioxide			
Annual arithmetic mean	30 $\mu g/m^3$ (0.01 ppm)	60 $\mu g/m^3$ (0.02 ppm)	
Average concentration over a 24-h period	150 $\mu g/m^3$ (0.06 ppm)	300 $\mu g/m^3$ (0.11 ppm)	800 $\mu g/m^3$ (0.31 ppm)
Average concentration over a 1-h period	450 $\mu g/m^3$ (0.17 ppm)	900 $\mu g/m^3$ (0.34 ppm)	
Suspended particulate matter			
Annual geometric mean	60 $\mu g/m^3$	70 $\mu g/m^3$	
Average concentration over a 24-h period		120 $\mu g/m^3$	400 $\mu g/m^3$
Carbon monoxide			
Average concentration over an 8-h period	6 mg/m^3 (5 ppm)	15 mg/m^3 (13 ppm)	20 mg/m^3 (17 ppm)
Average concentration over a 1-h period	15 mg/m^3 (13 ppm)	35 mg/m^3 (31 ppm)	
Oxidants (ozone)			
Annual arithmetic mean		30 $\mu g/m^3$ (0.015 ppm)	
Average concentration over a 24-h period	30 $\mu g/m^3$ (0.015 ppm)	50 $\mu g/m^3$ (0.025 ppm)	
Average concentration over a 1-h period	100 $\mu g/m^3$ (0.05 ppm)	160 $\mu g/m^3$ (0.08 ppm)	300 $\mu g/m^3$ (0.15 ppm)
Nitrogen dioxide			
Annual arithmetic mean	60 $\mu g/m^3$ (0.03 ppm)	100 $\mu g/m^3$ (0.05 ppm)	
Average concentration over a 24-h period		200 $\mu g/m^3$ (0.11 ppm)	300 $\mu g/m^3$ (0.16 ppm)
Average concentration over 1-h period		400 $\mu g/m^3$ (0.21 ppm)	1000 $\mu g/m^3$ (0.53 ppm)

TABLE 9 NATIONAL AIR QUALITY OBJECTIVES* (CONTINUED)

Air contaminant	Maximum desirable level	Maximum acceptable level	Maximum tolerable level
Hydrogen fluoride**			
Average concentration over a 70-day period		0.20 $\mu g/m^3$ (0.2 ppb)	
Average concentration over a 30-day period		0.35 $\mu g/m^3$ (0.4 ppb)	
Average concentration over a 7-day period	0.20 $\mu g/m^3$ (0.2 ppb)	0.55 $\mu g/m^3$ (0.7 ppb)	
Average concentration over a 24-h period	0.40 $\mu g/m^3$ (0.5 ppb)	0.85 $\mu g/m^3$ (1.0 ppb)	
Hydrogen sulphide**			
Average concentration over a 24-h period		5.0 $\mu g/m^3$ (3.6 ppb)	
Average concentration over a 1-h period	1.0 $\mu g/m^3$ (0.7 ppb)	15.0 $\mu g/m^3$ (10.8 ppb)	

* Conditions of 25°C and 1013.2 mb are used as the basis for conversion from µg/m to ppm and ppb.
**Proposed.

NATIONAL EMISSION GUIDELINES

General

Under Section 8 of the Clean Air Act provision is made for the promulgation of national emission guidelines. The purpose of these guidelines is to specify levels of emissions of air contaminants that reflect the application of best operating practices and best practicable technology in air pollution control to the industrial processes involved. These emission limits are intended to be minimum requirements for new plants and objectives toward which control of emissions from existing plants should be directed. The adoption of these guidelines by appropriate regulatory agencies will result in significant reductions in emissions of air contaminants and thus prevent deterioration of ambient air quality. 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.

Guidelines have been published for the cement industry, the asphalt paving industry, the coke oven industry and for arctic mining operations. The Government of the Northwest Territories has promulgated Arctic Mining Industry Emission Regulations based on the federal government's guidelines. The Yukon Territorial Government has agreed in principle to implement the guidelines for arctic mining operations and asphalt plants as regulations under territorial legislation. Three of the five cement plants in British Columbia have received provincial permits. Of 57 asphalt plants in the province, 41 have received permits. Sixteen are operating in compliance with the federal guideline and 25 are not in compliance. The province of Quebec has assumed responsibility for the control of air pollution emissions from the cement plants and asphalt plants in the province. There are no coke ovens in Quebec. In the Atlantic Region of the Service, the Province of New Brunswick has promulgated regulations for asphalt plants that are compatible with the federal guidelines and has an approval

system for cement plants that incorporates the intent of the federal guidelines. The Province of Nova Scotia has proposed provincial guidelines for asphalt plants that are not as restrictive as the federal guidelines. A federal-provincial study is underway to determine whether the province's asphalt plants can meet the federal guideline limits by installing medium-priced control systems. The single cement plant in Nova Scotia is operating within the federal guidelines. The Province of Prince Edward Island has proposed guidelines for emissions of air pollutants from asphalt plants.

