THE CLEAN AIR ACT
ANNUAL REPORT
1972 – 1973

Air Pollution Control Directorate
Environmental Protection Service
Department of the Environment

May 1973

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Minister
Environment Canada

Ministre
Environnement Canada

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

May it Please Your Excellency:

I have the honour herewith, for the information of Your Excellency and the Parliament of Canada, to present the Annual Report on the Clean Air Act for the fiscal year ended March 31, 1973.

Respectfully submitted,

Jack Davis
Minister of the Environment

Deputy Minister
Environment Canada

Sous-ministre
Environnement Canada

To the Honourable Jack Davis, M.P.,
Minister of the Environment,
Ottawa, Canada

Sir:

I submit herewith the Annual Report on the Clean Air Act for the fiscal year ended March 31, 1973.

I have the honour to be, Sir,

Your obedient servant,

R.F. Shaw
Deputy Minister

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INTRODUCTION

The Clean Air Act was officially proclaimed on November 1, 1971. This is the first report submitted in accordance with Section 41 of the Act and covers operations for the period ending March 31, 1973.

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

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

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

RESPONSIBILITIES OF THE MINISTER

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

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

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

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

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

(e) publish or otherwise distribute or arrange for the publication or distribution of all pertinent information 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.

AIR POLLUTION CONTROL DIRECTORATE

Within the Department of the Environment the administration of the Clean Air Act is carried out by the Air Pollution Control Directorate. The responsibilities of the Directorate are divided among three branches.

The *Air Pollution Programs Branch* carries out the surveillance of ambient air pollution in Canada, collects and evaluates information regarding air pollution sources in Canada, conducts source and area surveys and studies, assesses social and economic effects of air pollution control regulations and programs, and develops interagency cooperative programs. The Air Pollution Programs Branch consists of four divisions: data analysis, regulations and development, interagency programs, and surveillance.

The *Abatement and Compliance Branch* is responsible for carrying out engineering and technical assessment of pollution emissions and emission control and abatement methods to establish the technical basis for development of air pollution control guidelines, standards, and regulations. The Abatement and Compliance Branch is composed of five divisions: (a) chemical process sources, (b) mining, mineral, and metallurgical, and (c) combustion sources, which cover major stationary sources; (d) mobile sources, which is concerned with emissions from motor vehicles, railways, ships, and aircraft; and (e) fuels, which is concerned with fuel composition and additives.

The *Technology Development Branch* is responsible for fostering the development and demonstration of control technology and scientific and technical methods for the control and abatement of air pollution. The branch provides chemical services, the development of sampling, analysis, and measurement procedures for air pollutants, a motor vehicle testing facility, and a technology transfer service that incorporates both publications and training. The Technology Development Branch comprises three divisions: engineering, chemistry, and publications and training.

Major activities of the Directorate in the 1972–1973 period included such things as the compilation of inventories of air pollutant sources and emissions, the coordination of a National Air Pollution Surveillance Network, the establishment of National Air Quality Objectives, the prescription of National Emission Standards and Guidelines, the control of air pollution from works, undertakings, and businesses under federal legislative authority, and the control of the composition of fuels that may be produced in Canada or imported into the country. Specific tasks carried out on these and other programs are outlined in more detail in the following pages.

An organization chart for the Directorate and a resources summary for the overall Air Pollution Control Program are shown in Figure 1 and Table 1, respectively.

INTERAGENCY COOPERATION AND COLLABORATION

General

To assist in effectively utilizing available resources for air pollution control in Canada, the Air Pollution Control Directorate maintains close contact with all provincial agencies responsible for air pollution control, as well as with foreign and international organizations.

Coordination of provincial agencies is centralized within the Directorate. Such collaboration is essential because the provinces have jurisdictional control over most air pollution sources. Control programs initiated by the Directorate are in many instances carried out 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.

Together with other agencies in the Federal Government, the Air Pollution Control Directorate participates in a number of international environmental organizations. These include the Organization of Economic Cooperation and Development (OECD), the World Health Organization (WHO), and the North Atlantic Treaty Organization – Committee on the Challenges of Modern Society (NATO-CCMS).

The Directorate also contributes to the activities of the International Joint Commission through membership on the International Air Pollution Advisory Board. Members of the Directorate continue to be involved in a joint study with United States officials in response to recommendations contained in the International Joint Commission report on transboundary air pollution in Detroit–Windsor and Sarnia–Port Huron areas.

