Environment Canada
Environmental Protection Service

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The Clean Air Act Annual Report 1981 - 1982

Canada

ERRATA

The Clean Air Act Annual Report 1981-1982

Page 31

In Section on "Lead-Free Gasoline Program", 2nd paragraph, last sentence. "Forty-eight percent of these had..." should read "Forty-eight of them, or 14% had..."

Rapport annuel 1981-1982 sur les opérations relatives à la Loi sur la lutte contre la pollution atmosphérique

Page 33

Dans la section "Essence sans plomb" 2ième paragraphe, dernière phrase. "En Ontario, 48 pour cent des 355..." on devrait lire "En Ontario, 48 des 355 ou 14 pour cent..."

THE CLEAN AIR ACT
ANNUAL REPORT
1981-1982

Air Pollution Control Directorate
Environmental Protection Service
Environment Canada

March 1983

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Minister
Environment Canada

Ministre
Environnement Canada

His Excellency
The Right Honourable Edward Schreyer, C.C., C.M.M., C.D.
Governor General and Commander-in-Chief of Canada
Rideau Hall
Ottawa, Ontario
K1A 0A1

Your Excellency,

I have the honour to present to Your Excellency and the Parliament of Canada the Annual Report on the Clean Air Act for the fiscal year ended March 31, 1982.

I have the honour to be, Sir, Your Excellency's obedient servant,

John Roberts

Deputy Minister
Environment Canada

Sous-ministre
Environnement Canada

Ottawa, Ontario
K1A OH3

APR 22 1983

The Honourable John Roberts, P.C., M.P.
Minister of the Environment
Ottawa, Ontario

Dear Mr. Roberts:

I have the honour to submit the Annual Report on the Clean Air Act for the fiscal year ended March 31, 1982.

Yours sincerely,

Jacques Gérin

HIGHLIGHTS

The long-range transport of airborne pollutants and, in particular, acid rain remained the principal environmental concern during the 1981-1982 fiscal year. Both domestically and internationally a number of significant events relating to this issue occurred.

On April 28, 1981, guidelines for new thermal power facilities were published in the Canada Gazette. They are designed to ensure that new facilities will not contribute to the acid rain problem by specifying emission limits for sulphur dioxide, nitrogen oxides and particulate matter, and are for use by the provinces through their own legislation.

In accordance with the Memorandum of Intent signed with the United States in August, 1980, formal negotiations towards a bilateral agreement on transboundary air pollution commenced on June 23, 1981. Also during the fiscal year, the second phase of the joint Canada/U.S. Working Group reports was completed. These reports are designed to provide technical information required to support the ongoing negotiations.

In January 1982, Environment Canada intervened before the National Energy Board to recommend that no increases in sulphur dioxide emissions be allowed as a condition of an Ontario Hydro proposal to export 1000 megawatts of electricity to General Public Utilities of New Jersey. The proposal was subsequently withdrawn by Ontario Hydro.

The federal Acid Rain Control Strategy Program, which was launched during the previous fiscal year, continued in cooperation with the provinces to develop and evaluate alternative abatement options and control strategies.

Federal research activities included ongoing monitoring of atmospheric composition and deposition and modelling of atmospheric transport and deposition.

Information activities focussed on increasing public and political awareness of the acid rain problem in both Canada and the United States. Several reports and public information documents were published and a film on the subject was produced in collaboration with the National Film Board.

On November 1, 1981, reorganization of the Air Pollution Control Directorate took place. The new system has consolidated the Directorate's three branches into two; the Air Pollution Programs Branch and the Engineering Assessment Branch. In addition a Projects Coordination Group consisting of four issue coordinators was created to oversee major program activities in the areas of acid rain, energy, toxics and oxidants.

Also during the review period, implementation of the four Federal Clean Air Act Regulations continued in cooperation with the provinces. In the case of the Crown prosecution of a secondary lead smelter in Winnipeg for violation of federal regulations, the Company offered as part of its defence that the Clean Air Act is ultra vires the federal parliament in that the legislation infringes upon provincial legislative power. Constitutional arguments by the Crown and the Company were heard in January 1982 and the Court's decision is pending.

Under the National Air Pollution Surveillance (NAPS) activities, a plan for the systematic replacement of aging air quality monitors was developed and proposed to cooperating agencies. The plan will be implemented during the next fiscal period.

Construction and commissioning of the high hazards laboratory established by Environment Canada for the trace analysis of hazardous toxic substances was completed. One use of the facility has been in analyses for dioxin and dibenzofuran as part of a departmental sampling program for emissions from the combustion of municipal refuse and coal.

A study was undertaken in the Vancouver area to determine whether elevated ozone levels are the result of local or a combination of local and long-range emissions.

Vehicle inspection programs continued and were conducted in Vancouver, Calgary, Edmonton and Montreal. A total 4 150 vehicles were checked. Checks of exhaust gas recirculation valves, which control NO_x output, were conducted for the first time in large metropolitan areas. Resulting data indicate tampering rates of 28%, 23% and 15% in Vancouver, Calgary/Edmonton and Montreal, respectively. Preliminary tests indicate that such tampering would double an individual vehicle's NO_x emissions.

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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, 1982.

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 within their legislation, become enforceable by that province.

The third objective is to provide 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.

By virtue of an amendment given Royal Assent on December 17, 1980, the Clean Air Act empowers the federal government to take steps to control the emission of pollutants affecting another country. This amendment provides the discretionary authority needed to control these pollutants without requiring that an international agreement be in place, as previously required under Section 7-1(b). It will only apply to countries providing reciprocal protection.

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 which would serve to inform the public in respect to all aspects of the quality of the ambient air and of the control and abatement of air pollution.

ENVIRONMENTAL PROTECTION SERVICE

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 Acitivites Assessment Branch in Ottawa. A resource summary for the Air Pollution Control Program is shown in Table 1. The Atmospheric Environment Service (AES) plays a role in the research aspects of air pollution control. Their activities are covered in the Atmospheric Environment Service section of this report.

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
1980-1981	148	3 681 725	3 452 845	372 354	7 506 924
1981-1982	142	4 256 642	2 443 746	607 290	7 307 678

Air Pollution Control Directorate

Following a reorganization on November 1, 1981, the responsibilities of the Air Pollution Control Directorate (APCD) are shared by the Air Pollution Programs Branch, the Engineering Assessment Branch and the Projects Coordination Group.

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 analyzes air quality trends, population exposure, and emission trends for past and future years, and 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: Pollution Measurement, Pollution Data Analysis, and Inter-agency Policy and Programs. During the 1981-82 fiscal year, as part of the reorganization, responsibility for Laboratory Services, previously a part of the Technology Development Branch, was transferred to the Air Pollution Programs Branch. 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 analysis of air pollutants; the provision of a computerized information service on air pollution control; the editing, publication 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 are performed in three divisions: Control Development, Chemistry, and Publications and Training.

The **Engineering Assessment Branch** is primarily concerned with the application of known 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 the responsibilities of three divisions of the Branch: Mineral and Metal Processes, Chemical Process Sources, and Combustion Processes. Emissions from motor vehicles, ships, locomotives and aircraft are the responsibility of the Mobile Sources Division. A fifth division, Fuels Processes, develops fuels composition and additive regulations, fuel inventories and emission guidelines for major production or refining sources.

The **Projects Coordination Group** is responsible for the design of projects to meet issues of concern in the field of air pollution control. The current issues are acid rain, oxidants, toxics and energy, and a project coordinator is responsible for projects in each of these areas.

Environmental Protection Service Regional Offices

Contact with provincial environmental protection agencies is maintained chiefly through the five EPS regional offices located in Dartmouth, Montreal, Toronto, Edmonton and Vancouver. Regional Directors provide 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 Assessment Branch

The Federal Activities Assessment Branch, originally established to demonstrate the federal government's resolve to control pollution from its own facilities, now acts in an advocacy and advisory capacity to ensure that the federal government plays a leadership role and that satisfactory control measures are incorporated into the design of federal facilities. It is concerned with all forms of pollution and is also responsible for environmental impact assessment of off-shore oil and gas developments, mining activities north of 60° latitude, and linear transportation facilities, and supports the Department's activities in the nuclear fuel cycle program.

Through both headquarters and regional offices, the Federal Activities Assessment Branch coordinates and provides an overall interface on behalf of EPS for environmental protection matters pertaining to activities of the federal government.

NATIONAL AIR POLLUTION PROGRAM

The National Air Pollution Program utilizes a program planning and evaluation system consisting of four principal elements:

1) identification, characterization and assessment of pollution problems;
2) technology;
3) prevention and control measures;
4) program planning, evaluation and liaison.

APCD's operating budget for the fiscal year was prepared using this project planning system. An evaluation system, now being developed, will provide management with information on the efficiency and effectiveness of resource utilization in achieving program objectives.

