RESEARCH ACTIVITY ON THE LRTAP

ACTIVITÉS DE RECHERCHE SUR LE TGDPA

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A CANADIAN RESEARCH ACTIVITY CATALOGUE
ON
THE LONG-RANGE TRANSPORT OF AIR POLLUTANTS
AND ACIDIC PRECIPITATION

CATALOGUE DES ACTIVITÉS DE RECHERCHE AU CANADA
SUR
LE TRANSPORT À GRANDE DISTANCE DES POLLUANTS ATMOSPHÉRIQUES ET LES PRÉCIPITATIONS ACIDES

THIS CATALOGUE IS AN ASSEMBLY OF LRTAP RESEARCH QUESTIONNAIRES COMPLETED BY FEDERAL AND PROVINCIAL GOVERNMENT AGENCIES, ACADEMIC INSTITUTIONS, AND INDUSTRY.

LE CATALOGUE EST CONSTITUÉ DE QUESTIONNAIRES CONCERNANT LA RECHERCHE SUR LE TGDPA AUXQUELS ONT RÉPONDU LES ORGANISMES DES GOUVERNEMENTS FÉDÉRAL ET PROVINCIAUX, LES ÉTABLISSEMENTS D'ENSEIGNEMENT ET CONSEILS DE RECHERCHE ET LE SECTEUR PRIVÉ.

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Environment Canada
4905 Dufferin Street
Downsview, Ontario
M3H 5T4

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February, 1981 février 1981

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FOREWORD

The long-range transport of air pollutants (LRTAP) and associated "acid rain" has become one of the major environmental problems of this decade. The purpose of this catalogue is to draw together brief overviews of research projects which are underway in Canada to examine the various aspects of this problem. Although work has been underway in several areas for many years, it is in the last few years that a concerted effort has been launched to examine the various components of this complex problem.

In Canada, acid rain research received a major financial boost when the Federal Government approved a substantial increase in LRTAP funds in 1980. Present federal spending approximates $42,000,000. over the four-year period 1980 to 1984, involving several federal departments. Among the provinces, the Ontario Government has the most extensive program with a yearly budget of approximately $5,000,000. The academic and private sectors add further to the total Canadian LRTAP research effort.

This catalogue includes 328 project overviews. The projects are listed according to subject as indicated in the table of contents which follows. Within each subject title the projects are alphabetically listed by surname of the principle investigator. In some cases a section may contain no projects (for example, 2.2.4 Atmospheric Chemistry of Other Compounds). These sections are maintained since the subjects are listed as second priorities in other study areas and secondly, because these sections may contain projects in subsequent catalogues.

Federal LRTAP Liaison Office
February 27, 1981

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Section 1

EMMISSIONS

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Inventory of Anthropogenic Sources and Emissions of Organic Compounds (1976).

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:

Wilfrid Jan
Project Engineer, Emissions Inventory Section
Data Analysis Division

Agency & Department: Environment Canada, EPS, Air Pollution Control Directorate

Address: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

Phone: (819) 997-3354

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 11/80 - 3/81: $45,000.00 (contract only)

Objectives: To prepare an inventory on anthropogenic sources and emissions of organic compounds in Canada, including development of a reactivity classification system.

Method: Will be contracted out to engineering consultant with internal review for technical accuracy.

Anticipated Results: A report will be published upon completion of the contract work.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Emissions Inventory 1975 - 1980

N. B. Power - Sulphur Dioxide

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:

James F. L. Knight

Agency & Department: Environmental Section, New Brunswick Power

Address: 527 King Street
Fredericton, N. B.
E3B 4X1

Phone: (506) 453-3021

Co-operating agencies and investigators (if applicable):

Duration of each phase: 1 month

Approximate Cost (indicate applicable yearly period): $500.00

Objectives:

a) Verify National Emissions Inventory - 1975

b) Record Emissions Levels and Trends by Plant

Method:

Compiled records of monthly fuel useage and chemical analyses. Calculated SO_2 emissions based on 100% conversion of sulphur to SO_2.

Anticipated Results:

Report issued to management and to Environment New Brunswick, Pollution Control Branch.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Inventory of Anthropogenic Sources and Emissions of Fine Particulate Matter (1976)

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:
Tony Kosteltz
Project Engineer, Emissions Inventory Section
Data Analysis Division
Agency & Department: Environment Canada, EPS, Air Pollution Control Directorate

Address: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

Phone: (819) 997-3354

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 10/81 - 3/81: $75,000.00 (Contract only)

Objectives: To prepare an inventory on anthropogenic sources and emissions of fine particulate matter, including particle size distribution profiles and chemical composition of the fine particulates.

Method: Contracted out to SNC/GECO, an engineering consultant, with internal review for technical accuracy.

Anticipated Results: A report will be published upon completion of the contracted work.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Seasonal Variations in Emissions

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:

Tony Kosteltz
Project Engineer, Emissions Inventory Section
Data Analysis Division
Agency & Department: Environment Canada, EPS, Air Pollution Control Directorate

Address: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

Phone: (819) 997-3354

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 10/80 - 3/81: (Salaries) $2,500.00

Objectives: To develop seasonal variations information for the following contaminants: particulate matter, SO_2, NO_x, hydrocarbons, CO.

Method:

a) Review of literature
b) Personal communications
c) Questionnaires (in-house) for any available information.

Anticipated Results: Data will be used as part of the modelling component of the LRTAP program.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The British Columbia Coastal Precipitation Chemistry Study

Subject Code (s) in order of priority:	1.1 2.3.1 2.2.4 2.2.1 2.2.2

Principal Investigator's Name:

Dr. M. S. Kotturi

Agency & Department: British Columbia Ministry of Environment
Air Studies Branch

Address: 765 Broughton Street
Victoria, B. C.
V8W 1E2

Phone: (604) 387-5888

Co-operating agencies and investigators (if applicable): Atmospheric Environment Service
Mr. Steve Nikleva

Duration of each phase:

a) Set-up: 7/80 - 8/80
b) Operation: 9/80 - 8/81

Approximate Cost (indicate applicable yearly period): 7/80 - 8/81: $7,000.00

Objectives:

a) To establish chemistry of Westcoast precipitation.

b) Results would provide the background data which would provide reference assistance in assessing precipitation quality in areas impacted from industrial and other emissions in British Columbia and other parts of Canada.

Method:

a) At 3 sites (Sandspit, Port Hardy and Bamfield) modified Hubbard Brook collectors will be used for event precipitation sampling. At Port Hardy site, event sampling data will be co-related with CANSAP data. Only CANSAP type of data will be collected at Cape St. James.

b) Event sampling analysis will be carried out by the Environmental Laboratory of the Province of British Columbia Ministry of the Environment. Analysis of CANSAP data will be done by the Analytical Laboratories, Water Quality Branch, Canada Centre for Inland Water, Burlington, Ontario

Anticipated Results:

a) Data will be entered into the Ministry of Environment data base.

b) Ministry reports will be issued to the public after internal review.

c) The Ministry of Environment and AES joint report will be published based on meteorological and CANSAP data from AES and event sampling data from the Ministry of Environment.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Precipitation Quality in the Area of Terrace, B. C.

Subject Code (s) in order of priority:	1.1 2.3.1 2.2.4 2.2.1 2.2.2

Principal Investigator's Name:

Dr. M. S. Kotturi

Agency & Department: British Columbia Ministry of Environment
Air Studies Branch

Address: 765 Broughton Street
Victoria, B. C.
V8W 1E2

Phone: (604) 387-5888

Co-operating agencies and investigators (if applicable): Atmospheric Environment Service
Mr. Steve Nikleva

Duration of each phase:

a) Set-up: 5/80 - 8/80
b) Operation: 9/80 - 8/81

Approximate Cost (indicate applicable yearly period): 5/80 - 8/81: $8,000.00

Objectives:

a) The object of the study is to determine the cause of low pH in precipitation at Terrace.

b) To relate chemical species of precipitation to selected meteorological parameters and local emission sources.

Method:

a) At 5 sites (near Port Edward, Salvus, Terrace, Onion Lake and Kitimat), event precipitation sampling will be done using plastic canisters.

b) At Onion Lake, a remote site, a battery activated Sangamo precipitation collector will be used for event sampling

c) The samplers collected at these sites are analyzed for conductivity pH and the ionic constituents (N_a+, K+, Ca++, Mg++, Al+++, cl^-, F^-, NO_3^-, $SO_4^=$) and total acidity.

d) Analysis will be carried out by the Environmental Laboratory of the province of British Columbia Ministry of Environment.

Anticipated Results:

a) Data will be entered into the Ministry of Environment data base.

b) Ministry reports will be issued to the industry and public after internal review.

c) The Ministry of Environment and AES joint report will be published based on meteorological and CANSAP data from AES and event sampling data from Ministry of Environment.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Updating of Regional Emission Inventories

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:

J. Kozak/J. Richmond

Agency & Department: EPS/Dept. of Environment

Address: Bank of Montreal Tower, 16th Floor
5151 George Street
Halifax, N. S.
B3J 1M5

Phone: (902) 426-6132

Co-operating agencies and investigators (if applicable):

a) Environment New Brunswick
b) Newfoundland Dept. of Environment
c) N. S. Dept. of Environment
d) P.E.I. Dept. of Environment
e) Industries in the Atlantic Region

Duration of each phase: 04/80 - 04/81

Approximate Cost (indicate applicable yearly period): 04/80 - 04/81: $600.00

Objectives: To update regional inventories for SO_2 to the end of 1980.

Method:

a) Review of the draft 1976 National Inventory

b) Discussions with provincial agencies and industries to determine available emission data or estimates to the end of 1980. An attempt will be made to determine the accuracy of the data or emissions.

Anticipated Results: The data collected will be used to update the national emission inventory system and provide data for regional modelling for sulphur deposition.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Emission Inventory of SO_2, NO_x and Particulate from NSPC's Thermal Generating Stations (1965-1999)

Subject Code(s) in order of priority: 1.1 1.2

Principal Investigator's Name:

Mr. P. J. LeBlanc

Agency & Department: Nova Scotia Power Corporation

Address: P. O. Box 910
Halifax, N. S.
B3J 2W5

Phone: (902) 424-8503

Co-operating agencies and investigators (if applicable): Mr. P. J. Wright
Interprovincial Engineering Ltd.

Duration of each phase:
a) Data gathering - 6/79 - 2/80
b) Calculation & Report - 8/80 - 9/80

Approximate Cost (indicate applicable yearly period): To 9/80 - $10,000.00

Objectives:
a) The objective of this study is to calculate and document sulphur dioxide, nitrogen oxides and particulate emissions on a yearly basis for NSPC's thermal generating stations for the period 1965-1999.

b) The results of the study will be used for modelling the short range and long range transport of emissions and to assist in establishing emission control strategies and monitoring programs.

Method:
a) Emission data for SO_2 are obtained using fuel consumption and fuel sulphur content.

b) Emission data for NO_x are obtained using US EPA emission factors.

c) Emission data for particulate matter from coal fired generating stations are based on ash analyses and dust collector efficiency.

d) Emission data for particulate matter from oil fired generating stations are based on US EPA emission factors and dust collector efficiency.

e) Emission data for period 1980-1999 are calculated on one of our system planning options which is based on coal as the major fuel for the thermal generating stations.

Anticipated Results:
a) Data obtained in this study will be reviewed and compared to that reported in Environment Canada's National Emission Inventory.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Monitoring Stack Emissions

Subject Code (s) in order of priority:	1.1 1.2

Principal Investigator's Name:

R. G. Orr

Agency & Department: Inco Metals Company

Address: Manitoba Division
Thompson, Manitoba
R8N 1P3

Phone: (204) 677-5374

Co-operating agencies and investigators (if applicable): Manitoba Department of Consumer and Corporate Affairs and the Environment,
Environmental Management Division

Duration of each phase: Since 1970
Since 1974 - summer only - for manual tests
Continuous - Lear Siegler Monitor

Approximate Cost (indicate applicable yearly period):

Objectives:

a) To measure emissions from Smelter

b) To control Cottrell operation.

Method:

a) Manual - sampling with modified EPA train.

b) Lear Siegler Monitor - optical density, calibrated by manual tests.

c) Analysis of dust samples for metals.

Anticipated Results:

a) Results reported annually to Manitoba Environmental Management Division.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Mesure des émissions de mercure provenant de l'exploitation des incinérateurs municipaux.

Code du (des) sujet(s) par ordre de priorité : 1.1

Nom du chercheur responsable :

D. Pilon

Ministère, organisme ou organisme privé, service : Environnement Canada
Service de la protection de l'Environnement
Région du Québec

Adresse: Bureau 410
1550 Maisonneuve Ouest
Montréal, Québec
H3G 1N2

Téléphone: (514) 283-7192

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) :

Durée de chaque phase:
Prélèvements Octobre, Novembre 1980
Analyses Décembre 1980
Rapport préleminaire, Janvier 1981
Rapport final Mars 1981

Coût approximatif (indiquer pour quelle période annuelle): Oct. 1980 - Mars 1981: $16,000.00

Objectifs de travail:

Mesurer les émissions de mercure de 2 incinérateurs municipaux et relier ces émissions aux quantités de déchets alimentés afin d'en arriver, en tenant compte des dispositifs d'épuration utilisés, à un or des facteurs d'émissions applicables à d'autres incinérateurs municipaux à travers le Canada.

Méthode de travail :

Six mesures d'émissions de mercure à l'incinérateur de la Communauté Urbaine de Québec et 6 mesures à l'incinérateur des Carrières de Montréal. Les prélèvements faits selon la méthode normalisée EPS-1-AP-74-1 d'Environnement Canada. Les analyses seront faites selon la méthode décrite dans le document: "Draft modifications to EPS-1-AP-74-1 for mercury determinations".

Une évaluation des quantités de déchets alimentés lors des mesures d'émissions sera faite.

Résultats prévus:

Un rapport final présentera les données recueillies, en fera la synthèse et présentera une évaluation des facteurs d'émissions de mercure applicable à des installations similaires.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Nitrogen Oxides Emissions for Alberta - 1974, 1977, 1979

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:

Dr. H. S. Sandhu
R. R. Peters

Agency & Department: Alberta Environment (Research Management Division)

Address: 9820 - 106 Street
Edmonton, Alberta

Phone: (403) 427-3943

Co-operating agencies and investigators (if applicable):
a) Alberta Environment
b) ERCB
C) Environment Canada

Duration of each phase: a) Data Collection: January 1980 - May 1980

Approximate Cost (indicate applicable yearly period):

Objectives: To collect all available nitrogen oxides emissions data for major industries in Alberta. Evaluate the data and report the emissions of these industries.

Method: Collected emission data from all government monitoring agencies and industries. Evaluate and compile emissions data for a final emission report.

Anticipated Results: Summary of major industrial nitrogens oxides emissions for Alberta. Report to be published by December 1980.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Characterization and Quantification of Natural Emissions of Nitrogen and Mercury Compounds and Hydrocarbons

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:
Arthur Sheffield
Project Engineer, Emissions Inventory Section
Data Analysis Division
Agency & Department: Environment Canada, EPS, Air Pollution Control Directorate

Address: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

Phone: (819) 997-3354

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 9/79-3/81: $50,000.00 (Contracts & Salary)

Objectives: To prepare inventories on natural sources and emissions of nitrogen, mercury and organic compounds in Canada.

Method: Contracted out to the Environmental Applications Group Ltd., an engineering consultant, with internal review for technical accuracy.

Anticipated Results: A report for each of nitrogen, mercury and organic compounds will be available by mid-1981.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Inventory of Anthropogenic Sources and Emissions of Mercury (1978)

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:
Arthur Sheffield
Project Engineer, Emissions Inventory Section
Data Analysis Division
Agency & Department: Environment Canada, EPS, Air Pollution Control Directorate

Address: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

Phone: (819) 997-3354

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 5/80 - 8/81 (Salaries - $8,000.00)

Objectives: To update the 1970 inventory of man-made sources and emissions of mercury in order to provide a more recent data base for LRTAP activities.

Method: In-house development of inventory by literature review and personal communications.

Anticipated Results: A draft report will be available for comments by the provincial regulatory agencies in early 1981. A final publication will be issued by the fall of 1981.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Characterization and Quantification of Natural Emissions of Particulate Matter

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:

Arthur Sheffield
Project Engineer, Emissions Inventory Section
Data Analysis Division

Agency & Department: Environment Canada, EPS, Air Pollution Control Directorate

Address: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

Phone: (819) 997-3354

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 9/80 - 1/81: $18,000.00 (Contract only)

Objectives: To prepare an inventory on natural sources and emissions of particulate matter in Canada.

Method: Contracted out to the Environmental Applications Group, an engineering consultant, with internal review for technical accuracy.

Anticipated Results: A report will be published upon completion of the contracted work.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Characterization and Quantification of Natural Emissions of Sulphur Compounds

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:

Arthur Sheffield
Project Engineer, Emissions Inventory Section
Data Analysis Division

Agency & Department: Environment Canada, EPS, Air Pollution Control Directorate

Address: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

Phone: (819) 997-3354

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 10/78-2/80: $25,000 (Contract & Salary)

Objectives: To prepare an inventory on natural sources and emissions of sulphur compounds in Canada.

Method: Contracted out to the Environmental Applications Group Ltd., engineering consultant, with internal review for technical accuracy.

Anticipated Results: A report is presently available in published form (Report EPS 3-AP-79-2, Air Pollution Control Directorate, Environment Canada, February 1980).

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Particulate and Sulphur Dioxide Sampling of Emission from Oil Fired Generating Plant

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:

Judith M. Skidmore

Agency & Department: Newfoundland and Labrador Hydro
Environmental Services

Address: P. O. Box 9100
St. John's, Newfoundland
A1A 2X8

Phone: (709) 737-1400

Co-operating agencies and investigators (if applicable):

a) Department of Environment, St. John's.
b) Environmental Protection Service, St. John's.

Duration of each phase:

a) Set up 08/79.
b) Data collection 09/79 to at least 12/83.

Approximate Cost (indicate applicable yearly period): Direct and indirect, $12,000.00.

Objectives:

a) The objective is to measure particulate and SO_2 emission from main generation point for comparison with Provincial and Federal standards.

Method:

a) Sampling at 2 sites, 2 km and 6 km from the 450 MW plant, one high volume particulate sampler and one SO_2 monitor (Philips).
b) Hi-Vol sampler is on 6 day sample cycle, analysis done in-house.
c) SO_2 sampler (ug/m^3) is collected on hourly basis.
d) Results submitted regularly to Provincial Dept. of Environment.

Anticipated Results:

a) Data will be evaluated by Provincial Environment.
b) An inhouse report will indicate levels and trends of emission with meteorological and load factors considered, and data application to theoretical model computed in 1976.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Origin and Fate of Emissions of Sulfur Compounds from Petroleum Refineries - A Literature Review
Pace Report No. 80 - 2

Subject Code (s) in order of priority:	1.1 2.2.1 2.4.1 2.4.2 2.5 (1 - 4)

Principal Investigator's Name:

United Technology and Science Inc.
Toronto

Agency & Department: PACE

Address: Suite 400, 130 Albert Street
Ottawa, Ontario
K1P 5G4

Phone: (613) 236-9122

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives:

Method:

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:
Gridded NO_x Emissions Inventory

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:

Frank Vena, Pollution Data Analysis Division

Agency & Department: Environment Canada, EPS, Air Pollution Control Directorate

Address: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

Phone: (819) 997-3354

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 4/80 - 03/81: $2,000.00 (O&M + salaries)

Objectives: To prepare an updated (1976-79) NO_x emissions inventory for Canada on a 127 km grid basis as required by the modelling component of the LRTAP program

Method:

a) Point sources (large commercial/industrial establishments) are located within each specific grid cell (lat.-long. coordinates).

b) Area sources within each specific grid cell are agglomerated and presented as total NO_x emissions from each grid cell.

Anticipated Results: Canadian NO_x emissions inventory (1976-79) data) on a 127 km grid, in computer compatible format and in map form.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Gridded SO_2 Emission Inventory

Subject Code (s) in order of priority: 1.1

Principal Investigator's Name:
F. Vena
Head, Emissions Inventory Section
Data Analysis Division
Agency & Department: Environment Canada, EPS, Air Pollution Control Directorate

Address: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

Phone: (819) 997-3354

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 4/80 - 03/81: (O&M + Salaries) $10,000.00

Objectives: To prepare an updated (1976 - 79) SO_2 emissions inventory for Canada on a 127 km grid basis as required by the modelling component of the LRTAP program.

Method:

a) Point sources (large commercial/industrial establishments) are located within each specific grid cell (lat.-long. coordinates).

b) Area sources within each specific grid cell are agglomerated and presented as total SO_2 emissions from each grid cell.

Anticipated Results: Canadian SO_2 emissions inventory (1976-79 data) on a 127 km by 127 km grid, in computer compatible format and in map form.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Fluid Bed Mechanisms

Subject Code (s) in order of priority: 1.2

Principal Investigator's Name:

F. D. Friedrich

Agency & Department: Canada Centre for Mineral and Energy Technology
Department of Energy, Mines and Resources

Address: 555 Booth Street
Ottawa, Ontario
K1A 0G1

Phone: (613) 996-4570 Ext. 185

Co-operating agencies and investigators (if applicable): Queen's University

Duration of each phase: Start 1979 - Completion 1984

Approximate Cost (indicate applicable yearly period): 1980 $110K in contracts

Objectives: To elucidate the mechanisms of in-situ sulphur and nitric oxide neutralization during combustion using additives to the coal feed and by changes in combustion parameters.

Method:

a)	Acquisition of instrumentation.	May	1980
b)	Purchase and installation of CCRL-designed fluid-bed.	July	1980
c)	Debugging trials.	Oct.	1980
d)	Trials with two coals including one with limestone.	April	1981
e)	Rig modifications.	July	1981
f)	Trials with two coals including one with limestone.	April	1982

Anticipated Results: An in-depth study of the chemistry of SO_x and NO_x emissions and neutralization with limestone in fluid-bed combustion.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Pilot-Scale Fluid Bed

Subject Code (s) in order of priority: 1.2

Principal Investigator's Name:

F. D. Friedrich

Agency & Department: Canada Centre for Mineral and Energy Technology
Department of Energy, Mines and Resources

Address: 555 Booth Street
Ottawa, Ontario
K1A 0G1

Phone: (613) 996-4570 Ext. 185

Co-operating agencies and investigators (if applicable):

Duration of each phase: Start 1976 - Completion 1984

Approximate Cost (indicate applicable yearly period): 1980 $180K in-house
$ 35K in contracts

Objectives:

To develop and extrapolate fluid-bed technology to burn low-grade Canadian coals and coal rejects in steam generating and process heat applications under acceptable environmental conditions.

Method:

a)	Install and debug Mark 2 FBC at CCRL.	Sept. 1980
b)	Burn trials with two coals in Mark 2 FB.	Apr. 1981
c)	Burn trials with two coals in Mark 1 FB.	June 1980
d)	Reports (3) on Mark 1 trials.	Oct. 1980
e)	Liaise with contracting parties under IEA agreement for FB data exchange.	Apr. 1984
f)	Preliminary tests with feasibility of ΔT diagnostics.	Oct. 1980
g)	Contract on coal feeder trials.	Oct. 1980

(N.B. All burn trials include monitoring of SO_x and NO_x. The effect of limestone addition will be determined on high sulphur coals.)

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Summerside Fluid-Bed

Subject Code (s) in order of priority: 1.2

Principal Investigator's Name:

F. D. Friedrich

Agency & Department: Canada Centre for Mineral and Energy Technology
Department of Energy, Mines and Resources
Address: 555 Booth Street
Ottawa, Ontario
K1A 0G1

Phone: (613) 996-4570 Ext. 185

Co-operating agencies and investigators (if applicable): Department of National Defence
Dominion Bridge
Foster Wheeler

Duration of each phase: Start 1976 - Completion 1984
Total Cost $10 M

Approximate Cost (indicate applicable yearly period): 1980 $ 32K in-house
$930K on contracts

Objectives:

To design and demonstrate the feasibility of FBC technology for steam raising using Maritime coals and wood at CFB Summerside.

Method:

a) Pilot-scale evaluation of design coal and limestone for input into Phase 3 contracts. March. 1980

b) Two Phase 3 contracts for detail engineering designs and obtain firm price proposals. Dec. 1980

c) Selection of Phase 4 construction. Feb. 1981

d) Develop work statement for demo combustion program for Phase 5. Dec. 1982

e) Liaise with DCL/DND during project management of Phase 4 construction at Summerside. Feb. 1983

f) Phase 5 demonstration of feasibility. Apr. 1984

g) Second boiler specification and installation. Feb. 1986

Anticipated Results:

A fluid-bed unit capable of burning high sulphur coal with limestone addition to produce low NO_x and SO_x emissions.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Bitumen/Heavy Oil and Processed Product Characterization and End Use Assessments

Subject Code (s) in order of priority: 1.2

Principal Investigator's Name:

Dr. A. E. George
Dr. M. Ternan

Agency & Department: Canada Centre for Mineral and Energy Technology
Department of Energy, Mines and Resources

Address: 555 Booth Street
Ottawa, Ontario
K1A 0G1

Phone: (613) 996-4570

Co-operating agencies and investigators (if applicable): Petro-Canada/Lummus Canada Limited

Duration of each phase: Start 1979 - Completion 1982

Approximate Cost (indicate applicable yearly period): 1980 $500K

Objectives: Several projects are involved within this general activity which include investigations on chemical composition and removal of sulphur and nitrogen compounds from bituman/ heavy oils as part of the overall activity.

Method:

a) Report on the effect of hydrocracking on sulphur-type distribution

b) Report on catalytic desulphurization of pitch.

c) Reports on the use of sorbents for the removal of nitrogenous compounds from hydrocracked bitumen and heavy oils.

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Capture-Fixation of SO_2 from Dilute Smelter Gases

Subject Code (s) in order of priority:	1.2 1.1

Principal Investigator's Name:

C. A. Hamer

Agency & Department: Canada Centre for Mineral and Energy Technology
Department of Energy, Mines and Resources

Address: 555 Booth Street
Ottawa, Ontario
K1A 0G1

Phone: (613) 995-4114

Co-operating agencies and investigators (if applicable):

Duration of each phase: Fiscal Year 1980

Approximate Cost (indicate applicable yearly period): $50K Internal, up to $90K Contract

Objectives: To evaluate processing options for the capture and disposal of SO_2 from smelter gases.

Method:

a) Literature survey of flue gas desulphurization processes.

b) Compile sulphur mass balance sheets for Canadian smelters.

c) Prepare capital and operating cost estimates for the most practical and economical flue gas desulphurization process(es) to treat smelter off-gases. To be contracted out.

Anticipated Results:

a) A reasonable cost estimate of the flue gas desulphurization option for treating smelter off-gas.

b) The study will be available to government and industry for social and economic impact studies.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Automobile and Truck Fuel Economy

Subject Code (s) in order of priority: 1.2

Principal Investigator's Name:

A. C. S. Hayden

Agency & Department: Canada Centre for Mineral and Energy Technology
Department of Energy, Mines and Resources

Address: 555 Booth Street
Ottawa, Ontario
K1A 0G1

Phone: (613) 996-4570 Ext. 182

Co-operating agencies and investigators (if applicable): Automobile Manufacturers
Environment Canada
Ministry of Transport

Duration of each phase: Start 1977 - Completion 1984

Approximate Cost (indicate applicable yearly period): 1980 $20 K in-house
$100 K in contracts

Objectives:

To determine the influence of Canadian climatic conditions, new engine technology, deteriorating fuel quality and substitute fuels on fuel economy.

Method:

a) Evaluation of fuel economies and emissions for improved spark ignition engines fueled by leaded gasoline.

b) Evaluation of fuel economies of new model diesel automobiles.

c) Evaluation of the effects of increased aromatics in, and alcohol additions to, diesel fuel.

d) Fuel economy evaluation of innovative engine technologies.

(N.B. All evaluations include emissions testing.)

Anticipated Results:

a) Completion of road evaluations with lead traps. Oct. 1980

b) Two reports per year on evolving engine technology and degrading fuel quality until 1984.

c) Current awareness of engine performance using gasohol. Apr. 1982

d) One report on engine performance using propane. Apr. 1982

e) One report on engine performance using diesel/alcohol. Apr. 1983

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Residential Space Heating

Subject Code (s) in order of priority: 1.2

Principal Investigator's Name:

A. C. S. Hayden

Agency & Department: Canada Centre for Mineral and Energy Technology
Department of Energy, Mines and Resources

Address: 555 Booth Street
Ottawa, Ontario
K1A 0G1

Phone: (613) 996-4570 Ext. 182

Co-operating agencies and investigators (if applicable):

Duration of each phase: Start 1978 - Completion 1983

Approximate Cost (indicate applicable yearly period): $32K 1980

Objectives: To evaluate performance and safety characteristics of wood stoves and furnaces for inclusion in standards and to assess effect of various woods and solid fuel substitutes on efficiency and pollution.

Method:

a) Evaluate performance of methanol in No. 2 oil furnaces.

b) Evaluate four stoves, three fireplace inserts and a wood boiler.

(Note: All evaluations include measurements of pollutants.)

Anticipated Results:

a) Publish report showing influence of stove design on combustion performance.

b) Input to CSA and ULC standards on wood-fired appliances and their installation.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Control of Combustion Products

Subject Code (s) in order of priority: 1.2, 2.1.1, 4.0

Principal Investigator's Name:

G. K. Lee

Agency & Department: Canada Centre for Mineral and Energy Technology
Department of Energy, Mines and Resources

Address: 555 Booth Street
Ottawa, Ontario
K1A 0G1

Phone: (613) 996-4570 Ext. 181

Co-operating agencies and investigators (if applicable): International Energy Association
Canadian Electrical Association
Environment Canada

Duration of each phase: Start 1978 - Completion 1985

Approximate Cost (indicate applicable yearly period): 1980 $100 K in-house
$120 K in contracts

Objectives:

To minimize emissions from conventional coal combustion through control of flame properties, chemical additives, burner design and flue gas clean-up. Pollutants of interest are SO_x, NO_x, fly-ash and trace elements.

Method:

In cooperation with industry and above agencies, development work and tests will be conducted to reduce NO_x and SO_x from thermal power combustion.

a) Demonstration testing of low NO_x burners at Nanticoke to reduce NO_x by 50%.

b) Screening of seven Canadian coals in IEA low NO_x burners in U.S.

c) Testing of limestone addition to coal for SO_x reduction.

Anticipated Results:

a) The above will be on-going beyond 1980.

b) A report will be issued consolidating CANMET's work since 1969 on plume dispersion spread.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Control of Toxic Pyrometallurgical Emissions

Subject Code (s) in order of priority:	1.2 1.1

Principal Investigator's Name:

Dr. P. Pint

Agency & Department: Canada Centre for Mineral and Energy Technology
Department of Energy, Mines and Resources

Address: 555 Booth Street
Ottawa, Ontario
K1A 0G1

Phone: (613) 995-4798

Co-operating agencies and investigators (if applicable): Environment Canada, MOE
Non-Ferrous Smelting Industry

Duration of each phase: Start April 1979 - Complete December 1985

Approximate Cost (indicate applicable yearly period): 1980 $90K in-house

Objectives: To provide fundamental data on the form and distribution of the major toxic elements encountered in Canadian non-ferrous pyrometallurgical processes and to develop and evaluate economically attractive methods for controlling these emissions.

Method:

a) A literature survey will be produced summarizing the available data on mercury emissions from pyrometallurgical operations throughout the world, and the status of pollution abatement technologies for controlling these emissions.

b) Investigations will be carried out by August 1981 to determine the form and distribution of mercury and associated pollutants in at least two Canadian pyrometallurgical circuits (2 reports).

c) A report will be produced by 1981 on the laboratory scale development and evaluation of one pollution abatement concept for mercury.

d) Flow sheets and mass balances for toxic elements.

Anticipated Results:

a) Development of a high temperature Hg scrubber.

b) An understanding of the distribution and chemistry of toxic elements pyrometallurgical processes, e.g., to develop models to anticipate the behaviour of new ore bodies.

c) Characterization of toxic elements in concentrates and off gas particulates.

d) Development of analytical methods.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Coal Preparation

Subject Code (s) in order of priority: 1.2

Principal Investigator's Name:

Dr. B. J. P. Whalley

Agency & Department: Canada Centre for Mineral and Energy Technology
Department of Energy, Mines and Resources

Address: 555 Booth Street
Ottawa, Ontario
K1A 0G1

Phone: (613) 996-4570 Ext. 186

Co-operating agencies and investigators (if applicable): Canadian Coal Producers
Warnock Hersey

Duration of each phase: Start 1982 - Completion 1985

Approximate Cost (indicate applicable yearly period): 1980 $250K in-house
Est. $ 85K in contracts

Objectives:

To contribute to the technology of economically upgrading coal to reduce dependence on oil, reduce transportation costs, to improve end-use, and to reduce environmental pollution.

Method:

Part of this project will include:

a) An investigation of the removal of pyrite from coals by high gradient magnetic separation.

b) A preliminary technical evaluation of chemical comminution for releasing fine pyrite coals.

c) Studies on various physical coal cleaning processes.

Anticipated Results:

Reports will be issued on the work as it progresses.

Section 2

ATMOSPHERIC

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Diffusion Characteristics of the Boundary Layer in Central Alberta

Subject Code (s) in order of priority: 2.1.1

Principal Investigator's Name:

R. P. Angle

Agency & Department: Air Quality Control Branch
Alberta Environment

Address: 9820 - 106 Street
Edmonton, Alberta
T5K 2J6

Phone:

Co-operating agencies and investigators (if applicable):

Duration of each phase: Ongoing until 1985

Approximate Cost (indicate applicable yearly period):

Objectives: To develop a climatology of:
a) inversion height and strength
b) mixing layer thickness
c) growth rates
d) the three components of turbulence
e) stability
f) wind profiles
g) net radiation
h) albedo

Method: At a station south of Edmonton, a monostatic SODAR is operated continuously. During the middle month of each season up to five temperature and wind profiles are obtained each weekday using a balloonborne minisode tracked by one or two optical theodolites. Vertical turbulence and heat flux are also recorded. Other continuous measurements include: wind speed and direction at two levels on a 20 m tower, delta-T, incoming, outgoing and net radiation, surface pressure, crosswind and along wind turbulence, surface temperature.

Anticipated Results: Statistics on boundary layer structure and evolution complete with joint frequency distributions of the atmospheric variables which drive diffusion models.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Boundary Layer Aspects of LRTAP

Subject Code(s) in order of priority: 2.1.1 2.3.2

Principal Investigator's Name:

Boundary Layer Research Division

Agency & Department: Atmospheric Environment Service

Address: 4905 Dufferin St.,
Downsview, Ontario
M3H 5T4

Phone: (416) 667-4789

Co-operating agencies and investigators (if applicable):

Duration of each phase: Continuing

Approximate Cost (indicate applicable yearly period): 1/4/80-1/4/81: $15K

Objectives:

a) To understand the Boundary Layer processes leading to the deposition of pollutants.

Method:

a) Experimental studies of boundary layer.

b) Special deposition seniors.

Anticipated Results:

Better parameterization procedures for dry deposition processes.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Airshed Management System - Model Development

Subject Code (s) in order of priority: 2.1.1, 2.1.2, 2.3.2

Principal Investigator's Name:
Intera Environmental Consultants Ltd. (D. S. Davison), Calgary
Western Research and Development (M. Davies)
(Funded by Alberta Environment)
Agency & Department: Alberta Environment (Research Management Division)

Address: 15th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta

Phone: (403) 427-3943

Co-operating agencies and investigators (if applicable):

Duration of each phase:
a) Phase I - completed 5/80
b) Phase II - 3/81
c) Phase III - 3/82

Approximate Cost (indicate applicable yearly period):
a) $130,000.00
b) $120,000.00
c) $150,000.00 (Approx.)

Objectives:

a) Develop and validate Gaussian frequency distribution model for AOSERP Study Area.

b) Test and verify complex terrain/complex meteorology models for Study Area.

c) Demonstrate model applications in identifying areas of concern under scenarios of industrial development.

Method:

a) Develop frequency distribution model incorporating site specific meteorology, dispersion data and emission characteristics.

b) Perform sensitivity tests to determine output variability as a function of alternative parameterization formulations.

c) Validate Gaussian model with observed air quality monitor data.

d) Identify meteorological situations where model fails to perform, recommend suitable alternative models, validate such models and recommend specialized data collection requirements.

e) Develop and implement simple dry gaseous deposition formulation to estimate local fluxes.

Anticipated Results:

a) Models to be useful for scenario assessment and integration of AOSERP data base.

b) Analysis of niteorological conditions, their frequency and impact on local air quality.

c) Objective basis to justify resource development scenarios.

d) Model input to interdisciplinary studies (water quality model, bio-monitoring).

LRTAP ACTIVITY DESCRIPTION

Activity Title:

INCO - Thompson Dispersion Study

Subject Code (s) in order of priority: 2.1.1 2.1.2

Principal Investigator's Name:

M. Hirt

Agency & Department: M. E. P. Company

Address: Downsview, Ontario

Phone: (416) 661-4960

Co-operating agencies and investigators (if applicable): INCO Metals Company

Duration of each phase: February 1977 - February 1978

Approximate Cost (indicate applicable yearly period): $45,000.00

Objectives: To model distribution of SO_2 from Thompson Smelter Stack

Method:

a) Mini-Sonde soundings twice daily for one year.

b) Computerized analysis of Mini-Sonde and other data from airport to indicate wind frequencies, stability, etc.

c) Modelling using MEP model of anticipated SO_2 dispersion characteristics.

Anticipated Results: Report produced in March 1979 showing modelling results and interpretation.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Air Pollution Dispersion Modelling

Subject Code (s) in order of priority:	2.1.1 2.1.2

Principal Investigator's Name:

Mr. G. J. Lajeunesse

Agency & Department: Nova Scotia Power Corporation

Address: P. O. Box 910
Halifax, N. S.
B3J 2W5

Phone: (902) 424-2982

Co-operating agencies and investigators (if applicable):

Duration of each phase: Project will be completed by mid-1981

Approximate Cost (indicate applicable yearly period): $50,000.00

Objectives: To develop air pollution dispersion models for use in estimating the contribution of existing and future power plants to the ambient air quality and problem of acid rain in the near and far fields.

Method:

a) Near field and far field air quality models will be surveyed to determine those suitable for use in modelling the impact of existing and future thermal power generating plants.

b) The models will then be modified as required and installed on Nova Scotia Power Corporation's computer.

c) These models will be tested using existing emission and meteorological data.

Anticipated Results: Data will be reviewed and will be considered in future plant siting, plant expansion and coal conversion.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Application of a LRTAP Statistical Model to Eastern North America

Subject Code (s) in order of priority: 2.1.1, 2.1.2

Principal Investigator's Name:

Dr. A. Ryan
Dr. A. C. McMillan
Dr. S. Dutta

Agency & Department: Ontario Hydro
Research Division

Address: 800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

Phone: (416) 231-4111 Ext. 6866

Co-operating agencies and investigators (if applicable): Dr. B. Fisher, CEGB
Leatherhead,
Surrey, U. K.

Duration of each phase: Completion by June 1981

Approximate Cost (indicate applicable yearly period): June 1980 - June 1981 -- $10,000.00

Objectives: Estimate ambient concentrations and deposition of SO_2 and $SO_4^=$ in eastern North America.

Method:

a) Adapt B. Fisher's statistical model to eastern North America

b) The SURE emissions inventory and that of AES (Eva Volner) along with estimated meteorological averages will be used as input to the model.

Anticipated Results: A report will be issued documenting results.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Coordination and Review of DOE LRTAP Scientific Program Atmospheric Component

Subject Code (s) in order of priority: 2.1.1

Principal Investigator's Name:

Dr. Douglas M. Whelpdale

Agency & Department: Environment Canada
Atmospheric Environment Service, AQRB

Address: 4905 Dufferin St.,
Downsview, Ontario
M3H 5T4

Phone: (416) 667-4785, 4793

Co-operating agencies and investigators (if applicable):

Duration of each phase: Throughout Federal LRTAP Program

Approximate Cost (indicate applicable yearly period): 04/01/80 - 03/31/81: $70,000.00

Objectives: To lead, coordinate and review the atmospheric portion of the DOE LRTAP Program.

Method:

a) Plan and review program within AES and DOE.

b) Coordinate atmospheric programs with other agencies in Canada and in other countries.

c) Report to program and DOE management.

d) Provide information from atmospheric program to other program components and users.

e) Contract work on NO_x review and Pb deposition.

Anticipated Results:

a) Technical and program briefings

b) Scientific reports and papers

c) Status reports

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Analyse des Concentrations d'Ozone

Code du (des) sujet(s) par ordre de priorité :	2.1.2 2.1.3 2.2.3

Nom du chercheur responsable :

Conrad East.

Ministère, organisme ou organisme privé, service : Université du Québec à Montréal
Centre de recherches en sciences de l'environnement
(C.E.R.S.E.)

Adresse: C. P. 8888
Montréal, Québec
H3C 3P8

Téléphone: (514) 282-8201

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Réal Thivierge (CERSE)
Robert Catalfamo (CERSE)

Durée de chaque phase: Trois Ans (1977 - 80)

Côut approximatif (indiquer pour quelle période annuelle):

$15,000.00/an

Objectifs de travail:

a) Déterminer l'origine lointaine ou locale des concentrations d'ozone à Montréal.

b) Déterminer la distribution spatiale de l'ozone au sol, en ville et en banlieve.

c) Definir une relation empirique entre les concentrations d'ozone et celles de monoxyde d'azote.

Méthode de travail :

a) Corrélation entre les concentration horaires d'ozone avec la direction des vents.

b) Analyse des trajectoires de l'air associees aux conc. élevées d'ozone.

c) Relevé des conc. instantanées d'ozone et de monoxyde d'azote en station mobile, en ville et enbanlieve.

Résultats prévus: Voir les trois rapports ci-joints.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Meteorological Data Acquisition System

Subject Code (s) in order of priority:	2.1.2 2.1.3

Principal Investigator's Name:

Joel Kurtz

Agency & Department: Ontario Ministry of the Environment
Air Resources Branch

Address: Air Quality & Meteorology Section
880 Bay St., 4th Floor
Toronto, Ontario
M5S 1Z8

Phone: (416) 965-5068

Co-operating agencies and investigators (if applicable):

Duration of each phase: System implementation to be complete by 12/80.

Approximate Cost (indicate applicable yearly period): Fiscal 1980 - $60,000.00

Objectives: Design and implementation of a mini-computer-based meteorological acquisition and analysis system.

Method: By implementing existing software and preparing new software to perform data acquisition (from Environment Canada) and analysis functions on ECLIPSE mini-computer.

Anticipated Results: An operational system by December 1980.

This system will make available to the analyst observed and analyzed meteorological information required for acid precipitation studies. In particular, the system will facilitate the generation of air parcel trajectories for precipitation events in order to determine the relative importance to the precipitation chemistry of various source regions.

LRTAP ACTIVITY DESCRIPTION

Activity Title:
Analysis of Pollutant Trajectory Statistics

Subject Code (s) in order of priority:	2.1.2

Principal Investigator's Name:

Dr. Barbara E. Ley

Agency & Department: Ontario Ministry of the Environment
Air Resources Branch

Address: 880 Bay St., 4th Floor
Toronto, Ontario
M5S 1Z8

Phone: (416) 965-5068

Co-operating agencies and investigators (if applicable):
Dr. Akula Venkatram
Air Resources Branch
Ontario Ministry of the Environment

Duration of each phase:
a) Method Development: 6/80 - 12/80
b) Operation: 10/80 to at least 6/81

Approximate Cost (indicate applicable yearly period): 6/80 - 3/81: $10,000.00

Objectives:
To determine the statistics (x, y, o_x, o_y) of pollutant trajectories for major emittors in northeastern North America.

Method:
a) An objective analysis method using 2-D orthogonal polynomials for mean sea level (msl) geostrophic winds has been implemented.
b) The relationship of msl geostrophic winds and "advecting" wind will be studied and the geostrophic winds adjusted appropriately.
c) Monthly, seasonal and yearly trajectory statistics will be calculated from the trajectories generated.

Anticipated Results:
Monthly, seasonal and yearly trajectory statistics for major emittors in northeastern North America.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Structure Spatio-Temporelle de la Précipitation

Code du (des) sujet(s) par ordre de priorité : 2.1.2 2.5.1

Nom du chercheur responsable :

I. Zawadzki

Ministère, organisme ou organisme privé, service : UQAM

Adresse: 1200 St. Alexandre, Montréal, Québec

Téléphone: (514) 282-3320

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : R. R. Rogers McGill University

Durée de chaque phase:

Côut approximatif (indiquer pour quelle période annuelle):

Objectifs de travail:

Méthode de travail : Un analyse des probabilitiés conjoutes de l'intensité de la pluie a été faite pour applications à des modéles de transport des polluants que tienent comple du balayage des polluants par la précipitation.

Résultats prévus:

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Calcul du mouvement vertical à l'échelle synoptique

Code du (des) sujet(s) par ordre de priorité :	2.1.2 2.5.3 2.1.3

Nom du chercheur responsable :

M. Peter Zwack

Ministère, organisme ou organisme privé, service : Département de Physique
Université du Québec à Montréal

Adresse: C. P. 8888, Succ. A
Montréal, Québec

Téléphone: (514) 282-3326

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) :

Durée de chaque phase:
a) Vérification expérimentale du modèle général 80/10 - 81/4.
b) Vérifier les simplifications possible afin d'utiliser les observations horaires 81/5 - 82/4.
c) Implantation du modèle final au Centre de prévision du Qué.

Côut approximatif (indiquer pour quelle période annuelle): 82/5 - 83/4

80/10-81/4: $15,000.00 81/5-82/4: $25,000.00 82/5-83/4: $25,000.00

Objectifs de travail:

Calculer le mouvement vertical à l'échelle synoptique afin de mieux;
a) calculer les trajectoires de l'air à longue distance.
b) comprendre la distribution des nuages et des précipitations.

Méthode de travail :

a) Améliorer les modèles diagnostiques basés sur la théorie quéorie quasi-géostrophique en introduisant la tendence de pression au niveau du sol.

b) Vérification expérimentale du modèle en comparant à la distribution des nuages et de la précipitation.

c) Examiner la prévision du calcul en utilisant seulement les observations horaires.

Résultats prévus:

Les modèles calculeront:

a) le mouvement vertical, exactement à chaque 12 heures.

b) un bon estimé du mouvement vertical dans la basse atmosphère (premier 3 km) chaque heure.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Minisonde Data Collection at Lingan Generating Station

Subject Code (s) in order of priority: 2.1.3 2.1.2

Principal Investigator's Name:

Mr. G. J. Lajeunesse

Agency & Department: Nova Scotia Power Corporation

Address: P. O. Box 910
Halifax, N. S.
B3J 2W5

Phone: (902) 424-2982

Co-operating agencies and investigators (if applicable): Mr. E. Brandon
Atmospheric Environment Service

Duration of each phase: To be completed Fall 1980

Approximate Cost (indicate applicable yearly period): $20,000.00

Objectives:

To collect minisonde data for a two-week period during each season of the year at Lingan Generating Station, Lingan, Nova Scotia.

Method:

a) A helium-filled balloon is launched carrying a fast-response temperature sensing device and a transmitter which sends a continuous record of the atmospheric temperature to a receiver which records it on a calibrated moving chart.

b) The balloon is tracked by two theodolites which are located at each end of base line, located perpendicular to the wind direction.

Anticipated Results:

The minisonde data will be analysed for the purpose of incorporating realistic daily mixing heights into the Nova Scotia Power Corporation CRSTER Model.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Aircraft Sampling of Acid Rain Related Pollutants

Subject Code (s) in order of priority:	2.2.1 2.2.2 2.2.3 2.2.4

Principal Investigator's Name:

Kurt Anlauf

Agency & Department: Dept. of Environment, Atmospheric Environment Service

Address: 4905 Dufferin St., Downsview, Ontario

Phone: (416) 667-4794

Co-operating agencies and investigators (if applicable):

A. Wiebe (AES)
P. Fellin (AES)
B. Schroeder (AES)

Duration of each phase: July 15 - Aug. 15, 1980 (Aircraft measurements)

Approximate Cost (indicate applicable yearly period): $20K (Cap) & $70K (O&M)

Objectives: To measure atmospheric concentrations of acid rain related pollutants.

Method: Aircraft sampling under specific meteorological conditions using teflon filters and gaseous pollutant analyzers.

Anticipated Results: Atmospheric concentrations of acid rain related pollutants will be correlated with specific meteorological conditions and modelling calculations will attempt to duplicate the measured concentrations.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Measurement of Plume Constituents and Chemical Raction Rates in the AOSERP Study Area

Subject Code (s) in order of priority:	2.2.1 2.2.2 3.5

Principal Investigator's Name:

Dr. J. W. Bottenheim

Agency & Department: Alberta Environment (Research Management Division)

Address: 15th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta

Phone: (403) 427-3943

Co-operating agencies and investigators (if applicable):

a) Alberta Environment (H. S. Sandhu)
b) Intra Environmental Consultants Ltd. (K. Grandia)
c) Alberta Research Council (J. M. Gray)
d) University of Alberta, Hydrocarbon Research Centre (O. P. Strausz)

Duration of each phase:

a) data collection 1/80, 3/80, 6 - 7/80
b) analysis & report to 11/80

Approximate Cost (indicate applicable yearly period): 1/80, 3/80: $50,000.00
6 - 7/80: $45,000.00

Objectives:

To collect data on plumechemistry (SO_2, NO_x, O_3, Hydrocarbons) and to verify and validate plume chemistry models, in particular with respect to transformation of $SO_2 \rightarrow$ sulphate and $NO/NO \rightarrow$ nitrate, and the formation of excess ozone.

Method:

Data collection by instrumented fixed-wing aircraft (Intera) (continuous NO_x, O_3, SO_2, rel. hum., temp.; filterpack and hivol sampling for particulate - HNO_3 - SO_2; grab sampling in Tedlar bags for hydrocarbons). Filter analysis by ion chromatography (A.R.C.). Hydrocarbon analysis for light HC by gaschromatography (H.R.C.). Overall chemical data analysis and mechanistic verifications by computer modelling, using separately developed Reactive Plume Model (H.R.C.)

Anticipated Results:

a) Confirmation on SO_2 oxidation rates as function of season and time of day.
b) Theory on excess ozone formation tested with experimental data.
c) Information on $NO_x \rightarrow$ nitrate conversion.
d) Data base on light hydrocarbons in the AOSERP study area.
e) Verification of chemically Reactive Plume Model.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Preparation of a Map Indicating Sensitivity of Alberta Soils to Sulphur Impingement

Subject Code (s) in order of priority: 2.2.1

Principal Investigator's Name:

Dr. N. Hollowaychuk
Funded by Alberta Environment and Canadian Petroleum Assoc.

Agency & Department: Alberta Research Council

Address: Soils Division
Alberta Research Council
11315 - 87 Avenue
Edmonton, Alberta

Phone:

Co-operating agencies and investigators (if applicable): Alberta Environment
Canadian Petroleum Association (50:50 interest)
(J. D. Lindsay)

Duration of each phase: 1979 - 1980

Approximate Cost (indicate applicable yearly period): $31,710.00

Objectives:

a) Exhaustive literature search in soil properties and associated terrain features useful in estimating the effect of sulphur additions on soil as a medium for plant growth - in Alberta - "Sensitivity Classification".

b) Preparing maps of selected areas showing aerial distribution of soil classified into categories according to their potential sensitivity to acidification.