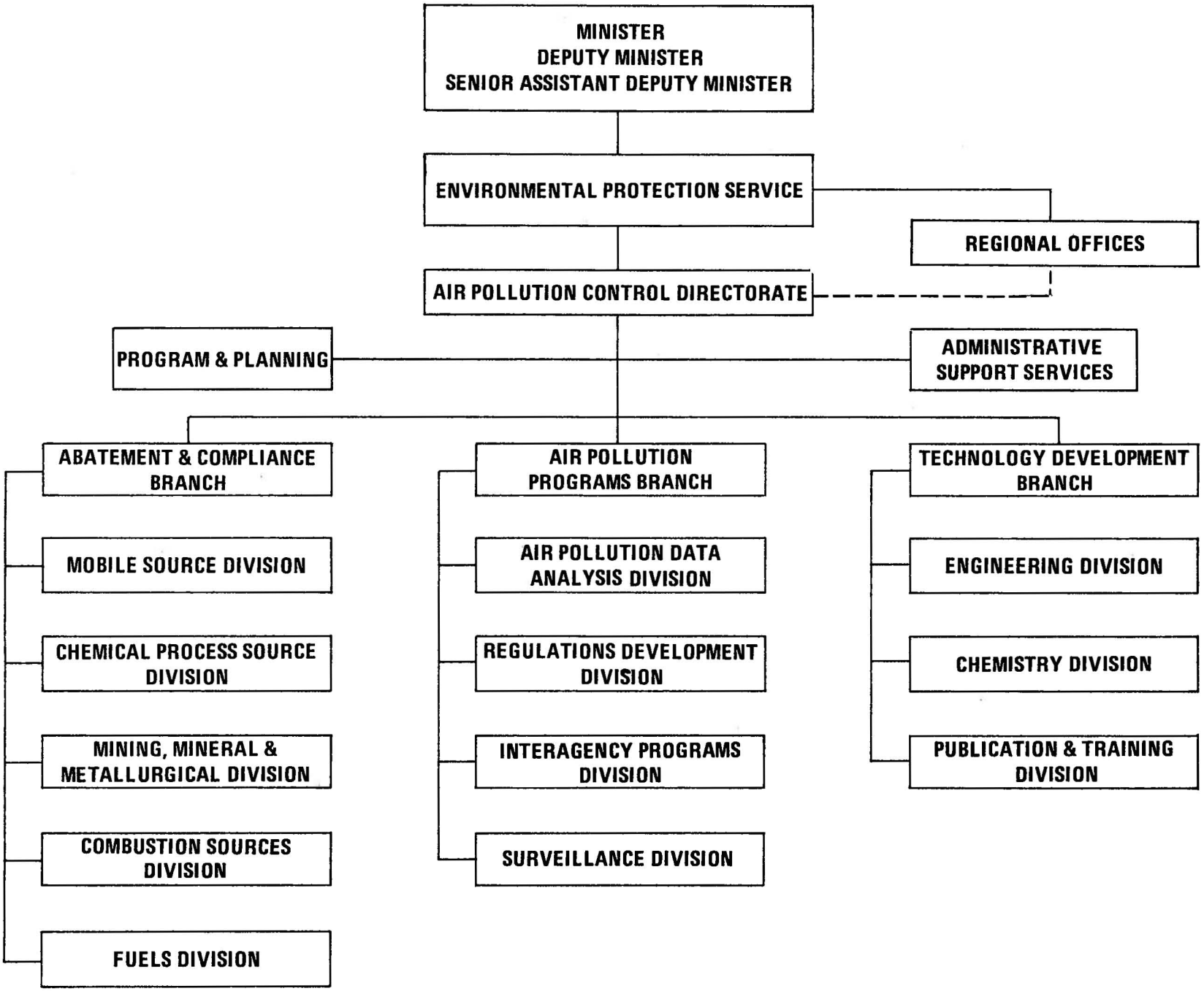

FIGURE 1 ORGANIZATION OF THE AIR POLLUTION CONTROL DIRECTORATE

TABLE 1 AIR POLLUTION CONTROL PROGRAM RESOURCE SUMMARY

Fiscal year	End of year strength	Salaries ($)	Goods and services ($)	Capital ($)	Total expenditure ($)
1970-1971	38	268 326	113 527	157 458	539 311
1971-1972	76	900 000	455 000	660 000	2 015 000
1972-1973	147	1 711 000	644 000	1 079 000	3 434 000

Federal—Provincial

The Federal—Provincial Committee on Air Pollution is the principal formal mechanism for obtaining federal—provincial cooperation and ensuring participation in specific projects of all provincial agencies that wish to be involved.

This committee was established on an ad hoc basis in 1969 by the Department of National Health and Welfare, which at that time had responsibility for federal air pollution control programs. With the establishment of the Department of the Environment in 1971, the committee was formally established under the aegis of the Minister of the Environment. The committee serves as an effective forum for examination of priorities for the development of national air pollution control programs, control technology, an expanded air pollution surveillance network, source inventories, and similar matters of common interest. During the period under review, a meeting of the committee was held in Ottawa, November 21—22, 1972, at which all ten provinces were represented.

In 1970, the Federal—Provincial Committee on Air Pollution established a subcommittee of experts to recommend to the parent committee appropriate levels for National Air Quality Objectives.

The first recommendations of the subcommittee on National Air Quality Objectives led to the announced air quality objectives for sulphur dioxide, suspended particulates, carbon monoxide, and oxidants, which were published in Part 1 of the Canada Gazette on December 16, 1972.

Membership on the subcommittee of National Air Quality Objectives varies depending on its expert needs. It now comprises six members: four members from three provinces, one member from the Department of National Health and Welfare, and one member from the Department of the Environment. Secretariat services to the subcommittee are provided by the Air Pollution Control Directorate.

Another important activity of the Federal—Provincial Committee on Air Pollution is the National Air Pollution Surveillance (NAPS) Network. The NAPS Network is a joint project based on the cooperative efforts of the federal and provincial levels of government, designed to monitor all locally significant air pollution parameters in all significant centers of population. The network provides a ready means of auditing progress in air pollution control across the country. Its method of operation and other pertinent details are explained elsewhere.

Since the provinces have jurisdictional control of most air pollution sources, the Department has adopted the basic strategy of promoting and supporting viable provincial control agencies through federal—provincial cooperative efforts. Projects aimed at assisting the provinces include a free exchange of data, training of air pollution technicians, providing monitoring equipment for the National Air Pollution Surveillance Network, and supplying technical services on request.

Present cooperative efforts may at some future date become formalized in bilateral agreements as authorized by Section 19 of the Clean Air Act. These agreements could specify the respective responsibilities of each jurisdiction in the abatement and control of air pollution. Essential to such agreements would be the adoption by the provinces of the National Air Quality Objectives and National Emission Guidelines as minimum standards.

Foreign and International

Environmental Protection Agency. Increasing liaison with officials of the United States Environmental Protection Agency has provided considerable value to Canada's air pollution control program.

Environmental Protection Agency officials have significantly assisted the Directorate in developing new Canadian programs. In the field of motor vehicle emission control a number of exchange visits have taken place from which Canada has profited. The exchange of benefits is mutual as Canada is now providing United States officials with data on motor vehicle emissions in cold weather.

United States Environmental Protection Agency officials continue to provide access to their very considerable resources by making available published and unpublished reports and data in problem areas of particular interest to Canada. Such information in the area of ambient air quality research, priorities, and programs has assisted the Directorate in keeping abreast of current needs for protection of the Canadian people. Such background data help Canadian officials avoid duplicating ineffective control programs.

International Organizations. To project an accurate image of Canada's capability in air pollution control, to assist in fulfilling Canada's international obligations, and to obtain maximum benefit for Canada from developing air pollution technology in various parts of the world, the Air Pollution Control Directorate is participating in a number of international programs. This participation is coordinated through the Department of External Affairs. It involves, for example, a contribution to the World Health Organization's program of urban air pollution surveillance. This program provides an international monitoring network for world

comparisons of air pollution levels in urban centers in commercial, industrial, and residential settings. The Directorate's Chemistry Division is also participating as part of a WHO working group for the provision of standard reference material for polycyclic aromatic hydrocarbons. This same laboratory has been designated by the World Health Organization as the National Reference Centre for Canada with regard to the analysis of air pollutants.

