THE CLEAN AIR ACT
ANNUAL REPORT
1979-1980

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, 1980.

Respectfully submitted,

John Roberts
Minister of the Environment

Deputy Minister
Environment Canada

Sous-ministre
Environnement Canada

The Honourable John Roberts
Minister of the Environment
Ottawa, Canada

Dear Mr. Roberts:

I have the honour to submit the Annual Report on the Clean Air Act for the fiscal year ended March 31, 1980.

Respectfully sumitted,

J.B. Seaborn

HIGHLIGHTS

History will record that the seventies were years of progress in environmental protection. While much of the social upheaval of the sixties simmered with the dawn of a new decade, concern for the environment did not. Instead, it bubbled over into the seventies. Expanding industrial activity, resource development and the ever-increasing popularity of the automobile gave urgency to the battle against pollution.

Canada responded to the challenge. Parliament passed the Clean Air Act in November 1971, setting in motion an extensive array of legislative mechanisms and programs developed and implemented in cooperation with the provinces. The result for Canadians has been cleaner, clearer and safer air.

The challenge of containing air pollution, never easy or simple, became all the more imposing in the early seventies. Sharply rising energy prices triggered changes in economic priorities and governments struggled to mesh the equally desirable goals of environmental protection and energy security. By the mid-to-late seventies, growing fears of energy shortages were prompting closer looks at alternative energy sources, some new, some old.

One of these sources is coal. Being plentiful, it is expected to play a renewed and larger role in countries wishing to lessen their dependence on imported oil. On the negative side, it can, without proper controls, be a serious polluter emitting large amounts of sulphur oxides and nitrogen oxides. These pollutants are the main precursors of acidic precipitation, a formidable foe of sensitive ecosystems in eastern North America and considered one of the greatest environmental challenges of the eighties.

Environment Canada's programs and activities during the 1979-80 fiscal year to address the problem of acidic precipitation and other air pollution problems are described in detail in this report. The following are the highlights.

In the area of the long-range transport of air pollution, and resulting acidic precipitation, or acid rain as it is commonly referred to, a federal control strategy program has been designed to enable the development and implementation of a national plan for abatement of emissions of acid-causing pollutants. Negotiations are also underway with the United States government on a bilateral air quality agreement to address the transboundary aspects of the problem. Canada-U.S. coordination progressed with the release of the Bilateral Research Consultation Group's first annual report in October 1979.

In November 1979, Canada joined more than 30 other nations in the signing of the United Nations, Economic Commission for Europe, Convention on Long-Range Transboundary Air Pollution. The convention is symbolic of the growing recognition of the international character of the long-range transport of air pollution, and is indicative of the need for multilateral cooperation in protecting the global environment.

A comprehensive departmental research program is addressing all aspects of the acid rain problem. Typical of the research is a study conducted in the Atlantic Provinces indicating that 75% of the sulphate being deposited from the atmosphere onto Nova Scotia originates outside the province, while 25% comes from local sources. A federal-provincial committee has been established to define the severity of the problem in Western Canada.

By virtue of the powers vested in it by the Clean Air Act, the federal government continued its leadership role in the protection of public health against hazardous air contaminants. National emission standards regulations for vinyl chloride emitted by vinyl chloride and polyvinyl chloride manufacturing plants were published in Part II of the Canada Gazette on April 11, 1979 and became effective on July 1, 1979.

Proposed national emission standards regulations for the control of arsenic emissions from gold roasting plants were announced in Part I of the Canada Gazette on October 13, 1979. Accompanying the proposed regulations was a socio-economic impact analysis (SEIA), the first such analysis for regulations under the Clean Air Act.

To date, regulations covering five contaminants deemed hazardous to public health have been either finalized or proposed under the Act. The other three are for lead (from secondary lead smelters), mercury (from chlor-alkali plants) and asbestos (from asbestos mines and mills). Enforcement of these latter three regulations continued in co-operation with the provinces and agreements regarding vinyl chloride were developed.

A national emission guideline for the wood pulping industry was published in Part I of the Canada Gazette on September 22, 1979. This brings to six the number of guidelines developed to date.

During the fiscal year, the National Air Pollution Surveillance (NAPS) Network was further improved. As of March 31, 1980, the system consisted of 548 air monitoring instruments at 161 sampling stations located in all of the major urban areas of the 10 provinces and two territories. Forty-three of these stations provide continuous monitoring for all five of the most common air contaminants. In addition to the regular collection of data, which are published as monthly and annual summaries, a special NAPS

study was conducted between July and November of 1979 to monitor particulate sulphate and nitrate.

Analysis of air quality trends for the 1974-78 period, based on NAPS data, confirm that pollution levels for most contaminants are generally on the decrease. The exceptions are nitrogen dioxide and ozone levels which have not shown any significant decrease over this period.

The federal-provincial survey of fluoride concentrations in the ambient air and vegetation of Cornwall Island continued throughout the 1979 growing season and the 1979-80 winter season. The growing season results indicated another substantial reduction in concentrations of particulate fluorides while the concentrations of gaseous fluorides were unchanged.

Comprehensive air quality monitoring and precipitation analyses continued in the program to study the local and long-range effects of air pollution resulting from the growth of heavy industry around the Nanticoke site in southern Ontario.

Environment Canada has developed considerable expertise in the analysis of toxic substances (trace metals and organic compounds). During the year numerous analyses were done for regional, provincial, federal and international agencies for such substances as heavy metals, vinyl chloride, dioxins, PCB's and polycyclic hydrocarbons.

A broad range of issues and activities related to air pollution were supported through technical review and advisory activities. Some of these were the following:

- participation with National Defence and Energy, Mines and Resources in a technical committee to test the capability of a new fluidized-bed combustor for the National Defence heating plant at Summerside, P.E.I. to capture sulphur dioxide released during coal combustion while maintaining low emissions of oxides of nitrogen;
- involvement in an International Energy Agency project on the control of nitrogen oxides emissions from coal combustion processes;
- assessment of possible emissions and effects on local air quality in the event of re-activation of the Come-by-Chance oil refinery in Newfoundland;
- contribution to a government-industry task force developing guidelines for the safe destruction of polychlorinated biphenyls (PCB's) in cement plants, plasma furnaces and diesel engines;
- participation in the development of instrumentation for the measurement of PCB's by a new process called laser optoacoustics;

- participation in the review of the environmental impact potential of major developments in the regions, including the Quinsam coal development, the Northern Gas Pipeline, the expansion of the Vancouver International Airport, the Dow Chemical liquid bulk chemical terminal and the Ocelot methanol plant.

With motor vehicles remaining a major source of urban air pollution and consumer of non-renewable energy, federal research and regulations continued their role in reducing unwanted tailpipe emissions and minimizing fuel usage by:

- ensuring compliance with new-car standards. About 40 new vehicles were subjected to more than 500 emission tests under controlled driving conditions and 25 were tested for fuel consumption verification;
- gathering more information on emissions from vehicles already in use. Inspection projects, conducted in Halifax and Winnipeg in cooperation with the two provinces, on more than 1 000 vehicles showed that about 75% had excessive emissions;
- testing vehicle emissions at winter temperatures. Several years of testing have shown that modern vehicles achieve the same emission reductions at cold temperatures (down to -30°C) as they do in warmer temperatures;
- the calling of a technical advisory committee to prepare a guideline on emissions from in-use motor vehicles;
- participating actively in the Interdepartmental Technical Evaluation Committee to protect the Canadian public from promoters of fuel-saving devices;
- testing 2630 samples of lead-free gasoline in the national monitoring program. About 5.3% exceeded the allowable lead limit and corrective action was taken.

A review has begun of the effects of lead from gasoline on the environment and public health, along with a socio-economic impact analysis of industries engaged in the manufacture of tetraethyl lead, the maintenance of automobiles and the refining of lead-free gasoline.

The department responded to three emergencies associated with air pollutants and their effects. These were the release of radionuclides at Three Mile Island, Pa., the train derailment and resultant chlorine spill at Mississauga, Ontario, and the train derailment and vinyl chloride spill in Manitoba. During these incidents, meteorological and dispersion information was provided.

A National Working Group on Atmospheric Radioisotope Releases was established to coordinate and evaluate models to determine the environmental impact of radionuclide releases in the nuclear fuel cycle.

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INTRODUCTION

This report, submitted in accordance with Section 41 of the Clean Air Act, covers activities for the period ending March 31, 1980.

The Clean Air Act, proclaimed November 1, 1971, 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 which, if adopted by a province as models for legislation, become enforceable by that province.

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 cooperative efforts between provincial and federal authorities are required. 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 necessary.

RESPONSIBILITIES OF THE MINISTER

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

a) ensuring the development of regulations limiting the emission of hazardous substances and guidelines indicating limits to the quantities and concentrations of air contaminants that may be emitted from any source;

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

c) collecting, 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 information that 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

The Clean Air Act is administered within the Department of the Environment by the Environmental Protection Service (EPS) 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.

TABLE 1 AIR POLLUTION CONTROL PROGRAM RESOURCE SUMMARY

Fiscal Year	End of year strength	Salaries ($)	Goods and services ($)	Capital ($)	Total expenditure
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
1978-1979	147	3 580 000	1 410 000	1 260 000	6 250 000
1979-1980	146	3 800 777	1 126 299	539 395	5 466 471

Air Pollution Control Directorate

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

The **Air Pollution Programs Branch** develops and coordinates Canada's National Air Pollution Surveillance (NAPS) Program and conducts specific ambient air monitoring and source sampling surveys. Nationwide inventories of air contaminant emissions are developed and maintained as prerequisites to the national programs of air pollution control and abatement, and serve as an effective means of evaluating the success of control programs. The Branch does air quality trend analyses, population exposure analyses and emission trend analyses for past and future years and also provides data for the development of regulations and guidelines. It coordinates the development and prescription of National Ambient Air Quality Objectives and is also responsible for interservice, intergovernmental and international liaison and coordination. These functions are performed in three divisions: Surveillance, Pollution Data Analysis, and Program Coordination.

The **Abatement and Compliance Branch** is primarily concerned with the application of proven technology to the capture and containment of pollutants from stationary and mobile sources. It is the focal point of engineering and technical expertise on air pollution emissions and control and abatement methods. It prepares technical assessments, state-of-the-art reviews and industry studies used as the basis for the development of air pollution control standards, regulations and guidelines. Government-industry task forces, planned, organized and chaired by the Branch, recommend abatement technology for use in establishing regulations and guidelines. Major stationary sources of air pollution, such as iron and steel mills, non-ferrous smelters, pulp and paper mills, thermal power generating stations and incinerators are under the jurisdiction of three divisions of the Branch: Mining, Mineral and Metallurgical, Chemical Process Sources, and Combustion Sources. Emissions from motor vehicles, ships, locomotives and aircraft are the responsibility of the Mobile Sources Division. A fifth division, Fuels, develops fuel composition and additive regulations, fuel inventories and emission guidelines for major fuel production or refining sources.

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 engaged in the analysis of air pollutants; the provision of a computerized information service on air pollution control; the editing, publishing and distribution of all Directorate scientific and technical reports; the transfer of technical information and technology through seminars; and the training of inspectors, analysts and enforcement officers in federal, provincial and municipal jurisdictions. These functions are performed in three divisions: Control Development, Chemistry, and Publications and Training.

Environmental Protection Service Regional Offices

Contact with provincial environmental protection agencies is maintained chiefly through the five EPS Regional Offices located in Halifax, Montreal, Toronto, Edmonton and Vancouver. Regional Directors provide, within their regions, direction and supervision of EPS programs arising from the Clean Air Act together with policies and commitments resulting from bilateral and international agreements. They also 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. It is Environment Canada's contact 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. It 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 of the federal government.

Centres for facilitating exchanges between the many organizations that have needs and those that have expertise have been established in the EPS 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.

DETERMINATION OF AIR POLLUTION PROBLEMS

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 the compilation of emission inventories, and for providing consultative services to federal or provincial agencies on air pollution surveillance.

Emission Inventories

A prerequisite to an effective air pollution control program is an accurate definition of the pollution problem. Such a definition is made by determining the sources and magnitude of emissions, and by measuring the concentration of contaminants in the atmosphere. The latter is accomplished through the NAPS network and ambient air quality studies, which are discussed later, the former through the compilation of national inventories of air contaminant emissions. Inventories are compiled for the five most common air contaminants and for those that are potentially hazardous.