Method:

a) International Literature Search

b) Computer generation of data base including aerial distribution and identity of soils obtained by digitizing the soil survey map by quarter sections and the category of sensitivity of each soil.

c) Available soil test data on topography and capability for agriculture of each soil will be encoded for generation of companion maps.

Anticipated Results: Soil - Sulphur Problems
Final Report

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Sulphur Isotopes in the Environment
Amerada Minerals Flaring Plant near Valleyview

Subject Code (s) in order of priority: 2.2.1

Principal Investigator's Name:

Drs. H. R. Krouse and J. S. Case
Funded by Alberta Environment

Agency & Department: University of Calgary

Address: University of Calgary
Calgary, Alberta

Phone: (403) 284-5871

Co-operating agencies and investigators (if applicable): Alberta Environment
(Dr. H. S. Sandhu)

Duration of each phase: Feb. 1/80 - Mar. 31/81

Approximate Cost (indicate applicable yearly period): $36,049.00

Objectives:

a) Determine $^{34}S/^{32}S$ abundance ratio and S pH content of several air, water and vegetation samples.

b) Monitor meteorological parameters during sample collections.

c) Determine impact of flaring on soil characteristics.

Method:

a) Number and location of sampling locations, in the Valleyview region, determined on the basis of field surveys, soil types, meteorological records, air quality records, and consultation with Alberta Environment and local farms.

b) Determined $^{34}S/^{32}S$ and pH of variables during winter, spring and summer of 1980.

c) Monitored meteorological parameters during winter, spring and summer of 1980.

Anticipated Results: Determine the impact of flaring on the Valleyview area.
Report due in Summer, 1981

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Chemistry of Power Plant Plumes

Subject Code (s) in order of priority:	2.2.1 2.2.2 2.2.3 2.5.4

Principal Investigator's Name:

O. T. Melo

Agency & Department: Ontario Hydro
Research Division

Address: 800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

Phone: (416) 231-4111

Co-operating agencies and investigators (if applicable):

(a) Atmospheric Environment Services
Drs. A. Wiebe and K. Anlauff

(b) US Environmental Protection Agency
Dr. W. Wilson

Duration of each phase:

(a) Set-up and field sampling: 1/80 - 8/80
(b) Data analysis: 9/80 -12/81
(c) Additional field sampling & data analysis: 1/81 -12/82

Approximate Cost (indicate applicable yearly period): 1/80 - 6/81: $225,000.00

Objectives:

a) Measure the rates of SO_2 and NO oxidation in power plant plumes as a function of ambient air quality, proximity to large urban centers and season.

b) Measure the contribution of Ontario Hydro to transboundary pollutant fluxes and deposition of acidic substances over sensitive areas in Ontario

Method:

a) An instrumented helicopter was used as a platform for airborne plume sampling.

b) Background transboundary pollutant fluxes measured by others (AES & EPA) will be compared with our in-plume measurements to calculate relative contributions.

c) Modelling will be used to extend background and in-plume flux measurements to expected contribution to acidic deposition over sensitive receptors.

Anticipated Results:

A report describing the July 14 - August 15, 1980 field studies will be available by June 1981. Other phases of the work will be done and reported by the end of 1982.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Precursors of Acid Precipitation
A PACE Report

Subject Code (s) in order of priority:	2.2.1 2.2.2

Principal Investigator's Name:

PACE

Agency & Department: PACE

Address: Suite 400, 130 Albert Street
Ottawa, Ontario
K1P 5G4

Phone: (613) 236-9122

Co-operating agencies and investigators (if applicable):

Duration of each phase: Compilation anticipated 1st quarter of 1981

Approximate Cost (indicate applicable yearly period):

Objectives:

Method:

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Study of Sulphate/Sulphide Interconverstion under Anaerobic Conditions Using 35S as a Tracer

Subject Code (s) in order of priority: 2.2.1

Principal Investigator's Name:

Dr. P. Roberts

Agency & Department: Ontario Ministry of the Environment
Lab Services Branch, Water Quality Section

Address: P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3512

Co-operating agencies and investigators (if applicable): Microbiology Section
Laboratory Services Branch

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives: The reduction of sulphate to sulphide under anaerobic conditions results in the net consumption of several protons. Our work is aimed at developing a laboratory technique for determining the rate and extent of such a reduction process.

Method: Samples of water containing radiolabelled sulphate will be incubated anaerobically under various conditions of temperature and pH liquid scintillation counting will be used to study the conversion of sulphate to sulphide.

Anticipated Results: Application of such a method of field samples could give information regarding the importance of such a reduction process in partially offsetting the effects of acid precipitation.

LRTAP ACTIVITY DESCRIPTION

Activity Title: Regional Scale Transport and Monitoring Research Project.

Subject Code (s) in order of priority:	2.2.1 2.3.3 3.1.1 1.1

Principal Investigator's Name: Dr. S.R. Shewchuk, Dr. J. Maybank.

Agency & Department: Saskatchewan Research Council
Physics Division

Address: 30 Campus Drive
Saskatoon, Saskatchewan
S7N 0X1

Phone: (306) 664-5437

Co-operating agencies and investigators (if applicable):
a) Environment Canada
Mr. A. Mann
b) Environment Alberta
Dr. H. Sandhu
c) Environment Saskatchewan
Mr. L. Lechner

Duration of each phase:

a) Problem analysis: 5/80 to 3/81

b) Operation: 3/81 begin.

Approximate Cost (indicate applicable yearly period): For 5/81 to 3/81 $45,000

Objectives:
a) Emission magnitude to 2000 A.D. for N. Alberta and Saskatchewan.
b) Determination of sensitive areas to acidic deposition.
c) Recommend research studies or monitoring projects to better document effects.

Method:
a) Aquatic and Terrestrial systems sensitivity parameters.
b) Model dispersion and transformation of SO_2 and NO_x products with the region.
c) Recommend monitoring for SO_2 with filters impregnated with potassium carbonate-glycerol solution.
d) Snowpack data collection studies.

Anticipated Results:
a) Sensitivity mapping of the Northern parts of Alberta and Saskatchewan to acidic deposition.
b) Bibliography on past research in the region.
c) Summary - what are the background contaminates within the region
d) Time frame as to when significant effects become apparent.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Persistent Elevated Pollution Episodes (PEPE) Field Study

Subject Code (s) in order of priority: 2.2.1, 2.2.2, 5.1

Principal Investigator's Name:

A. Wiebe

Agency & Department: DOE/AES

Address: 4905 Dufferin St.,
Downsview, Ontario

Phone: (416) 667-4797

Co-operating agencies and investigators (if applicable):
F. Fanaki (AES)
K. Anlauf (AES)
P. Fellin (AES)
Ontario Hydro
Ontario Ministry of Environment
U. S. Environmental Protection Agency

Duration of each phase: July 15 - August 15, 1980 Field Study

Approximate Cost (indicate applicable yearly period): (2K cap) (15K O&M)

Objectives: To provide compositional measurements of sulphur and nitrogen compounds within the boundary layer during trans-boundary transportation from the U.S. into the southern Ontario region during episodes of elevated pollutant concentrations.

Method: Measurements were made by instrumented aircraft, and at selected field sites in southern Ontario.

Anticipated Results: Mechanisms for the formation and transport of acidic atmospheric species will be formulated, as determined from the results obtained during the field study, for inclusion in atmospheric deposition models and calculations.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Physiological Effects of Low Concentration of NO_2 on Alberta Plant Species.

Subject Code (s) in order of priority: 2.2.2

Principal Investigator's Name:

Dr. Edward M. van Zindren Bakker
Funded by Alberta Environment

Agency & Department: Kananaskis Centre for Environmental Research

Address: University of Calgary
Calgary, Alberta
T2N 1N4

Phone: (403) 284-5455

Co-operating agencies and investigators (if applicable): Dr. A. H. Legge
Alberta Environment

Duration of each phase: 1978 - 1979

Approximate Cost (indicate applicable yearly period): $100,980.00 approximate cost

Objectives:

a) To determine the sensitivity of selected crop and native Alberta plant species to injury or damage by low concentrations of NO_2.

b) At what concentration this injury or damage is first evident.

c) Effects of low concentrations on photosynthetic ratio, water relations and stomatal response.

d) If the selected species will acclimate to low conc. NO_2 effect.

Method:

a) The branches and shoot of *Pinus banksiana* (Lodgepole Pine), *Populus Tremuloides* (Aspen) and *Medicago sativa* (alfalfa) to be exposed under controlled environment to low levels of NO_2 (0 to 1 p.p.m.).

b) The outside air preconditioned before reaching cuvette.

c) The CO_2 conc. held at ambient level, control changes in CO_2 effecting photosynthesis, stomatal aperture and hence NO_2 uptake by leaves and needles.

d) The NO_2 source a permeation device and NO_2 conc. in cuvette to be regulated by a mass flow control system.

e) NO_2 conc. monitored by analyser (percalibrated).

f) The air velocity and relative humidity controlled within the cuvette.

g) The effect of NO_2 monitored in the CO_2 exchange rate.

h) Measuring CO_2 in air before entering the cuvette. These combined with leaf area could be used to calculate the photosynthesis and respiration rates.

Method:

i) Transp. rates of pH of material in cuvettes will be determined.

j) Stomatal diffusion measured.

k) Data recorded and 5 replicates of each species tested for statistical analysis.

Anticipated Results:

Response of plant species, Native and Agricultural to NO_2 exposures. One year project.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Oxides of Nitrogen and their Interactions in the Environment: A Review

Subject Code (s) in order of priority:	2.2.2

Principal Investigator's Name:

Dr. A. H. Legge
Funded by Alberta Environment and Canadian Petroleum Association

Agency & Department: Kananaskis Centre for Environmental Research

Address: The University of Calgary
Calgary, Alberta

Phone:

Co-operating agencies and investigators (if applicable): Alberta Environment
Canadian Petroleum Association
E. M. Bakker Jr.
E. Peake
D. C. Lindsay

Duration of each phase: 1978 - 1979

Approximate Cost (indicate applicable yearly period): $35,000.00

Objectives: To review present knowledge base concerning the impact of the nitrogen oxides and their photochemical derivatives upon man's environment in Alberta and the world.

Method:

a) By analytical methods

b) By sampling analysis

Anticipated Results:

a) Knowledge on chemical behaviour of nitrogen plumes from point source in Alberta.

b) Effects of variable gas mixture on human biology.

One year project.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Atmospheric NO_x Studies

Subject Code (s) in order of priority:	2.2.2 4.0 5.1

Principal Investigator's Name:

A. Wiebe

Agency & Department: DOE/AES

Address: 4905 Dufferin St.,
Downsview, Ontario
M3H 5T4

Phone: (416) 667-4797

Co-operating agencies and investigators (if applicable): K. Anlauf (AES) McMaster University
P. Fellin (AES) Concord Scientific Corporation

Duration of each phase: July 15 - Aug. 15, 1980
Jan/Feb. 1981 (Field Measurements)

Approximate Cost (indicate applicable yearly period): 80/81 (657.95 13K Cap)
(23K O&M)
(657.A98 45K O&M)

Objectives:
To measure atmospheric concentrations of nitrogen containing particulates and gases as they relate to atmospheric acidic deposition and transport.

Method:
NH_3, gaseous nitric acid and particulate nitrate are measured by means of denuder tubes, teflon and nylon filters, and diode lasers at selected regional sights in southern Ontario.

Anticipated Results:
Atmospheric concentrations of acidic nitrogen species are measured and will be interpreted in terms of formation mechanisms, atmospheric transport and deposition. These will be presented at scientific conferences and published in scientific publications and internal reports.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Photochemical Oxidants in Canada
PACE Report No. 78-4

Subject Code (s) in order of priority:	2.2.3

Principal Investigator's Name:

S. C. Barton and R. A. Rae
Ontario Research Foundation

Agency & Department: PACE

Address: Suite 400, 130 Albert Street
Ottawa, Ontario
K1P 5G4

Phone: (613) 236-9122

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives:

Method:

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

New Brunswick Ozone Study

Subject Code (s) in order of priority: 2.2.3, 2.5.4

Principal Investigator's Name:

Melvyn Estey
Jim Knight

Agency & Department: Environment New Brunswick
Pollution Control Branch

Address:
P.O. Box 6000
Fredericton, N. B.
E3B 5H1

Phone: (506) 453-2861

Co-operating agencies and investigators (if applicable): State of Main
Department of Environment Protection

Duration of each phase: December 1, 1980 to February 20, 1981

Approximate Cost (indicate applicable yearly period): $8,000.00

Objectives:

a) To determine if Ozone episodes in New Brunswick (St. John) can be associated with specific weather patterns moving into the province.
b) To determine if existing Ambient Guideline Objectives are appropriate with observable data.

Method:

a) Investigate trends in ambient levels measured in New Brunswick.
b) Compare New Brunswick levels with those in Maine, Nova Scotia, Quebec and Ontario.
c) Attempt to associate high levels of Ozone with specific weather systems.
d) Review studies on the effect of Ozone on vegetation, materials and humans.

Anticipated Results:

a) Weather systems passing over the northeastern United States appear to have a strong influence on Ozone episodes in New Brunswick.
b) The hourly limits seem to be respected upon most occasions, however, the 24 hour limits are exceeded a significant number of times.

Atmospheric Chemistry of Other Compounds

No first priority projects

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Deposition Monitoring Network, Northeastern Ontario

Subject Code (s) in order of priority:	2.3.1 2.3.2

Principal Investigator's Name:

D. Balsillie

Agency & Department: M.O.E. Northeastern Region, Technical Support

Address: 199 Larch Street
Sudbury, Ontario
P3E 5P9

Phone: (705) 675-4501

Co-operating agencies and investigators (if applicable):

MOE-Air Resources Branch
880 Bay Street
Toronto, Ontario
Attention: Walter Chan

MOE Lab Services Branch
Resources Road
Rexdale, Ontario

Duration of each phase: Ongoing Monitoring Program

Approximate Cost (indicate applicable yearly period): $37,000.00 (plus lab support)

Objectives:

To monitor wet and dry deposition on a monthly basis in Northeastern Ontario

Method:

a) Collection of wet and dry deposition samples using Sangamo samplers.

b) Samples to be collected on a monthly basis

c) Sampling locations:

McKellar
Mattawa
Killarney
Burwash
Lively
Hanmer
Bear Island (Temagami)
Ramsey
Gowganda
Moonbeam
Attawapiskat

Anticipated Results:

To determine the chemical composition of wet and dry deposited materials in Northeastern Ontario and thus determine the atmospheric loadings to terrestrial and aquatic ecosystems in Northeastern Ontario.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Precipitation Monitoring During INCO's Strike Shutdown Period (September 15, 1978 - June 4, 1979)

Subject Code (s) in order of priority: 2.3.1 2.1.2

Principal Investigator's Name:

Patrick M. Bolger

Agency & Department: Environmental Control
Inco Metals Company
Address: General Engineering Building
Copper Cliff, Ontario
POM 1NO

Phone: (705) 682-0601, Ext. 248

Co-operating agencies and investigators (if applicable): B. J. Bell
G. Laporte
F. Bruhmuller

Duration of each phase: Project carried out between September 1978 and June 1979.

Approximate Cost (indicate applicable yearly period): $14,000.00

Objectives: Determine background levels of precipitation acidity near Sudbury in the absence of INCO's SO_2 emissions.

Method: A precipitation monitoring station was set up 10 km west of Sudbury. Four plastic containers were set out during each episode to obtain quadruplicate samples of precipitation for analyses of pH, sulfates and nitrates. Meteorological information was obtained to assist in the interpretation of the pH data.

Anticipated Results: The project provided a better perspective regarding INCO's contribution to the acid precipitation problem.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Precipitation Sampler and Analysis Study

Subject Code (s) in order of priority: 2.3.1, 5.1

Principal Investigator's Name:

Viktor Komadina

Agency & Department: Environment Canada, Water Quality Branch

Address: P. O. Box 861
Moncton, N. B.
E1C 8N6

Phone: (506) 388-6606

Co-operating agencies and investigators (if applicable):

Duration of each phase:
a) Set-up: 5/80 to 7/80
b) Operation: 8/80 to 11/80

Approximate Cost (indicate applicable yearly period): $2,000 & 0.2 PY

Objectives:

a) Measure concentrations of H^+, NH_4^+, $SO_4^=$ and NO_3^- as well as "major ions" sequentially during an event.

b) Determine suitability of all glass sampler to monitor these parameters (or others) sequentially during an event.

Method:

a) At one experimental site in Moncton, N. B., the all glass sampler will collect rain events sequentially and in bulk simultaneously.

b) The samples will be analysed by Analytical Services Division of WQB-AR.

c) Results will be compared with CANSAP data and event data from Kejimkujik Park bulk samplers.

Anticipated Results:

a) Data will be transferred to NAQUADAT.

b) This sequential sampler developed by the WQB Atlantic Region will provide information on the chemistry of sequential elements of each rain event sampled, for comparison with a sample of the integrated event.

c) The results of b. will be useful to those agencies who are concerned with the chemistry variations which occur during a precipitation event, i.e. (initial pH is generally lower than final pH of each event).

LRTAP ACTIVITY DESCRIPTION

Activity Title:

INCO 381 m Chimney and Hydro Nanticoke Stack Plume Washout Study

Subject Code (s) in order of priority:	2.3.1

Principal Investigator's Name:

Dr. Maris Lusis

Agency & Department: Ontario Ministry of the Environment
Air Resources Branch

Address: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

Phone: (416) 965-1634

Co-operating agencies and investigators (if applicable): Contractors: Dr. S. Barton, Ontario Research Foundation
Dr. M. Millan, Barringer Research

Duration of each phase: 05/80 - 12/80 (possibility of extension)

Approximate Cost (indicate applicable yearly period): 05/80 - 12/80: $118,780.00

Objectives:

To define the washout phenomenon due to precipitation of the plume constituents of the INCO 381 m and Hydro Nanticoke stacks.

Method:

a) Only frontal precipitation events are considered. Field crew will be mobilized upon favourable weather forecasting.

b) COSPEC will be used to detect SO_2 and NO_2 to define the plume boundaries.

c) Both background and under-plume precipitation samples will be collected. The Sudbury INCO samples will be analyzed for acid related species, major ions and trace metals; the Nanticoke Hydro samples will be analyzed for only acid-related species and major ions. Some selected samples will be analyzed for dissolved SO_2.

Anticipated Results:

A report will be submitted by the contractor to MOE in December 1980.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Precipitation Sampler Intercomparison

Subject Code (s) in order of priority:	2.3.1

Principal Investigator's Name:

Dr. Maris Lusis

Agency & Department: Ontario Ministry of the Environment
Air Resources Branch

Address: 880 Bay St., 4th Floor
Toronto, Ontario
M5S 1Z8

Phone: (416) 965-1634

Co-operating agencies and investigators (if applicable): Contractor: Dr. S. Stevens formerly with United Science and Technology, now with Concord Scientific Corporation

Duration of each phase:

a) Field work: 08/79 - 03/80

b) Report Preparation: 04/80 - 10/80

Approximate Cost (indicate applicable yearly period): $53,598.00

Objectives:

a) To evaluate the performance of the Aerochem Metric(HASL), funnel and bottle type and MOE-SES type collectors as event rain samplers.

b) To evaluate the performance of snow collectors of different height to diameter ratios.

Method:

a) Samplers of different types will be co-located at the Woodbridge farm site for collection of rain and snow samples.

b) The sample will be analyzed for various parameters.

c) These data will be subject to statistical analysis. Based on these results, recommendation of the choice sampler will be made.

Anticipated Results: A report will be submitted by the Contractor to MOE in October 1980.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Investigation of Atmospheric Deposition in Pacific Coastal Regions

Subject Code (s) in order of priority: 2.3.1 2.3.3

Principal Investigator's Name:

Dr. Gordon McBean

Agency & Department: Atmospheric Environment Service
Institute of Ocean Sciences

Address: P. O. Box 6000
9860 West Saanich Road
Sidney, B. C.
V8L 4B2

Phone:

Co-operating agencies and investigators (if applicable): B. C. Ministry of Environment

Duration of each phase: Continuing

Approximate Cost (indicate applicable yearly period): 1/11/80 - 1/4/81: $8K

Objectives:

a) To measure and explain the deposition of sulphate, nitrate and hydrogen ion in Pacific coastal regions.

Method:

a) Interpretation of CANSAP data.

b) Specialized observation at OWS P.

c) Snow surveys of coastal regions.

d) Specialized precipitation chemistry samplers.

Anticipated Results:

a) Quantifications of atmospheric deposition in Pacific coastal regions.

b) Interpretations of results, including source identification.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Effect of Meteorology on the Chemistry of Precipitation

Subject Code (s) in order of priority:	2.3.1 2.4.1 2.1.3

Principal Investigator's Name:

Mr. O. T. Melo
Dr. A. C. McMillan

Agency & Department: Ontario Hydro
Research Division

Address: 800 Kipling Avenue
Toronto, Ontario
M8Z 5Z4

Phone: (416) 231-4111

Co-operating agencies and investigators (if applicable): Atmospheric Environment Service
Dr. Y. S. Cheung

The MEP Company
Dr. B. Wiseman

Duration of each phase: 1/80 - 6/81

Approximate Cost (indicate applicable yearly period): 1/80 - 6/81: $25,000.00

Objectives:

a) Define the effect of storm track, air parcel trejectory and precipitation type, amount and intensity on the chemistry of precipitation.

b) Relate ambient sulphate aerosol levels to sulphate levels in precipitation.

Method:

Data from Ontario Hydro's air and precipitation monitoring network will be segregated into several groups on the basis of meteorological conditions prevailing at the type of sampling. Within group and between group variability will be calculated and any obvious differences identified.

Anticipated Results:

A report will be available at the end of the study documenting any identified relationship between precipitation chemistry and meteorology.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

A.5. Snow Quality as Affected by Altitude and Distance from Urban Centre

Subject Code (s) in order of priority:	2.3.1

Principal Investigator's Name:

Dr. Gilles Robitaille

Agency & Department: Environment Canada
Canadian Forestry Service

Address: Laurentien Forest Research Center
1080 duVallon
C. P. 3800
Ste. Foy, Quebec

Phone: G1V 4C7
(418) 658-6945

Co-operating agencies and investigators (if applicable): Dr. Len Barrie
Atmospheric Environment Service

Duration of each phase:
a) Sampling: 12/80 on a weekly basis in season
b) Operation: 'Til end of season 1981

Approximate Cost (indicate applicable yearly period): 12/80 to 4/81: $1,000.00

Objectives:
To determine the effect of altitude and distance from an urban center on snow quality.

Method:
a) The unleached layer of snow is sampled using a 200 cm^2 surface cylinder. Sampled on a weekly basis and stored frozed in plastic bags until analysed.
b) pH taken and analysed for the elements as in activity A.1.a

Anticipated Results:
a) Data on the effects of orographic precipitation on snow quality versus LRTP snow quality.
b) Support data for activities A.3.d.

LRTAP ACTIVITY DESCRIPTION

Activity Title: Toxic Substances in Precipitation

Subject Code (s) in order of priority: 2.3.1

Principal Investigator's Name: W. M. J. Strachan

Agency & Department: Department of Environment, National Water Research Institute

Address: Canada Centre for Inland Waters
Box 5050, Burlington, Ontario L7R 4A6

Phone: 416 637-4222

Co-operating agencies and investigators (if applicable): Environmental Contaminants Contract Fund

Duration of each phase: This phase to be completed FY 80-81.
Effort is expected to be continuing if the sampler is proven satisfactory.

Approximate Cost (indicate applicable yearly period): 0.6 PY 10 K operating costs.

Objectives: To investigate and measure the concentration of organic compounds in precipitation.

Method: A modified rain sampler capable of collecting the large samples needed for quantification of the contamination of synthetic organics will be designed and tested. Samples will be collected in a remote and industrial area and analyzed for a range of synthetic organic compounds which have been identified in precipitation during prior measurements.

Anticipated Results: Report of the sampler performance and of the organic contaminants observed.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Analytical Techniques as Applied to Deposition (Wet, Dry and Bulk)

Subject Code (s) in order of priority:	2.3.1 2.3.2 2.3.3

Principal Investigator's Name:

Mr. F. Tomassini
Mrs. J. Crowther

Agency & Department:

Address:

Ontario Ministry of the Environment
Lab Services Branch, Water Quality Section
P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone:

(416) 248-3512

Co-operating agencies and investigators (if applicable):

Ontario Ministry of the Environment
Air Resources Branch (Dr. W. Chan)
Lab Services Branch (ITL) (Dr. B. Loescher)

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives:

To provide the analytical techniques appropriate to the analysis of all precipitation samples collected during the Acid Precipitation in Ontario Study (APIOS)

Method:

a) Provide the current accepted techniques of analysis to users in the APIOS Study.

b) Develop new methodologies.

c) Improve current techniques were applicable.

d) Develop and automate the ion chromatography laboratory.

Anticipated Results:

To provide appropriate analytical methodologies with optimal sensitivity, accuracy, turnaround time and costs adequately meet the overall objectives of the APIOS program.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Examination of Relationships between Local Industrial Emissions and Chemical Composition of Rainwater

Subject Code (s) in order of priority:	2.3.1 2.4.1

Principal Investigator's Name:

W. G. Wallace

Agency & Department: Alcan Smelters and Chemicals Ltd.

Address: P. O. Box 1800
Kitimat, B. C.
V8C 2H2

Phone: (604) 632-3111

Co-operating agencies and investigators (if applicable): Air Management Branch
B. C. MOE
M. S. Kottuir

Duration of each phase: September 1980 to December 1981

Approximate Cost (indicate applicable yearly period): $5,000.00 to December 1981

Objectives:

a) To collect samples from two storms per season and analyse for acidity, pH, NO_3^-, $SO_4^=$, F^-, Cl^-.

b) To collect 3 - 4 samples per month and analyse for pH.

Method:

a) Samples will be collected at one site by means of a Sangamo precipitation collector, Type A.

b) Analysis will be carried out by the Alcan Kitimat Laboratory. Some may be done at the Environmental Laboratory, Ministry of Environment.

Anticipated Results:

Data will be supplied to the Air Management Branch, MOE, for inclusion in their more extensive program.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Effects of Atmospheric Effluents from Mining and Smelting Industries on Forest Vegetation and Soils in Northern Manitoba.

Subject Code (s) in order of priority:	2.3.1 3.2.3

Principal Investigator's Name:

D. L. Wotton

Agency & Department: Environmental Management Division
Department of Consumer and Corporate Affairs and Environment

Address: Box 7, Building 2
139 Tuxedo Avenue
Winnipeg, Manitoba
R3N 0H6

Phone: (204) 895-5311

Co-operating agencies and investigators (if applicable): Dr. G. Hogan
Canadian Forestry Service
Northern Forest Research Centre
Environment Canada

Duration of each phase: (a) March 1980
(b) Operation to 1982

Approximate Cost (indicate applicable yearly period):

Objectives: To conduct a survey of the winter snowpack within the boreal forest ecosystem surrounding mining smelters in Northern Manitoba to function as an indicator of air pollution impingement.

Method:

a) At an established network of eight sites located in the primary areas of dispersion from mining smelters at Thompson and Flin Flon, a 100 metre transect is established through the forested area. Sampling with a Mount Rose Snow Sampler occurs at 10 metre intervals.

b) Snow samples are measured for pH and analysed for SO_4, Zn, Ni, Cu, Pb, Fe, Cd and As.

Anticipated Results:

a) Identification, quantification and extent of particular contaminants and sulphates present.

b) Background dispersion information for determination of air pollutant impingement.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Effects of Atmospheric Effluents from Mining and Smelting Industries on Forest Vegetation and Soils in Northern Manitoba

Subject Code (s) in order of priority:	2.3.1 3.2.3

Principal Investigator's Name:

D. L. Wotton/G. D. Hogan

Agency & Department: Environmental Management Division
Department of Consumer and Corporate Affairs and Environment

Address: Box 7, Building 2
139 Tuxedo Avenue
Winnipeg, Manitoba
R3N 0H6

Phone: (204) 895-5311

Co-operating agencies and investigators (if applicable): Canadian Forestry Service
Northern Forest Research Centre
Environment Canada

Duration of each phase: (a) Set-up: 5/80 - 10/80
(b) Operation: 5/79 - 10/82

Approximate Cost (indicate applicable yearly period): For 5/80 - 10/80: $10,000.00

Objectives:

a) The objective of this network is to sample rainfall within a 40 km radius of northern mining smelters for pH and heavy metal content.

b) The results will be used to determine wet deposition rates and to support the interpretation of event precipitation samples.

Method:

a) At an established network of eight sites located in the primary areas of dispersion from smelters at Thompson and Flin Flon, a closed precipitation collector is established to collect above the forest canopy.

b) At four week intervals, samples are collected and analysed for pH, Zn, Cu, Pb, Fe, Cd and As.

Anticipated Results:

a) Mean Monthly pH in the localized area of the smelters.

b) Identification, quantification and extent of particulate contaminants present.

Activity Title:

Dry Deposition of SO_2

Subject Code (s) in order of priority:	2.3.2 2.1.2 3.2.2 3.2.4

Principal Investigator's Name:

Ray Desjardins

Agency & Department: LRRI, Agriculture Canada

Address: Agmet, LRRI,
Bldg. # 74
C. E. F.
Ottawa, Ontario

Phone: K1A 0C6
(613) 995-9039

Co-operating agencies and investigators (if applicable):

a) Alberta Environment, Edmonton, Alta.

b) Promet Environment Group, Calgary, Alta.

c) Concord Scientific Corporation, Downsview, Ontario

Duration of each phase: 1980 - 1983

Approximate Cost (indicate applicable yearly period): $50K from Alberta Environment

Objectives:

The objective is to use the Desjardines' integrating flux technique to measure dry deposition of SO_2 and compare it to other techniques.

Method:

The method which is based on the eddy flux technique but because of the sampling technique it does not require a fast responding gas analyzer.

Anticipated Results:

Mean flux of SO_2 on a 10-minute basis should be obtained. This should give us information on the amount of SO_2 deposited on different crops at different locations. We should also be able to determine the amount of dry deposition of SO_2 on soil versus different types of vegetation.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Atmospheric Levels and Dry Deposition of Sulphur Dioxide at St. Margaret's Bay, Nova Scotia

Subject Code (s) in order of priority:	2.3.2 2.5.2

Principal Investigator's Name:

J. Kozak

Agency & Department: EPS/Environment

Address: Bank of Montreal Tower, 16th Floor
5151 George Street
Halifax, N. S.
B3J 1M5

Phone: (902) 426-6132

Co-operating agencies and investigators (if applicable): AES (Atlantic Region) provides meteorological data

Duration of each phase: 10/80 - 04/82

Approximate Cost (indicate applicable yearly period): (10/80 - 03/81): $500.00

Objectives: Measurement of Ambient SO_2 levels at a rural site near Halifax, N. S. to estimate magnitude of dry deposition of SO_2 and relative contributions of local and distant sources.

Method: Twenty-Four hour air samples are drawn through a Whatman 40 Cellulose Pre-Filter (for removal of particulate SO_4) and SO_2 is absorbed on a Whatman 41 Filter impregnated with Aqueous (10% Glycerol) Potassium Carbonate. Both filters are analyzed for sulfate by Barium Chloride Titration (Methyl Thymol Blue Indicator). Back trajectories are constructed on 850 Millibar Meteorological charts.

Anticipated Results: Halifax emissions (approximately 1800gSO_2s-1) are expected to predominate in dry deposition at this site (25 km from Halifax).

LRTAP ACTIVITY DESCRIPTION

Activity Title:

National Air Pollution Surveillance (NAPS) Special Sulphate and Nitrate Studies 1975, 1976 and 1979.

Subject Code (s) in order of priority:	2.3.2 2.4.2

Principal Investigator's Name:

Roger J. Lafleur
Head, Ambient Monitoring Section

Agency & Department: Environment Canada
Environment Protection Service

Address:
Air Pollution Control Directorate
Surveillance Division
Ottawa, K1A 1C8

Phone: (614) 998-4272

Co-operating agencies and investigators (if applicable): All provincial departments of the Environment and Environment Canada

Duration of each phase:
a) 18/4/75 to 30/5/75
b) 29/7/76 to 28/8/76
c) 26/7/79 to 11/11/79

Approximate Cost (indicate applicable yearly period): Cost breakdown impossible

Objectives:

To determine ambient air quality levels for particulate sulphates and nitrates across Canada.

Method:

The 110 high volume samplers at NAPS stations across Canada routinely collect total suspended particulate matter every 6th day. This network has been in operation since 1970. On three separate occasions, special studies were carried out during which the collected particulate matter was also analysed for sulphates and nitrates.

Anticipated Results:

Three separate reports published:
-1975
-1976
-1979
Available from Environment Canada (Above Address.)

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Air Quality Criteria and Standards: Dry Deposition Studies

Subject Code (s) in order of priority: 2.3.2

Principal Investigator's Name:
H. H. Neumann
G. den Hartog

Agency & Department: Atmospheric Environment Service

Address: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

Phone: (416) 667-4954

Co-operating agencies and investigators (if applicable):

Duration of each phase: Continuous

Approximate Cost (indicate applicable yearly period): '80/'81: $20K Cap. $15K O&M

Objectives: Measure fluxes of sulphur dioxide and sulphate particulates to vegetation and other natural surfaces and relate these to controlling physical and physiological processes.

Method: Dry deposition of air pollutants to the underlying surface is an essential ingredient of models of air pollutant transport and has also been shown to be an important fact in determining the degree of injury to vegetation. In most pollutant transport models, deposition is very simplistically modelled by a constant deposition velocity whereas actual deposition varies widely with the nature of the surface. Better understanding is required of variation of uptake by different natural surface and of the variability of uptake by a particular surface, depending internal and external conditions. This knowledge is to be gained by measuring the actual fluxes for a variety of conditions and relating these to physical and physiological parameters. The program consists of:

a) development of instrumentation for fast response measurements of SO_2 and particulates, and data reduction methods.

b) field studies to obtain appropriate turbulence measurements along with the air pollutant data to calculate the actual fluxes.

Anticipated Results: Improved characterization of the dry deposition of air pollutants to natural surfaces. Results would be applicable pollutant transport models and published in the scientific literature.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Atmospheric Level and Dry Deposition of Aerosol Sulfate at St. Margaret's Bay

Subject Code (s) in order of priority: 2.3.2, 2.5.2

Principal Investigator's Name:

R. Shaw (Contact J. Kozak)

Agency & Department: EPS/Environment

Address: Bank of Montreal Tower, 16th Floor
5151 George St.,
Halifax, N. S.
B3J 1M5

Phone: (902) 426-6132

Co-operating agencies and investigators (if applicable): AES (Atlantic Region) provides Meteorological Data

Duration of each phase: 04/80 - 04/82

Approximate Cost (indicate applicable yearly period): 04/80 - 04/81: $1,000.00

Objectives:

Measurement of aerosol sulfate levels at the rural site near Halifax, Nova Scotia to estimate contributions by local and distant sulphur emissions to atmospheric levels and dry deposition process.

Method:

Particulate sulfate (high volume sampler, 24h) is collected on a Whatman 41 Cellulose Filter and analyzed by Barium Chloride Titration (Thorin or methyl thymolblue indicator). Back trajectories are constructed on 850 mb meteorological charts.

Anticipated Results:

Dry deposition of aerosol sulfate is anticipated to be small relative to wet deposition, with local (Halifax: distance 25km; emissions 1800 $g SO_2 s^{-1}$) and distant sources both contributing significantly.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Effects of Atmospheric Effluents from Mining/Smelting Industries on Forest Vegetation and Soils in Northern Manitoba

Subject Code (s) in order of priority:	2.3.2 3.2.3 3.2.6

Principal Investigator's Name:

D. L. Wotton/G. D. Hogan

Agency & Department: Environmental Management Division
Department of Consumer and Corporate Affairs and Environment

Address: Box 7, Building 2,
139 Tuxedo Avenue
Winnipeg, Manitoba

Phone: (204) 895-5311

Co-operating agencies and investigators (if applicable): Canadian Forestry Service
Northern Forest Research Centre
Environment Canada

Duration of each phase:
a) Set-up: 5/80 - 10/80
b) Operation: 5/79 - 10/82

Approximate Cost (indicate applicable yearly period): For 5/80 - 10/80: $3,000.00

Objectives:

To establish a moss trap network within a 40 km radius of northern mining smelters to absorb and trap airborne pollutants for identifying, quantifying and determining the extent of air pollutant impingement.

Method:

a) Moss traps were suspended in replicates of five at an established network of eight sites located in areas of primary dispersal from smelters at Thompson and Flin Flon.

b) At four week intervals, replicates were exchanged and exposed traps submitted to analysis for Cu, Zn, and Pb.

Anticipated Results:

a) Identification, quantification and extent of particulate contaminants present within 40 km of mining smelters.

b) Background dispersion information for determination of air pollutant impingement.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Joint Snow Surveys-Thompson, Manitoba

Subject Code (s) in order of priority:	2.3.3 5.1 5.2

Principal Investigator's Name:

J. S. Ashton D. Wotton

Agency & Department: INCO Metals Company, Manitoba Division

Manitoba Department of Consumer & Corporate Affairs & the Environment

Address:

Thompson, Manitoba
R8N 1P3

Environmental Management Division
139 Tuxedo Avenue
Winnipeg, Manitoba

Phone: (204) 778-6701 (204) 895-5311

Co-operating agencies and investigators (if applicable):

Duration of each phase: 1980 - Preliminary Study
1981 - To be developed

Approximate Cost (indicate applicable yearly period):

Objectives: To study the acidity and metals content of snow within a radius of 50 miles of Thompson, Manitoba

Method:

a) Snow sampling and measurement
b) pH measurement
c) Metals and anions analysis
d) Evaluation of sampling and analytical techniques.

Anticipated Results:

a) Preliminary study completed - indicates necessity for improved techniques.
b) Results will be evaluated.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

A Snowpack Chemistry Survey

Subject Code (s) in order of priority: 2.3.3 2.3.2

Principal Investigator's Name:

Dr. Leonard A. Barrie

Agency & Department: Department of Environment
Atmospheric Environment Service

Address: 4905 Dufferin St.,
Downsview, Ontario

Phone: (416) 667-4796

Co-operating agencies and investigators (if applicable):

Duration of each phase: December - March, 1980/81

Approximate Cost (indicate applicable yearly period): $35K

Objectives: To measure the total (wet plus dry) deposition rate of major ions and trace metals in acid sensitive areas of eastern Canada.

Method: Sample snowpacks that have been unleached by meltwater and exposed for at least three weeks.

Anticipated Results:

a) Total deposition rate of major ions and trace metals in Canadian Shield.

b) Estimates of the ratio of dry to wet deposition.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Subject Code (s) in order of priority:	2.3.3 1.1 2.1.1 2.2.1 ~~2.2.2.~~

Principal Investigator's Name:

S. G. Djufors

Agency & Department: Syncrude Canada Ltd.
Environmental Affairs

Address: 10030 - 107 Street
Edmonton, Alberta
T5J 3E5

Phone: (403) 429-9867

Co-operating agencies and investigators (if applicable): Oil Sands Environmental Study Group

Duration of each phase: Initiation: 4/80 - 8/80
Operation: 9/80 - 12/80

Approximate Cost (indicate applicable yearly period): $75,000.00 for 1980

Objectives:

Compute deposition patterns of SO_4, S, NO_3, and N in the Alberta Oil Sands area for the period 1967 - 2017

Method:

Model Calculations:

- short-term Eulerian grid model
- variable mixing height
- wet and dry deposition
- first order chemical reactions (sulphur)
- site tuned dispersion scheme

Anticipated Results:

This study will provide the necessary input to a further study (under separate cover) which is to determine the effects of acidic gases on vegetation and soils.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Local Emissions from Halifax on Adjacent Aquatic and Terrestrial Environments

Subject Code (s) in order of priority: 2.3.3

Principal Investigator's Name:

J. Machell

Agency & Department: EPS - Dept. of Environment

Address: Bank of Montreal Tower, 16th Floor
5151 George Street
Halifax, N. S.
B3J 1M5

Phone: (902) 426-6132

Co-operating agencies and investigators (if applicable):

Duration of each phase: 04/80 - 04/81

Approximate Cost (indicate applicable yearly period): 04/80 - 04/81: $7,000.00

Objectives:

a) The objective of this study is to define the extent and nature of the effects of Halifax emissions on the local receiving environment.

Method:

a) The water sampling of 20 lakes 5 to 70 km east and west of Halifax.

b) The monitoring of metal levels in vegetation east and west of Halifax.

c) The chemical analysis of samples by the Environmental Protection Service.

Anticipated Results:

a) In support of control strategy development the study may demonstrate the importance of local geology on lake water quality rather than current local emissions. It may show gradients of certain metals in vegetation which would suggest the influence of local emissions.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Survey of Heavy Metal and Sulphur Deposition in the Maritimes

Subject Code (s) in order of priority:	2.3.3

Principal Investigator's Name:

K. E. Percy

Agency & Department: Environment Canada
Canadian Forestry Service

Address: Maritimes Forest Research Centre
P. O. Box 4000
Fredericton, N. B.
E3B 5P7

Phone: (506) 452-3532

Co-operating agencies and investigators (if applicable):

Duration of each phase:

a) Field Collection 7/79 - 9/79
b) Sample Analysis 10/79 - 10/80
c) Data Compilation 10/80 - 4/81

Approximate Cost (indicate applicable yearly period):

7/79 - 9/79: $2,000
10/79 - 10/80: 8,000
10/80 - 4/81 100

Objectives:

a) To document regional deposition patterns of selected heavy metals and sulphur.
b) To identify areas of extreme deposition for future studies of receptor response.

Method:

a) Sixty ombrotrophic bogs were selected on 50 km^2 grid in the three Maritime provinces.
b) Sphagnum sp samples were collected, prepared and assayed for: Cd, Co, Cr, Cu, Hg, Ni, Zn, Pb, Fe, Mn and S.

Anticipated Results:

Data will be published in 1981.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Atmospheric Deposition Patterns of Sulphur and Trace Metals as Measured by Biomonitors

Subject Code (s) in order of priority: 2.3.3, 3.2.6

Principal Investigator's Name:

Dr. K. J. Puckett

Agency & Department: Atmospheric Chemistry Division
Atmospheric Environment Service

Address: 4905 Dufferin St.,
Downsview, Ontario
M3H 5T4

Phone: (416) 667-4797

Co-operating agencies and investigators (if applicable): Dr. P. J. Beckett
Department of Biology
Laurential University
Sudbury, Ontario

Duration of each phase: Feasibility Study
September 1, 1980 - January 31, 1981

Approximate Cost (indicate applicable yearly period): Sept. 1980 - Jan. 1981: $15K

Objectives: To determine the feasibility of producing deposition maps of sulphur in eastern Canada using lichens and mosses as biomonitors.

Method: Selected sampling sites in a north-south (Fort Chimo, P.Q.-Kejimkujik Park, N.S.) and east-west (Sept. Iles, P.Q. - Gravenhurst, Ontario) will be sampled for lichen and moss species and analysed for sulphur, mercury, lead, nickel and copper to determine if: (a) are there any significant differences in the element concentrations in lichens collected from the different sites? (b) Can any differences between sites be related to the existing deposition patterns as described by CANSAP and modelling activities?

Anticipated Results: A recommendation as to the feasibility of mapping in more detail the deposition patterns over larger areas of eastern Canada.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Air-Precipitation Network

Subject Code (s) in order of priority: 2.4.1, 2.4.2

Principal Investigator's Name:

L. A. Barrie

Agency & Department: Air Quality and Inter-Environmental Research Branch
Atmospheric Environment Service

Address: 4905 Dufferin Street
Downsview, Ontario.
M3H 5T4

Phone: (416) 667-4796

Co-operating agencies and investigators (if applicable): Water Quality Branch, ECS
P. Brooksbank (Ottawa)
J. Coburn (Burlington)

Duration of each phase: 5 stations commenced operation in 1978, increasing to 7 in 1980.

Approximate Cost (indicate applicable yearly period): $92K O&M; $100K Capital (80/81)

Objectives: To determine the chemical composition of event precipitation samples and the daily average ambient concentration of sulphur dioxide and particulate major ions on a regional scale in eastern Canada so as to define the extent and severity of the acid deposition problem.

Method:

1. Filterpack is used to collect 24-hour average samples of atmospheric SO_2 and particulate. Filters analyzed at AES for SO_2, SO_4, NO_3, CI, Na, K and NH_4. Data is archived at AES.
2. Sangamo wet-only sampler is used to collect 24-hour samples of precipitation which are analyzed at WQB, Burlington, for pH, SO_4, NO_3, Ca, NH_4, Mg, Na, CI, K, conductance, acidity and total P. Data is archived at AES and NAQUADAT, Ottawa.
3. Data to be published annually by AES.
4. Pilot study to measure selected organics in air at two APN sites to commence in 1980.

Anticipated Results:

Publications containing quality-controlled data in yearly blanks to be published within 7 months of data collection.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Baseline Event -
Precipitation Sampling in Eastern Manitoba

Subject Code (s) in order of priority: 2.4.1

Principal Investigator's Name:

Dave Bezak

Agency & Department: Manitoba Department of Consumer and Corporate Affairs and Environment

Address: Environmental Management Division
Box 7, Building 2, 139 Tuxedo Avenue
Winnipeg, Manitoba
R3C 0V8

Phone: (204) 895-5273

Co-operating agencies and investigators (if applicable): Atmospheric Environment Service
Hugh Fraser

Duration of each phase: It is proposed:

a) Set-up: Fall of 1980
b) Operation: Fall of 1980 - March of 1981

Approximate Cost (indicate applicable yearly period): $8,000.00

Objectives:

a) To monitor levels for various chemical constituents/indicators in the remote Canadian Shield area of Eastern Manitoba.

b) To use this data in conjunction with other activities to determine whether acid precipitation is occurring.

Method:

a) Sangamo Type A Precipitation collectors will be set up at existing AES weather sites at Norway House and Island Lake.

b) Samples will be collected in a manner similar to the CANSAP operations.

c) Analyses will be performed for sulphates, nitrogen compounds, Chloride, metal ions (NA, K. Ca, Mg. As, Cu, Pb, Zn, Fe), acidity, alkalinity, pH, electrical conductance.

Anticipated Results:

a) Data will be used to determine the need for continued monitoring.

b) Data levels will be used along with other studies to identify and quantify the extent of acid precipitation.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Cumulative Wet and Dry Deposition Network

Subject Code (s) in order of priority: 2.4.1, 2.4.2

Principal Investigator's Name:

Dr. Walter Chan

Agency & Department: Ontario Ministry of the Environment
Air Resources Branch

Address: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

Phone: (416) 965-1634

Co-operating agencies and investigators (if applicable):

Duration of each phase:

a) Network Design & Implementation: 4/80 - 8/80

b) Operation: 9/80 to at least 3/82

Approximate Cost (indicate applicable yearly period): $150,000.00 (4/80 - 3/81)

Objectives:

To establish the long term wet and dry deposition distribution patterns of acid, acid forming materials and trace metals across the Province of Ontario.

Method:

a) MOE-modified Sangamo type A, wet and dry samplers are used in 30 background sites across Ontario.
b) Polyethylene bags custom-made to fit the Sangamo bucket will be used to collect precipitation and dry samples separately over a one month or 4 week period.
c) In winter snow sampling, the container will be modified to give a 4:1 height to diameter ratio to improve sampling efficiency.
d) Storage gauge will be used to measure precipitation.
e) Samples will be sent to the Toronto-MOE-LSB laboratory in polyethylene bags for chemical analysis (volume, conductivity, pH, total acidity, SO_4, NO_3, Cl, NH_4, Ca, Na, K, TKN, TP, Mg, Zn, Fe, Ni, Cu, Pb, Al, Cd, Mn and V).

Anticipated Results:

a) Data will be entered into the MOE database, and after editing will be transferred to NAQUADAT in Ottawa and Saroad in RTP (US EPA).
b) Ministry reports will be issued to the public after internal review.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Event Wet Deposition Network

Subject Code (s) in order of priority: 2.4.1

Principal Investigator's Name:

Dr. Walter Chan

Agency & Department: Ontario Ministry of the Environment
Air Resources Branch

Address: 880 Bay St., 4th Floor
Toronto, Ontario
M5S 1Z8

Phone: (416) 965-1634

Co-operating agencies and investigators (if applicable):

Duration of each phase:

a) Network Design & Implementation: 4/80 - 10/80

b) Operation: 7/80 to at least 3/82

Approximate Cost (indicate applicable yearly period): $150,000.00 (4/80 - 3/81)

Objectives:

a) To study the chemical composition, frequency and intensity of acidic precipitation episodes in the Province.

b) To determine in combination with trajectory analysis the acidic loading associated with air masses from different sectors.

Method:

a) At 3 sites (Dorset, London & Kingston areas) co-located with airborne particulate sampling trains. At each site, there will be 5 samplers. The distance between the two pairs is about 50 - 100 km and that between the two samplers within a pair is on the order of 10 km. The fifth sampler will be co-located a few meters apart from one of the four others.

b) Precipitation sampling over a 24 hr period (0800-0800): in the summer time, Aerochem metric wet only samplers will be used; in the winter time, polyethylene buckets with larger collect ion area will be used. All samples will be collected in polyethylene bags inserted into the samplers.

c) Samples will be transferred to Toronto MOE-LSB laboratory for chemical analysis (volume, conductivity, pH, total acidity, SO_4, NO_3, Cl, NH_4, CA, Na, K, Mg).

d) At some sites, Fisher Porter and Tipping bucket rain gauges and Nipher gauges will be also in operation.

Anticipated Results:

a) Data will be entered into the MOE database, and after editing will be transferred to NAQUADAT and SAROAD databases.

b) Ministry reports will be issued to the public after internal review.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Acid Rain Data Base Development WQB #259

Subject Code (s) in order of priority: 2.4

Principal Investigator's Name:

T. A. Clair

Agency & Department: Environment, Water Quality Branch

Address: P. O. Box 861
Moncton, N. B.
E1C 8N6

Phone: (506) 388-6606

Co-operating agencies and investigators (if applicable): See below

Duration of each phase: Ongoing

Approximate Cost (indicate applicable yearly period): 1980/81 - 0.5 TY; $2,000.00 O&M

Objectives:

a) To acquire and achieve all the historical LRTAP related water data that can be solicited from other agencies (federal, provincial, universities and private) for inclusion into NAQUADAT.

b) To establish mechanisms whereby participating agencies will be able to submit their data as they become available.

Method:

All potential contributors are being visited and acquired data is being sent onto NAQUADAT, Ottawa

Anticipated Results:

A better data base from which investigators can get useful information.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Event Precipitation Network

Subject Code (s) in order of priority: 2.4.1 2.3.1 2.5.4

Principal Investigator's Name:

Dr. Frank Frantisak

Agency & Department: Noranda Mines Ltd.

Address: P. O. Box 45,
Commerce Court West
Toronto, Ontario
M5L 1B6

Phone: (416) 867-7306

Co-operating agencies and investigators (if applicable):

Duration of each phase: Commenced 1977, in operation.

Approximate Cost (indicate applicable yearly period):

Objectives:

Method:

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Subject Code (s) in order of priority:	2.4.1 2.4.2 2.4.3 3.1.1

Activity Title:

Snow-Core Sampling Program

Principal Investigator's Name:

Dr. Frank Frantisak

Agency & Department: Noranda Mines Ltd.

Address: P. O. Box 45,
Commerce Court West
Toronto, Ontario
M5L 1B6

Phone: (416) 867-7306

Co-operating agencies and investigators (if applicable):

Duration of each phase: Commenced 1977, in operation.