The Air Pollution Control Directorate provides Canada's delegate to the OECD Air Management Sector Group as well as participating through the Interdepartmental Committee of International Environmental Affairs in activities of the Environment Committee and other sector groups. Canada has recently agreed to participate in several new studies being planned by the Air Management Sector Group. These include a determination of the magnitude and control strategies available for control of photochemical oxidants and a study of the "polluter pays" principle in relation to sulphur dioxide emissions from thermal power generating stations.

International Joint Commission. Several air pollution references have been investigated by the International Joint Commission over the years. The most recent reference in 1966 resulted in a detailed analysis of the transboundary air pollution problems in the Detroit–Windsor and Sarnia–Port Huron areas. The report on the study was issued by the International Joint Commission in 1972 and it contained recommendations for abatement and control of the transboundary air pollution.

At a bilateral meeting of American and Canadian officials in Washington in October 1972, a joint working task force was established to consider aspects of the recommendations contained in the International Joint Commission report and to report back to the parent group. Members of the Air Pollution Control Directorate participated in the October meeting and are the lead agency for the Canadian sector of the working task force. It is expected that a basis for agreement and a positive program will emerge from these deliberations.

The Air Pollution Control Directorate also provides the Canadian chairman of the International Air Pollution Advisory Board, a standing board of the International Joint Commission. The board investigates on behalf of the International Joint Commission any air pollution problems that arise along the Canada–United States border and reports the results of their investigations to the International Joint Commission. In the past year the board has been called upon to investigate two transboundary air pollution incidents, one in Ontario and one in British Columbia.

SURVEILLANCE ACTIVITIES

General

A section of the Act that is now impacting on Canadian industry is the Minister's mandate to collect and publish data on air pollution. This includes a responsibility to maintain a continuing record of ambient air pollution levels in urban areas on a national basis, to define problem areas through field investigations, to ensure compliance with regulations, to form a basis for legal proceedings, and to provide consultative services to federal or provincial agencies in matters of air monitoring and surveillance.

Nationwide Emission Inventories

One of the first actions taken with the passage of the Clean Air Act was to contract with an outside consultant for the compilation of a National Emission Inventory for Canada. This inventory provided an across-the-board view of pollution problems in relation to the five major contaminants: sulphur dioxide, particulate matter, carbon monoxide, hydrocarbons, and nitrogen oxides. A summary of the results of this study is presented in Tables 2 and 3.

More recently action has focused on pollutants that may prove to be of significant danger to health. Close to completion, again through outside consultants, is an inventory of lead, beryllium, asbestos, and mercury emissions. This type of study requires the full support of provinces and industry. Response has been excellent, and it has not been necessary to invoke the legal authority available under the Act to obtain the information required. Both these studies were based on data collected in 1970 since more recent data were unavailable. It is intended to update the inventories periodically.

National Air Pollution Surveillance Network

This network consists of air monitoring instruments located in significant centers of population across Canada. A knowledge of the nature and extent of air pollution across Canada is fundamental to the sound planning of control and abatement programs. The chief purpose of the National Air Pollution Surveillance program, therefore, is to provide this information on a continuing basis. However, the program also serves a number of other needs and will become increasingly more useful as data accumulate. For example, it will be possible to detect trends in the levels of pollution with changing industrial activity, population density, and air pollution abatement progress. Information collected by the program can be used in epidemiological studies and in the development of air quality objectives. Moreover, since the National Air Pollution Surveillance Network is a cooperative effort between the federal, provincial, and municipal levels of government, its usefulness in fostering federal–provincial

TABLE 2 NATIONWIDE EMISSIONS BY POLLUTANT, 1970
(10^3 tons per year)

Pollutant	Weights of pollutants	Percentage of total weight
CO	17 312	55.4
Particulates	2 290	7.3
SO_x	7 209	23.1
Hydrocarbons	3 072	9.8
NO_x	1 359	4.4
TOTAL	31 242	100.0

Note: SO_x and NO_x are expressed as SO_2 and NO_2.

TABLE 3 NATIONWIDE EMISSIONS BY SOURCE, 1970
(10^3 tons per year)

Source	Total weight of pollutants	Percentage of total weight
Transportation	17 784	56.9
Fuel combustion in stationary sources	2 578	8.3
Industrial processes	7 650	24.5
Solid waste disposal	840	2.7
Miscellaneous	2 390	7.6
TOTAL	31 242	100.0

cooperation cannot be overemphasized. It provides a direct route between control agencies of the Provincial and the Federal Governments in administering a mutually beneficial program.

The data from these stations are compiled by the Directorate on a monthly basis. An annual summary is also produced. Measurements include soiling index, suspended particulates, lead, dustfall, sulphation rate, and sulphur dioxide. Tables 4 and 5 present values obtained in commercial downtown core areas across Canada for sulphur dioxide and suspended particulates, respectively.

During the past year the National Air Pollution Surveillance Network was expanded and improved. As of March 31, 1973, the network consisted of 268 air sampling instruments in 39 cities across 10 provinces and the Northwest Territories. A map showing the location of the sampling stations is presented in Figure 2. Expansion of the network also included:

(a) the installation of 14 sulphur dioxide monitors in five Canadian cities;

(b) the purchase of 71 air pollution monitors for distribution to 10 major Canadian cities to measure six parameters: particulates, sulphur dioxide, carbon monoxide, oxides of nitrogen, ozone, and hydrocarbons;

(c) a review of four potential sites for the installation in Ottawa of a remote automatic air pollution monitoring station for demonstration and training purposes.

Source Testing and Area Surveys

Several questionnaires for the collection of air pollutant emission data have been developed and are being evaluated to assess their usefulness. Forms to reduce data and to simplify its transfer to computer storage were designed and remain to be evaluated. Estimates of major pollutant emissions for 12 Canadian cities were compiled and used chiefly to assist in determining optimum locations of pollution monitors. Estimates of pollutants from several individual industrial plants were made to evaluate their impact on community air quality and to assess the need for surveillance monitoring.

Air monitoring surveys to determine airborne mercury levels in the vicinity of four chlor-alkali plants were completed and the results published. The data collected on mercury emissions will be used as a guide in the development of regulations to be applied to this industry. A New Brunswick chipboard manufacturing facility was monitored to assess the effects of its emissions on community air quality and the results were made available to the provincial control agency for appropriate abatement action. Survey proposals for monitoring airborne fluorides, arsenic, and mercury in the vicinity of plants emitting these pollutants were prepared, and associated air monitoring activities are scheduled to commence early in the new fiscal year.