During the review period, a decision-making framework was developed to enable consideration of air pollution problems on a priority basis. Mechanisms to establish priorities for subsequent regulation or guideline development or other forms of intervention are also incorporated into the framework.

PROBLEM IDENTIFICATION, CHARACTERIZATION AND ASSESSMENT

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 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 National Air Pollution Surveillance (NAPS) network and ambient air quality studies, which are discussed later. The NAPS network maintains 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 assist federal and provincial control agencies in developing programs and establishing control priorities. During the review period, national inventories of the sources and emissions of copper and nickel were published, bringing the total of such inventories to 15. National inventories of the sources and emissions of antimony, barium, bismuth, chromium, cobalt, tin, phosphorus, chlorine, and hydrogen sulphide were finalized.

Reports on the sources and emissions of mercury and lead (base year 1978) were completed for the purpose of assessing the impact of air pollution control legislation that has been implemented since the original inventories (base year 1970) were prepared. These reports will be published in the next review period.

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, 1974, 1976 and 1978. The 1978 inventory was drafted during the review period and the preliminary data are summarized in Table 2.

In addition to showing the magnitude and distribution of emissions, the inventory describes, for each sector emitting any or all of the five contaminants, the process(es) employed the specific source(s) of the emissions and the type and efficiency of controls in place, if any.

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. In addition to providing information on a provincial census division or metropolitan area census basis, the system also has the capability to estimate emissions on a 127-km x 127-km grid cell basis.

During the review period, data on particulate matter size distribution, hydrocarbon compound classes and reactivity and primary sulphates were input to the system (see Section on LRTAP).

Long Range Transport of Air Pollutants

The long-range transport of airborne pollutants (LRTAP), in particular acid rain and its deleterious effects on sensitive ecosystems, continued to be the priority of the Air Pollution Control Program in 1981-82. Long a documented problem in Scandinavia and other European countries, acid rain originates principally as emissions of sulphur and nitrogen oxides from such sources as thermal power plants, non-ferrous smelters and motor vehicles. Carried aloft, these pollutants are transformed into acidic substances which fall to earth often far from the polluting sources.

Federal Control Strategies Program. The Federal Government of Canada initiated research into acid rain a number of years ago as a result of discoveries indicating that acidic precipitation was a far more serious problem than previously believed. In response to the problem of acid rain, the Federal LRTAP/Acid Rain Control Strategies Program was launched in 1979 in co-operation with the concerned and affected provinces. Its purpose is to identify, develop and evaluate alternative abatement strategies and to assess the potential impact in Canada of various options to reduce emissions in the U.S. The Program has been designed to provide a clear set of recommendations for domestic

TABLE 2 SUMMARY OF NATIONWIDE EMISSIONS OF AIR CONTAMINANTS, 1978 (preliminary)

Category	Emissions (tonnes x 10^3)									
	Particulate matter	% of total	Sulphur oxides*	% of total	Nitrogen oxides**	% of total	Hydro-carbons	% of total	Carbon monoxide	% of total
Industrial processes	1 439	59.1	2 770	62.2	50	2.7	417	20.9	1 070	11.0
Fuel combustion/ stationary sources	275	11.3	1 537	34.5	652	35.3	116	5.8	308	3.1
Transportation	92	3.8	143	3.2	1 115	60.5	851	42.7	7 245	74.3
Solid waste incineration	36	1.5	3	0.1	5	0.3	31	1.6	376	3.9
Miscellaneous	592	24.3	-	-	22	1.2	577	29.0	755	7.7
TOTAL	2 434	100.0	4 453	100.0	1 844	100.0	1 992	100.0	9 754	100.0

* Expressed as SO_2
** Expressed as NO_2

programs and a basis for our negotiation of an Air Pollution Control Agreement with the United States.

The Control Strategies Program has four basic components. The first, **Source Identification and Application of Control Technology,** was developed to provide an assessment of the major sources of sulphur and nitrogen oxides including non-ferrous smelting, thermal power generation and transportation. Background studies were conducted to assess the size and composition of the emitting industry sectors, the processes used and the resultant emissions. Control technology studies were also undertaken to review existing, emerging, and future methods of emission reduction. Particular emphasis was placed on putting Canadian industry in a worldwide context. The studies that comprise this program component were completed during the 1981-82 fiscal year.

The second component, **Assessment of Direct Costs and Indirect External Costs of Control,** which is nearing completion, consists of commodity studies, by-product feasibility studies, financial analysis of the application of technological fixes and analysis of the cost of controls to emitting sectors. The data acquired will be used in the determination of the social and economic consequences of applying various levels of emission reduction to emitting sources and the implications for other sectors of society.

In the third component, **Assessment of Benefits,** expected to commence in the 1982-83 fiscal year, the objective will be to identify the economic and social value of affected sectors of society including such areas as tourism, sport fishing, agriculture and forestry. This information will then be combined with effects information available from scientific studies and other appropriate sources to estimate the social and economic significance of the acid rain problem to various sectors of society. The result will provide a base line from which to evaluate the tangible and intangible benefits that would result from various levels of emission reduction.

The fourth component, **Analysis of Alternatives,** will consist of an analysis of data sets and information gathered in the first three components of the program to develop and evaluate alternative abatement options. Where possible, econometric models will be used to manage economic information.

Federal-Provincial Liaison. In the area of federal-provincial liaison, participation continued on the joint Canada-Ontario task force established in August 1980 to assess the abatement options for INCO and Falconbridge Mines. Also, a joint study was initiated with the province of Quebec on the Noranda Smelter and Environment Canada

officals appeared before the Manitoba Clean Environment Commission at hearings for the permit renewals of the Flin Flon and Thompson Smelters.

Canada-U.S. Acid rain was the dominant issue in Canada's air pollution control activities vis-à-vis the United States during the fiscal year. Pursuant to the Canada-U.S. Memorandum of Intent (MOI) of 1980 which established bilateral work groups to develop the technical basis for an air pollution agreement, a second series of reports was completed which better defined the magnitude of the threat. One of the reports identified a maximum target loading of wet sulphate of 20 kilograms per hectare per year to protect moderately sensitive aquatic ecosystems. Measured deposition levels in most of eastern Canada were found to be well over this threshold target. On June 23, 1981 formal negotiations between Canada and the U.S. for a bilateral air quality agreement commenced.

In cooperation with federal/provincial efforts to address the acid rain issue, in February, 1982, provincial environment ministers committed themselves to achieving the 20 kilograms per hectare per year target loading east of the Saskatchewan/Manitoba border through a 50% reduction in SO_2 emissions contingent on parallel U.S. action. Predictive modelling information from (the MOI) scientific investigations indicated that without significant reciprocal U.S. reductions, significant areas of the Canadian environment such as the Muskoka-Haliburton area could not achieve the target loading. Provincial environment ministers also undertook to apportion emission reductions among themselves by the end of 1982. Canadian negotiators put forward the proposal for a reciprocal 50% reduction in SO_2 emissions in Eastern North America; however, U.S. negotiators did not accept it. In the United States, the Senate Subcommittee on Environment and Public Works passed a bill calling for an 8-million ton reduction in SO_2 by 1995, but no bill was passed in the House.

Public awareness of the acid rain issue in the United States and Canada continued to increase and there were a significant number of speaking engagements by the Minister and other senior officials. A number of visits were sponsored to acquaint U.S. journalists with the acid rain situation in Canada and an award winning film - "Acid Rain - Requiem or Recovery" was made, which is expected to be a long-term educational aid on the issue.

A number of EPS regional and headquarters activities associated with acid rain were carried out.

A preliminary report entitled "A Study of Acidification in Sixteen Lakes in Mainland N.S. and Southern N.B." was completed in the Atlantic Region. Further lake sampling was carried out and a final report is expected to be completed in the next fiscal year.

A lake sampling and precipitation/aerosol monitoring study was conducted in the Halifax area. This study indicates that a decrease in acidic precipitation in the Atlantic region must include local as well as distant source emission reductions.

Cost studies were completed for sulphur dioxide control at the Lingan Thermal Power Generation Station in Nova Scotia, and the proposed oil to coal conversion at the Coleson Cove power station in New Brunswick was reviewed to determine the application of the Thermal Power Guidelines to the converted facility.

In Ontario, the EPS Regional Office funded and provided advice to an extensive acid rain information campaign conducted in the Temiskiming area. Participation continued on various committees concerning the long-range transport of airborne pollutants.

A report on the pollutant emissions generated by fuels burned in Quebec which lead to acid rain has been finalized. The report deals with the historical background of these emissions, summarizes the situation (1979), and provides projections for the years 1985, 1990, 1995. Also, a Regional Scientific Committee has been formed and, as a participant, EPS Quebec will focus on inventories, technology and control strategies.

During the review period, the Air Pollution Control Directorate continued to work on the identification and quantification of Canadian sources and emissions of compounds implicated in the acid rain problem and in long-range transport in general. Studies focused on both natural and man-made sources in order that atmospheric transport, transformation and deposition can be adequately studied. Inventories of primary fine particulates, volatile organic compounds and primary sulphates were completed.