In the Ontario Region, the Province of Ontario has agreed to incorporate the federal guidelines into its approvals procedures for new coke ovens, cement plants and asphalt plants. The three provinces in the Northwest Region of the Service have all taken action with respect to asphalt plants and cement plants. The Clean Environment Commission of Manitoba has issued orders incorporating the federal guideline limits to the cement plants in the province and has initiated action to issue similar orders to the asphalt plants. The Province of Saskatchewan is in the process of implementing the federal guidelines for asphalt plants through its licensing procedure. The Province has not yet implemented the federal guidelines for cement plants. All of the asphalt plants in Alberta now meet the requirements of the federal guidelines. The Province of Alberta has issued licenses to the two cement plants in the province.

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
Pulp and paper industry
Iron and steel industry
Nonferrous smelting industry
Ferrous foundry industry
Ferro-alloy industry
Incineration

The fertilizer industry and the surface coating industry are being studied to determine whether guidelines are required. State-of-the-art reports were completed during the review period on packaged incinerators, residential heating and internal combustion engines used in thermal power generation.

NATIONAL EMISSION STANDARDS

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. The Air Pollution Control Directorate consults with the Health Protection Branch of Health and Welfare Canada to obtain advice on the potential health hazards of such contaminants. In response to Health and Welfare Canada's advice that it would be prudent to control atmospheric emissions of vinyl chloride and arsenic to minimize the danger to public health, development of regulations for these contaminants began in 1976 and continued in the 1977-78 fiscal year. Health and Welfare Canada had previously made similar recommendations for lead, mercury and asbestos.

Secondary Lead Smelters

National Emission Standards Regulations for Secondary Lead Smelters were adopted by the Governor-in-Council and promulgated in Part II of the Canada Gazette on July 28, 1976. The regulations became effective on August 1, 1976. The Quebec Region of the Service has finalized an agreement on a joint working program with the Province of Quebec for the purpose of enforcing the regulations. During the review period, emission tests were completed at six smelters in the region. Four were operating in compliance with the regulations, one is taking corrective action and the sixth will move to new facilities in June 1978. The Northwest Region has negotiated an agreement with the Province of Alberta to audit the enforcement of Alberta's regulations. The Region has assumed full responsibility for the enforcement of the national emission standards regulations in Manitoba. Emission tests were performed on three smelters in Winnipeg. Two were operating in compliance with the regulations. At the third smelter, replacement of control equipment could not be completed before

the test. No action was required in Saskatchewan because that province has no secondary lead smelters. Negotiations continued between the Ontario Regional Office and the Province of Ontario. In the Atlantic Region, under a working arrangement with the Province of Nova Scotia, an emission test was performed on the only secondary lead smelter in the region and the results showed that the plant was in compliance with the regulations. The Pacific Region, working with the Greater Vancouver Regional District, continued its program to ensure that all secondary lead smelters in the District were operating in compliance with the regulations.

Asbestos

National Emission Standards Regulations for Asbestos Mines and Mills were promulgated in Part II of the Canada Gazette on July 13, 1977. The emission limits will take effect on December 31, 1978.

During the review period, significant progress was made toward ensuring that asbestos mines and mills across the country will be operating in compliance with the regulations when they come into effect. The Province of Quebec is the second largest producer of asbestos in the world. The EPS Quebec Region negotiated an agreement with the Province on a joint working program to enforce the regulations at the nine plants in the province. The Atlantic Region has assumed responsibility for enforcement of the regulations at the only plant in the region, in Newfoundland. The plant is expected to be operating in compliance with the regulations by December 31, 1978. There are two plants in the Pacific Region, one of which will close in 1978 because of depletion of the ore body. At the other plant, a modernization program is underway and the plant will shortly be operating in compliance with the federal regulations. The Province of British Columbia has agreed to incorporate the requirements of the federal regulations into its permit system. Negotiations are continuing in the Ontario Region concerning the only plant in the Province of Ontario. There are no asbestos mines and mills in the Northwest Region.

Developmental work on an amendment to the regulations to include emissions from dry drilling operations was completed. A draft amendment was prepared. A study of the asbestos emissions from the manufacturing sector of the industry was initiated.

Mercury

National Emission Standards Regulations for Mercury Cell Chlor-Alkali Plants were promulgated in Part II of the Canada Gazette on July 27, 1977. The regulations take effect on July 1, 1978.

There are mercury cell chlor-alkali plants in each region of the Environmental Protection Service and progress was made during the fiscal year toward ensuring that the plants will be operating in compliance with the regulations before July 1, 1978. One of the two plants in the Atlantic Region is already meeting the emission limits of the regulation and the other is expected to be in compliance within the next few months. There are three plants in the Quebec Region. An agreement on a joint working program to enforce the regulations was finalized with the Province of Quebec and all three plants were tested for mercury emissions. Some problems remain to be resolved before these plants will meet the emission limits. Emission testing was initiated at the only mercury cell chlor-alkali plant in Ontario and preliminary results indicate that the plant will meet the emission limits by July 1, 1978. In the Northwest Region, the only plant that uses the mercury cell process is changing to the membrane cell process. There is one mercury cell chlor-alkali plant in the Pacific Region. The Province of British Columbia has incorporated the intent of the federal regulation requirements into a new permit issued to the company. New pollution control equipment is being installed and the plant is expected to be in compliance with the federal regulation shortly.

Arsenic

The major sources of emissions of arsenic into the atmosphere have been identified as the gold roasting industry, the iron ore processing industry and the nonferrous primary metallurgical industry.