TABLE 4 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR SULPHUR DIOXIDE – COMMERCIAL DOWNTOWN CORE AREAS

Location	Annual arithmetic mean (parts per hundred million)		
	1970	1971	1972
Halifax N.S., Tech College			3.25
Saint John, 110 Charlotte			4.40
Montreal, 1125 Ontario	5.43	4.06	3.70
Montreal, 1212 Drummond	9.94	8.01	6.61
Hull, Rue Principale	2.38	1.65	1.33
Ottawa, Slater & Elgin	4.46	2.15	3.03
Toronto, 67 College	7.10	5.17	2.97
Toronto, City Hall		4.10	2.05
Hamilton, Barton & Wentworth	3.72	2.91	1.65
London, King-Rectory		1.42	0.58
Sarnia, 156 Victoria		2.65	1.93
Windsor, 471 University	3.64	4.25	3.62
Winnipeg, Kennedy & York			0.97
Edmonton, 109 St & 98 Ave (7-months data)			0.10
Calgary, 620-7 Ave SW (7-months data)			0.45
Vancouver, 739W Hastings (6-months data)			1.89
Victoria, Police Stations (6-months data)			1.53
Regina, 12th & Smith			0.03

Stack sampling tests were conducted at several incinerators and heating plants operated by the Federal Government in the Ottawa area as part of the federal facilities abatement program. Source testing procedures, techniques, and instrumentation were evaluated in several field and laboratory projects. A Federal Source Testing Code of Practice has been drafted and is being reviewed for publication. A paper entitled "Stack Sampling – The View from Ottawa" was presented at a meeting of a professional association and later published in the technical press. Representation was provided on one international and one national committee dealing with source testing matters.

Survey data generated by the Strait of Canso Air Monitoring Network are being passed to several organizations as they become available. A report summarizing and interpreting survey data for the first 12 months of network operation was undertaken and will be available in 1973. Work has begun on redesigning the network to meet the objectives of a cooperative project involving the Atmospheric Environment Service, provincial agencies, and the Environ-

TABLE 5 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR SUSPENDED PARTICULATES – COMMERCIAL DOWNTOWN CORE AREAS

Location	Annual geometric mean (micrograms per cubic meter)		
	1970	1971	1972
St. John's, Duckworth & Ordinance			54
Fredericton, Woodstock	33	36	
St. John, 110 Charlotte	61	54	46
Moncton, Post Office	77	54	54
Montreal, 1212 Drummond		111	132
Hull, Rue Principale	77	73	69
Quebec, Parc–Autos Paquet–Laliberte			83
Chicoutimi, City Hall			75
Ottawa, Slater & Elgin	109	92	75
Toronto, 67 College	110	99	92
Hamilton, Barton & Wentworth	140	142	133
Peterborough, Fire Station		61	
London, King-Rectory		125	95
Sarnia, 156 Victoria		105	98
Windsor, City Hall	142	122	91
Sault Ste. Marie, Prov. Ont. Bldg		55	66
Thunder Bay, 14 Algoma		69	60
Winnipeg, Kennedy & York	76	73	75
Regina, 1955 Smith	66	57	49
Saskatoon, City Library		72	68
Moose Jaw, Telephone Bldg			48
Prince Albert, 49-12th St E			51
Edmonton, 98th & Jasper	80	60	66
Calgary, 7th Ave & 2nd St SE	117	105	85
Red Deer, 4720 49th St	71	64	58
Medicine Hat, 770 1st St SE	67	57	57
Lethbridge, 13th St & 9th Ave S	34	41	37
Vancouver, 739W Hastings			77
Victoria, Police Station	52	59	44
Sudbury, 50 Cedar		110	

FIGURE 2 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK, JANUARY 1972

mental Protection Service. An air pollution model of the Strait of Canso area will eventually be constructed and used to predict air pollution episodes and to guide future industrial development of the area.

Survey proposals for area-wide monitoring of pollutants at three different locations in Canada were reviewed and redesigned to provide more useful data. A mobile air monitoring laboratory was designed, purchased, and instrumented for regional operations.

Special Studies

Field Testing of Air Monitoring Instruments and Associated Equipment. Work is continuing on the purchase and evaluation (under actual conditions of use) of instruments to measure carbon monoxide, reactive and nonreactive hydrocarbons, particulates, ozone, nitrogen oxide, nitrogen dioxide, and total nitrogen oxides in the atmosphere. In addition, evaluations are being conducted on associated testing, calibration, and data recording equipment. The purpose of this program is to find more reliable equipment and methods for monitoring air pollution levels.

Effects Studies. An air pollution study of Sydney, Nova Scotia, is underway and is expected to run for several years. When completed it will provide information on air contaminant levels near the steel mill and their effects on health and welfare. This study is being carried out in cooperation with the Department of National Health and Welfare. Information will also be obtained on total particulate mass and particulate size distribution, sulphur dioxide levels, sulphation rate, various meteorological parameters, and the effects of air pollution on various types of metals and plant material.

Windsor Study. A new air monitoring station was built in Windsor, Ontario, in an area with high dustfall characteristics. The station is equipped with a number of different instruments to measure particulate size distribution. The data from the various instruments will be compared in an attempt to assess the accuracy and performance of each one. The most accurate and useful instrument indicated from this work will be recommended for inclusion in the National Air Pollution Surveillance Network.

Special Assignments. Three consultant firms were contracted to conduct surveys of lead and cadmium levels in Montreal, Toronto, and Vancouver. Results of the lead studies have been published. A contract has been awarded for design and construction of a computer-based automatic air monitoring system. It is expected that the central station and the first remote station, to be located in Ottawa, will be operational in August 1973. The system has the capability for an additional nine remote stations, which can be connected to

the central station by means of telephone lines. It will be used primarily for demonstration and training purposes.

TECHNOLOGY DEVELOPMENT

General

Section 3 of the Clean Air Act provides a broad mandate for technology development and demonstration. The Department plans to draw heavily on the private sector both in demonstration of new technology and in identification of problems for which technological solutions appear suitable.

Industry is now submitting proposals to the Environmental Protection Service for a variety of projects for which priorities are being established. A program is being developed to provide funding on a contract basis for government-approved projects.

Standard Reference Methods

Standard reference methods to be used for the measurement of sulphur dioxide, suspended particulates, oxidants, and carbon monoxide have been published and are available from the Department.