Air Quality Monitoring

The National Air Pollution Surveillance (NAPS) Network. This network was instituted by and still receives the strong support of the Federal-Provincial Committee on Air Pollution (FPCAP). As of March 31, 1982, the NAPS network consisted of 506 air monitoring instruments at 157 sampling stations located in the following cities: St. John's, Charlottetown, Halifax, Sydney, Glace Bay, Fredericton, Saint John, Moncton,

Montreal, Hull, Quebec City, Sherbrooke, Chicoutimi, Rouyn, Sept-Iles, Trois-Rivières, Arvida, Tracy, Thetford Mines, Shawinigan, Baie-Comeau, Ottawa, Windsor, Kingston, Toronto, Hamilton, Sudbury, Sault Ste. Marie, Thunder Bay, London, Sarnia, Peterborough, Cornwall, St. Catharines, Kitchener, Oshawa, Oakville, Winnipeg, Brandon, Regina, Saskatoon, Moose Jaw, Prince Albert, Edmonton, Calgary, Red Deer, Lethbridge, Yellowknife, Vancouver, Prince George, Victoria, Kamloops and Whitehorse. This coverage includes 37 stations that provide continuous monitoring for all five of the most common air contaminants. An additional ten stations monitor all but one parameter continuously. Of the 506 instruments, 79 monitor sulphur dioxide, 52 monitor carbon monoxide, 48 monitor nitrogen dioxide and 50 monitor ozone, all on a continuous basis. Suspended particulate matter is monitored by 117 high-volume samplers operating every sixth day over a 24-hour period and 64 Coefficient of Haze (COH) tape samplers run continuously.

All NAPS stations except those in the National Capital area, the Yukon and the Northwest Territories are operated by the provinces and municipalities, which receive technical assistance and training from EPS regional and headquarters personnel in the maintenance and repair of monitoring equipment.

The evaluation of dichotomous particulate samplers continued through 1981/82. Samplers were operated in seven major cities in an effort to establish a data base on levels of fine particulate air contaminants and, at the same time, refine measurement and analytical methodologies. In association with this project, filter media are being assessed for the collection of particulate sulphate.

A pilot project for the development of a sampling and analytical capability for measurement of organic air pollutants was initiated. Methods for measuring volatile organics and particulate and gaseous phase polycyclic aromatic hydrocarbons are being developed and samplers are to be deployed in the NAPS network. During 1981/82 activities were confined to the design and purchase of sampling system components, development of a calibration system, evaluation of sample clean-up and extraction procedures, and set-up of analytical facilities.

Data screening software has been integrated into the NAPS air quality data base and is being used as a matter of routine in the processing of NAPS data summaries. A plan for the systematic replacement of aging NAPS monitors was developed and proposed to cooperating agencies. The plan calls for the replacement of instruments over the next several years according to a schedule that would ensure that very few, if any,

instruments remain in service for more than 10 years. If approved, the plan will be implemented beginning in 1982/83.

The 1980 NAPS Network Annual Summary and 12 Monthly Summaries were published during the fiscal year. Data from annual summaries, updated to 1981 on suspended particulates and lead, are given in Tables 3 and 4 for a cross-section of network stations.

Headquarters laboratory support to NAPS included analyses of about 4 000 samples for pollutants including lead, arsenic, sulphates and nitrates.

Air Monitoring Surveys. Environmental Protection Service (EPS) headquarters and regional staff again took part in numerous air quality monitoring surveys across the country. These surveys are usually in response to severe local or regional problems that have surfaced or been identified by communities or municipalities. EPS staff cooperate by helping to set up equipment and train operators, as well as analyzing samples and advising on controls. Other surveys may be initiated simply with a view to monitoring potential problems. In most cases the surveys continue for more than one year.

During the review period a study of the significance of photochemical oxidants in Vancouver was undertaken. This study was designed to determine whether elevated ozone levels in Vancouver were the result of local emissions alone or a combination of long range transport emissions and local emissions. The study is expected to be completed in the next fiscal year.

EPS continued to participate in the Nanticoke Environmental Monitoring Program established several years ago to assess the pollution levels resulting from new industrial activity in the Nanticoke area on Lake Erie.

EPS also continued its arsenic monitoring program in Yellowknife N.W.T. Arsenic concentrations in both suspended particulates and settleable particulates are being monitored and results continue to indicate the presence of low concentrations of arsenic in the ambient air.

Ambient air monitoring for carbon monoxide and nitrogen dioxide in the city of Whitehorse during the cold weather months continued. In addition, suspended particulate matter was measured in a residential area of the city in response to complaints about high pollution levels from residential wood burning appliances.

TABLE 3 NATIONAL AIR POLLUTION SURVEILLANCE DATA FOR SUSPENDED PARTICULATES -- SELECTED SITES, 1976-81

Location	Annual geometric mean (micrograms per cubic metre)					
	1976	1977	1978	1979	1980	1981
St. John's, Duckworth & Ordinance	50	*	37	45	48	41
Charlottetown, 56 Fitzroy	44	39	32	43	*	25
Halifax, N.S. Tech. College	49	47	42	39	*	*
Sydney, County Jail	73	53	52	57	65	*
Fredericton, York	43	52	52	47	51	38
Saint John, 110 Charlotte	53	62	57	58	68	58
Montreal, 1212 Drummond	78	74	76	76	*	69
Montreal, Duncan & Décarie	112	99	121	141	149	128
Montreal, 2900 boul. Concorde	68	59	62	63	59	*
Hull, Gamelin & Joffre		*	41	38	42	41
Quebec, Parc-Autos Paquet-Laliberté	85		76	89	93	*
Sherbrooke, Wellington & Albert	54	*	*	*	65	*
Chicoutimi, 222 Racine			73	68	62	65
Rouyn, Hôtel de Ville	*	*	31	32	34	41
Trois-Rivières, Hart & Ste-Cécile	72	51	89	71	78	80
Arvida, Powell & Hoopes	*	*	66	78	62	70
Tracy, Garneau & Rte 132		56	56	45	48	44
Shawinigan, Frigon & Laval		*	147	137	113	106
Ottawa, Slater & Elgin	60	63	56	55	57	59
Windsor, City Hall	76	83	79	74	77	69
Kingston, Queen's University	38	36	30	24	36	22
Toronto, 67 College	63	67	65	78	72	*
Toronto, Lawrence & Kennedy	65	58	60	67	69	59
Toronto, Elmcrest	*	49	*	61	54	*
Hamilton, Barton & Sanford	101	85	*	96	89	76
Sudbury, 19 Lisgar	46	44	48	51	55	43
Sault Ste. Marie, 550 Queen St. W.			62	*	*	*

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

TABLE 3 NATIONAL AIR POLLUTION SURVEILLANCE DATA FOR SUSPENDED PARTICULATES -- SELECTED SITES, 1976-81 (Continued)

Location	Annual geometric mean (micrograms per cubic metre)					
	1976	1977	1978	1979	1980	1981
Thunder Bay, 14 Algoma	*	49	42	39	46	44
London, King & Rectory	64	62	73	77	83	58
Sarnia, Front			*	67	76	62
Peterborough, 500 George	*	*	42	60	53	40
Cornwall, Memorial Park	44	46	43	57	52	48
St. Catharines, North & Geneva	*	69	60	66	64	57
Kitchener, Edna & Frederick		54	68	*	64	63
Oakville, Rebecca & Woodside		38	44	50	*	47
Oshawa, Ritson & Olive				*	61	57
Winnipeg, Jefferson & Scotia	57	43	36	39	36	38
Winnipeg, 65 Ellen			76	73	78	63
Brandon, 11th & Princess	62	59	*	*	58	55
Regina, 12th & Smith	57	58	47	*	62	64
Saskatoon, 30th St. & 833 P Ave.	63	53	52	58	53	*
Moose Jaw, Fairford & 1st Ave.	74	65	53	60	66	70
Prince Albert, 1257-1st Ave. E.	73	73	*	*	64	70
Edmonton, 10255-104th St.	*	103	*	96	100	102
Calgary, 316-7th Ave.	111	93	94	113	159	149
Red Deer, 4747 50th	63	66	53	68	70	61
Lethbridge, 13th St. & 9th Ave. S.	46	44	45	56	53	*
Yellowknife, 50th Ave. & 51st St.	54	*	*	50	68	*
Vancouver, 970 Burrard	68	69	67	62	70	66
Prince George, 1011 4th Ave.				*	76	78
Victoria, 1106 Cook	47	50	44	42	46	52
Kamloops, 301 Seymour			*	96	95	*
Whitehorse, Federal Bldg. 85	51	61	62	102	57	45