Two task forces consisting of federal and provincial government officials and industry representatives continued their work during the review period to develop regulations for arsenic emissions from these industries. Emission limits will be proposed shortly for arsenic emissions from the gold roasting industry. These limits will be incorporated into regulations in the next fiscal year. The standard reference method for the measurement of arsenic emissions from gold roasting operations is in

the final stages of completion. The first socioeconomic impact analysis to be undertaken for an emission standard regulation is now in preparation for the gold roasting emission regulations. Development work continued on standard reference methods for emissions of arsenic and mercury from non-ferrous smelters. Extensive source testing was completed in cooperation with the Province of Manitoba on a copper-zinc smelter in the province. The Service provided technical support to the Province of Quebec for a source test on a copper smelter in Quebec. The testing program will continue during the next fiscal year with source tests planned for two copper smelters, one copper-zinc smelter and one iron ore sintering plant.

Vinyl Chloride

Proposed National Emission Standards Regulations limiting the amount of vinyl chloride that may be emitted by vinyl chloride and polyvinyl chloride manufacturing plants were announced in Part I of the Canada Gazette on June 18, 1977. Comments received from interested parties have led to minor changes in the regulations. Announcement of the final regulations in Part I of the Canada Gazette is expected in the next fiscal year. The regulations will probably take effect on July 1, 1979.

It is estimated that 5000 tons of vinyl chloride were emitted into the atmosphere from the vinyl chloride and polyvinyl chloride manufacturing operations in Canada during 1973. Application of the proposed regulations is expected to reduce these emissions by 2700 tons per year. In addition, the Environmental Protection Service will promote the voluntary adoption of measures to reduce fugitive emissions. These measures should lead to a further reduction of 2000 tons in vinyl chloride emissions per year.

In 1976 the industry had sales of over $100 million. The pollution control measures required to meet the regulations are expected to cost the industry $6 -$9 million. The voluntary measures to reduce fugitive emissions will cost $1 - $2 million.

Metallurgical Industries Information Regulations

Section 6 of the Clean Air Act empowers the Minister to obtain information relating to any work, undertaking or business, the operation of which the Minister has reasonable grounds to believe results in the emission into the ambient air of an air contaminant. Regulations concerning information on arsenic and mercury emissions from the primary metallurgical industry have been promulgated.

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 made under the Act. In 1977-78, additional inspectors were designated. The training of these personnel for their enforcement duties continued 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 and public health protection. The Department of the Environment 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 the Department of the Environment 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 the Department of the Environment 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.

Incinerators

Several incinerator projects have been initiated at federal facilities to study exemplary equipment for air pollutant containment and solid waste processing. Among these are:

- heat recovery incinerators at Toronto International Airport, Vancouver International Airport, Canadian Forces Base (CFB) Downsview and CFB Summerside that have been assessed, costed and designed for installation in the near future;
- a solid waste-sewage incinerator suitable for vessels or arctic work camps that has been installed and tested at the Bedford Institute of Oceanography; and
- a portable "pit-type" incinerator for remote locations that has been designed, purchased and installed to demonstrate the use of this equipment under adverse weather conditions.

Boilers

Projects to minimize air pollution emissions from federal boilers included:

- the purchase for the Experimental Farm heating plant of an oil-water emulsifier designed to reduce particulate emissions and save fuel-oil;
- the continuation of a project to purchase and install an oxygen-monitoring system to control automatically the burner inputs to the boilers at the Mackenzie Building in Toronto. This system will also reduce emissions of pollutants and save fuel-oil;
- agreement with the Canadian Penitentiary Service to apply air pollution control measures to the central heating plant at Springhill Penal Institution; and
- the continuation of an investigation into the installation of a sulphur dioxide scrubber at CFB Gagetown to demonstrate an alternative to fuel switching as a method for reducing emissions of sulphur dioxide.

Guidelines

The following guidelines have been completed:

- Air Pollution Guidelines Applicable to Incinerators at Federal Establishments;
- Air Pollution Guidelines Applicable to Boilers at Federal Establishments; and
- Guidelines for the Monitoring and Surveillance of Pollution Control at Federal Establishments.

Air Pollution Assessment Studies

Air pollution assessment studies were completed for various facilities including the Atomic Energy of Canada Ltd. heavy water plant at Laprade, Quebec; a thermal power plant at Hat Creek, B.C.; the Kitimat oil port; the Northern Pipeline; the Silver Dahl Pipeline; the proposed expansion to Vancouver International Airport; the Canadian Coast Guard Base at Dartmouth; and numerous boilers, incinerators and agriculturally oriented plants. Among many Department of Regional Economic Expansion projects reviewed were a pulp and paper mill in St-Félicien and a calcium carbide plant at Shawinigan.

Railways

Plant inspections were completed at railway facilities in Alberta to ensure that appropriate coal dust suppression techniques were being used. In the Pacific Region, a report on coal dust suppression techniques was completed and responsibility for monitoring unit trains was transferred to the Canadian Transport Commission.

The major expansion at Luscar-Sterco, Alberta, which will supply coal to Ontario Hydro thermal power plants, will incorporate the recommended code of good practice.