Approximate Cost (indicate applicable yearly period):

Objectives:

Method:

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Wet-Dry Deposition of Sulphur, Nitrogen and Heavy Metals Network

Subject Code (s) in order of priority:	2.4.1 2.4.2

Principal Investigator's Name:

Dr. Frank Frantisak

Agency & Department: Noranda Mines Ltd.

Address: P. O. Box 45
Commerce Court West
Toronto, Ontario
M5L 1B6

Phone:

Co-operating agencies and investigators (if applicable):

Duration of each phase: Commenced 1977, in operation.

Approximate Cost (indicate applicable yearly period):

Objectives:

Method:

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Wet Deposition Monitoring and Analysis in Eastern Newfoundland

Subject Code (s) in order of priority: 2.4.1

Principal Investigator's Name:

Dr. Les Hulett

Agency & Department: Dept. of Consumer Affairs & Environment
Government of Newfoundland and Labrador

Address: Elizabeth Towers, 100 Elizabeth Avenue
St. John's, Newfoundland
A1B 1R9

Phone: (709) 737-2554

Co-operating agencies and investigators (if applicable): Canadian Forestry Service
J. G. Zakrevsky

Duration of each phase: a) Set-up: 8/80 to 12/80
b) Operation: 1/81 to 12/84

Approximate Cost (indicate applicable yearly period): For 1980/81: $3,650.00

Objectives: The establishment of three deposition monitoring sites to collect wet deposition on a weekly basis, in Eastern Newfoundland. The samples will be analyzed for the same parameters as those of the CANSAP program.

Method: Three Sangamo type monitors will be located at Cape Broyle, Whitbourne and on the Burin Peninsula. Wet deposition will be collected weekly and sent to St. John's for analysis. The following parameters will be determined: pH, conductivity, acidity, Na^+, K^+, Mg^{2+}, Ca^{2+}, Cl^-, NO_3^-, and SO_4^{2-}. The cations will be determined using an atomic absorption spectrophotometer and the anions will be determined by ion chromatography.

Anticipated Results: Acidic deposition levels will be assessed and compared with that found at the three CANSAP stations in the Province. The results will also be made available to other Provincial and Federal agencies for their assessment and use.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Subject Code (s) in order of priority: 2.4.1 3.2.2

Principal Investigator's Name:

Prof. W. M. Langille

Agency & Department: Nova Scotia Agricultural College, Chemistry Department

Address: Nova Scotia Agricultural College
P. O. Box 550
Truro, N. S. B2N 5E3

Phone: (902) 895-1571

Co-operating agencies and investigators (if applicable): Agriculture Canada
Nova Scotia Department of Agriculture & Marketing

Duration of each phase: 5/78 - 7/80 (5 months/annum)

Approximate Cost (indicate applicable yearly period): 5/80 - 9/80: $4,500.00

Objectives: Collection of summer precipitation to establish acidity/alkalinity, sulphate/sulphur content and reaction with soil supplements.

Method:

a) Sample collectors at 12 sites in Maritime Provinces, i.e. Nova Scotia, Prince Edward Island & New Brunswick. Samples collected through nylon screening and in specially prepared sample collector. Entry at 3 week intervals.

b) Analysis of sample for pH and sulphate/sulphur content.

c) Solution effect of precipitation on soil additives, i.e. limestone and fertilizers.

Anticipated Results:

a) Date will be interpreted and presented in report form for agriculturists' information.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Precipitation (Event) Sampling Network

Subject Code (s) in order of priority: 2.4.1, 2.1.2, 2.5.2

Principal Investigator's Name:

J. Machell J. Kozak

Agency & Department: EPS/Environment

Address: Bank of Montreal Tower
16th Floor, 5151 George St.,
Halifax, N. S.
B3J 1M5

Phone: ( ) 426-6132

Co-operating agencies and investigators (if applicable): J. Underwood, Nova Scotia Department of Environment
B. R. Enman, Prince Edward Island Department of Community Affairs

Duration of each phase: 04/80 - 04/82

Approximate Cost (indicate applicable yearly period): 04/80 - 04/81: $5,000.00

Objectives:

a) Measurement of concentrations of free hydrogen ion, sulfate ion and nitrite ion in precipitation in the Halifax region and estimation of annual loadings and the relative contributions to acid deposition by NO_x and SO_x emissions.

b) Partitioning of estimated loading between local and distant emissions.

c) Resolution of discrepancies between the results of Federal (event and CANSAP) and Provincial precipitation networks.

Method:

a) Precipitation samples are collected on an event basis using Sangamo wet-only samplers. Analysis of pH, sulfate, nitrate and chloride ion is carried out by the Environmental Protection Service.

b) Partitioning of local and distant contributions to wet deposition in the region of Halifax, Nova Scotia is performed by constructing back trajectories on 850 mb meteorological charts.

c) Comparisons are made between the results of the event sampling network, the CANSAP (monthly) network, and the Provincial (weekly, wet-only and bulk) network.

Anticipated Results:

Demonstration of the impact of local (eg. Halifax) sulphur emissions at various distances from Halifax and the resolution of current discrepancies between the estimates of sulphur and hydrogen ion loadings being made by Federal and Provincial agencies.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Precipitation Monitoring - CANSAP

Subject Code (s) in order of priority: 2.4.1

Principal Investigator's Name:

K. E. Percy

Agency & Department: Environment Canada, Canadian Forestry Service

Address: Maritimes Forest Research Centre
P. O. Box 4000
Fredericton, N. B.
E3B 5P7

Phone: (506) 452-3532

Co-operating agencies and investigators (if applicable): Dr. R. Berry, AES

Duration of each phase: 11/79 onwards

Approximate Cost (indicate applicable yearly period): 1) Equipment purchase $1,800.00 (11/79)

Objectives:

a) To purchase and establish a Sangamo Type A collector at the CFS-Acadia Forest Experiment Station.

b) To operate, collect, ship precipitation samples as a station within the CANSAP network.

Method: A Sangamo was in place and operational as of 11/79.

Anticipated Results: Reported by CANSAP.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Collection and Analysis of Precipitation Chemistry Data in the AOSERP Study Area

Subject Code (s) in order of priority: 2.4.1

Principal Investigator's Name:

R. Peters
W. D. Hume
H. S. Sandhu

Agency & Department: Alberta Environment
Research Management Division

Address: 15th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

Phone: (403) 427 -3943

Co-operating agencies and investigators (if applicable):

a) Atmospheric Environment Service - A. S. Mann (Western Region)
b) Alberta Forest Service

Duration of each phase:

a) Analysis of current 3 year data base till 11/80
b) Continued collection and analysis 5/81 - 10/82

Approximate Cost (indicate applicable yearly period):

a) $8,000.00
b) $15,000.00

Objectives:

a) Collection of precipitation on an event basis and measurement of chemical composition of samples.
b) Estimate wet depositional fluxes (and pH) originating from local sources under various meteorological conditions.

Method:

a) Event samples collected at 15 Alberta Forestry Station lookout towers.
b) Collection period from May through September.
c) Samples collected and stored in plastic containers.
d) Samples refrigerated until chemical analysis performed.
e) Chemical analysis performed by Chemical and Geological Laboratories of Edmonton, Alberta.
f) Data analysis proposal - literature search
- case studies
- classification of background vs contaminated samples
- isopleths of ions analysed

Anticipated Results:

a) 5 year data base to obtain estimates of wet deposition fluxes.
b) Analysis of meteorological conditions relating to wet deposition to identify geographical areas of impact.
c) Identify trends as a function of number of oil sands extraction plants in operation.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Environment New Brunswick Precipitation Network

Subject Code (s) in order of priority:	2.4.1 2.3.1

Principal Investigator's Name:

A. J. Spavold

Agency & Department: Environmental Services Branch
Environment New Brunswick

Address: P. O. Box 6000
Fredericton, N. B.
E3B 5H1

Phone: (506) 453-2669

Co-operating agencies and investigators (if applicable): K. Percy,
Canadian Forestry Service
Environment Canada
Fredericton, N. B.

Duration of each phase:
a) Set-up: 03/80 - 10/80
b) Operation: 11/80 to at least 03/83

Approximate Cost (indicate applicable yearly period): $1980: $20,000.00

Objectives:
a) To monitor the quality of rainwater at locations in N.B. remote from local pollutant sources.
b) To assess special and temporal variation in deposition and concentration of pollutants in rainwater in New Brunswick.

Method:
a) Designed to be compatible with data collected by CANSAP network.
b) Monthly collections of wet precipitation using Sangamo Type A Precipitation collectors
c) 3 stations established in 1980:
   2 permanent - Grand Manan, N.B., Nictau, N.B.
   1 temporary - Acadia Forest Experiment Station, Fredericton, N.B. for comparison of results and methodology with CANSAP.
d) 2 additional stations proposed for 1981-82.
e) Analysis for pH, Acidity, Conductivity, $SO_4^{=}$, NO_x, Cl^-, NH_3, Na^+, K^+, Mg^{++}, Ca^{++}.
f) Event sampling planned for 1981.
g) Analysis for trace metals to be incorporated in 1982.

Anticipated Results:

Data to be incorporated into Ednironment New Brunswick data storage system (NAQUADAT) and forwarded after editing to the federal NAQUADAT system, Ottawa.
Interim and Technical Reports to be issued after internal review.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Canadian Network for Sampling Precipitation (CANSAP)

Subject Code (s) in order of priority: 2.4.1

Principal Investigator's Name:

M. E. Still

Agency & Department: Air Quality and Inter-Environmental Research Branch
Atmospheric Environment Service

Address: 4905 Dufferin Street
Downsview, Ontario.
M3H 5T4

Phone: (416) 66-7-4793

Co-operating agencies and investigators (if applicable): Water Quality Branch, ECS
P. Brooksbank (Ottawa)
J. Coburn (Burlington)

Duration of each phase: 9 stations in 1973 increasing to 49 stations in 1977 and 50 stations in 1978.

Approximate Cost (indicate applicable yearly period): 90K O&M; 30K Capital (80/81)

Objectives: To determine the temporal and spatial variation of the trace constituents in precipitation across Canada on a regional scale.

Method:

1. Monthly composite samples of precipitation collect at 50 stations across Canada with a Sangamo wet-only collector.
2. Samples analyzed at WQB, Burlington, for acidity, pH, conductance, SO_4, NO_3, CI, NH_4, Na, Ca, Mg and K.
3. Data published in 3-month blocks by AES and archived in NAQUADAT in Ottawa.
4. Three-station intercomparison to be made with the U.S. National Atmospheric Deposition Program (NADP) commencing in 1980.

Anticipated Results:

Publications containing quality-controlled data in 3-month blocks within 7 months of data collection.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Réseau de Collecte des Précipitations sèches et humides

Code du (des) sujet(s) par ordre de priorité : 2.4.1

Nom du chercheur responsable :

Lévis Talbot

Ministère, organisme ou organisme privé, service : Ministrè de l'Environnement du Québec, Direction des Inventaires, Service de la Qualité des Eaux
Complexe Scientifique

Adresse: 2700 Einstein
Ste-Foy, Q.C.
G1P 3W8

Téléphone: (418) 643-4425

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Service de la Météorologies - G. Fréchette
Direction des Laboratoires - Guy Longpré

Durée de chaque phase: Achat et instalation des appareils sur l'ensemble du territoire du Québec. Octobre 1980 à mai 1981.

Côut approximatif (indiquer pour quelle période annuelle): $115,000: 10/80 - 5/81

Objectifs de travail: Le but de réseau est d'évaluer les taux de dépôts acides au Québec, en mettant l'accent sur les zones sensibles à l'acidification.

Méthode de travail : Des collecteurs de las précipitation sèches et humide seront opérés à 46 stations disséminées sur le territoire du Québec. Mensuellement, les paramètres suivants seront analysés: pH, alcalinité et acidité, sulfates, soufre total, oxydes d'azote, azote ammoniacal, chlorures, fluorures, ions métalliques majeurs.

Résultats prévus:

a) Les données seront stockées dan un système d'information.

b) Les données seront révisées et éditées périodiquement.

c) Des calculs de bilan massique de substances seront effectués et les zonalités géographiques établies.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Precipitation Quality Monitoring Program

Subject Code (s) in order of priority: 2.4.1

Principal Investigator's Name:

J. E. Torneby

Agency & Department: Air Quality Control Branch
Alberta Environment

Address: 9820 - 106 Street
Edmonton, Alberta
T5K 2J6

Phone: (403) 427-5893

Co-operating agencies and investigators (if applicable): Agriculture Canada - Beaverlodge
Defence Research Establishment - Suffield

Duration of each phase: Operational since April 1978

Approximate Cost (indicate applicable yearly period):

Objectives:

a) To detect any significant changes that may occur as a result of industrialization or pollutant transport into the Province.

b) To provide an historical data base that may be used to specify the ultimate fate of pollutants and determine the long-term effects on soil and water bodies.

Method:

Same as CANSAP. There are six stations: Edmonton, Calgary, Red Deer, Whitecourt, Suffield and Beaverlodge.

Anticipated Results: Data are published annually.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Precipitation Chemistry in Nova Scotia

Subject Code (s) in order of priority: 2.4.1, 2.4.2, 2.4.3

Principal Investigator's Name:

John K. Underwood (Mr.)

Agency & Department: Nova Scotia Department of the Environment

Address: P. O. Box 2107
Halifax, N. S.

Phone: 424-8600

Co-operating agencies and investigators (if applicable):

Duration of each phase: a) 2 years) Costs exclude salaries
b) 3 - 5 years)

Approximate Cost (indicate applicable yearly period): a) $60,000 - Oct. 77 - Nov. 79
b) $20,000 - Nov. 79 - ?

Objectives: Determine loading of acids, nutrients and metals in Nova Scotia

Method:

a) 8 Sangamo Samplers, 1 bulk sampler
b) 5 Sangamo Samplers

Wet and dry samples are collected on a weekly basis and are analyzed for 38 parameters.

Anticipated Results: Results to date show 40,000 tonnes of non-marine S fall on N. S. annually. pH changes from 4.5 in S. W. of Province to 5.0 in Cape Breton - Average pH 4.7. S. to N. ratio 2.54:1 (on equivalent basis from SO_4 and NO_3). Loading most severe in Yarmouth, Digby and Annapolis Counties. Strong evidence for both washout/rainout of acids and neutralization as storm tracks move from S.W. to N.E. S.W. sector contributes most to loading of acids.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Airborne Particulate and SO_2 Sampling Network

Subject Code (s) in order of priority:	2.4.2

Principal Investigator's Name:

Dr. Walter Chan

Agency & Department: Ontario Ministry of the Environment
Air Resources Branch

Address: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

Phone: (416) 965-1634

Co-operating agencies and investigators (if applicable):

Duration of each phase:
a) Network Design & Implementation: 4/80 - 11/80
b) Operation: 11/80 - 3/80 (at least)

Approximate Cost (indicate applicable yearly period): $30,000.00 (4/80 - 3/81)

Objectives:

To determine long term ambient concentration of various chemical parameters including SO_2.

To supplement dry deposition data obtained from the cumulative wet and dry deposition network.

Method:

a) Low volume sampling over a one-month or 4-week interval.
b) The prefilter is a Ghia teflon filter for particulate sampling and it is followed by W41 K_2CO_3-glycerol impregnated filter for trapping of SO_2.
c) Filters will be submitted to MOE-LSB for chemical analysis. The teflon filter samples will be analyzed for SO_4, NO_3, NH_4, major ions, nutrients, and trace metals.

Anticipated Results:

a) Data will be entered into the MOE database, and after editing will be deposited into NAQUADAT and SAROAD databases.

b) Ministry reports will be issued to the public after internal review.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Particulate and Gaseous Sulphur and Nitrogen Compound Sampling Network

Subject Code (s) in order of priority: 2.4.2, 2.4.1, 2.2.2

Principal Investigator's Name:

Dr. Walter Chan

Agency & Department: Ontario Ministry of the Environment
Air Resources Branch

Address: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

Phone: (416) 965-1634

Co-operating agencies and investigators (if applicable):

a) Ontario Hydro, Research Division - Mr. O. Melo
b) Atmospheric Environment Service - Dr. L. Barrie

Duration of each phase:

a) Set-up: 3/80 - 7/80
b) Operation: 7/80 to at least 4/82

Approximate Cost (indicate applicable yearly period): $50,000.00 (4/80 - 3/81)

Objectives:

a) To measure particulate sulphate, nitrate and NH_4^+, and gaseous SO_2 and HNO_3 on a daily basis (0800-0800).
b) The results of these measurements will be used to determine dry deposition rates associated with air masses having different sectors of origin, to support the interpretation of event precipitation, and to evaluate atmospheric reaction mechanisms associated with LRTAP.

Method:

a) At 3 sites co-located with event precipitation collectors (near London, Dorset, & Kingston) use 47 mm low-volume filter packs at a height of 10 meters to collect samples daily, as follows:
b) Particulates will be collected on teflon pre-filters.
c) HNO_3 will be collected on nylon filters.
d) SO_2 will be collected on W-41 filters impregnated with potassium carbonate-glycerol solution.
e) Analysis will be carried out by the MOE-LSB.
f) During the measurement program, a field intercomparison of the network with Ontario Hydro and AES networks will occur.

Anticipated Results:

a) Data will be entered into the MOE database and after editing will be transferred to NAQUADAT and SAROAD databases.
b) Ministry reports will be issued to the public after internal review.
c) A review of our data along with similar data taken by Ontario Hydro and AES networks will be made periodically and a joint publication will hopefully result.

LRTAP ACTIVITY DESCRIPTION

Activity Title: Sulfation plate network in the Sudbury area.

Subject Code (s) in order of priority: 2.4.2. 2.2.1.

Principal Investigator's Name:

Bruce R. Dreisinger

Agency & Department: Environmental Control Department, Inco Metals Company,

Address: General Engineering Bldg., Copper Cliff, Ontario. POM 1NO

Phone: (705) 682-2043

Co-operating agencies and investigators (if applicable): M. E. Buchanan, M. O. Carr, P. M. Bolger, J. Johnston

Duration of each phase: Set up 5/71: Operating 1971 to 1979

Program continuing on a much reduced scale in 1980.

Approximate Cost (indicate applicable yearly period): 1971 to 1980: $460,000

Objectives: Determine SO_x levels (mg/ SO_3/100 cm^2/day) and distribution patterns throughout Sudbury area before and after the operation of a 1250' chimney and also after other emission reduction programs at Inco.

Method:

(a) A total of 90 sulfation plate stations were established in all directions and at various distances up to 175 miles from Copper Cliff.
(b) Monthly analyses of exposed plates (3 per station) were made
(c) Distribution patterns of SO_x were determined and printed by computer.
(d) Extra sets of plates were exposed during unusual conditions, i.e., strikes and plant closures for vacation to determine SO_x levels when Inco was not operating.

Anticipated Results:

(a) The 1250' chimney was very effective in reducing ground level concentrations of SO_x in the Sudbury area.
(b) The improvement in air quality in the immediate Sudbury area was not achieved at the expense of air quality at the more distant stations. Sulfation levels at stations over 100 miles from Copper Cliff remained at background levels before and after the operation of the chimney.

LRTAP ACTIVITY DESCRIPTION

Subject Code (s) in order of priority:	2.4.2 2.2.1 2.2.2 2.5.4

Activity Title:

Particulate and Gaseous Sulphurs and Nitrogen Compound in Ambient Air Sampling Network

Principal Investigator's Name:

Dr. Frank Frantisak

Agency & Department: Noranda Mines Ltd.

Address: P. O. Box 45
Commerce Court West
Toronto, Ontario
M5L 1B6

Phone: (416) 867-7306

Co-operating agencies and investigators (if applicable):

Duration of each phase: Commenced 1977, in operation

Approximate Cost (indicate applicable yearly period):

Objectives:

Method:

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

National Air Pollution Surveillance (NAPS) Network - Particulate, Sulphates and Nitrates

Subject Code (s) in order of priority: 2.4.2

Principal Investigator's Name:

Roger J. Lafleur
Head, Ambient Monitoring Section

Agency & Department: Environment Canada

Address:
Environmental Protection Service
Air Pollution Control Directorate
Surveillance Division
Ottawa, K1A 1C8

Phone: (613) 998-4272

Co-operating agencies and investigators (if applicable): All provincial Department of the Environment and Environment Canada

Duration of each phase: Sampling for particulate sulphates and nitrates on a continuing basis began January 1980. Network has been in operation since 1970.

Approximate Cost (indicate applicable yearly period): Cost breakdown according to pollutant is impossible.

Objectives: To provide measurements in all major Canadian urban areas of particulate sulphate and nitrate levels in order to determine present air quality and to establish long term trends.

Method: Suspended particulate matter is collected on glass fibre filters every sixth day at about 110 stations in all major urban areas across Canada by use of the high volume sampler. The collected particulate matter is analyzed for water-soluable sulphate and nitrate starting January 1980. Total suspended particulate matter and lead are also determined, this since 1970.

Anticipated Results: Data will be entered into the NAPS data base and will be published monthly and annually in the NAPS reports.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Ontario Hydro's Air and Precipitation Monitoring Network

Subject Code (s) in order of priority:	2.4.2 2.2.1 2.2.2

Principal Investigator's Name:

O. T. Melo

Agency & Department: Ontario Hydro
Research Division

Address: 800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

Phone: (416) 231-4111

Co-operating agencies and investigators (if applicable):

a) Ontario Ministry of the Environment
Dr. Walter Chan

b) Atmospheric Environment Service
Dr. L. Barrie

Duration of each phase:

a) Set-up: 6/75
b) Operation: 6/75 - 12/80
c) Upgrading: 9/80 - 12/80
d) Operation: 1/81 to at least 12/82

Approximate Cost (indicate applicable yearly period): 1/80 - 12/80: $125,000.00

Objectives:

a) Determine the spatial and temporal variability of air and precipitation chemistry in Ontario

b) Obtain data to compare against model results.

c) Study the effect of meteorology, emission density and other variables on pollutant levels.

Method:

a) Dichotomous samplers with filter packs (teflon/nylon/K_2CO_3 impregnated W41) on the fine particle size stream and wet-only precipitation gauges are used at six sites in Ontario (Essex, Toronto, Vankleek Hill, Muskoka, Mississauga and Abitibi Canyon).

b) Samples are collected from 08:00 to 08:00 of the following day during weekdays.

c) Air concentrations of SO_2, $SO_4^=$ aerosol, nonvolatile NO_3^- and HNO_3 vapour are measured.

d) Volume, pH, acidity and major ion concentration are measured in precipitation.

e) Intercomparison with OME and AES will be carried out.

Anticipated Results:

a) Data will be stored in a data base and bimonthly reports issued on a regular basis.

b) Interpretative reports will be prepared on an annual basis.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Monitoring Dustfall and SO_2 in Thompson Area

Subject Code (s) in order of priority: 2.4.3

Principal Investigator's Name:

J. S. Ashton

Agency & Department: Inco Metals Company
Manitoba Division

Address: Thompson, Manitoba
R8N 1P3

Phone: (204) 778-6701

Co-operating agencies and investigators (if applicable):

Duration of each phase: Since 1958 - Sulfation
1972 - Dustfall
1972 - Continuous SO_2 Monitoring

Approximate Cost (indicate applicable yearly period): $20,000.00

Objectives: To evaluate deposition of SO_2 and Dustfall in Thompson area.

Method:

a) SO_2 - sulfation candles to 1976. Sulfation plates from 1977.

b) SO_2 - Phillips Monitor in Thompson 1973. Two Teco Monitors - 1977 at Paint Lake and Birchtree.

c) SO_2 - 20 locations for sulfation in 40 mile radius of Thompson to 1972.

d) Sulfation and Dustfall since 1972 - 35 locations + 11 locations in Thompson city - 80 mile radius.

e) Dustfall analysed for nickel.

f) Some samples monthly. Some annual.

Anticipated Results:

Annual summaries prepared.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Dustfall Collection in the Sudbury Area

Subject Code (s) in order of priority: 2.4.3

Principal Investigator's Name:

Patrick M. Bolger

Agency & Department: Environmental Control
Inco Metals Company

Address: General Engineering Building
Copper Cliff, Ontario
POM 1NO

Phone: (705) 682-0601 Ext. 248

Co-operating agencies and investigators (if applicable): M. E. Buchanan

Duration of each phase: The monitoring program was carried out between 1976 and 1980 and is continuing at a reduced level.

Approximate Cost (indicate applicable yearly period): Approximately $180,000 between 1976 and 1980.

Objectives:

Determine levels of dust and metal fallout near Sudbury.

Method:

A network of 46 dustfall stations were established within 125 km radius of Sudbury. Plastic collectors were set out at each station and exposed for one month periods. Contents were analyzed for total dust, total inorganic dust, copper, nickel and iron.

Anticipated Results:

The program was carried out to assist in establishing the impact of mining activities on air quality in the Sudbury area.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Snow-core sampling in the Sudbury Area

Subject Code (s) in order of priority:	2.4.3 2.3.3

Principal Investigator's Name:

Bruce R. Dreisinger

Agency & Department: Environmental Control
Inco Metals Company,

Address: General Engineering Bldg.,
Copper Cliff, Ontario.
POM 1NO

Phone: (705) 682-2043

Co-operating agencies and investigators (if applicable):

M. O. Carr
M. E. Buchanan
P. M. Bolger
J. Johnston

Duration of each phase: Each winter since 1972

Approximate Cost (indicate applicable yearly period): $150,000: 1972 to 1979

Objectives:

(a) Determine heavy metal content and acidity of snow on the ground in the Sudbury area.
(b) Since 1975, determine nitrate/sulfate ratios of snow.

Method:

(a) Snow-core samples of snow were collected at 92 stations close to and far (up to 275 miles) from Copper Cliff.
(b) The samples were kept frozen until ananlyses at Inco's Process Tech Lab in Copper Cliff.
(c) Deposition patterns were produced by computer from results calculated on a lbs/sq.mile/day basis.

Anticipated Results:

Reports of Nov. 1977 and April 1980 show that:

(a) Acidity of snow was independent of distance from smelter activities.
(b) The sulfate content of snow did not correlate with distance from the smelter.
(c) Nitrate levels were consistently higher than sulfate levels in snow.
(d) Good correlations with distance were found for copper, nickel and iron in snow.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Développement d'un modèle numérique pouvant estimer le transport à grande distance des composés du soufre.

Code du (des) sujet(s) par ordre de priorité :	2.5.1 2.1.1 2.1.2 2.2.1

Nom du chercheur responsable :

Dr. Jean-Pierre Fortin

Ministère, organisme ou organisme privé, service : INRS-Eau (Université du Québec)

Adresse: C. P. 7500
Ste-Foy, Québec
G1V 4C7

Téléphone: (418) 657-2281

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Environnement Québec, Service de la météorologie
M. Claude Lelièvre

Durée de chaque phase: Développement d'un premier modèle simple: 80/10 à 81/11

Côut approximatif (indiquer pour quelle période annuelle):

du 80/10 au 81/11: $48,000.00

Objectifs de travail:

a) Développement d'un modèle numérique d'estimation du transport à grande distance des composés du soufre.

b) Etudes préliminaires en vue du développement d'un modèle plus complexe pouvant estimer le transport à grande distance des principaux polluants atmosphériques (composés du soufre et de l'azote).

Méthode de travail :

a) Identification des divers phénomènes atmosphériques qui doivent être considérés dans le domaine des précipitations acides.

b) Revision critique des divers modèles de transport de polluants à longue distance.

c) Développement d'un modèle tenant compte de a) et b), des données disponibles actuellement ou dans un avenir propre, de la précision escomptée et de la rapidité d'exécution sur ordinateur.

d) Compilation des taux moyens tant annuels que saisonniers d'émissions de composés du soufre dans l'atmosphère par certaines sources ponctuelles.

Résultats prévus:

a) Détermination de la contribution relative de certaines sources émettrices ponctuelles québécoises sur les bilans annuels, sinon saisonniers, des composés du soufre ainsi qu leur incidence sur les précipitations acides au Québec.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Modelisation du problème des pluies acides.

Code du (des) sujet(s) par ordre de priorité : 2.5.1 2.1.2

Nom du chercheur responsable :

Claude Lelièvre

Ministère, organisme ou organisme privé, service : Environnement-Québec
Service de la Météorologie

Adresse: 194, Ave. St-Sacrement
Québec, G1N 4J5

Téléphone: (418) 643-4588

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) :

a) Baston Paulin, Environnement-Québec, Direction de la Recherche
b) M. Lachance, I/N/R/S/ Eaux

Durée de chaque phase:

a) Développement d'un modèle statistique: de 80/09 à 81/01
b) Application au Québec: de 80/09 à 81/09

Côut approximatif (indiquer pour quelle période annuelle):

de 80/09 à 81/09: $50,000.00

Objectifs de travail:

a) Bilan des retombées acides sur le Québec et identification des principales sources.
b) Evaluation de l'effet de l'usine de Rouyn-Noranda et conséquences d'une réduction des émissions.

Méthode de travail :

a) Modèle de référence: Fisher (1977)
b) Utilisation des inventaires d'émission sur l'est de l'Amérique.
c) Compilation des données climatologiques nécessaires aux models, telles les vents, hauteur de couche limite, etc.

Résultats prévus:

a) Estimation du bilan transfrontalier de pollution.
b) Évaluation des possibilités d'un modèle stastique.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Atmospheric Sulphur Budgets for the Atlantic Provinces of Canada

Subject Code (s) in order of priority: 2.5.1, 1.1

Principal Investigator's Name:

D. A. Lord
J. F. Wiltshire

Agency & Department: EPS/Environment

Address: Bank of Montreal Tower, 16th Floor
5151 George Street
Halifax, N. S.
B3J 1M5

Phone: (902) 426-6132

Co-operating agencies and investigators (if applicable): AES (Atlantic Region) provides meteorological data

Duration of each phase: 04/80 - 12/80

Approximate Cost (indicate applicable yearly period): $1,000.00

Objectives: To estimate the relative contributions of local emissions and imported emissions to the deposition of sulphur in the Atlantic provinces.

Method: Sulphur emissions in the Atlantic provinces are inventoried and transport and deposition processes are estimated using a drift model (point sources). A comparison with measured wet deposition (CANSAP data) and estimated dry deposition and deposition of natural sulphur deposition yields complete sulphur budgets (including export and import terms) for each of the Atlantic provinces. Method is described in EPS-5-AR-79-8.

Anticipated Results: Net import in all of the Atlantic provinces with significant inter-provincial exchanges.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Modelling of the Long-Term Concentrations of Sulphur Over North-Eastern United States and Canada

Subject Code (s) in order of priority: 2.5.1

Principal Investigator's Name:

Dr. Akula Venkatram

Agency & Department: Ontario Ministry of the Environment
Air Resources Branch

Address: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

Phone: (416) 965-5068

Co-operating agencies and investigators (if applicable): Dr. B. Ley
Air Resources Branch

Duration of each phase: 3/80 - 4/81

Approximate Cost (indicate applicable yearly period): $40,000.00

Objectives: To develop a statistical long range transport model to estimate long-term concentrations of acid causing pollutants.

Method: Development will continue until model predictions compare well with measurements.

Anticipated Results: A Model which will be used to study source-receptor relationships. This will provide input to strategies for acid rain abatement.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Lagrangian Model Study of the Long Range Transport of Air Pollutants

Subject Code (s) in order of priority: 2.5.2

Principal Investigator's Name:

Dr. Barbara E. Ley

Agency & Department: Ontario Ministry of the Environment
Air Resources Branch

Address: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

Phone: (416) 965-5068

Co-operating agencies and investigators (if applicable):
Dr. Akula Venkatram
Air Resources Branch
Ontario Ministry of the Environment

Duration of each phase:
a) Development Stage 1: 9/80 - 2/81
b) Verification: 1/81 - 3/81
c) Development Stage 2: 2/81

Approximate Cost (indicate applicable yearly period): $15,000.00 (9/80 - 3/81)

Objectives:

a) To develop a Lagrangian-type model for the study of acid precipitation in Ontario.

b) To quantify long range transport of sulphur over north-eastern North America.

Method:

a) Stage 1: Development of a 'basic' Lagrangian model using trajectories calculated objectively from m.s.l. pressures.
b) The model will be verified using observations of sampling networks.
c) Sulphur deposition patterns for northeastern North America will be calculated for periods of interest.
d) Stage 2: development of a more sophisticated model as need indicates.

Anticipated Results:

a) Quantification of acid precipitation in the Ontario region on seasonal and possibly monthly time scales.

b) Intercomparison with other Lagrangian-type models.

c) Ministry reports and scientific journal publication.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Lagrangian Modelling of LRTAP

Subject Code (s) in order of priority: 2.5.2

Principal Investigator's Name:

Dr. P. K. Misra
Dr. A. C. McMillan

Agency & Department: Ontario Hydro

Address: Research Division
800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

Phone: (416) 231-4111 Ext. 6867

Co-operating agencies and investigators (if applicable):

Duration of each phase:

a) Model Development: 9/80 - 12/81

b) Operation: 12/81

Approximate Cost (indicate applicable yearly period): $50,000.00 per annum

Objectives:

To develop a long range lagrangian transport and dispersion model to predict short term/long term concentrations and deposition.

Method:

a) Compute geostrophic winds from station pressure field.

b) Compute trajectories from sources and build up trajectory statistics.

c) Incorporate scavenging and chemical transformation.

d) Compute concentration of SO_2, NO_x, SO_4, and NO_3 for different averaging times.

Anticipated Results:

a) A report will be produced at each phase of development of the model.

b) A final report will be produced on model performance by 4/82.

c) Intercomparison with models developed at AES and Ontario MOE will be performed.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Atmospheric Modelling

Subject Code (s) in order of priority:	2.5.2 2.5.1 2.1.2 1.1

Principal Investigator's Name:

M. P. Olson
J. W. S. Young

Agency & Department: Air Quality and Inter-Environmental Research Branch
Atmospheric Environment Service

Address: 4905 Dufferin Street
Downsview, Ontario.
M3H 5T4

Phone: (416) 667-4903 (Olson)
(416) 667-4786 (Young)

Co-operating agencies and investigators (if applicable):

Duration of each phase: Re Method section below, commenced 1. 1976, commenced 2. 1980, commenced 3. 1977, commenced 4. 1978, commenced 5. 1980, commenced 6. 1978, commenced 7. 1980.

Approximate Cost (indicate applicable yearly period): 105K O&M (80/81)

Objectives: To develop and apply an atmospheric modelling capability for the simulation of the transport and deposition of NO_x and SO_x over eastern North America on time scales from episodal to climatological.

Method:

a) Development of a Lagrangian concentration/deposition box model on a 127 km grid with a 3-hour time-step.
b) Development of a statistical climatological LRT model.
c) Development of an SO_x, NO_x emissions inventory for eastern North America.
d) Evaluation of model output against available monitored data.
e) Develop methodology for parameterizing short-range (sub-grid) deposition.
f) Application of models to needs of research and control strategy sectors.
g) Application of Husar model to estimation of transboundary fluxes.

Anticipated Results: Estimates of regional concentration and deposition patterns for SO_x and NO_x over eastern North America plus estimates of international and inter-provincial trans-boundary fluxes.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Modèle de transport sur des grandes distances de polluants atmosphériques

Code du (des) sujet(s) par ordre de priorité :	2.5.3 2.5.2 2.1.1

Nom du chercheur responsable :

C. S. Maddukuri (M.)

Ministère, organisme ou organisme privé, service :

Adresse: Département de Physique
Université du Québec à Montréal
C. P. 8888
Montréal, Québec H3C 3P8

Téléphone: (514) 282-3313

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) :

Durée de chaque phase:

Côut approximatif (indiquer pour quelle période annuelle):

Objectifs de travail: Faire un modèle de transport sur des grandes distances des polluants atmosphériques et comparer les résultats aux observations.

Méthode de travail : Méthode d'Euler.

Résultats prévus:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

LRTAP: Data Analysis and Modelling

Subject Code (s) in order of priority: 2.5.3

Principal Investigator's Name:
C. S. Matthias & A. Lo (1) }
E. Wilson & L. A. Barrie (2) } (See objectives below)
S. Daggupaty & R. V. Portelli (3) }

Agency & Department: Atmospheric Environment Service

Address: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

Phone: (416) 667-4795/4780/4787

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 01.09.80 - 31.04.81: $40K

Objectives:

a) To develop a long range climatological model.

b) To carry out a study of snow melt shock potential with respect to acidic impacts.

c) To acquire and evaluate regional dispersion data.

Method:

a) Analytical scheme of Fay & Rosenweig will be basis of model to be tested out on North American Grid.

b) Analysis of precipitation data and snow melt conditions to be combined with deposition model.

c) Contract to be carried out by consultant for analyses of various existing data sets.

Anticipated Results:

a) Working model plus reports on usage etc.

b) Climatological mapping of snow melt acidic shock potential for one or two regions of Canada with report.

c) Data on dispersal characteristics in various regions plus report on results.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Atmospheric NO_x Chemistry as Related to Long Distance Transport and Acidic Precipitation

Subject Code (s) in order of priority:	2.5.4

Principal Investigator's Name:

Dr. Maris Lusis

Agency & Department: Ontario Ministry of the Environment

Address: Air Resources Branch
880 Bay St., 4th Floor
Toront o, Ontario
M5S 1Z8

Phone: (416) 965-1634

Co-operating agencies and investigators (if applicable): Contractor: Dr. J. E. Hunt, Concord Scientific Corporation

Duration of each phase: Phase 1: Items a & b below
Phase 2: Item c below
09/80 - 03/81

Approximate Cost (indicate applicable yearly period): $13,900.00

Objectives:

To carry out a literature survey of relevant work on the conversion of NO_x to nitric acid, nitrates and other products and on the basis of the results, recommend how NO_x chemistry can best be incorporated into MOE's long range transport models.

Method:

a) Review literature for laboratory and field studies of NO_x conversion to products and approaches used in mathematical modelling of this phenomenon.

b) Identify the most important reactions and evaluate if the incorporation of these into a simple mathematical model is feasible.

c) If (b) is realistic, recommend rate constants.

Anticipated Results:

A report of Phase 1 results by mid-February, 1981 and if Phase 1 is favourable, a report of Phase 2 will be available by March, 1981.

Section 3

EFFECTS STUDIES

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Water, Vegetation, Soil Surveys

Subject Code (s) in order of priority:	3.1.1 3.2.2 3.2.3

Principal Investigator's Name:

J. S. Ashton

Agency & Department: Inco Metals Company
Manitoba Division

Address: Thompson, Manitoba
R8N 1P3

Phone: (204) 778-6701

Co-operating agencies and investigators (if applicable):

Duration of each phase:

a) Water since 1958
b) Vegetation, soil and revised water since 1972
c) Effluent since 1960.

Approximate Cost (indicate applicable yearly period):

Objectives:

To survey possible impact of emissions and effluents in 80 mile radius around Thompson.

Method:

a) 43 Stations - water 1958-1972.
b) Revised to 20 Stations in 1972. More complete analysis.
c) Vegetation and soil 35 locations since 1972.
d) Sampling and analyses for metals, sulphur, etc.
e) Reduced 1978 - 1980 - Overlap with Slaney Study.
f) Effluents from Thompson plant sampled and analysed regularly.

Anticipated Results:

a) Annual Summaries
b) Monthly reports on effluents - some reported to Manitoba Environmental Management Division.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Sensitivity of Saskatchewan Lakes to Acidification.

Subject Code (s) in order of priority:	3.1.1 3.1.4

Principal Investigator's Name:

F. M. Atton

Agency & Department: Fisheries and Wildlife Branch
Department of Tourism and Renewable Resources

Address: 30 Campus Drive
Saskatoon, Saskatchewan
S7N 0X1

Phone: (306) 664-5760

Co-operating agencies and investigators (if applicable): Wen K. Liaw

Duration of each phase: One Year

Approximate Cost (indicate applicable yearly period): $45,000.00 per year

Objectives:

a) Determine buffering capacity of a broad sample of lakes-approximately 700.

b) Classify the lakes in this respect and describe the distribution of these classes.

Method:

a) Visit lakes not previously examined to obtain water samples for appropriate analysis (Chemical)

b) Complete the analysis of records of lake chemistry from 1938 to 1979.

Anticipated Results:

a) Description of sensitivity of lakes to acidification over the province with a high risk area in the north (Precambrian) and rather low risk areas in the southern 0.67 part of the province.

b) Model to predict the sensitivity of individual lakes.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Hydrogeochemistry of Turkey Lake Forested Watershed

Subject Code (s) in order of priority:	3.1.1 3.1.6

Principal Investigator's Name: E. B. Bennett
R. Semkin

Agency & Department: Department of Environment, National Water Research Institute

Address: Canada Centre for Inland Waters
Box 5050, Burlington, Ontario L7R 4A6

Phone: 416 637-4307
705 949-9461

Co-operating agencies and investigators (if applicable): Great Lakes Forestry Research Centre, Sault Ste. Marie. Great Lakes Biolimnology Laboratory, CCIW. Ontario Ministry of Natural Resources, Sault Ste. Marie.

Duration of each phase:
Basin site development - 1980
Comprehensive measurements - 1980-82
Continued monitor level study - continuing

Approximate Cost (indicate applicable yearly period): 4.0 PY 105K FY 80-81

Objectives: To quantify the effects of acidic precipitation on the hydrogeochemistry of the Turkey Lake Forested Watershed - a series of non-calcareous basins within a Great Lakes hardwood forest.

Method:

a) Define the basic hydro-geologic components of the basin
b) Establish networks of year-round quantitative measurements of precipitation, surface flows, lake levels, evaporation and evapotranspiration.
c) Establish networks of quantitative measurements of the pertinent chemical constituents of the hydrologic regime.
d) Intercompare response of basins of differing levels of acid loading.

Anticipated Results: In coordination with the research of Great Lakes Forestry Research Centre and Great Lakes Biolimnology Laboratory the watershed study is expected to quantify the ecosystem effects of atmospheric deposition on a poorly buffered forested watershed.

LRTAP ACTIVITY DESCRIPTION

Activity Title: Aquatic Regime Acidification Models

Subject Code (s) in order of priority: 3.1.1

Principal Investigator's Name: E. B. Bennett
M. E. Thompson

Agency & Department: Department of Environment, National Water Research Institute

Address: Canada Centre for Inland Waters
Box 5050, Burlington, Ontario
L7R 4A6

Phone: (416) 637-4301

Co-operating agencies and investigators (if applicable): DOE, Inland Waters Directorate
Canadian Wildlife Service

Duration of each phase:

Preliminary historical data analysis	1980
Application of Models to Watershed Studies	1981-83

Approximate Cost (indicate applicable yearly period): 2 PY 76 K operating costs FY 1980-81

Objectives: Develop phenomenological models of geochemical responses of rivers and lakes to various levels of acidic deposition.

Method: Through use of geochemical ionic balance considerations utilize historical chemical data bases for rivers and lakes in poorly buffered regions of Canada to develop statistical, phenominological relationships between the atmospheric deposition and basin responses.

Anticipated Results: Phenomenological models which provide a gross capability to quantify the response of a basin to changes in ionic loading.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Impact des précipitations acides sur la variabilité spatio-temporelle de la qualité physico-chimique des eaux lacustres du Québec

Code du (des) sujet(s) par ordre de priorité : 3.1.1

Nom du chercheur responsable : Dr. Bernard Bobée, Professeur
Marius Lachance, agent de recherche
Mario Deslauriers, étudiant en thèse de maîtrise

Ministère, organisme ou organisme privé, service : INRS-Eau (Université du Québec)

Adresse: 2700 Einstein
C.P. 7500
Ste-Foy
G1V 4C7

Téléphone: (418) 657-2539

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Service de la Qualité des Eaux,
Ministère de l'Environnement, Québec
MM. Paul Potvin & Lévis Talbot

Durée de chaque phase:
a) Mise en forme de la banque des données du 80/07 au 80/11
b) Analyse et interprétation du 80/12 au 81/06

Côut approximatif (indiquer pour quelle période annuelle):
Subventionné en partie par F.C.A.C.-EQ92 pour un montant total de l'ordre de $22,000.00.
Subventionné par le minisère de l'Environnement du Québec (en négociation):∿ $20,000.00.

Objectifs de travail:
a) Décrire, analyser et interpréter la variabilité spatiale et temporelle des paramètres physico-chimiques reliés à l'acidité et mesurés dans les eaux lacustres du Québec.
b) Estimer le niveau d'acidification des eaux lacustres du Québec.
c) Effectuer des recommandations pour la planification de l'acquisition future des données d'eaux de surface (densité, fréquence, périodes critiques à échantillonner, paramètres caractérisant le niveau d'acidité).

Méthode de travail:
a) Constituer une sous-banque de données limnologiques pour les paramètres reliés à l'acidification et pour les régions sensibles à l'acidification.
b) Identifier au moyen de méthodes multi-variées des zones homogènes pour divers paramètres.
c) Utiliser des techniques regressives pour estimer le niveau d'acidification des eaux lacustres à l'intérieur de ces zones.

Résultats prévus:
a) Mieux connaître l'étendue et l'intesité de l'acidification des eaux lacustres du Québec.
b) Fournir des connées essentielles à l'élaboration et à la planification d'études ultérieures sur l'acidification des eaux de surface au Québec.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Inventory of Effects of Acidification on Fish and Fish Habitat in Newfoundland and Labrador

Subject Code (s) in order of priority:	3.1.1 3.1.4 3.1.3

Principal Investigator's Name:

W. J. Bruce

Agency & Department: Research and Resource Services
Fisheries and Oceans Canada

Address:

P. O. Box 5667
St. John's, Newfoundland
A1C 5X1

Phone: (709) 737-4492

Co-operating agencies and investigators (if applicable):

a) Canadian Forestry Service
Dr. S. Sidhu

b) Newfoundland Department of Consumer Affairs and Environment
Mr. L. Huelt

Duration of each phase:

a) Planned Set-up: 01/81 - 04/81

b) Operation: 05/81 - 09/81

Approximate Cost (indicate applicable yearly period): 05/81 - 12/81: $337,000.00

Objectives:

To assess the current condition of Newfoundland and Labrador water quality and freshwater and anadromous fishes as a function of atmospheric deposition of acidifying materials and contaminants.

Method:

a) A number of susceptible headwater lakes in Newfoundland and Labrador will be sampled for the following:

i) examination of the fishery and its contaminant burden

ii) food base availability and well-being

iii) habitat analysis

iv) core chronology

Anticipated Results:

a) Date will be entered into a national DFO base and later transferred to NAQUADAT in Ottawa.

b) The data will serve the base of a time series set of data and thus serve as indicators of change occurring from atmospheric deposition when re-sampled in 3-5 years.

Activity Title:

Kejimkujik National Park Baseline Characterization
WQB # 253

Subject Code (s) in order of priority:	3.1.1 3.1.6 3.1.5

Principal Investigator's Name:

Thomas A. Clair

Agency & Department: Environment, Water Quality Branch

Address: P. O. Box 861
Moncton, N. B.
E1C 8N6

Phone: (506) 388-6606

Co-operating agencies and investigators (if applicable): Canadian Wildlife Service
Dr. J. Kerekes

Duration of each phase: 1980/81 - Sampling and analysis of water, sediment and benthic invertebrate samples.

Ongoing - Mersey River daily sampling

Approximate Cost (indicate applicable yearly period): 1980/81 - 1.0 PY; $8,400.00 O&M

Objectives: To characterize long term trends in Kejimkujik National Park of:

a) Mersey River pH and alkalinities

b) Benthic invertebrate populations

c) Sediment-water exchanges of nutrients and metals

Method:

a) Daily sampling of the Mersey River at one site to try to understand normal pH changes over the year. The data will be subjected to time series and linear regression analysis to see how pH is related to river flow and temperature. The sampling will continue for as long as is necessary to show long-term trends (probably 5 to 10 years).

b) Intensive benthic invertebrate sampling was carried out in 1980 and 50 cm. sediment cores were taken. A paleslimnological study of invertebrate headcapsules will be undertaken from the cores and the old compared to present populations to see if any changes in species composition can be attributed to increases in lake acidity.

c) Sediment cores from Kejimkujik Lake were incubated with overlying water of different pH's constant temperature. The pH values were 4.5, 5.5, and 6.0. The cores were sampled weekly.

Anticipated Results:

a) Edited data will be transmitted to NAQUADAT and a model of pH changes in the Mersey will be developed.

b) Should the results show a meaningful change in populations, a scientific publication will be prepared.

c) Results showed that with the type of sediment used, there was no difference in phosphorus regeneration between various pH's, but an increase in total aluminum with increases in acidity. An internal WQB report has been prepared.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Kejimkujik National Park Groundwater Characterization
WQB # 260

Subject Code (s) in order of priority: 3.1.1

Principal Investigator's Name:

Thomas A. Clair

Agency & Department: Environment, Water Quality Branch

Address: P. O. Box 861
Moncton, N. B.
E1C 8N6

Phone: (506) 388-6606

Co-operating agencies and investigators (if applicable):

a) Dr. J. Kerekes
Canadian Wildlife Service, Halifax

b) Mr. K. Percy
Canadian Forestry Service, Fredericton

Duration of each phase:

Set-up: April 1980 to March 1981
Operation: April 1981 to March 1983

Approximate Cost (indicate applicable yearly period):

1980/81 0.2 PY; $1,000.00
1981/82 ($2,000.00)
1982/83 ($2,000.00)

Objectives:

To obtain a delineation of groundwater characteristics of the Kejimkujik Calibrated Basin for inclusion in ion mass balance calculations.

Method:

The work is coordinated by Water Quality Branch and includes, cross-sectioning of the lake with CTD measurements to find underwater flows; piezometer studies of the overburden, sampling of ephemeral streams in the spring and analyzing for environmental isotopes in groundwater.

Anticipated Results:

a) To be used in mass balance studies of the calibrated basins.

b) DOE report or publication.

c) Results to be entered into NAQUADAT, Ottawa

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Atlantic Region Acid Rain Sensitivity and Trend Assessment
WQB # 255

Subject Code (s) in order of priority: 3.1.1 2.5.1

Principal Investigator's Name:

Thomas A. Clair

Agency & Department: Environment, Water Quality Branch

Address: P. O. Box 861
Moncton, N. B.

Phone: (506) 388-6606

Co-operating agencies and investigators (if applicable): Water Resources Branch, Halifax
Resources Branch, Department of Fisheries & Oceans, Halifax, Dr. W. Watt

Duration of each phase: Ongoing

Approximate Cost (indicate applicable yearly period): 1980/81 - 1.6 PY; $30,500 O&M
1981/82 - 1.6 PY (est.) $30,500 O&M

Objectives:

To find which areas of the Atlantic Provinces are sensitive to acid precipitation and then to follow trends in pH and metals over time in the sensitive areas.

Method:

Sampling of surface waters for pH, major ions and metals to get aerial coverage as well as monthly sampling at 26 selected rivers is being done. All samples are being analyzed and maps of sensitive areas have been prepared. Long term trends in river pH's will be subjected to time series analysis to try to detect changes over time.

Anticipated Results:

a) All edited data will be placed into NAQUADAT.

b) Information will be used by Water Quality Branch and IWD in development of sensitivity maps, trend assessment and be available to those working on control strategies and in Research.

LRTAP ACTIVITY DESCRIPTION

Subject Code (s) in order of priority:	
	3.1.1
	3.1.2
	3.1.3
	3.1.4

Activity Title:

Effects of Acidification on Lake and Stream Chemistry and Biology

Principal Investigator's Name:

P. Dillon

Agency & Department: Ministry of the Environment

Address: P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3058

Co-operating agencies and investigators (if applicable): Dr. H. Harvey
Dept. of Zoology
University of Toronto

Duration of each phase: Ongoing, reports prepared as data warrant

Approximate Cost (indicate applicable yearly period): $200K (1981/82)

Objectives: To determine the long-term effects of the input of acids on the chemistry and biology of lakes and streams and the short-term effects of individual events of high loading.

