



ORGANIZATIONAL AND TECHNICAL ACTIVITY SUMMARY

Public-Private Atmospheric Research in Support of Air Quality Management

The NARSTO partnership is a non-binding, **tri-national public/private alliance**, open to science agencies, regulatory agencies, regulated industries, academic institutions, environmentalists, and public interests groups in Canada, Mexico and the United States. The NARSTO program is an U. S. Presidential Research Initiative established under the guidance of the National Science and Technology Council (NSTC), Committee on Environment and Natural Resources (CENR). The NARSTO research program and organizational structure were instituted with the Charter Signing Ceremony hosted by the Office of Science and Technology Policy at the White House on February 13, 1995.

NARSTO membership consists of three types. **Sponsoring Partners** comprise the Executive Assembly. They are Charter signatories and each brings resources to the program. They are encouraged to appoint one representative to the Science and Resource Planning Group (S&RPG), where funding allocation decisions are made. **Participating Partners** primarily represent the university and contractor communities. They are Charter signatories and each institution brings valued expertise and experience to NARSTO program planning and assessment activities. However, since they represent potential recipients of NARSTO work, they are restricted from serving on the Executive Assembly and the Science & Resource Planning Group to avoid conflict of interest. **Affiliated Partners** are organizations that operate outside the current geographical or scientific scope of NARSTO, but have commensurate interests. Such organizations may request membership, and upon approval by the NARSTO Executive Steering Committee, will be granted membership as an Interorganizational Liaison Group. Affiliated Partners do not sign the Charter. Affiliated Partners do enter into a reciprocal relationship for the purposes of information exchange and collaboration and they agree that the reciprocating parties will cover all expenses associated with such activities.

The NARSTO **mission** is to plan, coordinate, and facilitate comprehensive, long-term, policy-relevant scientific research and assessment of primary and secondary pollutant species emitted, formed, transformed, and transported in the troposphere over the North American continent. The current emphasis is directed toward the study of ozone, particulate matter, and their precursors. To accomplish this mission, NARSTO provides a cross-organization planning process that determines the most effective strategies for scientific investigation, and establishes and maintains effective communication channels with the policy, control technology, and health and ecological effects communities.

The **central programmatic goal** of NARSTO is to provide data and information for use in the determination of workable, efficient, and effective strategies for local and regional ozone and fine particle management. NARSTO is guided by the long-term (10-Year), science-focused, policy-relevant research plan described in the document entitled, *NARSTO Research Strategy and Charter (November 1994)*, and the Strategic Execution Plan that establishes the near-term research agenda. These documents can be downloaded from the NARSTO Web Page.

The NARSTO **research focus** is in four broad technical program areas: (1) Atmospheric Chemistry and Modeling Research, (2) Emissions Research, (3) Observations Research, and (4) Integrated Analysis and Assessment. NARSTO limits its research activities to the measurement and analysis of atmospheric processes that occur between the source and the receptor. NARSTO coordinates information exchange and collaboration with other scientists and policy-makers (both national and international) through liaison arrangements.

The NARSTO partnership is engaged in several data and information gathering and dissemination activities including critical science reviews, state-of-science assessments, and data archival and retrieval systems development. **Some of the major regional field campaigns** linked to NARSTO through the Observations Research program area include: NARSTO-Northeast (NE), NARSTO-Canada East (CE), the Southern Oxidants Study (SOS), the Southern California Ozone Study-1997 (SCOS97-NARSTO), the study coordinated by the University of Michigan -- the Program for Research on Oxidants: Photochemistry, Emissions, and Transport (PROPHET), and the California Regional PM_{2.5}/PM₁₀ Air Quality Study (CRPAQS). **Other major research activities** include the Tri-National Model Intercomparison Study and the projects planned and implemented by the VOC Reactivity Research Working Group. Each of these activities is linked to NARSTO through the Modeling and Chemistry Research program area.