Residents near the Calder Yards in Edmonton have voiced concern about odors from idling Canadian National diesel units. The Northwest Region is working with Canadian National to reach a solution to this problem.

In the past, old railway ties have been disposed of by burning them in the open along railway rights-of-way. The Service is working with Canadian National to determine alternative means of disposal near residential areas, expressways and airports.

Other Activities

Other activities during the review period included:

- discussions with the National Harbours Board in Halifax on problems of dust arising from grain elevators. Design work on control systems will begin in 1978-79; and
- agreement reached with officials of the Department of National Defence to implement a number of pollution control measures at CFB Gagetown.

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, the Service presented a summary of its findings in the Yellowknife Environmental Survey to the Canadian Public Health Association hearing in Ottawa. Among other advisory or technical services provided were:

- provision of advice to the Department of Public Works in the Ottawa Master Plan Study for Heating and Cooling for Government Buildings in the Ottawa - Hull area;
- participation in the Interdepartmental Committee on District Heating;
- participation with the Atmospheric Environment Service in the technical assessment of a proposed coal-fired power-generating station in Lingan, Nova Scotia;

- provision of advice concerning analytical method development to the World Health Organization, the United States Environmental Protection Agency, the National Bureau of Standards and the American Society for Testing and Materials;
- participation with the Greater Vancouver Regional District in the assessment of air pollution emissions from a fluidized bed sludge incinerator;
- provision of technical advice to organizations such as the North Atlantic Treaty Organization, the Economic Commission for Europe, the World Health Organization and the United States Environmental Protection Agency;
- with respect to the Poplar River thermal power project, completion of tests on a Canadian Combustion Research Laboratory boiler, fired with a western lignite coal, to ascertain the retention of sulphur by lignitic ash;
- provision of technical advice to the Department of External Affairs on proposed thermal power generating stations at Atikokan, Hat Creek and Poplar River and on a proposed expansion at Burrard Inlet;
- participation in the Porter Commission hearings on future electric power generation in Ontario;
- 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 by participation on a task force for the development of emission control regulations for the potash industry;

- participation with the Province of Quebec and le Bureau d'Étude des Substances Toxiques in method development and source testing for mercury and arsenic emissions at the Noranda Mines Smelter in Noranda, Quebec;
- participation on a committee to investigate the environmental impact of fluoride emissions from an aluminum smelter at Kitimat, B.C.
- participation with the Province of Manitoba in meetings concerning a nonferrous smelter in Thompson, Manitoba;
- provision of technical advice and participation in the Public Enquiry on Environmental Objectives for the Province of British Columbia;
- participation in international standards committee work to ensure international uniformity of analytical methods;
- provision of technical advice to industry concerning 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

General

Sections 22 through 26 of the Clean Air Act provide for the regulation of fuel composition and fuel additives and for the necessary administrative procedures to reduce emissions of air pollutants when fuels are burned. To develop appropriate limits for Section 22 of the Act, regulations have been developed to obtain the required information on the current composition of petroleum fuels, including sulphur content, and on their additives and the impurities in crude oils. The Fuels Information Regulations, No. 1, were published in Part II of the Canada Gazette on August 10, 1977. Since that time, a requirement for a minor amendment has been identified, and it is expected that the amendment will be published in the next fiscal year with an effective date for the regulations of January 1, 1979. Future regulations may be developed for coal.

Lead-Free Gasoline Program

During the review period, 2594 samples of lead-free gasoline were tested under the national monitoring program. One hundred and three samples exceeded the allowable concentration of 0.06g of lead per imperial gallon of lead-free gasoline. Immediate corrective action was taken in each instance by the gasoline marketing companies. One consignment of gasoline fuel was seized in New Brunswick when 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 the Department of the Environment since September 1974 on the quantities of lead being added to gasolines at each refinery. In 1977, about 29 million pounds of lead were added to the premium and regular gasolines. This represents a decrease of approximately 3 million pounds from the amount added in the previous year. Lead-free gasoline production has increased from 3.1% of the total gasoline marketed in 1975 to 19.6% in 1977. In the 1976-77 fiscal year, one company failed to report the importation and production of leaded gasoline and was found to have produced leaded gasoline that contained more than the allowable maximum content of 3.5g per imperial gallon. The legal proceedings initiated then were concluded in 1977. The company pleaded guilty and was fined $3000.

MOBILE SOURCES

General

There are no direct provisions in the Clean Air Act for the regulation of air pollution emissions from mobile sources. The 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.

Control of Emissions by New Vehicle Design Standards

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 1971 models. Transport Canada was made responsible for the administration of the Motor Vehicle Emissions Regulations and the Department of the Environment for the execution of the required compliance testing and the provision of technical advisory services in support of the regulations.

Emission Standards. To achieve significant 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, 39.0 and 3.0 grams per mile (CVS-CH test procedure) for hydrocarbons, carbon monoxide and oxides of nitrogen, respectively, 1973-74 model year cars were emitting only about one-third as much as uncontrolled vehicles. The Canadian standards for 1975 were established at 2.0, 25.0 and 3.1 grams per mile (CVS-CH test procedure) for hydrocarbons, carbon monoxide and oxides of nitrogen, respectively. These standards, which led 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 new standard designed to limit carburetor maladjustment on cars of the 1980 and later model years is being developed. To facilitate the tuning of motor vehicles with respect to emissions, new labelling requirements are also being considered.