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

TABLE 4 NATIONAL AIR POLLUTION SURVEILLANCE DATA FOR PARTICULATE LEAD -- SELECTED SITES, 1976-1981

Location	Annual arithmetic mean (micrograms per cubic metre)					
	1976	1977	1978	1979	1980	1981
St. John's, Duckworth & Ordinance	0.44	*	0.31	0.26	0.21	0.21
Charlottetown, 56 Fitzroy	0.24	0.23	0.18	0.11	*	*
Halifax, N.S. Tech. College	0.20	0.18	0.16	0.10	*	*
Sydney, County Jail	*	0.42	0.29	0.17	0.18	*
Fredericton, York	0.55	0.42	0.32	0.39	0.34	0.34
Saint John, 110 Charlotte	0.31	0.23	0.19	0.21	0.19	0.20
Montreal, 1212 Drummond	1.01	*	0.73	0.64	*	*
Montreal, Duncan & Décarie	2.26	1.61	1.35	1.36	1.35	0.63
Montreal, 2900 Boul. Concorde	0.57	0.42	0.35	0.35	0.29	*
Hull, Gamelin & Joffre		*	0.32	0.27	0.26	0.27
Quebec, Parc-Autos Paquet-Laliberté	*	*	0.71	0.66	0.57	*
Sherbrooke, Wellington & Albert	*	*	*	*	0.35	*
Chicoutimi, 222 Racine			*	0.51	0.59	0.52
Rouyn, Hôtel de Ville	*	*	*	0.36	0.40	0.33
Trois-Rivières, Hart & Ste-Cécile			0.38	0.35	0.36	0.39
Arvida, Powell & Hoopes		*	0.47	0.37	0.45	0.39
Tracy, Garneau & Rte 132		0.30	0.23	0.21	*	0.15
Shawinigan, Frigon & Laval			0.28	0.25	0.25	0.23
Ottawa, Slater & Elgin	0.81	0.67	0.53	0.50	0.39	0.40
Windsor, City Hall	0.60	0.62	0.68	0.38	0.35	0.26
Kingston, Queen's University	0.21	0.13	0.13	0.09	0.10	0.13
Toronto, 67 College	*	*	0.66	0.44	0.28	*
Toronto, Lawrence & Kennedy	*	*	0.42	0.34	0.28	0.28
Toronto, Elmcrest	*	*	*	0.21	0.12	*
Hamilton, Barton & Sanford	*	*	*	0.62	0.50	0.60
Sudbury, 19 Lisgar	*	0.37	0.43	0.36	*	0.20
Sault Ste. Marie, 550 Queen St. W.			*	*	*	*
Thunder Bay, 14 Algoma	*	0.39	0.23	0.22	*	0.18

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

TABLE 4 NATIONAL AIR POLLUTION SURVEILLANCE DATA FOR PARTICULATE LEAD -- SELECTED SITES, 1976-1981 (Continued)

Location	Annual arithmetic mean (parts per hundred million)					
	1976	1977	1978	1979	1980	1981
London, King & Rectory	*	0.55	0.58	0.47	0.35	0.21
Sarnia, Front			*	0.19	0.11	0.05
Peterborough, 500 George		*	0.38	0.34	0.30	0.23
Cornwall, Memorial Park	*	*	*	*	0.07	0.10
St. Catharines, North & Geneva			0.35	0.26	0.15	0.23
Kitchener, Edna & Frederick			0.76	*	0.45	0.66
Oakville, Rebecca & Woodside		*	*	0.25	*	0.14
Oshawa, Ritson & Olive				*	0.36	0.19
Winnipeg, Jefferson & Scotia	0.28	0.31	0.22	0.34	0.29	0.21
Winnipeg, 65 Ellen			0.50	0.58	0.52	0.36
Brandon, 11th St. & Princess	0.22	0.26	*	*	0.33	0.24
Regina, 12th & Smith	0.32	0.25	0.25	*	0.22	0.23
Saskatoon, 30th St. & 833 P Ave.	0.11	0.10	0.10	0.12	0.13	*
Moose Jaw, Fairford & 1st Ave.	0.21	0.16	0.15	0.16	0.16	0.17
Prince Albert, 1257-1st Ave., E.	0.23	0.22	*	*	0.18	0.20
Edmonton, 10255-104th St.	*	0.26	*	*	*	*
Calgary, 316-7th Ave.	0.22	0.36	0.33	*	*	*
Red Deer, 4747 50th	0.19	0.17	0.21	*	*	*
Lethbridge, 13th St. & 9th Ave. S.	0.09	0.05	0.08	*	*	*
Yellowknife, 50th Ave. & 51st St.	0.10	*	*	0.22	0.21	*
Vancouver, 970 Burrard	1.29	0.98	0.80	0.75	0.73	0.88
Prince George, 1011 4th Ave.				*	0.26	0.28
Victoria, 1106 Cook	0.61	0.59	0.42	0.42	0.40	0.52
Kamloops, 301 Seymour			0.53	0.55	0.47	*
Whitehorse, Federal Bldg. 85	0.26	0.19	0.24	0.19	0.19	0.24

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

Air quality monitoring at the Gold River Native Indian Community on Vancouver Island finished during the review period and all data have been sent to the Department of National Health and Welfare.

Ambient air monitoring of fluorides on Cornwall Island continued during the review period and changes have been made in the sampling procedures to improve the accuracy of the data obtained. The data collected during the 1980-81 winter season was analysed and the results indicate that air quality fluoride limits were exceeded on a few occasions. An analysis of data for the 1981 growing season will be conducted during the next review period.

The Cornwall Island Health Effects study undertaken by National Health and Welfare continued and is expected to be completed during the next fiscal year.

EPS is participating on a B.C. Government committee formed in 1981 to develop plans for a comprehensive air quality monitoring program that will cover all phases of coal development in northeast British Columbia including mining, coal preparation, rail transportation and port operations. Monitoring plans are expected to be completed in 1983.

The project to monitor coal dust emissions from trains passing through Agassiz, B.C., continued with EPS support. A close watch is maintained over offending trains and the coal mining companies are notified when corrective action is required. During the review period an intensive coal train inspection project was carried out and a draft report has been distributed to the coal mining and railway companies involved.

Also during the review period, a report of the ambient air survey for asbestos fibres done in Baie Verte, Nfld., by EPS in cooperation with the Newfoundland Department of the Environment was distributed to all interested agencies. The results indicate that the asbestos fibre sources are mainly fugitive. National Health and Welfare Canada has provided a review of the potential health implications to the Newfoundland Department of Health.

EPS Atlantic along with the Nova Scotia Department of the Environment initiated a polynuclear aromatic hydrocarbon ambient study in Sydney, Nova Scotia. A report should be available in 1982/83. Mobile sulphur dioxide monitoring was also provided by EPS Atlantic to Environment New Brunswick in the St. John Air Pollution Study in July/August 1981.

General. Development of standard reference methods for the measurement of mercury, arsenic and benzene in the ambient air continued.

Trend Analysis

During the review period, a trend analysis report covering NAPS Air Quality for the period 1970-79 was published. In addition, the analysis for the 1979-1980 period was completed. Results of the analysis for the 1974-1980 period are shown in Tables 5 and 6.

TABLE 5 AVERAGE OF THE ANNUAL MEANS OF NAPS STATIONS FOR 1974-80

Contaminant	1974	1975	1976	1977	1978	1979	1980	Change 1979-80	Change 1974-80
Sulphur dioxide (pphm)	1.6	1.5	1.4	1.4	1.3	1.2	1.2	-	-25%
Suspended particulates ($\mu g/m^3$)	78.6	65.9	65.7	61.9	61.4	66.0	66.8	+1%	-15%
Lead ($\mu g/m^3$)	.68	0.55	0.49	0.46	0.42	0.39	0.34	-13%	-50%
Nitrogen dioxide (pphm)	-	-	-	3.1	2.9	2.6	2.5	-4%	-19%*
Carbon monoxide (ppm)	2.4	1.9	1.6	1.6	1.5	1.7	1.5	-12%	-38%
Soiling Index (COH)	0.38	0.28	0.28	0.27	0.25	0.28	0.28	-	-26%
Ozone (pphm)	-	-	-	-	-	1.5	1.6	+7%	-

* Change is for the years 1977-80

A study on the population exposure to suspended particulate matter in selected Canadian cities was completed and a report will be prepared.

Work to provide an overview of emissions for the five common air contaminants for the years 1955 and 1965 for historical and comparative purposes was completed. An emissions trends report for the years 1970-1978 was initiated and work commenced on the development of emission forecasting models.