Inventories of potentially hazardous air contaminants. These inventories deal with contaminants that may present a significant danger to human health or the environment. They aid in defining air pollution problems and assist federal and provincial control agencies in developing programs and establishing control priorities. To date, 13 such inventories have been published. During the review period, data previously collected by a consultant were complemented with other data to form the basis for national inventories of the sources and emissions of nickel, cobalt, antimony, tin, bismuth, chromium, copper, barium, phosphorus, chlorine and hydrogen sulphide. Some of these inventories will be compiled and published during subsequent review periods. Inventories are updated as new data become available.

In Quebec, a study to determine what proportion of mercury and arsenic emissions in the province arises from the combustion of petroleum fuels was completed. Data were obtained by analyzing petroleum samples from refineries. The results for mercury, compared with inventory data compiled for 1970, indicate that mercury emissions calculated then for the combustion of petroleum fuels were significantly overestimated. An updated comprehensive mercury inventory will be compiled by headquarters during the next fiscal year.

Inventories of common air contaminants. One of the first actions taken after passage of the Clean Air Act was to compile and publish a nationwide inventory of air contaminant emissions in Canada. The first inventory was an overview for 1970 of air pollution problems with respect to the five contaminants most significant in quantity: sulphur oxides, particulate matter, carbon monoxide, hydrocarbons and nitrogen oxides. The inventory was subsequently updated to provide similar overviews of nationwide emissions for 1972 and 1974. A further revision based on 1976 data is being completed and will be available in the next fiscal year. At the same time, a 1978 update will be initiated.

The inventory is updated biennially to provide a mechanism to evaluate the effectiveness of air pollution control programs in Canada. In addition, it provides vital information for the development of air pollution control strategies.

National Emissions Inventory System. All inventory information about the five common air contaminants is stored in the computerized National Emissions Inventory System which provides easy retrieval of data and has rapid updating capabilities. The inventory information developed for the potentially hazardous air contaminants will be added to the system in due course.

The Long-Range Transport of Air Pollution

The long-range transport of air pollution is considered the most pressing environmental issue facing eastern North America. Consequently Environment Canada has assigned highest priority to a research program that has two major objectives. The first is to determine the current state of the environment in eastern Canada, before the impact of emissions from increased coal-burning in North America is felt. The second is to develop a clear understanding of the occurrence and effects of long-range transport of air pollution within and into Canada, including geographical extent, severity and socio-economic costs. The departmental program has four major components: sources and emissions; atmospheric transport, transformation and deposition; aquatic effects; and terrestrial effects.

During the review period, work progressed in the Air Pollution Control Directorate on the sources and emissions component of the program. The major objective is to identify and quantify the sources, both man-made and natural, and emissions of sulphur compounds in Canada in order that the atmospheric transport, transformation and deposition aspects of the problem can be adequately studied. A report on natural sulphur

emissions was published. Similar studies have been undertaken for nitrogen oxides and hydrocarbons, important precursors in the formation of ozone, and for mercury.

Work continued on the assessment of available control technologies. Through a monitoring project undertaken during the fiscal year, particulate sulphate and nitrate were measured between July and November at various stations of the NAPS network across Canada. These are a major constituent of the pollutant burden carried through the long-range transport of air pollution. Data from the survey will be published in the next fiscal year.

EPS continued its project to monitor aerosol sulphate and to determine the chemical composition of precipitation at a rural site in Nova Scotia. It is estimated that the deposition of atmospheric sulphur, an important acidifying substance, is about 15 kilograms per hectare per year from sources outside Nova Scotia. This is a value similar to that found in Scandinavia where decreases in fish population have been linked with the deposition of atmospheric acid. In Nova Scotia, about 80% of the deposition of sulphur is by rain and snow. Meteorological analyses indicate that during 1979 an estimated 80% of the sulphur carried into Nova Scotia originated in the United States and 20% in Canada. In addition to the "imported" sulphur, about 5 kilograms of sulphur per hectare is estimated to originate from sources within the province.

A survey of water quality in lakes in Nova Scotia has shown that acidity has increased two to five times during the past 20 to 25 years. The acidity in some lakes has reached the point where sensitive species of fish such as salmon and trout would have difficulty reproducing. The origin of the increased acidity is not certain, although the deposition of acid from the atmosphere is one likely cause. Further large increases in the acidity of the lakes can be expected because they have relatively little capacity to neutralize additional acid.

Technical information was provided by EPS at the Alsands Public Hearing on long-range transport (acid rain) in order to support the Alberta Environment guideline requiring further sulphur dioxide containment. Concern about the environmental sensitivity of the Western Canadian Shield resulted in the formation of a federal-provincial ad hoc technical committee with the provinces of Saskatchewan and Alberta. It was charged with the responsibility of defining the magnitude of the acid rain problem in Western Canada and the baseline study program. Public seminars on acid rain were held in northern Saskatchewan.

As a contribution to public awareness, Environment Canada participated in the preparation and presentation of a public seminar on acid rain held in Toronto in November 1979.

Air Quality Monitoring

The National Air Pollution Surveillance Network. Sound planning of an air pollution control program requires a continuously updated knowledge of the nature and extent of air pollution across Canada. The National Air Pollution Surveillance (NAPS) network collects data on ambient air concentrations of the most common contaminants on a continuing basis. Short-term surveys are done in response to special requirements. The NAPS network, consisting of air monitoring instruments located in major population centres across Canada, is a cooperative effort of the federal, provincial and municipal governments. Data accumulated by the network have permitted the detection of trends in the levels of pollution with changing industrial activity, population density and air pollution abatement progress. Data can also be used in epidemiological studies and in the development of air quality objectives.

As of March 31, 1980 the NAPS network consisted of 548 air monitoring instruments at 161 sampling stations located in all of the major urban areas of the 10 provinces and two territories (Figure 1). This extensive coverage includes 43 stations that provide continuous monitoring for all five of the most common air contaminants. An additional six stations monitor all but one parameter continuously. Of the 548 instruments, 85 monitor sulphur dioxide, 51 monitor carbon monoxide, 49 monitor nitrogen dioxide and 47 monitor ozone, all on a continuous basis. Suspended particulate matter is monitored by 115 high-volume samplers operating every sixth day over a twenty-four period.

Technical assistance was provided to provincial and municipal network operators by regional and headquarters personnel on maintenance and repair of NAPS monitoring equipment. This assistance included coordinating warranty and normal repair requirements with the equipment suppliers, the upkeep of a spare parts inventory for minimizing instrument downtime, the provision of essential preventive maintenance supplies, operator training and the repairing of failed instruments either in the field or at headquarters.

The NAPS stations in the National Capital area, in the Halifax-Dartmouth area and in the Yukon and Northwest Territories were operated by EPS regional and headquarters personnel. All others are operated by the provinces and municipalities.

During the fiscal year, 10 new photometric ozone instruments were deployed in the network. Two new stations, in Ottawa and Saint John, N.B., were upgraded by the addition of continuous monitors for all five major pollutants.

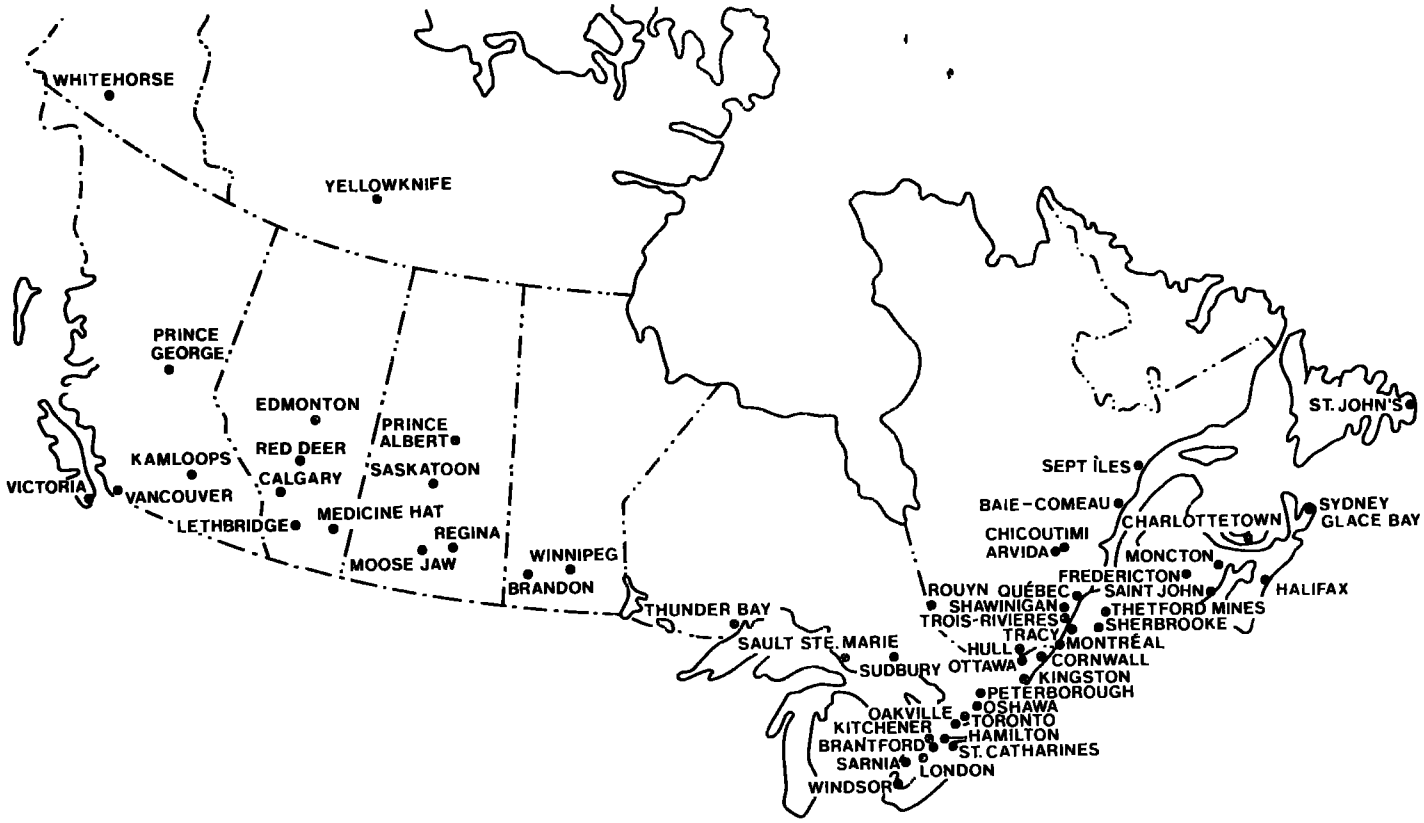

FIGURE 1 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK (MARCH 1980)

The implementation of a complete quality assurance program for data produced by the NAPS network received priority during the review period. In order that air monitoring data be useful for regulatory, health assessment and trend determination purposes, it is essential that they satisfy objectives for representativeness, accuracy, precision and completeness. A "Quality Assurance Plan" was adopted and implementation begun during the fiscal year. The regular calibration program was combined with newly outlined projects in order that all aspects of the air monitoring data collection process be performed under the umbrella of a quality assurance program.

During 1979-80, the NAPS quality assurance program comprised the following activities:

1. Analysis, and distribution to all operators, of nitric oxide, carbon monoxide and zero air compressed gases and sulphur dioxide sources. This activity ensures the standardization of field calibration materials throughout the network.
2. Fifteen complete calibration systems were provided to cooperating agencies. These devices allow routine multi-point calibrations to be performed for all continuous gas analyzers. The cooperating agencies have all implemented routine multi-point calibration programs and now routinely report the calibration results done on monitors in the NAPS network.
3. A performance audit program was introduced and 32 stations, covering all the provinces, were audited. The program consisted of verifying the NAPS monitors by introducing audit control standard gases into the sampling and analysis systems and monitoring the system output. The auditors were chosen from EPS headquarters, ensuring a uniform independent audit service to all provincial and regional operators.

   In the 1979-80 audit program, 20 out of the 115 high-volume samplers were verified. Eight of the 20 proved to be unsatisfactory. Twenty-eight out of 85 sulphur dioxide monitors were audited and five proved to be unsatisfactory; 16 out of 49 nitrogen dioxide monitors and 16 out of 47 ozone monitors were audited and two of each were unsatisfactory. Of the 51 carbon monoxide monitors, 21 were audited and all passed.
4. Comprehensive site documentation information for all major NAPS stations was collected. This information will be published to aid all data interpretation activities.

5. The new photometric ozone monitors purchased for the network were put through an acceptance testing program and instruments requiring warranty service were immediately repaired before installation in the field.