Compliance Audit. 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, operated jointly by Transport Canada and the Department of the Environment, 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. During the review period, more than 350 000 miles were accumulated on approximately 50 vehicles on a prescribed urban-rural route in the Ottawa area. More than 300 emission tests were completed.

Aircraft Emissions. A preliminary study of emissions that arise within airport boundaries was completed during the review period.

Control of Excess Emissions from In-Use Vehicles

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 program to review and evaluate compulsory emission inspection systems used in Canada, the United States and several European countries is continuing. The Air Pollution Control Directorate has proposed tentative guidelines for provincial and municipal motor vehicle inspection programs. The Vehicle Testing Section continued to perform emission tests to determine the effects of maintenance on vehicle emissions and to evaluate test equipment that could be used in these inspections. A program is continuing in cooperation with taxi companies in the Ottawa-Hull area to determine the emissions from a fleet of vehicles throughout their lifetime.

Other Programs

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.

ATMOSPHERIC ENVIRONMENT SERVICE

General

The objective of the Atmospheric Environment Service's activities with respect to the Clean Air Act is to develop a clear understanding of the nature of the important atmospheric processes of transport, distribution and transformation of pollutants to provide an improved assessment of their impact on the environment.

These activities involve substantial programs of environmental monitoring on local to national scales, experimental studies of environmental processes, the development of specialized instruments and experimental techniques, and the development of comprehensive modelling capabilities to permit the objective assessment of impacts. These activities are undertaken by the Atmospheric Research Directorate in two Branches. The Air Quality and Inter-Environmental Research Branch is responsible for studies on pollutants of tropospheric significance whereas the Atmospheric Processes Branch does major studies on the chemistry and dynamics of the stratosphere to assess the effect of various pollution sources on the solar radiation spectrum reaching the biosphere.

The Service supplements its internal research activities by cooperating with other federal and provincial agencies and with universities. This is achieved through agreements, the science subvention program and scientific contracts totalling $463,000.

During the review period, about 75 Service permanent staff and several post-doctorate fellows and temporary staff were involved in activities related to the Clean Air Act.

Long Range Transport of Air Pollutants

The long range transport of air pollutants is recognized as a major environmental problem in eastern North America and the Department of the Environment has assigned high priority to this subject. A program that has two primary objectives is underway: to determine the current state of the environment in eastern Canada, before the impact of emissions from projected increased coal-burning in North America; to develop a clear understanding of the occurrence and effects of long range transport of air pollutants within and into Canada, including geographical extent, severity and socioeconomic costs. The Service is the lead agency for the departmental program which has four major components: emissions, abatement and controls; atmospheric transport, transformation and deposition; aquatic effects; and terrestrial effects. The atmospheric transport, transformation and deposition component has the following objectives:

1. to determine the concentration and deposition fields of sulphur compounds, with special reference to acidic precipitation, in eastern Canada during the lifetime of the program;

2. to determine the geographical extent and frequency of occurrence of long range transport, and the resulting flows of pollutants into or out of various regions of Canada;

3. to identify regions from which pollutants are transported over long distances and to determine the relative contributions of local and distant sources to pollutant loadings in Canada; and

4. to develop the capability to predict, on the regional to continental scale, episodes of long-range transport, pollutant concentration and deposition fields.

Operation of the Canadian Network for Sampling Precipitation, which has fifty stations, began in May, 1977. Results from this network and previous monitoring studies, shown in Figure 2, along with air parcel trajectory analysis, confirm the occurrence of long range transport within and into Canada. The pH of precipitation over southern Ontario, southern Quebec and the Maritimes was found to range from 4.0 to 4.5, alarmingly acidic. Elevated concentrations of particulate sulphate were also found.

Alberta Oil Sands Environmental Research Program

The Alberta Oil Sands Environmental Research Program is a cooperative effort sponsored and funded equally by the Department of the Environment and the Alberta Department of the Environment. The primary objective of this ten-year program is to examine the present environment of the oil sands area and assess the probable effects of large scale oil sands mining, extraction and upgrading processes on the atmosphere, aquatic life, vegetation, wildlife, communities and existing life styles. The Atmospheric Environment Service plays a significant role by studying present meteorological and air quality conditions and by assessing the impact of future developments. The Service's activities include field research and the development of simulation models.