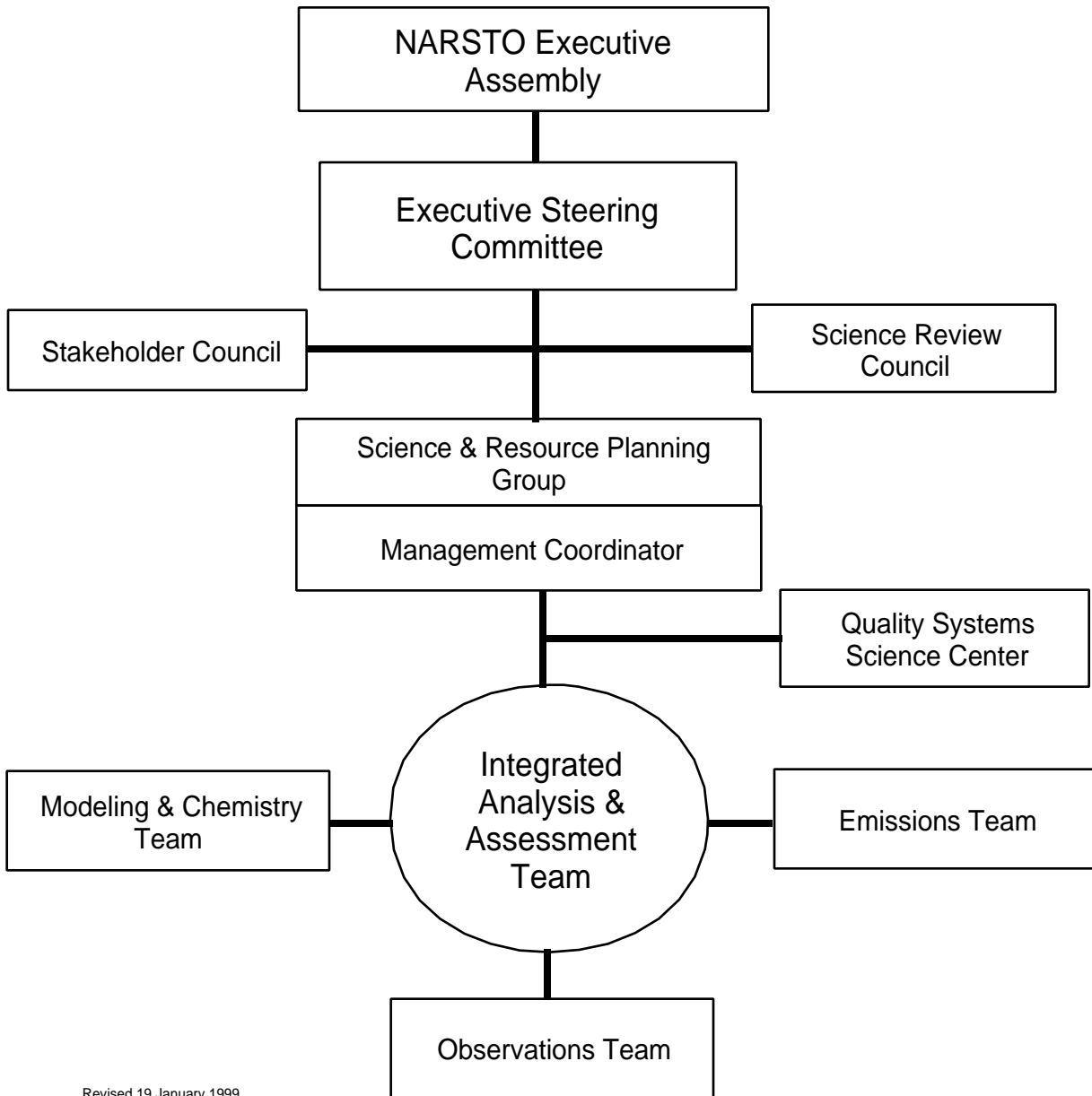
Quality Assurance and Data Management assistance and guidelines are available to all NARSTO research planners, project managers, and principal investigators through the NARSTO Quality Systems Science Center located at the Department of Energy's Oak Ridge National Laboratory (<http://cdiac.esd.ornl.gov/programs/NARSTO/>). The NARSTO **Methods Compendium** has been developed and made available on the Internet (<http://narsto.esd.ornl.gov/Compendium/>). The NARSTO **Permanent Data Archive** is maintained by the NASA EOSDIS Distributed Active Archive Center at the Langley Research Center (<http://eosweb.larc.nasa.gov/>). **Peer Review** of NARSTO research plans, major products, and science management practices is coordinated by the U.S. National Academy of Sciences.

Annual program costs are estimated on the basis of the independently funded NARSTO-related research and management tasks reported by the Sponsoring Partners. The reported task descriptions and associated costs allow NARSTO management to (1) inventory ongoing and planned research for comparison with the research priorities agreed upon in the NARSTO Strategic Execution Plan, and (2) provide a measure of the financial commitment from the various stakeholder communities. Figure 1 shows the NARSTO organizational structure. Appendix A describes key organizational roles, identifies the Partners, and lists the scientists and policy-makers who are presently serving in NARSTO leadership positions.

The **1999 State-of-Science Assessment Report** will be the first NARSTO science assessment. Although, the primary intent of the Assessment Report is to inform the Mexican, Canadian and U.S. policy communities, the Report will not make policy recommendations. Appendix B delineates the specific policy and science questions that will guide the development of this Assessment Report. The scientific inferences in the Report will be derived from the critical review papers commissioned by NARSTO and prepared by experts on the subjects listed in Appendix C. Both the critical review topics and the science and policy questions were developed in workshops sponsored by the NARSTO Integrated Analysis and Assessment Team.