TABLE 6 PERCENTAGE OF NAPS STATIONS EXCEEDING MAXIMUM ACCEPTABLE ANNUAL LEVELS OF AIR QUALITY OBJECTIVES, 1974-80

Objective	1974	1975	1976	1977	1978	1979	1980
Sulphur dioxide (annual)	18	11	10	5	7	4	2
Suspended particulates (annual)	49	42	37	24	27	34	35
Nitrogen dioxide (annual)	N/A	N/A	N/A	4	0	0	0
Carbon monoxide (8 hours)	29	27	16	10	8	20	8
Ozone (annual)	N/A	N/A	N/A	N/A	N/A	50	54

N/A - not available

Technology

The Program for the Development and Demonstration of Pollution Abatement Technology (DPAT). Section 3 of the Clean Air Act provides for federal financial support of control technology development projects. Out of this authority came, on April 1, 1975, the DPAT Program of cost-shared agreements with industry to develop and demonstrate new control technology. Fiscal constraints resulted in termination of the program's funding on March 31, 1979; however, existing projects were supported until their completion.

During the review period, one DPAT contract with the Algoma Steel Corporation Ltd. for the demonstration of a high-pressure water-jet system for cleaning coke oven doors remained outstanding. The aim of this project was to demonstrate that the water-jet technique was a significant improvement over current mechanical methods for removing hydrocarbon deposits from door seals, thereby improving the seals' effectiveness and minimizing hydrocarbon emissions to the atmosphere during the coking cycle. This aim was successfully achieved and a final report was prepared and published.

With the completion of the Algoma Steel contract all projects under the DPAT Program in the air section have been concluded.

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. A project carried out with EPS support by the University of Montreal's École Polytechnique to find ways of improving the effectiveness of the demisters employed for controlling emissions from the tenters used in the textile industry was completed. Although the cooling unit developed has not given the results expected due to the physical-chemical characteristics of the emissions, its application could be useful in other fields. This study has had secondary results with regard to improving techniques used to sample and analyse the components of organic gas compounds.

Technical Information Dissemination. The Technical Information System, in operation since 1973, fills the information requests of senior management, the personnel of the Air Pollution Control Directorate, staff in regional offices and the Canadian air pollution control and research community. Research and current awareness services in the area of air pollution are provided to all levels of government. The Environmental Protection Agency APTIC file (100 000 microfiche titles) is available for searching and reprints. During 1981-82, 122 literature searches were conducted; and 1432 information requests were answered. In addition to the microfiche collection, the system circulates over 126 serials and has over 7400 documents in hard copy.

Training in Air Pollution Control Technology. EPS headquarters and regions again supported regulatory activities across Canada by presenting air pollution control training courses for enforcement officers of the federal, provincial and municipal governments and industry personnel. During the review period a stack sampling course sponsored by EPS was held in Vancouver. Attendees came from provincial and municipal governments and various industries.

EPS Quebec participated actively in the Acid Rain seminar held in April 1981. This seminar was organized jointly by the Ontario and Quebec sections of the Air Pollution Control Association and the federal-provincial scientific committee on LRTAP and was attended by 250 scientists.

EPS Atlantic presented a seminar on the test kit used to sample lead levels in gasoline to the Nova Scotia Board of Public Utilities.

As in past years, EPS regions continued to contribute to numerous regional events such as seminars, conferences and exhibitions, often in cooperation with municipalities.

Publications. During the review period, 28 technical reports in the EPS national series were edited and published by APCD. Overall, about 20 000 copies of reports, news releases, Canada Gazette announcements and factsheets were distributed.

The reports published during the review period were the following:

Regulations, Codes and Protocols Series

EPS 1-AP-73-3 Standard Reference Method for the Measurement of Ozone in the Atmosphere (Chemiluminescence Method) (Revised) (Bilingual)

EPS 1-AP-81-1 The Clean Air Act - Compilation of Regulations and Guidelines (Bilingual)

Economic and Technical Review Series

EPS 3-AP-76-5F La pollution atmosphérique et les techniques antipollution: la production d'énergie par voie thermique. Volume 1 - Les moteurs à combustion interne

EPS 3-AP-81-2 Control of Excessive Emissions and Fuel Consumption by In-Use Motor Vehicles

EPS 3-AP-81-3 Technology for Controlling Emissions from Power Plants Fired with Fossil Fuel

EPS 3-AP-81-4 National Inventory of Sources and Emissions of Copper and Nickel (1976)

EPS 3-AP-81-5 Air Pollution Emissions and Control Technology: Ferroalloy Production and Allied Industries

Surveillance Series

EPS 5-AP-80-7 to 80-12 National Air Pollution Surveillance Monthly Summaries, July to December 1980 (Bilingual)

EPS 5-AP-81-1 to 81-6 National Air Pollution Surveillance Monthly Summaries, January to June 1981 (Bilingual)

EPS 5-AP-81-13 National Air Pollution Surveillance Annual Summary, 1980 (Bilingual)

EPS 5-AP-81-14 Urban Air Quality Trends in Canada, 1970-79

Miscellaneous Publications

National Inventory of Natural Sources and Emissions of Mercury Compounds

National Inventory of Natural Sources and Emissions of Primary Particulates

High Pressure Water Cleaning of Coke Oven Doors

Air Pollution Control Systems on International Copper and Nickel Smelters

Clean Air Act Annual Report 1980-1981 (Bilingual)

The Control of Air Pollutant Emissions from a Kraft Recovery Boiler Using an Alkaline-Carbon Scrubbing System

Fine Particulate Emission Control with Granular Bed Filter

DEVELOPMENT OF PREVENTION AND 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, based on Health and Welfare Canada's recommendations, action has been taken to regulate lead, mercury, asbestos and vinyl chloride from certain sources. Regulations governing other sources and contaminants have been proposed or are under development, as follows.

Arsenic (Gold Roasting). A significant source of emissions of arsenic into the atmosphere is gold roasting. Proposed regulations concerning the emission of arsenic from gold roasting operations were published in 1979 in Part I of the Canada Gazette. A socio-economic impact analysis (SEIA) assessing the impact of the regulations was prepared. The proposed regulations are being reconsidered by Environment Canada in light of changes in procedure under the new Environmental Quality Policy, comments received on the proposed regulations and SEIA, and structural and economic changes in the gold mining industry. This review is expected to be completed in 1983.

Asbestos (Manufacturing). Work continued on the assessment of the need for national emission regulations for asbestos manufacturing operations.

Lead, Mercury and Arsenic (Non-ferrous). The non-ferrous smelting industry in Canada is a major source of emissions of lead, mercury and arsenic. The development of regulations to limit these emissions is closely associated with the program underway to develop a sulphur dioxide abatement strategy for non-ferrous smelters since sulphur dioxide control at the source will result in a substantial decrease in trace metal emissions.

Standard reference methods for measuring lead and mercury emissions have been field tested and considered acceptable. They will undergo a technical review during the next fiscal year. Development of a standard reference method for arsenic continued

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*Report EPS 1-AP-81-1, entitled "The Clean Air Act - Compilation of Regulations and Guidelines", contains all regulations, guidelines and air quality objectives published in the Canada Gazette up to April, 1981.

to pose problems; however, a proposed modified testing method will be evaluated during the next fiscal year.

Fuels Regulations

The socio-economic impact analysis (SEIA) initiated to investigate the phase-down of lead content in gasoline continued. A decision as to further regulation is expected in the next fiscal year.

Regulations for Mobile Sources

Under the Motor Vehicle Safety Act, Transport Canada is responsible for the administration of the Motor Vehicle Emissions Regulations and Environment Canada for the required compliance testing and technical advisory services in support of the regulations.

The federal government, in the past, followed a policy of paralleling U.S. motor vehicle emission regulations. The Canadian standards for 1975 were established at 2.0, 25.0 and 3.1 grams per mile (1.25, 15.63, and 1.94 g/km, 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. Environment Canada has been conducting studies into the possibility of further reductions in the nitrogen oxide emission levels and during the review period a notice was published in the Canada Gazette stating the Department's intention to conduct a SEIA, which was subsequently initiated with the concurrence of the Department of Transport, on a 0.63 g/km (1.0 gram per mile) NO_x standard slated to go into effect in 1985.

Guidelines for Stationary Sources

Section 8 of the Clean Air Act makes provision for the federal government to publish national emission guidelines governing emissions of pollutants from certain industrial sources, stationary or mobile. 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 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.

During fiscal year 81-82, activity in this field included:

Ferrous Foundries. A draft guideline recommending emission limits for this industry is under study.

Thermal Power Generation. National emission guidelines for thermal power stations were finalized and published in the Canada Gazette on April 28, 1981. They specify emission limits for sulphur dioxide nitrogen oxides and particulate matter. Supporting documents which discuss control technologies for sulphur dioxide and nitrogen oxides were also published.

Petroleum Refineries. Preparation of the industry study report on petroleum refining and identification of emission limits continued.

Natural Gas Processing. The development of recommended emission limits for this industry sector continued. The associated industry study report is expected to be completed during the next review period.

Other Industry Sectors. The background report on the iron and steel industry was completed and will be published during the next fiscal year. A ferroalloy production and allied industry report was published.