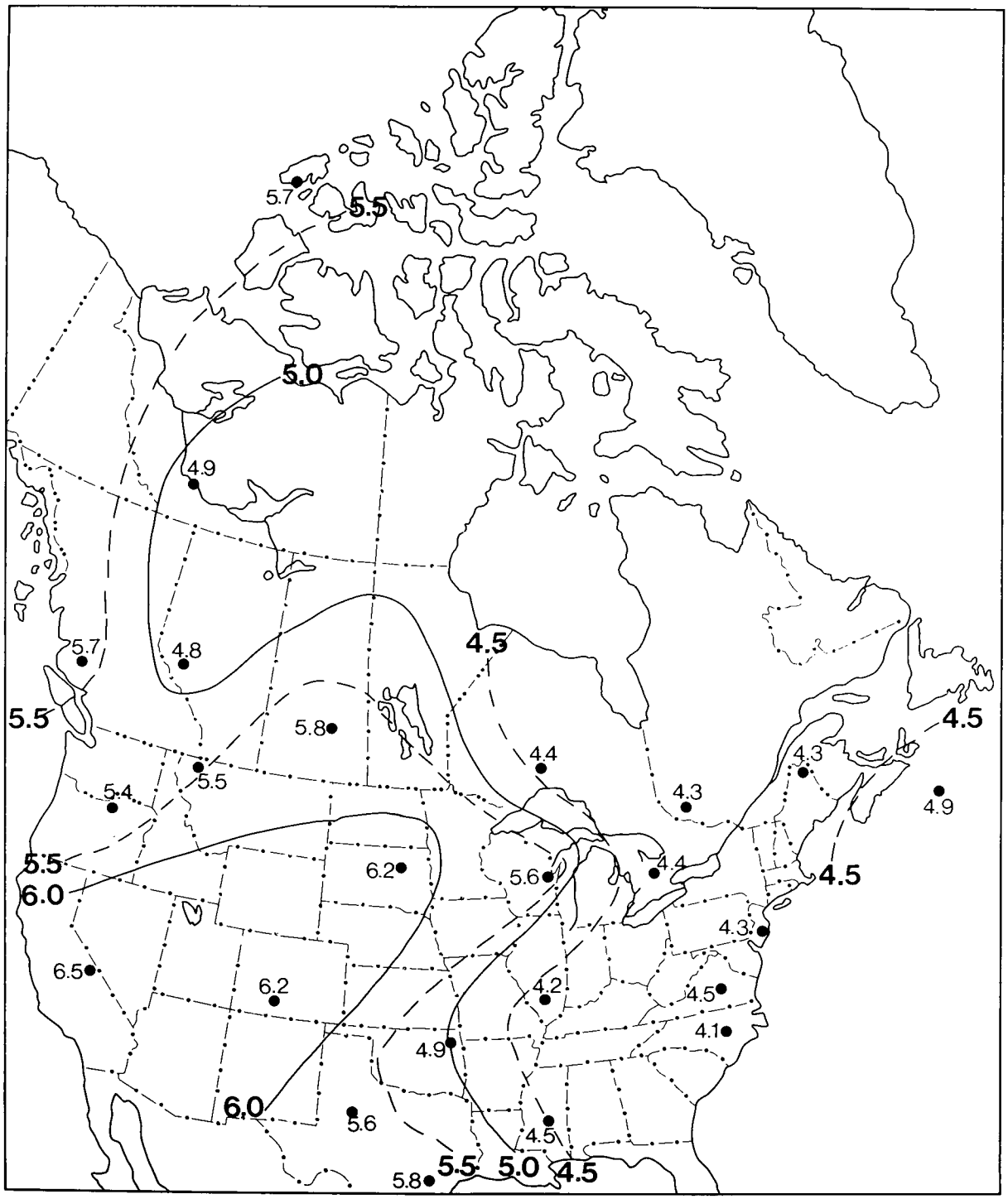

FIGURE 2 PRECIPITATION-AMOUNT-WEIGHTED MEAN pH AT STATIONS IN THE WORLD METEOROLOGICAL ORGANIZATION'S BACKGROUND AIR POLLUTION NETWORK DURING 1974 & 1975.

Three field studies have now been completed in the oil sands area during winter and summer seasons. The objectives of these studies were to:

1. obtain detailed information in space and time on wind flow, temperature and turbulence structure of the atmospheric boundary layer;
2. obtain information on the behaviour and dispersion of the plumes from the Great Canadian Oil Sands plant as a function of meteorological conditions and downwind distance; and
3. investigate the air quality and pollutant deposition.

The studies were extended to include a program to measure the rate of sulphur dioxide oxidation in the plumes and the spectral distribution of the global solar radiation. Analysis of these data is proceeding as planned.

Modelling studies with the Climatic Dispersion Model of the Oil Sands area have permitted the definition of seasonal and annual pollutant patterns from the pollution source. A comprehensive literature survey of practical mathematical models led to the selection of more sophisticated models that will be used in the oil sands area. One of these, the CRSTER model, is being used to investigate changes in the concentration of pollutants for various meteorological situations and to identify very adverse situations for further study.

Atmospheric Contaminants Program

During 1977-78, the Service was involved in a number of activities in support of the Environmental Contaminants Program. Work was performed under contract by Scintrex Limited to develop and evaluate a method for airborne measurement of ambient forms of mercury in air. Using a light aircraft equipped with a mercury spectrometer, field measurements were made on eighteen flights during July, August and September, 1977 over southern Ontario. The Service was represented on a mercury sampling and analysis review committee which was established by the Environmental Contaminants Steering Committee to review and make recommendations on sample collection, preservation and analytical techniques to ensure that future data on mercury concentrations in Canada are intercomparable and reliable. The report has been completed and is in press.

Stratospheric Pollution Studies

Experimental and theoretical studies of the stratosphere to assess the effects of anthropogenic pollutants on the ozone layer continued. The studies included the effects of freons, nitrogen-containing fertilizers and pollutants generated by supersonic transports.