Attachments

Figure 1
NARSTO Organization Chart



Revised 19 January 1999

NARSTO KEY ROLES AND PRINCIPLE DOCUMENTS

KEY ROLES

Executive Assembly (EA) -- Determines ESC composition, appoints members, and approves replacements.

Executive Steering Committee (ESC) -- Establishes overall strategy (i.e., vision, mission, policy, guidelines); approves research plans, assessment reports, and other major outputs; acquires resources; establishes process for assigning resources to research activities; and selects and approves NARSTO leaders.

Science and Resource Planning Group (S&RPG) -- Defines and coordinates the research needed to address the prioritized science and policy issues; identifies and prioritizes program-level needs, activities, and resources; and recommends which sponsoring organization(s) might fund activities.

Management Coordination Office (MCO) -- Recommends technical team leaders; oversees program quality assurance and data management; and coordinates program planning, implementation, integration, assessment, outreach, information dissemination, communication, and technology transfer. The Management Coordinator serves as Executive Secretary of the S&RPG.

Science Team (ST) -- Sets the research agenda. There are science team co-chairs appointed for each of the following four broad technical areas: *modeling and atmospheric chemistry; emissions; observations, meteorology, and methods development; and integrated analysis and assessment.*

Science Review Council (SRC) -- Reviews research plans and draft products; conducts bi-annual program reviews; provides counsel on **science issues**; and evaluates science management practices. The SRC is a standing committee of the **National Research Council** established by the **U.S. National Academy of Sciences**.

Stakeholder Council (SC) -- Communicates *across NARSTO community*; reviews draft products; provides counsel (to ESC and MCO) on **policy issues**; evaluates integration and assessment, long-/short-term research balance and research priority issues; and provides advice regarding leadership appointment decisions.

Quality Systems Science Center (QSSC) -- Develops quality systems and data management guidelines and procedures, and provides assistance to NARSTO research managers and principal investigators. The Oak Ridge National Laboratory manages the QSSC. The **NARSTO Permanent Data Archive** is maintained by the Distributed Active Archive Center at the NASA-Langley Research Center.

PRINCIPLE DOCUMENTS

NARSTO Research Strategy and Charter (November 1994) -- A science-focused, policy-relevant, long-term (10-year) research agenda. Distributed for review and comment to 600 scientists, air quality managers, and environmental policy makers in North America and Europe. Developed through technical workshops and the collaborative efforts of EPA-ORD, NOAA, EPRI, and CARB, in response to the 1991 NRC report, *Rethinking the Ozone Problem in Urban and Regional Air Pollution*. The Research Strategy was adopted, by the Executive Assembly on February 13, 1995, and serves as the primary NARSTO research program guide. On February 14, 1995, the Executive Steering Committee approved the Charter as the guide for NARSTO organizational governance.

NARSTO Quality Systems Management Plan -- A comprehensive guideline document for planning, managing, and ensuring NARSTO product quality, credibility, integrity, accessibility, and delivery. This Plan is available through the Internet (<http://cdiac.esd.ornl.gov/programs/NARSTO/narsto.html#qsmp>).

NARSTO Quality Planning Handbook – Guidance for developing project and program Quality Integrated Work Plans, Data Quality Objectives, Standard Operating Procedures, and Quality Assessment Reports. This Handbook is available through the Internet (<http://cdiac.esd.ornl.gov/programs/NARSTO/narsto.html#qsmp>).

NARSTO Data Management Handbook – Recommendations and guidance on data reporting, data validation, data documentation and transmittal, data archival and dissemination, software configuration control, and data management system administration. This Handbook is available through the Internet (<http://cdiac.esd.ornl.gov/programs/NARSTO/narsto.html#qsmp>).

NARSTO Methods Compendium – A convenient reference source for atmospheric measurement techniques for ozone, ozone precursors, aerosol precursors, particulate matter, and meteorological parameters. The Compendium covers methods for in-situ and remote sensing, continuous and integrated techniques, and will include method applications for both routine monitoring and the latest R&D methods. The Compendium is accessible on the Internet (<http://narsto.esd.ornl.gov/Compendium>).

NARSTO Strategic Execution Plan -- A document derived directly from the NARSTO Research Strategy and Charter, and provides a quantitative description of the projected scientific program, including definitive characterization of near-term (three-to-five years) scientific tasks, their schedules, their priorities, and their deliverable milestones. [Three of five chapters completed as of this date.] Chapter Four will be the PM research agenda and Chapter Five will be the VOC reactivity research agenda.

NARSTO State-of-Science Ozone Assessment Report -- A document that will address specific science and policy questions. The NARSTO Assessment Synthesis Team will base its writings on 18 critical review papers commissioned from recognized experts in the related fields. The science and policy questions and the critical review topics were developed out of workshops facilitated by the NARSTO Analysis and Assessment Team. The Ozone Assessment Report is scheduled for delivery in late 1999.