Method: The chemistry, phytoplankton, zooplankton benthos and fisheries of 8 study lakes and of varying alkalinities (20 to 200 eq l^{-}) have been studies since 1976. Intensive studies of several streams (chemistry and periphyton) are undertaken each year during peak runoff.

Anticipated Results: Eventually, some of the cause effect relationships linking acidic precipitation and metal deposition to changes in the chemistry and biology of lakes will be quantified, so that measurements at a point in time will be useful for predicting the degree of acidification of the water body.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Watershed Mass Balances

Subject Code (s) in order of priority:	3.1.1 3.2.1 3.2.3

Principal Investigator's Name:

P. Dillon

Agency & Department: Ministry of the Environment

Address: P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3058

Co-operating agencies and investigators (if applicable):

Duration of each phase: Ongoing, reports prepared as data warrant

Approximate Cost (indicate applicable yearly period): 1981/82: $200K

Objectives:

To develop and test models relating the net output of substances (major ions, nutrients, metals, acidity, alkalinity) from different watersheds to geology, land use and hydrology.

Method:

Approximately 30 individual watersheds ($<10 km^2$) have been instrumented for continuous hydrologic measurements since 1976. Atmospheric deposition, and stream chemistry are monitored, geology and soil characteristics are under study, and net and gross watershed budgets calculated.

Anticipated Results:

A preliminary model relating the inputs of acid and acidifying substances to output of the products of weathering reactions as a function of geology will be completed in 1982. This will be the basis for estimating watershed acidification rates.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Lake Mass Balances

Subject Code (s) in order of priority:	3.1.1

Principal Investigator's Name:

P. Dillon

Agency & Department: Ministry of the Environment

Address: P. O. Box
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3058

Co-operating agencies and investigators (if applicable):

Duration of each phase: On-going, reports prepared as data warrant.

Approximate Cost (indicate applicable yearly period): $200K (1981/82)

Objectives: To develop and test models relating hydrology, morphometry, physical factors and input and output of major ions, nutrients, metals, acidity and alkalinity to the lake chemistry.

Method: The major inputs (atmospheric deposition streamflow) to and outflow from 8 lakes have been increased since 1976 with hydrology and precipitation measured continuously. Models developed for these lakes will be tested on 7 additional lakes for which lake and stream chemistry only have been measured.

Anticipated Results: Preliminary models are currently in preparation. If successful, they will allow us to predict the effects of current inputs of the substances measured on lake chemistry.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Surveys of Lake Sensitivity to Acidification

Subject Code (s) in order of priority: 3.1.1

Principal Investigator's Name:

Dr. D. P. Dodge

Agency & Department: Ontario Ministry of Natural Resources
Fisheries Branch

Address: Whitney Block, Room 4422
Queen's Park
Toronto, Ontario
M7A 1W3

Phone: (416) 967-7887

Co-operating agencies and investigators (if applicable): Ontario Ministry of the Environment
Water Resources Branch/Laboratory Services Branch

Duration of each phase:
Sampling: 05/80 to 10/80
Data Analysis: Complete by 12/80

Approximate Cost (indicate applicable yearly period): For 05/80 to 12/80: $96,000.00

Objectives:

To determine the proportion of lakes sensitive to input of acidic materials in areas of Ontario believed to be potentially susceptible to acidification.

Method:

a) At selected lakes in potentially susceptible areas, single samples of water are taken for analysis of pH, alkalinity and conductivity.

b) A plastic tube is used to sample the water column from the surface to the bottom of the thermocline.

c) Total inflection point alkalinity is determined by Gran analysis.

d) Sampling and analysis are carried out by field crews, with intercomparison of results by Ministry of the Environment.

Anticipated Results:

a) Results will consist of single measurements of pH, alkalinity and conductivity on approximately 800 lakes.

b) Together with previous results (1979) and other similar data, results will be used to determine the proportion of Ontario lakes which are, or could eventually become, acidic.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

A Search for Acidification in a Sensitive, Oligotrophic Nova Scotian Lake

Subject Code (s) in order of priority: 3.1.1 3.1.2

Principal Investigator's Name:

Dr. Jean-Claude Dol

Agency & Department: Dept. Chemistry, Universite Ste. Anne

Address: Church Point
Digby County
Nova Scotia
BOW 1MO

Phone:

Co-operating agencies and investigators (if applicable): Nova Scotia Department of the Environment
John K. Underwood

Duration of each phase: a) 8 months
b) 2 - 5 years

Approximate Cost (indicate applicable yearly period): a) $3,000.00 b) Undetermined

Objectives: "Clearwater Lake" is situated in that portion of Nova Scotia most heavily inundated by atmospheric acids. All indications are that the lake will acidify, although no noticeable change has yet occurred.

Method: The lake will be regularly sampled to provide background data with which to examine acidification processes (if they in fact will occur).

Anticipated Results: The lake maintains a pH of about 6.1 despite an alkalinity of only 20 ue.L^{-1}. We expect that it will acidify, and in so doing, provide evidence of the acidification process - both chemically and biologically.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Surface Water Quality Program

Subject Code (s) in order of priority: 3.1.1

Principal Investigator's Name:

Dr. Frank Frantisak

Agency & Department: Noranda Mines Ltd.

Address: P. O. Box 45
Commerce Court West
Toronto, Ontario
M5L 1B6

Phone: (416) 867-7306

Co-operating agencies and investigators (if applicable):

Duration of each phase: Commenced 1977, in operation.

Approximate Cost (indicate applicable yearly period):

Objectives:

Method:

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Lake Sampling Program

Subject Code (s) in order of priority:	3.1.1

Principal Investigator's Name:

M. J. German

Agency & Department: Southeastern Region, MOE

Address: 133 Dalton Avenue
Kingston, Ontario
K7L 4X6

Phone: (613) 549-4000

Co-operating agencies and investigators (if applicable):

Duration of each phase: Continuous - Ongoing

Approximate Cost (indicate applicable yearly period): $23,000.00 per year

Objectives:

a) To inventory the alkalinity, pH and conductivity of lakes in Southeastern Ontario (50 to 75 lakes per year).

b) To carry out long-term monitoring of alkalinity and pH levels in lakes with low alkalinity and pH levels in lakes with low alkalinity and high susceptibility to acidification (25 lakes per year).

Method:

a) The inventory phase consists of one visit sampling of lakes via aircraft to collect data necessary for classification of sensitivities to acidification.

b) Cyclic sampling (6 to 8 visits per year) of selected lakes determined to have low alkalinity levels and hence high sensitivity to acidification.

Anticipated Results:

a) The inventory phase will assist the Province in determining the magnitude of the potential acidification problem.

b) The long-term monitoring component will assist the Ministry's research efforts towards measuring rates of acidification.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Aquatic Effects: Water Chemistry

Subject Code (s) in order of priority:	3.1.1 3.1.6

Principal Investigator's Name:

J. M. Goddard
B. C. Ministry of Environment

Agency & Department: Inventory and Engineering Branch (Presently)
Penticton, British Columbia

Address: Dr. R. J. Buchanan
Director, Aquatic Studies Branch
B. C. Ministry of Environment
Buildings, Victoria, B. C. V8V 1X5

Phone: (604) 387-1511

Co-operating agencies and investigators (if applicable):

Duration of each phase: Completed - Summer 1977

Approximate Cost (indicate applicable yearly period):

Objectives: Baseline water chemistry for two lakes in central B. C. which might be affected by thermal generating plant, if constructed.

Method:

Anticipated Results:

Report Completed:

Goddard, J. M. 1978. Interim Report of the Lake Monitoring Program (Acid Rain Baseline Data Project) 1977 Field Season. Water Investigations Branch. B. C. Ministry of Environment. 21 pp. W.R.S. Report # 2637.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Acid Sensitivity and Nutrient Relationships in Dystrophic vs Oligotrophic Nova Scotian Lakes

Subject Code (s) in order of priority: 3.1.1

Principal Investigator's Name:

Dr. W. C. Hart

Agency & Department: Geo-Limnos Consulting

Address: R. R. #1
Tantallon, N. S.

Phone: (902) 826-7198

Co-operating agencies and investigators (if applicable): Nova Scotia Department of the Environment (John K. Undersood)

Duration of each phase: 1 year

Approximate Cost (indicate applicable yearly period): July 1980 - July 1981: $24,500.00

Objectives: To examine humic acid interference in both lake sensitivity to acid depositions, and on nutrient-productivity relationships.

Method: Four lakes are being sampled regularly: 2 clear water, 2 coloured; 2 with cottage development, 2 without. A wide variety of analyses are being performed.

Anticipated Results: Humic acids will most certainly affect chemical and biological processes in the study lakes. The questions concern magnitude and direction of effects (positive and negative.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Acidification on New Brunswick Ecosystems: Sensitivity Mapping

Subject Code (s) in order of priority:	3.1.1 3.2.1 3.2.2 3.2.4

Principal Investigator's Name:

G. R. Hawkins
A. J. Spavold

Agency & Department: Environmental Services Branch
Environment New Brunswick

Address: P. O. Box 6000
Fredericton, N. B.
E3B 5H1

Phone: (506) 453-2669

Co-operating agencies and investigators (if applicable):

Duration of each phase: January 5 - March 31/1981

Approximate Cost (indicate applicable yearly period): $7,000.00 / 1981

Objectives:

a) To analyse a variety of provincial data (particularly water chemistry data) to determine which parts of New Brunswick are most sensitive to acidic precipitation.
b) To provide a series of maps depicting the sensitivity of N.B. geology, soils, rivers and lakes and terrestrial systems to acidic precipitation.
c) To assess the compatibility of these findings with other attempts to describe sensitive areas in N.B.

Method:

a) Editing of provincial river and lake chemistry data for LRTAP purposes.
b) Review of other provincial data on soils, geology and aquatic systems.
c) Preparation of maps depicting sensitive areas in N.B.

Anticipated Results:

a) Edited water quality data issued to Inland Waters Directorate (NAQUADAT) (1980).
b) Technical Report to be issued after internal review.

LRTAP ACTIVITY DESCRIPTION

Activity Title: Airborne organic pollutants in a southern Ontario ecosystem.

Subject Code (s) in order of priority:	
	3.1.1
	3.1.4
	3.1.5

Principal Investigator's Name: M.G. Johnson

Agency & Department: Great Lakes Biolimnology Laboratory

Address: Box 969, Owen Sound

Phone: (519) 371-0040

Co-operating agencies and investigators (if applicable): Ontario Ministry of Natural Resources
Environment Canada

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives:

a) determine baseline concentrations (1980) of selected organic pollutants in snow, rain, bulk precipitation, lake water, sediments, biota.

b) estimate earlier loading rates by examination of sediment cores.

c) estimate possible significance of future, elevated loadings. Bulk precipitation collectors - paired stainless steel collectors - sampled on "event basis" as much as possible. Benthos corer used to collect sediment cores. Biological collections with routine methodology.

Anticipated Results: Expect report (to primary literature) in 1982.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Qualité de l'eau et de la neige

Code du (des) sujet(s) par ordre de priorité : 3.1.1 3.1.6

Nom du chercheur responsable :

Gérald Jones

Ministère, organisme ou organisme privé, service : Institut national de la recherche scientifique (INRS-Eau)

Adresse: Complexe scientifique
2700 rue Einstein
Ste-Foy, Québec
G1V 4C7

Téléphone: (418) 657-2533

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Environnement Canada
Dir. Eaux intérieures (Denis Labonté)

Durée de chaque phase: janvier 80 à mai 1980: Echantillonnage
mai 80 à juin 1980: Rédaction

Côut approximatif (indiquer pour quelle période annuelle):

Janvier 1980 à Mai 1980 janvier 1980 à mai 1980: $9,500.00

Objectifs de travail: Déterminer l'évolution temporelle et spatiale des paramétres liés à l'acidité de la neige pendant l'accumulation et la fonte de la couverture nivale de janvier à mai 1981.

Méthode de travail :

a) pH métre radiométre
b) Auto-analyseur technicon II
c) Spectrophotométre

Résultats prévus: Voir le rapport ci-joint

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Chimie des précipitations et des eaux de ruissellement d'un bassin versant fragile.

Code du (des)	
sujet(s) par	3.1.1
ordre de	3.1.2
priorité :	2.3.3

Nom du chercheur responsable :
Dr. H. G. Jones
Dr. J. C. Auclair

Ministère, organisme ou organisme privé, service : INRS-Eau (Université du Québec)

Adresse: 2700 Einstein
C.P. 7500
Ste-Foy, Québec
G1V 4C7

Téléphone: (418) 657-2961

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : M. Raymond Lemieux, Environnement Canada, Direction des Eaux intérieures, Ste-Foy, Québec

Durée de chaque phase: Installation des échantillonneurs: 80/7 - 80/10
Exploitation: 81/5 - 81/11, au minimum

Côut approximatif (indiquer pour quelle période annuelle):

du 80/7 au 81/11: $6,000.00

Objectifs de travail:

a) Déterminer, en fonction de la direction prédominante des évènements de pluie et de leur volume, les lessivages des ions Ca, Mg, Mn et Al d'un bassin versant fragile.

b) Evaluer les effets de ces ions sur un écosystème lacustre acide (le lac Tantarie).

Méthode de travail : L'étude se poursuit dans le Réserve écologique de Tantaré à 40 km au nord de Québec. Le tributaire principal du lac de même que les dépôts humides sont échantillonnés avant, pendant et après d'évènements de pluie.

Résultats prévus: Les résultats devraient nous permettre d'évaluer l'impact du lessivage des ions sur les eaux lacustres, notamment en ce qui concerne les interactions entre l'aluminium, la matière organique dessoute et les phosphates.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Assessment of the effects of spring melt upon stream water quality in the sensitive areas of the G.L. basin and the effect upon, particularly, Georgian Bay.

subject Code(s) in order of Priority:	3.1.1

Principal Investigator's Name: Dr. M.G. Johnson

Agency & Department: Department of Fisheries and Oceans

Address: Great Lakes Biolimnology Laboratory
1180 20th Street E., P.O. Box 969
Owen Sound, Ontario N4K 6H6

Phone: (519) 371-0040

Co-operating agencies and investigators (if applicable): Dr. J.R.M. Kelso

Duration of each phase:
- stream monitoring to 1982.
- assessment of conditions in Georgian Bay to continue.

Approximate Cost (indicate applicable yearly period): estimated stream monitoring $5,000./annum; Georgian Bay - $15,000./annum

Objectives:

a) to assess the meltwater conditions in stream re fishery success.

b) determine loading and impariment of quality, especially re airborne contaminants, of Georgian Bay.

Method:

a) Monitor stream water quality during primary melt period.

b) chemical, biological, sediment assessment in embayments of Georgian Bay.

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Chemical and biological status of sensitive Ontario headwater lakes in relation to long range transport of atmospheric contaminants.

Subject Code(s) in order of priority: 3.1.1

Principal Investigator's Name: J.R.M. Kelso

Agency & Department: Department of Fisheries & Oceans

Address: Great Lakes Biolimnology Lab.
875 Queen Street East
Sault Ste. Marie, Ontario P6A 2B3

Phone: (705) 942-2848

Co-operating agencies and investigators (if applicable): R.J.Love, R.Dermott, R.L. Thomas, B. Olliver
Canada Centre for Inland Waters
W.H.Kwain, OMNR

Duration of each phase:
A) field collection fall, 1979, fall 1980, spring 1981.
B) analysis 1981-82.

Approximate Cost (indicate applicable yearly period): field collection - $20,000.
analysis - $100,000.

Objectives:
a) to relate biological well-being and body loading to chemical status.
b) to establish a biological/chemical benchmark against which change is to be measured.
b) to provide survey procedures from which a Canadian approach can be developed.

Method:

in headwater lakes in differing intensities of deposition determine chemical status, phytoplankton, zooplankton, benthic and fish community structure, contaminant body burden in fish.

Anticipated Results: see objectives

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Calibrated Lake Basins Study, Kejimkujik National Park Nova Scotia, Stream, Lake Water Chemistry and Budgets

Subject Code (s) in order of priority:	3.1.1 2.4.1 2.4.2

Principal Investigator's Name:

Dr. Joseph Kerekes

Agency & Department: Environment Canada
Canadian Wildlife Service

Address: c/o Biology Department
Dalhousie University
Halifax, N. S.
B3H 4J1

Phone: (902) 426-6356

Co-operating agencies and investigators (if applicable):

a) Parks Canada (Kejimkujik National Park)
b) Atmopsheric Environment Service, Downsview, Ontario
c) Inland Waters Directorate, Moncton, N. B.
d) Water Resources Branch, Halifax, N. S.

Duration of each phase:

a) Set-up: 6/78 - 5/79
b) Operation: 6/79 to indefinite (Several years)

Approximate Cost (indicate applicable yearly period): 3 man years: $25,000.00

Objectives:

Provide a baseline characterization of the lake basins, exposed to a cool and wet maritime climate, including temporal and annual variation in water chemistry (major ions, heavy metals, nutrients). Estimate annual load of major ions, their retention and losses from the watersheds.

Method:

Take water samples from inflows weekly. Sample lakes at the deepest point and other stations as required, twice a month.

Atmospheric loading is estimated from CANSAP and APN network station located at the study area.

Anticipated Results:

a) Water chemistry data will be published in a data report and entered into NAQUADAT.

b) Limnological data will be documented in a data report.

c) Reports for each water year will be issued after internal review.

d) Review of our results, along with other calibrated basin study will be made periodically and a synthesis of lake response to acid precipitation could be made with some confidence at various levels of SO_2 and NO_x emissions.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Resample Lakes in Nova Scotia and Newfoundland, Obtain Water Quality Baseline Data in Labrador.

Subject Code (s) in order of priority: 3.1.1

Principal Investigator's Name:

Dr. Joseph Kerekes

Agency & Department: Environment Canada
Canadian Wildlife Service

Address: Atlantic Region
c/o Biology Department
Dalhousie University
Halifax, N. S.
B3H 4J1

Phone: (902) 426-6356

Co-operating agencies and investigators (if applicable): Inland Waters Directorate
Moncton, N. B.

Duration of each phase: 7/80 - 12/80

Approximate Cost (indicate applicable yearly period): $9,000.00

Objectives:

Detect possible changes of acidity in lake water during the last ten (10) years in central Nova Scotia and eastern Newfoundland. Provide water quality baseline data in headwater lakes in Labrador.

Method:

Resample forty (40) lakes in Kejimkujik National Park and twenty-eight (28) lakes in Terra Nova National Park for water chemistry and compare existing conditions with results obtained a decade ago.

Sample about forty (40) lakes in Labrador.

Anticipated Results:

a) Water chemistry data will be published in a data report and entered into NAQUADAT.

b) Reports will be issued after internal review.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Effets des pluies acides sur 22 lacs du Parc National de la Mauricie

Code du (des) sujet(s) par ordre de priorité : 3.1.1, 3.1.6, 3.1.2

Nom du chercheur responsable :

Raymond Lemieux

Ministère, organisme ou organisme privé, service : Eaux intérieures
Environnement Canada

Adresse: 2700 boul. Laurier
Edifice Champlain, 4e étage
Ste-Foy, Québec
G1V 4H5

Téléphone: (418) 694-3921

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Parc National de la Mauricie (Lac Foisy)
Dir. eaux intérieures
Labor. de la qualité à Longueuil (Yves Duval)

Durée de chaque phase:
Echantillonnage de l'eau: 06/80 à 03/81
Diagnoses des lacs: 06/80 à 08/80
Rapport Final: 12/80

Côut approximatif (indiquer pour quelle période annuelle): $62,500.00

Objectifs de travail:

a) Mesurer une fois par mois une série de paramétres qui serviront à établir une carte de sensibilité des lacs aux pluies acides.

b) Caractériser chacun de ces lacs.

Méthode de travail :

a) Prélever un échantillon par lac avec un échantillonneur Van Dorn.

b) T, O_2, pH, conductivité sur place avec un Hydro lab.

c) Autres paramétres mesurés au laboratoire d'Environnement Canada.

d) Végétation par méthode des transects, mesures de débits.

e) Géomorphologie des bassins versants.

Résultats prévus:

a) Physico-chimie des 22 lacs:

- carte de sensibilité
- mesures d'acidification
- mesures du pouvoir tampon

b) Caractérisation écologique des 22 lacs.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Bilan ionique du bassin et état biochimique du lac

Code du (des) sujet(s) par ordre de priorité : 3.1.1

Nom du chercheur responsable :

Raymond Lemieux

Ministère, organisme ou organisme privé, service : Environnement Canada
Direction des eaux intérieures

Adresse: 2700 boul. Laurier
Edifice Champlain, 4e étage
Place Laurier
Ste. Foy, Québec

Téléphone: (418) 694-3921

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) :
Environnement Canada (DREI-Q)
Relevés hydrologiques à Longueuil (Solly Huberman)
Environnement Canada (DREI-Q)
Laboratoire de la Qualité (Yves Duval)

Durée de chaque phase:
10/80 à 05/81: Echantillonnage préliminaire
05/81 à 1984: Echantillonnage continu

Côut approximatif (indiquer pour quelle période annuelle):

Objectifs de travail:

a) Evaluer le débit du bassin
b) Evaluer le flux chimique de sortie du bassin
c) Evaluer l'état chimique du lac

Méthode de travail : Méthodologies usuelles d'échantillonnage d'eau (en préparation)

Résultats prévus:

a) Bilans ioniques
b) Données de la qualité de l'eau
c) Appréciation du processus de tamponnage des précipitations.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Impact of Long Range Transport on the Water Quality of Selected Nova Scotian Lakes

Subject Code (s) in order of priority: 3.1.1

Principal Investigator's Name:

J. Machell

Agency & Department: EPS/Environment Canada, Environmental Protection Service

Address: 5151 George Street
Halifax, N. S.
B3J 1M5

Phone: (902) 426-6132

Co-operating agencies and investigators (if applicable):

Duration of each phase: 04/80 - 04/82

Approximate Cost (indicate applicable yearly period): 04/80 - 04/81: $10,000.00

Objectives:

a) The objective of this study is to compare existing water quality conditions with past data; to establish a reliable data for future comparisons and define the relative sensitivity of Nova Scotian waters.

Method:

a) Water sampling programs will be conducted in six Nova Scotian lakes.

b) Chemical analysis of samples will be handled by the Environmental Protection Service

c) Buffering capacities will be estimated by use of gram alkalinities.

d) Inter-comparisons will be made with provincial programs.

Anticipated Results:

The study will result in a report which will allow, in the future, for acidification rates to be determined, and document the extremely sensitive nature of maritime receiving waters.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Ecosystem Impacts of Acid Precipitation in Algonquin Highlands Lakes

Subject Code (s) in order of priority:	3.1.1 3.1.3 3.1.4 8.0

Principal Investigator's Name:

Dr. James A. MacLean

Agency & Department: Ontario Ministry of Natural Resources (OMNR)

Address: Research Section, Fisheries Branch
Box 50,
Maple, Ontario
L0J 1E0

Phone: (416) 832-2761

Co-operating agencies and investigators (if applicable): OMNR: Algonquin Fisheries Assessment Unit-Mr. Frank Hicks
Ontario Ministry of the Environment, Limnology and Toxicity Section - Dr. P. J. Dillon

Duration of each phase: Set up: 1980, 1981
Operation: 1981 - ? (3 - 5 year planning horizon)

Approximate Cost (indicate applicable yearly period): $48,000.00 (1980)
$55,000.00 (1981 to end)

Objectives:

a) Establish extent of impact and direction and rate of change.

b) Quantify the processes impacting the dynamics of fish communities.

c) Provide an integrative simulation model.

Method:

a) Describe baseline conditions re: water chemistry, zooplankton, benthos, and fish in 5-9 variously susceptible lakes. Establish an appropriate subset of community indices to follow long-term trends and establish a sound sampling program for this purpose.

b) Provide analytical models of acid effects on survival and growth of major fish species and hence the dynamics of their communities based on the data generated in (a) and from extensive past studies.

c) Examine effects on fish reproduction in both field and lab assays.

d) Initiate re-iterative simulations of the system based on models of responses to other stresses.

Anticipated Results:

a) Realistic estimates of the present state of the fish communities and supportive ecosystem components in representative Algonquin Highlands lakes.

b) Better understanding of the acid induced changes to be expected in these lakes and reasonable estimates of the rates at which these changes may be expected, at least in the short run.

c) A dynamic, predictive model suitable to provide the estimates in (b) and designed to allow easy incorporation of new information and better understanding as a basis for improvement.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Aquatic Effects
Water Chemistry and Budgets

Subject Code (s) in order of priority:	3.1.1

Principal Investigator's Name:

L. W. Maki

Agency & Department: MOE, Northwest Region

Address: 435 James Street South
Thunder Bay, Ontario
P7C 5G6

Phone: (807) 475-1215

Co-operating agencies and investigators (if applicable): D. Hollinger, as above

Duration of each phase: Yearly

Approximate Cost (indicate applicable yearly period): $80K

Objectives: To assess water chemistry of 200 lakes scattered across the NWR; to define sensitivity to acidification.

Method: Water column sampling via float plane.

Anticipated Results: Sensitivity of lakes is directly related to bedrock geology and soils. Over 70% of NWR lakes are sensitive.

LRTAP ACTIVITY DESCRIPTION

Activity Title: Determination of the Organic Buffering Capacity of Aqueous Ecosystems

Subject Code (s) in order of priority: 3.1.1

Principal Investigator's Name: B. Oliver

Agency & Department: Department of Environment, National Water Research Institute

Address: Canada Centre for Inland Waters
Box 5050, Burlington, Ontario
L7R 4A6

Phone: (416) 637-4604

Co-operating agencies and investigators (if applicable): Canadian Wildlife Service, Halifax, N.S.
Inland Waters Directorate, Moncton, N.B.

Duration of each phase: Phase one to be completed March 1981.
Follow-up not planned.

Approximate Cost (indicate applicable yearly period): 1.2 PY 6 K operating costs

Objectives: To determine the influence of organic components such as silica and humic matter on the buffering capacity of soft waters.

Method: The effect of equilibria, other than CO_2- HCO_3^--CO_3^{2} system, on the buffering capacity of lakes will be carried out as a laboratory study of the different reactions involved. Water samples for this analysis are obtained from high organics, soft waters typical of areas where acidification is evident.

Anticipated Results: An internal report is to be prepared at the end of FY 1980-81.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effect of Lake pH on Denitrification - Contribution of Denitrification to Lake Buffering

Subject Code (s) in order of priority:	3.1.1 3.1.5

Principal Investigator's Name:

Dr. J. W. M. Rudd

Agency & Department: Department of Fisheries and Oceans
Freshwater Institute

Address: 501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Phone: (204) 269-7379

Co-operating agencies and investigators (if applicable): NIL

Duration of each phase: 3/81 - 3/86: (If funds available)

Approximate Cost (indicate applicable yearly period): $20K/yr.

Objectives:

a) To assess the pH tolerance of denitrifying bacteria.
b) Establish the contribution of denitrification to lake buffering by the production of alkalinity.

Method:

Denitrification will be assayed by:

a) Reduction of $^{15}NO_3^- \rightarrow {}^{15}N_2$
b) Acetylene blockage method in which nitrate reduction is blocked and N_2O accumulates and is assayed by gas chromatography.
   - Natural sediment and water samples acclimated to neutral and reduced pH will be examined for their pH tolerance and rates of activity at reduced pH.
   - This work will be done as part of an experiment in which a lake basin is acidified by HNO_3 addition.

Anticipated Results:

Denitrifying bacteria, particularly in quite productive lakes, are expected to provide significant buffering to incoming H^+ in cases where significant acid input is HNO_3.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Incidences des Précipitations Acides sur les Aspects Physiques, Chimiques et Biologiques des Ecosystems Lacustres

Code du (des) sujet(s) par ordre de priorité : 3.1.1 3.1.3

Nom du chercheur responsable :

Lévis Talbot

Ministère, organisme ou organisme privé, service : Ministère de l'Environnement, Service de la Qualité des Eaux

Adresse: Complexe scientifique
2700 Einstein
Ste-Foy, Québec
G1P 3W8

Téléphone: (418) 643-4425

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Ministère du loisir, de la chasse et de la pêche direction de la recherche faunique Michel Lagacé (643-2227)

Durée de chaque phase: Cueillette des données:
Avril à Septembre 1980.
Analyse et interprétation:
Avril 1980 à Juin 1981.

Côut approximatif (indiquer pour quelle période annuelle):
Cueillette: $200,000.00
Analyse: $ 20,000.00
Interprétation: $ 80,000.00

Objectifs de travail: Délimiter les zones sensibles à l'acidification à l'aide de paramètres physico-chimiques et biologiques, évaluer s'il y a eu évolution des paramètres, et établir les relations intra-systèmes.

Méthode de travail : Réaliser un inventaire physico-chimique et biologique de 225 lacs, comprenant l'analyse d'une izaine de paramètres reliés au phénomène de l'acidification, et 300 autre lacs comprenant une physico-chimie sommaire.

- Inventorier les données existantes.
- Appliquer différents indices pour calculer la sensibilité des écosystèmes.
- Appliquer l'analyse mathématique multivariable et factorielle pour dégager les regroupements de lacs et de facteurs.

Résultats prévus:

a) Cartographie des lacs pour indiquer les zones acidifiées et les zones sensibles menacées.

b) Identification de certains effets biologiques.

c) Mise en évidence des relations causes-conditions-effets.

d) Choix de lacs à restaurer, si requis.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Background Concentration Levels of Trace Metals in Shield-Type Lakes

Subject Code (s) in order of priority:	3.1.1 3.1.6

Principal Investigator's Name:

R. Wagemann

Agency & Department: Department of Fisheries and Oceans
Toxicology Section

Address: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Phone: (204) 269-7379

Co-operating agencies and investigators (if applicable):

D. W. Schindler
Limnology Section
Freshwater Institute
Winnipeg, Manitoba

Duration of each phase:

a) Presently in Progress
b) Concluding in fiscal 1981

Approximate Cost (indicate applicable yearly period): $5,000 per year exclusive of salaries and transportation costs.

Objectives:

a) To establish background concentration levels of trace metals in Shield-type lakes of the Experimental Lakes Area while still relatively pristine and unaffected by atmospheric pollution.
b) To provide a benchmark for assessing the influence of acidic inputs on metal regimes of Shield-type lakes.

Method:

Large volume samples (20L) are collected in plastic carboys, filtered (0.2 μm) and acidified with ultra-pure acid, pre-concentrated to 700 ml in a quartz still and analysed by flameless AA or emission spectrometry for Al, Cd, Co, Cr, Cu, Fe, Mn, Pb, Zn. Sample containers and apparatuses used in connection with filtration and preconcentration are rigorously cleaned before use.

Anticipated Results:

Data will be evaluated and discussed, and put into a technical report, or hopefully published in a scientific journal.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Factors Affecting the Methylation of Lead (II) Compounds at Low pH

Subject Code (s) in order of priority:	3.1.1 3.1.5 3.1.6

Principal Investigator's Name:

Dr. Paul T. S. Wong
Dr. Y. K. Chau

Agency & Department: Fisheries & Oceans

Address:
Great Lakes Biolimnology Laboratory
Canada Centre for Inland Waters
P.O. Box 5050
Burlington, Ontario
L7R 4A6

Phone:
(416) 637-4559

Co-operating agencies and investigators (if applicable):
University of Waterloo
Dr. C. I. Mayfield

Duration of each phase: January 15, 1981 - March 31, 1981

Approximate Cost (indicate applicable yearly period): $9,000.00

Objectives:

To examine the effects of various factors on the methylation of lead (II) compounds in the pH range of 7.5 to 3.5.

Method:

a) Experiments will be conducted in the presence of sediments with pH adjusted from 7.5 to 3.5.

b) Production of volatile alkyl-lead compounds will be detected and identified using a modified gas chromatograph-atomic absorption spectrophotometer.

c) Factors such as aerobic and anaerobic conditions, temperature, the effect of sulphur compounds, various methyl donors on the methylation process at low pH will be examined.

Anticipated Results:

A report will be available in May 1981.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Etude de la communauté phytoplanctonique du lac Laflamme

Code du (des) sujet(s) par ordre de priorité : 3.1.2 3.1.1

Nom du chercheur responsable :

Jean-Christian Auclair

Ministère, organisme ou organisme privé, service : Institut National de recherche sur l'eau (INRS-Eau)

Adresse: Complexe scientifique
2700 rue Einstein
Ste-Foy, Québec

Téléphone: (418) 657-2961

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Environnement Canada
Direction des eaux intérieures Québec

Durée de chaque phase: 09/80 à 02/81
03/81: Rapport Final

Côut approximatif (indiquer pour quelle période annuelle):

09/80 à 03/81: $12,200.00

Objectifs de travail:

a) Analyser la communauté phytoplanctonique du lac Laflamme en relation avec les caractéristiques physico-chimiques du lac.

b) Mesurer les paramètres chimiques qui influent sur la production en milieu aquatique.

Méthode de travail : Méthode standard d'identification du phytoplancton.

Résultats prévus: Caractérisation des populations phytoplanctoniques du lac Laflamme. Contribution au projet des pluies acides et ses effets sur le milieu.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Mutualism Between Yeasts and the Alga Euglena Mutabilus in Ponds of Extreme Acidity and Heavy Metal Content

Subject Code (s) in order of priority:	3.1.2 3.1.1 3.1.3

Principal Investigator's Name:

Professor T. C. Hutchinson

Agency & Department: Natural Science and Engineering Research Council

Address: Department of Botany
University of Toronto
Toronto, Ontario
M5S 1A1

Phone: (416) 978-3537

Co-operating agencies and investigators (if applicable): Department of the Environment
Fisheries and Marine

Duration of each phase: 1978 - ongoing

Approximate Cost (indicate applicable yearly period):

Objectives: To determine the degree of tolerances to low pH and elevated metal concentrations in the alga Euglena Mutabilis and the role of a constant associated yeast in its tolerance.

Method: Bioassay experiments in axenic conditions using inorganic defined media, Dialysis.

Anticipated Results: Conference papers and refereed journal papers. Extreme tolerances to pH of less 2.0 and to Al>500ppm, Mn>1000ppm etc. shown. Presence of yeast essential for high tolerances.

Activity Title:

Determination of biological response to LRTAP in a calibrated watershed in Algoma

subject Code(s) 3.1.2 in order of priority:

Principal Investigator's Name: J.R.M. Kelso (biological aspects)

Agency & Department: Department of Fisheries and Oceans

Address: Great Lakes Biolimnology Laboratory
875 Queen Street East
Sault Ste. Marie, Ontario P6A 2B3

Phone: (705) 942-2848

Co-operating agencies and investigators (if applicable): R.J.Love, R.Dermott, M.G.Johnson, R.L. Thomas (GLBL)
W.H.Kwain (OMNR)
R.Semkin,T.Morrison, J.Nicolson, N.Foster (DOE)
Canada Water Survey
Atmospheric Environment Service

Duration of each phase: - selection watershed 1979, Assessment community status & Production 1980, 1981, determination mechanisms and pH-metal interactions 1982 -- .

Approximate Cost (indicate applicable yearly period): 1979 - 105,000 1981 - 90,000
1980 - 102,000 1982 - 90,000

Objectives:
a) assess affects of reduced pH and other pollutants on flor & fauna communities of Precambrian Shield streams and lakes through calibrated watershed approach.
b) document the change in biota from commensurate changes in water quality.
c) determine mechanisms affecting biota.

Method:

Ghrough examination of the terrestrial/chemical link (GLFRC, CCIW) and effect of aquatic state on biota.

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Calibrated Lake Basin Study. Kejimkujik National Park, Nova Scotia. Aquatic Effects, Biological Investigations.

Subject Code (s) in order of priority:	3.1.2 3.1.3 3.1.5 3.1.6

Principal Investigator's Name:

Dr. Joseph Kerekes

Agency & Department: Environment Canada
Canadian Wildlife Service, Atlantic Region

Address: c/o Biology Department
Dalhousie University
Halifax, N. S.
B3H 4J1

Phone: (902) 426-6356

Co-operating agencies and investigators (if applicable): See Attached

Duration of each phase: 4/80 - 3/81 (See Attached)

Approximate Cost (indicate applicable yearly period): $56,000.00

Objectives: Provide baseline characterization of the biota and sediments of the three study lakes. Determine heavy metal levels in macrophytes, seston, invertebrates and fish.

Method: Using reliable accepted methods, sample phytoplankton, zooplankton, macro-invertebrates, macrophytes; identify species present; estimate annual planktonic primary production with C_{14} method, and annual macrophyte production with harvest method; estimate zooplankton production.

Anticipated Results: Reports for each project will be issued after internal review.

Cooperating Agencies, Investigators, Duration

Title of Project	Investigator	Duration
Zooplankton Community Assessment	Dr. Patricia Lane Dept. of Biology Dalhouse University Halifax, N. S.	5/80 - 3/83
Planktonic Primary Production	Mr. Steve Beauchamp Canadian Wildlife Service c/o Biology Department Dalhousie University Halifax, N. S.	4/79 - 3/81
Benthic Primary Productivity	Dr. Daniel Andrews c/o Biology Department Dalhousie University Halifax, N. S.	5/80 -10/80
Macroinvertebrate Assessment	Mr. Derek Knox St. Andrews, N. B.	5/80 -10/80
Macrophyte Survey and Productivity	Dr. Bill Freedman Biology Department Dalhousie University Halifax, N. S.	5/80 - 3/82
Heavy Metal Analysis in the Biota	Barringer Magenta Rexdale, Ontario	10/80 -12/80
Collection and Analysis of Biological Samples for Heavy Metals	Ms. Kathleen Fischer Canadian Wildlife Service National Wildlife Research Centre Ottawa, Ontario K1A 0E7	07/80 - 12/80

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Etude des populations phytoplanctoniques de 24 lacs du Parc National de la Mauricie et de la région de Québec

Code du (des) sujet(s) par ordre de priorité : 3.1.2

Nom du chercheur responsable :

Mlle. Estelle Lacoursière

Ministère, organisme ou organisme privé, service : Université du Québec à Trois-Rivières
Département de biologie

Adresse: 3351, boul. des Forges
C.P. 500
Trois-Riverières, P. Q.

Téléphone: (819) 376-5641

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Aucun

Durée de chaque phase:

a) Enchantillonnage: 80/08
b) Identification et interprétation: 80/08 au 80/11

Côut approximatif (indiquer pour quelle période annuelle):

80/08 au 80/12: $2,200.00

Objectifs de travail: Décrire les populations phytoplanctoniques des 24 lacs.

Méthode de travail :

a) Echantillonnage d'eau par traînées verticales et horizontales.
b) Fixation au lugol.
c) Identification en laboratoire.
d) Au cours des travaux, il y aura comparaison avec les données.

Résultats prévus: Acquisition de données de base sur les ressources biologiques (Phytoplancton) pour caractériser ces plans d'eau en relation avec l'acidité potentielle du milieu. Les données seront incluses dans un rapport global de la DREI-Q sur la sensibilité des lacs du parc national de la Mauricie.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Aquatic Effects
Algae and Zooplankton

Subject Code (s) in order of priority:	3.1.2 3.1.3

Principal Investigator's Name:

L. Maki

Agency & Department: MOE, Northwest Region

Address: 435 James Street South
Thunder Bay, Ontario
P7C 5G6

Phone: (807) 475-1215

Co-operating agencies and investigators (if applicable): D. Hollinger

Duration of each phase: Yearly

Approximate Cost (indicate applicable yearly period): $20 K

Objectives: To define phytoplankton and zooplankton populations in NWR lakes; to establish any trends or changes in population related to acidification.

Method: Euphotic zone composite samples 5 times annually in 70 representative lakes.

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Acidification on Aquatic Vegetation Phytoplankton and Benthic Invertebrates in Ten Southern New Brunswick Lakes

Subject Code (s) in order of priority: 3.1.2, 3.1.6, 3.1.1

Principal Investigator's Name:

A. J. Spavold

Agency & Department: Environmental Services Branch
Environment New Brunswick

Address: P. O. Box 6000
Fredericton, N. B.
E3B 5H1

Phone: (506) 453-2669

Co-operating agencies and investigators (if applicable): Dr. R. Peterson
Department of Fisheries and Oceans
Saint Andrews, New Brunswick

Duration of each phase:
Phase I - 07 - 08/80
Phase II - 06 - 09/81
Phase III - 06 - 09/86

Approximate Cost (indicate applicable yearly period): 1980 - 1981: $9,000.00

Objectives:

a) To describe the population structure of aquatic macrophytes, phytoplankton and benthic invertebrates in ten Southern New Brunswick Lakes.
b) To describe trends in water quality for these lakes and assess the impact of change on macrophytes, phytoplankton and invertebrates.

Method:

a) Collection of water quality data.
b) Preparation of species lists.
c) Quantitative description of aquatic macrophyte populations.
d) Collection, identification and quantitative description of phytoplankton and benthic invertebrate populations.
e) Resampling every five years to study alterations in water chemistry and population structure.

Anticipated Results: Interim and Technical Reports to be issued after internal review.

LRTAP ACTIVITY DESCRIPTION

Subject Code (s) in order of priority: 3.1.2 3.1.6

Activity Title:

Growth of Periphyton in Acid-Stressed Lakes in South Central Ontario

Principal Investigator's Name:

Pamela Stokes

Agency & Department: University of Toronto

Address: Toronto, Ontario

Phone: (416) 978-2163 (Office of Research Administration)

Co-operating agencies and investigators (if applicable): Ontario Ministry of the Environment
Limnology and Toxicology

Duration of each phase:
a) Preliminary 1979
b) Operating 1980
Expansion 1981 - 82

Approximate Cost (indicate applicable yearly period):
a) $ 3,000.00
b) $ 12,000.00
c) $ 60,000.00 Applied for

Objectives:

a) To determine the biomass and species of algae colonising substrates in the littoral zone of lakes of low alkalinity and increasing acidity.

b) To determine the impacts of increased periphyton growth on the over-all nutrient dynamics of the lake ecosystem.

c) To determine the impact of habitat modification for other lake biota.

Method:

a) Natural periphyton is monitored for seasonal change in abundance and species composition.

b) Artificial substrates are used to monitor colonisation and succession over seasons and over longer periods of time.

c) Biomass and species composition are related to chemical and physical parameters of the habitat, with the working hypothesis that the major variable influencing biological characters is decrease in pH, pH-related variables.

Anticipated Results:

a) A rapid and sensitive biological indication of acidification or amelioration of acidification is being developed.

b) Predictions of the changes in nutrient dynamics (primary production, benthic release of nutrients) resulting from excessive growth of periphyton in acidified lakes, will be made.

c) Some fundemental scientific questions concerning the phenomenon of increased green-algae periphyton in acidified waters will be addressed.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Response of Phytoplankton to Addition of Ions to a Lake

Subject Code (s) in order of priority: 3.1.2, 3.1.1

Principal Investigator's Name:

Pamela Stokes

Agency & Department: University of Toronto

Address: Toronto, Ontario

Phone: (416) 978-2163 (Office of Research Administration)

Co-operating agencies and investigators (if applicable): Dr. Jon Van Loon, Geology Department, University of Toronto

Duration of each phase: 1979 - 1981

Approximate Cost (indicate applicable yearly period):

Objectives:

a) To determine if short term or long term responses in phytoplankton can be related to the addition of ions (mainly hydrogen ions and heavy metals) to a lake.

b) To compare such responses in lakes of differing buffering capacity.

Method:

a) Bimonthly sampling for phytoplankton and water chemistry over three seasons (ice-free period).

b) Identification and enumeration of algae.

c) Analysis for H^+, $-SO_4$, $-NO_3$, Ca, K Mg, Al, Mn, Ni, Cu, Zn, and Fe in water.

d) Corresponding ion analysis for precipitation-bulk and event from Ontario MOE data.

e) Multivariate analysis of input/water chemistry and water chemistry/community structure.

Anticipated Results:

a) Baseline data on phytoplankton communities in lakes of low buffering capacity.

b) Correlations between changes in water chemistry, as influenced by direct and indirect inputs, and the phytoplankton community.

c) Determination of any taxonomic units (division, class, genus) of algae which would serve as reliable indicators of the acidification process.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Diatom Evidence for Lake Acidification

Subject Code (s) in order of priority: 3.1.2

Principal Investigator's Name:

Dr. Hague Vaughan

Agency & Department: Consultant

Address: 71 Herring Cove Road
2
Halifax, N. S.
B3N 1P9

Phone: (902) 477-1103

Co-operating agencies and investigators (if applicable): Nova Scotia Department of the Environment
John K. Underwood

Duration of each phase: 3 months

Approximate Cost (indicate applicable yearly period): August - November 1980: $2,500.00

Objectives: To determine if diatoms in Nova Scotian lake sediments can be used to indicate acidity/alkalinity conditions in water column.

Method:

a) diatom data from surficial sediments in about 40 lakes around Halifax were produced in 1970. The present effort is to classify the lakes according to ratios of acidophilous vs. alkaliphilous diatoms, and corresponding alkalinity data.

b) If encouraging results from (a), four lakes will be re-examined to see if changes are apparent in contemporary flora.

Anticipated Results: Initial results showed a good relationship between flora (diatoms) and alkalinity and indicate that diatom stratigraphy may provide good fossil evidence for presence/absense of acidification in Nova Scotian lakes.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Tolerances of Zooplankton and Benthic Invertebrates to Lake and Pond Acidification

Subject Code (s) in order of priority:	3.1.3 3.1.5 3.1.1

Principal Investigator's Name:

Professor T. C. Hutchinson
Dr. Magda Havas

Agency & Department: Department of Environment
Fisheries and Marine

Address: Department of Botany and Institute for Environmental Studies
University of Toronto
Toronto, Ontario
M5S 1A1

Phone: (416) 978-3537

Co-operating agencies and investigators (if applicable): Natural Sciences and Engineering Research Council

Duration of each phase: 1975 - 1981

Approximate Cost (indicate applicable yearly period): $15,000.00 per annum

Objectives:

a) To determine the degree of tolerances of tundra and invertebrates at the Smoking Hills to the high acidity (pH<2.0) and high metal concentrations (Al, Mn, Fe and Zn) present in the ponds influenced by sulphur fumigations.

b) To determine the mechanisms of tolerance for those biota in the acid ponds and the mechanism of susceptibility of those absent from the acid ponds but present nearby.

Anticipated Results: Papers at conferences and in refereed journals e.g. Can. J. Fisheries and Aquatic Res. Comparisons with acid Lake studies in Europe and eastern N. America. PhD thesis.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Effects of Acid Stress on Eggs and Larvae of Fishes

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

Gillian Booth
Harold H. Harvey

Agency & Department: Zoology Department

Address: University of Toronto
Toronto, Ontario
M5S 1A1

Phone: (416) 978-3504

Co-operating agencies and investigators (if applicable): National Scientific and Engineering Research Council

Duration of each phase: 1978 - 1980

Approximate Cost (indicate applicable yearly period): $10,000.00 yearly

Objectives:

a) To establish physical and chemical differences in fish eggs incubated at a range of pH: to determine affects of water pH on eggs along.

b) To establish physical and chemical differences in fish eggs removed from fish in lakes of different pH: affect of parental stress on fish eggs.

Method:

a) Incubate fertile eggs from hatchery fish at a range of pH and sample for chemical content (neutron-activation), membrane strength, embryo development, mortality patterns.

b) Capture spawning fish from lakes of range of pH's. Dissect out egg samples, analyse for dry weight and chemical content (neutron activation). Perform SMR on lake chemistry to determine principle factors influencing egg chemistry.

Anticipated Results:

a) Documentation of effects of acid on eggs:
- Low pH effects on ion balance
- Low pH causes soft eggs
- Low pH interferes with development

b) Species react differently possibly due to feeding and habitat and spawning variations. Lake chemistry in total is more important than just pH in determining egg chemistry.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Impacts of Acid Stress on Fish Calcified Structures and Their Use in Age and Growth Determination

Subject Code (s) in order of priority:	3.1.4 3.1.6 5.1

Principal Investigator's Name:

Dr. John Casselman

Agency & Department: Ontario Ministry of Natural Resources (OMNR)
Research Section, Fisheries Branch

Address:
Box 50,
Maple, Ontario
LOJ 1EO

Phone: (416) 832-2761

Co-operating agencies and investigators (if applicable):
Ontario Ministry of the Environment, Limnology and Toxicity Section - Dr. P. J. Dillon
Fisheries and Oceans Canada - Dr. M. Johnson
University of Toronto - Dr. H. H. Harvey

Duration of each phase:
Establishment of Project - 1980/81
Continuation 1981 - ? (3 - 5 year planning horizon)

Approximate Cost (indicate applicable yearly period):
$50,000 (1980)
$50,000 (1981 et seq)

Objectives:
Describe the morphology, osteometrics, quantitative and qualitative composition of fish scales (and other calcified tissues) of a number of species in acid-stressed and -unstressed lakes with and without exploitation.

Method:
Capture-fluorochrome label-release-recapture; indexing of growth of scale (etc.) and fish in the natural environment. Examine glycine uptake in field and laboratory as an index of scale growth and of RNA/DNA indices of protein production in muscle of living fish. Electron and ion microprobe analyses of scale zonation to elucidate calcification, osteochronology, effects of acid (and other) stresses and to document concomitant heavy metal contamination.

Anticipated Results:

a) Recognition of stressed and unstressed growth patterns in scales (etc.)

b) Establishment of chronology of stressful events.

c) Quantifications of impacts on scale (etc.) growth and hence of body growth.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Salmonid Physiology and Toxicology

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

Dr. Peter G. Daye

Agency & Department: Daye Atlantic Salmon Corporation

Address: P. O. Box 1081
Armdale, N. S.
B3L 4L5

Phone: (902) 429-4181

Co-operating agencies and investigators (if applicable):

a) Department of Fisheries and Oceans, St. Andrews, N. B.

b) North American Salmon Research Center, Dr. B. Glebe

Duration of each phase:

a) Experiment: 11/70 - 3/80

b) Analysis: to about 12/80

Approximate Cost (indicate applicable yearly period):

Objectives:

Objectives of several interrelated studies are to determine low ambient pH effect on sperm motility, fertilization, meristic variation, growth, yolk absorption and tolerance of Atlantic salmon and rainbow trout.

Method:

Several laboratory experiments using unfertilized eggs, fertilized eggs, alevins, fry and parr were conducted.

Anticipated Results:

Low pH:

a) Lowers sperm motility in a linear function
b) decreases percentage of eggs fertilized
c) does not affect meristics
d) decreases growth of embryos at pH 4.5
e) does not effect growth at pH $\geq$ 5
f) does not effect gross growth efficiences between embryo and yolk
g) LL50 for Atlantic salmon parr and fry are pH 4.0

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Bioaccumulation, transport et dispersion de métaux lourds à partir de sédiments contaminés.

Code du (des) sujet(s) par ordre de priorité :	3.1.4 3.1.6 2.1 3.2.5 3.3

Nom du chercheur responsable :

Claude E. Delisle

Ministère, organisme ou organisme privé, service : Ecole Polytechnique de Montréal

Adresse: C. P. 6079,
Succursale "A"
Montréal, Québec
H3C 3A7

Téléphone: (514) 344-4718

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : CRSNG

Durée de chaque phase: Subvintion de trois (3) ans, 1978-79, 1979-80, & 1980-81

Côut approximatif (indiquer pour quelle période annuelle):

± $120,000.00

Objectifs de travail:

(voir feuille annexée)

Méthode de travail : Essais biologiques à long terme en laboratoire et in situ s'avèrent l'outil le plus efficace pour évaluer les effets de ces substances toxiques sur les organismes aquatiques et finalement sur l'homme.