A program to evaluate and improve the quality of lead measurements in the NAPS network was carried out by headquarters.

NAPS air quality data are sent to Ottawa every month by the cooperating agencies for compilation. A NAPS annual summary and twelve NAPS monthly summaries are published each year. Data from the annual summaries, updated to 1979, on suspended particulates and carbon monoxide are given in Tables 2 and 3 for selected stations in the network. Monthly summaries are published within five months of data collection.

A study of filter media for high-volume samplers to evaluate the suitability of various filters for the measurement of ambient airborne sulphates and nitrates on a routine basis throughout the network continued.

A program was undertaken to assess the performance and operating characteristics of commercially available nitrogen oxide monitors. There are about 50 such monitors in the NAPS network. It will be necessary to begin replacing them in the near future and the choice of instrument will be guided by the results of the evaluation.

A study of sulphur dioxide sampling losses using various sampling line configurations to the sulphur dioxide monitor was completed. The study indicated that corrective action had to be taken at a number of NAPS stations to increase the monitoring accuracy for sulphur dioxide.

A project to study the accuracy of certification of commercial gas mixtures in cylinders and the stability of these gases in storage was begun. These gases are to be measured at regular intervals over a period of 18 months.

A field station for the evaluation of air monitoring devices under realistic and typical conditions has been set up in the Ottawa area.

Headquarters staff provided laboratory support to NAPS agencies by analyzing 1076 samples for lead, 733 for sulphate, and 733 for nitrate. An internal quality control program was instituted for lead analysis.

Two newsletters giving up-to-date information on Ambient Air Pollution Monitoring were published during the fiscal year. These newsletters are sent to some 100 operators and technical personnel associated with ambient air pollution monitoring in Canada.

TABLE 2 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR SUSPENDED PARTICULATES -- SELECTED SITES

Location	Annual geometric mean (micrograms per cubic metre)					
	1974	1975	1976	1977	1978	1979
St. John's, Duckworth & Ordinance	51	49	50	*	37	45
Charlottetown, 56 Fitzroy	49	43	44	39	32	43
Halifax, N.S. Tech. College	47	52	49	47	42	39
Sydney, County Jail	68	*	73	53	52	57
Fredericton, York		46	43	52	52	47
Saint John, 110 Charlotte	60	55	55	62	57	58
Montreal, 1212 Drummond	128	101	78	74	76	76
Montreal, Duncan & Décarie	167	136	112	99	121	141
Montreal, 2900 boul. Concorde			68	59	62	63
Hull, Gamelin & Joffre				*	41	38
Quebec, Parc-Autos Paquet-Laliberté	104	103	85	*	76	89
Sherbrooke, Wellington & Albert		*	54	*	*	*
Chicoutimi, 222 Racine					73	68
Rouyn, Hôtel de Ville				*	31	32
Trois-Rivières, Hart & Ste-Cécile			72	51	89	71
Arvida, Powell & Hoopes				*	66	78
Tracy, Garneau & Rte 132				56	56	45
Shawinigan, Frigon & Laval				*	147	137
Ottawa, Slater & Elgin	91	77	60	63	56	55
Windsor, City Hall	122	80	76	83	79	74
Kingston, Queen's University	*	42	38	36	30	24
Toronto, 67 College	81	71	63	67	65	78
Toronto, Lawrence & Kennedy			65	58	60	67
Toronto, Elmcrest			*	49	*	61
Hamilton, Barton & Sanford	105	98	101	85	*	96
Sudbury, 19 Lisgar	55	50	46	44	48	51
Sault Ste. Marie, 550 Queen St. W.					62	*
Thunder Bay, 14 Algoma	60	54	*	49	42	39

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

TABLE 2 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR SUSPENDED PARTICULATES -- SELECTED SITES (Continued)

Location	Annual geometric mean (micrograms per cubic metre)					
	1974	1975	1976	1977	1978	1979
London, King & Rectory	92	73	64	62	73	77
Sarnia, Front					*	67
Peterborough, 500 George			*	*	42	60
Cornwall, Memorial Park			44	46	43	57
St. Catharines, North & Geneva			*	69	60	66
Brantford, Dalhousie & Queen			57	53	49	*
Kitchener, Edna & Frederick				54	68	*
Oakville, Rebecca & Woodside				38	44	50
Winnipeg, Jefferson & Scotia			57	43	36	39
Winnipeg, 65 Ellen					76	73
Brandon, 11th & Princess	69	49	62	59	*	*
Regina, 12th & Smith	66	64	57	58	47	*
Saskatoon, 4th Ave. & 23rd St.	71	77	91	112	*	*
Moose Jaw, Fairford & 1st Ave.	69	74	74	65	53	69
Prince Albert, 1257-1st Ave. E.	71	68	73	73	*	*
Edmonton, 100 St. & 102 Ave.	71	117	137	92	63	79
Calgary, 316-7th Ave.	122	125	111	93	94	113
Red Deer, 4747 50th	62	57	63	66	53	68
Medicine Hat, 770 1st St. SE	88	71	78	61	*	*
Lethbridge, 13th St. & 9th Ave. S.	45	37	46	44	45	56
Yellowknife, 50th Ave. & 51st St.	60	49	54	*	*	50
Vancouver, 970 Burrard		*	68	69	67	62
Victoria, 1106 Cook		*	47	50	44	42
Kamloops, 301 Seymour					*	96
Whitehorse, Federal Bldg.	85	52	51	61	62	102

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

TABLE 3 NATIONAL AIR POLLUTION SURVEILLANCE NETWORK FOR CARBON MONOXIDE -- SELECTED SITES

Location	Annual arithmetic mean (parts per million)					
	1974	1975	1976	1977	1978	1979
Halifax, Barrington & Duke				1.4	1.3	1.6
Montreal, 1125 Ontario	2.5	2.4	2.7	2.3	2.1	2.3
Montreal, 677 Ste-Catherine, W.		*	5.4	4.3	3.6	3.4
Montreal, Peel & Maisonneuve				*	3.1	3.5
Quebec, 155 Dorchester S.	*	2.4	2.4	*	1.7	1.6
Ottawa, Slater & Elgin	3.2	3.1	3.0	2.2	2.4	2.5
Ottawa, Rideau & Wurtemburg			0.9	0.9	0.5	1.0
Windsor, 471 University	5.1	4.8	*	2.2	2.2	2.0
Toronto, 67 College***	1.9	1.3	1.1	2.8	3.5	3.9
Toronto, Lawrence & Kennedy	*	2.1	2.4	1.8	2.0	1.5
Toronto, Elmcrest			1.0	1.3	1.6	1.3
Hamilton, Barton & Sanford	2.0	1.5	1.4	1.4	*	1.5
Sudbury, Ash	*	*	1.0	0.8	<0.5	<0.5
London, King & Rectory	1.0	1.5	1.7	1.1	0.9	<0.5
St. Catharines, North & Geneva			*	1.5	0.9	0.9
Kitchener, Edna & Frederick			*	*	1.4	1.0
Oakville, Rebecca & Woodside				1.6	1.6	1.3
Winnipeg, 65 Ellen					1.2	1.1
Winnipeg, Jefferson & Scotia			0.7	0.8	0.7	0.7
Regina, 1620 Albert					*	0.8
Edmonton, 10255-104th St.				2.0	2.0	3.2
Edmonton, 127 St. & 133 Ave.		1.6	1.9	1.5	1.3	1.8
Calgary, 620-7th Ave. SW	3.1	2.5	2.1	2.3	2.8	**
Calgary, 39 St. & 26 Ave. NW		1.9	1.3	1.4	1.2	1.0
Vancouver, 2294 West 10th Ave.	2.6	*	*	1.7	*	1.9
Vancouver, 250 West 70th Ave.	1.2	*	1.2	1.3	1.3	1.5
Victoria, 1106 Cook		1.2	1.8	*	1.7	1.6

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

Air Monitoring Surveys. During the review period, EPS again conducted a number of air monitoring surveys. Participation usually involved supplying equipment and technical assistance in the operation and calibration of air monitoring equipment.

The survey undertaken by EPS and the Ontario Ministry of the Environment to monitor fluoride concentrations in the ambient air and vegetation of Cornwall Island continued throughout the 1979 growing season and the 1979-80 winter season. The growing season results indicated another substantial reduction in concentrations of particulate fluorides in the ambient air while the concentrations of gaseous fluorides were unchanged. The source of the fluoride emissions is an aluminum smelter in New York State. The results of the surveys are presented regularly to the International Joint Commission, as the problem is an important element of the bilateral negotiations concerning the transboundary flow of air pollution. The studies will continue through the 1980 growing season.

In accordance with the Canadian Public Health Association Task Force's recommendations and based on the federal government's concern for the health of the local population, the arsenic monitoring program in Yellowknife continued. Arsenic concentrations in both suspended and settleable particulates were monitored. Results continue to indicate the presence of low concentrations of arsenic in the ambient air around Yellowknife.

A survey was conducted in Uranium City, Saskatchewan, from July to October, 1978, to measure concentrations of specific radio-isotopes in both suspended and settleable particulates in the ambient air. An interim report has been prepared.

EPS continued to participate in the Nanticoke Environmental Monitoring Program. The growth of heavy industry in the Nanticoke area of southern Ontario has led to an increase in emissions of air contaminants. The local and long-range effects of the air pollution are under study and comprehensive air quality monitoring and precipitation analyses are being carried out. EPS is represented on management and technical committees on which there are also participants from the Ontario Ministry of the Environment, Ontario Hydro and industry. The study will probably continue for several years.

In Whitehorse, Yukon, EPS continued to monitor the ambient air for concentrations of the automobile-related contaminants during the winter season. In response to a request by Environment Quebec, EPS participated in a study to measure and evaluate emissions from the Tricil incinerator at Ville Mercier. This incinerator is used for the destruction of liquid wastes. Analyses were carried out on chlorides, particulate matter

and certain heavy metals such as iron, zinc, lead, magnesium, sodium, copper, chromium and aluminum.

As a result of community concerns over coal dust emissions from trains passing through Agassiz, B.C., EPS installed and maintained a small ambient air monitoring system in a residential area contiguous to the rail line in order to evaluate pollution levels. Federal-provincial cooperation has also begun in a study of the emission problem likely to occur with the increase in coal transportation throughout the country.

Activities in support of ambient air monitoring continued. In British Columbia, EPS participated in a provincial committee formed in 1978 to investigate the potential impact of fugitive coal dust emissions from the proposed Ridley Island coal terminal on a nearby pulp mill. The mill owners are concerned about the potential contamination of their final pulp products by the coal dust. A report on the expected coal contamination impact, and a report presenting recommendations on air pollution controls for the terminal and rail cars were drafted.

EPS collected information on the grain handling industry in British Columbia including operating plants, existing air pollution control technology, and applicable provincial emission requirements. It also participated in a B.C. Waste Management Branch study of controls necessary for fluoride emissions from the Alcan aluminum smelter at Kitimat.

Assistance was provided in the implementation of surveys for particulate lead in the vicinity of secondary lead smelters in Winnipeg. Also begun was a review of the Saskatchewan Department of the Environment licence for the Saskatchewan Power Corporation Poplar River project; meetings were attended to evaluate the continuous emission and ambient monitoring program and information exchange mechanisms between Canada and the United States. Monitoring equipment was loaned to the province to complete the ambient monitoring network.

A number of major energy-related projects were reviewed from the perspective of the long-range transport (transboundary) of air pollutants and the environmental impact with respect to federal lands and interests. These included the Esso Cold Lake (heavy oil), Alsands (tar sands) and Key Lake (uranium) proposals. Environmental impact assessment documents were examined, the local and long-range impacts were evaluated and the capability of control technology was determined. Advice was provided to the Cold Lake Tribal Administration regarding the need for an ambient monitoring program and the nature of the environmental impact on the Indian reservation.

EPS advised Health and Welfare Canada on ambient air monitoring for hydrogen sulphide and sulphur dioxide at the Blueberry River Indian Reserve and the Gold River Indian Reserve, both in British Columbia. For the latter, monitoring equipment was loaned to Health and Welfare and assistance was provided on site selection and equipment installation; continued assistance is being given through air sample analysis. Assistance was given to the Yukon District Office in reviewing air quality data from Cassiar Asbestos Corporation's monitoring project on fugitive asbestos fibre emissions from its abandoned mining/milling plant.