NARSTO SPONSORING PARTNERS

Sponsoring Partners comprise the Executive Assembly. The following list of organizations (governmental, sub-governmental, and private sector institutions) in Canada, Mexico and the United States have signed the NARSTO Charter and concur with the research needs, goals, and approaches described in the NARSTO Research Strategy. Each Sponsoring Partner accepts the organizational structure and governance contained in this Charter, intends to cooperate through existing bilateral and trilateral environmental agreements such as those mentioned in the Charter (where appropriate), and intends to individually sponsor portions of the research and development described in the NARSTO Research Strategy on an annual basis (subject to the availability of funds):

AMERICAN PETROLEUM INSTITUTE
 BALTIMORE GAS & ELECTRIC COMPANY
 CALIFORNIA AIR RESOURCES BOARD
 CHEMICAL SPECIALTIES MANUFACTURERS ASSOCIATION
 COMMONWEALTH EDISON
 COMMONWEALTH OF MASSACHUSETTS, EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
 COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL RESOURCES
 CONECTIV
 COORDINATING RESEARCH COUNCIL, INC.
 DUNN-EDWARDS CORPORATION
 DUQUESNE LIGHT COMPANY
 E.I. DUPONT de NEMOURS & COMPANY
 EASTMAN KODAK COMPANY
 EDISON ELECTRIC INSTITUTE
 ENVIRONMENT CANADA, ATMOSPHERIC ENVIRONMENT SERVICE
 EPRI
 FIRST ENERGY CORPORATION
 FORD MOTOR COMPANY, FORD RESEARCH LABORATORY
 GENERAL MOTORS CORPORATION
 INSTITUTO MEXICANO del PETROLEO - MEXICO
 INSTITUTO NACIONAL de ECOLOGIA, MINISTRY FOR THE ENVIRONMENT (SEMARNAP) - MEXICO
 LAKE MICHIGAN AIR DIRECTORS CONSORTIUM
 LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY
 LYONDELL CHEMICAL COMPANY
 MARYLAND DEPARTMENT OF THE ENVIRONMENT
 MID-ATLANTIC REGIONAL AIR MANAGEMENT ASSOCIATION (MARAMA)

NARSTO SPONSORING PARTNERS

(Continued)

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
NATIONAL RENEWABLE ENERGY LABORATORY
NATIONAL SCIENCE FOUNDATION
NEW ENGLAND ELECTRIC SYSTEM
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION & ENERGY
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
NEW YORK STATE ELECTRIC & GAS CORPORATION
NEW YORK STATE ENERGY R&D AUTHORITY
NORTHEAST STATES FOR COORDINATED AIR USE MANAGEMENT (NESCAUM)
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEASTERN STATES POWER COMPANY
NORTHERN INDIANA PUBLIC SERVICE COMPANY
ONTARIO MINISTRY OF THE ENVIRONMENT
PECO ENERGY COMPANY
PENNSYLVANIA POWER & LIGHT COMPANY
PENRECO
POTOMAC ELECTRIC POWER COMPANY
PUBLIC SERVICE ELECTRIC & GAS COMPANY
SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
SOUTHERN COMPANY SERVICES
TENNESSEE VALLEY AUTHORITY
TEXAS NATURAL RESOURCES CONSERVATION COMMISSION
THE UNITED ILLUMINATING COMPANY
U. S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE
U. S. DEPARTMENT OF DEFENSE, AIR FORCE RESEARCH LABORATORY
U. S. DEPARTMENT OF ENERGY, FEDERAL ENERGY TECHNOLOGY CENTER
U. S. DEPARTMENT OF ENERGY, OFFICE OF ENERGY RESEARCH
U. S. DEPARTMENT OF INTERIOR, NATIONAL PARK SERVICE
U.S. DEPARTMENT OF COMMERCE, NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF TRANSPORTATION, VOLPE NATIONAL TRANSPORTATION SYSTEMS CENTER
U. S. ENVIRONMENTAL PROTECTION AGENCY

NARSTO PARTICIPATING PARTNERS

Participating Partners primarily represent the university and contractor communities. They are Charter signatories and each institution brings valued expertise and experience to NARSTO program planning and assessment activities. However, since many are potential recipients of NARSTO work, they are restricted from serving on the Executive Assembly and the Science & Resource Planning Group (where NARSTO funding allocation decisions are made) to avoid conflict of interest. Each Participating Partner concurs with the research needs, goals, and approaches described in the NARSTO Research Strategy, and accepts the organizational structure and governance contained in this Charter:

ATMOSPHERIC AND ENVIRONMENTAL RESEARCH, INC.
ATMOSPHERIC RESEARCH & ANALYSIS, INC.
GEORGIA INSTITUTE OF TECHNOLOGY
HOUSE SUBCOMMITTEE ON ENERGY & ENVIRONMENT, U.S. CONGRESS
LAMAR UNIVERSITY, GULF COAST HAZARDOUS SUBSTANCE RESEARCH CENTER
MICROELECTRONICS CENTER OF NORTH CAROLINA
MIDWEST RESEARCH INSTITUTE
NORTH CAROLINA STATE UNIVERSITY
RADTECH INTERNATIONAL NORTH AMERICA
RESEARCH TRIANGLE INSTITUTE
SASKATCHEWAN RESEARCH COUNCIL
SONOMA TECHNOLOGY, INCORPORATED
STATE UNIVERSITY OF NEW YORK
THE PENNSYLVANIA STATE UNIVERSITY
THE SOUTHERN OXIDANT STUDY
UMDNJ - ROBERT WOOD JOHNSON MEDICAL CENTER
UNIVERSITY OF ALABAMA, HUNTSVILLE
UNIVERSITY OF CALIFORNIA, IRVINE
UNIVERSITY OF CALIFORNIA, RIVERSIDE
UNIVERSITY OF COLORADO, BOULDER
UNIVERSITY OF MARYLAND
UNIVERSITY OF MIAMI
UNIVERSITY OF MICHIGAN

NARSTO AFFILIATED PARTNERS

Affiliated Partners are organizations or groups that operate outside the current scope of NARSTO, but have commensurate interests. Such organizations may request membership, and upon approval by the NARSTO Executive Assembly, will be granted membership as an Interorganizational Liaison. Affiliated Partners do not sign the Charter, but do enter into a reciprocal relationship for information exchange and collaboration. Affiliated Partners also agree that all travel and other expenses will be paid by the reciprocating representatives, thus eliminating financial transactions between the two parties.

EUROTRAC -- A coordinated scientific research project for the study of pollutant transport and chemical transformation in the troposphere over Europe.

International Global Atmospheric Chemistry Project (IGAC) -- A core project carried out under the joint sponsorship of the International Geosphere-Biosphere Program and the Commission on Atmospheric Chemistry and Global Pollution of the International Association of Meteorology and Atmospheric Sciences.

NARSTO EXECUTIVE STEERING COMMITTEE

Federal Members

1. Department of Energy
Peter Lunn
Office of Biological and Environmental Research
2. National Oceanic & Atmospheric Administration
Daniel L. Albritton, Ph. D.
Director, Aeronomy Laboratory

Alternate Federal Members

- * Department of Interior
Mark Scruggs, Ph. D.
Acting Chief, Air Quality Division
- * Environmental Protection Agency
Gary J. Foley, Ph. D.
Director, National Exposure Research Laboratory
Office of Research and Development
- * Tennessee Valley Authority
Roger Tanner, Ph. D.
Senior Scientist

State Members

1. California Air Resources Board
Bart E. Croes
Chief, Planning & Technical Support Division
2. State of New Jersey Department of Environmental Protection
John C. Elston
Administrator, Air Quality Management

Alternate State Members

- * Lake Michigan Air Directors Consortium
Michael Koerber
Executive Director
- * New York State Department of Environmental Conservation
John P. Cahill, Esq.
Commissioner
- * Texas Natural Resource Conservation Commission
Cyril Durrenberger
Assistant Director, Air Quality Planning and Assessment

**NARSTO EXECUTIVE STEERING COMMITTEE
(Continued)**

Utility Members

1. EPRI
Peter K. Mueller, Ph. D.
Manager of NARSTO Programs
2. Pennsylvania Power and Light Company
Alfred F. Ferullo
Atmospheric Scientist

Alternative Utility Members

- * First Energy Corporation
Fred J. Starheim
Senior Environmental Engineer
- * Northeast Utilities Service Company
Dominic Scerbo
Manager, Environmental Programs
- * Public Service Electric & Gas Company
James Shissias
General Manager
- * The United Illuminating Company
David B. Damer
Director, Environmental Management

Industry Members

1. American Petroleum Institute
Howard J. Feldman (Private Sector Co-Chair Elect)
Research Program Coordinator
2. General Motors Corporation
Steve Cadle, Ph. D. (Private Sector Co-Chair - Term Ending Feb 2000)
Principal Research Scientist

Alternate Industry Members

- * Dunn-Edwards Corporation
Robert Wendoll
Director of Environmental Affairs
- * Ford Motor Company
David Chock, Ph. D.
Principal Research Scientist

**NARSTO EXECUTIVE STEERING COMMITTEE
(Continued)**

Canadian Member

1. Environment Canada, Atmospheric Environment Services
Don C. McKay, Ph.D. (Public Sector Co-Chair - Term Ending Feb 2001)

Alternate Canadian Members

- * Environment Canada, Atmospheric Environment Services
Maris Lusic, Ph.D.
- * Environment Canada, Atmospheric Environment Services
Carmelita Olivotto