Air Sampling Technology

Long term studies are continuing on the fundamental vapor pressures and the practical collection efficiencies of substances having particular importance to public health and welfare. The list of substances under investigation includes the polycyclic aromatic hydrocarbons, arsenic trioxide, selenium dioxide, mercury vapor, inorganic compounds of mercury, methyl mercury compounds, and individual polychlorinated biphenyls. Evidence has been accumulated to indicate that conventional methods of sampling, particularly the high volume method, do not collect these substances quantitatively. Accordingly, experiments are in progress to establish optimum sampling conditions.

Measurement Methods Development

A simple, rapid, and direct method of measuring lead in gasoline based upon flame atomic absorption has been developed. Calibration experiments were carried out against three different primary standards of lead. This method was prescribed by notice in Part I of the Canada Gazette as the reference method for determination of lead in gasoline.

The development of methods for various international agencies was continued. Methods for polycyclic hydrocarbons were developed for the International Agency for Research on Cancer and the Intersociety Committee. Methods for the measurement of metals in air were developed for the International Union of Pure and Applied Chemistry and the Scientific Committee on Problems of the Environment.

In the past, gas chromatographic methods for polycyclic aromatic hydrocarbons have been lacking in sensitivity with air samples because of the low concentrations found in air. Work is in progress to adapt atomatic processing of chromatographic data, in general, to any ambient air sample. Work is also in progress to prepare analytical programs for the ultimate analysis of the aliphatic and aromatic fractions of air samples. Computer programs have been prepared to evaluate the accumulated data on the important polycyclics.

The size of various suspended particulates is being investigated using several methods. Differences in the particle size values have been found by various methods and the reasons for the variation are under study. Accurate knowledge of particle size is important if objectives are to be set involving the respirable and nonrespirable fractions.

Publications

Publications produced during the period covered by this report are listed here.

Regulations, Codes, and Protocols Series

EPS 1-AP-72-3	Standard Reference Method for the Measurement of Total Oxidants in the Atmosphere (Iodometric Titration)
EPS 1-AP-72-4	Standard Reference Method for the Measurement of Sulphur Dioxide in the Atmosphere (West—Gaeke Method)
EPS 1-AP-73-1	Standard Reference Method for the Measurement of Carbon Monoxide in the Atmosphere (Non-Dispersive Infrared Spectrometry)
EPS 1-AP-73-2	Standard Reference Method for the Measurement of Suspended Particulates in the Atmosphere (High Volume Method)

Technical Appraisal Series

EPS 3-AP-73-1	A Nationwide Inventory of Air Pollutant Emissions — Summary of Emissions for 1970

EPS 3-AP-73-3	Methods for the Removal of Sulphur from Coal

Technology Development Series

EPS 4-AP-72-1	Determination of Airborne Particulate Lead by Atomic Absorption Spectrophotometry
EPS 4-AP-72-5	Determination of Airborne Particulate Cadmium by Atomic Absorption Spectrophotometry
EPS 4-AP-72-9	Determination of Airborne Particulate Manganese by Atomic Absorption Spectrophotometry
EPS 4-AP-72-8	Determination of Airborne Particulate Vanadium by Atomic Absorption Spectrophotometry
EPS 4-AP-72-10	Determination of Airborne Particulate Chromium by Atomic Absorption Spectrophotometry

Surveillance Series

EPS 5-AP-72-2	National Air Pollution Surveillance Monthly Summary – January 1972
EPS 5-AP-72-3	National Air Pollution Surveillance Annual Summary – 1971
EPS 5-AP-72-4	An Air Pollution Study of the National Capital Region
EPS 5-AP-72-5	National Air Pollution Surveillance Monthly Summary – February 1972
EPS 5-AP-72-6	National Air Pollution Surveillance Monthly Summary – March 1972
EPS 5-AP-73-1	National Air Pollution Surveillance Monthly Summary – April 1972
EPS 5-AP-73-2	Exploratory Lead Studies in High Traffic Density Areas in Vancouver, Toronto, and Montreal

Air Pollution Control Directorate (APCD) Series

APCD-71-8	The Collection and Measurement of Airborne Mercury – I
APCD-71-11	Industrial Air Pollution Control Engineering
APCD-71-12	Collection and Measurement of Airborne Mercury – II
APCD-71-14	Collection and Measurement of Airborne Mercury – III

APCD-71-19	The Federal Role in Air Pollution Control in Canada
APCD-72-1	Air Pollution from a Burning Coal Refuse Dump, Springhill, N.S.

NATIONAL AIR QUALITY OBJECTIVES

General

On November 13, 1971, in the Canada Gazette, National Air Quality Objectives were proposed by the Department of the Environment and comments were invited from interested individuals and organizations. The proposed objectives have now been reviewed taking these comments into account. Numerous individuals and organizations submitted comments that reflected a broad range of opinion. Many were concerned with the lack of specified methods to be used for measuring the pollutant levels. This omission has now been rectified and standard reference methods for each pollutant have been indicated.

Under the Clean Air Act, the National Air Quality Objectives are designed to protect public health and welfare by setting limits on levels of pollution in the air. The Clean Air Act calls for three levels of air quality objectives – "desirable", "acceptable", and "tolerable" – for each major air pollutant. The objectives now being promulgated concern only the first two of these levels.

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

The maximum desirable level defines the long term goal for air quality and provides a basis for an anti-degradation policy for the unpolluted parts of the country and for the continuing development of control technology.

Maximum tolerable levels, to be announced at a later date, are intended to indicate the onset of an "imminent danger" requiring immediate abatement action.

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

connection with the methods of measurement, rather than the objectives. Considerable attention is now being given to this aspect, especially in relation to the selection of a suitable, specific reference method to reflect particle size distribution and to the need for standardization in measurement.

Several comments pointed out that in various parts of the country the naturally occurring background levels of oxidants approached or exceeded the proposed desirable annual levels. For this reason, and to ensure that the objectives are meaningful, the desirable objective of an annual arithmetic mean for oxidants has been dropped for the present. Several briefs suggested that no noticeable effect on human health attributable to oxidants had been demonstrated in Canada. It was also suggested that the nature of photochemical reactions under Canadian climatic conditions was not well understood and that until this was rectified no effort should be made to control oxidants by setting air quality objectives for them. However, after considering the evidence currently available, it was concluded that the objectives are necessary for the protection of the public health and welfare.