Environment Canada has developed considerable expertise in the analysis of toxic substances (metals and organic compounds) and during the year undertook numerous chemical analyses and special studies. Assistance to and collaboration with regional laboratories and other directorates within EPS included the analysis of seven samples for dioxins; the analysis of 15 iron ore samples for mercury; the preparation of 50 standards for the collection of benzene in ambient air; and the analysis of samples from a PCB spill in Winnipeg and the provision of standards.

Assistance to the provinces included: collaboration with six other agencies in a program of method development and quality assurance for the measurement of smelter emissions (province of Manitoba); analysis of 200 ambient air samples for heavy metals (provinces of Saskatchewan and New Brunswick); participation with eight other groups in a study of method development and quality assurance for heavy metals in ambient air (province of Ontario); quality control study for lead and benzpyrene in ambient air (province of Alberta); analysis of ambient air samples for heavy metals (New Brunswick); and assistance in emergency operations after a vinyl chloride spill by providing standards and arranging shipments of sampling equipment (province of Manitoba).

Assistance to other services, other federal departments and foreign agencies included: collaboration in two quality assurance studies for the determination of arsenic, selenium and mercury in water and sediments; analysis of vinyl chloride in tiles of Canadian Navy vessels; assistance in a study of lead in RCMP firing ranges; determination of polycyclic hydrocarbons; participation in two quality assurance studies for the determination of sulphate and nitrate in ambient air; participation in a quality assurance study to determine the reliability of commercial analysis for toxic metals in coal; in another study the concentration of benzpyrene in 45 different coals was determined.

Calibration services were provided to a number of different agencies at all levels of government. Particulate samplers or reference devices for these have been calibrated for Health and Welfare Canada's radioactive particulate sampling network and

for various provincial or municipal agencies. Reference gases have been certified for Transport Canada and Health and Welfare Canada.

General. An instrument to continuously monitor mercury in chlor-alkali plants was developed and several models were constructed and used on a trial basis at STANCHEM (Beauharnois). Methods are also being developed to determine separately different species of mercury in ambient air (different species differ in their toxicity). The method for the determination of lead in ambient air is being revised.

DEVELOPMENT OF AIR POLLUTION CONTROL MEASURES

Regulations for Stationary Sources

Section 7 of the Clean Air Act empowers the Governor in Council to prescribe national emission standards for air contaminants that constitute a significant danger to human health. 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. To date, Health and Welfare Canada has recommended action to control lead, mercury, asbestos, vinyl chloride and arsenic.

Vinyl Chloride. Vinyl chloride is a colourless gas and a proven human carcinogen for which no safe human exposure level has been established. Health and Welfare Canada has recommended that, as a public health protection measure, vinyl chloride emissions from stationary sources in Canada be controlled and maintained at the lowest possible level. Accordingly, Environment Canada initiated action in 1975 to regulate vinyl chloride emissions from polyvinyl chloride manufacturing and vinyl chloride manufacturing operations which account for 89% and 10%, respectively, of vinyl chloride emissions in Canada. In 1977, proposed regulations were announced in the Canada Gazette. The amended regulations incorporating comments received in response to the proposal were published in the Canada Gazette on August 26, 1978. Additional comments were received but did not result in further changes to the final regulations which were published in Part II of the Canada Gazette on April 11, 1979. The regulations, entitled "Regulations prescribing national emission standards for vinyl chloride emitted by vinyl chloride and polyvinyl chloride plants", became effective on July 1, 1979. The EPS regional offices have developed implementation agreements with the provincial governments and implementation activity is proceeding.

A recommended code of operating practice was published in the Canada Gazette on August 26, 1978. It is expected that adherence to the regulations and the code will reduce vinyl chloride emissions by approximately 95%. The standard reference method for the measurement of vinyl chloride emissions from the regulated sources was published in June 1979.

Arsenic. The major sources of emissions of arsenic into the atmosphere are the gold roasting industry, the iron-ore processing industry and the non-ferrous primary metallurgical industry.

During the review period, proposed regulations concerning the emission of arsenic from the gold roasting industry were published in Part I of the Canada Gazette. The industry study report was published and the standard reference method for the measurement of arsenic emissions from the industry will be published early in the next fiscal year. EPS cooperated with two of the four gold mining operations using roasters in studies to assess the ability of the companies' control facilities to meet the limits stated in the proposed regulations. The socio-economic impact analysis (SEIA) for these regulations, the first such analysis carried out for regulations under the Clean Air Act, was completed and made available to the public. The purpose of the SEIA was to assess the effects the proposed regulations will have on the industry and the economic and social structures of the communities where the companies are located. The public may comment on the SEIA and the proposed regulations, and after review of these comments the regulations will be promulgated, likely in the next fiscal year.

Asbestos. Work continued on the development of national emission standards regulations for asbestos manufacturing operations. These will be completed in the next fiscal year. EPS updated its inventory of such operations in the Pacific region and copies of the proposed federal regulatory emission requirements were transmitted to the companies and provincial agencies for their review and comment. The industry study on asbestos manufacturing operations in Canada will be published in the next fiscal year.

Lead, Mercury and Arsenic. The non-ferrous smelting industry in Canada is a major source of emissions of lead, mercury and arsenic. Work continued on the development of regulations to limit these emissions. The standard reference method used for measuring lead emissions from secondary lead smelters has been successfully applied to the non-ferrous smelter industry. Four stack-test surveys were conducted and a paper dealing with the method was published in a technical journal. The proposed method for mercury was field-tested and further refinements were found to be necessary. A paper on this method was also published. The proposed arsenic method was field-tested at a copper

smelter and a copper-zinc smelter. Further testing will be done in the next fiscal year. Work continued on the assessment of control technologies in the industry.

Regulations for Mobile Sources

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 Environment Canada for the execution of the required compliance testing and for the provision of technical advisory services in support of the regulations.

To achieve significant reductions at low cost, the federal government, in the past, followed the policy of paralleling U.S. motor vehicle emission regulations. As a result, by meeting standards of 3.4, 39.0 and 3.0 grams per mile (CVS test procedure) for hydrocarbons, carbon monoxide and oxides of nitrogen, respectively, 1973-74 model 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. In July, 1978, Transport Canada announced that these standards, which reduce emissions to about 72% of uncontrolled values, will remain the same through the 1984 model year. Corresponding U.S. standards for 1981 and later require about 95% control. A new standard designed to limit carburetor maladjustment on in-use vehicles is now expected for the 1982 model year. To facilitate the tuning of motor vehicles with respect to emissions, new labelling requirements are also being considered.

A new standard and test procedure has been prepared for evaporative emissions of gasoline from light-duty vehicles which parallels the standard and test procedure promulgated in the United States for the 1978 model year. It should be promulgated by Transport Canada for implementation on 1982 models.

The official test for emissions is done at a standard temperature of about 20°C. Several years of research testing at more typical Canadian temperatures (down to -30°C) have indicated that modern vehicles are achieving equivalent emission reductions at these colder temperatures. At the same time the fuel economy of the modern vehicles, due to more sophisticated engine controls, is three to four times less sensitive to cold weather than that of earlier models.

Regulations Relating to Fuel Composition

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. An amendment to the regulations was published in the Canada Gazette during the review period.

Guidelines for Stationary Sources

Section 8 of the Clean Air Act makes provision for the federal government to publish national emission guidelines indicating the quantities and concentrations in which any air contaminant should not be emitted into the ambient air from sources of any class, stationary or otherwise. Each guideline consists of a document specifying emission limits for new sources and an industry study report in which available emission control strategies for existing sources are assessed. The technical review and assessment of control strategies is done by committees of representatives from federal and provincial governments and industry. The limits specified in the guidelines can become enforceable if they are prescribed by other regulatory agencies (provinces or municipalities) as standards or requirements. Guidelines have been published for the cement industry, the asphalt paving industry, the coke oven industry, arctic mining operations, the wood pulping industry and for packaged incinerators.

Packaged Incinerators. National emission guidelines for new packaged incinerators were published in Part I of the Canada Gazette on November 25, 1978.

The term packaged incinerator is used to describe a prefabricated unit that burns up to 900 kg/hour of solid waste at the site where the waste is generated. Industrial, commercial and institutional establishments in every province use these units to dispose of waste containing paper, furniture, food, animal products and pathological remains. There are over 10 000 such units in Canada and they consume approximately half of the solid waste incinerated in Canada.

Packaged incinerators can be a significant cause of local pollution and nuisance complaints. The major contaminants emitted by them are particulate matter, sulphur dioxide and hydrogen chloride. The guidelines specify emission limits for particulate matter and plume opacity based on the use of new incinerator technology

which reduces emissions by approximately 50% compared with older installations. Emission limits for sulphur dioxide and hydrogen chloride were included in the guideline to control these emissions from incinerators burning waste with significant quantities of rubber or polyvinyl chloride.

The draft standard reference method for hydrogen chloride emissions from packaged incinerators was tested in Montreal. Modifications and revisions were found to be necessary before the method can be published.

Wood Pulping Industry. National emission guidelines for new kraft pulping plants, new sulphite pulping plants and new steam-producing combustion facilities associated with these plants were published in Part I of the Canada Gazette on September 22, 1979.

The guidelines specify emission limits for particulate matter, total reduced sulphur (TRS) compounds and sulphur dioxide. New kraft pulping plants constructed to meet the guideline emission levels will have particulate emissions reduced by 70% from the average emissions reported by existing plants for the years 1973-74. Similarly, TRS emissions will be reduced by over 90%. Sulphur dioxide emissions from new sulphite pulping plants will be less than 50% of those reported from existing plants. New steam-producing combustion facilities associated with pulping plants will have particulate emissions reduced by over 60%.

The TRS standard reference method was completed and reviewed by the pulp and paper industry task force.

Residential Heating. A comprehensive report on residential heating in Canada was published. The report discusses the types of units used, the fuels burned, and the air pollution emissions. Ways to minimize emissions are recommended.

Ferrous Foundries. The industry study report on the ferrous foundry industry was published. A guideline recommending emissions limits for the industry may be published in the next fiscal year.

Thermal Power Generation. The standard reference method for determining the concentration of nitrogen oxides in stack gases from combustion sources was published. The industry study report on particulate emissions from steam-powered stations will be published early in the next fiscal year.

Petroleum Refineries. Preparation of the industry study report on petroleum refining and identification of emission limits continued. The draft of the standard reference method for carbon monoxide emissions was completed.

Natural Gas Processing. The development of recommended emission limits for this industry sector continued. The associated industry study report is expected to be published in the next fiscal year.

Other Industry Sectors. The emission guideline and the background report on the iron and steel industry were completed and will be published in the next fiscal year. The fertilizer industry was reviewed and a draft report incorporating information provided by the industry was completed. A report on the surface coatings industry was reviewed to determine the need for further study of the industry. Work continued on the development of emission limits for sulphur dioxide from non-ferrous smelters; emission tests were done at a copper smelter. A study of sulphur containment technology for the non-ferrous metallurgical industry will be published early in the next fiscal year. Work in this area is being done in conjunction with the control program for the long-range transport of air pollution. Standard reference methods for the collection and analysis of eight metals (copper, zinc, nickel, iron, cadmium, selenium, antimony and bismuth) released from the same industry were tested in the laboratory and in the field.

Guidelines for Mobile Sources

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, vehicle emissions, fuel composition regulations and federal-provincial cooperative programs.

Although the control of emissions from in-use motor vehicles is outside federal jurisdiction, the very high concentrations of air pollutants emitted by badly maintained vehicles are of great concern. Two projects were carried out in support of the program to develop guidelines for the control of in-use vehicle emissions. In Halifax, the Nova Scotia Department of the Environment, the Nova Scotia Technical College and EPS cooperated in a survey in which about 600 automobiles were tested and, if possible, minor adjustments were made to improve fuel economy and reduce emissions. An estimated average saving of 16% in fuel costs and reduced air pollution emissions resulted when carburetor adjustments were made. A similar test of over 500 cars was conducted in Winnipeg by the province, the Manitoba Motor League and EPS. Only about 27% of the cars had satisfactory pollution levels. Carburetor adjustments led to improved performance in fuel economy and emissions control. The Winnipeg survey determined that some drivers were using regular or premium leaded gasoline in cars designed for lead-free, with the result

that emission control equipment failed to function properly. Overall results from the two surveys confirmed results from similar inspection projects in Vancouver, Edmonton, Calgary, Ottawa and Montreal.

A program to review and evaluate compulsory emission inspection systems used in Canada, the United States and several European countries is continuing. During the fiscal year, a Federal-Provincial Industry Technical Advisory Committee was called to formulate a national guideline for the control of emissions from in-use motor vehicles. This guideline should be completed in the next fiscal year.