Mexican Member

1. Instituto Nacional de Ecologia, Secretariat for the Environment, Natural Resources & Fisheries (SEMARNAP)
Adrian A. Fernandez-Bremauntz, Ph.D.
Director General for Environmental Management

Alternate Mexican Members

- * Instituto Nacional de Ecologia, SEMARNAP
Victor Hugo Paramo, Ph.D.
Deputy Director for Air Quality Management
- * Instituto Nacional de Ecologia, SEMARNAP
Victor Gutierrez-Avedoy
Director of the National Center for Environmental Research & Training (CENICA), SEMARNAP

NARSTO
-- FUNCTIONAL UNITS --

Management Coordinator	Dr. Jeremy (Jake) M. Hales (Envair)
Associate Management Coordinator	Mr. Ronald (Ron) K. Patterson (EPA)
Science Review Council	National Research Council Committee
Quality Systems Science Center (QSSC)	Dr. Les A. Hook Oak Ridge National Laboratory, Department of Energy
Permanent Data Archive	Langley Research Center, NASA (via the QSSC)
Stakeholder Council:	
Chairperson	Mr. Robert Wendoll (Dunn-Edwards Corp)
Research Representative	Dr. Ellis Cowling (NC State Univ)
Industry Representative	Dr. Steve Cadle (GM)
Utilities Representative	(OPEN)
U.S. Government Representative	Dr. Ari Patrinos (DOE)
Mexican Government Representative	Dr. Adrian Fernandez Bremauntz (INE-Mexico)
Canadian Government Representative	Dr. Don McKay (AES-Canada)
Interorganizational Liaison Groups:	
EUROTRAC	Dr. Peter Borrell (Garmisch-Partenkirchen, Germany)
IGAC	Dr. Alex Pszenny (Massachusetts Institute of Technology)
Technical Program Teams:	
Integrated Analysis & Assessment Team Co-Chairs	Ms. Marjorie Shepherd (E C - Canada) and Dr. George Hidy (UA-B)
Observations Team Co-Chairs	Dr. Fred Fehsenfeld (NOAA) and Dr. Don Hastie (York U-Canada)
Modeling/Chemistry Team Co-Chairs	Dr. Robin Dennis (EPA/NOAA) and Dr. S.T. Rao (NY DEC)
Emissions Team Co-Chairs	Mr. Cyril Durrenberger (TNRCC) and Mr. Larry Jones (EPA)

NARSTO Technical Programs:

VOC/NO _x Reactivity Research Working Group	Dr. Donald L. Fox (University of North Carolina-Chapel Hill)
Model intercomparison Study	Dr. Maris Lusic (AES-CAN) and Dr. Alan Hansen (EPRI)
Program for Research on Oxidants: Photochemistry, Emissions, and Transport (PROPHET)	Dr. Mary Ann Carroll (University of Michigan)
California Regional PM ₁₀ /PM _{2.5} Air Quality Study (CRPAQS)	Ms. Karen Magliano (CARB)
Southern Oxidant Study (SOS)	Dr. Ellis Cowling (North Carolina State University)
Texas 2000 Field Study of Ozone, PM _{2.5} , and Regional Haze	Mr. James Thomas (TNRCC)
Southeastern Aerosol Research and Characterization Study (SEARCH)	Dr. Alan Hansen (EPRI)
North East – Oxidant and Particle Study (NE - OPS)	Dr. Charles Russell Philbrick (Penn State University)
NARSTO - Northeast	Dr. Peter Mueller (EPRI)
NARSTO - Canada East	Dr. Don McKay (Environment Canada)
PM Measurements Research Subcommittee	Dr. Dan Albritton (NOAA) and Dr. Dan Greenbaum (HEI)

Science and Resource Planning Group:

Executive Secretary	Dr. Jeremy Hales (NARSTO Mgmt. Coord.)
Policy Representatives	Mr. John Bachmann (EPA)
State Representative	Mr. Cyril Durrenberger (TNRCC)
QA & Data Management Representative	Dr. Wanda Ferrell (DOE)
Mexican Sponsors Representative	Dr. Victor Paramo (INE-Mexico)
Canadian Sponsors Representative	Dr. Maris Lusic (AES-Canada)
United States Sponsoring Organization Representatives:	
American Petroleum Institute (API)	Mr. Howard Feldman
Baltimore Gas & Electric Company	Dr. John Quinn
California Air Resources Board	Mr. Bart Croes
Coordinating Research Council	Mr. Brent Bailey
Department of Energy	Mr. Peter Lunn
Dunn-Edwards Corporation	Mr. Robert Wendoll
E. I. DuPont de Nemours & Company	Dr. John Dege
EPRI	Dr. Alan Hansen
Environmental Protection Agency (EPA)	Mr. Kenneth Schere (EPA/NOAA)
Ford Motor Company	Dr. David Chock
National Oceanic & Atmospheric Administration (NOAA)	Dr. Dan Albritton
National Renewable Energy Laboratory	Dr. Douglas Lawson
Northeast Utilities Service Company	Mr. Dominic Scerbo
Pennsylvania Power & Light Company	Mr. Al Ferullo
Tennessee Valley Authority	Dr. Roger Tanner

POLICY QUESTIONS FOR NARSTO 1999 ASSESSMENT

Policy Question 1.