A great deal of consideration was given to the proposed objectives for hydrocarbons in view of the fact that these form a class of substances whose composition varies and, consequently, whose effects also vary depending on the source. In addition, satisfactory methods of measurement have yet to be developed for those hydrocarbons that are the most relevant. Moreover, the proposed objectives for hydrocarbons were intended to provide protection against oxidants and were not intended to reflect the effects of the hydrocarbons per se. It has been correctly pointed out that this approach is inconsistent with the established basis for the National Air Quality Objectives. Consequently, objectives for hydrocarbons have been dropped for the present.

Revised National Air Quality Objectives promulgated in the Canada Gazette on December 16, 1972, are given below. Further revisions are expected as the needs arise.

Maximum Acceptable Levels

Sulphur Dioxide
- 60 micrograms per cubic meter (0.02 ppm) annual arithmetic mean
- 300 micrograms per cubic meter (0.11 ppm) as a maximum 24-hour concentration
- 900 micrograms per cubic meter (0.34 ppm) as a maximum one-hour concentration

Particulate Matter — 70 micrograms per cubic meter annual geometric mean
— 120 micrograms per cubic meter as a maximum 24-hour concentration

Carbon Monoxide — 15 milligrams per cubic meter (13 ppm) as a maximum eight-hour concentration
— 35 milligrams per cubic meter (30 ppm) as a maximum one-hour concentration

Total Oxidants — 30 micrograms per cubic meter (0.015 ppm) annual arithmetic mean
— 50 micrograms per cubic meter (0.025 ppm) 24-hour concentration
— 160 micrograms per cubic meter (0.08 ppm) as a maximum one-hour concentration

Maximum Desirable Levels

Sulphur Dioxide — 30 micrograms per cubic meter (0.01 ppm) annual arithmetic mean
— 150 micrograms per cubic meter (0.06 ppm) as a maximum 24-hour concentration
— 450 micrograms per cubic meter (0.17 ppm) as a maximum one-hour concentration

Particulate Matter — 60 micrograms per cubic meter annual geometric mean

Carbon Monoxide — 6 milligrams per cubic meter (5 ppm) as a maximum eight-hour concentration
— 15 milligrams per cubic meter (13 ppm) as a maximum one-hour concentration

Total Oxidants — 30 micrograms per cubic meter (0.015 ppm) as a maximum 24-hour concentration
— 100 micrograms per cubic meter (0.05 ppm) as a maximum one-hour concentration.

NATIONAL EMISSION GUIDELINES AND STANDARDS

Under Section 8 of the Act the Federal Government can prescribe National Emission Guidelines. These will provide guidance to provincial control agencies on best practicable

control technology now available in various industry sectors and are being developed through the mechanism of industry and government joint task forces. They will also establish the requirements for all works, businesses, and undertakings involving the Federal Government. Work is now underway on the preparation of background material leading to the development of guidelines for a number of industries, as outlined below.

Cement Industry

Information from both a literature survey and a questionnaire will be used by a government industry task force to develop emission guidelines applicable to Canadian cement plants. These guidelines are expected to be completed and published early in 1974.

Chlor-alkali Plants

A literature review of the state-of-the-art process and control technology has been completed, and a draft paper on the chlor-alkali industry prepared. A draft questionnaire, which will be used to obtain a detailed emission inventory and other information for the industry study, has also been prepared and will be reviewed with the industrial association.

Asphalt Plants

This study encompasses the hot mix asphalt paving industry in Canada. The procurement and transportation of raw materials, operations, and processes involved were also examined to establish reference points necessary to investigate air pollutant emissions evolving from this industry.

To obtain background information on this industry, an intensive literature survey was conducted and contacts were made with equipment manufacturers, Statistics Canada, and the Department of Industry, Trade and Commerce. Major customers for asphalt paving mixtures were contacted for their annual use and material specifications. These included the Provincial Department of Highways and the Federal Departments of Transport, Public Works, and National Defence. Contact was also made with the existing provincial environmental agencies and the National Asphalt Pavement Association of the United States. The state-of-the-art phase for the asphalt industry is now completed.

Thermal Power Plants

A study is underway to determine the emission rates of air pollutants discharged from operations associated with the generation of thermal electric energy in Canada, and to provide information for assessing the relationships between air pollutant emissions and generating parameters to meet National Air Quality Objectives.

Incinerators

This study includes all types of incineration units in Canada, including municipal, industrial, commercial, and residential. It consists of an intensive literature search on the best practicable technology in use, as well as contact with manufacturers, municipalities, industrial and commercial institutions, and provincial regulatory authorities across Canada. The literature review is well under way. Guidelines have been formulated for solid waste incinerators of up to 2000 pounds per hour capacity.

Coke Ovens

A literature survey of state-of-the-art process and air pollution control technology is currently under way on the seven coke oven plants in Canada. Initial contacts have been made with the industry. A draft emissions questionnaire has been prepared and the final review with the industry will be in June, 1973.

Iron and Steel Industry

This study will involve four basic steel plants and thirteen other steel plants in Canada. A Canadian Steel Industry Committee has been formed to interface with Environment Canada on air and water pollution matters. Four draft questionnaires (blast furnaces, basic oxygen furnaces, electric arc furnaces, and open hearth furnaces) have been prepared, and a preliminary review has been carried out with the industry committee. A state-of-the-art literature survey is under way.

Ferro-alloy Industry

A state-of-the-art literature survey of six plants in the ferro-alloy and allied industry is under way.

Non-ferrous Smelters, Iron Foundries, and Secondary Lead Smelters

State-of-the-art literature surveys have been initiated for these three industries.

FEDERAL ACTIVITIES PROTECTION

Boiler and Incinerator Guidelines for Federal Facilities

Boiler and incinerator emission guidelines for federal facilities have been completed in draft and have been circulated to the government departments affected for review and comment. Engineering directives for the evaluation of plans and specifications to meet these guidelines are being prepared.

Emissions from a Smelter at Flin Flon, Manitoba

This facility comes under federal jurisdiction as a result of having been declared a works for the general benefit of Canada by an Act of Parliament. Departmental representatives presented a brief at a public hearing in Flin Flon, Manitoba, on a Hudson Bay Mining and Smelting Company application to the Manitoba Clean Environment Commission for a 15 year licence to emit pollutants to the atmosphere. To reduce ground-level concentrations of particulates and sulphur dioxide to meet the provincial requirements, the company proposed to construct a 750 foot stack to emit pollutants to the atmosphere. As a result of the hearings, the company was issued a licence granting permission to erect the stack and to emit air pollutants subject to restrictions in allowable ground-level concentrations for five years. The company appealed the term of the licence, and subsequently a hearing de novo was held before the Manitoba Municipal Board when the Departmental representatives presented the Federal Government's position. The Municipal Board ruled to extend the licence to seven years but required the parties concerned, the federal and provincial agencies, and the company, to meet to develop a program of pollution containment based on best practicable technology. This matter is continuing.