IMPLEMENTATION OF AIR POLLUTION CONTROL MEASURES

Implementation of Regulations for Stationary Sources

Secondary Lead Smelters. National Emission Standards Regulations for Secondary Lead Smelters were promulgated in Part II of the Canada Gazette on July 28, 1976 and became effective on August 1, 1976. They were amended during the review period to incorporate the use of the modified standard reference method for the measurement of emissions of lead and particulates, which was published during the review period.

Enforcement monitoring by the EPS regional offices continued. There are nine plants in the Pacific region, all located in, and operating under permits of, the Greater Vancouver Regional District, the agency in charge of enforcement. Visits were made to the four largest plants, all of which were found to be in compliance. Alberta Environment has licensed all three plants in Alberta. Three plants in Manitoba were inspected by EPS representatives and two were tested for lead emissions. Ambient air monitoring equipment was loaned to the province for evaluating air quality near the smelters and on the basis of preliminary results the plant inspection program has been stepped up. EPS cooperation with the Ontario Ministry of the Environment resulted in a detailed assessment of 31 plants in the province. Two of the plants were considered clearly out of compliance and stack emission tests from them are being reviewed by the province. One of the largest smelters in Ontario was placed under a control order by the province, a move expected to reduce emissions substantially and ensure the plant's full compliance with the federal regulation by December 1980. In Quebec, 12 plants were visited and 10 found to be in compliance. The other two were temporarily closed down in order to effect the changes necessary to reduce emissions. An emission test at the only smelter in the

Atlantic Region showed that the blast furnace was in compliance; other sources are as yet not controlled but are under discussion with the company.

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

The only plant in British Columbia completed its implementation of extensive control measures and an amended permit issued to it by the province reflects federal regulatory requirements. Emission tests showed some processes to be in compliance. Emissions from the cell room area are not accurately known, however, owing to difficulties in testing this source. Results of a study carried out by the company are expected in the next fiscal year.

The only chlor-alkali plant in the Prairie Provinces has switched to the membrane cell process and mercury emissions have therefore been eliminated. Tests conducted at the only facility in Ontario indicate its emissions to be within federal limits. The company is continuing to monitor its operations. Out of four plants in operation in Quebec when the regulations took effect, only one is now operating. It was found to be in compliance according to a plant inspection. Both plants in the Atlantic Region were in compliance. Despite an explosion in the hydrogen stack control device of the plant in Dalhousie, New Brunswick, the situation was rectified and total plant emissions were contained within the allowable limit.

Vinyl Chloride and Polyvinyl Chloride Plants. National Emission Standards Regulations were promulgated in Part II of the Canada Gazette on April 11, 1979 and became effective on July 1, 1979.

One vinyl chloride and one polyvinyl chloride plant have been licensed by the province of Alberta. Both plants are reporting emission information regularly to the province. Of the three applicable operations in Ontario, two have committed themselves to schedules that should bring them into compliance with the regulations in the next fiscal year. The status of the third is under review by the province and EPS. In Quebec, EPS is cooperating with the province on the implementation of the regulations. During the fiscal year a demonstration was conducted at the B.F. Goodrich plant at Shawinigan to demonstrate the techniques of sampling and analysis to EPS and plant personnel and provincial representatives. The Goodrich plant is the only Quebec plant affected by the regulations.

Asbestos Mining and Milling Operations. National Emission Standards Regulations for Asbestos Mines and Mills were promulgated in Part II of the Canada

Gazette on July 13, 1977 and took effect on December 31, 1978. An amendment to the regulations to include dry drilling operations was published on April 4, 1979 and took effect July 1, 1979.

Enforcement programs, developed by the provinces concerned in collaboration with EPS, were continued during the review period. Installation of all air pollution controls was completed at the one applicable plant in British Columbia despite a prolonged work stoppage in the previous fiscal year. The plant is, for the most part, in compliance although the confirmation of source testing data on some processes is still pending.

There are no plants in the Prairie Provinces or Ontario subject to the regulations. In Quebec, 47 emission sources (out of a total of 150) were sampled, in the presence of inspectors, in the province's nine plants. In general the standards are being met by these sources. Five processes are affected by the regulations: primary dry drilling; crushing; drying; milling; and dry rock storage. Further sampling will be done in the next fiscal year to ensure that all processes conform to the regulations.

An extensive pollution control program at Advocate Mines in Baie Verte, Newfoundland is nearing completion. Emission testing of asbestos fibres emitted from the dryer and the primary and secondary crushers showed that these sources were in compliance with the regulations.

The Air Pollution Control Directorate purchased a new microscope system for counting asbestos fibres. Preliminary evaluation of the unit in the laboratory produced promising results and a proposal was developed to test it more vigorously. Staff also attended meetings of the fibre definition committee of the American Society for Testing and Materials.

Other Activities. A draft of the quality assurance program for particulate testing was drawn up, and revisions are being made. The program is being applied to all work done on reference method development to ensure that data gathered are of the best quality. All survey data for the past three years have been put on tape and have been analyzed using the random error analysis computer program. This program indicates random variations in the emission rate for various parts of the particulate sampling train. A sample conditioning system and continuous monitor for total reduced sulphur was evaluated in the laboratory and is now undergoing extensive field testing at a kraft pulp mill.

A draft of a modified set of procedures for calibration of the various components of the particulate test train was drawn up and revisions are being made to the document.

Implementation of Fuels Regulations

Leaded Gasoline Regulations. Refineries have been submitting quarterly reports to Environment Canada since September 1974 on the quantities of lead being added to gasolines at each refinery. In 1979, 26.3 million pounds of lead were added to the premium and regular leaded gasolines. This represents a decrease of approximately 0.6 million pounds from 26.9 million pounds used in 1978. This is attributable to the increased use of lead-free gasoline.

EPS has begun a review, in the Pacific Region, of historical data on ambient air lead levels to determine whether levels have decreased discernibly in relation to the reduction of lead emissions from gasoline-powered motor vehicles.

The Air Pollution Control Directorate has begun reviewing the impact of lead emissions from motor vehicles on the environment and public health, and has begun a socio-economic analysis of industries engaged in the manufacture of tetraethyl lead, the refining of lead-free gasoline and the maintenance of automobiles.

Lead-Free Gasoline Program. Lead-free gasoline sales, as a percentage of the total gasoline marketed, increased from 3.8% in 1975 to 32% in 1979. During the review period, 2630 samples of lead-free gasoline were tested in the national monitoring program. One hundred and twenty-two (122) samples exceeded the allowable concentration of 0.06 grams of lead per imperial gallon of this gasoline. As usual, corrective actions were taken immediately to rectify these violations of regulations.

Fuels Information Regulations. 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, promulgated on August 10, 1977, were amended in Part II of the Canada Gazette on March 23, 1979 and on February 11, 1980.

As a result of these regulations, numerous data on fuels produced or imported, their sulphur content and fuel additives used, have been received from the industry.

General. The standard reference method for the determination of phosphorus in automotive gasoline was revised and published during the fiscal year. The method for lead in gasoline was revised and will be published in the next fiscal year.

Implementation of Regulations for Mobile Sources

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 Environment Canada, is designed to ensure that emission rates from new automobiles do not exceed those standards.

Each year new motor vehicles, representing the most popular makes, models and engines sold in Canada, are tested for compliance with the emission standards. During the review period more than 300 000 kilometres were accumulated on approximately 40 vehicles driven on prescribed urban-rural routes in the Ottawa area. More than 250 emission tests were completed in this emission compliance program.

Approximately 25 additional vehicles were tested to verify fuel economy claims made by the manufacturers.

Implementation of Guidelines for Stationary Sources

Arctic Mining Industry National Emission Guidelines. EPS assisted the Yukon Territorial Government in drafting regulations based on the federal guidelines. The regulations are expected to be promulgated in 1980, subject to final approval by the Yukon Government. The Northwest Territories previously promulgated similar regulations.

Asphalt Paving Industry National Emission Guidelines. The Yukon Territorial Government is expected to promulgate regulations on asphalt paving in 1980, based on the federal guidelines. In British Columbia there are 67 known plants, 63 of which have been issued permits by the Waste Management Branch or the Greater Vancouver Regional District. The other four plants have applied for permits. Of the known plants, 31 comply with the federal guideline and 36 do not. In Ontario, emission limits for asphalt plants will be incorporated into the province's approval requirements with respect to new installations. For information on the status of this guideline in the other provinces, readers should refer to the 1978-79 annual report.

Cement Industry National Emission Guidelines. The Ontario Ministry of the Environment has confirmed that particulate emissions from existing cement plants in the

province are generally in compliance with federal guidelines. Any new plants being built will be required to meet the federal limits. For information pertaining to other provinces, readers should refer to the 1978-79 annual report.

Metallurgical Coke Manufacturing Industry National Emission Guidelines. A provincial permit was issued in 1978 to the one coke manufacturing plant in British Columbia; it required more stringent controls for particulate matter emissions. Controls for source emission reductions for sulphur dioxide were not imposed because of the age of the plant, high cost and technical difficulties. New pollution control objectives issued by the province indicate that new plants are likely to be well controlled. In Ontario, guidelines for coke ovens are being incorporated into provincial approval requirements with respect to new plants. The only coke ovens in the Atlantic Provinces are located in Sydney, Nova Scotia. Because of the age of the ovens, the province chose not to develop regulations.

Other Guidelines. To date there have been no significant developments with regard to provincial implementation of federal guidelines on packaged incinerators or the wood pulping industry.

Control Technology Development

Program for the Development and Demonstration of Pollution Abatement Technology (DPAT). The effective abatement of air contaminant emissions from industrial sources depends upon the availability of technically sound and economically feasible control technology. Recognizing that it might be necessary for the federal government to encourage the development and demonstration of new control technology, provision was made in Section 3 of the Clean Air Act for the financial support of appropriate demonstration projects. On this basis, the Environmental Protection Service developed the DPAT Program, which provides for cost-shared agreements with industry to develop and demonstrate new control technology. This program began on April 1, 1975. In the air sector, initial emphasis was placed on the development of technology for the capture and containment of fine particulates and sulphur dioxide. Later the scope of the program was broadened to include pollutants for which regulations and guidelines have been published or are under development. Because of fiscal constraints, funding for the DPAT Program was terminated on March 31, 1979; however, the program itself was not

terminated and three on-going projects were supported by the Air Pollution Control Directorate during the fiscal year, as described below.

British Columbia Forest Projects Limited completed its investigation of a new type of granular-bed filter for the control of fine particulates emitted from boilers fired with wood waste. These particulates consist primarily of salt which arises because the logs, from which the waste is derived, are transported and stored in seawater. Emission tests have shown that the filter system has a somewhat lower collection efficiency than had been anticipated; however, the company is optimistic that the collection efficiency can be improved and plans further development to achieve this aim.

The St. Anne-Nackawic Pulp and Paper Company in New Brunswick is continuing the development of a scrubber for the simultaneous collection of fine particulate matter and sulphur compounds emitted from the recovery boiler of its kraft paper mill. Initial tests have shown that the collection efficiency of the scrubber exceeds design requirements. Based on this good performance, a number of other Canadian kraft mills have decided to install the scrubber. Its application has the advantage of not only significantly reducing air contaminant emissions but also of recovering, and recycling to the plant, valuable chemicals currently being emitted into the atmosphere.

The third DPAT contract, with the Algoma Steel Corporation Limited, is for the demonstration of a high-pressure water-jet system for cleaning coke oven doors. During the coking cycle, volatile matter from the coal condenses on the doors and door jambs, which are cooler than the oven. To obtain satisfactory door sealing, and thereby minimize the emission of hydrocarbons into the atmosphere from leakage, these deposits must be removed, preferably after each cycle. At present, this is done mechanically by scraping, a method that is not satisfactory. The successful demonstration of the water-jet cleaning system could lead to its adoption by the four steel companies in Canada and by similar plants in other countries.

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 from EPS.

One project was completed during the year. This was a study to identify factors that influence the collection efficiency of electrostatic precipitators used in the

non-ferrous smelting industry and involved a detailed physico-chemical investigation of the properties of the particulates and the carrier gas. It was shown that gas conditioning agents had a beneficial effect on precipitator operating characteristics.

A second study is an investigation into the significance of road dust as a source of suspended particulates in Hamilton, Ontario. This study is expected to provide sound scientific data on the proportion of particulate air pollution due to dust generated, and re-entrained, by vehicular traffic on city streets, and the most cost-effective methods for its control. Certain aspects of this comprehensive investigation are also being supported by the Ontario Ministry of the Environment, Stelco and Dofasco.