Résultats prévus: Neutraliser ou minimiser l'accumulation de mercure et d'autres méteau lourds, tels le Cd et le Cr chez les organismes aquatiques.

ANNEXE

DELISLE, Claude E.

OBJECTIFS

Les objectifs de ce projet de recherche sont les suivants:

1) Standardiser une méthode pour évaluer le potentiel de bioaccumulation des métaux lourds, dont le mercure, contenus dans des sédiments contaminés en provenance du lac St-Louis, région des Iles de la Paix à Beauharnois, Québec. D'autres sédiments pourront aussi être utilisés.

2) Déterminer le ou les meilleurs organismes indicateurs dans le cas de bio-essais à partir de ces sédiments contaminés par les métaux lourds.

3) Identifier un ou des agents complexants et de recouvrement pouvant annihiler, neutraliser ou minimiser le potentiel de bioaccumulation des métaux lourds des sédiments contaminés chez les organismes aquatiques et, simultanément voir les répercussions de ces agents sur la flore bactérienne responsable de la méthylation. Changements de composition des populations.

4) Etudier, en laboratoire et in situ le transport et la dispersion de ces sédiments contaminés à l'aide d'un isotope radioactif (Au^{198}).

5) Etudier les aspects d'ingénierie liés à l'application et à la faisabilité des méthodes correctives définies en 3.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Fisheries Assessment Units Quetico/Lac Des Mille Lacs; Algoma

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

Dr. D. P. Dodge

Agency & Department: Ministry of Natural Resources

Address: Whitney Block
Queen's Park
Toronto

Phone: (416) 965-7887

Co-operating agencies and investigators (if applicable): Ontario Ministry of the Environment

Duration of each phase: Indefinitely

Approximate Cost (indicate applicable yearly period): $475,000.00

Objectives: Collection of long term data on harvest fish population and habitation on 31 lakes in acid-sensitive areas. Together with units already operating, these will provide most of the Ministry's detailed biological information on how fish populations are affected by acid precipitation.

Method:

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Water Quality Monitoring in Four Salmon Streams of the St. Lawrence North Shore

Subject Code (s) in order of priority:	3.1.4 3.1.1

Principal Investigator's Name:

Jean-Denis Dutil (Scientific Delegate)

Agency & Department: Ministère des Pêches et Océans
Direction de la recherche

Address: Gare maritime Champlain
C. P. 15500
901, Cap Diamant
Québec, G1K 7Y7

Phone: (418) 694-3478

Co-operating agencies and investigators (if applicable): Société d'aménagement général de l'environnement (SAGE)
G. Schooner and D. Brouard

Duration of each phase: Total duration of contract: 01/81 to 03/81

Approximate Cost (indicate applicable yearly period): $24,000 (Scientific)
$28,000 (Helicopter)

Objectives:

a) To monitor acid precipitation related water quality parameters in four salmon streams of the St. Lawrence North Shore.
b) Based on water chemistry, a quality assessment of these streams as salmon habitat will be made.

Method:

a) Five sampling sites will be chosen based on their potential for salmon reproduction. Sites will be similar in terms of drainage area and flow.
b) Snow and surface water samples will be collected monthly for three months.
c) Twenty-four (water) and ten (snow) parameters will be measured on these samples.

Anticipated Results:

Data will be:
a) Used to determine whether present water chemistry conditions meet salmon requirements.
b) Used in planning future research work in the area.
c) Incorporated in monitoring programs to be undertaken this year.

LRTAP ACTIVITY DESCRIPTION

Activity Title:
Fish Toxicity Mechanisms Program - Endocrine Toxicology

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:
Robert Evans
Dr. T. J. Hara
Scott Brown

Agency & Department: Department of Fisheries and Oceans
Freshwater Institute

Address:
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Phone: (204) 269-7379

Co-operating agencies and investigators (if applicable):
Dr. J. G. Eales
Department of Zoology
University of Manitoba

Duration of each phase:
a) Set-up and Preliminary Investigation: 9/80 - 3/81
b) Operation: 3/81 - 3/84

Approximate Cost (indicate applicable yearly period): Approximately $25,000/annum

Objectives:
To investigate the effects of acid stress (and subsequently heavy metals which are mobilized by acid) on the following neurohumoral systems: (1) pituitary-andrenal; (2) pituitary thyroidal; (3) pituitary gonadel.

Method:
Fish will be acutely and chronically exposed to various levels of acid stress in conjunction with cardivascular-respiratory and ionic-osmotic components of the program and the following endocrine functions examined:

a) Pituitary, thyroid, adrenal and gonadal histology to identify any pathological changes in these glands.
b) Plasma hormone levels using radioimunoassay procedures (corticosteroids, thyroid hormones, sex steriods).
c) Treatment of fish with appropriate labelled hormone or precursor to determine production and degradation rates under conditions of acid stress.
d) Measurement of related variables such as plasma protein, electrolytes, glucose and iodide levels.

Anticipated Results:

a) Identification of the direct effects of acid stress on the described endocrine functions.
b) Integration of these effects with ionic-osmotic regulations and cardiovascular-respiratory aspects of the program.
c) Identification of an endocrinological sensitivity profile to estimate the degree of stress in previously acidified aquatic systems.

d) Provide basis for investigations of the interactions between acid and increased heavy metal concentrations which are associated with acidification.

From 11/80 to 3/82 emphasis will be placed on examination of pituitary-adrenal and pituitary-thyroid functions. This includes preliminary setup and methods development for corticosteroids and thyroid hormone measurements as well as metabolic studies.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Etude de la faune ichtyenne du lac Laflamme

Code du (des) sujet(s) par ordre de priorité : 3.1.4

Nom du chercheur responsable :

Gerry Fitzgerald

Ministère, organisme ou organisme privé, service : Université Laval
Département de biologie

Adresse: Université Laval
Département de biologie
Faculté des sciences et de génie
Ste. Foy, Québec

Téléphone: (418) 656-2469

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) :

Durée de chaque phase: 09/80 à 03/81: relevés de terrain
12/80 à 03/81: travail en laboratoire
02/81 à 03/81: rédaction

Côut approximatif (indiquer pour quelle période annuelle):

Sept. /80 à mars/81: $13,500.00

Objectifs de travail:

a) Echantillonner, analyser et décrire la population ichtyenne du lac Laflamme.

b) Etudier la période du frai et le développement larvaire.

Méthode de travail :

a) Installation de filets (verveux). Marquage et recapture.

b) Observations des sites de frai.

c) Développement larvaire en laboratoire.

d) Méthode Jolly-Seber pour structure d'âge et mortalité.

Résultats prévus:

Connaissance de la population ichtyenne du lac Laflamme et des effets (s'il y a lieu) des précipitations acides sur cette faune.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Early Diagnosis of Acid-Stress in Fishes

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

Grant Fraser
Harold H. Harvey

Agency & Department: Zoology Department

Address: University of Toronto
Toronto, Ontario
M5S 1A1

Phone: (416) 978-3504

Co-operating agencies and investigators (if applicable): Fisheries and Oceans, Ottawa
National Scientific and Engineering Research Council

Duration of each phase: 1978 - 1980

Approximate Cost (indicate applicable yearly period): $10,000.00 (yearly)

Objectives:

a) To establish the Blood ionic changes in fish subjected to a range of acid stress.

b) To measure the same blood parameters in fishes from lakes over a range of pH.

Method:

a) Capture fish, retention in tanks of known pH controlled by pH, statsystem.

b) Periodic blood sampling; analysis for plasma Na, Cl, etc. Whole body analysis for major ions.

c) Repeat with fish taken from natural populations.

Anticipated Results: A practical indicator of acid stress in fishes. Severe loss of blood Na and Cl in response to acid stress.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Mechanisms of Toxic Action of Acid to Fish: Cardio/ Vascular/Respiratory and Ionic/Osmotic Regulatory Systems

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

Dr. M. A. Giles

Agency & Department: Department of Fisheries and Oceans
Freshwater Institute

Address: 501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Phone: (204) 269-7379

Co-operating agencies and investigators (if applicable): Freshwater Institute, Aquatic Toxicology Section
Dr. T. Hara
S. Brown
R. Evans

Duration of each phase:
Set-up 6/80 - 3/81
Operation 4/81 - 3/84

Approximate Cost (indicate applicable yearly period):
6/80 - 3/81: $35,000
4/81 - 3/82

Objectives:

a) To determine the actions and interactions of hydrogen ion and carbon dioxide on cardiovascular/respiratory function and blood electrolyte regulation in fish.
b) To interrelate the results of these studies with the results of neuro-endocrinological and histopathological investigations (Hara, Brown & Evans) on the same stocks of fish to provide a comprehensive statement of the mechanisms by which acid adversely influenced basic physiological functions in fish.

Method:

1] 6/80 - 3/81

a) Install a water treatment system capable of providing water of the exceptional quality and chemical definition required by these studies.
b) Install a water acidification/degassification system to provide water of controlled pH and carbon dioxide/oxygen concentration.
c) Estimate the acid tolerance of our laboratory fish stocks through conventional bioassay techniques
d) Determine the effect of acute acid exposure (pH range 4.25 to 7.4) upon cardiac and respiratory function and blood/urine electrolyte concentrations.

Method:

2] 4/81 - 3/82

a) The effect of chronic exposure to acid upon cardio-vascular/respiratory functions and electrolyte regulation of adult fish will be investigated using a variety of approaches from isolated gill preparations to whole fish. Preliminary integration with the neuro-endocrinology studies will be made at this point to define primary and secondary modes of action.

Anticipated Results:

a) Experimental results will be prepared for publication in primary scientific journals.

b) Experimental observations and conclusions will be disseminated to other "acidicication projects" such as the ELA studies for verification under "field conditions".

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Lake Trout Reproduction in Acidified Waters

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

John Gunn

Agency & Department: Ontario Ministry of Natural Resources

Address: P. O. Box 3500, Station "A"
Sudbury, Ontario
P3A 4S2

Phone: (705) 522-7823

Co-operating agencies and investigators (if applicable): Research Branch, Ontario Ministry of Natural Resources
Dr. W. Kwain

Duration of each phase:
a) Field Collections May - Oct. 1980
b) Laboratory Bioassay Oct. 1980 - June 1982

Approximate Cost (indicate applicable yearly period): 1980: $5,000.00 1981: $5,000.00

Objectives:
a) Determine the effects of low pH on lake trout ovaries *in situ*.
b) Determine viability of eggs produced by resident female from acid lake.

Method:
a) Lake trout ovaries were collected from several Sudbury area lakes (various pH levels).
b) Eggs are collected from females in acid lake, fertilized and tested for viability by bioassay procedures.

Anticipated Results:
a) Should determine which aspects of lake trout reproduction are affected by acidification.
b) Report issued after internal review.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Survival, Growth and Changes in Calcified Tissues for Stocked Trout in Acidic Lakes

Subject Code (s) in order of priority:	3.1.4 6.1

Principal Investigator's Name:

John Gunn

Agency & Department: Ontario Ministry of Natural Resources

Address:

P.O. Box 3500
Station "A"
Sudbury, Ontario
P3A 4S2

Phone: (705) 522-7823

Co-operating agencies and investigators (if applicable):

Research Branch, Ministry of Natural Resources
Dr. J. Casselman

Duration of each phase:

a) Initial Stocking: October 1980
b) Field Collections: October 1980 - June 1982
c) Lab Analysis: October 1980 - August 1982

Approximate Cost (indicate applicable yearly period):

$ 1,000.00 - 1980
$10,000.00 - 1981
$10,000.00 - 1982

Objectives:

a) Determine the effects of low pH on survival and growth of stocked fish.

b) Follow changes in calcified tissues as a test of aging techniques for fish from low pH lakes.

Method:

a) Four lakes (2 low, 2 high pH) stocked with equal number (per area) of yearling lake trout.

b) Sampled regularly by index netting to determine relative numbers and growth rate.

c) Calcified tissues examined to test present aging techniques.

Anticipated Results:

a) Evaluation of aging techniques for lake trout from soft water, low pH lakes.

b) Determine success of hatchery introductions.

c) Report issued after internal review.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Compilation of Data on the Effects of Acidification on Lake Trout Stocks in Sudbury Area

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

John Gunn

Agency & Department: Ontario Ministry of Natural Resources

Address: P. O. Box 3500, Stn. "A"
Sudbury, Ontario
P3A 4S2

Phone: (705) 522-7823

Co-operating agencies and investigators (if applicable): Chemical analysis provided by
Ontario Ministry of the Environment
North East Region

Duration of each phase:

Chemical Sampling -	June 1979-Sept. 1980
Netting Survey-	June 1979-Sept. 1981
Interviews & Literature Search -	June 1980-Sept. 1981

Approximate Cost (indicate applicable yearly period): $10,000.00: 1979
$15,000.00: 1980
$15,000.00: 1981

Objectives:

Summarize changes that have occurred through acidification in the lake trout stocks in the Sudbury area.

Method:

a) Chemical sampling of all l. trout lakes (past & present).

b) Netting surveys of 50 present stocks (carried out under the Ontario Aquatic Inventory Program).

c) Detailed description of changes in 3 - 4 "type" lakes, to be presented as case histories.

d) Interviews with long term residents and anglers in the area.

Anticipated Results:

a) An overview of the changes in lake trout angling opportunity resulting from acidification.

b) Report issued after internal review.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Monitoring Changes in the Fish Populations in the Lakes of the LaCloche Mountains

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

Harold H. Harvey

Agency & Department: Zoology Department

Address: University of Toronto
Toronto, Ontario
M5S 1A1

Phone: (416) 978-3504

Co-operating agencies and investigators (if applicable): Ontario Ministry of Natural Resources

Duration of each phase: 1979 - 80

Approximate Cost (indicate applicable yearly period): $26,000.00 (one year)

Objectives:

a) To monitor the changes in fish populations in the lakes of the LaCloche Mountains and compare present status with those of 1967, 1972 studies.

b) Prepare a review of loss of fish and fisheries in 68 LaCloche Lakes, during acidification.

Method:

a) Capture of fishes in every type of habitat by means of trap and gill nets, seine, plastic and baited traps.

b) Record weight, length, age, sex, maturity, etc.

c) Define age-class, composition of key species, especially white sucker, yellow perch, rock bass.

d) Estimate population abundances by catch per unit effort.

Anticipated Results:

a) Definition of the continuing changes in fish populations in a set of acid-stressed lakes.

b) Contribution of essential biological data to modelling the acidification of these lakes.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Algonquin Assessment Unit

Subject Code (s) in order of priority:	3.1.4

Principal Investigator's Name:

F. J. Hicks

Agency & Department: Ontario Ministry of Natural Resources
Algonquin Park District

Address: Box 219
Whitney, Ontario
K0J 2M0

Phone: (705) 637-2780

Co-operating agencies and investigators (if applicable): Harkness Laboratory of Fisheries
Research - J. A. Maclean
Ministry of the Environment - Ron Reid, Dorset Lab.

Duration of each phase: Continuing program

Approximate Cost (indicate applicable yearly period): Difficult to assess LRTAP associated costs.

Objectives: To assess effects of acid precipitation on specific fish communities in an assessment unit context.

Method: Population and community structure studies, reproductive success, water quality monitoring, creek census, setting, experimental stocking programs.

Anticipated Results: Annual progress reports.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Aquatic Effects, Fisheries

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

D. Hollinger

Agency & Department: MOE, N. W. Region

Address: 435 James Street South
Thunder Bay, Ontario
P7C 5G6

Phone: (807) 475-1215

Co-operating agencies and investigators (if applicable): P. Ryan, MNR

Duration of each phase: Yearly

Approximate Cost (indicate applicable yearly period): $10 K

Objectives: To establish the relationships between decreasing alkalinity (and pH) and mercury uptake in top predator fish in diluted Precambrian Shield lakes.

Method: Fish netting and analyses of fish flesh for mercury.

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Subject Code (s) in order of priority:
3.1.4
3.2.2
3.2.3
3.2.4
2.2.1
1.2
6.1
3.3
3.4

Activity Title:

A Book on the Sources, Effects, Regulation, and Outlook for Acidic Precipitation titled "Acid Rain: The North American Forecast".

Principal Investigator's Name:

Mr. Ross Howard
Mr. Michael Perley

Agency & Department: Publisher: House of Anansi Press Ltd.

Address: 35 Britain Street
Toronto, Ontario

Phone: (416) 363-5444

Co-operating agencies and investigators (if applicable): Canadian Environmental Law Research Foundation
5th Floor South,
8 York Street
Toronto, Ontario
M5J 1R2

Duration of each phase: Publication: October 1, 1980

Approximate Cost (indicate applicable yearly period): N/A

Objectives:

a) To describe how acidic precipitation was first discovered in North America, particularly in Canada, and how it developed as an environmental issue.

b) To survey scientific work on the effects of acidic precipitation on the ecosystem.

c) To analyze scientific, political, and industrial response to the issue to date.

Method:

a) A survey of all major articles related to acidic precipitation generated in the U.S. and Canada within the last ten years.

b) In-person attendance at conferences and seminars and workshops on the subject during the past eighteen months.

c) Interviews with a wide variety of government administrators and scientists, representatives of industry, and public interest groups on the subject.

Anticipated Results:

We hope that our book will focus public attention on the difficulties surrounding the control of the sources of acidic precipitation, and the complexities of the political and regulatory systems which must be brought to bear in order that acidic precipitation be quickly and effectively controlled.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Long Term Effects of Acid Rain on Aquatic Organisms

Subject Code (s) in order of priority:	3.1.4 3.1.2 3.1.1

Principal Investigator's Name:

J. W. Kiceniuk

Agency & Department: Fisheries and Oceans Canada

Address: P. O. Box 5667
St. John's, Newfoundland
A1C 5X1

Phone: (709) 737-2087

Co-operating agencies and investigators (if applicable): Memorial University of Newfoundland

Duration of each phase: 3 years minimum

Approximate Cost (indicate applicable yearly period): $20,000.00

Objectives: To determine the amount of pH decrease which produces minimal long-term effects (growth productivity, etc.) in aquatic organisms.

Method: Growth and reproduction studies in presence of constant or repeated dosage of low pH water.

Anticipated Results: We don't anticipate our results. If we could foretell the results, why would we need to do the experiments?

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Experimental Acidification on Fish in the Natural Environment

Subject Code (s) in order of priority:	3.1.4

Principal Investigator's Name:

J. F. Klaverkamp

Agency & Department: Department of Fisheries and Oceans
Toxicology Section

Address: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Phone: (204) 269-7379

Co-operating agencies and investigators (if applicable):

Duration of each phase: 1980 - 1985

Approximate Cost (indicate applicable yearly period): 1980 - 1981: $29,000 O & M

Objectives:

a) To determine sub-lethal biochemical and histological effects of experimental acidification on individual fish in the ELA, NW Ontario.
b) To determine the relevance of these effects by relating them to adverse effects observed on fish populations.
c) To determine the most sensitive life history stage of acid-toxicity to fish.

Method:

a) Small, oligotrophic lakes containing lake trout, white-fish, suckers, fathead minnows, dace and other species are experimentally acidified using sulfuric or nitric acid.
b) Investigations on ionic and metabolite concentrations, on enzyme activities, and on cellular and sub-cellular structures are conducted on individual fish from natural populations.
c) Population estimates and year-class distributions are obtained using traditional methods.
d) In situ lake incubators are used to determine effects on developing embryos, and histological methods are used to assess stages of gametogenesis.

Anticipated Results:

a) Simple indicators of acid-stress on individual fish are evaluated for use in predicting adverse effects on whole populations.
b) Understanding of biochemical mechanisms of acid stress to natural fish stocks.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Co-operative Turkey Lakes Ecosystem Studies with Fisheries and Oceans, Canada

Subject Code (s) in order of priority:	3.1.4 3.1.6

Principal Investigator's Name:

Dr. Wen Hwa Kwain

Agency & Department: Ontario Ministry of Natural Resources
Research Section, Fisheries Branch

Address: Northeastern Region
Sault Ste. Marie, Ontario

Phone: (705) 942-1411

Co-operating agencies and investigators (if applicable): Fisheries and Oceans Canada - Dr. John Kelso
Laurentian University

Duration of each phase: A 5 year study commencing 1980.

Approximate Cost (indicate applicable yearly period): $22,000.00 per annum (1980 $$)

Objectives: Contribute to understanding long and short-term acid stress of fish community of the Turkey Lakes, Algoma District, Ontario. As part of a multi-disciplinary ecosystem study by F&O Canada.

Method:

a) Survival, growth and behaviour of caged fish in lakes of different pH.

b) Laboratory studies of effects of low pH on early life history of principal fish species.

c) Laboratory studies on effects of pH on heavy metal toxicity.

d) Effects of pH on ion concentrations of fish body fluids as stress indicators.

Anticipated Results: A component of a comprehensive study of an acid stressed ecosystem. Fisheries baselines in the Algoma area for comparison with those in Algonquin, Muskoka/Haliburton lakehead and other areas of Toronto.

LRTAP ACTIVITY DESCRIPTION

Activity Title: pH, dissolved oxygen and CO_2 levels in Atlantic salmon redds

Subject Code (s) in order of priority: 3.1.4 3.1.5

Principal Investigator's Name: G. Lacroix (P.D.F.)

Agency & Department: Canada Department of Fisheries and Oceans, Environmental Sciences Division

Address: Biological Station, St. Andrews, New Brunswick E0G 2X0

Phone: (506)-529-8854

Co-operating agencies and investigators (if applicable): Freshwater and Anadromous Division, Department of Fisheries and Oceans

Duration of each phase: 10/80 to 5/81

Approximate Cost (indicate applicable yearly period): $5,000 (10/80 to 5/81)

Objectives: Relate mortality of Atlantic salmon eggs and alevins in natural spawning areas to the pH regime in the spawning gravel.

Method:

a) At 6 sites (streams with varying ambient pH's), newly fertilized eggs will be planted in early November.

b) pH, DO, and dissolved CO_2 will be monitored periodically through development.

c) Egg samples will be excavated periodically to assess mortality in the various streams.

Anticipated Results: Primary publication

LRTAP ACTIVITY DESCRIPTION

Activity Title: Distribution and Abundance of Fish Communities in Acid-sensitive lakes of Ontario

Subject Code (s) in order of priority: 3.1.4 7.0

Principal Investigator's Name: Dr. Charles K. Minns

Agency & Department: Department of Fisheries & Oceans
Great Lakes Biolimnology Laboratory

Address: 867 Lakeshore Road, P.O. Box 5050
Burlington, Ontario
L7R 4A6

Phone: (416) 637-4730

Co-operating agencies and investigators (if applicable): Ontario Ministry of Natural Resources (OMNR)

Duration of each phase: Continuing - Began in 4/79.

Approximate Cost (indicate applicable yearly period): 10K, 4/80 - 3/81

Objectives:

a. To identify those fish communities that may be at risk given expected lake sensitivity and acid rain loading.

b. To estimate the number of locations of such lakes.

Method: Analysis of OMNR Lake Inventory database in the Ontario Fisheries Information System.

Anticipated Results:

a. A report will be prepared and distributed

b. A methodology will be developed for describing the scope of potential impact in Eastern Canada.

LRTAP ACTIVITY DESCRIPTION

Subject Code (s)	3.1.4 2.5.4
in order of priority:	3.1.1 7.0

Activity Title: Effects of Acid Rain on Recreational Fisheries in Ontario Lakes 1981-2021

Principal Investigator's Name: Dr. Charles K. Minns

Agency & Department: Department of Fisheries & Oceans

Address:
Great Lakes Biolimnology Laboratory
867 Lakeshore Road, P.O. Box 5050
Burlington, Ontario
L7R 4A6

Phone: (416) 637-4730

Co-operating agencies and investigators (if applicable):
Ontario Ministry of Natural Resources (OMNR)
Ontario Ministry of the Environment
Hough, Stansbury and Michalski (Contractor)

Duration of each phase:
a) Set Up: 8/80 - 11/80
b) Contract: 12/80 - 5/81
c) Report: 6/81 - 12/81

Approximate Cost (indicate applicable yearly period):
for 12/80 - 5/81 - $63K

Objectives:
To assess the potential impact of acid rain on recreational fishing opportunities and harvest in Ontario Lakes, now and in the near future.

Method:
a. Analysis of resource inventory data
b. Analysis of fishing activity data
c. Modelling of acidification
d. Modelling of fish harvest

(Best concensus modelling will be used)

Anticipated Results:
1. a) Likely losses of fish resources will be estimated.
   b) Likely losses of fish harvest will be estimated.
   c) Likely losses of fishing opportunities will be estimated
   All in relation to possible future acid loading scenarios.
2. Methodology for application in other regions of Canada will be developed.
3. Reports will be prepared and distributed.

LRTAP ACTIVITY DESCRIPTION

Activity Title: Water chemistry and fish populations in 10 N.B. lakes

Subject Code (s) in order of priority: 3.1.4 3.1.1

Principal Investigator's Name: R.H. Peterson

Agency & Department: Canada Department of Fisheries and Oceans, Environmental Sciences Division

Address: Biological Station, St. Andrews, New Brunswick EOG 2X0

Phone: (506)-529-8854

Co-operating agencies and investigators (if applicable): Department of Environment, Water Quality Branch, Moncton, N.B.

Duration of each phase: a) Initial survey 5/78 to 10/78
b) Next survey 5/83 to 10/83
c) Next fish survey 5/88 to 10/88

Approximate Cost (indicate applicable yearly period): $10,000 (5/83 to 10/83)

Objectives: Determine possible rates of acidification in N.B. lakes and the effects on fish populations in these lakes.

Method:
a) Water samples from each of the 10 lakes will be analyzed for major ions and alkalinity on a monthly basis every 5 years.
b) Fish populations will be sampled; food habits, age structure, and growth rates will be assessed every 10 years.

Anticipated Results: Internal Report. Water chemistry data placed on NAQUADAT.

LRTAP ACTIVITY DESCRIPTION

Activity Title: Water chemistry of an acid-stressed salmon stream.

Subject Code(s) in order of priority: 3.1.4 3.1.1

Principal Investigator's Name: R.H. Peterson

Agency & Department: Canada Department of Fisheries and Oceans, Environmental Sciences Division

Address: Biological Station, St. Andrews, New Brunswick EOG 2X0

Phone: (506)-529-8854

Co-operating agencies and investigators (if applicable): Consulting Firm

Duration of each phase: 12/80 to 4/81

Approximate Cost (indicate applicable yearly period): $50,000 (12/80 to 4/81)

Objectives: Comprehensive measurements of water chemistry and hydrology of an acid-stressed salmon stream as a prelude to a study of the salmon populations.

Method:
a) Various inputs to the stream (tributaries, lakes, precipitation, ground water, surface flow) measured quantitatively.
b) The various ions present in these inputs will be measured.
c) Contributions of various species to stream acidity will be assessed.

Anticipated Results: Internal Report

LRTAP ACTIVITY DESCRIPTION

Activity Title: Population dynamics and energetics of a salmon population in an acid-stressed stream.

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name: R.H. Peterson

Agency & Department: Canada Department of Fisheries and Oceans, Environmental Sciences Division

Address: Biological Station, St. Andrews, New Brunswick E0G 2X0

Phone: (506)-529-8854

Co-operating agencies and investigators (if applicable): Department of Fisheries and Oceans, Freshwater and Anadromous Division

Duration of each phase:
a) Set-up: 4/81 to 4/82
b) Operation: 4/82 to 4/86 (at least)

Approximate Cost (indicate applicable yearly period): $300,000 (4/81 to 4/82)

Objectives: Quantitatively assess effects of low pH on Atlantic salmon productivity.

Method:
a) The stream will be furnished with traps so that adult escapement and smolt production can be measured.
b) Mortality of the various freshwater stages of the life cycle from egg to smolt will be measured by sampling redds and by seining fry and parr intensively enough to do populations estimates.
c) Food habits of fry and parr will be estimated quantitatively.
d) Nutrient content of the food and of the various freshwater stages will be measured.
e) Nutrient flow through the salmon population will be assessed.
f) Similar measurements will be performed in a stream that is not acid stressed.

Anticipated Results: Primary publications
Public information

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Body Movements of Fish Embryos at Various pH's

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

R. H. Peterson

Agency & Department: Canada Department of Fisheries and Oceans
Environmental Sciences Division

Address: Biological Station
St. Andrews, N. B.
E0G 2X0

Phone: (506) 529-8854

Co-operating agencies and investigators (if applicable):

Duration of each phase: 1/81 - 4/81

Approximate Cost (indicate applicable yearly period): $500.00 (1/81 - 4/81)

Objectives: To determine whether low pH (4.0 - 5.0) affects embryonic movements within the egg capsule. These movements are important to facilitate hatching.

Method: Salmon eggs will be reared in various pH's and will be examined microscopically to make counts of body movements when hatching is imminent.

Anticipated Results: Primary publication.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Acid Pulse Monitoring - Georgian Bay Rivers

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

A. Rettie

Agency & Department: Ontario Ministry of Natural Resources
Parry Sound District

Address: 4 Miller Street
Parry Sound, Ontario
P2A 1S8

Phone: (705) 746-4201

Co-operating agencies and investigators (if applicable):

Duration of each phase: Annual project - monthly except during Spring runoff period, then weekly.

Approximate Cost (indicate applicable yearly period):

Objectives: Determine seriousness and extent of acid pulse in 5 rivers running into Georgian Bay - namely: Moon, Sequin, Shawanaga, Magnetawan, Pickerel with a view to the long range effects on walleye spawning success.

Method: Sample using stainless steel buckets for grab samples - surface. Analysis using Gran titration methods.

Anticipated Results: Annual report to be prepared by district.

LRTAP ACTIVITY DESCRIPTION

Activity Title:
Whole Lake Addition of Selenium as a Hg-Acid Ameliorating Agent

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

Dr. John W. M. Rudd

Agency & Department: Department of Fisheries and Oceans
Freshwater Institute

Address: 501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Phone: (204) 269-7379

Co-operating agencies and investigators (if applicable): This research would be contracted out.

Duration of each phase: 3/81 (if funds available) to 3/86

Approximate Cost (indicate applicable yearly period):

Objectives: To assess the effects of selenium on bioaccumulation of Hg in acidified and non-acidified aquatic ecosystems. Se and Hg are both present in emission from fossil fuel generating plants.

Method: Selenium will be added to a whole lake over a 5 year period to assess its effect on uptake of Hg as the pH of the lake is lowered. Bioaccumulation of Hg and Se will be followed in various compartments of the ecosystem with 203 Hg and 75S isotopes.

Anticipated Results: Previous large enclosure experiments have demonstrated that low level (∿/ug/l) Se additions will reduce the rate of bioaccumulation of Hg by fish. In addition the Se is efficiently bioaccumulated and is then present in fish flesh to detoxify mercury when the fish flesh is consumed. Selenium present in acid rain may reduce the severity of the Hg-Acid effect.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Productivity of Boreal Lakes

Subject Code (s) in order of priority:	3.1.4 3.1.1 3.1.6

Principal Investigator's Name:

Mr. Richard A. Ryder

Agency & Department: Ontario Ministry of Natural Resources
Research Section, Fisheries Branch

Address: North Central Region
Thunder Bay, Ontario

Phone: (807) 683-6232

Co-operating agencies and investigators (if applicable): Fisheries and Oceans Canada - Dr. D. Schindler

Duration of each phase: Existing on-going study

Approximate Cost (indicate applicable yearly period): $28,000.00 per annum (1980 $$)

Objectives: Determination of factors determining fish production and yield in a set of small lakes in the boreal forest on the Precambrian Shield.

Method:

a) Measurement of limnological variables, measurement of species composition and diversity and the realized niches occupied by the fish species forming the communities of these typical Canadian lakes.

b) Monitoring of pH and alkalinity.

c) Manipulation of exploitation.

Anticipated Results: Baseline data for lightly stressed, or acid unstressed, lakes with simple fish communities for comparison with other more heavily stressed systems.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Acid Waters on Locomotor Responses of Freshwater Salmonids and Invertebrates

Subject Code (s) in order of priority:	3.1.4 6.1

Principal Investigator's Name:

Dr. E. Scherer

Agency & Department: Department of Fisheries and Oceans
Freshwater Institute

Address: 501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Phone: (204) 269-7379

Co-operating agencies and investigators (if applicable):
Department of Fisheries and Oceans
Dr. D. W. Schindler
Dr. M. Giles
Mr. J. F. Flannagan

Duration of each phase:
a) Set-up and initiate experiments: 8/80 - 3/81
b) Conclusive experiments, results, publications: 4/81 - 3/82

Approximate Cost (indicate applicable yearly period):
a) $8,000.00
b) $18,000.00/annum

Objectives:
To determine effects of acid waters on spatial distribution and abundance of selected freshwater organisms, by investigating preference/avoidance responses, effects on swimming performance and locomotor activity of fish, and on drift behaviour of invertebrates.

Method:
A combination of laboratory and field experiments is used. Recording of locomotor activity of rainbow trout (Salmo gairdneri), lake whitefish (Coregonus clupeaformis), and brook trout (Salvelinus fontinalis) in field cages and lab aquaria; studies on preference/avoidance responses and maximum sustained swimming speeds of these species in existing lab set-ups with subsequent field checks; analysis of drift behavious of selected stream dwelling invertebrates in two northern Manitoba Woodland streams and laboratory stream channels presently under construction.

Anticipated Results:
Above methods have been successfully applied internationally to assess ecological effects of a number of organic and inorganic chemical compounds; comparable data on effects of acidified waters are very scarce. Results will determine effects of acidification on responses directly underlying spatial distribution and abundance, namely selection and maintenance of habitat by freshwater organisms, with special attention to possible mitigative adaptation mechanisms under chronic exposure.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Fish Communities of 50 Lakes over a Range of Acid Stress in the Wawa Area

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

Keith M. Somers
Harold H. Harvey

Agency & Department: Zoology Department

Address: University of Toronto
Toronto, Ontario
M5S 1A1

Phone: (416) 978-3504

Co-operating agencies and investigators (if applicable): Ontario Ministry of Natural Resources
Fisheries and Oceans, Canada

Duration of each phase: 1978 - 1980

Approximate Cost (indicate applicable yearly period): $22,000.00 over 2 years

Objectives:

a) To define the fish communities in a series of lakes over a range of acid and metal stress.

b) To relate the above to acid loading.

Method:

a) Analysis of lake water chemical quality, including pH, alkalinity, T.D.S., metals, various ligands, O_2.

b) Measurement of 12 physical parameters.

c) Fish collections, all habitats, for kinds and abundance of fishes.

d) Mathematical analysis using stepwise multiple regression, cluster analysis, principle components.

Anticipated Results:

a) Definition of kinds and abundance of fishes in stressed and unstressed lakes.

b) Provision of data for measuring time-trend effects in the future.

c) Information on tolerance by species.

d) Comparison of present state, expecially water quality, with historic data.

e) Define fish communities in stressed and unstressed lakes.

LRTAP ACTIVITY DESCRIPTION

Activity Title:
Aquatic Effects: Fisheries

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:

K. Suns

Agency & Department: Ministry of the Environment
Limnology & Toxicity Section

Address: Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3011

Co-operating agencies and investigators (if applicable):

Duration of each phase: One Year

Approximate Cost (indicate applicable yearly period): $16,000

Objectives: To determine the effects of lake acidification on mercury uptake in fish.

Method:

First Phase: Investigate mercury uptake in yearling yellow perch.

Second Phase: Investigate mercury uptake in adult bass populations.

Anticipated Results:

Ministry report for yearling perch appended.

Ministry report for bass available in the spring of 1981.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Effect of Acid Stress on the Growth, Maturation, Fecundity and Survival of White Suckers

Subject Code (s) in order of priority: 3.1.4

Principal Investigator's Name:
Edward Trippel
Harold H. Harvey

Agency & Department: Zoology Department

Address: University of Toronto
Toronto, Ontario
M5S 1A1

Phone: (416) 978-3504

Co-operating agencies and investigators (if applicable): Natural Scientific and Engineering Research Council

Duration of each phase: 1980 - 1982

Approximate Cost (indicate applicable yearly period): $10,000.00 annually

Objectives: To provide a physiological explanation for the observed changes in white sucker population in acidifying lakes.

Method:

a) To determine the effect of hydrogen ion on maturation of white suckers, over the pH range 4.0 - 7.0.

b) To continue field observations on white sucker populations throughout the year with respect to maturation and spawning.

Anticipated Results: An explanation of the mechanism of action of acid stress on one aspect of the physiology of the white sucker.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

National Geochemical Reconnaissance 1:2 000 000 Compilation Series

Subject Code (s) in order of priority:	3.1.5 3.1.1 3.3 7.0 3.2.1 3.2.2

Principal Investigator's Name:

W. B. Coker
D. J. Ellwood

Agency & Department: EMR - Geological Survey of Canada

Address: 601 Booth Street
Ottawa, Ontario
K1A 0E8

Phone: (613) 995-4950

Co-operating agencies and investigators (if applicable): National Geochemical Reconnaissance (N.G.R.)
Uranium Reconnaissance Program (U.R.P.-1975/79)

Surveys were jointly planned and funded under agreements with the provinces of B.C., Sask., Man., Ont., & Nfld. All members of the Resource Geochemistry Subdivision participate in project.

Duration of each phase:

Initial Atlas of 1:2 000 000 Coloured Compilation Maps completed between February 1980 and July 1980.

Approximate Cost (indicate applicable yearly period): $15,000 (February - July 1980)

Objectives: To produce a Geochemical Atlas of all available lake and stream water and sediment geochemical data in order to outline:

a) the degree of lake and stream water acidification and

b) bedrock lithologies and/or glacial overburden with chemical characteristics which could be of potential environmental concern in an "acidified" landscape.

Method:

Method: Coloured complilation maps (1:2 000 000) of all geochemical variables from all areas surveyed under the N.G.R.-U.R.P. withing B. C., Sask., Man., Ont., Nfld., N.W.T., and Yukon were produced (total number of maps ~250) . The coloured moving average maps were produced using an Applicon colour plotter under directives from a computer mapping package (APPMAP) developed in the Resource Geochemistry Subdivision.

Anticipated Results: If a reasonable method of colour reproduction can be found (colour xeroxing is being investigated) and additional funding is secured, the atlas or individual maps will be made available on a request basis to the public.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Paleolimnology of Acid Susceptible Lakes

Subject Code (s) in order of priority: 3.1.5

Principal Investigator's Name:

L. D. Delorme

Agency & Department: Department of Environment
National Water Research Institute

Address: Canada Centre for Inland Waters
Box 5050,
Burlington, Ontario
L7R 4A6

Phone: (416) 637-4382

Co-operating agencies and investigators (if applicable):

Duration of each phase: Program is expected to be continued over a three year period.

Approximate Cost (indicate applicable yearly period): 1 PY $15K operating costs

Objectives: To delineate, within a time framework of the last 200 years, the changes in Hydrogen ion concentration within a given lake.

Method: Core samples from several presently acidic lakes will be analyzed for a matrix of diatoms and paleofossils and combined with the geochronology of the core to provide a historical record of the acidity of the water body.

Anticipated Results: Preliminary reports on the applicability and findings for the lakes studied. An assessment of the chronology of lake acidification to the resolution provided by the sediment core.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Lake Sediment Studies

Subject Code (s) in order of priority:	3.1.5

Principal Investigator's Name:

P. Dillon

Agency & Department: Ministry of the Environment

Address: P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3058

Co-operating agencies and investigators (if applicable): Dr. D. Evans
Department of Environmental Studies
Trent University

Duration of each phase: Evaluated yearly

Approximate Cost (indicate applicable yearly period): 1980/81: $10K

Objectives: To determine the rates of accumulation of substances (metals, nutrients) in lake sediments. To reconstruct deposition rates in the lakes.

Method: The chronologies of sediment cores from multiple sites in each of 10 lakes have been established using ^{210}Pb methodology and the deposition patterns in the lakes investigated.

Anticipated Results: Whole lake accumulation rates of sediments, metals and nutrients will be obtained and related to mass balance measurements. Attempts to construct predictive sedimentation models will follow.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Chronology of Lake Acidification

Subject Code (s) in order of priority:	3.1.5 3.1.2 3.1.3 3.1.1

Principal Investigator's Name:

Dr. N. M. Hooper-Reid

Agency & Department: Ontario Hydro
Biological Research Section

Address: 800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

Phone: (416) 231-4111 Ext. 6862

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Phase I 1980 - 81
Phase II 1982 - 83

Approximate Cost (indicate applicable yearly period):

Objectives:

To reconstruct record of lake pH changes in selected Ontario lakes on the basis of sediment core analysis, supplemented by historical pH survey information.

Method:

Phase I

a) Compile all available records of lake pH in selected areas.

b) Develop inference system for lake pH based on analyses of chironomid, diatom and cladoceran remains in upper sediment samples collected from 25 lakes representing a wide pH/heavy metal range.

Phase II

Apply inference system to site-specific core analyses.

Anticipated Results:

Reports of Phase I will be prepared by December 1981.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Impact of Lake Acidification on Sediment Chemistry

Subject Code (s) in order of priority:	3.1.5 3.1.1

Principal Investigator's Name:

Professor T. C. Hutchinson

Agency & Department: None

Address: Department of Botany
University of Toronto
Toronto, Ontario
M5S 1A1

Phone: (416) 978-3537

Co-operating agencies and investigators (if applicable): None

Duration of each phase: Commenced summer 1980

Approximate Cost (indicate applicable yearly period): $3,000.00 internal funds

Objectives: To access the degree and depth of sediment acidification and related chemical changes in lake of different acidities and histories.

To determine the ability of sediments to buffer overlying water bodies.

Method: Surface sediments and cores collected from 20 Ontario lakes. Micrososm studies combined with analytical chemistry.

Anticipated Results: Scientific Papers

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Acid Precipitation and Heavy Metal Contamination on Bacteria and Zooplankton Sensitive to Change in pH (in progress)

Subject Code (s) in order of priority:	3.1.5 3.1.3

Principal Investigator's Name:

Dr. S. G. Lawrence

Agency & Department: Department of Fisheries and Oceans

Address: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Phone: (204) 269-7379

Co-operating agencies and investigators (if applicable):

Department of Microbiology
University of Manitoba
Dr. N. E. R. Campbell

Department of Fisheries & Oceans
Dr. D. W. Schindler
Dr. D. F. Malley

Duration of each phase:

a) 4/80 - 9/81
b) 10/81 - at least 4/84

Approximate Cost (indicate applicable yearly period): 4/80 - 3/81: $37,000.00

Objectives:

a) To assess effects of acidification and/or heavy metal contamination on carbon cycling by bacteria in the sediments and water columns of Precambrian Shield Lakes.
b) To assess response of zooplankton species and communities in Precambrian Shield Lakes to acidification and/or heavy metal contamination.

Method:

a) Small (20L) laboratory maintained impoundments of lake sediments and overlying water are manipulated by additions of acid and/or heavy metal and rates of methane and CO_2 evolution measured.
b) Large ($2x10^3$ L) impoundments placed in an artificially eutrophied Precambrian Shield Lake are manipulated by addition of acid and/or heavy metal and rates of methane evolution, available $SO_4^=$, NO_3^-, and organic and inorganic carbon measured.
c) Zooplankton are sampled weekly or twice weekly in three lakes being acidified gradually under differing regimes; biomass and species diversity changes assessed.
d) Series of continuously flowing impoundments of zooplankton communities are incubated in situ in two gradually acidified lakes and subjected to altered heavy metal concentrations biomass and diversity changes assessed.

Anticipated Results:

Anticipated Results:

a) Data on bacteria in sediments will be analyzed and serve as basis for further experimentation in lakes and lake impoundments.
b) Two graduate theses and accompanying research reports should result.

c) Data on zooplankton will form part of the Experimental Lakes Area (maintained by DFO near Kenora, Ontario) data base and will be used to assess effects of acidification and of heavy metal contamination on freshwater ecosystems particularly sensitive to pH changes.

d) Several research publications on zooplankton in such systems should result.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Aspects paléolomnologiques du lac Laflamme

Code du (des) sujet(s) par ordre de priorité : 3.1.5 3.1.6

Nom du chercheur responsable :

Marcel Ouellet

Ministère, organisme ou organisme privé, service : Institut National du recherche sur l'eau (INRS-Eau)

Adresse: Complexe Scientifique
2700 rue Einstein, C.P. 7500
Ste-Foy, Québec
G1V 4C7

Téléphone: (418) 657-2555

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) :

Durée de chaque phase: Janvier 1980: Echantillonnage
Fév. 1980 à avril 1980: Analyse et rédaction

Côut approximatif (indiquer pour quelle période annuelle):

Janv. 1980 à mars 1980: $7,000.00

Objectifs de travail:

a) Caractériser les sédiments lacustres du lac Laflamme

b) Etudier stratigraphiquement les sédiments.

c) Déceler certains effets anthropogéniques reliés aux transports atmosphériques de polluants.

Méthode de travail : Méthodes paléolimnologiques telles que la géochimie ainsi que la composition et l'abondance des communautés fossiles phyto et zooplanctoniques. (Cs^{-137}, méthode de chauffage, procédures de Guimont et Pichette (1979) etc., examens sur lames microscopiques.)

Résultats prévus: Voir le rapport.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Paléolimnologie et géochimie des sédiments lacustres.

Code du (des) sujet(s) par ordre de priorité :	3.1.5 3.1.1 3.1.2 3.1.3 ~~3.2.1~~ 2.1.1

Nom du chercheur responsable :

Dr. Marcel Ouellet }
Dr. H. G. Jones } Professeurs

Ministère, organisme ou organisme privé, service : INRS-Eau (Université du Québec)

Adresse: 2700 Einstein
C.P. 7500
Ste. Foy, Québec
G1V 4C7

Téléphone: (418) 657-2555/2533

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) :

M. Dickman, Brock University
C. Barbeau, Université Lavel
Y. Vignault, Environnement Canada, Direction des Eaux intérieures, Ste-Foy, Québec

Durée de chaque phase: 1980-81

Côut approximatif (indiquer pour quelle période annuelle):

du 80/6 au 81/3: $17,000.00

Objectifs de travail: Développer des indices paléolimnologiques de l'impact des polluants atmosphériques sur les lacs du bouclier canadien.

Méthode de travail :

a) Préliver des sédiments lacustres au moyen d'un carottier (ex.: Lac Laflamme, Lac Tantarie), subdiviser les carottes stratigraphiquement.

b) Déterminer paramètres géochimiques: pH, C-inorg., Cℓ, S, C-org; Ca, Mg, K, Na, Al, Mn, Fe, As, Cd, Co, Cu, Hg, Ni, Pb, Zn, ^{14}C, ^{137}Cs.

c) Déterminer paramètres biologiques: pollens et spores; diatomées, cladocères, copépodes.

Résultats prévus: La comparaison des courbes stratigraphiques des sédiments les plus récents des lacs étudiés des diverses régions nous permettra de mettre en évidence l'importance du transport à longue portée de certains polluants atmosphériques.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of pH on Methylation and Demethylation of Mercury

Subject Code (s) in order of priority: 3.1.5, 3.1.1

Principal Investigator's Name:

Dr. John W. M. Rudd

Agency & Department: Department of Fisheries and Oceans
Freshwater Institute

Address: 501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Phone: (204) 269-7379

Co-operating agencies and investigators (if applicable): NIL

Duration of each phase: a) Start: 3/80
b) Finish: 12/82

Approximate Cost (indicate applicable yearly period): 3/80 - 3/81: $16K

Objectives:

To determine if the acidification of lakes will promote the methylation of mercury or inhibit the demethylation of Hg.

Method:

a) Methylation will be assayed by a $^{203}Hg^{2+}$ isotope method.
b) Demethylation will be assayed by a $^{14}CH_3Hg^+$ isotope method.
c) Natural sediment and water samples acclimated to neutral and acid pH's will be examined for their pH tolerance and for rates of activity at reduced pH.
d) Methylation and demethylation rates will be followed on an annual basis as part of whole lake acidification experiments.

Anticipated Results:

Hg concentration in fish are thought to increase during the early stages of acidification. This may be a consequence of increased methylation or decreased demethylation at lower pH. These questions will be answered with the two radiochemical techniques.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Sensibilité des eaux du Québec aux effets des pluies acides

Code du (des) sujet(s) par ordre de priorité :	3.1.6 3.1.1 8.0

Nom du chercheur responsable :

André Ahern .

Ministère, organisme ou organisme privé, service : Bio-Conseil Inc.

Adresse: 12-755, Marguerite-Bourgeois
Québec
G1S 3V9

Téléphone: (418) 683-9839

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Min. Environnement du Québec (Lévis Talbot)

Durée de chaque phase: Nov./80 à Mars/81: Interprétation des données de qualité de l'eau disponibles pour évaluation de la sensibilité des eaux du Québec aux pluies acides.

Côut approximatif (indiquer pour quelle période annuelle):

Nov./80 à Mars/81: $9,500.00

Objectifs de travail:

a) Interpréter les données de qualité disponibles

b) Collaborer avec le gouv. provincial.

c) Evaluer la qualité (sensibilité) des eaux du Québec aux pluies acides.

Méthode de travail :

a) Utilisation du CSI

b) Traitement informatique (Etude de regroupement et analyse factiorielle en composante principale).

c) Relations pH vs Ca

Résultats prévus: Carte de sensibilité pour l'ensemble du Québec.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Etude de sensibilité des lacs de la région de Québec aux pluies acides

Code du (des) sujet(s) par ordre de priorité : 3.1.6 3.1.1

Nom du chercheur responsable :

Jean-Christian Auclair

Ministère, organisme ou organisme privé, service : Institut national de recherche sur l'eau (INRS-Eau)

Adresse: Complexe scientifique
2700 rue Einstein
Ste-Foy, Québec

Téléphone: (418) 657-2961

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Environnement Canada (Raymond Lemieux)
Direction des eaux intérieures

Durée de chaque phase: Sept./80, Nov./80, Janv./81 } Echantillonnage (27 lacs)

Rapport final pour mars 1981

Côut approximatif (indiquer pour quelle période annuelle):

Sept./80 à Mars/81: $6,000.00

Objectifs de travail:

a) Vérifier la sensibilité d'un certain nombre de lacs dans la région des Laurentides.

b) Vérifier l'importance de certaines caractéristiques (altitude, rapport Superf. bassin versant/Superf. lac, épaisseur de dépôts meubles etc.) versus la qualité des plans d'eau.

Méthode de travail :

a) Echantillons intégrés.

b) Paramètres pH, alcalinité-gran, Ca, Mg, Na, SO_4, Cl, Mn et Al

Résultats prévus: Carte de sensibilité des lacs du sud du parc des Laurentides.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Monitoring pH of Fresh Water from Lake Water Supply

Subject Code (s) in order of priority: 3.1.6

Principal Investigator's Name:

Bowater Mersey Paper Co. Ltd.

Agency & Department: Control Department

Address: P. O. Box 1150,
Liverpool, N. S.
B0T 1K0

Phone: (902) 354-3411

Co-operating agencies and investigators (if applicable):

Duration of each phase: 3 Tests per Week

Approximate Cost (indicate applicable yearly period): Negligible

Objectives:

To assess the condition of untreated process water at its source.