Expansion of Natural Gas Processing Plant at Fort Nelson, British Columbia

This facility comes under federal jurisdiction as a result of being part of a gas pipeline subject to the Federal National Energy Board Act. The plant is being expanded to a gas sale capacity of 950 million cubic feet per day. This gas sale capacity will be fully utilized by 1975, at which time, the sulphur dioxide emissions would have increased to 700 long tons per day. The company had not planned any control measures, and the sulphur dioxide ground-level concentrations during the reporting period were exceeding National Air Quality Objectives. The Department of Environment assisted the British Columbia Pollution Control Branch in developing emission guidelines for the Fort Nelson operation and proposed steps to ensure that compliance is achieved within a reasonable time period. This matter is continuing.

Miscellaneous

Technical advice and assistance was provided on the following Federal activities:

(a) Department of Regional Economic Expansion – technical assessment of the air pollution control measures proposed by applicants for DREE grants;

(b) Ministry of Transport – technical assistance and advice on the development of motor vehicle emission regulations under the Motor Vehicle Safety Act; monitoring for compliance with these regulations;

(c) Department of National Revenue – technical assessment of air pollution controls for applications under the depreciation incentive program; technical advice on rebates from sales tax on air pollution control equipment.

TECHNICAL AND ADVISORY SERVICES

British Columbia Hearing on Food Processing Industry

The Department prepared a brief and participated in a British Columbia Pollution Control Branch hearing on Food Processing Industries.

Assessment of Air Pollution at Sydney, Nova Scotia

At the request of the Nova Scotia Department of Health an assessment was made of particulate and sulphur dioxide emissions from a steel complex and the effects of these emissions on ambient air for the years 1972 and 1975.

Assessment of Thermal Power Stations

Assessments of thermal power station emissions were carried out for Prince Edward Island and Nova Scotia.

Training

Two training courses on instrumentation for the National Air Pollution Surveillance Network were conducted for provincial technicians.

REGULATION OF FUELS AND FUEL ADDITIVES

An important source of air pollution results from the combustion of gasoline and gasoline additives. The problem is twofold: the first is the direct emission of an additive such as lead, a toxic material; and the second is the impact of fuel additives on motor vehicle emission control devices designed to reduce carbon monoxide and hydrocarbon emissions.

During the fiscal year 1972 – 1973, the efforts in this field have been directed towards the development of regulations to control the amount of lead additive permitted in leaded grades of gasoline and to limit trace amounts of lead and phosphorus permitted in unleaded grades of gasoline. Several discussions with the Canadian industries concerned were held. Proposed regulations limiting the amount of lead in leaded gasoline to 2.5 grams per Imperial gallon were published in the October 28, 1972, edition of Part I of the Canada Gazette and comments were invited from all interested parties. Three individuals and eight companies

submitted briefs to the Government. The information thus received was carefully analyzed and considered.

The Department has also examined the question of lead in the ambient air as a potential health hazard. The Department of National Health and Welfare was consulted and has submitted views on this subject. Although available evidence does not indicate that a health hazard exists in Canada today, there appears to be sufficient cause for concern to warrant control as being prudent in the long term.

The economics of lead in gasoline are under study through an extensive survey of the oil industry by questionnaire and through consultation with the Provincial Governments. The Department plans to promulgate in 1973 – 1974 final regulations for both leaded and unleaded gasolines.

MOBILE SOURCES

General

The control of air pollution from mobile sources is not dealt with directly by any section of the Clean Air Act. Other federal acts presently exist that provide the powers to regulate these sources. The Clean Air Act does, however, address itself to this subject under its general provisions for air quality objectives, air quality monitoring and surveillance, fuel composition regulation, and federal – provincial cooperative programs.

With the passage of the Motor Vehicle Safety Act the Federal Government initiated a program to combat air pollution from all new motor vehicles manufactured in or imported into Canada, starting with the 1971 model year. The Ministry of Transport was made responsible for the administration of the Motor Vehicle Emissions Regulations; the Department of the Environment was designated to carry out the required compliance testing and to provide technical advisory services in support of the regulations. Within the Department of the Environment, these activities were carried out by the Mobile Sources Division and by the Emission Testing Laboratory of the Air Pollution Control Directorate.

Current activities of the Directorate in this area are orientated towards programs designed to reduce pollution caused by motor vehicles. These include monitoring new motor vehicles for compliance with current standards, assessing the contribution of the motor vehicle to the total air pollution burden, and, finally, recommending legislation and developing new technology for the control and abatement of air pollution from this source.

Compliance Monitoring Program

The compliance monitoring program ensures that all new motor vehicles offered for sale in Canada conform to current emission standards as certified by the manufacturers. At the beginning of a model year the Ministry of Transport selects a representative sample of all the makes and models of motor vehicles imported into or made in Canada. This sample is then thoroughly tested for compliance with the emission standards by the Department of the Environment.

Test procedures permit an estimation of the deterioration of the emission control systems during the lifetime of the motor vehicle. With these known deterioration factors the emission level determined at 4000 miles after engine break-in may be related to that at 50 000 miles.

The Emissions Testing Laboratory was established in its permanent location in March, 1972, and began emission testing of 1972 model year vehicles in June 1972. A total of 15 motor vehicles, domestic and foreign, were tested under the 1972 model year program. The 1973 model year program began in November 1972. The testing capacity was doubled early in 1973 by the addition of a second chassis dynamometer.

Assessing the Contribution of the Motor Vehicle to the Air Pollution Burden in Canada

General. Until recently, this assessment was based almost entirely on United States and European studies because of the lack of Canadian data. The situation is now being corrected through initiation of a number of programs involving in-depth studies supported by actual Canadian emission results.

Cold Weather Programs. This 2-year program was initiated in November 1972 to determine the effects of our Canadian climate on emissions in the temperature range −10 to 60 °F. The program consists of the daily conditioning and 23 min emission testing at ambient temperatures of a fleet of nine vehicles, with 25% of the tests conducted at baseline conditions (65 − 80 °F) on a rotational basis for comparison. Data from more than 100 tests indicate that emission levels increase substantially as temperature decreases. For example, at −10 °F the levels can be as much as 150% higher, and at 20 °F, 100% higher than are baseline results. Complementing this program, the Alberta Motor Association in cooperation with the Federal Government conducted emission tests at idle on 6000 vehicles in Edmonton during the 1972 − 1973 winter.