A third project is for a study of rate of conversion of nitric oxide into nitrogen dioxide in the emissions from pipeline compressor stations. Nitric oxide is not an air pollutant and is the predominant nitrogen oxide emitted. However, very little information is available on its conversion into the pollutant, nitrogen dioxide, and these data are important because of the large nitric oxide emissions from compressor stations, which could lead to high local concentrations of nitrogen dioxide if the rate is high.

Other Technology Development Programs. Modifications have been approved to the Enterprise Development Program of the Department of Industry, Trade and Commerce to permit the support of research and development, or demonstration, of new or improved equipment, facilities, or processes for the elimination or reduction of air pollution from Canadian operations. The introduction of these modifications ensures that federal support for the development of pollution abatement technology will be maintained following the termination, on March 31, 1979, of the DPAT and CPAR Programs. A number of submissions under the Enterprise Development Program are now in the assessment stage.

Technical Information Dissemination

Air Pollution Information System. Programs developed under the authority of the Clean Air Act require accurate, comprehensive and timely information from many sources including published literature, consultants' reports and computerized information banks. The Air Pollution Information System, established in 1973, responds to the information requirements of the Canadian air pollution control and research community as well as providing a current awareness to keep senior management abreast of new developments. Free searches of the Environmental Protection Agency APTIC file are provided to all levels of government. All others are done at cost. During the review period, 150 computerized literature searches were completed and more than 5500

information requests were answered. The system has more than 100 000 documents available on microfiche, a journal collection of over 70 titles and over 5000 documents in hard copy.

Training in Air Pollution Control Technology. In support of regulatory activities across Canada, air pollution control training courses are presented for enforcement officers of the federal, provincial and municipal governments, and industry personnel. Five courses were offered during the year: two on stationary source testing, two on air pollution meteorology and one on the statistical evaluation of air pollution data. They were attended by 125 persons. The Industrial Research Institute of the University of Windsor developed and presented the course on stationary source testing under contract. The course on air pollution meteorology was developed internally and presented by lecturers of the Environmental Protection Service and the Atmospheric Environment Service. The course on statistical evaluation of data was prepared and presented under contract by two professors from the Université de Montréal.

A seminar on the petroleum refining industry held in Montreal was attended by 60 persons. There was also active participation in a large public seminar on acid rain held in Toronto. It was attended by over 800 persons from governments, universities, industries, action groups and the general public.

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. Courses are held at six- or twelve-month intervals for recertification.

Publications. During the review period, 30 technical reports in the EPS national series were edited and published by the Air Pollution Control Directorate. Seven new factsheets were published. Overall, about 31 000 copies of reports, news releases, Canada Gazette announcements and factsheets were distributed. Several scientific papers written by Directorate staff were published in international journals.

The reports published during the review period were the following:

Regulations, Codes and Protocols Series

EPS 1-AP-73-4 Standard Reference Methods for the Determination of Phosphorus in Automotive Gasoline (Spectrophotometric Method) (Revised) (Bilingual)

EPS 1-AP-77-1 Standard Reference Methods for Source Testing:
Measurement of Emissions of Vinyl Chloride from Vinyl Chloride and Polyvinyl Chloride Manufacturing (Bilingual)

EPS 1-AP-77-3 Standard Reference Methods for Source Testing: Measurement of Emissions of Nitrogen Oxides from Stationary Sources (Bilingual)

EPS 1-AP-78-3 Standard Reference Methods for Source Testing: Measurement of Emissions of Particulate Matter and Lead from Secondary Lead Smelters (Bilingual)

EPS 1-AP-79-2 The Clean Air Act - Compilation of Regulations and Guidelines (Bilingual)

Economic and Technical Review Series

EPS 3-AP-75-4F Techniques d'élimination et d'utilisation des résidus de bois par combustion

EPS 3-AP-77-6F Les techniques de lutte contre la pollution atmosphérique dans l'industrie de la pâte de bois

EPS 3-AP-78-1 Air Pollution Emissions and Control Technology: Ferrous Foundry Industry

EPS 3-AP-79-1F Enquête par questionnaire postal sur les véhicules automobiles particuliers au Canada

EPS 3-AP-79-2 National Inventory of Natural Sources and Emissions of Sulphur Compounds

EPS 3-AP-79-3 Air Pollution Emissions and Control Techniques: Residential Heating Units

EPS 3-AP-79-4 National Inventory of Sources and Emissions of Benzene (1976)

EPS 3-AP-79-5 Arsenic Emissions and Control Technology: Gold Roasting Operations

Technology Development Series

EPS 4-AP-78-1F Effets du froid sur les gaz d'échappement et la consommation de carburant des véhicules automobiles

Surveillance

EPS 5-AP-76-7F Étude interlaboratoire de la corrélation entre les résultats des comptages des fibres d'amiante prélevées en cheminée et de leur distribution

EPS 5-AP-78-23 24 and 25 National Air Pollution Surveillance, Monthly Summaries for October, November and December 1978 (Bilingual)

EPS 5-AP-78-26 National Air Pollution Surveillance, Annual Summary 1978 (Bilingual)

EPS 5-AP-78-27 National Air Quality Trends 1970-1977

EPS 5-AP-79-1 to 79-10 National Air Pollution Surveillance, Monthly Summaries January 1979 to October 1979 inclusive (Bilingual)

Air Pollution Control Directorate Series

APCD 79-1 Development of a Sulphur Trioxide Detector

Miscellaneous Publications

List of Publications - Air Pollution Control Directorate (Bilingual)

Clean Air Act Annual Report 1978-1979 (Bilingual)

Guidelines for a Short-Term Air Quality Index (Bilingual)

Study of Factors Affecting the Electrostatic Precipitation Efficiency of Particulates in Non-Ferrous Smelter Gases

Marketing Study for By-Product Sulphuric Acid Produced by Canadian Non-Ferrous Smelters

Air Pollution Control Directorate Fact Sheets:

Air Quality Trends
Emission Inventories
Air Pollution and Your Car

Lead in Gasoline
Winter Driving
Airborne Asbestos
Controlling Airborne Mercury

Control of Emissions from Federal Facilities

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. Environment Canada has direct responsibility for ensuring that the federal government minimizes adverse environmental effects from all of its works, undertakings and businesses. This is accomplished through the Federal Activities Branch.

During the review period:

- an integrated waste management project at the Ste Anne de Bellevue Veterans' Affairs Hospital was partially completed. The project is expected to be operating satisfactorily by the end of 1980-81;
- most of the work on the installation of a continuous air pollution monitoring system for the Ste Anne de Bellevue hospital incinerator was completed;
- environmental assessment studies at two Canadian Forces bases to determine the air pollution emissions from central heating plants were completed;
- preliminary evaluation of the incinerator installed aboard CCGS Louis St. Laurent indicated an extremely satisfactory performance.

Technical Review and Advisory Activities

During the year, the Air Pollution Control Directorate and the Environmental Protection Service's regional offices initiated and continued numerous technical reviews and advisory work on a broad range of issues. Some of the more important activities were the following:

- review of the environmental impact statement for a proposed uranium refinery in Saskatchewan, and participation in the development of the EPS brief to the B.C. inquiry on uranium mining;
- technical review of and recommendations pertaining to the Province of Manitoba's proposed emission control requirements for a copper-zinc smelter;

- review of existing combustion technologies ranging in scale from domestic space heating to large industrial applications, as a contribution to the departmental study on the possible environmental consequences of the increasing use of energy derived from forest biomass;
- participation with National Defence and Energy, Mines and Resources in a technical committee to test the ability of a new fluidized-bed combustor for the National Defence heating plant at Summerside, P.E.I., to capture sulphur dioxide released during coal combustion while maintaining low emissions of oxides of nitrogen;
- assessment of possible emissions and effects on local air quality in the event of re-activation of the Come-by-Chance oil refinery in Newfoundland, and assistance to the New Brunswick Pollution Control Branch with respect to sulphur dioxide emissions by a refinery;
- advice to Energy, Mines and Resources on mercury monitors and gasoline analysis, and to the Department of Labour on vinyl chloride analysis;
- discussions with visiting delegates of the Institute of Environmental Research of the People's Republic of China on analytical and sampling technology;
- organization of an inspection visit by representatives from Ontario, Quebec and Alberta to Germany, Switzerland and Holland to discuss emission control programs and enforcement methods for in-use vehicles;
- participation in a government-industry task force developing guidelines for the safe destruction of polychlorinated biphenyls (PCB's) in cement plants, plasma furnaces and diesel engines;
- provision of technical advice to the Department of Regional Economic Expansion on the environmental aspects of numerous projects under consideration for funding, including the Arctic Grain Company's elevator at Prince Rupert and Petrosul's sulphur pelletizing plant at Taylor;
- participation in the review of the environmental impact potential of major developments in the regions, including the Quinsam coal development, the Northern Gas Pipeline, the Roberts Bank Port expansion, expansion of the Vancouver International Airport, the Dow Chemical liquid bulk chemical terminal and the Ocelot methanol plant;
- review of applications for the Accelerated Capital Cost Allowance program through which the capital cost of pollution abatement equipment can be written off on an accelerated depreciation scale;

- provision of technical advice to the Province of British Columbia and the Greater Vancouver Regional District on permit applications including the proposed Pine River natural gas plant and the proposed expansion of Gulf Oil's petroleum refinery at Kamloops;
- participation in an International Energy Agency project on the control of nitrogen oxides emissions from coal combustion processes;
- participation in the development of instrumentation for the measurement of PCB's by a new process called laser optoacoustics;
- discussions with the National Energy Board and the B.C. government about the non-compliance of sulphur dioxide emissions from Westcoast Company's natural gas plant at Fort Nelson;
- advice in reviewing literature on the destruction efficiency of the incineration of pentachlorophenol (PCP) in regard to the problem of the PCP spill at Penticton;
- review of the Saskatchewan Department of the Environment licence for the Saskatchewan Power Corporation Poplar River Project;
- advice and support to the Province of Manitoba through participation on the Hudson's Bay Mining and Smelting Triparty Committee;
- participation in panels on polycyclic hydrocarbons and dioxins;
- provision of technical assistance to the Saskatchewan Research Council in the development of stack sampling expertise;
- review of several technology development programs including odour and particulate control at kraft mills, and metal recovery from arsenic dusts collected in a smelter baghouse; and
- participation in numerous technical committees including the National Research Council's Committee on Criteria for Pollutants, the Canadian Standards Association and the American Society for Testing and Materials.

The Air Pollution Control Directorate undertook special chemical analytical studies and provided advice to other organizations to promote the development of analytical methods. It continued research to maintain its expertise in x-ray fluorescence, gas chromatography and mass spectrometry. Projects were continued to develop expertise in high-pressure liquid chromatography, high-resolution capillary chromatography, ion chromatography, electrochemical analysis, gas mixing, and the production of test atmospheres. These techniques will be used in the development of

standard reference methods for the measurement of air contaminants in gas streams and in the ambient air.

LIAISON, PROGRAM PLANNING AND PROGRAM EVALUATION

National and International Participation and Cooperation

General. Air pollution control is a shared federal-provincial jurisdiction. The National Air Pollution Control Program is therefore developed through consultation and cooperation with provincial environment agencies. Control programs initiated by the federal Environmental Protection Service are implemented by provincial agencies whenever possible.

Federal-Provincial Committee on Air Pollution. The Federal-Provincial Committee on Air Pollution is the principal national mechanism for obtaining federal-provincial cooperation and for promoting provincial participation in specific national projects. The committee was established in 1969 and 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. The annual meeting of the committee was held in Ottawa, May 23-25, 1979.

In 1970, a subcommittee was established to recommend to the parent committee appropriate levels for National Air Quality Objectives designed to protect public health and the environment by setting limits on the concentrations of contaminants in the ambient air.

The Clean Air Act enables the development and promulgation of three levels of these objectives, "desirable," "acceptable" and "tolerable" for major air contaminants.

The maximum desirable level defines the ultimate 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.

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.

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 lifestyle or, ultimately, to an air quality that poses a substantial risk to public health. Recommendations of the subcommittee have permitted air quality

objectives to be prescribed in the Canada Gazette at the desirable and acceptable levels as noted in Table 4. A separate subcommittee was established to develop the tolerable level air quality objectives. Those prescribed to date also appear in Table 4.

The two subcommittees meet twice a year. They are currently reviewing the existing objectives as well as considering the need for objectives for other air contaminants.