Method:

pH Meter

Anticipated Results:

Variations in pH show effect of acid precipitation.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Aquatic Effects: Water Chemistry

Subject Code (s) in order of priority:	3.1.6 2.3.1

Principal Investigator's Name:

R. J. Crozier

Agency & Department: Waste Management Branch
B. C. Ministry of Environment

Address: 310 Ward Street
Nelson, B. C.
V1L 5S4

Phone: (604) 352-2211

Co-operating agencies and investigators (if applicable):

Duration of each phase: In preparation

Approximate Cost (indicate applicable yearly period):

Objectives: Effects of metal smelter complex at Trail, B. C. on precipitation chemistry and aquatic chemistry of local alpine lakes.

Method:

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Assessment of the Impact of Acid Precipitation on Wildlife

Subject Code (s) in order of priority:	3.1.6 3.2.5 3.2.6

Principal Investigator's Name:

K. L. Fischer

Agency & Department: Canadian Wildlife Service
Environment Canada

Address: National Wildlife Research Centre
Ottawa, Ontario
K1A 0E7

Phone: (819) 997-1410

Co-operating agencies and investigators (if applicable): K. Clark
Biota Environmental Contractors
Box 533
Beamsville, Ontario

Duration of each phase: a) Initial Report: 1/4/80 - 1/12/80

b) Refinement of original assessment and prediction by 1982

Approximate Cost (indicate applicable yearly period):

Objectives:

a) To prepare a report on what is known about the biological impacts of long range air pollutants from the literature in relation to wildlife food and habitat requirements.

b) To prepare maps on the distribution and density of sensitive wildlife in areas of acid deposition.

Method:

Information presently available in the literature on the biological effects of acid precipitation is reviewed in conjunction with sensitive wildlife species and habitats. Species of wildlife most likely to be affected are discussed.

Anticipated Results: Report by December 1980.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Monitoring Toxic Metals in Acid-Stressed Shield Lakes using Unionacean Clams as Biological Indicators

Subject Code (s) in order of priority:	3.1.6 3.1.2 3.1.1

Principal Investigator's Name:

Dr. Andrew J. Forester

Agency & Department: Institute for Environmental Studies
University of Toronto

Address: Haultain Building,
University of Toronto
Toronto, Ontario
M5S 1A4

Phone: (416) 978-7339

Co-operating agencies and investigators (if applicable): Environment Canada
Inland Waters Directorate
(Dr. W. E. Lowe)

Duration of each phase: 4/80 - 7/81

Approximate Cost (indicate applicable yearly period): 4/80 - 7/81: $98,400.00

Objectives:

a) Development of a methodology for using unionacean clams as indicators of the bioavailability of metals in acid stressed shield lakes.

Method:

a) Water, sediments and clams collected from Ontario lakes having geological, chemical, biological and trophic characteristics.

b) Analysis by INAA & AA for Cu, Ni, Zn, Mn, Al, Cd, Pb.

c) Quantification of biological variables (age, size, etc.) and methods (sampling strategy, use of biosphere controls, use of caged animals etc.) that affects the use of clams as biological indicators.

Anticipated Results:

a) A recommended protocol for using clams as biological indicators of metals in acid-stressed lakes.

b) Application of the method to shield lakes so that they may be characterized according to their pollutant status.

c) Production of internal report for the funding agency, followed by submissions to scientific journals.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Benthic Animals of 20 Calibrated-Watershed Lakes in the Muskoka-Haliburton Area of Ontario

Subject Code (s) in order of priority: 3.1.6

Principal Investigator's Name:

Harold H. Harvey
William Allison
Ann Douglas

Agency & Department: Zoology Department

Address: University of Toronto
Toronto, Ontario
M5S 1A1

Phone: (416) 978-3504

Co-operating agencies and investigators (if applicable): Ontario Ministry of the Environment

Duration of each phase: 1979 - 1981

Approximate Cost (indicate applicable yearly period): $30,277.42 (over two years)

Objectives:

a) To establish the kinds and abundance of benthic animals in 20 study lakes, Haliburton-Muskoka.
b) To relate this data to concurrent studies of water chemistry, phyto & zooplankton, fishes, etc.
c) To incorporate this information into predictive models.

Method:

a) Transect lines placed on lake bottom.
b) Divers swim lines, counting macrobenthos in one-meter band, day and night. Organisms, identity and numbers recorded on underwater tape recorders.
c) Sediment cores taken along transect lines, 60 per lake. Organisms in cores separated by floatation.
d) All organisms identified by taxon.
e) Abundance of types of organisms expressed as numbers and weights m^{-2}, by depth zone.

Anticipated Results:

a) Quantitative information on the benthic standing crop.
b) Information which will serve as a basis for future comparisons; modelling time-trend effects.
c) Immediate comparisons between lakes in Haliburton-Muskoka and with acidic and non-acidic lakes elsewhere.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Benthic Animal Communities of Acid-Stressed Lakes

Subject Code (s) in order of priority: 3.1.6

Principal Investigator's Name:
Harold H. Harvey
William Allison
Ann Douglas

Agency & Department: Zoology Department
University of Toronto

Address: Toronto, Ontario
M5S 1A1

Phone: (416) 978-3504

Co-operating agencies and investigators (if applicable): Ontario Ministry of Natural Resources

Duration of each phase: 1980 - 1981

Approximate Cost (indicate applicable yearly period): $50,000.00 (One year)

Objectives: To determine the kinds and abundance of benthic animals in 25 lakes, spanning a wide range of acid stress, La Cloche Mountains, Ontario

Method:

a) Transect lines placed on lake bottom.

b) Divers swim lines, counting macrobenthos in one-meter band, day and night. Organisms, identity and numbers recorded on underwater tape recorders.

c) Sediment cores taken along transect lines, 60 per lake. Organisms in cores separated by floatation.

d) All organisms identified by taxon.

e) Abundance of types of organisms expressed as numbers and weights m^{-2}, by depth zone.

Anticipated Results:

a) Quantative data on benthic standing crop.

b) Basic information for future time-trend comparison.

c) Comparison of benthic standing crop in lakes of varying degree of acidification.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Acid Precipitation in Ontario Study (APIOS)

Subject Code (s) in order of priority:	3.1.6 3.1.4

Principal Investigator's Name:

Keith Holtze
Cecil Inniss

Agency & Department: Ontario Ministry of the Environment
Limnology & Toxicity Section

Address: Environmental Contaminants Laboratory
Water Resources Branch
P. O. Box 213
Rexdale, Ontario M9W 5L1

Phone: (416) 248-3011

Co-operating agencies and investigators (if applicable): Fish Pathology Laboratory
Department of Pathology
University of Guelph

Duration of each phase: 6 - 12 months

Approximate Cost (indicate applicable yearly period): $17.5K

Objectives:

a) To determine the relative toxicities of aluminum and manganese to rainbow trout embryos and alevins under varying conditions of pH and water hardness

b) To determine the effects of aluminum and pH on growth and survival of rainbow trout during the embryonic and larval developmental periods.

Method:

The tests will involve exposing rainbow trout to various concentrations of metals and acids at different levels of water hardness including 15, 60 and 135 mg/l as $CaCO_3$ under static and continuous flow conditions. The tests will be carried out using an artificial water supply. Four growth phases within the embryo and alevin developmental periods will be examined including (1) cleavage phase (2) embryonic phase (3) eleuthero-embryonic phase and (4) alevin phase.

Anticipated Results:

Identification of the relative importance of aluminum and manganese-elevated concentrations in acid-stressed waters.

LRTAP ACTIVITY DESCRIPTION

Activity Title: Interaction of Acid Rain and Ground Water.

Subject Code (s) in order of priority: 3.1.6

Principal Investigator's Name: L. M. Johnston

Agency & Department: Department of Environment, National Hydrologic Research Institute

Address: 562 Booth Street, Ottawa, Ontario

Phone: 613 995-4031

Co-operating agencies and investigators (if applicable): National Water Research Institute
Ontario Ministry of Environment

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 1 PY 24 K operating costs.

Objectives: To study the actual impact of acid rain and other airborne contaminants on ground water.
To study the potential impact of acid rain on ground water.

Method: Participation in watershed studies to determine the interactions between acid precipitation and groundwater chemistry through isotopic analysis of stream, lake and ground waters.

Anticipated Results: Assessment of the degree of modification of ground water due to acid precipitation and the influence of this modification on lake and stream ecosystems.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Intoxication des oiseaux fréquentant les milieux acides

Code du (des) sujet(s) par ordre de priorité : 3.1.6, 3.2.6, 3.1.1

Nom du chercheur responsable :

Pierre Laporte

Ministère, organisme ou organisme privé, service : Environnement Canada
Service canadien de la faune

Adresse: 2700 boul. Laurier
C.P. 10100
Ste.-Foy, Québec
G1V 4H5

Téléphone: (418) 694-3914

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : M. Paul Potvin
Service de Qualité de Eaux
Environnement Québec

Durée de chaque phase: a) Planification et analyse préliminaire - 80/81
b) Cueillette des données - 81/82

Côut approximatif (indiquer pour quelle période annuelle): 80/81: $15,000.00
81/82: $30,000.00

Objectifs de travail: Déterminer si la fréquentation des milieux aquatiques acidifiés peut entraîner des phénomènes d'intoxication chronique chez les oiseaux.

Méthode de travail : Etude de l'équilibre physico-chimique de certains éléments traces dans des lacs diversément affectés par les précipitations acides. Cette étude sera mise en relation avec la physiologie et la toxicologie de ces élements chez les oiseaux.

Résultats prévus: Cette étude nous permettra de vérifier si les oiseaux seront affectés par les précipitations acides. Même si l'on peut prévoir des effets minimes, l'étude pourra conduire à des indicateurs biologiques des milieux acides.

Activity Title:

Haliburton Highlands Assessment Unit

Subject Code (s) in order of priority: 3.1.6

Principal Investigator's Name:

D. A. Loftus

Agency & Department: Ontario Ministry of Natural Resources
Bancroft District

Address: P. O. Box 500
Bancroft, Ontario
K0L 1C0

Phone: (613) 332-3940

Co-operating agencies and investigators (if applicable): Ministry of the Environment
Ron Reid
Dorset Lab.

Duration of each phase: Continuing Program

Approximate Cost (indicate applicable yearly period): Approximately $100 K/annum

Objectives: Study the effects of acid precipitation on a set of type lakes in the Haliburton Highlands - Hastings - Muskoka area of Ontario

Method: To be determined and refined.

Anticipated Results: Annual progress reports.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Etude hydrologique du bassin versant du lac Laflamme

Code du (des) sujet(s) par ordre de priorité : 3.1.6

Nom du chercheur responsable :

André Plamondon

Ministère, organisme ou organisme privé, service : Université Laval
Département d'aménagement et sylviculture
Faculté de foresterie et géodésie

Adresse: Université Laval
Faculté de foresterie et géodésie
Ste-Foy, Québec

Téléphone: (418) 656-7120

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Relevés hydrologiques du Canada
Direction des eaux intérieures
Env. Canada

Durée de chaque phase: Août-Septembre 1980 - Préparation et travail en cabinet
Septembre 1980 - Début des relevés
Mars 1981 - Rapport final

Côut approximatif (indiquer pour quelle période annuelle):

09/80 à 03/81: $15,000.00

Objectifs de travail:

a) Améliorer la connaissance des processus hydrologiques sur le bassin du lac Laflamme.
b) Mesurer la précipitation sur le bassin.
c) Mesurer la teneur en eau du sol.
d) Mesurer le niveau de la nappe phréatique.
e) Mesurer la fonte de la neige.
f) Mesurer la qualité de la neige.

Méthode de travail:

a) Etablissement de places-échantillons.
b) Utilisation de soudes à neutron.
c) Utilisation de piézomètres de surface.

Résultats prévus: Les données seront incluses dans l'étude globale du lac Laflamme sur les précipitations acides.

LRTAP ACTIVITY DESCRIPTION

Activity Title: Acid Rain Effects on Nutrient Regeneration and Assimilation Processes

Subject Code (s) in order of priority: 3.1.6

Principal Investigator's Name: S. S. RAO

Agency & Department: Department of Environment, National Water Research Institute

Address: Canada Centre for Inland Waters
Box 5050, Burlington, Ontario L7R 4A6

Phone: 416 637-4312

Co-operating agencies and investigators (if applicable): Great Lakes Biolimnology Laboratories - CCIW

Duration of each phase: The study is expected to continue over a two year period terminating in March 1982.

Approximate Cost (indicate applicable yearly period): 1 PY 14 K per year.

Objectives:

To study the effect of acidification on microbial populations.
To determine if microbial population shifts in species or densities can be used to predict lake changes.
To establish baselines in several soft and hard water lakes.

Method:

Chemostat studies - using hard and soft water and pH changes to evaluate population shifts and changes in nitrification potential.
Batch studies - study the effects of pH on rates of degradation of organics and changes in toxicants.
Field Studies - changes in physiological group predominance with changing pH in soft and hard water lakes.

Anticipated Results: Reports of the influence of pH changes on the microbial regeneration processes in acidified lakes.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effect of Acid Precipitation on Microbial Activities and Population in Streams in the Algoma Area

Subject Code (s) in order of priority:	3.1.6 3.1.1 3.1.5

Principal Investigator's Name:

J. B. Robinson

Agency & Department: Department of Environmental Biology
University of Guelph

Address:

Guelph, Ontario
N1G 2W1

Phone: (519) 824-4120 (Ext. 3829)

Co-operating agencies and investigators (if applicable): N. K. Kaushik
Department of Environmental Biology
University of Guelph

Great Lakes Biolimn. Laboratory
Burlington and Sault Ste. Marie

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 4/80 - 3/81: $15,000.00

Objectives:

a) To determine numbers and activity of organisms important in the cycling of S and N in streams and stream sediments affected by acid precipitation.

b) To assess the impact of these activities on transport of S and N in streams.

Method:

Monthly samples of sediment and water from several streams in the Turkey Lakes E.L.A. in Algoma are being examined for populations of nitrifying, denitrifying, S-oxidizing and S-reducing bacteria as well as heterotrophs and acid tolerant heterotrophs. Beginning later this year, column studies of conversion rates of dissolved S and N compounds will be carried out in the laboratory using bottom sediment collected from these streams. When information on process rates under normal conditions has been obtained, the effect of acid pulses on these processes will be determined. In addition, decomposition rates of autumn-shed leaves will be determined in the field.

Anticipated Results:

Early results indicate the presence of most groups of bacteria important to N and S cycling. We anticipate that N cycling in sediments will be a significant process but cannot speculate on the significance of S cycling or on the impact of these processes on the transport of ions containing S or N.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effect of Acid Rain on Waterfowl Populations, Northern Ontario

Subject Code (s) in order of priority:	3.1.6 3.2.5

Principal Investigator's Name:

R. K. Ross
D. McNicol

Agency & Department: Ontario Region, Canadian Wildlife Service

Address: 1725 Woodward Drive
Ottawa, Ontario
K1A 0E7

Phone: (613) 998-4693

Co-operating agencies and investigators (if applicable): Canadian Wildlife Service, Headquarters
Dr. D. B. Peakall

Department of Fisheries and Oceans
Dr. J. Kelso

Duration of each phase: Pilot or first year studies - 1980

Project termination date forecast as March 1983

Approximate Cost (indicate applicable yearly period): 4/80 - 3/81: $90K (incl. salaries)

Objectives:

a) To determine if correlations exist between acid rain levels and the status of waterfowl populations (distributions, densities, productivities, feeding strategies).

b) To establish whether acid rain is influencing the status of waterfowl, to gain insight into the mechanisms involved, and to determine how such influences may be most effectively measured.

Method:

a) The breeding distribution of waterfowl will be systematically examined in relation to water chemistry parameters (pH, conductivity and buffering capacity) of the nesting and brood-rearing ponds in a 100 km square flock north of Sault Ste. Marie.

b) Waterfowl data will include detailed information on productivity, and on physiography and vegetative characteristics of preferred habitats.

c) Water chemistry data available from Dr. J. Kelso's fisheries studies in the region will be augmented by supplementary sampling of all ponds in the study area.

d) Both pH and conductivity measurements will be taken in field, and alkalinity determinations performed within 24 hours based on "total inflection point" titrations.

e) Temperature profiles taken using a thermistor probe.

Method:

f) Other water chemistry parameters to be determined from a series of sub-samples, and analyses to be performed by Great Lakes Forest Research Centre at Sault Ste. Marie. Heavy metals (copper, zinc, lead, manganese, mercury, iron, aluminum, cobalt, cadmium and arsenic), major cations (calcium, magnesium, potassium and sodium) and sulphate concentrations will be measured.

Anticipated Results:

a) After first years field project, a preliminary report will be prepared.

b) Project plans and strategies will be modified to reflect first year results.

c) Data will be incorporated into data base of DFO.

d) There may be potential for including water chemistry data into the MOE data base, and after editing, incorporation into NAQUADAT.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Whole Lake Acidification by Addition of Sulfuric Acid to Lake 223

Subject Code (s) in order of priority: 3.1.6

Principal Investigator's Name:

Dr. D. W. Schindler
Dr. D. F. Malley

Agency & Department: Department of Fisheries and Oceans
Limnology Section
Address: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6
Phone: (204) 269-7379 Ext. 373

Co-operating agencies and investigators (if applicable):

a) Toxicology Section (R. Wagemann, S. Lawrence, J. Klaverkamp, J. Rudd)
b) Lamont-Doherty Geological Observatory

Duration of each phase:

a) Pre-acidification background 1974 - 1975
b) Acidification 1976 - 1985

Approximate Cost (indicate applicable yearly period): 1980 - 1981: $150,000 O & M

Objectives:

To study the impact of progressive acidification with a known amount of strong acid on the alkalinity, production, biota, metals and other aspects of water chemistry of a Precambrian Shield Lake.

Method:

a) Twice-weekly measurements of pH during ice-free season followed by addition of H_2SO_4 to epilimnion to bring pH to target value.
b) Biweekly or weekly sampling of conductivity, alkalinity, various fractions of C, P, N; algae, zooplankton, heavy metals, chlorophyll, primary production, benthos.
c) Population studies (size, age structure, fecundity) of fish, benthos, crayfish, opposum shrimp Mysis.
d) Studies of microbial activities.
e) Effects of metal-acid interactions on zooplankton and on drayfish ion physiology.
f) Laboratory studies of mortality, growth, reproduction in crustacenas (crayfish, amphipod, Mysis).
g) Laboratory studies of effects of acid on crayfish ion physiology, and mechanisms of inhabition of ion (Ca^{++}) uptake by low pH.

Anticipated Results:

Prediction of rate of acidification (loss of alkalinity and lowering of pH) of Precambrian Shield lakes in relation to amount of sulfuric acid entering the lake. Data on contribution of sulfate-reducing bacteria to generation of alkalinity

Anticipated Results:

Anticipated Results:

in stratified lakes; and on leaching of heavy metals from sediments in response to acidification will be collected. The most acid-sensitive components of the food web and the impact of their loss on the lake community will be determined. Data will be provided to the supporting agency and will be published in journal and report form.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Acid Precipitation on Microbial Activities and Population in Streams in the Algoma Area

Subject Code (s) in order of priority:	3.1.6 3.1.1 3.1.5

Principal Investigator's Name:

Dr. Paul T. S. Wong
Dr. Murray G. Johnson

Agency & Department: Fisheries & Oceans
Great Lakes Biolimnology Laboratory

Address: Canada Centre for Inland Waters
P. O. Box 5050
Burlington, Ontario
L7R 4A6

Phone: (416) 637-4559

Co-operating agencies and investigators (if applicable): University of Guelph
Drs. J. Robinson & N. Kaushik

Duration of each phase: April 1, 1980 to March 31, 1981

Approximate Cost (indicate applicable yearly period): $14,900.

Objectives:

To determine the numbers and activities of microorganisms carrying out a variety of processes in streams in the Algoma Area and to determine the impact on these microorganisms and processes of chemical changes accompanying acidification of the stream waters.

Method:

a) At 3 sites at each of 5 streams linking the Turkey Lakes in the Algoma area, water and sediment samples will be taken 10 times during the year.
b) Numbers of nitrifiers, denitrifiers, sulphate-reducers, sulphur-oxidizing bacteria, heterotrophic bacteria and actinomycetes will be determined and related to water and sediment quality parameters e.g. dissolved and particulate carbon, all forms of nitrogen.
c) Weighted leaf packs of different indigenous tree species will be placed in the streams in the autumn of 1980 and the weight loss of these leaves over the following year will be determined.

Anticipated Results:

a) A report will be available in May 1981.

b) Data obtained, hopefully, will be useful to other scientists working in the same area.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Aerobic Microbial Activity

Subject Code (s) in order of priority:	3.1.6

Principal Investigator's Name:

Michael Young

Agency & Department: Ontario Ministry of the Environment
Laboratory Services Branch

Address: Microbiology Section
P. O. Box 312
Resources Road
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3008

Co-operating agencies and investigators (if applicable):

Duration of each phase: Set-up: Will begin 6/80 but will be required for different phases of the programme.
Operation: 11/80 to at least 4/86

Approximate Cost (indicate applicable yearly period): $13,000.00 - 6/80 - 4/81

Objectives:

a) To develop methods for measuring the activity of aerobic microorganisms involved in the sulphur, nitrogen and carbon cycles.
b) To evaluate the effect of various factors such as decreasing pH and temperature on microbial activity.
c) To determine potential damage to the sulphur, nitrogen and carbon cycles as a result of lake acidification.
d) To evaluate possible effects that aerobic microbial activity may have on decreasing, stabilizing or increasing lake pH.

Method:

A number of methods will be developed and utilized. Experimental data and published literature will be used to develop and expand techniques. The methods anticipated for use at this time are:

Anticipated Results:

a) Chemical analyses and possibly on specific probes will be employed to study the rates of decrease and increase of specific nutrients in both water and media systems. Once rates have been established the effects of lowering pH and altering temperature will be assessed.
b) Similar studies to (a) will be conducted utilizing respirometry techniques to determine activity.
c) When experimental procedures have been developed for static experiments, the data base will be expanded by use of continuous flow studies.

d) When it becomes possible radiotracer techniques will be employed in activity studies because they allow the use of much lower concentrations of nutrients being studied.

e) Methods for studying microbial activity in sediments decided on but one possibility is the use of columns of sediment through which water can be allowed to percolate. Changes in nutrient concentrations and effects of changing pH can then be monitored.

f) The studies comprising this "activity" will be conducted by the Microbiology Section, Laboratory Branch, Ministry of the Environment.

Anticipated Results:

a) It is anticipated that this "activity" will take several years to complete because of the number of potential areas to be studied. Each nutrient cycle involves many micro-organisms often requiring different growth conditions. Studies will have to concentrate on one area at a time until a larger picture can be put together and possibly some complex experiments involving various interactions conducted if this proves necessary.

b) As individual studies are completed, the data will be evaluated and issued as Ministry reports after internal review.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Anaerobic Microbial Activity

Subject Code (s) in order of priority:	3.1.6

Principal Investigator's Name:

Michael Young

Agency & Department: Ontario Ministry of the Environment
Laboratory Services Branch

Address: Microbiology Section
P. O. Box 213
Resources Road
Rexdale, Ontario

Phone: M9W 5L1
(416) 248-3008

Co-operating agencies and investigators (if applicable):

Duration of each phase:
a) Set-up: 1/81 - 4/81 (Tentative)
b) Operation: 5/81 to at least 4/85

Approximate Cost (indicate applicable yearly period): $2,029.00: 1/81 - 4/81

Objectives:

a) To develop methods for laboratory culture of anaerobic bacteria such as methanogenic bacteria, sulphate reducers and denitrifying bacteria.
b) To develop methods for studying the activity of anaerobic bacteria.
c) To determine the effects of decreasing pH on anaerobic activity and to evaluate the effects that this type of microbial activity might have on lake pH and buffering.

Method:

Method:

a) Media and methods published in the literature will be tested to develop a method for isolating the different types of anaerobic microorganisms from the environment.
b) Methods for studying growth and activity will be developed in the laboratory under static conditions. Microbial concentrations and various chemical parameters will be evaluated at set times during incubation under standard conditions.
c) Once methods have been developed incubations will be conducted at different temperatures and pH to assess the effect on acitivity.
d) When static media systems have been developed, the study will be expanded to look at activity in lake water systems and continuous flow conditions.
e) Cultures of sulphate reducing bacteria will be incubated with Methanogenic bacteria to study possible interactions and effects on buffering overlying waters.

Anticipated Results:

f) All experiments will be conducted under atmospheres devoid of oxygen. This will require specialized techniques and equipment. Because of the complexities involved, it is expected to take several years to properly carry out these studies.

g) Work will be conducted by the Microbiology Section, Laboratory Services Branch, Ministry of the Environment.

Anticipated Results:

a) As experiments are completed, the data will be summarized and assessed in conjunction with other available data and literature.

b) Ministry reports will be written and issued after internal review.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Lake Surveys

Subject Code (s) in order of priority:	3.1.6

Principal Investigator's Name:

Michael Young

Agency & Department: Ontario Ministry of the Environment
Laboratory Branch, Microbiology Section

Address: P. O. Box 213, Resources Road
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3008

Co-operating agencies and investigators (if applicable):

Duration of each phase:

a) Set-up: 4/80 - 5/80
b) Operation: 5/80 to at least 4/86

Approximate Cost (indicate applicable yearly period): $89,170.00: 4/80 - 4/81

Objectives:

a) To determine populations of microorganisms involved in the cycling of sulphur, nitrogen and carbon in lakes of varying acidity and chemical composition.
b) To evaluate the effects of acidification on the microorganisms studied and determine if any single and/or combination of parameters can be used as useful indicators of lake acidification.

Method:

Method:

a) Water and sediment samples will be collected from selected lakes in the Muskoka and La Cloche areas. Sampling locations will be near inflow, outflow and midlake. Water will be collected at approximately 1 m below the surface and 1 m above the sediment. Sediment will be collected only at mid-lake.
b) Levels of microorganisms involved in the cycling of sulphur and nitrogen will be determined by standard MPN methods.
c) Heterotrophic microbial levels (carbon cycle) will be determined by direct plating and membrane filtration methods.
d) Analyses will be carried out by the Microgiology Section, Laboratory Services Branch, Ministry of the Environment.

Anticipated Results:

Anticipated Results:

a) Data will be summarized and evaluated with reference to published literature.

b) Possible correlations with various chemical and physical parameters will be evaluated.

c) The intensity of and methods used for surveys will be modified depending on survey results and the results of other studies.

d) A Ministry report will be prepared and issued after internal review.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Leaf Decomposition

Subject Code (s) in order of priority:	3.1.6

Principal Investigator's Name:

Michael Young

Agency & Department: Ontario Ministry of the Environment
Laboratory Services Branch

Address: Microbiology Section
P. O. Box 312
Resources Road
Rexdale, Ontario M9W 5L1

Phone: (416) 248-3008

Co-operating agencies and investigators (if applicable):

Duration of each phase:

a) Set-up: 5/80 - 6/80 (Colonization Study)
9/10 - 10/80 (Laboratory Decompostion Study)

b) Operation: 7/80 to at least 4/85

Approximate Cost (indicate applicable yearly period): $4,500.00: 5/80 - 4/81

Objectives:

a) To determine possible effects that the decreasing pH of fresh water lakes may have on leaf litter colonization and decomposition.

b) To determine if decomposition rate can be used as a sensitive parameter of acidification.

Method:

a) The first colonization study will be conducted in the laboratory. Solid surfaces, in the form of leaf discs, membrane filters and glass slides, will be provided for microbial colonization. The study material will be incubated in lake water at different temperatures and pH and rates of colonization determined by scanning electron microscopy, light microscopy and plate counts.

b) The first decomposition studies will also be conducted in the laboratory. Packets of pre-weighed leaf discs will be incubated in lake water at different temperatures and pH. At preselected times leaf discs will be weighed to determine the degree of decomposition. Concentrations of various microbial and chemical parameters will also be assessed.

c) When adequate data has been obtained from laboratory studies, similar studies will be conducted at selected field sites if the required manpower is available.

d) These studies will be conducted by the Microbiology Section, Laboratory Branch, Ministry of the Environment.

Anticipated Results:

a) Data will be summarized and evaluated. Reference will be made to published literature.

b) A Ministry report will be prepared and issued after internal review.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Etude de la géologie et des eaux souterraines du lac Laflamme

Code du (des) sujet(s) par ordre de priorité :	3.2.1 3.2.7 3.1.1 3.1.6

Nom du chercheur responsable :
L. M. Azzaria
P. J. Gélinas

Ministère, organisme ou organisme privé, service : Centre de recherches sur l'eau

Adresse: CENTREAU
Pavillon Pouliot
Université Laval
Ste-Foy, Québec G1K 7P4

Téléphone: (418) 656-2913

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : André Plamondon
Université Laval (Géodésie et Foresterie)

Durée de chaque phase:
10/80 à 12/80: géologie (cartographié)
01/81 à 03/81: analyses granulométriques et chimiques

Côut approximatif (indiquer pour quelle période annuelle):

10/80 à 03/81: $30,000.00

Objectifs de travail:

a) Identification du cadre hydrogéologique qui influence le régime des eaux souterraines.

b) Variation de la qualité de l'eau au cours de son transport dans la zone saturée.

Méthode de travail : Méthodes descriptives courantes pour connaître la nature minéralogique et les processus géochimiques.

Résultats prévus: Reconnaître l'influence des matériaux géologiques dans la neutralisation des eaux acides qui entrent dans le bassin.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Lake Sediment Geochemistry-Ontario

Subject Code (s) in order of priority: 3.2.1

Principal Investigator's Name:

R. Barlow

Agency & Department: Ministry of Natural Resources
Ontario Geological Survey

Address: 77 Grenville St.,
Toronto

Phone: (519) 965-1697

Co-operating agencies and investigators (if applicable):

Duration of each phase: 1980 - 84

Approximate Cost (indicate applicable yearly period): $100,000 for 1980/81

Objectives:

a) To privide a fuller understanding of the effect of acid precipitation on the geochemistry of otherwise uncontaminated soils and lake sediments.

b) To develop and perfect methods of conditioning both mineral exploration and environmentally oriented surveys in contaminated environments.

Method:

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Bedrock Sensitivity Map (1:1 000 000), Eastern Canada

Subject Code (s) in order of priority:	3.2.1 3.2.2 3.1.1 3.1.5

Principal Investigator's Name:

K. D. Card
B. V. Sanford
W. H. Poole

Agency & Department: EMR - Geological Survey of Canada

Address: 601 Booth Street
Ottawa, Ontario
K1A 0E8

Phone: (613) 995-4935 (Card)

Co-operating agencies and investigators (if applicable): W. W. Shilts

Duration of each phase: Preliminary map compiled February - July 1980

Approximate Cost (indicate applicable yearly period): $10,000.00

Objectives:

To produce a geologic map with map units and designators specially chosen to reflect bedrock capability for producing soils (by glacial or other processes) with varying sensitivity to acid loading.

Method:

1:1 000 000 base maps of Canada from Ontario-Manitoba border eastward and south of 52° latitude were produced. On maps, geology from most detailed scale maps available was transferred to base at 1:1 000 000 using a common legend. Experts on Precambrian (Card), Appalachian (Poole), and St. Lawrence-Great Lakes lowlands (Sanford) geology compiled geology from these three regions. Legends group rocks into categories indicating low, low-intermediate, intermediate, and high sensitivity to acid loading. Categories are chosen on basis of predominance and type of carbonate strata and on presence of rock types capable of producing soils with varying exchange capacities.

Anticipated Results:

If money is available ($60-70K), it is our intention to reproduce these maps in 3 x 1:1 000 000 sheets in colour using a colour coding related to relative sensitivity. An overlay showing glacial dispersal of the bedrock should be prepared also, but although critical, is not presently funded.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Ecological Data Summary of Land Areas Throughout Canada Currently Affected by Acidified Precipitation

Subject Code (s) in order of priority: 3.2.1 7.0

Principal Investigator's Name:

C. D. Rubec

Agency & Department: Lands Directorate, Environment Canada

Address: Place Vincent Massey
Ottawa, Ontario
K1A 0E7

Phone: (819) 997-2320

Co-operating agencies and investigators (if applicable): Canada Land Data Systems Division
Lands Directorate, DOE

Duration of each phase: 1980 - 1981

Approximate Cost (indicate applicable yearly period):

Objectives: To provide tabular and graphic summaries of ecological data concerning land areas in all of Canada which currently receive acidified rainfall and concerning areas that may be susceptible to acidified rainfall.

Method: Overlay of 10 thematic maps, mainly selected from 1:15,000,000 maps within the National Atlas (EMR Publication), using computerized geographic map retrieval. Maps were scribed, entered, and automatically retrieved via computer terminal. Data summaries of coincident data and computer maps were produced using the Canada Land Data System (CGIS software package).

Anticipated Results: Working Paper Report by Late 1980 with data summaries, maps and explanatory text.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Establishment of a National Ecological Data Base at 1:1,000,000 to Study and Quantify the Effects of Airborne Pollutants and Other Toxic Substances on the Canadian Environment

Subject Code (s) in order of priority: 3.2.1, 7.0

Principal Investigator's Name:

C. Rubec (Coordinator)-Lands H.Q. Staff
G. M. Wickware, D. Cowell (Burlington)
J. L. Belair (Quebec)
D. Taylor, H. Hirvonen (Halifax)
J. Senyk (Victoria)-Lands Regional Staff

Agency & Department: Lands Directorate, Environment Canada

Address: H. Q.
Ottawa, Ontario
K1A 0E7

Regional Offices in Victoria, Burlington, Quebec and Halifax

Phone: (819) 997-2320

Co-operating agencies and investigators (if applicable): Canada Committee on Ecological Land Classification
Canadian Forestry Service

Duration of each phase: The project is phased to complete Ontario sector by Winter, 1980; with Quebec and Maritimes in 1981; remainder of Canada by 1983.

Approximate Cost (indicate applicable yearly period):

Objectives:

a) Establishment of a 1:1,000,000 ecological land data base to include an ecoregion framework and complementary data maps relating to the sensitivity and impacts of airborne pollutants.

b) Studies using computer modelling of ecological data base information to identify the geographic location and economic/ecological impacts of highly sensitive (to acid rain) areas in Canada, especially east of Manitoba.

Method: Input into the Canada Land Data System of a series of 1:1,000,000 maps including shorelines, ecoregions, soil sensitivity for agricultural areas; sensitive bedrock areas; airborne loadings of pollutants and acid rain pH. Map overlays, data analysis and reports.

Anticipated Results: Sensitivity maps, data reports; and identification of key areas for detailed 1:250,000 data analysis vis-à-vis Canada Land Inventory and Census data.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Ecological Land Survey of LRTAP Study Watersheds in Ontario and Quebec

Subject Code (s) in order of priority: 3.2.1

Principal Investigator's Name:

G. M. Wickware and D. W. Cowell - Lands Directorate, Burlington, Ont.
J. L. Belair - Direction régional des terres, Québec

Agency & Department: Lands Directorate, Environment Canada

Address:

Box 5050
Burlington, Ontario
L7R 4A6

C. P. 10,100
Tour A, Place Laurier
Ste-Foy, Québec

Phone: (416) 637-4552 (418) 694-3964

Co-operating agencies and investigators (if applicable): Canadian Forestry Service - Sault Ste. Marie (Dr. J. Jeglum)
- Ste.-Foy (Dr. G. Robitaille)

Duration of each phase: Preliminary Field Work and Report in Ontario September 1980
Preliminary Studies in Quebec October 1980

Approximate Cost (indicate applicable yearly period):

Objectives: To provide a standardized 1:100,000 ecological data base in the Turkey Lakes and Lac Laflamme LRTAP Watersheds in cooperation with CFS; studies of soil-forest system nutrient dynamics and hydrogeological regimes.

Method: On-site field studies of vegetation occurrence, regeneration; soil dynamics classification and morphology; soil water sampling; transects and plots.

Anticipated Results:

a) Soil nutrient-moisture regime used to produce a forest ecosystem classification.

b) Hydrogeological regime classification.

c) Ecological land survey maps of LRTAP watersheds at detailed scale.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Terrestrial Effects Program

Subject Code (s) in order of priority:	3.2.2 3.2.3 3.2.4 3.2.6

Principal Investigator's Name:

D. Balsillie
W. D. McIlveen

Agency & Department: MOE Northeastern Region
Technical Support

Address: 199 Larch Street
Sudbury, Ontario
P3E 5P9

Phone: (705) 675-4501

Co-operating agencies and investigators (if applicable):

MOE Air Resources Branch
880 Bay Street
Toronto, Ontario
Attn: Dr. S. N. Linzon

MOE Lab Services Branch
Resources Road
Rexdale, Ontario
Attn: Mr. Jim Bishop

Duration of each phase: Ongoing Program

Approximate Cost (indicate applicable yearly period): Fiscal 1980/81: $35,000.00

Objectives:

To determine effects of acidic precipitation on terrestrial ecosystem in Northeastern Ontario

Method:

a) Develop a soil sensitivity map for Northeastern Ontario.

b) Establish and monitor tree seedling plots for effects of long-range transported pollutants.

c) Establish and monitor white pine plots for effects of long-range transported pollutants.

Anticipated Results:

Determine areas of Northeastern Ontario which will be most sensitive to acidic input.

Develop a data base against which to measure future changes in tree growth which could be attributed to long-range transported pollutants.

LRTAP ACTIVITY DESCRIPTION

Subject Code (s) in order of priority:	3.2.2. 3.2.3. 3.2.4. 2.4.2.

Activity Title:

Soil and vegetation sample for heavy metals in the Sudbury area.

Principal Investigator's Name:

Bruce R. Dreisinger

Agency & Department: Environmental Control, Inco Metals Company,

Address: General Engineering Building, Copper Cliff, Ontario. POM 1NO

Phone: (705) 682-2043

Co-operating agencies and investigators (if applicable): M.O. Carr, M.E. Buchanan, P. Bolger

Duration of each phase: Set up 6/71: operating 1971 to 1978

Approximate Cost (indicate applicable yearly period): 1971 to 1978: $600,000

Objectives:

(a) Determine existing heavy metal levels in soils and vegetation in the Sudbury area before the operation of the 1250' chimney.
(b) Determine changes in levels and distribution patterns after the operation of the new chimney.

Method:

(a) Samples of soil and vegetation were collected during the growing seasons at 90 stations near to and far (up to 175 miles) from Inco's Copper Cliff smelting operations.
(b) Distribution patterns (in multiples of background) were determined by computer for periods before and after the operation of Inco's 1250' chimney.

Anticipated Results:

Latest report in February 1979 documents specific areas of metal accumulation in soils and vegetation in the Sudbury area. While soils did not show any consistent increases or decreases in metal content, metal levels in vegetation have generally declined over the study years.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Impact of Acid Deposition on Forest Soils

Subject Code (s) in order of priority:	3.2.2 3.2.3

Principal Investigator's Name:

Dr. Neil W. Foster

Agency & Department: Department of the Environment
Canadian Forestry Service

Address: Great Lakes Forest Research Centre
P. O. Box 490
Sault Ste. Marie, Ontario
P6A 5M7

Phone: (705) 949-9461

Co-operating agencies and investigators (if applicable): NWRI, IWD, DOE, GLBL, DFO, OMNR

Duration of each phase:
Set-up: 7/80 to 7/81
Operation: 7/81 to at least 7/83

Approximate Cost (indicate applicable yearly period): $75,000 per annum

Objectives:

a) To elucidate the influence of atmospheric deposition of acidifying substances upon soil chemical properties and processes.

b) To elucidate the modifying influence of forest soil on properties of percolating acid precipitation.

Method:

A small catchment with shallow till supporting sugar maple-yellow birch forest was selected for hydrochemical studies which include partitioning the water cycle into precipitation, throughfall, stemflow, forest floor percolate, mineral soil percolate, groundwater and streamflow. Nutrients, major ions, and trace metals will be determined on a "event basis", the work carried out in cooperation with Drs. I. K. Morrison and J. A. Nicolson of GLFRC.

Anticipated Results:

A biogeochemical model for an old growth hard maple-yellow birch forest that describes the transport and transformations of elements in the forest ecosystem.

LRTAP ACTIVITY DESCRIPTION

Subject Code (s) in order of priority:	3.2.2 2.3.2 3.2.7

Activity Title:

Differences in the Composition of Soils under Open and Canopy Conditions at Two Sites Close-In to the Great Canadian Oil Sands Operation

Principal Investigator's Name:

Dr. J. Baker

Agency & Department: Environment Canada
Canadian Forestry Service

Address: Northern Forest Research Centre
5320 - 122 Street
Edmonton, Alberta
T6H 3S5

Phone: (403) 435-4210

Co-operating agencies and investigators (if applicable): Alberta Environment 50:50 Interest
Environment Canada

Duration of each phase: 1979 - 1980

Approximate Cost (indicate applicable yearly period): $15,000.00

Objectives:

a) Study the differences in soil composition in relation to open and closed forest types.

b) Study the sulphur content in such forest leaves.

Method:

a) Macronutrients analysis of soils under open and canopy forest conditions of two sites.

b) Chemical analysis of Jack Pine leaves.

Anticipated Results:

Effect of SO_2 emissions on pH, macronutrients, micro and macroflora of soil and also its effect on vegetation.

5/5 year project.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Study on the Acid-Buffering Capacity of Ontario Soils

Subject Code (s) in order of priority: 3.2.2

Principal Investigator's Name:

Dr. H. T. Chan
Mrs. H. Johnston

Agency & Department: Ontario Hydro
Soils Section

Address: Civil Research Department
800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

Phone: (416) 231-4111

Co-operating agencies and investigators (if applicable):

Duration of each phase: October 1980 - September 1981

Approximate Cost (indicate applicable yearly period): $15,000.00

Objectives:

To study the factors controlling the acid-buffering capacity of soils and to investigate the practicality and effectiveness of maintaining their buffering capacity by liming.

Method:

Conduct column experiments in the laboratory to measure the chemical changes in soils and the changes in pH in the leachate through the soil columns.

Anticipated Results:

To gain a better understanding of the chemical processes occurring in soils and the effectiveness of improving the soil buffering capacity by addition of lime to soils.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Terrestrial Effects: Soils

Subject Code (s) in order of priority:	3.2.2

Principal Investigator's Name:

Supervisor: Dr. H. D. Griffin
Investigator: W. R. Carswell

Agency & Department: Ministry of the Environment

Address: P. O. Box 5000
435 James Street South
Thunder Bay, Ontario
P7E 6E3

Phone: (807) 475-1215

Co-operating agencies and investigators (if applicable):

Duration of each phase: The program has been proposed to last at least 5 years.

Approximate Cost (indicate applicable yearly period): $60,000 per annum

Objectives: To investigate the effects of acidic deposition on soils. To delineate areas which are potentially sensitive to impact from acid deposition.

Method: Permanent sample plots will be established to monitor soil chemistry, and precipitation quality. Special open-top soil columns may be placed in the field during the summer of 1981. Approximately thirty (30) soil parameters will be analyzed.

Anticipated Results: Results will probably show a very small impact on soil quality from long range transport. Environmental impact on the soil will be difficult to measure because of scant base line data and rapid changes in analytical technology.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Deposition Patterns and Impact of Gaseous and Particulate Air Pollutants from Major Regional Sources on Forest Vegetation and Soils

Subject Code (s) in order of priority: 3.2.2

Principal Investigator's Name:

G. D. Hogan
S. S. Malhotra
J. Baker

Agency & Department: Department of Environment
Canadian Forestry Service

Address: Northern Forest Research Centre
5320 - 122 Street
Edmonton, Alberta
T6H 3S5

Phone: (403) 435-7210

Co-operating agencies and investigators (if applicable):

a) Province of Manitoba (Smelter Studies)
Department of Consumer and Corporate Affairs & Environment
Mr. D. Wotton

b) Province of Alberta (Oil Sands Studies)
Department of Environment
Dr. P. Sims

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives:

a) To determine the distribution and deposition of metal particulates and sulphur and nitrogen compounds by the examination of gradients of bulk deposition around major regional sources (smelters and oil sands operations).
b) To determine the direct and indirect effects of metal particulate and sulphur deposition on community structure and composition around smelter operations.
c) To determine the impact of air pollutants, introduced by both wet and dry depostion on forest soil processes and chemistry (field and controlled environment pollution chamber studies - applicable to major industrial areas.).
d) To determine the cycling of metals and sulphur compounds within affected and control forest systems around smelter operations.

Method:

Intensive air pollutant impact studies will be carried out at major sites within the region in 1981.

a) A network of bulk deposition collectors will be established around smelters to collect bulk deposition on a bi-weekly basis throughout the summer months (May - October). The collectors will be placed in a gradient, starting at 5 km and ending at 180 km from each source. Analysis will be made on the bulk deposition to determine input as As, Cu, Ni, Pb, Zn and S. A similar system will be established to monitor deposition patterns from the oil sands operation.

b) A complete community description will be carried out at the two detailed study sites and comparisons made to existing data and between sites. Changes in vegetation will be compared with deposition data to determine if such changes can be attributed to atmospheric inputs.

c) Cycling of metals and sulphur will be examined within each stand by the investigation of descrete compartments, i.e. soils, trees, shrubs and lower plants (smelter studies).

d) Soil biological processes will be examined as a measure of impact. Fractionation of metals found in soils will be carried out (field and controlled environment pollution chamber studies - application to major industrial areas).

e) Results of all analysis will be compared with current as well as historical bulk deposition data. Relationships between the various facets of the program will be investigated (major regional sources).

Anticipated Results:

a) The study will provide information concerning the local and medium range transport of metal particulates and sulphur. This baseline information is needed to design further LRTAP studies on the impact of industrial emissions on the environment.

b) The study will provide information about the effects of metallic particulate (As, Cu, Ni, Pb, Zn) and sulphur and nitrogen loadings on forest systems. These results will allow us to extrapolate to less polluted situations based on current input figures.

c) The study of the cycling of metal pollutants, and the study of the effects of hydrogen ion input on these cycles, will allow us to understand how the combination of these factors interact with vegetation.

d) Sensitive biological processes within the soil will be identified and examined. Predictions based on current deposition rates will be made to enable us to predict carrying capacities and threshold levels.

e) Biomonitoring species will be identified, perhaps with an application to other situations where LRTAP is in evidence.

Anticipated Resources:

Professional p/y: 3.0 (Province of Alberta = 1 p/y)
(CFS = 2 p/y)

Support p/y: 2.3 (Province of Alberta = 1 p/y)
(CFS = 1.3 p/y)

O & M:	110K	(Province of Alberta = 70K) (Province of Manitoba = 20K) (CFS = 20K)

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Terrestrial Effects of Acidic Precipitation

Subject Code (s) in order of priority:	3.2.2 3.2.3 3.2.4

Principal Investigator's Name:

Dr. S. N. Linzon

Agency & Department: Phytotoxicology Section, Air Resources Branch
Ontario Ministry of the Environment

Address: 880 Bay Street
Suite 347
Toronto, Ontario
M5S 1Z8

Phone: (416) 965-4516

Co-operating agencies and investigators (if applicable): Ontario Ministry of Natural Resources
Ontario Ministry of Agriculture and Food

Duration of each phase:

Approximate Cost (indicate applicable yearly period): 1980/81: $270,000.00

Objectives: To determine the present status of effects of acidic precipitation on terrestrial systems (soil and vegetation); to determine the sensitivities of soil types and map their locations in Ontario; to study the influence of terrestrial systems on acid precipitation en route to watercourses.

Method: Baseline surveys across Ontario by sampling and analyzing soil and vegetation in vicinity of precipitation collectors; resurvey old soil surveys; lysimeter, throughflow and stemflow studies in conjunction with watershed budget studies; simulated acid rain experiments.

Anticipated Results: Present status of soil and vegetation condition with respect to acidic preciepitation; sensitivity of different soil types and their locations; rate of degradation of soil; direct and indirect effects on vegetation.

LRTAP ACTIVITY DESCRIPTION

Activity Title:
Effect of Simulated Acid Precipitation on Composition of Percolate from Reconstructed Profiles of Two Northern Ontario Forest Soils

Subject Code (s) in order of priority:	3.2.2 3.1.1

Principal Investigator's Name:

Dr. Ian K. Morrison

Agency & Department: Department of the Environment
Canadian Forestry Service

Address: Great Lakes Forest Research Centre
P. O. Box 490
Sault Ste. Marie, Ontario
P6A 5M7

Phone: (705) 949-9461

Co-operating agencies and investigators (if applicable):

Duration of each phase:
Set-up: 1977
Operation: 1977 to at least 1982

Approximate Cost (indicate applicable yearly period): $5,000.00 per annum, incl. salaries

Objectives:

a) To compare products of leaching, chiefly bases, H^+-ion and SO_4^{--} -ion from reconstructed profiles of two northern Ontario forest soils under different regimes of dilute H_2SO_4 addition.

b) To compare effects of different dilute H_2SO_4 addition on soil chemical properties.

Method:

a) Two soils (a podzol and a brunsol, both from beneath mid-age jack pine forest) were reconstructed into 100 cm high column lysimeters.

b) Dilute H_2SO_4 ranging in pH, but at environmentally realistic rate, i.e., 1000 mm/annum has been drip-fed to each of the 24 columns weekly since mid-1977.

c) Volumes are measured weekly; monthly the following are determined on the percolates: pH, specific conductance, K^+, Ca^{++}, Mg^{++}, Na^+, several trace metals, SO_4^{--}.

d) At the culmination of the experiment the soil will be analysed by horizons.

Anticipated Results:

Time course of SO_4^{--} retention, then movement is followed in relation to loading together with time-course of cation transport.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

A.1. Effects of Acid Precipitation on the Podzolic Soils of the Lac Laflamme catchment.
a) Soil Leaching Studies in the Field

Subject Code (s) in order of priority:	3.2.2 3.2.3 3.1.1

Principal Investigator's Name:

Dr. Gilles Robitaille

Agency & Department: Environment Canada
Canadian Forestry Service

Address: 1080 duVallon
C.P. 3800
Ste. Foy, Quebec
G1V 4C7

Phone: (418) 658-6945

Co-operating agencies and investigators (if applicable): University of Laval
Dr. Claude Camiré

Duration of each phase: a) Set-up: 9/80 - 10/80
b) Operation: 5/81 to at least 10/83

Approximate Cost (indicate applicable yearly period): 9/80 - 3/81: $8,000.00
4/81 - 3/82: $9,000.00

Objectives:

To determine the quantities of nutrients and metals leached from the organic and metal horizons of a podzol as influenced by throughfall rain chemistry.

Method:

a) 16 zero tension lysimeters were set up in soil pits at 4 different sites under balsam fir.

b) 4 lysimeters at each site, 2 each under the organic and the metal horizons (ie LFH and Bhf_2).

c) Lysimeters are 20.5 cm diameter nagalene funnels packed with acid washed silica and glass wool. Tygon tubing connects the funnel to a 4 liter nagaline collecting bottle.

d) Leachate will be collected on a precipitation event basis starting with the spring snow melt.

e) Analysed for SO_4, NO_3, NO_2, PO_4, Cl, Br, F, NH_4, Na, K, Mg, Ca by ion chromatography and for Al, Fe, Cu, Pb, Zn and Cd by AAS. The pH will also be measured.

Anticipated Results:

a) Data on mobilization of nutrients in a podzol in relation to nutrient input via acid throughfall.

b) Data on nutrient distribution from the organic horizon to the mineral Bhf_2 below and from the organic plus Bhf_1 and Bhf_2 horizons to the lower horizons.