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 sources under its general provisions for air quality objectives, air quality monitoring and surveillance, vehicle emissions, fuel composition regulations, and federal-provincial co-operative programs, and therefore allows for the development of guidelines governing these sources.

During the fiscal year a socio-economic impact analysis (SEIA) of the National Emission Guideline for in-use Motor Vehicles was undertaken and a background report entitled "Control of Excessive Emissions and Fuel Consumption by In-Use Vehicles" (EPS-3-AP-81-2) was published. The National Guideline will be published during the next fiscal year.

In support of the guideline program EPS with the Department of Energy, Mines and Resources, the Government of the Yukon and the Whitehorse City Council operated a Test and Tune Clinic. The objectives of the program were to improve fuel economy and reduce emissions. Preliminary results indicate that the objectives were met for both fuel economy and air quality.

In addition to the Whitehorse project, similar clinics were run in Vancouver, where 400 vehicles were inspected, Calgary and Edmonton, where 3 000 vehicles were tested and tuned, and Montreal, where 750 in-use vehicles were checked. In these clinics a check of the exhaust gas recirculation valve which controls NO_x output was carried out for the first time in large metropolitan areas. Resulting data indicated a tampering rate of 28%, 23% and 15% in Vancouver, Calgary/Edmonton and Montreal respectively. Preliminary laboratory studies indicate that such tampering would double the individual vehicle emissions.

IMPLEMENTATION OF PREVENTION AND 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.

Enforcement monitoring by the EPS regional offices continued. There are eight plants in the Pacific region, all located in and operating under permits of the Greater Vancouver Regional District (GVRD), the agency in charge of enforcement. The GVRD has applied the requirements of both the federal and provincial standards in their permits. All eight plants are considered to be in compliance based on an audit of GVRD's implementation program.

In Alberta, stack emission tests conducted in 1980 indicated that two of the three plants were out of compliance. These plants subsequently undertook to improve their pollution control systems. Source tests in 1981 indicated that one of the plants was in compliance with the lead emission limits specified although some problems were encountered in meeting the particulate limits. The other plant has terminated operations.

In Manitoba, source tests in 1981, indicated that all three plants were in compliance. The Crown proceeded with a prosecution against one company for exceeding limits specified in the regulation in 1980.

EPS cooperation with the Ontario Ministry of the Environment resulted in a detailed assessment of the 34 plants in the province. Two of the plants were considered to be out of compliance and additional emission testing has been scheduled for both plants following process improvements.

In Quebec, ten plants are operating. All of the major plants were inspected and emission tests were conducted at two facilities. All of the plants were considered to be in compliance.

In the Atlantic Region, two plants are subject to the regulation. Source testing was conducted at both plants in 1981. One plant was in compliance and the owners of the second plant agreed to install new equipment which will ensure compliance with the regulation.

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.

Five mercury cell chlor-alkali plants operate in Canada, one in each of British Columbia, Ontario, Quebec, New Brunswick and Nova Scotia. All are in compliance with the regulations.

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.

The provinces of Alberta and Quebec have since enacted their own vinyl chloride regulations which are at least as stringent as the federal regulations. These two provinces are enforcing their own regulations in cooperation with EPS.

Alberta has licensed one vinyl chloride and one polyvinyl chloride plant. Compliance tests showed that under normal operating conditions, the plants are well within compliance. However, upset conditions have resulted in short-term excessive emissions. Alberta Environment has required that the companies undertake certain actions designed to reduce the frequency of these incidents.

In Quebec the sole polyvinyl chloride plant was tested and found to be in compliance. However, several major incidents were responsible for the discharge of large amounts of vinyl chloride to the atmosphere. The company was requested to prepare a plan which would reduce the number and magnitude of incidents. The company complied with the request and the proposed prevention plan is being evaluated.

Ontario has one vinyl chloride and two polyvinyl chloride plants. Testing has been undertaken, but not witnessed. Compliance is scheduled to be witnessed early in the 82-83 fiscal year.

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 include dry drilling operations was published on April 4, 1979 and took effect July 1, 1979.

The one plant in British Columbia to which the regulations apply is in compliance. There are no plants in the Prairie Provinces or Ontario subject to the regulations.

In Quebec, the application of the national regulation is carried out jointly with provincial authorities. Ninety-two emission sources were measured in the provinces 11 mills. In 90% of the cases, the standards are being met. There has been a considerable reduction in poor operating conditions following modifications carried out to the flues of the mineral process driers.

Source testing was conducted at Advocate Mines Limited in Baie Verte, Newfoundland in June 1981. All sources covered by the regulations were in compliance. The mine/mill complex shut down indefinitely at the end of December, 1981.

Implementation of Fuels Regulations

Leaded Gasoline Regulations. According to information contained in quarterly reports to Environment Canada by refineries, 10.5 million kilograms (23.1 million lb) of lead were added to premium and regular leaded gasolines in 1981. This was approximately 0.5 million kilograms (1.2 million lb) less than in 1980, reflecting the increased use of lead-free gasoline. Fifty-five samples of leaded gasoline were tested in 1981 and four exceeded the allowable concentration of 3.5 grams per imperial gallon (0.77 grams per litre).

Lead-Free Gasoline Program. Lead-free gasoline sales, as a percentage of total gasoline marketed, has increased from 5.7% in 1975 to 39% in 1981. During the review period, 3 476 samples of lead-free gasoline were tested in the national monitoring program. One hundred and thirty-eight (138) samples, or 3.9%, exceeded the allowable concentration of 0.06 grams of lead per imperial gallon (0.013 grams per litre). A violation rate of 3.9% compared to 5.9% in 1980.

Nozzle switching, whereby leaded gasoline can be dispensed into cars calling for lead-free gasoline, has been common in some parts of Canada. During the review period, EPS Quebec observed that of 2 539 filling nozzles checked, 31% did not comply with the relevant standards and 51% of the retailers checked had at least one improper nozzle. In Ontario 355 retail outlets were checked. Forty-eight percent of these had at least one improper nozzle.

EPS Western and Northern Region observed an increase in tampering with vehicle fuel inlets in rural farming communities as drivers attempted to gain access to cheaper leaded gasoline.

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. In support of this activity, regulations are in effect to obtain the required information on the sulphur content of petroleum fuels as well as their additives. During the fiscal year, sulphur data for 1978, 1979, 1980 and 1981 were reviewed and additional information for 1981 was requested from the industry in order to verify the sulphur material balance.

A contract study undertaken to determine the cost of desulphurizing light fuel oils to 0.3% sulphur by weight and heavy fuel oils to 1.0 and 0.5% was completed and further work on establishing the cost of desulphurization is underway.

General. The standard reference method for the determination of lead in automotive gasoline was revised and published during the 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, 48 vehicles were tested for compliance with the Department of Transport's emissions regulations and 27 vehicles were tested to verify fuel economy claims made by the manufacturers.

Implementation of Guidelines for Stationary Sources

Discussions regarding the adoption of the Thermal Power Guidelines were held in the fall of 1981 with the provinces of Alberta and Saskatchewan.

Controls of Emissions from Federal Facilities

The federal government recognizes the need to set a good example in the control of emissions. Environment Canada is the department responsible for ensuring minimal adverse environmental effects from all federal establishments, operations and businesses. This is accomplished through the Federal Activities Assessment Branch.

During the review period, the integrated waste management project at the Ste-Anne-de-Bellevue Veteran's Affairs Hospital continued. In spite of modifications undertaken by the contractor, the project was unable to meet specified requirements and Public Works Canada intends to initiate legal action.

In response to departmental initiatives, Eldorado Nuclear at Port Hope, Ontario has proposed a major retrofit program to reduce fluoride and radioactive dust emission levels.

Also, a study was conducted at the Royal Military College, Kingston, of the emissions from a pilot plant furnace designed to dispose of polychlorinated biphenyls (PCB) contaminated oil. A report should be completed during the next fiscal year.

Scientific and Technical Advice and Support

During the fiscal year, APCD and the EPS regional offices carried out numerous technical reviews, chemical analyses and advisory activities. These arise not only from planned programs but also from requests from the provinces, municipalities, industry, the public and agencies and groups in other countries. Some of the more important activities are described in the following paragraphs.

APCD is participating in a study with the Canadian Electrical Association, Energy, Mines and Resources (EMR) and the Water Pollution Control Directorate of EPS to determine the fate of trace contaminants in coal-fired power production. The project involves extensive field sampling at four Canadian power plants and will take 30 months to complete. During the fiscal year, the sampling protocol was developed and Phase I of the sampling program was initiated at the Battle River Generating Station in Alberta.

In another major project, APCD in cooperation with EMR and the Department of National Defense (DND), is participating in the modification of a large heating boiler at an eastern military base. The design changes are intended to show that large reductions in sulphur dioxide and nitrogen oxide emissions can be achieved by alterations to the boiler fuel burners and the simultaneous injection of limestone with the pulverized coal, eliminating the need for flue gas desulphurization involving wet chemistry.