In 1975 an ad hoc subcommittee was established to examine the possibilities for, and development of, a system of national air quality indexes. Eventually a report recommending a short-term index and an annual index was accepted by the parent committee. During the review period, a report called "Guidelines for a Short-Term Air Quality Index" was published. "Guidelines for an Annual Air Quality Index" will be published in the next fiscal year. As provinces and agencies implement the indexes, experience gained will be reported by the committee.

The Federal-Provincial Committee on Air Pollution also conducts an inter-laboratory quality control program for methods of analysis of air pollutants. During the review period, about 70 laboratories participated in programs for sulphates and fluoride.

Work continued on the development of the standard reference method for hydrogen sulphide. Revisions of the methods for ozone and hydrogen fluoride neared completion.

The EPS Pacific Regional Office is participating in a subcommittee of the National Research Council that is preparing a criteria document on atmospheric particles.

An important concern of the Federal-Provincial Committee is the National Air Pollution Surveillance (NAPS) network. It is described elsewhere in this report.

Participation in Canada/U.S. Programs. The major Canada-U.S. concern in air pollution is the long-range transboundary movement of pollutants particularly acid-causing compounds. The Canada-U.S. Bilateral Research Consultation Group's first report was released on October 15, 1979. It indicated that large areas of North America are sensitive to damage from acidic precipitation; thousands of lakes in eastern Canada and the United States are already showing the initial signs of acidification including decreased productivity of fish species as well as spawning failure. Continued pollutant loading of the region at present levels will result in continued degradation with extensive irreversible acidification occurring during the next 10 years. The report concluded that in view of mounting evidence of serious and continuing environmental degradation in eastern North America as a result of acidification, it should be recognized that delays in

TABLE 4 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 a 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 a 1-h period		400 $\mu g/m^3$ (0.21 ppm)	1000 $\mu g/m^3$ (0.53 ppm)
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 101.325 kPa are used as the basis for conversion from $\mu g/m^3$ to ppm and ppb.

** Proposed.

Note: 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.
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.
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 Canadian lifestyle or, ultimately, to an air quality that poses a substantial risk to public health.

undertaking action to address the presently deteriorating situation will result in greater damage and increasing economic cost in the future.

Against this background and in response to an invitation from the U.S. State Department, Canada has engaged in bilateral discussions with the United States on the negotiation of a cooperative bilateral agreement on transboundary air quality.

A benchmark of these continuing discussions was the release of a joint statement on July 26, 1979 in which the two governments resolved to develop a cooperative air quality agreement that would address the problem of transboundary air pollution. To this end the two governments have held a series of technical meetings to develop the mechanisms and data bases necessary.

In recognition of the time-sensitive nature of the problem and the irreversibility of the impacts, programs to examine possible control measures and to increase scientific knowledge of the phenomenon have been developed and are being carried out cooperatively by the federal government and the provinces most affected by acid rain.

The control strategies program comprises:

1) assessment of the major sources of concern and of reduction in emissions that could accrue from the application of specific abatement technologies;
2) examination and assessment of the economic and social consequences of achieving various levels of reduction in emissions from sources of concern;
3) macro-scale assessment of physical and economic benefits that would be expected from reduced environmental damage; and,
4) development and analysis of abatement options.

The national scientific program was recently modified to meet two objectives, one aimed at providing a knowledge basis for short-term remedial efforts, and the other designed for the longer term. The short-term activities are aimed at providing as much scientific information as possible for use in the design of an interim control program and also to support current discussions with the United States toward an air quality agreement. The longer-term research aims at a more comprehensive scientific understanding of the phenomenon and its effects.

The department continued its regular contact with U.S. agencies to keep abreast of developments in research, priorities and programs. EPS cooperated with the EPA in quality assurance programs, for both stationary and mobile source work, by testing the agency's analytical methods and by exchanging samples for interlaboratory comparisons.

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, one other member and technical assistance. The Atmospheric Environment Service also has a member on the Board.

During the year, the Board continued to advise the Commission on the extensive bilateral discussion and studies of the long-range transport of air pollution, and in particular, the resulting increase in acidic precipitation. The Board also monitored and reported to the Commission on the Boundary River power plant development in Saskatchewan; on the development of a cooperative monitoring arrangement for the Poplar River boundary region; on the status of studies of environmental contamination on Cornwall Island; and on a proposed primary zinc smelter to be located in Ogdensburg, N.Y.

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.

In its fifth progress report to the IJC, in March 1980, the Board reported on the status of the sulphur dioxide control strategy being developed for the Sarnia-Port Huron area; on the consultations between the Province of Ontario and the State of Michigan on the Belle River Thermal Power Project; and on the results of its study of sulphur content of fuels used by power generating plants in the area. At the request of the Commission, the Board reviewed the desirability of establishing an IJC objective for ozone in the area. It concluded that since the ability to accurately monitor the problem and develop the necessary solutions lay beyond the Board's terms of reference, it would be inappropriate for it to develop an objective for ozone. The Board therefore proposed to ensure adequate monitoring of ozone levels within the boundary area.

Participation in Other International Programs. Environment Canada continued to contribute to and benefit from participation in a number of international programs dealing with the development of policies and technology for air pollution control. The projects are directly related to Canadian interests in such areas as the long-range

transport of air pollution, the study of control strategies for sulphur and nitrogen oxides, and the control of toxic substances in the atmosphere.

Participation in such programs is coordinated through the Department of External Affairs and involves 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 Group is provided by the Air Pollution Control Directorate as is the delegate to the United Nations, Economic Commission for Europe's Working Party on Air Pollution Problems and the Special Group on Long-Range Transboundary Air Pollution.

Bilateral consultations were held during the year with visiting representatives of environmental protection agencies from Norway, Japan, Tunisia, and the People's Republic of China.

The Air Pollution Control Directorate continued to participate in the WHO Air Quality Monitoring Project. Air quality data for sulphur dioxide, suspended particulate matter and soiling index from 11 stations located in Vancouver, Hamilton, Toronto and Montreal, are forwarded quarterly to WHO headquarters in Geneva. In addition, NAPS operates one station in Toronto as a comparison station where WHO standard reference measurement methods are used concurrently with standard instrumental methods.

The Directorate, along with the Department of Energy, Mines and Resources, represented Canada as a member country of the International Energy Agency in contracting for an Agreement for the Establishment of a Project on the Control of Nitrogen Oxide Emissions during Coal Combustion. This project is sponsored by the U.S. Environmental Protection Agency and involves the trial burning of member countries' indigenous coals to evaluate their performance in a low-NO_x (nitrogen oxides) pulverized coal combustor.

Other international activities during the review period included:

- continued participation in an ECE Task Force on emission guidelines for non-ferrous smelters and preparation of two chapters of the background report;
- participation in a subcommittee of the UN-ECE Working Party 29 -- Groupe de Rapporteurs sur Pollution et Energie -- dealing with motor vehicles;
- participation in an interlaboratory cross-correlation program for vehicle emission testing organized by the Japanese Automobile Manufacturers Association;

- participation in a European Economic Community bilateral working group on the asbestos industry;
- participation in a UNEP project on non-ferrous smelters and preparation of the chapter on the nickel sector;
- maintenance of a bank of polycyclic aromatic hydrocarbons and provision of research samples to environmental organizations throughout the world.

Inter-Departmental Negotiation and Liaison. Environment Canada consults regularly with the Environmental Health Directorate of Health and Welfare Canada on public health and risk assessment aspects of air pollution control. In international activities, EPS is the primary advisor to the Department of External Affairs on technical matters and on policies and negotiating strategies related to air pollution control. Of particular significance in this area are the negotiations with the U.S. Government on transboundary air pollution, and in particular, acid rain. Environment Canada is represented on the Air Subcommittee of the National Research Council's Associate Committee on Scientific Criteria for Environmental Quality.

The Department of Indian and Northern Affairs is kept informed of EPS activities with the governments of the Yukon and Northwest Territories related to the development and implementation of air pollution control programs. Regular contact is maintained with Energy, Mines and Resources and the National Energy Board on energy/environment matters, and with Industry, Trade and Commerce on environment/industrial policy matters, particularly as they relate to the domestic program for the control of acid-causing air pollutants.

As part of the departmental study of the environmental impacts of an increased use of coal, several aspects of the problem were investigated by the Air Pollution Control Directorate. A forecast of increased coal use for thermal power generation was prepared for the period 1980 to 2000. Using this information, emission forecasts for sulphur oxides, nitrogen oxides and particulate matter as well as trace elements were assembled and supplied to the department's Atmospheric Environment Service for atmospheric modelling as a basis of their contribution to the report. Contributions to the report also included a review of end-use technologies and available pollutant abatement measures.

Trend Analysis. During the review period, a national trend analysis for the 1970-77 era of air quality data from the National Air Pollution Surveillance (NAPS)

network was published. Further analysis for the 1974-78 period are shown in Tables 5 and 6. A new report on trends up to the end of 1979 will be developed in the next fiscal year.

Population exposure analyses were done for the Toronto and Montreal urban areas. Studies examined exposure to sulphur dioxide and suspended particulate matter in these centres. Results of the analyses will be made available upon completion. Analyses on the past and future trends in air contaminant emissions from the copper-nickel smelting industry also commenced. Results will be made available during the next fiscal year. Other sectors to be studied include thermal power generation and natural gas processing.

TABLE 5 AVERAGE OF THE ANNUAL MEANS OF NAPS STATIONS FOR 1974-78

Air Contaminant	1974	1975	1976	1977	1978	Change 1977-78	Change 1974-78
Sulphur dioxide (pphm)	1.6	1.5	1.4	1.4	1.3	-7%	-19%
Suspended particulates ($\mu g/m^3$)	78.6	65.9	65.7	61.9	61.4	-1%	-22%
Lead ($\mu g/m^3$)	0.68	0.55	0.49	0.46	0.42	-9%	-38%
Nitrogen dioxide (pphm)	--	--	--	3.17	2.85	-10%	--
Carbon monoxide (ppm)	2.44	1.89	1.60	1.55	1.53	-1%	-37%
Soiling Index (COH)	0.38	0.28	0.28	0.27	0.25	-7%	-34%

Program Planning and Evaluation. The format of the Clean Air Act Annual Report reflects the project planning system now in use within the Environmental Protection Service. The report is therefore organized on the basis of the four projects that make up the National Air Pollution Program:

1) Identification and characterization of pollution problems;
2) Development of pollution control measures;
3) Implementation of pollution control measures;
4) Liaison, program planning and evaluation.

TABLE 6 PERCENTAGE OF NAPS STATIONS EXCEEDING MAXIMUM ACCEPTABLE ANNUAL LEVELS OF AIR QUALITY OBJECTIVES, 1974-78

Objective	1974	1975	1976	1977	1978
Sulphur dioxide	18	11	10	5	7
Suspended particulates	49	42	37	24	27
Nitrogen dioxide	NA	NA	NA	4	0
Carbon monoxide (8 hours)	29	27	16	10	8

NA - not available

The operating budget of the Air Pollution Control Directorate for the fiscal year was developed using this project planning system to give management improved control over resource allocation and to provide flexibility to meet changing priorities. An evaluation system is now being developed that will provide management with information on the efficiency and effectiveness of resource utilization in achieving program objectives.

During the review period, the Air Pollution Control Directorate refined its newly developed decision-making framework, a means through which air pollution problems are selected with a view to promulgating regulations or guidelines. Mechanisms to establish priorities for subsequent regulation or guideline development are also incorporated into the decision-making framework. There are four phases, with appropriate feedback loops, in the framework:

- the identification of existing and potential air pollution problems and the relative ranking of these concerns in each of three categories: immediate, medium-term and long-term concerns;
- the development of work plans based on the approved list of Directorate concerns;
- the detailed assessment of a contaminant or industrial sector of concern and information-gathering activities; and
- the activities that must be completed after the decision has been made by Directorate management that a concern investigated in Phase III warrants the development of a regulation or guideline.

During the latter part of the review period, the Directorate continued its compilation of contaminant and industrial sector profiles for existing and potential air pollution concerns. These profiles are two-page summaries of various objective and subjective criteria that justify identification of a concern. An initial relative ranking of concerns was also completed.

ATMOSPHERIC ENVIRONMENT SERVICE

General

The Atmospheric Environment Service (AES) is another important arm of Environment Canada devoted to, among other things, air pollution problems. AES continues to work toward a better understanding of the atmospheric processes of pollutant transport, chemical transformation during transport, areal distribution and short- and long-term effects of deposition on the environment. Results of experimental studies are presently applied in the modelling of the physical and chemical behaviour of pollutants and atmospheric processes in order to better describe and predict air quality and environmental impacts in a consistent manner.