Motor Vehicle Air Pollutant Inventory. Emissions of the three principal motor vehicle pollutants have been estimated. Data were compiled and evaluated from statistics-gathering

agencies and from technical studies in several Canadian provinces and in other countries, as well as from the cold weather and compliance testing programs at the Emission Testing Laboratory. The inventory will be updated continually as new information becomes available. The results indicated that motor vehicles in Canada in 1970 were responsible for 75% of the total man-made carbon monoxide, 65% of the hydrocarbons, and 53% of the nitrogen oxides.

Control and Abatement of Air Pollution from Motor Vehicles

Emission Standards. Recognizing that motor vehicles are responsible for approximately 60% of the pollutants emitted into the atmosphere in Canada, the Federal Government amended the 1971 motor vehicle emission regulations, requiring as of 1 January, 1973, a reduction of at least 25% in the average nitrogen oxide emissions actually measured from current vehicles to 3.0 grams per vehicle mile. Emission standards for carbon monoxide and hydrocarbons continued at 39 grams and 3.4 grams, respectively.

Emission Control Technology. New concepts in emission control systems, alternate power plants such as turbine, diesel, and electric, and alternate fuels such as propane, natural gas, and hydrogen are being evaluated continuously through literature research and laboratory testing. Current laboratory support included testing to 50 000 miles a motor vehicle equipped with a Wankel engine and the evaluation of two vehicles modified for propane as an alternative to gasoline for limited use in fleet vehicles.

Annual Vehicle Inspections. Although the control of emissions from in-use motor vehicles is outside federal jurisdiction, the dramatic increase in emissions from badly maintained vehicles is of great concern. A comprehensive review and evaluation of all compulsory emission inspection systems used in Canada, the United States, and several European countries is now in progress, and will be published shortly. The Air Pollution Control Directorate intends to recommend guidelines for provincial and municipal motor vehicle inspection programs. These programs will be coordinated with the Ministry of Transport's feasibility study on annual safety inspections. Emission Testing Laboratory support consisted of emission testing to determine effects of maintenance and evaluation of test equipment that could be used in these inspections.

ATMOSPHERIC ENVIRONMENT SERVICE

General

With the formation of the Department of the Environment, the Canadian Meteorological Service was renamed the Atmospheric Environment Service (AES). Its mandate

was expanded to include an air quality research program in support of federal regulatory programs under the Clean Air Act, provincial regulatory programs, and other air management activities of the Federal Government. The program of AES, initiated in 1971, includes sub-programs dealing with air quality monitoring, atmospheric dispersion processes, real-time air quality prediction systems, large-scale long-distance transport phenomena, atmospheric chemistry, environmental impact studies, and scientific criteria for air quality objectives.

Air Quality Research Branch

Primary responsibility for air quality research activities in AES falls within the Air Quality Research Branch. During the reporting period the Branch expended resources totalling $1.6 million and had a strength of 31 at year end. In carrying out its program it is organized into three divisions: atmospheric chemistry, dispersion, and monitoring and surveys.

Atmospheric Chemistry Studies

A field project involving the chemical analysis of precipitation in the Sudbury area was initiated. A contract study was designed and let to Laurentian University to determine the effects of SO_2 on Artic lichens. Feasibility studies were undertaken on the development of data on the sensitivity of lichens to photochemical oxidants, on background levels of specific hydrocarbons in the atmosphere, and on the injury by air pollutants to agricultural crops. These data are required to provide the scientific criteria for establishing realistic air quality objectives. During the reporting period the Branch contributed a chapter on agriculture and forestry as sources and sinks of air pollution for a book titled *Advances in Plant Biometeorology*.

Dispersion Studies

Environmental assessments were conducted on the expected impact of emissions to the atmosphere from a proposed fossil fuel fired power station at Lorneville, New Brunswick, and from a proposed tall stack for a zinc smelter at Flin Flon, Manitoba. Planning was initiated for three air pollution dispersion field studies: at Sudbury, Ontario; at Lorneville, New Brunswick; and in the Strait of Canso area of Nova Scotia. Research and data gathering continued on several varied subjects including the air pollution climatology of Canada, air pollution modelling of urban centres, the air pollution dome over Toronto, SO_2 vertical profiles over water, snow, and grass, and spatial correlation patterns within monitoring networks. A mini-sonde was developed for obtaining the height of the urban surface mixed layer.

Monitoring and Surveys

Three categories of permanent stations are involved in the air quality monitoring program planned by the Atmospheric Environment Service. In addition, special stations or networks will be operated from time to time, usually in cooperation with other agencies, to test physical and numerical models or to provide special data.

World Meteorological Organization (WMO) Baseline Stations. Canada will operate three stations in this category, designed to measure the "background" composition of the atmosphere as far removed as possible from man-made or natural sources of pollution. During the reporting period activity was restricted to a search for possible sites. Ocean Station Papa, patroled by Canadian weather ships some 850 miles off the coast of British Columbia, is expected to be one of the three stations. Two other possible sites are Sable Island off the coast of Nova Scotia and a research station on Devon Island in the eastern Arctic. Oil exploration activities make it unlikely that Sable Island can meet the strict siting criteria. Logistics may prove a serious obstacle to use of the Devon Island site. The search continues.

WMO Regional Stations. These stations are designed to detect long term changes in atmospheric composition related to regional land-use practices and other activities. Canada is planning seven stations in the global network. Instruments were obtained and negotiations for sites have been started. Plans call for the establishment of the first two stations by the end of June, 1973. Additional stations will be instrumented and staff trained throughout the next few years. Possible sites include several weather-observing stations of the Atmospheric Environment Service and climatological stations, present or proposed, at locations such as the Matador Research Site established by the University of Saskatchewan under the International Biological Program.

Urban Reference Stations. Plans call for the establishment of urban reference stations across Canada, designed to provide long term high-quality records of air quality and meteorological parameters for research purposes. Present activity in this area was restricted to the evaluation and development of instrument systems.

Special Surveys. Meteorological towers were instrumented or re-instrumented in several locations across Canada in order to obtain low-level wind and temperature profiles for air quality and other purposes. Plans were developed for the data-collection phase of a demonstration project to be undertaken in a year or two, leading to the development of a meteorological and air quality model for one city in Canada.