A preliminary report on the results of a sampling program designed to identify emissions of dioxin and dibenzofuran from the combustion of municipal refuse and coal was completed. The interim report indicates the presence of dioxin and furan isomers in some fly ash samples. Further analysis of the samples is being carried out by APCD's high hazard laboratory, completed during the 1981/82 fiscal period, and a final report is expected during the next fiscal year.

APCD initiated a program for the reliable identification of toxic metals in the ambient air. Methods are being developed and facilities prepared to preserve and analyse samples which contain toxic elements at trace and ultra trace levels.

Considerable time and effort was spent by the Laboratory Services Division of APCD, in conjunction with the Toxic Chemicals Management Centre, on analyses for toxic organic substances and environmental contaminants, particularly polychlorinated biphenyls (PCB), dioxins, polycyclic aromatic hydrocarbons (PAH) and other halogenated hydrocarbons. In addition to the analysis of samples submitted by the Regional Offices, other Directorates within Environment Canada and the provinces, protocols for quality assurance programs are being developed.

APCD surveillance services included continued participation in the fluoride monitoring program at Cornwall Island and participation with Atmospheric Environment Service (AES) and Eldorado Nuclear in reviewing studies conducted on the haze problem in Port Hope. EPS Ontario Region also participated in these programs.

There is also an ongoing effort in such areas as assessing new monitoring techniques and instruments, testing new reference methods, and reviewing solicited and unsolicited proposals for technical merit.

EPS regional offices provided many services. EPS Pacific and Yukon continued to provide technical advice to the National Harbours Board on air pollution control requirements and ambient air monitoring in support of the Board's plans to expand the Roberts Bank Coal Terminal. The Region is also participating in a review of and providing technical advice in relation to proposed new energy developments, including the 2000-MW coal-fired thermal plant at Hat Creek and a number of proposed petrochemical developments. The Region assisted APCD in a field stack sampling project at the Cominco, Trail Smelter. This was one of several emission testing projects carried out at smelters to develop reference source test methods for heavy metals. The Region is participating on a subcommittee of the National Research Council that is preparing a report on atmospheric particles. A second draft of the report has been completed.

During the review period, EPS Northwest assisted EPS Headquarters in reviewing the best practical controls for SO_2 emissions from the proposed Alsands project. The environmental recommendations which resulted formed part of the non-fiscal agreements negotiated by EMR with Alberta and the Alsands consortium. EPS Northwest is also active in providing information, technical assistance and peer review in support of other federal government, provincial agency, and industry programs.

EPS Ontario continued its active participation in the Nanticoke Environmental Management Program. Extensive air monitoring continued. The program is designed to determine the pollution effects of this large industrial development located on the shore of Lake Erie and will continue for several years. The Region also continued to work closely with other federal and provincial personnel in the Cornwall Island study.

EPS Ontario continued to actively contribute to efforts to resolve the emission problems at Eldorado Nuclear in Port Hope. These ranged from smog problems resulting from nitric acid and ammonia emissions to fluoride and uranium emissions. After considerable effort, the smog problem was corrected, and during the review period a limited-source sampling program for fluoride and uranium emissions was instituted by Eldorado Nuclear. Data from the program were evaluated and discussed with the Crown Corporation which has proposed a major retrofit program to reduce these emissions.

EPS Quebec cooperated with the provincial government in developing a detailed provincial inventory of the sources and emissions of common contaminants in Quebec. This work will enable more rapid updating of the regional components of national inventories.

EPS Quebec worked with APCD, provincial and municipal authorities in organizing a motor vehicle inspection program held in conjunction with the motor vehicle emission guideline program.

Also during the fiscal year, EPS Quebec participated in a review of the existing data and information on air quality and emissions in the Lachine Canal zone with the objective of providing Parks Canada with recommendations regarding possible actions to improve the quality of air in the Canal zone.

EPS Atlantic continued to contribute to a broad range of advisory activities. Technical assistance was provided to the National Control Strategy program through participation on the U.S./Canada Work Group 3B and the review of a consultant study related to the Control program. Also, scientific assistance was provided to a Department of National Defence (DND) sponsored study on the environmental impacts of ash disposal from the fluidized bed combustion boiler plant under construction at Canadian Forces Base Summerside, P.E.I. In other areas, EPS Atlantic made recommendations to DND on stack heights and emissions control for heating plants and incinerators at CFB's Greenwood, Summerside, Shelburne and Halifax; reviewed an emergency ammonia release system for Public Works in St. John's, Nfld.; assisted New Brunswick in an evaluation of mercury emissions from a precious metal recovery proposal; and, in cooperation with the

Atmospheric Environment Service (AES), prepared a modelling report on the impact of wood stove emissions on air quality in Charlottetown, P.E.I.

PROGRAM PLANNING, EVALUATION AND LIAISON

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. Established in 1969, it 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 20-22, 1981, and the major topic was the Long-Range Transport of Airborne Pollutants (LRTAP). A resolution was drafted for the consideration of the Canadian Council of Resource and Environment Ministers, suggesting an improved federal-provincial structure for management of the LRTAP problem.

A major achievement of the Federal-Provincial Committee has been the development, by means of its two standing subcommittees, of National Air Quality Objectives designed to protect public health and the environment by setting limits on the concentrations of contaminants in the ambient air. These were published in the Canada Gazette under authorization of the Clean Air Act which enables promulgation of three ranges of these objectives, "desirable", "acceptable" and "tolerable", for major air contaminants. For definitions of these levels and for information on the pollutants involved, along with the recommended ambient concentrations for each, readers should refer to Report EPS 1-AP-81-1.

During the fiscal year the Subcommittee on Air Quality Objectives (Desirable and Acceptable) continued its ongoing review of existing objectives. The review of nitrogen dioxide was completed and it was concluded that no changes in the existing objective is required. The review of the remaining objectives is proceeding. Maximum tolerable levels objectives are also undergoing review in the context of a reexamination of the definition of the levels.

APCD continued to participate in a program to provide reliable standard reference materials to Canadian laboratories. During the review period a round robin commenced during the 1980-81 fiscal year examining smelter dust samples for heavy metals was completed.

Another important involvement of the Committee is the continuing development and operation of the National Air Pollution Surveillance (NAPS) network reported on in detail on pages 12 to 16.

Participation in Canada/U.S. Programs. In addition to participation in joint Canada/United States activities as discussed earlier in the LRTAP section of this report, Environment Canada continued its cooperation with U.S. agencies in a variety of other programs. One of these cooperative mechanisms is the International Air Pollution Advisory Board, 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 IJC. APCD continued to provide 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 review period the Board reported to the IJC that the epidemiological study to determine the relationship between environmental contaminants and the health of Canadian residents on Cornwall Island was continuing and should be completed during the next fiscal year. Discussions between the Canadian and U.S. Governments remain in abeyance pending the completion of the report.

APCD continued to provide the Canadian Chairman to the International Michigan-Ontario Air Pollution Board created as a result of the Michigan-Ontario agreement on transboundary air pollution to monitor the progress of control programs in the border area. Technical assistance is provided by both APCD and EPS Ontario. In its Sixth Annual Report the Board noted a significant reduction in total particulates in the Detroit-Windsor area, while indicating that this improvement is likely attributable to lower manufacturing activity due to economic conditions. The International Joint Commission (IJC) criterion for suspended particulates had not been achieved in much of the area. While levels of sulphur dioxide generated in the Sarnia-Port Huron area were up, an improved control strategy resulted in a significant reduction in emissions of sulphur dioxide. The number of emissions in excess of the Ontario criterion for ozone increased and this remains a transboundary concern. The Board also noted that greater attention should be focused on emerging problems and the adequacy of existing monitoring networks.

Participation in Other International Programs. Environment Canada contributes to and benefits from a number of international programs dealing with the development of policies and technology for air pollution control. These programs allow participating countries to draw on one another's expertise to develop acceptable solutions to complex environmental problems. Studies of control strategies for acid-causing pollutants and toxic substances are continuing to be of great importance.

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 Air Pollution Control Directorate (APCD) provides the Canadian delegate to the OECD Air Management Group, the principal focus of which is the examination of SO_2, NO_x and toxics in the atmosphere. APCD also provides the delegate to the United Nations ECE Working Party on Air Pollution Problems. Canada is a signatory to the ECE Convention on Long-Range Transboundary Air Pollution. An Interim Executive Body was created to coordinate activities related to the implementation of the provisions of the Convention, pending ratification and entry into force of the Convention. APCD provides the head of the Canadian delegation to the Interim Executive Body.

Bilateral consultations on policies, strategies, and information exchange were held during the year with visiting representatives of environmental protection agencies from Mexico, Norway, Sweden, Greece, India, China, Brazil and Japan.

APCD 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.