Much of the work is performed by two branches of AES, frequently in cooperation with other provincial, federal or international agencies. The two branches are: the Air Quality and Inter-Environmental Research Branch which concentrates on the lower atmosphere (troposphere ... up to an altitude of about 10 km); and the Atmospheric Processes Research Branch which specializes in studies of the upper atmosphere, in particular the effects of man-made pollutants on solar radiation and the ozone layer.

The total expenditure for the fiscal year was $2 493 000, consisting of $1 780 000 in salaries, $562 000 in goods and services, and $151 000 in capital. End-of-year strength was 71.

LONG-RANGE TRANSPORT OF AIR POLLUTANTS (LRTAP)

Increasing concerns, by both the Department and the public, about the effects of air pollutants (and related acidic precipitation) on the environment and the control of such pollutants, has resulted in a much needed financial boost to the federal LRTAP program.

Departmental activities during the past year concentrated on the following major areas of concern: pollutant emission inventories and source identification; atmospheric transport and coincident chemical/physical transformation; environmental effects studies; and the modelling of all relevant processes for a more informative description and prediction of present and future atmospheric conditions essential in negotiations and the development and monitoring of abatement procedures.

A LRTAP program office has been established to serve as a focal point for coordinating the various elements of the departmental program. The following are a few milestones associated with AES LRTAP activities:

- the Canadian Network for Sampling Precipitation (CANSAP) is now fully operational. Concentration and deposition measurements confirm that much of eastern Canada experiences rather acidic precipitation (average pH 4.5). Further detail is available in the section "Environmental Monitoring";
- the Air Precipitation Network (APN) provides a more detailed chemical analysis of the atmosphere. This network currently consists of five stations;
- a practical long-range transport model has been developed that can predict general pathways of pollutants during environmental emergencies;
- appropriate input inventory and meteorological data files have been created to serve in the development of long-range transport related models;
- support research was conducted (and is continuing) in a limited number of areas: aircraft sampling of long-range transport constituents; dry deposition; and nitrogen oxide measurements;
- the bilateral (Canada-U.S.) Research Consultation Group released its first annual report. An AES scientist is the co-chairman of this group;
- the first planning meeting regarding a jointly sponsored CMOS-AMS (Canadian Meteorological and Oceanographic Society-American Meteorological Society) conference related to the LRTAP problem was held. The conference is expected to take place April 28-May 1, 1981 in Albany, N.Y.;
- a LRTAP-related bibliography, presently consisting of about 1 700 entries, has been compiled from professional journals and agency reports. Arrangements to have this volume published are underway;
- plans have been initiated to hold an AES-sponsored LRTAP workshop at AES headquarters in the summer of 1980. As well, publication of a LRTAP Assessment

Catalogue, providing information on the present state of the Canadian research scene, has been scheduled to coincide with the above workshop;

- in addition to extensive technical, public relations, and media briefings during the year, LRTAP workshops were conducted in the AES Ontario and Atlantic regions.

ENVIRONMENTAL MONITORING

The Canadian Network for Sampling Precipitation (CANSAP) was established to monitor changes in the background levels of certain atmospheric constituents in precipitation. Constituents analyzed in the network samples include sulphates, nitrogen compounds, chloride ions, sodium, potassium, calcium and magnesium. The network was recently upgraded to ensure continued scientific validity of its data and continued operations. About half of the collectors in the network were upgraded to new design standards in an effort to improve the catch efficiency and reliability. The remaining instruments will be upgraded during 1980. Four new sampling sites were added, increasing the network to 54 stations.

A joint sampling program was undertaken in cooperation with the Ontario Ministry of the Environment to ensure that results from their APOS (Acidic Precipitation in Ontario Study) network would be comparable with those from CANSAP. Plans were finalized with the National Atmospheric Deposition Network in the United States to begin a joint sampling program at selected sites on both sides of the border in the spring of 1980. Results of a Pennsylvania State University sampling program are presently being analyzed.

As part of the WMO (World Meteorological Organization) environmental monitoring program, AES continued to measure CO_2 concentrations at three Canadian sites.

GREAT LAKES WATER QUALITY AGREEMENT PROGRAM

The 1978 Canada-U.S. Great Lakes Water Quality Agreement (GLWQA) identifies programs and measures required to evaluate the impact of air pollutants upon the Great Lakes and their drainage basin. These measures include identification of pollutant sources, their relative contributions, and more accurate definition of pollutant deposition rates.

Since September 1979, AES has been supporting the GLWQA program through two separate research programs. The first involves development of appropriate methodology for monitoring particulate dry deposition over snow, water and ice surfaces. Currently, equipment for generating tagged aerosols is being constructed and tested for application in field studies. The second project is designed to estimate the atmospheric input of certain nutrients, heavy metals and organic contaminants to the Great Lakes and to examine the relative importance of various sources through a comprehensive simulation modelling effort.

CANADIAN ARCTIC AIR POLLUTION PROGRAM (CAAPP)

In recent years, widespread particulate pollution has been observed in the Arctic, originating from emissions in mid-latitude regions of Europe and eastern North America. Because of the environmental and climatological implications of polluting the polar cap, the governments of Norway, Denmark, the United States and Canada are cooperating in a joint investigation of suspended particulate matter north of 60°N. The CAAPP is the Canadian component of this joint study and its objectives are (a) to determine the temporal and spatial variation in composition and concentration of trace substances in Canadian Arctic air, (b) to determine major pathways of pollutants into and within the Arctic and (c) to develop a predictive capability to assess the impact of increased emissions on Arctic air quality.

A weekly atmospheric analysis program is carried out at Mould Bay and Igloolik. The network will be expanded to include Alert in 1980-81.

STRATOSPHERIC POLLUTION AND OZONE MONITORING

The stratosphere, the layer of the atmosphere between an altitude of 10 kilometres and 60 kilometres, is a region of major global air circulation. It contains the ozone layer which prevents dangerous levels of ultra-violet solar radiation from reaching the earth's surface. Gaseous chlorine-bearing compounds such as chlorofluoromethanes emitted into the atmosphere by consumer and industrial processes are chemically destroying ozone in quantities that, although difficult to specify precisely, are predicted to be dangerously large.

The Atmospheric Processes Research Branch has undertaken high-altitude balloon experiments at Cold Lake, Alberta; Palestine, Texas and Mildura, Australia, to

measure quantities of key stratospheric chemical constituents to verify information gathered by the NIMBUS VII satellite and to produce theoretical model predictions of future and present ozone depletions. Instrumentation has recently been improved and test programs are being continued. Considerable work is done in collaboration with universities and other public institutions.

Measurements of the total ozone column in the atmosphere are made daily from ground level at five sites across Canada. An analysis to detect the currently expected ozone depletion in the Canadian ozone monitoring records indicates a small downward trend.

ENERGY REVIEW GROUP ACTIVITIES

In June, following discussions with the Department of Energy, Mines and Resources, Environment Canada initiated a review of environmental, health and safety aspects of nuclear energy and other electricity generating options. Task forces were established to study various fuel cycle scenarios (to the year 2000) for coal, nuclear, hydro and biomass. In this regard, AES sponsored a contract with a private meteorological consulting firm, MEP Co., to evaluate regional impacts of coal utilization. As department input to the Parliamentary Inquiry into nuclear energy, AES prepared substantive material on impacts of coal and nuclear energy scenarios.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

AES contributes to the departmental EIA program through the review of air quality aspects of EIA's and through the development of systems to transfer the related EIA technology to other AES components, other government agencies and the private sector.

In direct support of other agencies, an assessment of a uranium refinery in Corman Park, Saskatchewan, was carried out for EPS and a review of airport pollution models was completed for Transport Canada and the International Civil Aviation Organization (ICAO).

Impact assessment research focussed on air pollution potential in Canada and on the development of numerical models for the assessment of air quality under specific situations. Among the numerical models developed were: the Maritime Episode and three

Climatological Air Models (air quality); the Gaussian Puff Model (dispersion of radionuclides); and the Mixed Layer Model (frequency distribution of pollutant concentration).

Experiments on the effectiveness of air quality monitors, and pollutant transformation are in progress.

Courses and workshops on air pollution meteorology and environmental assessment were presented in Ottawa and Toronto.

ENVIRONMENTAL EMERGENCIES

During the year, AES responded to two major emergencies associated with air pollutants and their effects. The first incident was the release of radionuclides at Three Mile Island, Pa. In response to concerns about effects on Canadian territory, a trajectory model was implemented to delineate potential effects in terms of risk assessment. The second incident was a train derailment at Mississauga, Ontario, and a resultant chlorine spill. During this incident, on-site meteorological and dispersion information was provided to various authorities and the public.

Arising from these emergencies was the formation of a national working group to study various aspects of radioisotope releases. This working group will supply advice on models suitable for contingency planning and generate proposals for effective all-weather mobile units designed to provide on-site meteorological/dispersion information in the event of spills of toxic materials.

ENVIRONMENTAL CONTAMINANTS

AES contributes to the Federal Environmental Contaminants Program established under the Environmental Contaminants Act (1976). Research has been initiated to investigate the behaviour of atmospheric organic and inorganic contaminants interacting with the biosphere. Specific objectives are (a) to determine existing loadings and pathways of problem substances in the environment and (b) to interpret the effects of problem substances in the environment.

With respect to inorganic contaminants, particular emphasis is being placed on a number of metals which, upon entry to aquatic and terrestrial ecosystems, build up residues that have long-term effects on the environment and human health. The organic contaminants occur in a multitude of forms including the polychlorinated biphenyls (PCB's).

NANTICOKE ENVIRONMENTAL STUDY

The Nanticoke Environmental Study was a major field study carried out in June, 1978, in cooperation with AES Ontario Region, Ontario Hydro and the Ontario Ministry of the Environment. The objective was to determine shoreline effects of air pollutant concentrations in the vicinity of a lakeside thermal generating station. The follow-up work is now virtually complete with 12 project data reports prepared and four scientific papers being submitted to journals. The study has produced comprehensive and valuable documentation on increases of ground-level pollution caused by shoreline fumigation.

ATMOSPHERIC BOUNDARY LAYER* RESEARCH

Several numerical models applicable to the Clean Air Act were either developed and applied, or are presently in the testing stage. Among these are the Monte Carlo and Three-Dimensional Planetary Boundary Layer models used in the calculations of transport and dispersion of air pollutants, and a Complex Terrain model used to incorporate effects of isolated topographic features.

Field Experiments and Data Analysis

(a) New Tethersonde

A prototype for a new tethersonde was completed and successfully tested. The new design facilitates sampling of up to 10 channels of meteorological data and on-line recording and analyses.

(b) Upper Air Wind Data

The quality of VLF upper wind air data processed at 5 mb intervals has been assessed in comparison with the radar wind data.

(c) Acoustic Sounder

The highlight of this year's field experiment occurred in Boulder, Colorado, where the acoustic sounder was used in WMO-CIMO intercomparisons of low-level sounding systems. Such intercomparisons provide an excellent opportunity to examine all aspects of calibrating remote sensing systems.

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* The boundary layer is the lowest layer of the atmosphere (troposphere), extending from the earth's surface to about 1500 metres aloft.

Polynya Heat Budget Experiment

The second year of a three-year polynya study was undertaken in cooperation with the Frozen Sea Research Group of the Ocean and Aquatic Sciences (Department of Fisheries and Oceans). Preliminary results indicate drastic effects on the atmospheric characteristics of the boundary layer.

CRITERIA AND STANDARDS

AES provides scientific and technical support to the Federal-Provincial Committee on Air Pollution through its subcommittees on Air Quality Objectives and Air Quality Indexes. For the Objectives subcommittee, computer-based data management and display techniques were developed and tested for the preparation of criteria documents. For the Air Quality Indexes subcommittee, revisions on guideline documents for short-term and annual air quality indexes were completed.

A Panel on Particulate Effects on Atmospheric Processes was organized to prepare input to the Air Subcommittee of the NRC Associate Committee on Scientific Criteria for Environmental Quality.

TECHNOLOGY TRANSFER AND EXTRAMURAL ACTIVITIES

During the year, a number of extramural activities were undertaken in a continuing effort to foster cooperation and information exchange among scientists both within and outside of AES: branch personnel participated in conferences, meetings, and working groups; science subventions were awarded to a number of university academics; and numerous contracts were let to private sector and university personnel.

Date Due