What changes have occurred in tropospheric ozone science over the last decade that might alter (or confirm) the course of current ozone air quality management strategies?

Policy Question 2.

How manageable is the ozone problem for a given area? (What portion of the problem is local and what portion is transported in? What portion of the problem is essentially irreducible and what portion is potentially controllable?)

Policy Question 3.

Are existing emissions control measures helping to bring the ozone problem under control? (For a given area, if these control measures are continued, will they lead to ozone attainment?)

Policy Question 4.

What are the relationships between the on-going efforts to manage tropospheric ozone pollution and the scientific understanding of the issues?

Policy Question 5.

What are alternate approaches for reducing current and future high ozone concentrations on urban (<200 km) and regional (200-2000 km) scales?

Policy Question 6.

How can we best track and assess the progress and effectiveness of our ozone management efforts?

Policy Question 7.

Will our efforts to manage ozone help or hinder efforts to mitigate other environmental problems, such as acid rain, fine particles, and global climate change, and vice versa?

DETAILED SCIENCE QUESTIONS FOR NARSTO 1999 ASSESSMENT

Science Question 1. (Addresses Policy Question 1.)

What are the most significant research developments in tropospheric ozone science over the last decade.

- _ How have these developments confirmed or changed our conceptual picture of tropospheric ozone processes?
- _ What are the principal remaining scientific uncertainties?
- _ Are there any scientific breakthroughs on the horizon in the next few years?
- _ Would these breakthroughs/developments alter the way we are managing the ozone problem?

Science Question 2. (Addresses Policy questions 2,3,4,5.)

How does ozone accumulation on urban (<200 km) and regional (200-2000 km) scales depend on the source dimension and location? How does it depend on the relative contribution from urban and regional sources?

- _ What are the relationships among point source, urban, regional, and larger scale processes and tropospheric ozone levels?
- _ What are the regional transport influences on urban-scale ozone and the urban influences on regional tropospheric ozone?
 - > How large a region must be considered; do we know how large is large enough?
 - > What do modeling analyses and measurements tell us about transport scales of regional, urban, and point source emissions influences?
 - > What is the sensitivity of urban ozone to regional transport of ozone, of NO₂ / PAN, of VOCs / carbonyls?
 - > What spatial and temporal resolutions are required for modeling to assess regional transport effects on an urban area experiencing high ozone concentrations?
 - > What measurements are needed, where are they needed, and what degree of accuracy is needed to assess regional transport effects on an urban area experiencing high ozone concentrations?
- _ Can we better understand, further identify, isolate, and explain the fundamental physical, chemical, and meteorological processes responsible for ozone accumulation on urban and regional scales?
 - > What are ambient measurement programs revealing about fundamental processes?
 - > What are modeling studies revealing about fundamental processes?
 - > What are laboratory studies revealing about fundamental processes?
- _ What is the influence of stratospheric ozone concentrations?

Science Question 3. (Addresses Policy Questions 3,4,6.)

What are the most recent assessments of the relative contributions of VOCs, NO_x, and CO to ozone accumulation on urban and regional scales in North America?

- _ Is the accumulation of ozone limited by the availability of VOCs, or NO_x?
 - > Does this limitation change from day to day for a given area or region, or from area to area on a given day, based on changes in meteorology and emissions?
 - > What portion of the ozone precursors are from natural (biogenic) sources, and how will these emissions change with meteorological variability, land-use, and climate change perturbations?

Science Question 4. (Addresses Policy Questions 2,3,4,5.)

What are the strengths and limitations of the current scientific methods and tools in assessing tropospheric ozone issues and developing emissions management strategies?

- _ How do regional versus urban emissions controls affect urban ozone?
 - > What are results of modeling analyses indicating effects of regional versus urban emissions controls?
 - > What measurements can be made to assess the adequacy of modeled estimates of emissions control impacts on ozone?
- _ What are the critical limiting factors (uncertainties) in current models for assessing and managing urban and regional ozone problems?
 - > How do strengths and limitations affect the way emissions-based air quality models are best applied?
 - > Are emerging multi-scale air quality modeling systems more accurate and more useful than their predecessors in estimating regional/urban ozone, precursor, and other key species concentrations?
 - > Can single (urban) scale models be used to assess regional/urban interactions?
 - > What is the sensitivity of modeled ozone management strategies to the accuracies of emissions inventories?
 - > What confidence do we have in model-predicted changes in ozone given a change in precursor emissions?
- _ What are the critical limiting factors (uncertainties) in current measurement methods for assessing and managing urban and regional ozone problems?
 - > How do strengths and limitations affect the way measurements are best used?
- _ How might an efficient approach toward ozone management be constructed that combines observational analysis and modeling techniques?
 - > How might such an approach be made operational?
 - What is needed for a successful modeling study in support of air quality management?