Other international activities during the review period included:

- continued participation in a subcommittee of the UN-ECE Working Party 29 -- Groupe de Rapporteurs sur Pollution et Énergie -- dealing with motor vehicles;
- contribution to a UNEP project on non-ferrous smelters;
- review of the proposed air questionnaire for and contribution to the second OECD State of the Environment Report.

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 also 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 regularly informed of EPS activities involving the Yukon and Northwest Territories. Regular contact is maintained with Energy, Mines and Resources Canada, and the National Energy Board on energy/environment matters, and with Industry, Trade and Commerce Canada on environment/industrial policy matters, particularly as they relate to the domestic program for the control of acid-causing air pollutants.

ATMOSPHERIC ENVIRONMENT SERVICE

The Atmospheric Environment Service (AES) shares a decisive role within Environment Canada in the protection and enhancement of the quality of the environment. In this context, AES is striving toward a better understanding of the atmospheric processes of pollutant transport, chemical transformation during transport, areal distribution of pollutants, and the rates of deposition on the environment through the operation and maintenance of air and precipitation chemistry networks as well as by conducting experimental studies. Results obtained from these networks and special studies are applied in the modelling of atmospheric processes and the physical and chemical behaviour of pollutants.

Much of this 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 research in the lower atmosphere (i.e., the 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.

Long Range Transport of Air Pollutants (LRTAP)

AES continued to provide scientific coordination and liaison for the LRTAP program within the federal government as well as with the provinces and internationally. During the review period, substantial effort was devoted to supporting activities under the Canada/U.S. Memorandum of Intent which was signed in August, 1980. AES provided the Canadian Co-Chairman and the Technical Co-ordinator for Working Group No. 2 (Atmospheric Modelling) whose task was to describe the transport and transformation of air pollutants from their source regions to final deposition, especially deposition to sensitive ecosystems. During the fiscal period the second phase of supporting technical reports were completed.

Other LRTAP activities of significance within AES include the following:

- The decision was taken to integrate the CANSAP (Canadian Network for Sampling Precipitation) and APN (Air and Precipitation Network) Networks into one, to be known as CAPMON (Canadian Air and Precipitation Monitoring Network). The configuration of stations will be so as to eliminate local pollution influences and

hence to enhance the quality of the data and to provide a link with provincial and other networks.

- Methods are being developed to measure the direct flux of sulphur dioxide and ozone in order to improve understanding of dry deposition to natural surfaces.
- Instruments are being developed to measure nitric acid and reactive chemical components important in the formation of smog.
- Studies are being undertaken with the use of aircraft to better estimate the role of clouds in cleansing the atmosphere.
- Efforts are continuing to improve the models for determining the transboundary flow of sulphur components.

Oxidants Research Program

An Oxidants Research Program aimed at a clearer understanding of the phenomena associated with the occurrence of atmospheric oxidants in Canada is in progress.

AES is participating in activities which encompass literature reviews of the effects of nitrogen oxides and ozone on receptors, research on the effects of mixtures of oxidants and other contaminants on crop plants, surveys of the spatial distribution of ozone over southwestern Ontario, micro-meteorological measurement of ozone deposition to vegetated surfaces, preparation of standard measurement methodologies for measuring O_3 and NO_2 for the Canadian Standards Association, and development of methods to identify and measure the hydrocarbons which are important in the formation of oxidants.

Environmental Monitoring

In addition to the monitoring networks operating in support of LRTAP, two other monitoring activities associated with the global transport of atmospheric contaminants -particulate matter and carbon dioxide are underway.

- The Canadian Arctic Aerosol Sampling Network was initiated in 1979 as a result of concern for global transport of atmospheric particulate matter and the resulting pollution of the winter Arctic air mass. The light-scattering properties and chemistry of aerosol particles are measured weekly at three locations in the Arctic: Alert, Igloolik and Mould Bay. Results indicate that the Arctic haze observed in winter and early spring is due to acidic particulates originating from more southerly latitudes in North America, Europe and the USSR.

- AES continued to support the WMO (World Meteorological Organization) background carbon dioxide monitoring program by collecting air samples at Sable Island, N.S., and at Alert, N.W.T. The samples are analysed at the Institute of Ocean Sciences (IOS), Department of Fisheries and Oceans, in Sidney, B.C. Collaboration is continuing with IOS in selecting a suitable replacement site on the west coast for Ocean Station PAPA which was terminated in 1981. AES is also participating in the NOAA-GMCC (National Oceanographic and Atmospheric Administration - Geophysical Monitoring for Climate Change) expanded CO_2 monitoring program by collecting samples at Mould Bay, N.W.T. The samples are analysed at the NOAA-GMCC laboratory in Boulder, Colorado.

AES contributes to the departmental environmental impact assessment (EIA) program through the review of the air quality aspects of EIA's. During the 1981/82 fiscal year about 12 EIA documents were reviewed in support of the environmental assessment and review process as well as for other agencies. A number of these reports dealt with oil explorations, some with impacts of radionuclide releases, and others with liquid natural gas shipping on the east and west coasts. A review of the B.C. Hydro Hat Creek thermal power plant EIA led to numerical modelling of the acidic deposition in the snow pack and the snowmelt shock potential of the proposed power plant.

Impact assessment research on air pollution potential in Canada and on development of numerical models for various conditions continued. Of particular note is the Snow Melt Shock Potential model for Eastern Canada which examines the surge in acidity of the runoff during melt periods in the spring when acid-forming pollutants are released from the snow. Another notable model which was developed is the medium range (1000 km) surface trajectory model for tracing the movement of radioactive releases from nuclear reactors. Other initiatives included development of a technique to permit rapid assessment of loss of agricultural fertilizers to the atmosphere, and assessment of forest insecticide spray deposition to forests.

In support of environmental emergency programs, a package of computer programs known as AQPAC was developed for use by AES Regional personnel. The programs contain information on emergency procedures, chemical properties of various toxic substances, as well as a number of models for predicting the movement and ground level concentrations of substances accidentally released to the atmosphere.

AES participated, as a member of the Analysis Group of the Provincial Nuclear Emergency Committee in two simulated nuclear accident exercises related to the Pickering and Bruce Nuclear stations in Ontario. A presentation was also made to the Railway Transportation Committee of the Canadian Transport Commission on hazards associated with heavy gas spills.

Air Quality Criteria Documents

AES continued to provide scientific and technical support to the Federal/Provincial Committee on Air Pollution through its subcommittees on Air Quality Objectives. A criteria digest for ozone in support of the subcommittee review of the ozone objective is underway.

Great Lakes Water Quality Agreement (GLWQA) Program

The 1978 Canada-U.S. Great Lakes Water Quality Agreement 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 deposition rates.

AES has been supporting the GLWQA Program through two separate research projects. The first involves the development of an appropriate methodology for monitoring particulate dry deposition over snow, water and ice surfaces. The second project is designed to estimate the atmospheric input of certain nutrients, heavy metals and organic contaminants through a comprehensive simulation modelling effort. To support this modelling effort a heavy metals dispersion study was done this year.

Saint John Study

In response to an invitation by the New Brunswick Ministry of the Environment (ENB), AES participated in the Saint John air pollution study of July/August 1981. The main purpose of the study was to determine the meteorological conditions which give rise to episodes of high ground level sulphur dioxide (SO_2) pollution concentrations in East Saint John and to determine the sources of the SO_2 emissions.

During the three weeks of the project, several days were observed where the combination of sea breeze circulations and low mixing heights from the marine advection inversion caused poor air quality. The data from these days is being analysed and will be submitted to the Province in 1982. Recommendations for improved pollution control strategies will be made at that time.

Technology Transfer Activities

The AES one-week Air Pollution Meteorology course was offered in French at UQAM (Université de Québec à Montréal) to federal, provincial and industrial representatives and also in English in Toronto.

Work continues on the Atmospheric Interactive Modelling System (AIMS) which consists initially of Gaussian type air pollution models located on a central interactive computer at Dataline Systems Limited in Toronto and which will be accessible to users across Canada.

A limited edition of a seven-volume data set of Canadian Mixing Depth Statistics has been prepared describing maximum mixing heights, wind direction, wind speed and ventilation coefficients for various climatological regions of Canada.

Stratospheric Pollution and Ozone Monitoring

The stratosphere, the layer of the earth's atmosphere which lies typically between an altitude of 10 and 60 kilometres, contains the ozone layer which screens the earth from damaging ultraviolet radiation from the sun. Photochemical model estimates indicate that releases into the atmosphere of chlorine bearing chemicals, such as chlorofluoromethanes, may result in a depletion of this ozone layer which could cause an increase in skin cancer as well as damage to agricultural crops and aquatic food chains.

Major AES activities in this area involve monitoring, consisting of daily measurements of total ozone column at Churchill, Edmonton, Goose Bay, Resolute and Toronto; research, including major stratospheric balloon flights in conjunction with NASA to measure the trace constituents of the stratosphere as input to photochemical models and to validate existing theory; and, predictive modelling in conjunction with York University.

Date Due