Anticipated Results:

c) Data on nutrient loss from the upper horizons of a podzol to the water table.

d) Data to be used as part of a nutrient cycling model for balsam fir acid rain affected catchment.

e) Support data for activities A.1.b; A.2; A.3.b,c; A.4.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

A.1. Effects of Acid Precipitation on the Podzolic Soils of the Lac Laflamme Catchment.

b) Soil Incubation Studies

Subject Code (s) in order of priority:	3.2.2 3.2.3

Principal Investigator's Name:

Dr. Gilles Robitaille

Agency & Department: Environment Canada
Canadian Forestry Service

Address: 1080 duVallon
C.P. 3800
Ste-Foy, Québec
G1V 4C7

Phone: (418) 658-6945

Co-operating agencies and investigators (if applicable): University of Laval
Dr. Claude Camiré

Duration of each phase: a) Set-up: 9/80 - 11/80
b) Operation: 11/80 - 3/81

Approximate Cost (indicate applicable yearly period): 9/80 - 3/81: $8,000.00
4/81 - 3/82: $9,000.00

Objectives:

To determine the effect on nutrient release (short term basis) of adding solutions of differing acidity to given qualities of soil taken from the LF, H, Ae, Bhf_1, Bhf_2, Bf_1, Bf_2, BC and C horizons of a podzolic soil.

Method:

a) Soils were taken from soil pits under balsam fir stands from the Laflamme catchment.

b) 5 grams each from horizons LH, H and 20 grams each from the remaining soil horizons are incubated in 125 ml flasks at 5C with 5 and 2 ml respectively of solutions containing 2, 10, 20 and 100 meq/100 g of H_2SO_4.

c) Two extraction methods used: deionized water end Morgan's solution (pH 4.8, 10% sodium acetate and 3% acetic acid). The extraction is done by agitating the incubated soils for one hour in the extracting solutions. Solutions are then filtered and analysed.

d) Extraction will be done at 1, 2, 5, 10 and 20 weeks after incubation.

e) The leachates analysed for the same elements as in activity A.1.a.

f) At the end of the long term leaching period all of the columns will be disassembled and analysed for the nutrients remaining horizons.

Anticipated Results:

a) Data on rates of nutrient release under forced acid conditions.

b) Estimates as to rates of podzol degradation.

c) Data for incorporation into a nutrient cycling model for the catchment under forced acid conditions.

d) Support data for activities A.1.a,b; A.3.a,b,c.

LRTAP ACTIVITY DESCRIPTION

Subject Code (s) in order of priority:	3.2.2 3.2.3

Activity Title:

A.3. Effects of Acid Precipitation on the Nutrient Cycling Mechanism in Balsam Fir Stands of the Lac Laflamme Catchment
b) Nutrients in Soil Percolates

Principal Investigator's Name:

Dr. Gilles Robitaille

Agency & Department: Environment Canada
Canadian Forestry Service

Address: Laurentian Forest Research Center
1080 duVallon
CP 3800
Ste-Foy, Quebec
G1V 4C7

Phone: (418) 658-6945

Co-operating agencies and investigators (if applicable):

Duration of each phase: a) Set-up: 9/80 to 10/80
b) Operation: 10/80 to at least 10/83

Approximate Cost (indicate applicable yearly period): 9/80 to 3/81: $4,000.00
4/81 to 3/82: $4,000.00

Objectives:

To determine the contribution of soil percolates to the nutrient pool of the groundwater and to the aquatic ecosystem.

Method:

a) 20 tension cup lysimeters were set up in the catchment. A total of 12 in the podzol soil at six sites with the porous cup resting on the hard pan at between 1 and 1.3 meters in depth. A total of 8 in the organic soil bordering the lake.

b) The lysimeters are constructed from washed 5 cm diameter PCV pipe to which was attached a porous porcelain cup. The remaining end of the pipe was capped to permit a tension of about 1 atm to be applied.

c) Water to be collected from the lysimeters after every rain event. The volume is measured and a sample taken for analysis.

d) The percolates analysed for the same elements as in activity A.1.a

Anticipated Results:

a) Approximations on rates of nutrient displacement through the soil after a precipitation event.

b) Data on ionic fluxes into the lake system from ground water.

c) Additional data for the nutrient cycling model.

d) Support data for activities A.1.a,b; A.2; A.3.a,c,d; A.4

LRTAP ACTIVITY DESCRIPTION

Activity Title:

A.3. Effects of Acid Precipitation on the Nutrient Cycling Mechanism in Balsam Fir Stands of the Lac Laflamme Catchment.
d) Nutrients in Snow under Balsam Fir

Subject Code (s) in order of priority:	3.2.2 3.2.3

Principal Investigator's Name:

Dr. Gilles Robitaille

Agency & Department: Environment Canada
Canadian Forestry Service

Address: Laurentian Forest Research Center
1080 duVallon
C.P. 3800
Ste-Foy, Quebec

Phone: G1V 4C7
(418) 658-6945

Co-operating agencies and investigators (if applicable):

Duration of each phase: a) Sampling: Winter of Every Year
b) Operation: 10/80 to at least 4/84

Approximate Cost (indicate applicable yearly period): 10/80 to 3/81: $2,000.00
4/81 to 3/82 $3,000.00

Objectives:

To determine the accumulation of nutrients in snow.

Method:

a) Snow samples collected once a week during the snow season.
b) Samples collected with a 200 cm^2 surface cylinder (plastic).
c) Only unleached snow is collected, i.e. a column of snow down to the first ice layer encountered. Two samples taken at each of six sites under balsam fir. Stored in plastic bags in frozen condition until analysed.
d) pH taken and analysed for the elements as in activity A.1.a.

Anticipated Results:

a) Data on nutrient input and accumulation from and in the snow pack.
b) Input to the nutrient cycling model under balsam fir.
c) Data for inputs into the lake ecosystem.
d) Support data for activities A.1.a,b; A.2; A.3.a,b,c; A.4

LRTAP ACTIVITY DESCRIPTION

Activity Title:

A.3. Effects of Acid Precipitation on the Nutrient Cycling Mechanism in Balsam Fir Stands of the Lac LaFlamme Catchment.
a. Nutrient Distribution in the Thrufall & Stemflow

Subject Code (s) in order of priority:	3.2.2 3.2.3

Principal Investigator's Name:

Dr. Gilles Robitaille

Agency & Department: Environment Canada
Canadian Forestry Service

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G1V 4C7

Phone: (418) 658-6945

Co-operating agencies and investigators (if applicable):

Duration of each phase: a) Set-up: 9/80 - 10/80
b) Operation: 10/80 to at least 10/83

Approximate Cost (indicate applicable yearly period): 9/80 - 3/81: $3,000.00
4/81 - 3/81: $3,000

Objectives:

To determine nutrient inputs to the soil and vegetation contributed by rain water infiltrating through the balsam fir canopy and of rain water flowing along the stem of balsam fir.

Method:

a) 30 stemflow collars were set up on the stems of balsam fir in 6 sites on the catchment. Collars were constructed of inert polyurethane foam that hardens upon drying. Collars were placed at a 1 meter height on trees of varying diameter classes. The stemflow was collected in nagalene bottles, the volume measured and a sample saved for analysis. Every rain event will be sampled.

b) Thrufall was collected in one litre nagalene bottles. An 11 cm diameter nagalene funnel was attached to the bottle which was placed at ground level. Water samples were transferred to 250 ml nagalene bottles and later analysed. Every rain event is to be sampled.

c) Analysed for the same elements as in activity A.1.a.

Anticipated Results:

a) Data on nutrient additions to incident precipitation as it passes through the balsam fir canopy.

b) Data on inputs to the forest floor.

c) Data for the nutrient cycling model for the balsam fir ecosystem

d) Support data for activities A.1.a,b; A.2; A.3.b,c; A.4.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

A.4 Baseline Physico-Chemistry of the Soils of the Lac Laflamme Catchment

Subject Code (s) in order of priority:	3.2.2 3.2.3

Principal Investigator's Name:

Dr. Gilles Robitaille

Agency & Department: Environment Canada
Canadian Forestry Service

Address: Laurentian Forest Research Center
1080 duVallon
C.P. 3800
Ste-Foy, Quebec

Phone: G1V 4C7
(418) 658-6945

Co-operating agencies and investigators (if applicable):

Duration of each phase: a) Sampling: Once a month in season
b) Operation: 7/80 to at least 10/83

Approximate Cost (indicate applicable yearly period): 7/80 to 3/81: $2,000.00
4/81 to 3/82: $3,000.00

Objectives:

To obtain data on the physico-chemical characteristics of the podzols under balsam fir.

Method:

a) Soil samples taken at 17 permanent soil sampling areas on the catchment.

b) Soils analysed using standard techniques at the center's service laboratory.

Anticipated Results:

a) Data for comparisons for soil to be sampled in 1983.

b) Data for the nutrient cycling model of balsam fir stands.

c) Support data for activities A.1.a,b; A.2; A.3.a,b,c,d.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Soil Microbiological Response to Acid Rain

Subject Code (s) in order of priority:	3.2.2

Principal Investigator's Name:

P. O. Salonius

Agency & Department: Environment Canada
Canadian Forestry Service

Address: Maritimes Forest Research Centre
P. O. Box 4000
Fredericton, N. B.
E3B 5P7

Phone: (506) 452-3548

Co-operating agencies and investigators (if applicable): K. E. Percy
Maritimes Forest Research Centre

Duration of each phase: Part-time 1/81 - 12/81

Approximate Cost (indicate applicable yearly period): $200.00

Objectives: Investigate the effect of simulated and rain on forest soil microbial activity.

Method:

a) Forest soils will be treated with varying pH's of simulated acid rain in laboratory rainfall chambers.

b) Oxygen uptake patterns of the treated soils will be studied

Anticipated Results: Data will be published.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Sensitivity of Glacial Sediments and Soils of the Frontenac Arch to Acid Precipitation

Subject Code (s)	3.2.2
in order of priority:	3.1
	5.1

Principal Investigator's Name:

W. W. Shilts
I. M. Kettles

Agency & Department: EMR - Geological Survey of Canada

Address: 601 Booth Street
Ottawa, Ontario
K1A 0E8

Phone: 995-4523

Co-operating agencies and investigators (if applicable): A. N. Rencz
J. R. Bélanger

Duration of each phase:

a) Field Phase: 3 months, 1980
b) Laboratory Phase: 9 months, May - February 1980-81
c) Compilation: February - May 1981

Approximate Cost (indicate applicable yearly period): $42,000.00

Objectives:

a) To produce a map showing carbonate content and trace element concentrations of glacial sediment over eastern end of Grenville Structural Province.

b) Map other properties of glacial sediments that affect buffering capacity - CEC, clay content, mineralogy, etc.

Method:

c) Evaluate amount and importance of glacial dispersal of buffering components such as carbonate minerals.

Method:

a) Systematic sampling of glacial till and derived sediments over Frontenac Arch (Thousand Islands-Algonquin Park).

b) Analyses of <64μm fraction of till for carbonate and non-carbonate carbon by Leco Carbon analyzer.

c) Analyses of texture, trace element content of <2μm fraction, clay mineralogy, CEC on selected appropriate samples.

d) Map and report on glacial dispersal and buffering capacity of till.

e) Map by satellite imagery relative thicknesses of glacial and related sediments as index of buffering capacity.

Anticipated Results:

a) Map and Report - preliminary, 1981, summer.

b) Techniques may be applied to further sampling of Grenville Province, Appalachians, and other parts of shield in 1981 and following years.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Acid Rain on Vegetation and Soils in Newfoundland

Subject Code (s) in order of priority:	3.2.2 3.2.3 4.0 5.1

Principal Investigator's Name:

Dr. S. S. Sidhu

Agency & Department: Canadian Forestry Service
Newfoundland Forest Research Centre

Address: P. O. Box 6028
St. John's, Newfoundland
A1C 5X8

Phone: (709) 737-4829

Co-operating agencies and investigators (if applicable):

a) Department of Environment
Government of Newfoundland and Labrador
Dr. Les Hulett and Mr. B. Power

b) J. G. Zakrevsky
Canadian Forestry Service, Newfoundland

Duration of each phase:

See Attached

Approximate Cost (indicate applicable yearly period): 7/80 - 3/81: $150,000.00

Objectives:

a) To determine the relative sensitivity of the forest species to acid precipitation.

b) To determine the long term effects of simulated acid rain on selected forest species (including pollen and seed germination).

c) To determine the long term effect of simulated rainfall on nutrient depletion in soils and degree of irreversibility of these effects.

d) To evaluate and adopt methods for S-analysis in plants and soils.

Method:

a) Standard methods of soil and plant analysis will be followed. Methods may be modified if difficulties encountered during the study.

b) Soil leachates will be collected from soils for chemical analysis for cations and anions including sulphates, aluminum and trace metals.

Anticipated Results:

a) Sensitivity of selected forest species based on their foliar buffering capacity should be available during 1981.

b) Data on soils will not be available before the end of 1982. All the results will be published in the form CFS Information Report or papers in the research journals.

Duration of Each Phase:

a)	Field sampling of plants	7/80 to 9/80
b)	Analysis of plant samples	11/80 to 6/81
c)	Set-up greenhouse facilities with acid rain dispensing system	9/80 to 5/81
d)	Set-up simulated experiments in greenhouse conditions	9/81 to 11/81
e)	Collect soil samples	6/81 to 9/81
f)	Laboratory analysis of samples from simulated experiments	2/82 to 11/82
g)	First results available	
	(1) Plants	5/81
	(2) Soils	5/83
h)	Continue simulated acid rain experiments to 1985	

LRTAP ACTIVITY DESCRIPTION

Activity Title:

To Assess the Effect of Acid Precipitation on Agriculture Soils and its Impact on Soil Properties in Relation to Soil Management Practices

Subject Code (s) in order of priority: 3.2.2

Principal Investigator's Name:

Dr. Surinder S. Singh

Agency & Department: Agriculture Canada
Chemistry and Biology Research Institute

Address: Research Branch
C. E. F.,
Neatby Building
Ottawa, Ontario
K1A 0C6

Phone: 995-3700 Ext. 247

Co-operating agencies and investigators (if applicable): Land Resource Research Institute
Agriculture Canada
Ottawa

Duration of each phase: Three months

Approximate Cost (indicate applicable yearly period):

Objectives: To ascertain the seriousness of the problem due to acid precipitation on different types of soils.

Method: Literature survey and prepare a report in cooperation with members of the Land Resource Research Institute, Agriculture Canada.

Anticipated Results: A report on the significance of the acid rain problem to agriculture.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Yearly pH and Soil Moisture Fluctuations Within the Same Soil Type under Differing Land Uses.

Subject Code (s) in order of priority: 3.2.2

Principal Investigator's Name:

Ken T. Webb

Agency & Department: Atlantic Soil Survey Unit
Agriculture Canada

Address: Box 550 NSAC
Truro, N. S.
B2N 5E3

Phone: 895-1571 Loc. 158

Co-operating agencies and investigators (if applicable):

Duration of each phase: Set-up: 7/78
Operation: to approximately 1983

Approximate Cost (indicate applicable yearly period):

Objectives:

a) To establish baseline pH information for one soil type under forage/pasture and forested land use.

b) To monitor pH and soil moisture fluctuations at 10 cm intervals to a depth of 1 meter, bi-weekly.

Method:

a) Water content determined on a % by weight basis for each sample.

b) pH in H_2O and 0.01 M $CaCl_2$ determined for each sample.

c) Soil temperature at 10 cm increments determined to 30 cm at both sites.

d) Water tables monitored to a maximum depth of 120 cm.

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title: A.2.

Effect of Additions of Acid to a Reconstituted Podzol Soil Taken from the Lac Laflamme Catchment

Subject Code (s) in order of priority:	3.2.2 3.2.3 3.1.1

Principal Investigator's Name:

Dr. Gilles Robitaille

Agency & Department: Environment Canada
Canadian Forestry Service

Address: 1080 duVallon
CP 3800
Ste-Foy, Quebec
G1V 4C7

Phone: (418) 658-6945

Co-operating agencies and investigators (if applicable):

Duration of each phase:
a) Set-up: 9/80 - 12/80
b) Operation: 1/81 to at least 10/83

Approximate Cost (indicate applicable yearly period): 9/80 - 3/81: $49,000.00
4/81 - 3/82 $ 6,000.00

Objectives:

To determine the nutrient release (long term basis) of additions of acid solutions to reconstituted soil columns of podzols taken from the Laflamme catchment.

Method:

a) Enough soil samples were collected by horizons (horizon thickness measured) to fill 42 plexiglass 10 cm diameter columns. Soils taken from the Laflamme catchment under balsam fir and passed through a 7 mm sieve. Soils were then stored at 1°C. in plastic pags awaiting column filling.

b) The soils were placed in the columns by horizons on top of a filtering system consisting of acid washed glass wool and silica.

c) Three types of columns were prepared: one containing the LFH horizons, a second the LFH plus the Bhf_1 & BHF_2 horizons and a third containing the LFH, Bhf_1, Bhf_2, Bf_1 and Bf_2 horizons. Each series of columns was replicated three times and watered with H_2SO_4 solutions of pH 2, 3, 4, 5.

d) Solutions analysed for SO_4, NO_3, NO_2, PO_4, Cl, Br, F, NH_4, Na, K, Mg, Ca by ion chromatography and for Al, Fe, CU, Pb, Zn and Cd by AAS. pH will be measured.

Anticipated Results:

a) Data on rates of nutrient and metal release from a podzol under stressed acid conditions.

b) Relationships as to rate of podzol degradation.

c) Data to be used as part of a nutrient cycling model under forced acid conditions to give estimates of the rate of soil degradation of the catchment due to acid input.

d) Support data for activities A.1.a; A.2; A.3.b,c: A.4

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Determination of Sensitivity of Agricultural Soils in Eastern Canada to Long Term Acid Precipitation

Subject Code (s) in order of priority:	3.2.2 3.2.4 6.2

Principal Investigator's Name:

Dr. Chang Wang

Agency & Department: Agriculture Canada
Research Branch

Address: Land Resource Research Institute
K. W. Neatby Bldg.
Central Experimental Farm
Ottawa, Ontario

Phone: K1A 0C6
(613) 995-2323

Co-operating agencies and investigators (if applicable): Dr. D. R. Coote,
Land Resource Research Institute
Soil Survey of Canada

Duration of each phase: Spring-Summer 1980 (Completed)

Approximate Cost (indicate applicable yearly period): N/A

Objectives: Prepare a bulletin describing sensitivity of eastern Canadian soils to long term acid precipitation.

Method: Establish a classification system based on soil texture, base saturation and pH and prepare maps indicating degree of sensitivity of eastern Canadian soils based on soil survey data.

Anticipated Results: Bulletin: "Sensitivity Classification of Agricultural Land to Long Term Acid Precipitation in Eastern Canada" by C. Wang and D. R. Coote, Land Resource Research Institute, Agriculture Canada, Ottawa, 16 pp. plus map (in press).

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Baseline Condition of Jack Pine Biomonitoring Plots in the Athabasca Oil Sands Area 1976 - 1977

Subject Code (s) in order of priority: 3.2.3

Principal Investigator's Name:

Dr. P. A. Addison

Agency & Department: Environment Canada
Canadian Forestry Service

Address: 5320 - 122 Street
Edmonton, Alberta
T6H 3S5

Phone: (403) 435-7210

Co-operating agencies and investigators (if applicable):

a) Alberta Environment
b) Environment Canada

Duration of each phase: 1979-1980

Approximate Cost (indicate applicable yearly period): $50,000.00

Objectives:

a) Use of vegetation as biomonitors.

b) Use of vegetation eliminating the high cost of establishment of high cost instrument technology for biomonitoring.

Method:

a) Study the biochemical/metobolic changes in Jack pine in relation to gas emissions in Athabasca Oil Sands Area in 13 established sites.

Anticipated Results:

a) Jack-pine as successful biomonitors to air pollution.

b) Future reduced cost of Instrumentation Technology as Air pollutant monitors

5/5 year project.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Ecological Benchmarking and Biomonitoring for Detection of Air Borne Pollutant Effects on Vegetation and Soils

Subject Code (s) in order of priority: 3.2.3

Principal Investigator's Name:

Dr. P. S. Addison
Dr. J. Baker

Agency & Department: Environment Canada
Canadian Forestry Service

Address: 5320 - 122 Street
Edmonton, Alberta
T6H 3S5

Phone: (403) 435-7210

Co-operating agencies and investigators (if applicable):

a) Alberta Environment
b) Environment Canada

50:50 interest

Duration of each phase: 1979 - 1980

Approximate Cost (indicate applicable yearly period): $50,000.00

Objectives:

a) Establishment and inventory of selected plots as representative of the vegetation and soil before the initiation of Oil Sands Development.

Method:

Examining the impact of effluents on native vegetation at the plant community level in order to identify necessary successional studies.

Anticipated Results:

Develop techniques for determining SO_2 and subsequently to determine the tolerance of vegetation to SO_2 and other air pollutants in the region. 5/5 year project.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Long-Range Transport of Air Pollutants from the Alberta Oil Sands Plants

Subject Code (s) 3.2.3 in order of priority:

Principal Investigator's Name:

John R. Clements,
Chairman of the Committee

Agency & Department: Oil Sands Environmental Study Group
Committee on Effects of Air Pollutants on the Environment

Address: Syncrude Canada Ltd.
10030 - 107 Street
Edmonton, Alberta
T5J 3E5

Phone: (403)429-9847

Co-operating agencies and investigators (if applicable): Alberta Environment
Saskatchewan Environment

Duration of each phase: Phases 1 & 2 - 3 to 6 months each
Phase 3 - Not yet known

Approximate Cost (indicate applicable yearly period):

Objectives: To predict long-range and long-term effects of emissions to the atmosphere from present and future oil sands plants in Alberta upon ecosystems.

Method:

a) Mathematical modelling of the future dispersion and deposition (wet, dry seasonal) patterns in a zone 300 miles in radius centered over Fort McMurray, Alberta
b) Set numberical, sensitivity criteria re ecosystems in the zone; and compare depositions (loadings) to sensitivity criteria.
c) Identify needs and priorities for further research needs.

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Terrestrial Effects: Forests

Subject Code (s) in order of priority:	3.2.3

Principal Investigator's Name:

Supervisor - Dr. H. D. Griffin
Investigator - W. R. Carswell

Agency & Department: Ministry of the Environment

Address: P. O. Box 5000
435 James Street South
Thunder Bay, Ontario
P7E 6E3

Phone: (807) 475-1215

Co-operating agencies and investigators (if applicable):

Duration of each phase: The program has been proposed to last at least 5 years.

Approximate Cost (indicate applicable yearly period): $40,000 per annum

Objectives: To investigate the effects of acid deposition on forests.

Method: Methods are presently being proposed. Analysis of wood and foliage will probably take place. Some growth studies may also be undertaken.

Anticipated Results: Any effects caused by acidic deposition on forests will be miniscule. We, therefore, anticipate great difficulty in detecting effects.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effect of Foliar Base Status on Ability of Vegetation to Neutralise Acid Rain Events

Subject Code (s) in order of priority: 3.2.3, 3.2.2, 3.2.4

Principal Investigator's Name:
Professor T. C. Hutchinson and
Cindy Adams (graduate student)

Agency & Department: International Nickel Company of Canada

Address: Department of Botany
University of Toronto
Toronto, Ontario
M5S 1A1

Phone: (416) 978-3537

Co-operating agencies and investigators (if applicable): National Research Council

Duration of each phase: Commenced May 1980 and expected to run at least until 1982

Approximate Cost (indicate applicable yearly period): $15,000.00 per annum

Objectives: To assess the relationship between species and population tolerance to acid rain and SO_2, and the ability of foliage to neutralize the acidity effects.

Method: Field sites at Sudbury and the Smoking Hills area of N.W.T. Focus is on herbaceous species and on their comparative ability to deliver devalent cations Ca and Mg to leaf surfaces.

Anticipated Results:

a) An explanation for at least some of the known differences in SO_2 sensitivity and acid droplet tolerance.

b) To determine if SO_2 tolerance and acid rain tolerances in higher planes are related.

c) To thus provide pointers to breeding programs for acid rain rolerant terrestrial plants.

Papers will be presented at meetings and in refereed literature. M Sc thesis

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Multiple-Metal Tolerances of Grasses at Sudbury and Smoking Hills, N. W. T.

Subject Code (s) in order of priority:	3.2.3 3.2.2 3.2.6

Principal Investigator's Name:
Professor T. C. Hutchinson
Dr. R. M. Cox

Agency & Department: ALUR Program of Dept. of Indian & Northern Affairs and National Research Council Strategic Program

Address: Department of Botany & Institute for Environmental Studies
University of Toronto
Toronto, Ontario
M5S 1A1

Phone: (416) 978-3537

Co-operating agencies and investigators (if applicable):

Duration of each phase: Since fall of 1976 - ongoing.

Approximate Cost (indicate applicable yearly period): $25,000.00

Objectives:

a) To determine the evolutionary and physiological mechanisms of multiple metal tolerances in plants and the role of acidification in providing selection pressure for Al, Mn and Fe tolerances and of Sudbury smelters in selecting populations for Cu, Ni and Co tolerances.

b) To develop strains of grasses suitable for extreme environments of high acidity and metal contamination.

Method: Water culture techniques, soils and plant analyses, screenings for vigor, germination; studies of iso-enzymes using electrophoresis.

Anticipated Results: Refereed papers e.g. Nature 1979, New Phytologist, 1980
Reports for Department of Indian and Northern Affairs.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Study of the Spread of Grass Deschampsia Cespitosa in the Sudbury Area in Relation to Atmospheric Deposition and Soil Chemistry

Subject Code (s) in order of priority:	3.2.3 3.2.6 3.2.2

Principal Investigator's Name:

Professor T. C. Hutchinson
Dr. Roger Cox

Agency & Department: National Research Council

Address: Department of Botany and
Institute for Environmental Studies
University of Toronto
Toronto, Ontario

Phone: M5S 1A1
(416) 978-3537

Co-operating agencies and investigators (if applicable):

Duration of each phase: 1977 - 1981

Approximate Cost (indicate applicable yearly period): $8,000.00

Objectives: To determine the rate of spread and the factors controlling the spread of this grass which has actively colonised the Sudbury industrial barrens since 1975.

Method: Bulk sample collectors and sulphation plates run through growing seasons, maintenance of marked plots in colonies of the grass at 9 sites around the Sudbury region, analyses of rate of spread, chemical analyses of soils and dustfall.

Multiple regression techniques.

Anticipated Results: Relative roles of SO_2, sulphate aerosol, nickel and copper particulates, soil available heavy metals and soil pH on spread of the grass. Papers for reference journals.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Comparative Studies of Two closely Allied Grasses in the Sudbury Area

Subject Code (s) in order of priority: 3.2.3, 3.2.2, 3.2.4

Principal Investigator's Name:

Professor T. C. Hutchinson and
Mary Howson (graduate student)

Agency & Department: Natural Science and Engineering Research Council

Address: Department of Botany
University of Toronto
Toronto, Ontario
M5S 1A1

Phone: (416) 978-3537

Co-operating agencies and investigators (if applicable):

Duration of each phase: Commenced 1979 to 1982

Approximate Cost (indicate applicable yearly period): $8,000.00 per annum

Objectives: To determine the mechanisms and environmental constraints by which one species has invaded soils of high metal contamination and acidity around Sudbury while another, common in acid woodland in the area, has failed to invade these industrial barrens since SO_2 levels reduced in 1972.

Method: Field, greenhouse and laboratory studies on metal tolerance, root elongation tolerances to metals, seed dispersal and soil nitrification effects.

Anticipated Results: M. Sc. thesis plus refereed publications.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Effets des précipitations acides sur la productivité primaire des lichens servant de nourriture aux caribous

Code du (des) sujet(s) par ordre de priorité : 3.2.3 3.5

Nom du chercheur responsable :

Pierre Laporte

Ministère, organisme ou organisme privé, service : Environnement Canada
Service canadien de la faune

Adresse: 2700 boul. Laurier
C.P. 10100
Ste-Foy, Québec
G1V 4H5

Téléphone:

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : Dr. Martin Lechowicz

Durée de chaque phase: Voir Annexe

Côut approximatif (indiquer pour quelle période annuelle): $90,000.00

Objectifs de travail: Mesurer l'effet des précipitations acides sur la principale source de nourriture du caribou et le développement d'un modèle de prédiction de la productivité primaire en milieu acide.

Méthode de travail : Etude détaillée des bilans énergétiques, de la photosynthèse et de la respiration des lichens utilisés par les caribous. Cette étude se fera sous des conditions naturelles et experimentales d'acidification.

Résultats prévus: Cette étude nous permettra de connaître et de prévoir l'effet des pluies acides sur la productivité primaire des lichens. Ces connaissances permettront d'évaluer l'effet sur la nourriture des caribous dans les zones affectées par les précipitations acides.

Durée de Chaque Phase:

1980/1981: Etude expérimentale de la photosynthèse et de la respiration des lichens en laboratoire.

1981/1982: Etude de la photosynthèse et de la respiration des lichens en milieu naturel.

1982/1983: Etude de la productivité primaire nette et le développement d'un modèle.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Physiology & Mechanisms of Air Borne Pollutant Injury to Vegetation

Subject Code (s) in order of priority: 3.2.3

Principal Investigator's Name:

Dr. S. S. Malhotra

Agency & Department: Environment Canada
Canadian Forestry Service

Address: 5320 - 122 Street
Edmonton, Alberta
T6H 3S5

Phone: (403) 435-7210

Co-operating agencies and investigators (if applicable): Alberta Environment
Environment Canada 50:50 interest

Duration of each phase: 1979 - 1980

Approximate Cost (indicate applicable yearly period): $40,000.00

Objectives: To determine tolerance of selected native vegetation in Athabasca Oil Sands Area to SO_2 and other pollutant fumigations and to identify species that can be used as representative indicators of general air quality in the region.

Method: To develop simple field test for previsual symptons of effluent damage, this study first concentrated on biochemical and cellular physiological response of candidate revegetation species to SO_2. Study various metabolic processes - Respiration, N A R ratio, photosynthesis.

Anticipated Results: Develop techniques for determining SO_2 and subsequently to determine, the tolerance of vegetation to SO_2 and other air pollutants in the region.
5/5 year project.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Symptomology & Threshold Level of Air Pollutant Injury to Vegetation.

Subject Code (s) in order of priority: 3.2.3

Principal Investigator's Name:

Dr. S. S. Malhotra

Agency & Department: Environment Canada
Canadian Forestry Service

Address: 5320 - 122 Street
Edmonton, Alberta
T6H 3S5

Phone: (403) 435-7210

Co-operating agencies and investigators (if applicable): Alberta Environment
Environment Canada 50:50 interest

Duration of each phase: 1979 - 1980

Approximate Cost (indicate applicable yearly period): $45,000.00

Objectives: The general objectives were to develop operational techniques for detecting or diagnosing the impact of pollutant fumigation upon vegetation prior to visual symptoms.

Method:

a) To identify potentially resistant native species.

b) Determine the visual and previsual symptoms of effluent damage on native species and develop a field test for previsual and visual effluent.

Anticipated Results: The establishment and inventorying of selected plots as representative of the vegetation and soil before the initiation of oil sands development. 5/5 year project.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Impact of Air Pollutant Mixtures Characteristic of Oil Sands Operation on Forest Vegetation and Soils

Subject Code (s) in order of priority: 3.2.3

Principal Investigator's Name:

Dr. S. Malhotra
Dr. P. A. Addison

Agency & Department: Environment Canada
Canadian Forestry Service

Address: 5320 - 122 Street
Edmonton, Alberta
T6H 3S5

Phone: (403) 435-7210

Co-operating agencies and investigators (if applicable): Alberta Environment

Duration of each phase: 1980 - 1981

Approximate Cost (indicate applicable yearly period): $70,000.00

Objectives:

a) Conduct both controlled and field environmental research to describe and measure the physiological and visual impact of pollutant mixtures characteristic of Oil Sands Operation on native forest vegetation type.

b) Determine the impact of pollutant mixtures on native soils and their ability to support vegetation. Effect on seed germination, growth and physiological processes.

c) Develop predictive capability as to fate of forest soils and vegetation at the current or predicted rates of pollutant deposition in Oil Sands area.

Method:

a) Pollution chamber - controlled environment.

b) Seed germination, plant growth, physiological and biochemical processes and visual symptom development.

Anticipated Results:

Effects on Forest Vegetation and Soil.
One year project.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Impact of Acid Deposition on Forest Productivity

Subject Code (s) in order of priority:	3.2.3 3.2.2

Principal Investigator's Name:

Dr. Ian K. Morrison

Agency & Department: Department of the Environment
Canadian Forestry Service

Address: Great Lakes Forest Research Centre
P. O. Box 490
Sault Ste. Marie, Ontario
P6A 5M7

Phone: (705) 949-9461

Co-operating agencies and investigators (if applicable):
DOE, Inland Waters Directorate
DFO, Great Lakes Biolimnology Laboratory (Dr. J. R. M. Kelso)
OMNR, Sault Ste. Marie District

Duration of each phase:
Set-up: 1980
Operation: 1980 to at least 1985

Approximate Cost (indicate applicable yearly period): $70,000 per annum, incl. salaries

Objectives:

a) To elucidate the influence of atmospheric deposition of acidifying substances upon production and turnover processes within the vegetation of forest ecosystems.

b) To elucidate the modifying influence of the vegetation of forest ecosystems on precipitation properties.

c) To participate in the development of process models involving forest growth and biogeochemical processes.

Method:

a) Study is being carried out in old-growth hard maple-yellow birch woods, Algoma District, Ontario.

b) Study is closely coordinated with those of Drs. N. Foster and J. Nicolson.

c) Growth is being measured on large numbers of PSPs; correlations with soil chemical factors will be attempted.

d) Biomass is being measured by regression-stand table method with element storages being estimated following chemical analysis of components.

e) Transfer in litter being ascertained by studies of litterfall (transfer in by throughfall, stemflow being studies by colleagues).

f) Study of litter decomposition rate also being undertaken.

Anticipated Results:

Data, together with those of colleagues, will be used to calibrate a process model relating acid deposition and productivity of northern Ontario old-grown hardwood forest.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

A.6. Microclimatology of the Lac Laflamme Catchment

Subject Code (s) in order of priority:	3.2.3 3.2.2 2.1.2

Principal Investigator's Name:

Dr. André Plamondon

Agency & Department: University of Laval
Forestry Faculty, Sylviculture Department

Address: Ste-Foy, Quebec

Phone: (418) 656-7120

Co-operating agencies and investigators (if applicable): Environment Canada
Canadian Forestry Service
Dr. Gilles Robitaille

Duration of each phase:
a) Set-up: 10/80 to 12/80
b) Operation: 2/81 to at least 9/82

Approximate Cost (indicate applicable yearly period): 10/80 to 3/81: $16,000.00
4/81 to 3/82: $17,500.00

Objectives:

To obtain baseline data on the microclimate of the Laflamme catchment.

Method:

a) One observation site in a clearing adjacent to the catchment at which temperature and RH will be measured, precipitation data will be those acquired at the APN site.

b) 4 observation sites on the catchment under balsam fir stands. 2 sites on the north facing slope and 2 sites on the south facing slope at differing altitudes for air temperature & RH.

c) At one of the sites under balsam fir the solar radiation, soil temperature at 3 depths and air temperatures from the soil surface to above the canopy will be measured.

d) Results will be compared with data from other catchments in the Montmorency experimental forest.

Anticipated Results:

a) The data will give us an idea of the role climate plays in the control of tree growth and biomass production on the basin.

b) Will allow for a better approximation of growth in relation to possible effects due to LRTAP.

c) Will enhance accuracy of the modelization of growth.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Direct Effects on Simulated Acid Rain on Forest Trees

Subject Code (s) in order of priority: 3.2.3

Principal Investigator's Name:

K. E. Percy

Agency & Department: Environment of Canada

Address:
Canadian Forestry Service
Maritimes Forest Research Centre
P. O. Box 4000
Fredericton, N. B.
E3B 5P7

Phone:
(506) 452-3532

Co-operating agencies and investigators (if applicable):

Duration of each phase:

a) Construction of laboratory apparatus 5/80 - 11/80
b) Initial experimentation 12/80 - 12/81

Approximate Cost (indicate applicable yearly period):
5/80 - 12/80: $12,500 (Cap O & M)
12/80 - 12/81: $ 2,000

Objectives:

a) To determine the interspecific sensitivity of twenty Acadian forest tree species to simulated acid rain.
b) To initiate work on the morphology of individual species response.

Method:

a) Climate controlled plant growth chambers will be constructed and equipped with a rainfall application apparatus.
b) Various pH's (2.8, 3.6, 4.6, 5.6) of rain will be applied to tree seedlings at a rainfall intensity approximating natural rain (10 mm/hr).

Anticipated Results:

Data on the sensitivity of Acadian forest tree species to simulated acid rain in terms of germination, establishment and subsequent growth parameters will be published.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Kejimkujik Calibrated Chatchments Study (Activity 10-DOE-LRTAP)

Subject Code (s) in order of priority: 3.2.3, 3.2.2, 3.2.6

Principal Investigator's Name:

K. E. Percy

Agency & Department: Environment Canada
Canadian Forestry Service

Address: Maritimes Forest Research Centre
P. O. Box 4000
Fredericton, N. B.
E3B 5P7

Phone: (506) 452-3532

Co-operating agencies and investigators (if applicable): Dr. J. Kerekes, CWS
Dr. T. Pollock and Mr. T. Clair, IWD

Duration of each phase:
a) Field collection of inventory data, vegetation and soil samples, 8/79 - 10/80.
b) On site monitoring of forest ecology, 6/81 - 10/90.
c) Precipitation collection, 8/80 - 8/82.

Approximate Cost (indicate applicable yearly period): (a & c) 5/80 - 11/80: $12,500 O&M
(b) 8/80 - 8/82: $160,000 Cap*

Objectives:
a) To characterize the baseline condition of the forest vegetation and soils within the Beaverskin and Pebbleloggitch catchments in Kejimkujik National Park, N. S.
b) To elucidate trends in the forest ecology of the catchments and identify any LRTAP effects through long-term continuous monitoring.
c) To monitor intercepted and non-intercepted precipitation input (chemistry and quantity).

Method:
a) Intensive forest inventories, vegetation and soil sampling will be completed in the catchments.
b) Periodic resurveying of the catchments and the use of sensitive bioindicators will be used to follow evolutionary trends and any LRTAP impact.
c) Non-intercepted, throughfall and stemflow samples will be collected year-round.

Anticipated Results:
a) Report(s) detailing the baseline conditions of the catchments will be prepared.
b) Periodic review reports will be issued.

* Purchase of Plasma Emission Spectrometer for assay of vegetation and soil samples.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Terrestrial Ecosystem Status Surveys

Subject Code (s) in order of priority:	3.2.3 3.2.2

Principal Investigator's Name:

K. E. Percy

Agency & Department: Environment Canada,
Canadian Forestry Service

Address: Maritimes Forest Research Centre
P. O. Box 4000
Fredericton, N. B.
E3B 5P7

Phone: (506) 452-3532

Co-operating agencies and investigators (if applicable):

Dr. M. K. Mahendrappa
Canadian Forestry Service
Maritimes Forest Research Centre

Duration of each phase:

a) Field collection of plant material and subsequent analysis 8/80 - 12/80
b) Periodic resurvey 6/81 - 10/90

Approximate Cost (indicate applicable yearly period): 8/80 - 12/80: $500.00

Objectives:

To complete field collections required for the baseline characterization of soils and vegetation in five forest stands located on the CFS-Acadia Forest Experiment Station, N. B.

Method:

a) Field collections of ground vegetation will be made to complete the data base already compiled under another study.

b) Species composition, primary productivity, and foliar nutrient status of vegetation will be determined.

Anticipated Results:

Baseline characteristics of the five forest stands will be established.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Forest Study

Subject Code (s) in order of priority:	3.2.3 3.1 3.2

Principal Investigator's Name:

F. Philips

Agency & Department: F. F. Slaney & Company

Address: 402 West Pender Street
Vancouver, B. C.

Phone: (604) 687-0151

Co-operating agencies and investigators (if applicable):

a) Inco Metals Company, Manitoba Division

b) Manitoba Department of Consumer and Corporate Affairs and the Environment, Environmental Management Division

Duration of each phase: 1976 - 1981

Approximate Cost (indicate applicable yearly period): $1,000,000 for five years

Objectives:

To provide qualitative and quantitative descriptions of any damage to the environment in the Thompson area and to predict future cumulative impacts. This includes the impact of Smelter emissions and natural causes.

Method:

a) In depth examination, sampling and analysis of vegetation, soils, waters, wildlife, precipitation, arthropods, etc.

b) Set up two focal sites one in main dispersion area and one in background area for micro-site evaluation - sampling, analysis, species distribution and condition, soil classification, etc.

c) Set up grid sites for less detailed examination.

d) Evaluate results for trends, etc.

Anticipated Results:

a) Data will be computerized and in a data bank by 1981.

b) Summary of study - 1981.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Kejimkujik Park Non-Point Source Ion Budget

Subject Code (s) in order of priority: 3.2.3

Principal Investigator's Name:

Dr. T. L. Pollock

Agency & Department: Environment Canada, Water Quality Branch

Address: P. O. Box 861
Moncton, N. B.
E1C 8N6

Phone: (506) 388-6606

Co-operating agencies and investigators (if applicable): Maritime Forest Research Center
Dr. K. Percy

Duration of each phase: Operation: 8/80 to 3/81

Approximate Cost (indicate applicable yearly period): $4,600.00 and 0.8 PY

Objectives: To determine an ion budget for experimental forest plots in Kejimkujik Park.

Method: Water samples from open area, tree throughfall and tree stemflow collected weekly will be analysed for major ions and nutrients by Analytical Services Division of the Water Quality Branch.

Anticipated Results: The results will be forwarded to MFRC

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Acid Rain and Arsenic - Wawa Area

Subject Code (s) in order of priority:	3.2.3 3.2.6 3.2.2 3.3

Principal Investigator's Name:

A. N. Rencz

Agency & Department: EMR - Geological Survey of Canada

Address: 601 Booth Street
Ottawa, Ontario
K1A 0E8

Phone: (613) 995-4168

Co-operating agencies and investigators (if applicable): R. N. W. DiLabio
W. W. Shilts

Duration of each phase: Field feasibility study 1980 - 3 weeks

Approximate Cost (indicate applicable yearly period): 1st year - $3,000.00

Objectives:

a) To investigate cause of severe vegetation alteration northeast from Wawa, Ontario.

b) To evaluate relative importance of acid vs heavy metal deposition in altering vegetation patterns.

Method:

a) Sample certain vegetation species inside and outside of altered area.

b) Sample glacial sediments and evaluate net drift transport directions - glacial, glaciolacustrine, glaciofluvial.

c) Map vegetation types, trace element contents and surficial geology of altered and adjacent areas.

d) Evaluate usefulness of satellite imagery for defining area of stressed vegetation.

Anticipated Results:

Report on causes of vegetation alteration, Wawa area will show relative importance of heavy metals and acid precipitation in altering vegetation cover.

LRTAP ACTIVITY DESCRIPTION

Activity Title:
A.3. Effects of Acid Precipitation on the Nutrient Cycling Mechanism in Balsam Fir Stands of the Lac Laflamme Catchment.
c) Nutrient Distribution in the Vegetation Component

Subject Code (s) in order of priority:	3.2.3 3.2.2

Principal Investigator's Name:

Dr. Gilles Robitaille

Agency & Department: Environment Canada
Canadian Forestry Service
Address: Laurentian Forest Research Center
1080 duVallon
CP 3800
Ste-Foy, Quebec
G1V 4C7
Phone: (418) 658-6945

Co-operating agencies and investigators (if applicable):

Duration of each phase: a) Sampling: spring and fall of each year
b) Operation: 10/80 to at least 10/83

Approximate Cost (indicate applicable yearly period): 10/80 to 3/81: $2,000.00
4/81 to 3/81: $3,000.00

Objectives:

To obtain values for nutrient accumulation in vegetation.

Method:

a) Various types of plant material will be collected in the spring and fall of each year for analysis of nutrient content.
b) On the forest floor, 2 mosses and on the bole of balsam fir, 2 lichens will be collected, current year needles and increment cores will be taken.
c) To be analysed for the elements as in activity A.1.a.

Anticipated Results:

a) Data on amounts of nutrients immobilized by different components of the vegetation.
b) Approximations on the nutrient pool.
c) Data for the nutrient cycling model for balsam fir stands.
d) Support data for activities A.1.a,b; A.2; A.3.a,b,d; A.4.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Assessment of Possible Influences of Acid Precipitation on Tree Growth

Subject Code (s) in order of priority: 3.2.3

Principal Investigator's Name:

Cam Stevens

Agency & Department: Ontario Ministry of Natural Resources
Regional Forester, MNR N.E. Region Office

Address: Ontario Government Building
199 Larch St.,
Sudbury, Ontario
P3E 5P9

Phone: (705) 675-4120

Co-operating agencies and investigators (if applicable): Ontario Ministry of the Environment (Dr. Balsillie)
Ontario Forest Research Centre (Dr. Fagle)

Duration of each phase: 1980-81 - To be continued, depending on the results of the Assessment

Approximate Cost (indicate applicable yearly period): $50,000.00

Objectives: Feasibility Study to investigate the possibility of determining whether acid precipitation has any effect on tree growth.

Method: Measurement of ring width (and height increment) throughout the stem. Combined with analysis of stand structure and soil conditions. Some interpretations might be possible on environmental effects on growth. Young stands will be compared with old stands. Data will be collected and analysed using the Holman "Automic" Tree Ring Measurer.

Anticipated Results:

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Effets des Pluies Acides sur le Metabolishe Mineral et la Croissance des Epinettes

Code du (des) sujet(s) par ordre de priorité : 3.2.3

Nom du chercheur responsable :

Dr. R. Vancoillie * C. Chabot *
Dr. R. Maclean ** Y. Laberge

Ministère, organisme ou organisme privé, service : *Eco-Recherches (C.I.L.) ** Domtar

Adresse: 121 Boul. Hymus, Pointe Claire, Québec — Laboratoires de recherches, Senneville, Québec

Téléphone: (514) 697-3273 (514) 457-6810

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) :

Durée de chaque phase: 9/80 - 1/81: Bibliographie et prèliminaries
81: Recherche

Côut approximatif (indiquer pour quelle période annuelle): $50.000.00

Objectifs de travail: Préciser l'affet des pluires acides sur la prise d'ions mineraux du sol aux épinettes.

Méthode de travail : Dèterminations minèrals en situ:

Quantification des obiger èlèments par microsondes.

Etude de noissance.

Résultats prévus: Publication et/ou rapport à Environnement Canada

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Assessment of Impact on Long-Term Acidity From Atmospheric Deposition (Wet and Dry) on Agriculture in Canada

Subject Code (s) in order of priority:	3.2.4 3.2.2 6.2

Principal Investigator's Name:

Dr. D. Richard Coote

Agency & Department: Agriculture Canada
Research Branch

Address: Land Resource Research Institute,
K. W. Neatby Bldg.
Central Experimental Farm
Ottawa K1A 0C6

Phone: (613) 995-2323

Co-operating agencies and investigators (if applicable): Dr. Chang Wang, Land Resource Research Institute; Dr. D. Siminovitch and Dr. S. S. Singh, Chemistry and Biology Research Institute, Agriculture Canada, Ottawa

Duration of each phase: Continuing

Approximate Cost (indicate applicable yearly period): N/A

Objectives: Prepare a coordinated review and assessment of the significance of atmospheric deposition to agriculture to enable problem areas and research needs to be identified.

Method: Combine crop and soil sensitivity estimates, mapped with soil and agricultural census data, with estimates of soil and crop-affecting components of atmospheric deposition, fertilizer treatment practices and liming.

Anticipated Results:

a) Position paper for Agriculture Canada

b) Bulletin on soil sensitivity (co-author with C. Wang)

c) Maps identifying potential problem areas for agricultural soils and crops.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Survey problem of effect of SO_2 and acid rain on plant and kinds of assessment need to determine extent and severity of problem. (part of team studying this problem)

Subject Code (s) in order of priority: 3.2.4

Principal Investigator's Name:

Dr. David Siminovitch

Agency & Department: Agriculture Canada, Chemistry and Biology Research Institute, Research Branch

Address: C.E.F., Neatby Building,
Ottawa, Ontario.
K1A 0C6

Phone: 995-3700

Co-operating agencies and investigators (if applicable): Land Resource Research Institute
Neatby Building

Duration of each phase: Three months

Approximate Cost (indicate applicable yearly period):

Objectives: To appraise problem of gravity and nature of acid rain injury to crop plants from the point of view of plant physiology.

Method: For the time being survey literature and statistics on SO_2 and acid rain injury to crop plants and present a report in cooperation with members of the Land Resource Research Institute of the Research Branch.

Anticipated Results: Present a report on mechanism and evidence of SO_2 and acid rain injury to crop plants and suggest approaches in the assessment of the impact of SO_2 and acid rain in crop plants.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Effets de l'acidification des lacs sur la structure des communautés d'oiseaux aquatiques

Code du (des) sujet(s) par ordre de priorité : 3.2.5, 3.1.2, 3.1.1

Nom du chercheur responsable :

M. Jean-Luc DesGranges

Ministère, organisme ou organisme privé, service : Environnement Canada
Service canadien de la faune (SCF)

Adresse: 2700 boul. Laurier
C. P. 10100
Ste-Foy, Québec
G1V 4H5

Téléphone: (418) 694-3914

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) : M. Benoit Houde (SCF)
M. Paul Potvin, Service de qualité des eaux, Environnement Québec

Durée de chaque phase:
a) Planification: du 80/01 au 80/05
b) Collecte et analyse des données: du 80/05 au 81/12
c) Rédaction: du 82/01 au 82/04

Côut approximatif (indiquer pour quelle période annuelle):

du 80/01 au 82/04: $250,000.00

Objectifs de travail: Déterminer si la baisse des populations d'animaux aquatiques et les changements dans la végétation aquatique qu'entraînera l'acidification des lacs affectera les oiseaux aquatiques.

Méthode de travail : Etude détaillée de la sélection de l'habitat par les espèces qui fréquentent des lacs de différents pH dans chacun des biomes du Québec.

Résultats prévus: Une fois les niches écologiques caractérisées pour chacune des espèces d'oiseaux fréquentant des milieux aquatiques distribués le long d'un gradient naturel d'acidité, nous serons à même, à partir des données écologiques recueillies, de prévoir les effets à long terme des précipitations acides sur les communautés d'oiseaux aquatiques.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Methylmercury, Lead and Cadmium Contamination on the Reproduction Rate and Demography of Mink and Muskrat Populations in Acidified Areas.

Subject Code (s) in order of priority:	3.2.5 3.2.6

Principal Investigator's Name:

K. McCormick
K. Fischer

Agency & Department: Canadian Wildlife Service
Environment Canada

Address: Wildlife Toxicology Division
National Wildlife Research Centre
Ottawa, Ontario
K1A 0E7

Phone: (819) 997-1410

Co-operating agencies and investigators (if applicable):

Val Glooschenko
Ontario Ministry of Natural Resources
Wildlife Branch
Queen's Park
Toronto, Ontario
M7A 1W3

Duration of each phase:

a) Collection of specimens: January - April 1981.

b) Analysis and reporting of results by September 1981.

Approximate Cost (indicate applicable yearly period):

Objectives:

To determine contaminant burdens of Hg, Cd and Pb in muskrat and mink within an area impinged by acid rain and resulting effects on the reproductive success and distribution of these species.

Method:

A minimum of twenty carcasses of adult mink and muskrat (10 females and 10 males for each species) will be collected from each of the study areas selected in central Ontario and examined to determine age, weight and sex. Samples will be prepared and analyzed for methylmercury, lead and cadmium concentrations.