- > How can observational methods and emissions model techniques be combined to reduce uncertainty and risk? How can these risks best be communicated to decision makers?
- _ What are the scientific implications of assessing ozone and strategies for its control over periods longer than an episode (up to a season or year)?
 - > How will emissions control impacts change under a new primary standard, such as an 8-hr averaging period?
 - > How many episodes must be analyzed to assess against the new primary standard? Is episodic modeling meaningful?
 - > What new measurement and modeling methods might be required to assess a potential secondary (seasonal) ozone standard?
 - > Can we characterize the seasonal ozone "baseline" or clean continental concentration for different regions?

Science Question 5. (Addresses Policy Questions 3,5,6.)

What approaches are required to determine historic concentration trends of ozone and its precursors on urban and regional scales? What is required to demonstrate the effectiveness of emissions control strategies over time?

- _ What measurements are needed, and where, to track the impact of emissions, meteorology, ozone and precursors over time to detect a signal in each component?
- _ What techniques can be applied to observed concentration trends to minimize the confounding influence of the meteorological signal?
- _ What do models tell us about the confounding influence of the meteorological signal on pollutant concentration trends?
- _ Since urban ozone trends are generally downward, is the basic management strategy a sound one but with end for fine-tuning, or are there more fundamental problems?
- _ What do we know about ozone trends in rural areas? What is the urban ozone influence on rural concentrations?
- _ What approaches are required to evaluate ozone exposures of humans and ecosystems?
- _ How can measurements be best utilized?
 - > What are the most important additions/improvements in PACS and similar monitoring to facilitate emissions inventory evaluation and improvement, air quality model evaluation and improvement?
 - > What types of method development efforts, field studies, and training are needed to maintain high quality data from PACS and similar networks?
 - > What data analysis techniques are most useful, for scientific or regulatory purposes, in eliciting information from the PACS and similar data?
 - > How can the long-term sustained efforts in PACS or other monitoring be used to establish progress in achieving improved air quality?
 - > What improvements are needed in the long-term monitoring effort in rural areas?

Science Question 6. (Addresses Policy Question 7.)

What are the relationships between the control strategies designed to manage tropospheric ozone and those designed to manage other pollutant regimes of interest?

- _ What are the linkages and feedbacks between other pollutants of concern (especially, fine particles, regional haze, acid deposition, and airborne toxics) and tropospheric ozone?
- _ Can future operational assessments be performed in an integrated manner across different pollutant regimes?

NARSTO Critical Review Titles

1. Ozone Air Quality Over North America: A Critical Review of Trend Detection Techniques and Assessments
2. Methods for Gas-Phase Measurements of Ozone, O₃-Precursors and Aerosol Precursors
3. A Review of National Monitoring Networks in North America
4. A Review of Atmospheric Aerosol Measurements
5. Advances in Meteorological Measurement Methods for Application to Air Quality Research and Monitoring
6. Ozone Process Insights from Field Experiments
 - 6A. The Methods of Photochemical Indicators as a Basis for Analyzing O₃-NO_x-Hydrocarbon Sensitivity
 - 6B. Observation Based Analysis for Ozone Production
 - 6C. The Use of Extent Reaction to Qualitatively Identify Which Precursor Species Limit the Formation of Ozone
 - 6D. Regional Factors Influencing Ozone Concentrations
 - 6E. The Application of the Observation Based Model to Atmospheric Measurement Datasets
7. Comparison of Major Ozone Field Studies and Their Scientific Findings in North America and Europe
8. Atmospheric Chemistry of VOC's and NO_x
9. Chemical Oxidant Mechanisms for Air Quality Modeling
10. Heterogeneous Chemistry and Tropospheric Ozone
11. Meteorological Modeling for Air Quality Assessments
12. Dry Deposition Processes
13. NARSTO Critical Review of Photochemical Models and Modeling
14. A Critical Review of Regulatory Air Quality Modeling for Tropospheric Ozone
15. NARSTO Emission Inventory Overview
16. Mobile Sources Critical Review - 1998 NARSTO Assessment
17. Emissions from Stationary Sources
18. Natural Emissions of Reactive Trace Gases from North America
19. Fine Particles in the Troposphere: Integration with Ozone Research
20. Developing a Risk Management Approach to Ozone Control and Regulation

Note: The papers listed above can be read (or downloaded as PDF Files) from the NARSTO Web Site:
<www.cgenv.com/Narsto/assess_activities.html>