Results of the STRATOPROBE III balloon flights which were flown from Yorkton, Saskatchewan in August, 1976 were analysed. The vertical profiles of nitric oxide, nitrogen dioxide and nitric acid were similar to the profiles measured during the previous STRATOPROBE flights in 1974 and 1975. The concentrations of nitrogen compounds found in the STRATOPROBE series are in broad agreement with the nitrogen and freon assumptions used in stratospheric pollution models.

In February, 1977, a flight was made from Cold Lake, Alberta to study nitrogen chemistry. A simultaneous underflight was made by a United States National Aeronautic and Space Administration aircraft also measuring nitrogen compounds. The results indicated significant differences between the nitrogen compound distributions at high latitude in winter and those at mid-latitude in summer.

In August 1977, one flight of STRATOPROBE IV was flown from Yorkton to study chlorine chemistry at high altitudes. During the STRATOPROBE IV study ground-based measurements of nitrogen dioxide and total ozone were made at Yorkton.

A cooperative intercomparison experiment under the sponsorship of the United States National Aeronautics and Space Administration was completed at the National Scientific Balloon Facility at Palestine, Texas. Measurements of stratospheric constituent concentrations obtained by remote sensing will be compared with those made in the stratosphere.

Measurement Techniques and Systems

The construction of a mobile research laser radar (LIDAR) for use in plume dispersion studies was completed under contract. The instrument was tested in the June field study of the Alberta Oil Sands Environmental Research Program and good results were achieved.

An instrument is being constructed to measure the angular light scattering efficiency of aerosols. When such measurements are coupled to theoretical predictions, information will be obtained on the size distribution, concentration, and indices of refraction of aerosols in the ambient air. In addition, an improved spectrophotometer was developed to measure solar irradiance. Tests of a compact filter pack technique for the simultaneous sampling of gaseous and particulate sulphur compounds gave satisfactory results and the technique has been adopted by other groups.

Testing was started of two instruments developed by the Service: a point monitor for nitrous acid and a chlorophyll fluorosensor. The second device will be used to measure air pollution damage to plants.

Instrument development work in support of the World Meteorological Organization's global air quality monitoring network continued during the review period. A new multi-wavelength sunphotometer, developed for the atmospheric turbidity program, is being tested. A new precipitation collector was introduced early in the fiscal year. Field experience with this instrument led to certain modifications which will be incorporated in 1978.

Measurements of boundary layer profiles of wind, temperature and humidity were made using tethersondes at Lake Simcoe, Ontario; Rimouski, Quebec; Beaver Creek, Yukon; and in the Alberta Oil Sands Environmental Research Program. Some unusual decoupling phenomena were documented for valley flows during stable conditions. Development of an acoustic sounder system proceeded satisfactorily.

Environmental Monitoring

As part of the World Meteorological Organization's global network, Canada continued to operate a background air quality monitoring program at ten rural and remote locations across the country. The stations measure atmospheric turbidity and collect precipitation samples for chemical analysis.

In conjunction with the Canadian Network for Sampling Precipitation project, the Service provides operational support to a network of twelve departmental stations at which precipitation samples are collected for the analysis of organic constituents. Routine carbon dioxide flask sampling continued at Alert, Northwest Territories; Sable Island, Nova Scotia; and at the Ocean Station Papa to determine the suitability of these stations as baseline sites for the World Meteorological Organization.

The joint project with the University of Toronto and the National Research Council to place instruments on the CN Tower in Toronto progressed and complete data gathering operations are expected to begin during 1978-79.

Atmospheric Pollutant Processes

Plume process studies by helicopter were completed at the bitumen recovery and processing operation of the Great Canadian Oil Sands plant near Fort McMurray, Alberta and at the International Nickel Company smelter at Copper Cliff, Ontario. Results from the Alberta project showed the importance of homogeneous gas-phase processes for the conversion of sulphur dioxide to sulphuric acid and other sulphates. At Copper Cliff, analysis of the particulate matter emitted showed little water-soluble sulphite present.

The plume from the stack of the International Nickel Company was also observed using a remote correlation spectrometer sensor. The information obtained was combined with meteorological data to help explain the dispersion processes involved. Elevated sulphur dioxide concentrations observed near Toronto were associated with air trajectories passing over the Sudbury area. The stack of the International Nickel Company smelter appeared to be the pollutant source.

A comprehensive program to study the distribution and transport of ozone in the ambient air was completed. It was found that elevated ozone concentrations could arise from local or distant sources. A local maximum concentration was found about 30 km downwind from the centre of Toronto.

During August, 1977, a special one year program began to investigate the regional and local transport of air pollutants in the Toronto area. Three sampling sites are in operation at Toronto Island, Maple, and the 430 m level of the CN Tower in Toronto.

Air Pollution Effects

Research on plant injury caused by air pollution continued during the review period. The objective was to develop quantitative relationships between plant injury and air pollutant uptake as determined by the physiological responses of the plant and the environmental conditions.

The assessment of the impact of air pollution on vegetation continued near Saint John, New Brunswick. An index of atmospheric quality based on lichen species frequency, distribution and coverage, describing the existing response of the lichen flora to changes in air quality was completed. The input of some pollutants, e.g. heavy metals, into the ecosystem continued to be monitored by the analysis of permanent vegetation plots.