Anticipated Results:

Determine whether:

a) A correlation between contaminant concentrations in hair and other tissues exists.

b) Individual contaminant burdens will increase with increasing contaminant concentrations in prey species (relevant data on prey species is already available).

c) Individual contaminant levels may be correlated with the relative acidification of relevant ecosystems.

d) Reproductive output may be impaired with increased contaminant burdens.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Acid Precipitation - Sulfate on Nutritional Quality of Wildlife Browse and Selenium Deficiency Diseases in Forest Wildlife.

Subject Code (s) in order of priority:	3.2.5 3.2.2

Principal Investigator's Name:

Dr. G. G. Shaw

Agency & Department: Canadian Wildlife Service
Environment Canada

Address: Western & Northern Region
1000, 9942 - 108 Street
Edmonton, Alberta
T5K 2J5

Phone: (403) 435-7355

Co-operating agencies and investigators (if applicable):

Duration of each phase:

a) 1980/81 plants grown on experimental soils and misted with varying amounts of SO_4.
b) 1981/82 leaves and new woody growth analyzed for concentrations of selenium, copper, molybdenum, zinc and sodium.

Approximate Cost (indicate applicable yearly period):

Objectives:

a) To determine whether excessive acid rain sulfate will alter the elemental composition of herbivore browse.

b) To determine whether excessive acid rain sulfate and sulphur dioxide decrease the selenium concentration in herbivore browse species sufficiently to increase selenium deficiency diseases in wildlife.

Method:

Serviceberry plants will be misted with up to 20 ppm sulfate solution twice weekly. Soils will be treated with the same concentrations directly. Nutrient regimes will be selected according to the results of a preliminary experiment to determine the relationship between application concentrations and subsequent levels in foliage and new woody growth. Chemical analyses of foliage, twigs and soils will be performed following the treatment period.

Anticipated Results:

a) Determine changes in foliar concentrations of nutritional elements and interactions between elements with varying levels of sulfates.

b) The effects of sulfate and sulphur dioxide on plant selenium concentrations should also be determined.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Acid Precipitation on Net Primary Productivity of the Principal Caribou Forage Lichens.

Subject Code (s) in order of priority:	3.2.6 3.2.7

Principal Investigator's Name:

Dr. Martin Lechowicz

Agency & Department: Biology Department, McGill University

Address: 1205 Avenue Drive Penfield
Montreal, Quebec
H3A 1B1

Phone: (514) 392-4683/4614

Co-operating agencies and investigators (if applicable): Dr. P. Laporte, Canadian Wildlife Service
Environment Canada
2700 Laurier Blvd., 4th Floor
P. O. Box 10100
Ste. Foy, Quebec
G1V 4H5

Duration of each phase: 1980/81-Test the effects of acid precipitation on lichen photosynthesis and respiration in laboratory.
1981/82-Application of sulfates and nitrates to test plots near Schefferville.
1982/83-Develop a model predicting affects on net productivity.

Approximate Cost (indicate applicable yearly period):

Objectives:

a) To measure the effects of sulfate and nitrate concentrations typical of acid precipitation events on the photosynthesis and respiration of the principal terrestrial and arboreal lichens utilized by caribou in the tundra and taiga zones of northeastern Quebec.

b) To develop a mathematical model of net annual productivity of lichen Cladina stellaris as a function of climate and acid precipitation levels and test this model by exposing lichens in subarctic Quebec to a series of artificial acid precipitation levels.

Method: In 1980-81, lichens will be collected near Schefferville, Quebec and analyzed for net CO_2 exchange in a laboratory experiment varying concentrations of sulfate and nitrates.

In 1981-82, test plots will be misted at the end of natural precipitation events and net annual primary production determined for various levels of pollutants.

Anticipated Results: The proposed research will determine the sensitivity of northern lichen species to sulfates and nitrates and examine the effects of acid precipitation on the net primary productivity of the principal tundra and taiga lichens utilized by barren-ground and woodland caribou.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Biochemical Assay of Latent LRTAP Induced Plant Stress

Subject Code (s) in order of priority:	3.2.6

Principal Investigator's Name:

K. E. Percy

Agency & Department: Environment Canada
Canadian Forestry Service

Address: Maritimes Forest Research Centre
P. O. Box 4000
Fredericton, N. B.
E3B 5P7

Phone: (506) 452-3532

Co-operating agencies and investigators (if applicable):

Mr. S. I. Cameron
Canadian Forestry Service
Maritimes Forest Research Centre

Duration of each phase: 6/81 to 12/81

Approximate Cost (indicate applicable yearly period): 6/81 to 12/81: $500.00

Objectives:

To evaluate 2 plant enzymes known to be quantitatively affected by SO_2, for their reaction to acid rain and potential as field bioindicators.

Method:

a) Seedlings of 2 Pinaceae will be subjected to acid rain in simulated rainfall chambers.

b) Endogenous foliar concentrations of several enzymes will be determined pre-, during-, and post-application.

Anticipated Results:

Data on the viability of biochemical monitors of LRTAP stress will be evaluated.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Bioindicator Study

Subject Code (s) in order of priority:	3.2.6

Principal Investigator's Name:

K. E. Percy

Agency & Department: Environment Canada
Canadian Forestry Service

Address: Maritimes Forest Research Centre
P. O. Box 4000
Fredericton, N. B.
E3B 5P7

Phone: (506) 452-3532

Co-operating agencies and investigators (if applicable):

Duration of each phase: 10/81 - 10/90

Approximate Cost (indicate applicable yearly period): 10/80 - 10/81: $500.00

Objectives:

a) To monitor the deposition to, and uptake of sulphur and selected heavy metals by terrestrial receptors, through the use of sensitive bioindicator species in situ.

b) To document any deterioration in bioindicator morphology-physiology due to LRTAP should it occur.

Method:

Sphagnum sp. in ombrotrophic sites at both locations will be used.

Anticipated Results:

Yearly data will be available indicating short-term trends.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Kejimkujik Calibrated Catchments Study

Subject Code (s) in order of priority:	3.2.6

Principal Investigator's Name:

K. E. Percy

Agency & Department: Environment Canada,
Canadian Forestry Service

Address: Maritimes Forest Research Centre
P. O. Box 4000
Fredericton, N. B.
E3B 5P7

Phone: (506) 452-3532

Co-operating agencies and investigators (if applicable):

Dr. T. Pollock + Mr. T. Clair, IWD-WQB
Dr. G. Robitaille, CFS-CRFL
Dr. G. Hogan, CFS-NoFRC

Duration of each phase:

a) Field Collection of inventory data, vegetation and soil samples:8/79 - 10/80.
b) Chemical Analysis of samples:10/80 - 12/81 for baseline characterization.
c) Precipitation Collection: 8/80 - 8/82.
d) Lichen bioindicator study 10/80 onwards
e) Resurvey of baseline conditions: on site monitoring 7/81 onwards.

Approximate Cost (indicate applicable yearly period):

a) 8/79 - 10/80: $12,500
b) 10/80 - 12/81: 168,000 (Purchase of Plasma Emission Spectrometer for chemical analysis of vegetation and soil samples ($160,000 Cap.)
c) 8/80 - 6/81: 4,000
d) 1981: 400
e) 1981: 600

Objectives:

a) To characterize the baseline condition of the forest vegetation and soils within the Beaverskin and Pebbleloggitch catchments in Kejimkujik National Park, N. S.
b) To determine LRTAP and nutrient input into the catchments through the monitoring of non-intercepted and intercepted precipitation (stemflow and throughfall).
c) To monitor short-term trends in forest condition through the use of epiphytic lichens as bioindicators.
d) To elucidate trends in the forest ecology of the catchments and identify any LRTAP effects through long-term continuous monitoring.

Method:

a) An intensive forest inventory will be completed. Forest soils in the catchments will be sampled and a chemical and physical analysis performed. Species composition, density, primary productivity and nutrient data will be generated for the tree, shrub, herb and moss-lichen vegetation layers.

b) Precipitation samples will be collected at least weekly with an event sampling period during the summer.

c) Two techniques utilizing epiphytic lichens as ioindicators will be initiated to monitor short-term LRTAP impact on sensitive components should it occur.

d) Periodic resurvey of the plant-soil systems will be used to monitor long-term trends.

Anticipated Results:

A report detailing the baseline characteristics of the catchments will be prepared and followed by periodic updating.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Ozone and SO_2 on Vegetation: Field Investigations

Subject Code (s) in order of priority:	3.2.6 2.2.3

Principal Investigator's Name:

A. J. Spavold

Agency & Department: Environmental Services Branch
Environment New Brunswick

Address: P. O. Box 6000
Fredericton, New Brunswick
E3B 5H1

Phone: (506) 453-2669

Co-operating agencies and investigators (if applicable): Pollution Control Branch
Environment New Brunswick
Fredericton, N. B.

Duration of each phase: 05-10/1980, 05-10/1981

Approximate Cost (indicate applicable yearly period): 1980 - 1981: $5,000.00

Objectives:

a) To assess the extent to which ozone and SO_2 damage to vegetation is a problem in Saint John area of N. B.
b) To respond to complaints of suspected ozone and SO_2 damage to plants in the Saint John area.

Method:

a) Regular assessment of selected vegetation plots throughout the growing season.
b) Response and follow-up to complaints of vegetation damage.

Anticipated Results:

a) Technical Reports to be issued after internal review.
b) Regular reports to complainants.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Regional Bioindicator Studies: Trace Metals in Lichens in New Brunswick

Subject Code (s) in order of priority: 3.2.6

Principal Investigator's Name:

A. J. Spavold

Agency & Department: Environmental Services Branch
Environment New Brunswick

Address:
P. O. Box 6000
Fredericton, N. B.
E3B 5H1

Phone: (506) 453-2669

Co-operating agencies and investigators (if applicable):

Duration of each phase: 1977 - 1981 and beyond

Approximate Cost (indicate applicable yearly period): $30,000.00/1980

Objectives:

a) Assessment of background loadings of trace metals in lichens in New Brunswick.
b) Determination of relative contributions of local pollution sources and LRTAP to trace metal bio-accumulation.

Method:

a) Data obtained annually as part of sampling done for Regional Bioindicator Study Networks.
b) Survey of areas isolated from local pollution sources.
c) Trace metals analysed in lichen include Cd, Cr, Cu, Fe, Ni, Pb, Vo, Ti and Hg.

Anticipated Results:

a) Data stored on Environment New Brunswick data storage system.
b) Technical Reports to be issued after internal review.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

a) Transport of Terrestrial Organic Compounds to Oceans.
b) Transport of Terrestrial inorganic Compounds to Oceans.

Subject Code (s) in order of priority: 3.2.7

Principal Investigator's Name:

a) G. Lord, E. P. Jones, R. Pocklington, M. Bewers
b) P. Yeats, M. Bewers

Agency & Department: Department of Fisheries & Oceans
Ocean and Aquatic Sciences
Address: Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S.
B2Y 4A2
Phone: (902) 426-7079

Co-operating agencies and investigators (if applicable):

Duration of each phase: Continuing

Approximate Cost (indicate applicable yearly period): 2 MY, $5,000.00

Objectives: To assess amounts and types of materials transported to the ocean by way of the atmosphere. This includes both natural and anthropogenic materials.

Method:

Wet Sample:	Sangamo collector.
Dry Sample:	High speed pump and filter.
Sampling Site:	Head of St. Margarets Bay (same site as EPS, bisulphur sampling).

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Impact of Acid Deposition on Forest Hydrologic Processes

Subject Code (s) in order of priority:	3.2.7 3.1.1 3.2.3

Principal Investigator's Name:

Dr. J. A. Nicolson

Agency & Department: Department of the Environment
Canadian Forestry Service

Address:
Great Lakes Forest Research Centre
P. O. Box 490
Sault Ste. Marie, Ontario
P6A 5M7

Phone: (705) 949-9461

Co-operating agencies and investigators (if applicable):
a) DOE, Inland Waters Directorate
b) DFO, Great Lakes Biolimnology Laboratory
c) OMNR, Sault Ste. Marie District

Duration of each phase:
a) Set-Up: 6/79 to 12/80
b) Operation: 7/80 to at least 12/85

Approximate Cost (indicate applicable yearly period): 4/80 to 3/81: $75,000.00

Objectives:

Over the next five-year period to elucidate the influence of atmospheric deposition of acidifying substances upon the hydrochemical cycle and the export of elements from forested catchments through the collection of water samples and the measurement of runoff volumes.

Method:

In an old growth hard maple-yellow birch watershed on shallow till soils (Turkey Lake Forest Watershed).

a) Fourteen small gauged watersheds have been established and will be sampled at least weekly.

b) Six additional watersheds will be sampled and flow measured periodically.

c) Twelve plots have been established in one basin and event sampling has begun to study the partitioning of both the volume and chemistry of gross precipitation before it reaches the forest floor.

d) Chemical analysis of samples will be carried out in the Great Lakes Forest Research Centre laboratory.

Anticipated Results:

Anticipated Results:

a) Reports outlining acid rain effects on the terrestrial ecosystem study and the effects of the system on the acid rain before it enters the lakes and major streams.

b) Eventual development of process models involving hydrologic processes

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Ocular Effects of Bathing in Low pH Waters

Subject Code (s) in order of priority:	3.3. 3.1.6

Principal Investigator's Name:

Dr. P. K. Basu

Agency & Department: Department of Ophthalmology
University of Toronto

Address: 1 Spadina Crescent
Toronto, Ontario
M5S 2J5

Phone: (416) 978-2635

Co-operating agencies and investigators (if applicable): Ontario Ministry of Environment
Water Resources Branch
Planning and Coordination Section

Duration of each phase: Preliminary investigation is complete. Draft of report completed. Further work is pending grant monies.

Approximate Cost (indicate applicable yearly period):

Objectives: To determine if there is any effects on the eye involved in bathing in acidic waters.

Method: The eyes of rabbits and human volunteers were exposed to water from a low pH lake (pH 4.5) and water from a more neutral lake (pH 6.5). The eyes were observed for any adverse effects including: tear osmolarity, tear cytology, conjunctival congestion and permeability of cornea.

Anticipated Results: Judging from the results of the preliminary study, acidic water will have minimal effect on the eye and the MOE recreational use pH criteria can be modified to allow bathing in low pH lakes, if the proposed study is funded.

LRTAP ACTIVITY DESCRIPTION

Activity Title: Elevated metal levels in Domestic Water Supplies

Subject Code (s) in order of priority: 3.3

Principal Investigator's Name: Y. K. CHAU

Agency & Department: Department of Environment, National Water Research Institute

Address: Canada Centre for Inland Waters
Box 5050, Burlington, Ontario L7R 4A6

Phone: 416 637-4707

Co-operating agencies and investigators (if applicable): Contract to Barringer Mag. Ltd, Toronto

Duration of each phase: Contract completed by March 1981.

Approximate Cost (indicate applicable yearly period): 42 K contract

Objectives: To determine the influence of acidification on the elevation of metals in domestic water supplies in an acidified soft water area.

Method: Laboratory experiments will be conducted in a range of plumbing types to determine the metal dissolution as related to water pH.

Samples will be analyzed from a number of domestic supplies in soft water acidified areas.

Anticipated Results: Report on the elevation of metals in domestic water supplies in soft water areas.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Environmental Health in the Athabasca Oil Sands Region

Subject Code (s) in order of priority:	3.3

Principal Investigator's Name:

Dr. C. A. R. Dennis
Funded by Alberta Environment

Agency & Department: Prairie Institute for Environmental Health

Address: 2220 Lorne Street
Regina, Saskatchewan

Phone:

Co-operating agencies and investigators (if applicable):

Duration of each phase: One phase - one year tp to 1980

Approximate Cost (indicate applicable yearly period): $149,900.00

Objectives: To design research which would provide an understanding of relationships between human health and environmental conditions induced by oil sands development.

Method:

a) Use of secondary sources.

b) Use of medicare data.

c) Interview with health professional.

Anticipated Results:

a) Recommendations for research program on environmental health in the area.

b) Means for monitoring human health indicators.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Investigation of Deterioration to Historic Buildings by Pollutants

Subject Code (s) in order of priority:	3.4 8.0

Principal Investigator's Name:

Keith Blades

Agency & Department: Department of Public Works
Technical Support

Address: Facilities Maintenance,
National Capital
18th Floor, L'Esplanade Laurier
140 O'Connor St.,
Ottawa, Ontario K1A 0M3

Phone: (613) 593-7308

Co-operating agencies and investigators (if applicable): Conservation Division, Parks Canada, John Stewart
Heritage Canada Foundation, Martin Weaver

Duration of each phase: As determined by site conditions

Approximate Cost (indicate applicable yearly period):

Objectives: To ascertain the extent of deterioration through the actions of pollutants on heritage buildings in the care of the Department.

Method: In conjunction with the Conservation Division, Parks Canada, samples of efflorescence and masonry are removed from structures to determine the nature of chemical attack and deterioration. Because analysis techniques require removal of material from substrates this prohibits investigation of valuable detail which generally exhibits spectacular and accelerated decay.

Anticipated Results: Results will be instrumental in determining:

a) the extent of visible and latent pollutants contributing to deterioration, and
b) methods to effectively remove these residual elements and/or prevent, through the development of treatments, the loss of irreplaceable detail on historic buildings.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Chemical Assay of Historical Buildings and Monuments for the Residue of Air Pollutants

Subject Code (s) in order of priority:	3.4 8.0

Principal Investigator's Name:

John Stewart

Agency & Department: Conservation Division
Parks Canada

Address: 1570 Liverpool Court
Ottawa, Ontario
K1A 1G2

Phone: (613) 993-2125

Co-operating agencies and investigators (if applicable):

a) Engineering and Architecture Branch
Parks Canada

b) Department of Public Works, Keith Blades

Duration of each phase: Done on intermittant basis, as required

Approximate Cost (indicate applicable yearly period):

Objectives: To determine the chemical species causing damage to masonry or stone decoration on historical buildings.

Method: At sites possibly suffering from damage due to chemical attack samples of efflorescence, masonry, and stone are taken from the surface and by dry drilling from the interior. These samples are analyzed to determine the type, location, and quantity of the pollutants. The means of entry of the pollutant is determined by a study of the monument with architectural consultation.

Anticipated Results: The results will be used to determine the most effective means to stop future entry of pollutants and stop further damage due to pollutants already in the structure.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Investigation of the Causes of Deterioration of and Conservation Measures for the Peterborough Petroglyphs

Subject Code (s) in order of priority:	3.4 6.2 3.2.7

Principal Investigator's Name:

Address enquiries to:
Ian N. M. Wainwright

Agency & Department: Canadian Conservation Institute
National Museums of Canada

Address: 1030 Innes Road
Ottawa, Ontario
K1A 0M8

Phone: (613) 998-3721

Co-operating agencies and investigators (if applicable):

a) Ontario Ministry of Natural Resources
Bancroft District
Mr. M. P. Barker

b) Atmospheric Environment Service
Dr. H. C. Martin

Duration of each phase:

a) Initial Field and Laboratory Studies: 4/80 - 3/81
b) Field Testing Programme not yet established.

Approximate Cost (indicate applicable yearly period):

Objectives:

The Peterborough Petroglyphs comprise 221 well-defined and perhaps hundreds more vague or weathered carvings in a marble outcrop measuring 14 x 22 metres. The site, located in Petroglyphs Provincial Park, is vulnerable to agents of chemical, physical and biological weathering, including acidic precipitation. Our objective is to assess the impact of these agents on the conservation of the site and to recommend steps for their abatement.

Method:

A laboratory study was carried out to assess the increase (if any) in the amount of marble dissolved in rainwater, which could be attributed to increasingly acidic precipitation. Correlation of data on pH, dissolved calcium, and rates of dissolution in the laboratory study with data for rain and runoff collected at the site is being made. The assessment of the effect of dry deposition will depend on estimates of deposition from other research in the vicinity.

Anticipated Results:

An internal report incorporating the data on the effect of acidic precipitation on the marble will be made to the Ontario Ministry of Natural Resources in 1981. The section dealing with the laboratory tests on the dissolution of the marble will be available from the Canadian Conservation Institute by April 1st, 1981. It is anticipated that a publication in the open literature will result which will discuss all conservation aspects of the Peterborough Petroglyphs.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Investigation of Deterioration to Historical Buildings by Pollutants

Subject Code (s) in order of priority:	3.4 8.0

Principal Investigator's Name:

Martin E. Weaver

Agency & Department: Heritage Canada Foundation
Education and Technical Services

Address:
P. O. Box 1358
Station "B"
Ottawa, Ontario
K1P 5R4

Phone: (613) 237-1066

Co-operating agencies and investigators (if applicable): Conservation Division, Parks Canada, John Stewart, Department of Public Works, Technical Support, Keith Blades

Duration of each phase: As determined by site conditions

Approximate Cost (indicate applicable yearly period):

Objectives:

To ascertain the extent of deterioration through the actions of pollutants on heritage buildings in the care of the Department.

Method:

In conjunction with the Conservation Division, Parks Canada, samples of efflorescence and masonry are removed from structures to determine the nature of chemical attack and deterioration. Because analysis techniques require removal of material from substrates this prohibits investigation of valuable detail which generally exhibits spactacular and accelerated decay.

Anticipated Results:

Results will be instrumental in determining:

a) the extent of visible and latent pollutants contributing to deterioration, and
b) methods of effectively removing these residual elements and/or prevent, through the development of treatments, the loss of irreplaceable detail on historical buildings.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Compilation and preparation of Criteria Documents

Subject Code (s) in order of priority:	3.5 2.2.1

Principal Investigator's Name: Dr. I. Hoffman

Agency & Department: Environmental Secretariat
National Research Council of Canada

Address: Ottawa, Ontario K1A 0R6

Phone: (613)996-6810

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives: As discussed by telephone with Dr. Martin on 3 SEPT 1980 our CURRENT ACTIVITIES include the preparation of Criteria Documents entitled: (1) Increasing Acidity in the Canadian Aquatic Environment

(2) Hydrogen Sulfide in the Canadian Environment

Method: Publication of both are expected near the end of 1980.

The following documents are in print:

NRCC No.

14096 Photochemical Air Pollution: Formation, Transport and Effects. 1975. 224 pp. $2.50.

14097 La pollution photochimique de l'air: sa formation, son transport et ses effets. 1976. 203 pp. $2.50.

15015 Sulphur and Its Inorganic Derivatives in the Canadian Environment. 1977. 426 pp. $5.00.

15016 Le soufre et ses dérivés mineraux dans l'environnement canadien. 1978. 441 pp. $5.00.

Anticipated Results:

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Heavy Metal Concentrations in Some Marine Mammals from the Arctic

Subject Code (s) in order of priority:	3.5 3.1.4

Principal Investigator's Name:

R. Wagemann

Agency & Department: Department of Fisheries and Oceans
Toxicology Section

Address: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Phone: (204) 269-7379

Co-operating agencies and investigators (if applicable): Department of Indian and Northern Affairs

Duration of each phase:
a) Presently in progress
b) Concluding in fiscal 1980

Approximate Cost (indicate applicable yearly period): $10,000 per year, exclusive of salaries or logistics costs.

Objectives:
a) To measure heavy metal concentrations in various tissues of narwhal.
b) To compare the results with concentrations in other marine mammals, and to assess them for normalcy and interrelationships.

Method:
Samples of liver, kidney, miscles and blubber tissues of norwhal are collected opportunistically in conjunction with native hunts, are deep-frozen and transported to the the laboratory, where moisture, selenium and heavy metals are determined by proven methods.

Anticipated Results:
The results will be put into a report, which will be forwarded to the cooperating agency. Subsequently, we intend to publish this work in a scientific journal.

Section 4

INSTRUMENTATION DEVELOPMENT

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Techniques for Measuring the Dry Deposition of SO_2.

Subject Code (s) in order of priority:	4.0 2.3.2 5.1

Principal Investigator's Name:

R. P.Angle
Contract Manager

Agency & Department: Air Quality Control Branch
Alberta Environment

Address: 9820 - 106 Street
Edmonton, Alberta
T5K 2J6

Phone: (403) 427-5893

Co-operating agencies and investigators (if applicable): W. A. Murray, Promet Environmental Group
J. E. Hunt , Concord Scientific Corporation

Duration of each phase:

a) Assessment of methodologies - to December 1980
b) Design and construction of test facility - to April 1981
c) Field testing of methods - to October 1983

Approximate Cost (indicate applicable yearly period):

1980-81: $75,000.
1981-82: $60,000.
1982-83: $50,000.

Objectives:

a) To document the characteristics and practicality of each measurement technique.
b) To test two of the methods in a controlled field situation.
c) To pilot the development of a definitive means of measuring the dry deposition of sulphur dioxide near a sour gas plant.

Method:

a) Determine measurement system characteristics from theoretical considerations and literature search.
b) Assess benefit-to-cost and feasibility.
c) Design and construct field testing facility.
d) Test two techniques under varying stabilities, seasons and receptor conditions.

Anticipated Results:

Final report (a) documenting the measurement characteristics, benefit-to-cost assessment, field testing facility, field testing methodology, field test results, and preliminary deposition velocities with confidence limits: (b) making recommendations with respect to the adequacy of existing techniques, the need for further developments in instrumentation, and the design of a full-scale field program in the vicinity of a sour gas plant.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Opto-Acoustic Laser System

Subject Code (s) in order of priority:	4.0

Principal Investigator's Name:

T. Crane: UltraLasertech (Contract)

Agency & Department: Department of the Environment

Address: Atmospheric Environment Service
4905 Dufferin Street
Downsview, Ontario

Phone:

Co-operating agencies and investigators (if applicable):

Duration of each phase: Four months

Approximate Cost (indicate applicable yearly period): 1980 - 1981: $56K

Objectives: To manufacture dual cell feature for opto-acoustic laser system for measurement of HNO_3.

Method: Opto-acoustic measuring system

Anticipated Results: To lower detection limit for the continuous measurement of gaseous nitric acid in the ambient atmosphere.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Instrumentation

Subject Code (s) in order of priority:	4.0 2.2.2 3.2.4

Principal Investigator's Name:

Ray Desjardins

Agency & Department: LRRI, Agriculture Canada

Address: Agmet Section
LRRI
Bldg. # 74
C.E.F.
Ottawa, Ontario
K1A 0C6

Phone: (613) 995-9039

Co-operating agencies and investigators (if applicable): Engineering Research Services
Agriculture Canada

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives: Develop a system to measure the flux of gases - particularly NH_3 and oxides of nitrogen.

Method: The method is based on an eddy flux integrating technique. It has been mainly used to measure evapotranspiration and CO_2 exchange. It lends itself very well to the measurements of fluxes of gases such as oxides of nitrogen and ammonia.

Anticipated Results: We expect to be able to determine how much ammonia is lost in gaseous form under different types of management and environmental conditions. Development of a portable system is very dependent on future funding.

Section 5

ANALYSIS

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Gas Chromatograph - Mass Spectometer Facility Support

Subject Code (s) in order of priority: 5.1 2.2.4

Principal Investigator's Name:

Kurt Anlauf

Agency & Department: Department of Environment
Atmospheric Environment Service

Address: 4905 Dufferin St.,
North York, Ontario

Phone: (416) 667-4794

Co-operating agencies and investigators (if applicable): B. Schroeder (AES)

Duration of each phase: April 1/80 - March 31, 1981

Approximate Cost (indicate applicable yearly period): $15K (O&M)

Objectives: To outfit a gas-chromatograph mass spectrometer facility with laboratory furniture, fume hoods, plumbing equipment and other supplies.

Method:

Anticipated Results: The GC-MS facility will be used to analyze environmental samples for organics and mercury compounds.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Soil Classification Analysis

Subject Code (s) in order of priority:	5.1

Principal Investigator's Name:

Ann Bohdanowicz

Agency & Department: Ontario Ministry of the Environment
Inorganic Trace Contaminants Section

Address: Laboratory Services Branch
P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3346

Co-operating agencies and investigators (if applicable): Phytotoxocology Unit
Air Resources Branch
- Marg Griffith

Duration of each phase: 1 year - on going

Approximate Cost (indicate applicable yearly period): $150,000.

Objectives: Precise and accurate chemical data leading to the classification of Ontario soils.

Method: Available on request.

Anticipated Results: Provision of chemical data which will be used to monitor long-term effects of acid precipitation on soils in Ontario.

Activity Title:

Opto-acoustic Laser System

Subject Code (s) in order of priority:	5.1

Principal Investigator's Name:

T. Crane: Ultra Lasertech (Contract)

Agency & Department: AES

Address:

Phone:

Co-operating agencies and investigators (if applicable):

Duration of each phase: 4 months

Approximate Cost (indicate applicable yearly period): 80/81: $56K

Objectives: To manufacture dual cell feature for opto-acoustic laser system for measurement of H NO_3.

Method: Opto-acoustic measuring system.

Anticipated Results: To lower detection limit for the continuous measurement of gaseous nitric acid in the ambient atmosphere.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Aluminum Speciation in Natural Waters

Subject Code (s) in order of priority:	5.1

Principal Investigator's Name:

Barry Loescher

Agency & Department: Ontario Ministry of the Environment
Inorganic Trace Contaminants Section

Address: Laboratory Services Branch
P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3775

Co-operating agencies and investigators (if applicable): Ministry of the Environment
Water Resources Branch
- Peter Dillon

Duration of each phase: Yearly / on-going

Approximate Cost (indicate applicable yearly period): $15,000: 1st year

Objectives: To provide accurate estimates of ionic, complexed and colloidal aluminum in natural waters.

Method: In development, extraction, AAS ion exchange.

Anticipated Results: Analytical data which will provide a better understanding of the fish toxicity relationship of aluminum and pH.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Metals Analysis of Lake, River Waters, Soils and Sediments

Subject Code (s) in order of priority:	5.1

Principal Investigator's Name:

Barry Loescher

Agency & Department: Ontario Ministry of the Environment
Inorganic Trace Contaminants Section

Address: Laboratory Services Branch
P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3775

Co-operating agencies and investigators (if applicable): Ministry of the Environment
Water Resources Branch
- Peter Dillon

Duration of each phase: Yearly, On-going

Approximate Cost (indicate applicable yearly period): $100,000/year

Objectives: Accurate and precise trace and ultratrace metals analysis in environmental samples.

Method: Graphite furnace a.a.s., preconcentration, i.c.p., solvent extraction a.a.s., anodic stripping voltammetry as required.

Anticipated Results:

a) Reliable metals data on the systems described.

b) Increasingly better performance at sub ppb levels.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Metals Analysis of Wet and Dry Precipitation Collectors from Monthly Monitoring

Subject Code (s) in order of priority:	5.1

Principal Investigator's Name:

Barry Loescher

Agency & Department: Ontario Ministry of the Environment
Inorganic Trace Contaminants Section

Address: Laboratory Service Branch
P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3775

Co-operating agencies and investigators (if applicable): Ministry of the Environment
Air Resources Branch
- Walter Chan

Duration of each phase: On-going

Approximate Cost (indicate applicable yearly period): $15,000/Year

Objectives: Precise and accurate analytical data on wet and dry precipitation samples.

Method: Wet samples taken, preconcentrated 20x and analyzed by inductively coupled plasma atomic emission spectroscopy. Wet and dry sample bags are acid leached and leachates analyzed as above. Data tabulated and forwarded to Air Resources Branch.

Anticipated Results: Reliable data on metals content of acid precipitation in Ontario.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Detection of Dissolved Inorganic Carbon at Low ppm Levels Using a Continuous Flow Colormetric Procedure.

Subject Code (s) in order of priority: 5.1, 3.1.1

Principal Investigator's Name:

Mr. W. B. Moody

Agency & Department: Ontario Ministry of the Environment
Lab Services Branch, Water Quality Section

Address: P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3512

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives: To optimize a low level dissolved inorganic colormetric procedure to be used for the determination of DIC in lakes surveyed by the Acidic Precipitation in Ontario study (for establishing a background data base and for studying primary productivity in a selected number of lakes).

Method:

a) Optimization of the preliminary method by studying effects of pH, time and temperature.

b) Conducting precision, interference and perishability studies.

c) Establishing a standard procedure for the low level DIC system.

Anticipated Results: A standard methodology will be established to detect low levels of dissolved inorganic carbon using a continuous flow colormetric procedure.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

An Automated Method for the Determination of Total Inflection Point Alkalinity in Poorly Buffered Lake Waters

Subject Code (s) in order of priority:	5.1 3.1.1

Principal Investigator's Name:

Mr. M. Rawlings
Mr. F. Tomassini

Agency & Department: Ontario Ministry of the Environment
Lab Services Branch, Water Quality Section

Address: P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3512

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives: To provide a relatively inexpensive automated tetration system for precise low-level total inflection point alkalinity measurements.

Method:

a) Design, build and acquire the necessary hardware to provide reading, control and data analysis (hardware will consist of a digital pH meter, an auto burette, a microcomputer and an in-house design interface).

b) Develop the software to operate the system as a differentially controlled titration system with suitable data output.

Anticipated Results: An automated titration system will be developed to provide routine analysis of poorly buffered lake samples for total inflection point alkalinity.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Identification of Particulates Present in Precipitation Samples Using Scanning Electron Microscopy

Subject Code (s) in order of priority:	5.1 3.1.1

Principal Investigator's Name:

Dr. P. Roberts

Agency & Department: Ontario Ministry of the Environment
Lab Services Branch, Water Quality Section

Address:
P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3512

Co-operating agencies and investigators (if applicable):

MOE Air Resources Branch
Dr. W. Chan

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives:

To utilize the analytical technique of Scanning Electron Microscopy to study particulates present in precipitation samples collected under the Acid Precipitation in Ontario Study.

Method:

a) Initial characterization of particulates present.

b) Optimization of analytical capability.

c) Routine analysis provided for APIOS users.

Anticipated Results:

a) Provide a background data bank of normal particulates present in APIOS samples.

b) Recognize and characterize any anomalies found.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Acidity Component Fractionation

Subject Code (s) in order of priority: 5.1 2.4.1

Principal Investigator's Name:

Mr. F. Tomassini

Agency & Department: Ontario Ministry of the Environment
Lab Services Branch, Water Quality Section

Address:
P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3512

Co-operating agencies and investigators (if applicable):

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives:

To establish a standard methodology for determining the major acidic components in precipitation samples collected under the APIOS Program.

Method:

a) Develop an adequate quality control program for acidity.

b) Determine the effect of various methodologies on the carbonic acid component in precipitation samples.

c) Attempt to differentiate between strong and weak acid contributions to the acidity in precipitation samples.

Anticipated Results:

A standard methodology will be developed to the extent of providing as much information as possible regarding the acidity of precipitation samples.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

The Extraction and Analysis of Sequential Samples Filters

Subject Code (s) in order of priority:	5.1

Principal Investigator's Name:

Mr. F. Tomassini

Agency & Department: Ontario Ministry of the Environment
Lab Services Branch, Water Quality Section

Address: P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone: (416) 248-3512

Co-operating agencies and investigators (if applicable):

Atmospheric Environment Service	(Mr. P. Fellin)
Ontario Hydro	(Dr. H. Mehdi)
Air Resources Branch (MOE)	(Dr. W. Chan)

Duration of each phase:

Approximate Cost (indicate applicable yearly period):

Objectives:

To develop a standard procedure for the extraction and analysis of teflon, nylon and K_2CO_3/glycerol impregnated Whatmen 41 filters for the simultaneous sampling of particulate MO_3^-, SO_4^-, NH_4^+, aerosol HNO_3 and gaseous SO_2.

Method:

a) Evaluate existing methodologies of extraction.

b) Recommend the most appropriate analytical technique for analysis of filter extracts.

c) Co-operate with other agencies to develop a standard method of analysis for these types of samples.

Anticipated Results:

A standard methodology will be established for the extraction and analysis of sequential sample filters. This methodology will be applied to the analysis of routine samples submitted under the Acid Precipitation in Ontario study.

LRTAP ACTIVITY DESCRIPTION

Activity Title:
Evaluation of Filter Media and Analytical Methods for the Measurement of Particulate Sulphates and Nitrates in the Atmosphere Using the High Volume Sampler

Subject Code (s) in order of priority:	5.2

Principal Investigator's Name: Dr. R. D. S. (Sam) Stevens
Concord Scientific Corporation
2 Tippett Road
Downsview, Ontario

Agency & Department: Under Contract to:
Environment Canada

Address: Environmental Protection Service
Air Pollution Control Directorate
Ottawa, Ontario
K1A 1C8

Phone: Scientific Authority:
R. J. LaFleur, Head

Co-operating agencies and investigators (if applicable): Ambient Monitoring Section
(613) 998-4272

Duration of each phase: August 1980 to March 1981

Approximate Cost (indicate applicable yearly period): $12,955.00

Objectives: To review and synthesize into a report all the available literature on the sampling and analytical methodology for high volume sampling of sulphates and nitrates.

Method: Review and analysis of published literature and of field evaluation data obtained by Environment Canada, Environmental Protection Service

Anticipated Results: The identification of preferred sampling and analytical methodologies that may be applied for the monitoring of sulphate and nitrate in air pollution surveillance networks and especially in the National Air Pollution Surveillance (NAPS) network.

Section 6

MITIGATION

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Neutralization studies

Subject Code (s) in order of priority:	6.1 3.1.2 3.1.3 3.1.4

Principal Investigator's Name:

P. Dillon

Agency & Department: Ministry of the Environment

Address:

P. O. Box 213
Rexdale, Ontario
M9W 5L1

Phone:

(416) 248-3058

Co-operating agencies and investigators (if applicable):

Duration of each phase: 5 years for first phase

Approximate Cost (indicate applicable yearly period): 1981/82: ≃$200K

Objectives:

To determine the best methods for neutralizing already acidified water bodies, and maintaining acid neutralizing capacity in those in which it is declining.

Method:

Whole-lake and whole-stream neutralization experiments using a variety of techniques will be carried out (beginning in 1981). Chemistry and biology of the treated systems will be studies so that a quantitative model can be developed.

Anticipated Results:

This work should result in development of a predictive model that will define the best neutralization approach for each water body considered.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Hatching Survival and Growth of Rainbow Trout in a Limed Stream

Subject Code (s) in order of priority: 6.1 3.1.4

Principal Investigator's Name:

John Gunn

Agency & Department: Ontario Ministry of Natural Resources

Address: P. O. Box 3500, Station "A",
Sudbury, Ontario
P3A 4S2

Phone: (705) 522-7823

Co-operating agencies and investigators (if applicable): Ontario Ministry of Environment
W. Keller

Duration of each phase: May - June 1980

Approximate Cost (indicate applicable yearly period): $3,000.00

Objectives: To test the effectiveness of a limestone barrier for improving the hatch and survival of rainbow trout in a stream subject to spring time pH depression.

Method: Background: Limestone barrier (350 m tons) built by the Ontario Ministry of Environment in 1979. Detailed chemical data collected above and below barriers by M.O.E. from spring 1979 to present.

a) Hatching rates determined for eggs held in incubators above and below barrier.

b) Survival and growth of alevin determined from holding sites (above and below barrier).

Anticipated Results: Report to be issued after internal review.

Interim Mitigative Measures: Terrestrial

No first priority projects

Section 7

DATA STORAGE

Data Storage and Retrieval Systems

No first priority projects

Section 8

OTHER STUDIES OR ACTIVITIES

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Feasibility Study of Breeding or Mass Culturing Acid Resistant Invertebrates and Fish for Restocking Acid Affected Lakes and Streams (Planned)

Subject Code (s) in order of priority:	8.0 6.1

Principal Investigator's Name:

B. Ayles and
J. Flannagan

Agency & Department: Department of Fisheries and Oceans
Freshwater Institute

Address: 501 University Crescent
Winnipeg, Manitoba
R3T 2N6

Phone: (204) 269-7379

Co-operating agencies and investigators (if applicable): Contract Person

Duration of each phase: Until April 1/81

Approximate Cost (indicate applicable yearly period): 1980/81: $15,000.00

Objectives:

To search the literature, sample areas which contain acid resistant strains of fish and Ephemeroptera, in an attempt to assess the feasibility of obtaining and breeding or culturing acid and stocking resistant strains or species of fish and aquatic invertebrates.

Method:

a) Literature search to be carried out.
b) Areas known to contain acid resistant strains or species of animals to be sampled.
c) Biologists in these to be contacted and availability of specimens ascertained.

Anticipated Results:

a) Report produced on feasibility of procuring, breeding, culturing and the likely success of restocking, affected waterbodies.

b) Availability of animals documented.

DESCRIPTION DES ACTIVITÉS DU PROGRAMME D'ÉTUDE DU TGDPA

Titre de l'activité de recherche:

Bibliographie

Code du (des) sujet(s) par ordre de priorité : 8.0

Nom du chercheur responsable :

Lucie Brunelle

Ministère, organisme ou organisme privé, service : Environnement Canada
Direction des eaux intérieures

Adresse: 2700 boul. Laurier
Edifice Champlain, Place Laurier
C. P. 10100
Ste-Foy, Qué.
G1V 4H5

Téléphone: (418) 694-3921

Collaborateur(s), organisme(s) et chercheur(s) (le cas échéant) :

Durée de chaque phase: En continu

Côut approximatif (indiquer pour quelle période annuelle):

80/81

Objectifs de travail:

a) Mettre à la portée des chercheurs toute la documentation scientifique pertinente relative aux pluies acides.

b) Classer et cataloguer toute la documentation de façon à la rendre accessible au plus grand nombre d'usagers possible.

c) Diffuser une bibliographie qui soit la plus complète possible.

Méthode de travail : Dépouillement de bibliographies de périodiques, d'articles, de rapports.

a) Recherches bibliographiques dans les banques de données.

b) Commander des documents.

c) Classement des documents par ordre d'entrée et sujets.

Résultats prévus: Bibliographie complète.

Activity Title:

Analysis of Water Samples Collected by Federal Agencies at Request of Water Quality Branch to Supplement Information on Acid Rain Sensitivity and Trend Assessment.

Subject Code (s) in order of priority: 8.0

Principal Investigator's Name:

Thomas A. Clair
Dr. T. L. Pollock

Agency & Department: Environment Canada, Water Quality Branch

Address: P. O. Box 861
Moncton, N. B.
E1C 8N6

Phone: (506) 388-6606

Co-operating agencies and investigators (if applicable): Canadian Wildlife Service
Canada Department of Fisheries

Duration of each phase: April 1978 - April 1981
(To be evaluated each year)

Approximate Cost (indicate applicable yearly period): $5,500.00 AOM, 0.5 PY

Objectives: To acquire information from surface waters in Atlantic Canada not included in ongoing sensitivity and trend assessment projects.

Method: The participating agencies use sample containers supplied by the Water Quality Branch. The samples are analysed for pH, major ions and metals.

Anticipated Results:

a) All edited data will be placed on NAQUADAT.

b) Information will be used by Water Quality Branch and IWD in development of sensitivity maps, trend assessment and be available to those working on control strategies and in Research.

LRTAP ACTIVITY DESCRIPTION

Activity Title: Coordination of Environmental Conservation Service, LRTAP Aquatic Effects Program

Subject Code (s) in order of priority:	8.0

Principal Investigator's Name: F. C. ELDER

Agency & Department: Department of Environment, National Water Research Institute

Address: Canada Centre for Inland Waters
Box 5050, Burlington, Ontario L7R 4A6

Phone: 416 637-4212

Co-operating agencies and investigators (if applicable): Other DOE LRTAP programs in particular the Terrestrial Effects program coordinated by Dr. P. J. Rennie and DFO aquatic effects program.

Duration of each phase: Indefinite

Approximate Cost (indicate applicable yearly period): 0.3 PY 5K operations costs

Objectives: To develop and coordinate the ECS aquatic effects program through cooperative planning with the ECS regional laboratories and in conjunction with the other active components of Federal and Provincial LRTAP efforts.

Method:

Anticipated Results: A coordinated LRTAP program to provide an increased understanding of the interaction and influences of atmospheric deposited materials and the aquatic ecosystem.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Effects of Hydroelectric Development on Water Quality Parameters

Subject Code (s) in order of priority: 8.0

Principal Investigator's Name:

David J. Kiell

Agency & Department: Environmental Services Department
Newfoundland and Labrador Hydro
Address: Box 9100
Philip Place
St. John's, Newfoundland

Phone: (709) 737-1209

Co-operating agencies and investigators (if applicable): N/A

Duration of each phase: Initiated August 1979
Competion date unknown

Approximate Cost (indicate applicable yearly period): $20,000.00/year.

Objectives:

a) To quantitatively measure changes in water quality parameters caused by reservoir creation and project construction and operation on water quality in the affected watershed.

b) Develop ability to predict environmental impact of future hydroelectric developments.

Method:

a) Obtain predevelopment water chemistry data in reservoirs and selected streams in hydroelectricity project areas. Parameters measured include: pH, temperature, turbidity, suspended solids, total hardness, total alkalinity, dissolved oxygen, chloride, calcium.

b) Return to the sampling points during construction, first year of operation, and periodically thereafter and measure the same parameters.

c) Similar information will be obtained at water bodies outside the project area to be controlled.

d) Analysis will be done at Memorial University of Newfoundland.

e) Compare years and describe the impact of hydroelectric developments on water quality parameters.

f) Develop predictive tools, if possible, for assessment of future development.

Anticipated Results:

a) Results and discussions will appear in consultants reports. These will be public documents after they have undergone technical review.

b) An overview will be done periodically throughout the study and an internal report will be prepared.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Federal LRTAP Scientific Program Office

Subject Code (s) 8.0 in order of priority:

Principal Investigator's Name:

Dr. Hans C. Martin

Agency & Department: Environment Canada

Address: Atmospheric Environment Service
4905 Dufferin Street
Downsview, Ontario
M3H 5T4

Phone: (416) 667-4803/4885

Co-operating agencies and investigators (if applicable):

Duration of each phase: Throughout duration of Federal LRTAP Program

Approximate Cost (indicate applicable yearly period): Approximately $40K/Year

Objectives:

To lead, coordinate, review and update Federal LRTAP Scientific Program; prepare program plans, reports, briefs, serve as focal point for LRTAP scientific information dissemination.

Method:

Prepare Federal LRTAP Scientific Program plans and financial submissions.

Coordinate overall program reviews and evaluations, reports on milestones, new data, make recommendation to senior management on changes in priorities or direction.

Document resource utilizations.

Disseminate scientific information.

Stimulate public LRTAP awareness.

Anticipated Results:

A well organized, coordinated Federal LRTAP Scientific Program. The planning, preparation and distribution or managing of: Scientific reference materials, reviews and evaluations, research coordination catalogues, public information brochures, scientific conferences and workshops.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

Environmental Sulphur Research in Alberta: A Review

Subject Code (s) in order of priority:	8.0

Principal Investigator's Name:
Drs. H. S. Sandhu; H. P. Sims; R. A. Hursey;
W. R. MacDonald & B. R. Hammond

Agency & Department: Alberta Environment
Research Management Division

Address: 9820 - 106 Street
Edmonton, Alberta
T5K 2J6

Phone: (403) 427-3943

Co-operating agencies and investigators (if applicable):

Duration of each phase: 1977 - 1980

Approximate Cost (indicate applicable yearly period): In House

Objectives:

a) To compile a bibliography of published Alberta literature related to sulphur research.
b) To document total industrial sulphur emissions for the province.
c) To review and analyze available Alberta environmental research information.
d) To identify future research needs.

Method: Common method of review literature.

Anticipated Results: Review completed and recommendattions made.

Final report available.

LRTAP ACTIVITY DESCRIPTION

Activity Title:

New Brunswick Task Force on Long-Distance Drift of Forest Insecticides

Subject Code (s) in order of priority:	8.0	Incorporating 1.2, 2.1.1, 2.1.2, 2.2.4, 2.3.1, 2.4.1, 2.5.4, 3.2.3, 3.2.4, 3.3

Principal Investigator's Name:

Dr. I. W. Varty, Chairman of Task Force

Agency & Department: Canadian Forestry Service
Maritimes Forest Research Centre

Address: Box 4000
Fredericton, N. B.
E3B 5G4

Phone: (506) 453-4501

Co-operating agencies and investigators (if applicable): UNB Chemical Engineering - Dr. J. J. C. Picot
NB Research & Productivity Council - Drs. P. J. Silk & C. J. Wiesner
NRCC National Aeronautics Establishment-Dr. R. Crabbe
NHW Bureau of Chemical Hazards - Dr. C. A. Franklin

Duration of each phase: 1978 - 1980 Task Force
1979 - Indefinite: Research investigations recommended

Approximate Cost (indicate applicable yearly period): 1979 - $15,000 Task Force per se
1980 - $ 5,000

Objectives:

a) To prepare a statement on the state of the art in drift science.

b) To make recommendations for research to close gaps in knowledge with reference to generation, behavior and fate of insecticide aerosols and vapours resulting from aerial spraying.

Method:

a) Conference on long-range transport, atmospheric chemistry and ecology of drift detection and effects.

b) Preparation of reports to sponsor (NB Dept. of Natural Resources), with publication of conference proceedings and final review.

c) Promotion of modelling studies for drift transport and atmospheric chemistry to obtain data for toxicological assessment of public health risk.

Anticipated Results:

a) Satisfactory accountancy of air contamination and surface deposits of formulated insecticides.

b) Provision of data to public health authorities and pesticide regulating agency.

c) Predictive models of transport adaptable to sprayed materials not yet in use.

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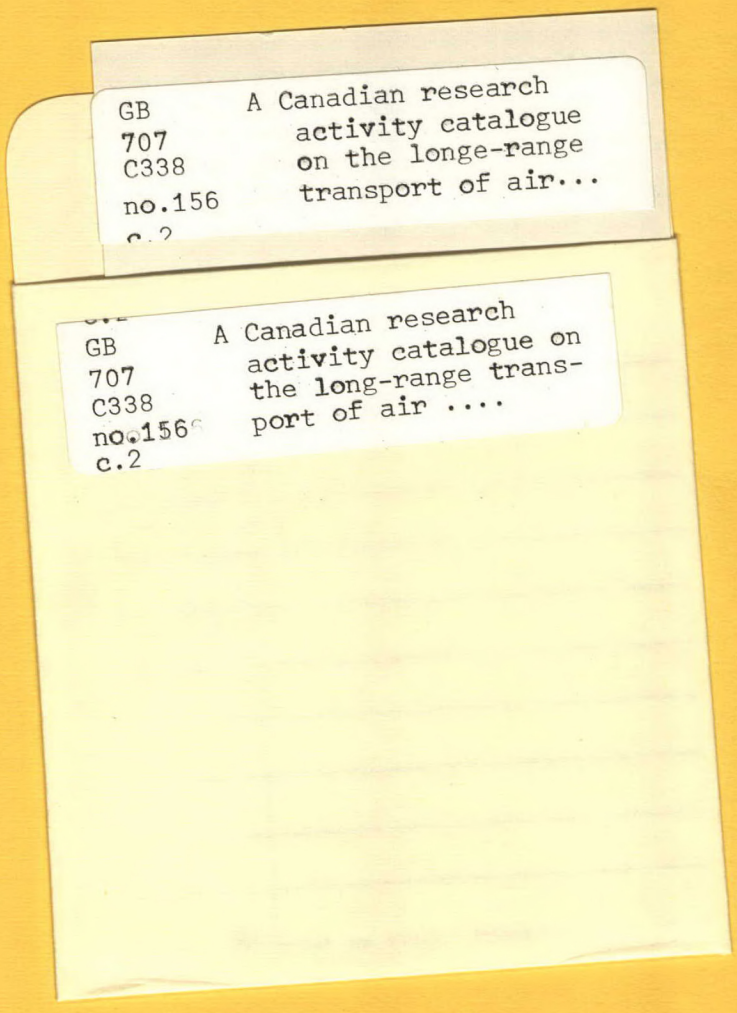

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