The analysis of vegetation from remote areas, e.g. the high arctic, is in progress to obtain background values for certain air pollutants. These values can provide a baseline for the study of the long range transport of air pollutants.

A third project is concerned with the effects of changes in air quality on arctic lichens. The project is being done in two parts: a laboratory study of the effect of different pollutants on the physiology of lichens to define the critical concentrations that produce metabolic damage under a variety of micro-climatic conditions; and a field study of lichen communities in the arctic to describe the microclimatological characteristics of different vegetation types.

As part of the Alberta Oil Sands Environmental Research Program, a study of epiphytic lichens continued to determine their sulphur and heavy metal content in order to define atmospheric deposition patterns around local sources. This study, combined with precipitation and aerosol information, will improve the understanding of observed changes in heavy metal content of area vegetation.

Good progress was made in a cooperative field study with the University of Guelph to relate meteorological factors to the seasonal uptake of ozone by a canopy of field corn. This study was part of a continuing program to relate crop injury and yield loss to ambient pollutant fumigation patterns. The results showed that reasonable estimates of ozone flow to the canopy could be derived from a knowledge of ambient ozone levels, canopy structure and the meteorological and physiological factors controlling gas exchange.

A workshop on Canadian research on the development of air quality criteria and standards was held during January, 1978. Present air quality criteria and standard-setting procedures were examined and the activities of various government agencies were reviewed. Other topics discussed were the general concepts of environmental criteria selection, the relationships between criteria, objectives and emissions, pollutant mixture effects, the air quality implications of changing patterns of energy use, the environmental aspects of the use of catalytic converters, and the long range transport of air pollutants. The proceedings of the workshop will be published during the next fiscal year.

Environmental Modelling

Mathematical models of dispersion and heterogeneous sulphur dioxide oxidation were used to interpret data obtained at a nickel smelter and a power plant. Another model, based on homogeneous gas-phase chemistry, was applied to data on nitric oxide conversion in a power plant plume. Work is continuing jointly with the University of Alberta to predict the rate of sulphur dioxide oxidation due to gas-phase photochemical processes in plumes.

Studies of washout were undertaken by modelling the rate of uptake and loss of sulphur dioxide by raindrops. The model was applied to washout from a typical plume containing sulphur dioxide.

Work began on a Lagrangian model with application initially to vertical pollutant dispersion in the surface layer. Initial results show encouraging agreement with observations. The model will be extended to permit incorporation within the environment of a diagnostic episode model, the initial phases of which are being developed under contract.

The formulation of plume rise and maximum ground level concentration in a fully convective boundary layer was re-examined. A method was proposed for the estimation of maximum ground level concentration by acoustic sounding.

The University of Virginia mesoscale model tests were completed and the development of a new model was started. Sensitivity tests were completed on the new model.

The development of an air parcel trajectory model was completed and work began on the development of a concentration/deposition box model. Trajectory model results have been very useful in interpreting data from several research studies.

Environmental Impact Assessment

The Branch was represented on an intergovernmental working group which developed guidelines for the control of the incineration of toxic compounds at sea. Two federal task forces had Service members. One task force was involved in the development of environmental assessment guidelines for fossil fuel power generation and the other in the preparation of environmental codes of practice for steam-electric power generation.

Air quality impact assessment studies were completed for the existing Hudson Bay Mining and Smelting Company operations at Flin Flon, Manitoba and the proposed thermal power plant at Atikokan, Ontario. Revised dispersion modelling estimates were made for the proposed thermal power plant at Poplar River, Saskatchewan.

A contract was let for the evaluation of a recommendation for improvements to the existing meteorological, air quality and source emission observational systems, with particular emphasis on the Montreal region.

Improved point source dispersion models and assessment methods were developed in some of the above studies. Adaptation of a new multi-source model, RAM, commenced. A study of the frequency of occurrence in the Canadian arctic of those variables that affect dispersion was started. The information will be used initially in assessing the impact of incineration of arctic oil spills and blowouts.

Scientific and Technical Information

The Atmospheric Environment Service continued to develop its Canadian, North American and international contacts to foster the development of activities related to air pollution and the environment. Internationally, the Service is represented on numerous bodies, including the United Nations Environment Program, the World Health Organization, the World Meteorological Organization, the North Atlantic Treaty Organization's Committee on the Challenges of Modern Society, the Inter-Governmental Maritime Consultative Organization, the Economic Commission

for Europe and participates in conferences and working groups. In North America, the Service has considerable interaction with research groups in the United States and provides support to agencies such as the International Joint Commission. The Service was an important contributor to the annual meeting of the Air Pollution Control Association in Toronto.

In Canada, the Service provides members to the Federal-Provincial Committee on Air Pollution and its sub-committees and to numerous other bodies. Staff continue to provide advice and assistance in specialized areas to other federal departments, provincial agencies, universities and industry. During the review period, a task group of staff of the Atmospheric Environment Service and the Environmental Management Service began work on an environmental bulletin that will inform the public on air and water quality indicators.

The Atmospheric Environment Service publishes papers in international journals and publishes and distributes Service reports to government agencies, international organizations, universities, industry and scientific institutions. During the review period, 21 scientific papers were published in international journals and 19 Branch reports were completed. A list of titles is available from the Air Quality and Inter-Environmental Research Branch.

Date Due